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Editorial

Fungal–Plant Interactions: Latest Advances and Prospects

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During the evolution of higher plants, many microorganisms evolve alongside them, creating a synergistic plant–microbe world. Among them, fungi have been demonstrated to perform many ecological functions that plants cannot. Beneficial soil fungi, ranging from endophytic fungi to arbuscular mycorrhizal (AM) fungi, are able to establish symbiotic associations with plant roots, allowing host plants to absorb water and nutrients in order to adapt to new environment changes. Moreover, the underground 'common mycorrhizal hyphal networks' facilitate the flows of nutrients and signals between neighboring plants. This communicative phenomenon is more evident in woody areas. On the other hand, there are harmful pathogenic fungi that infest trees and cause tree injury; however, trees can develop resistance in response to fungal invasions. As a result, fungal–plant interactions have received significant attention, and considerable advances have been made in recent years.

This Special Issue aims to present the latest advances and prospects in fungal–plant interactions. It consists of seven papers, five from China, one from Portugal, and one from Malaysia, all of which focus on forest trees and fungi.

Plant rhizospheres inhabit lots of mycorrhizal fungal populations that establish a symbiosis with plant roots, resulting in the creation of micro-ecosystems. Wang et al. [1] inoculated *Cinnamomum camphora* plants with *Funneliformis mosseae* or *Rhizophagus irregularis*, either alone or in combination. This study discovered that AM fungal treatments, especially *R. irregularis*, mitigated adverse effects of NaCl stress through optimizing biomass allocation, raising P and Mn^{2+} levels in the shoots of *C. camphora* and shifting the selective transporting capacity of K^+ versus Na^+ from the roots to shoots. Such findings provide a method for the healthy growth of plants grown in the coastal zone by exploiting AM fungi. Chen et al. [2] reported that an edible ectomycorrhizal fungal strain from Yunnan, China, *Tricholoma matsutake* strain YN1, was able to establish ectomycorrhizas with both exotic *Pinus elliottii* and native *P. armandi* plants, with native *P. armandi* exhibiting ectomycorrhizal structures earlier than exotic *P. elliottii*. Such ectomycorrhizal formation promoted the growth of both plants, opening up new possibilities for forest growth and the production of edible ectomycorrhizal fungi.

Besides mycorrhizal fungi, certain fungi serve as biological inducers for agarwood production. Jalil et al. [3] described in detail a non-invasive technique for infecting *Aquilaria malaccensis* trees with *Pichia kudriavzevii* and *Paecilomyces niveus* and gave a best combination for obtaining agarwood formation and conserving the endangered tree species. This technique can fulfill the needs of the agarwood industry and exhibit new possibilities for fungal applications on forests.

Soil-borne fungi in forests, such as *Phytophthora cinnamomi*, can cause cell death in infected tissues, leading to a decline in the presence of trees. Coelho and Schütz [4] used an α, β-k-feature set approach to find protein markers that can help in the early diagnosis

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Citation: Zou, Y.-N.; Xie, X.-A.; Wu, Q.-S. Fungal–Plant Interactions: Latest Advances and Prospects. *Forests* **2024**, *15*, 1364. https://doi.org/10.3390/f15081364

Received: 16 July 2024
Accepted: 25 July 2024
Published: 5 August 2024

of cork oak decline due to *P. cinnamomi*. The findings served as a guide for the ecological management of cork oak.

Soil microorganisms coexist alongside plants in a wide range of habitats, and their diversity complements plant growth and populations. Gao et al. [5] found that short-term fertilization and dry-season irrigation changed the structure and functional groups of fungal communities in *Eucalyptus* plantations in southern China by regulating soil moisture and nutrients. Such results provide appropriate management strategies for plantation forests in the future. In addition to fungi, both viruses and bacteria can be found surrounding plants. By investigating six viromes from three land use types in China, Yan et al. [6] observed that viral and bacterial communities differed significantly between land use types, as evidenced by the greater differences in viruses and the fact that viruses regulated bacterial carbon cycling processes by regulating auxiliary metabolic genes encoding carbohydrate-active enzymes. These findings also revealed that agricultural activities have a positive effect on viral richness.

Allelopathy is a common phenomenon in complex agroforestry ecosystems, affecting both the growth of surrounding plants and the microbial communities in soil. Li et al. [7] discovered that a root water extract of *Ficus carica* significantly increased the abundance of growth-promoting bacteria and reduced the number of pathogenic bacteria in *Taxus cuspidata*'s rhizosphere, hence indirectly stimulating the growth of *T. cuspidata*. This generates new ideas for managing *T. cuspidata* mixed forests.

In conclusion, this Special Issue provides theoretical advances in fungal–plant interactions, as well as in the development and application of novel technologies for forest management and specific fungal applications in the forest industry. We anticipate that this Special Issue will pave the path for future research on forest fungi and drive more novel outcomes.

Conflicts of Interest: The author declares no conflicts of interest.

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