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RESEARCH ARTICLE

EFFECT OF ENVIRONMENTAL FACTORS ON GROWTH AND DEVELOPMENT OF MEDICINAL PLANTS – A REVIEW

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ABSTRACT

With the emergence of human civilization, plants have been the main source to cure, heal and alleviate various diseases. Medicinal plants belong to a big plant group with a great interest due to its pharmaceutical, cosmetic and nutritional values. The effect of environmental factors on medicinal plants is particularly significant due to their value with traditional system of medicine. There are evidences that environmental change is causing noticeable effect on the medicinal plants. So, an attempt is being made here to review the work done on these important issues.

INTRODUCTION

Medicinal plants are the "backbone" of traditional medicine, which means more than 3.3 billion people in the less developed countries utilize medicinal plants on a regular basis. Medicinal plants consider as a rich resources of ingredients which can be used in drug development and synthesis. Besides that these plants play a critical role in the development of human cultures around the whole world. Moreover, some plants consider as important source of nutrition and as a result of that these plants recommended for their therapeutic values. These plants include ginger, green tea and walnuts etc. The use of medicinal plants and traditional medicine in most developing countries, as a basis for the maintenance of good health, has been widely observed by UNESCO. Furthermore, an increasing reliance on the use of medicinal plants in the industrialized societies has been traced to the extraction and development of several drugs and chemotherapeutics from these plants as well as from traditionally used rural herbal remedies. Medicinal plants frequently used as raw materials for extraction of active ingredients which used in the synthesis of different drugs. Like in case of laxatives, blood thinners, antibiotics and anti-malarial medicines, contain ingredients from plants.

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Moreover the active ingredients of Taxol, vincristine, and morphine isolated from foxglove, periwinkle, yew, and opium poppy, respective.

Characteristics Of Medicinal Plants

Medicinal plants have many characteristics when used as a treatment, as follow:

- **Synergic Medicine**: The ingredients of plants all interact simultaneously, so their uses can complement or damage others or neutralize their possible negative effects.
- **Support of official Medicine**: In the treatment of complex cases like cancer diseases the components of the plants proved to be very effective.
- **Preventive Medicine**: It has been proven that the component of the plants also characterize by their ability to prevent the appearance of some diseases. This will be used when the disease is already present i.e., reduce the side effect of synthetic treatment.

Objective of the present study

- How do medicinal plants respond to their environment?

Environmental Factors

Each plant has certain environmental requirements. The growth and development of plants is depending on abiotic and biotic factors. Abiotic factors include the physical environmental conditions and biotic factors include animals, insects and diseases. Light, water, temperature and soil are chief factors effecting plant growth, and any one of these factors in incorrect proportions will proper plant growth indoors. So, it is important to understand how these environmental factors effect on plant growth and development.

Light: All Light is made up of energy. Light is probably the most essential factor for any plant growth. The growth of plants and the length of time they remain active depend on the amount of light they receive. Light is necessary for all plants because the use this energy source to photosynthesize. When examining light levels for tropicals, consider three aspects of light, as follows.

Quality: Light is often referred to as white light and is composed of all colours of light. A colour of light would be the relative distribution of wavelengths from a radiation or reflective source.

Intensity: Light intensity is a major factor governing the rate of photosynthesis. The quantity or amount of light received by plants in a particular region is affected by the intensity of the incoming light and the length of the day. The intensity of light changes with elevation and latitude. The amount of sunlight also varies with the season of the year and time and time of day, as well as, other factors, such as clouds, dust, smoke or fog.

Duration: Due to the tilt of the earth's axis (23^0 from the vertical) and its travel around the sun, the length of the light period varies according to the season of the year and latitude. It varies from a nearly uniform 12-hour day at equator to continuous light or darkness throughout the 24 hours for a part of the year at the poles.

Water: Water is required by all living organisms. Plants can be stressed by lack of moisture as well as an excess of moisture. The availability of water was the most important environmental factor limiting growth and survival of range plants. Hsiao (1973) presented a sequence of events that occurred when a plant was growing in a moist situation and then encountered moisture stress. A slowing down of root and leaf growth was listed first. In his discussion on the relation of water stress to long-term growth and yield, he elaborated on the fact that cell growth was generally more sensitive to water stress than was stomatal opening and CO_2 assimilation.

