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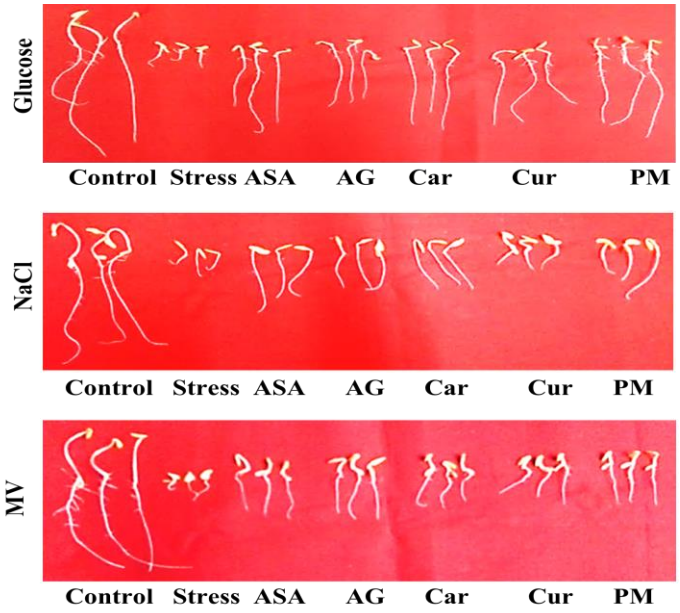
Improving stress tolerance of cucumber, tobacco and rice seedling

By Dr. Bilqeesa Bhat

Researchers at the Agri-biotechnology group, Regional Centre for Biotechnology (RCB), Faridabad have demonstrated small biomolecules can improve the growth of cucumber, tobacco and rice seedlings under stress conditions.

The research team headed by Dr. Vemanna S. Ramu has explored both enzymatic and non-enzymatic mechanisms to prevent cell damage caused by reactive carbonyl compounds (RCC) generated in cucumber, tobacco and rice seedlings under stress conditions. The oxidative stress was induced by exposing the seedling system to glucose, sodium chloride, and methyl viologen.



Growth of seedlings under different seed conditions

Small molecules cause detoxification of harmful RCC generated during stress conditions. Since, RCC are more stable than usual reactive oxygen species, they cause more deleterious impact on the plant cells. RCC damage and degrade proteins and phospholipid which are vital for normal growth and development of plants. Furthermore, the RCC adversely affects the activity and

performance of the seeds during germination and seedling formation. However, Plats have evolved mechanisms to detoxify and repair the damage caused by such reactive molecules.

In tobacco and rice, the enzyme aldo-keto reductase-1 (AKR1) caused detoxification of RCC, malondialdehyde, and methylglyoxal and improves seedling growth under stress conditions. Small molecules such as acetylsalicylic acid, aminoguanidine, carnosine, curcumin and pyridoxamine neutralize RCC non-enzymatically and rescued the cucumber seedling growth during stress conditions. Besides detoxification process, small molecules also prevent cell damage caused by RCC.

The seedling growth plays an important role in adaptation of plant to different environmental factors. Therefore, the study highlights the significance of small molecules which neutralize the harmful effects of RCC and to promote the seedling growth.

Study showed that these molecules can be used in seed treatment processes in agriculture and the enzyme encoding genes may be used as molecular markers and candidates for gene editing in crop improvement programs. The work has been published in the *Journal of Plant Growth Regulation*:

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