SHORT COMMUNICATION

Forest tree physiological responses to abiotic and biotic stress

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ABSTRACT

By maintaining nutrient cycles and acting as home for a variety of creatures, forests perform crucial ecological tasks. Additionally, they provide ecosystem services including carbon storage, erosion control, and the provision of valuable commodities like wood. Trees must adapt to their setting with many artificial and natural sources of stress. Long-lived tree species place a premium on resilience and resistance mechanisms to biotic and abiotic challenges. Due to the fact that trees can live for many years, if not centuries, in the same place, they must adapt their development and reproduction to the continuously shifting pedospheric and atmospheric circumstances. We sought contributions for this special issue that addressed the physiological reactions of forest trees to a variety of diverse stressors. Seventeen of the eighteen publications that were published discussed salt stress or drought as significant environmental cues, demonstrating the topic's significance in the face of climate change.

Cold stress was only examined in one publication. The necessity to comprehend tree responses to these environmental hazards from the molecular to the ecosystem level is supported by the prevalence of studies on drought and salt stress environmental biology. The papers that make up this issue explore these scientific topics in various parts of the world and include both conifer and broadleaf tree species. Additionally, bamboo is the subject of two research. Although technically a grass, bamboo was included since it serves comparable ecological purposes and has similar uses to trees.

Key Words: *Drought; Isohydric; Pinus koraiensis*

INTRODUCTION

This study focused on characteristics of conifers that experience wide differences in their growing environments.

In order to adapt to seasonal variations in environmental conditions, particularly summer drought evaluated the physiological plasticity of Aleppo pine (Pinus halepensis), a significant species in the Mediterranean region. They discovered that Aleppo pine is an isohydric species that uses drought avoidance as a survival tactic [1-3]. With Pinus massoniana, Lin et al. showed considerable acclimatory changes in needle carbohydrates following prolonged exclusion of precipitation [4]. This study supports the development of tolerance mechanisms (rather than avoidance mechanisms) to limit excessive water loss. A keystone species of temperate mountain forests, Pinus koraiensis, was the subject of a study by Fan et al. along an altitudinal gradient in China [5], where precipitation was one of the most important factors influencing sapling growth. The saplings grew more quickly in mixed Pinus koraiensis forests than in pure Pinus koraiensis woods, which is intriguing and suggests facilitation effects that were certainly not negated by other varying environmental restrictions. The nitrogen nutrition of European beech *(Fagus sylvatica)* in pure and mixed stands with silver fir was examined by Magh et al. in a similar manner (Abies alba) [6]. Because fir needles and beech leaves both contained less nitrogen, there may be less competition for nitrogen in mixed stands. Beech benefited from the interaction with fir when soil N levels were low, but not when soil N levels were high. evolutionist tactics These findings collectively emphasize how crucial it is to recognize various evolutionary methods adjusting to differential nutrient and water availability and supporting the idea that trees' reactions rely on their environment. The spread of diseases in stressed forests is a key problem that is causing increasing worry. The paper by Terhonen et al. is therefore particularly pertinent at this time [7]. According to their findings, poorly hydrated plants exhibit weaker disease symptoms and growth inhibition when exposed to Heterobasidion species than spruce (Picea abies). Therefore, the development of preventative strategies against forest pests is critically

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needed. The possibility of sudden tree death is serious in many parts of the world [8]. Depletion of carbohydrates or hydraulic collapse are the most frequent causes of sudden tree death. Eckert et al descriptions of how hardwoods adapt their hydraulic system to withstand environmental pressures is given here in (emphasis added) [9]. They provide an explanation of how basic wood structures are created, concentrating mostly on molecular regulation, and assemble data on how these structures are affected to preserve water flow under environmental restrictions. Researchers who want to get a glance into the intricate regulation of wood production might find their review to be interesting [10].

Salinity and combined stresses: from soil amendment to redox balance

Osmotic stress is brought on by salinity, and in this sense, drought stress is analogous [11]. However, because salinity also causes ionic stress, there is only some overlap between the reactions to salt and drought [12]. Reactive Oxygen Species (ROS) are frequently found in higher concentrations in salt-stressed plants. An excess of ROS causes damaging symptoms such chlorophyll degradation, membrane leakage, and ultimately necrosis because anti-oxidative systems are unable to counteract the excess ROS. This Special Issue also provides some illustrations of salt damage symptoms at the tissue and organelle levels. Finding salt-tolerant plant species and taking action to strengthen the resistance of crops and horticulture plants are urgently needed since soil degradation caused by increased salinization is a growing issue. Several publications in this Special Issue are focused on increasing salt tolerance. Osmanthus fragans (sweet olive), an ornamental plant with significant commercial potential, is the subject of a study. (e.g., for perfume production). They demonstrate that seeds exposed to moderate levels of -radiation had a long-lasting impact on seedlings' ability to tolerate salt, along with an overall increase in anti-oxidative enzyme activity and a decrease in superoxide buildup. The damage index of untreated seedlings was twice as high as that of -radiated seedlings under 80 mm salt, indicating that this horticulture species' vitality can be increased to withstand mild salt stress. To fully understand how -radiation causes this fascinating result, more research is necessary. The hornbeam (Carpinus turczaninowii) is renowned for its exquisite wood texture and stunning autumnal hues. Zhou et al. thoroughly evaluated the performance of this type of tree and its Carpinus betulus counterpart in Europe under moderate salt stress (up to 85 mm). They discovered that, in the presence of low salinity levels, the antioxidant systems of European species collapsed after approximately one month, whereas those of Asian species collapsed approximately two after months (30 mm to 50 Under these mm). circumstances, the plants manifested significant signs of damage, confirming the conclusion that both species are relatively salt-sensitive. Hydrogel-infused soil additives have the potential to significantly improve plant performance under osmotic and ionic stress. Li et al. evaluated the effects of adding synthetic hydrogels and biopolymers based on galactomannan to soils that were either salinized or dehydrated and contained Metasequoia glyptostroboides dawn redwood) on galactomannan to soils that were either salinized or dehydrated and contained Metasequoia glyptostroboides (dawn redwood) endangered species, can be improved by salt ion retention and greater water provision, despite the effects of hydrogels on growth rescue being moderate for single stress factors and positive for all evaluated chemicals when drought and salinity occurred simultaneously.

RESULTS AND CONCLUSION

Overall, a wide variety of tree species are discussed in this issue, along with how they react to salinity or drought at many levels, from ecophysiology to molecular processes. Because in-depth knowledge of basal stress pathways can be utilized to build protection methods for trees on salt- or drought-affected soils, we believe that initiatives like the current special issue can be used to find similarities and divergences of stress responses. Furthermore, specific protective measures for crucial agricultural trees can be implemented thanks to the distinct reactions of evolutionary stress-adapted tree species.

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