

Antibiotic and Fungicide Exposure Reveal the Evolution of Soil-Lettuce System Resistome

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Abstract : The emergence and spread of antibiotic resistance genes (ARGs) have become a pressing issue in global agricultural production. However, understanding how these ARGs spread across different spatial scales, especially when exposed to both pesticides and antibiotics, has remained a challenge. Here, metagenomic assembly and binning methodologies were used to determine the mechanism of ARG propagation within soil-lettuce systems exposed to both fungicides and antibiotics. The results of our study showed that the presence of fungicide and antibiotic stresses had a significant impact on certain bacterial communities. Notably, we observed that ARGs were primarily transferred from the soil to the plant through plasmids. The selective pressure exerted by fungicides and antibiotics contributed to an increase in unique ARGs present on lettuce leaves. Moreover, ARGs located on chromosomes and plasmids followed different transmission patterns. The presence of diverse selective pressures, a result of compound treatments involving antibiotics and fungicides, amplifies this phenomenon. Consequently, there is a higher probability of bacteria developing multi-antibiotic resistance under the combined pressure of fungicides and antibiotics. In summary, our findings highlight that combined fungicide and antibiotic treatments are more likely to drive the acquisition of ARGs within the soil-plant system and may increase the risk of human ingestion.

Keywords : soil-lettuce system, fungicide, antibiotic, ARG, transmission

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