Decomposition of Microplastics by Tenebrio molitor (Mealworm) Intestinal Facultative Anaerobes Facilitate Wheat Growth

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Soil MPs pollution intensifies rapidly, posing large negative impact on agriculture. Previously used MPs decomposing strains such as Citrobacter sp. were identified as low in efficiency. This project proposes in-vitro T.molitor intestinal facultative anaerobes have higher MPs decomposition efficiency and stronger adaptability, assesses its application feasibility and explores its facilitation on wheat growth under PP-MPs stress. The ability of T.molitor intestinal facultative anaerobes decompsing PP-MPs was verified through turbidity measurement and microscopy. Illumina platform was used to analyse species composition. KEGG, Metacyc were used for metabolic pathway analysis. PP-MPs concentration with the greatest negative impact on wheat was explored by concentration gradient test. Facilitation effect was evaluated through 6 physiological indicators. Results showed that in vitro T.molitor intestinal facultative anaerobes decomposed PP-MPs at 67.78% decomposition rate comparing with the traditional 35.75% one in 42d. In metabolic pathway analysis, Acidobacteria and Actinobacteria abundance increase after 40 generations cultivation, representing robustness and applicability. In 0.005% PP-MPs environment which had strongest negative impact on wheat growth, wheat seeds' rooting rate was increased by 12.02%±3.26% after 40h, wheat growth rate was increased by 0.48cm/d after adding T.molitor intestinal facultative anaerobes. Meanwhile, Chl a concentration was increased by 77mg/g in 9d; POD activity was reduced with significance thus slowing down lignification. Nitrogen and phosphorous absorption were enhanced by 67.12%±1.39%. This novel bio-decomposition method provides guidance for improving soil ecological health and agricultural productivity.

Awards Won:
Second Award of $2,000