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Gama Aminobutyric Acid in Plant Immune Responses: An Emerging Stress Responsive Candidate

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[Introduction]

GABA is a non-proteinogenic amino acid that is mostly known to accumulate in plants in response to many stresses, such as heavy metal accumulation, salinity, heat shock and wounding. The majority of studies about GABA in plants focus on abiotic stress, but reports about the involvement of GABA metabolism and signaling in plant immunity are steadily increasing, concerning both pests and pathogens. Here, we evaluated these emerging mechanisms with a focus on GABA accumulation processes, its mechanisms of action in relation to white-banded plant hopper (WBPH) stress and its interplay with reactive oxygen species.

[Materials and Methods]

Rice cultivar, Ilmi was used in this study. Plant were germinated until 3 weeks and then treated with 5 mM, 10 mM and 15 mM of GABA one week before the inoculation of WBPH. The WBPH were continuously reared in the insectarium in Plant Molecular Breeding lab, Kyungpook National University, Korea. Before the inoculation the insects were starved for two hours by keeping in beaker with wet tissue. The data was collected with different time points according to the experimental design.

[Results and discussion]

The phenotypic evaluation showed that the plants treated with 10 mM and 15 mM of GABA showed high level of resistance to the WBPH as the insect population was less as compared to the control and 5 mM GABA treated plants. We confirmed the exogenous application of GABA also enhance the seedling growth vigor. The plant recovery rate after WBPH infestation was higher in 15 mM and 10 mM GABA treated plants as compared to control and 5 mM GABA treated plants. Furthermore, our results evaluated that GABA application reduces oxidative stress as the H₂O₂, O₂ and electrolytic leakage was reduced in the plants treated with 15 mM and 10 mM GABA respectively, as compared to control plant. Ca⁺ has an essential role in plant endogenous GABA accumulation there for we quantify the Ca⁺ ion and we found that the Ca⁺ ions was significantly increased in the plant treated with exogenous GABA.

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