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Editorial

Plant Physiology under Abiotic Stresses: Deepening the Connotation and Expanding the Denotation

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Abstract: Abiotic stress factors influence many aspects of plant physiology. The works collected in the Special Issue deepen plant physiology's connotation (such as plant electrophysiology) under abiotic stress and expand the denotation (such as environmental pollutants as abiotic stress factors). At the same time, the achievements of the selected papers published in the Special Issue also exhibit their potential application value in the production of horticultural plants.

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1. The Effects of Various Abiotic Stresses

The effects of various abiotic stresses on substance metabolism, energy transformation, and the growth and development of different plants are disparate. Abiotic stress includes several adversities, such as drought, temperature, light, salinity, nutrients, and heavy metals, as well as complex stresses, such as karst environments, saline–alkali soils, and coastal wetland environments. Water is the essential substance necessary for plant survival. A water deficit adversely affects plant morphology, growth and development, and physiological and biochemical processes. Therefore, water stress is also the most common abiotic stress factor. Most of the research works collected in the Special Issue concern the effects of water stress on plant physiology, biochemistry, and growth and development [1–4]; however, these works also focus on some complex multifactorial stresses [5–7].

2. Moderate Drought Stress Has a Positive Effect on Plant Secondary Metabolism

Generally, water stress harms the primitive metabolism of plants [1–4], but appropriate water stress has a positive effect on plant secondary metabolism and adaptation. Honório et al. found that under moderate drought stress, the production of liriodenine and total alkaloids in *Annona crassiflora* Mart. increased, but photosynthesis did not decrease [3]. Al-Quraan et al. demonstrated that drought can promote γ-aminobutyric acid (GABA) accumulation, but it also inhibits the synthesis of chlorophyll a and chlorophyll b in green pea seedlings (*Pisum sativum* L.) [2]. The abovementioned works show that humans can control soil to reach a moderate humidity level to produce secondary metabolites.

3. The Application of Some Exogenous Organic Compounds Can Restore Metabolic Activity Reduced Due to Drought Stress

Drought causes damage to the cell membrane, disrupts cell function, and reduces the physiological vitality of plants. Yeast extract is rich in essential nutrients and is a natural and safe biofertilizer. Chitosan is an environmentally friendly biological polysaccharide obtained by the deacetylation of chitin, which is widely present in nature. However, Abdelaal et al. presented that the application of yeast extract (8 g/L) or chitosan (30 mM) alone or in combination can enhance the antioxidant capacity of plants and restore metabolic activity reduced due to drought stress [8]. We can expect that appropriate drought combined with the application of yeast extract and/or chitosan can increase the synthesis of secondary metabolites in plants.

4. Plant Electrophysiology Can Deepen the Understanding of Plant Physiology under Abiotic Stress

When affected by abiotic stresses, the anatomy, function, and metabolic activities of plant cells change, and these changes are bound to be reflected in the electrical properties of plant tissues and organs. Plant electrical signals can quickly respond to water status in the environment in real-time and characterize intracellular water metabolism. The works collected in the Special Issue demonstrate plant electrophysiology's great potential in the study of plant stress biology. According to the Gibbs free energy equation and Nernst equation, the relationship model between the clamping force and the electrical signal (capacitive reactance, resistance, impedance, and inductive reactance) of plant leaves can be quantitatively reflected in real-time by the intracellular water-holding capacity, water transfer rate, water-holding time, and water use efficiency of plant leaves. *Broussonetia papyrifera* (L.) Vent. and *Morus alba* L. have different intracellular water metabolism mechanisms adapted to soil water deficits [4]. The karst-adaptable plant *Orychophragmus violaceus* (L.) O. E. Schulz adapts to karst drought environments by synergistically regulating intracellular water transport, cell elasticity, and leaf anatomy [7]. The acquisition and analysis of plant electrophysiological information have opened up a broad path for studying plant physiology under abiotic stress.

5. The Environmental Pollutants Become Abiotic Stress Factors

Climate change and environmental pollution caused by human activities have gradually become abiotic stresses, which hugely impact plant life activities. With a background of elevated atmospheric carbon dioxide, the adverse effects of low temperature on plant growth and development are much greater than the adverse effects of high temperature on plant growth and development [5]. Environmental pollutants such as sulfur dioxide and bisulfites have become abiotic stress factors that seriously affect the physiological activities of plants. The work of Li et al. shows that suitable concentrations of $NaHSO_3$ can be used as a source of sulfur for plants to play a positive role in the physiological activities of plants, and high concentrations of $NaHSO_3$ reduce the photosynthetic capacity of plants and adversely affect plant growth and development. The effects of bisulfites as photorespiratory inhibitors are often masked [9].

6. Complexity and Diversity of Salinity Stress

Both salt in the soil and salt spray in the atmosphere can become abiotic stress factors. The influence of salt stress on coastal plants is caused by the superposition of soil salinity and atmospheric salt spray stress, and salt composition is also compounded. The root is the earliest organ to respond to salt stress in the soil. *Tilia cordata* Mill. can only respond to salinity by adjusting the stomatal conductance of leaves and reducing photosynthetic capacity by improving water use efficiency, as its roots do not prevent salt intake. *Pyrus pyraster* L. (Burgsd.) maintains stable photosynthesis under salt stress, as its roots limit the transfer of salt ions to leaves [10]. The first organ to respond to salt spray in the atmosphere is the leaves of plants. *Callistemon citrinus* significantly decreases photosynthetic capacity under salt spray stress [11]. In fact, plants growing in soil salinization areas are not simply affected by single-salinity adversity but by salinity–alkali compound adversity. Wang et al. found that low concentrations of saline–alkali stress ($NaCl:NaHCO_3$ = 3:1, 0~90 mM) can promote glucose metabolism and the synthesis of antioxidant enzymes, while high concentrations of saline–alkali stress ($NaCl:NaHCO_3$ = 3:1, 120~150 mM) reduce the activities of peroxidase and catalase [6]. This is related to the fact that at an appropriate concentration, bicarbonate improves the stress tolerance of plants [12]. In horticultural plant production, saltwater dilution irrigation is an effective measure.

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