Slatyer (1974) reported that the most obvious effects of prolonged water stress on shoot development were reduced internodes length and reduced leaf size. He stated that effects on leaf size, rate of leaf expansion, and rate of appearance of new leaves had profound effects on total dry matter production. Photosynthetic area increased less rapidly, and also stomata tended to become non-functional more quickly in older compared to younger leaves. Slatyer summarized the effects of water stress on annuals as:

- reduced leaf size and internode length,
- stunted tops of plants,
- suppressed root growth in proportion to shoot growth,
- delayed time of flowering and fruit set although they occurred at similar ontogenetic stages as in well watered species,
- reduced seed number, size and viability, and
- halted growth and development with severe stress, followed by death.

Slatyer indicated that a similar general effect of reduced leaf size and internode length could be expected on shoot development of perennial grasses. Root growth, however, could continue if roots were growing in moist soil. This continued growth resulted from the fact that root growth was controlled more by local levels of soil water potential than by mean plant-water potential. With increasing stress, reproductive development may be delayed, and floral initiation may not occur. With severe stress, shoot dieback may occur, but new tillers will develop from basal buds when water becomes available.

Temperature: Most plants function in a relatively narrow range of temperatures. The extremes of this range may be considered killing frosts at about 32^0F (0^oC) and death by heat and desiccation at about 105^0 F (40^0 C).

Cooper and Tainton (1968) reported that the optimum temperature for growth (dry matter increase or relative growth rate) occurs between 20^0 and 25^0C for most temperate Festucoid (C_3) grasses. Growth rate drops rapidly below 10^0C, but some growth occurs at 5^0C and the plant remains healthy. Growth is reduced above 25^0C and may cease above 30-35^0C, even with adequate soil moisture. Sub-tropical, non-festucoid (C_4) grasses have an optimum of 30-35^0C and grow extremely slow, if at all, at temperatures below 10-15^0C. Exceptions occur in some species with optimum temperatures shifting according to local conditions. Cold temperatures can affect plant productivity by delaying initiation of growth in spring, restricting water movement to roots, decreasing permeability of the membrane on the root surface, and delaying opening of stomata on a daily basis, thereby reducing the duration of daily photosynthesis. Freezing temperatures can also injure and kill plants. Smith (1964) reported that winter injury and death of forage plants is a major hazard of grassland farming in many areas of the world; mortality occurred frequently where below freezing temperatures prevail for long periods.

Smith (1964) indicated that winter injury was usually more serious in a stand of old plants than in stand of younger plants because:

- old plants are likely to be weakened by invasions of disease and insects,
- the fertility level of soil under an old stand is likely to be limiting, and
- older stands have fewer plants per unit area than young stand.

He indicated that evidence of injury to forage plants becomes apparent as growth begins in the spring. Injured plants begin growth slowly, are yellowish in colour, and may have only a few stems per plant. Time is required for healing of tissue if plants are going to survive and regain vigor.

Soil: Soil is a natural medium that provides anchorage for the plants and supplies water and mineral nutrients for normal growth. Soil consists of mineral matter, organic matter, air and water. The proportion of these four constituents and the types of mineral and organic material determines soil properties such as soil type, soil pH, and fertility.

Soil type: soil is made up in part of mineral particles grouped as sand (0.05 to 2 mm), silt (0.002 to 0.05mm), and clay (<0.002mm). Soil type determines the soil's capacity to store water and nutrients, aeration, drainage, and ease of field operations. Sandy soil are easily tilled, well-drained and aerated but usually have low fertility and water-holding capacity. Clayey soils, on the other hand, are more fertile and have high water retention but are poorly drained and aerated.

Soil pH: Soil pH is a measure of the soil's acidity or alkalinity, and it affects the plant indirectly by influencing the availability of nutrients and the activity of microorganisms. Nutrients are most available at pH levels between 6.5 and 7.5. Nutrients in the soil may be chemically tied up or bound to soil particles and unavailable to plants if the pH is outside this range. Individual plants have pH preferences and grow best if planted in soils that satisfy their pH requirements.

Soil Fertility: Soil Fertility is the inherent capacity of soil to provide plant nutrients in adequate amounts and in proper balance for the growth of specific plants. A fertile soil is usually rich in nitrogen, phosphorus, and potassium, and contains sufficient trace elements and soil organic matter that improves soil structure and soil moisture retention.

Conclusion

Medicinal Plants have been used for thousands of years to flavour and conserve food, to treat health disorders and to present diseases including epidemics. Medicinal plants can make an important contribution to the WHO goal to ensure, by the year 2000, that all peoples, worldwide will lead a sustainable socio-economic productive life.

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