

---

# Understand the important role of phenolic acids in rice allelopathy

Hai-Bin He\*<sup>†1</sup>, Jia-Yu Li , Qi Zhang , Chang-Xun Fang , Ruo-Lan Lin , and Li Li

<sup>1</sup>Key Laboratory of Agroecological Processing and Safety Monitoring, Fujian Agriculture and Forestry University, Fuzhou 350002, China (FAFU) – China

## Abstract

Phenolic acids are paying close attention by researchers in plant allelopathy, as well as rice allelopathy. However, there is a lot of discussion and controversy about phenolic acids as rice allelochemicals because of its concentration and effect, when a paper reported that no difference in the amounts of total phenolic acids released between allelopathic and non-allelopathic rice cultivars. As its low concentration released to hydroponic solution, for quite a while, phenolic acids seemed to be excluded from the list of rice allelochemicals. To clarify this confusion, 4-Aminoantipyrine(4-AAP) method, Folin-Ciocalteu(FC) method, and Solid-Phase Extraction/High Performance Liquid Chromatography(SPE-HPLC) were used to compare the levels of phenolic compounds in rice culture solutions. Only 0%-51.2% of recoveries of 8 phenolic acids showed 4-AAP method is inappropriate to evaluate phenolic acids, thus led to the unreal results. By FC method, the total contents of phenolic compounds were always significantly higher in the culture solution of allelopathic rice PI312777 than non-allelopathic rice Lemont at 3-7 leaf stages. The maximum was 710  $\mu\text{g}/\text{plant}$  in PI312777 at the 6-leaf stage, significantly higher than 10  $\mu\text{g}/\text{plant}/\text{day}$  reported earlier by 4-AAP method. By SPE-HPLC, the 7 phenolic acids was 1.29-2.15 folds in PI312777 than in Lemont at 3-7 leaf stages. The cinnamic acid which cannot be determined by 4-AAP method, was 6-times higher in PI312777 than in Lemont at 6-leaf stage. The ferulic acid was 48.54  $\text{ng}/\text{plant}$  in PI312777 at 6-leaf stage and no detection in Lemont. Moreover, various stress conditions up-regulated the biosynthesis of phenolic compounds. The phenolic acids increased the number of *Myxococcus xanthus* which could significantly increased miRNA expression in barnyard grass. Joint effects of ferulic acid and *M. xanthus* led to strongest inhibition on barnyard grass. We suggested phenolic acids, are not the only one, but are essential and principal components in "allelochemical cocktail".

**Keywords:** rice (*Oryza sativa* L.), Allelopathy, phenolic acids, rice exudates, bioactivity

---

\*Speaker

<sup>†</sup>Corresponding author: alexhbb@163.com