

## **Silica Nanoparticles Suppress the Root Rot of *Panax ginseng* from *Ilyonectria mors-panacis* Infection by Reducing Sugar Efflux into Apoplast**

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*Panax ginseng* Meyer (Korean ginseng) is in the spotlight of Oriental medicine and is proclaimed as the king of medicinal plants owing to its adaptogenic characteristics. Ginseng root rot is a devastating disease caused by the fungus, *Ilyonectria mors-panacis* that generally attacks younger roots (~2 years), leading to defects in root quality, ginsenoside accumulation and also life cycle of the plant. Hence, there is an indispensable need to develop strategies resulting in tolerance against ginseng root rot. In the present study, we evaluated the effect of silica nanoparticles(N-SiO<sub>2</sub>) in *Panax ginseng* during *I. mors-panacis* infection. Long term analysis (30 dpi) revealed a striking 50% reduction in disease severity index upon 1mM and 2mM treatment of N-SiO<sub>2</sub>. However, N-SiO<sub>2</sub> did not have any direct antifungal activity against *I. mors-panacis*. Membrane bound sugar efflux transporter, SWEET (Sugars Will Eventually be Exported Transporters) was identified in ginseng and as expected, its expression was suppressed upon N-SiO<sub>2</sub> treatment in the root rot pathosystem. Furthermore, the total and reducing sugars in the apoplastic fluid clearly revealed that N-SiO<sub>2</sub> regulates sugar efflux into apoplast. In a nut shell, N-SiO<sub>2</sub> administration induces transcriptional reprogramming in ginseng roots, leading to regulated sugar efflux into apoplast resulting in enhanced tolerance against *I. mors-panacis*.

**Key words:** *Panax ginseng*, Silica nanoparticles, Ginseng root rot, *Ilyonectria mors-panacis*

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