Influence of Silicon on Resistance of *Zinnia elegans* to *Myzus persicae*

Silicon is the second most abundant element in soil and is readily absorbed by plant roots. Studies have shown that conducting vessels and intra- and intercellular spaces are strengthened by the deposition of silica polymers, which imparts a physical barrier against a variety of folivores and stem borers. Silicon-induced chemical changes may also be responsible for defense against insect herbivores. The objectives of this study were to determine the effects of treating *Zinnia elegans* with K_2SiO_2 on the performance and population fitness of *Myzus persicae,* and quantify defense-related phenolics and peroxidase activity.

Z. elegans plants were irrigated every 2 days with a nutrient solution with or without K_2SiO_2. Quantification of leaf tissues by inductively coupled plasma optical emission spectroscopy (ICP-OES) confirmed significantly higher silicon concentrations in plants treated with K_2SiO_2 than control plants (Figure 1).

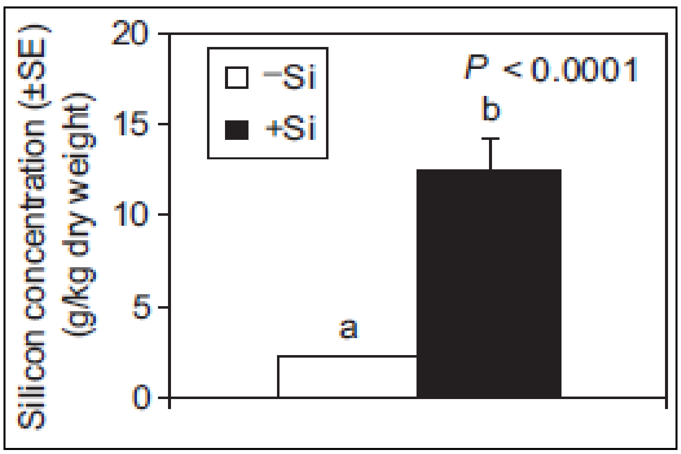

Figure 1. Mean (±SE) silicon concentration in leaves of *Z. elegans* plants irrigated with a nutrient solution amended with potassium silicate (+Si) or a nutrient solution without potassium silicate (-Si). Different letters indicate significant differences.

Length of the prereproductive period and survivorship of *M. persicae* were not affected by K_2SiO_2 treatment, but total cumulative fecundity and the intrinsic rate of increase (r_m) were slightly reduced on *Z. elegans* plants receiving soluble silicon (Figure 2).

High performance liquid chromatography-mass spectrometry (HPLC) was used to confirm and quantify phenolic acids and flavonols in leaf tissue. Only three of ten compounds (5-caffeoylquinic acid, p-coumaroylquinic acid, and rutin) were significantly elevated in tissues of plants treated with K_2SiO_2 (Table 1).

Overall, the results indicate treatment of *Z. elegans* with soluble silicon provides a modest increase in resistance levels to *M. persicae*, which may be caused by defense-related compounds.

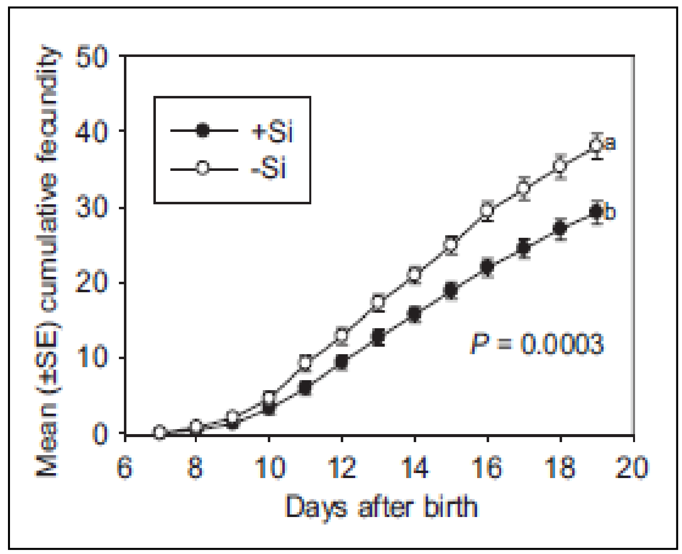

Figure 2. Mean (±SE) cumulative fecundity of the green peach aphid, *M. persicae*, confined to leaves of *Z. elegans*. Different letters indicate significant differences in offspring production 18 days after birth.

Compound	Mean ± SE concentration (μg/g of dry weight)[a]		P
	+Si	−Si	
5-Caffeoylquinic acid	2436.38 ± 30.92a	1944.72 ± 6.93b	0.0001
p-Coumaroylquinic acid	930.16 ± 2.71a	835.80 ± 8.64b	0.0005
Dihydroxycinnamoyl amide	330.64 ± 1.69a	318.24 ± 6.22a	>0.05
Rutin	165.47 ± 9.52a	126.66 ± 4.53b	0.032
Phloridzin	33.19 ± 0.73a	37.03 ± 0.88a	>0.05
Quercetin	22.13 ± 0.98a	22.33 ± 5.60a	>0.05
Quercetin-3-rhamnoside	16.39 ± 2.64a	18.90 ± 5.06a	>0.05
Luteolin-3-galactoside	6.01 ± 2.98a	1.01 ± 1.00a	>0.05
Isorhamnetin-3-galactoside	4.49 ± 0.61a	6.94 ± 0.99a	>0.05
3,5-Dicaffeoylquinic acid	1.93 ± 0.85a	2.48 ± 1.09a	>0.05

[a] Means followed by the same letter in a row are not significantly different ($\alpha = 0.05$; Tukey's studentized range [HSD] test; $n = 5$ for each treatment).

Table 1. Phenolic acid and flavonol derivatives quantified from leaves of *Z. elegans*.

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Ranger, C., A.P. Singh, J.M. Frantz, L. Canas, J.C. Locke, M.E. Reding, and N. Vorsa. 2009. Influence of silicon on resistance of *Zinnia elegans* to *Myzus persicae* (Hemiptera: Aphididae). Env. Entomol. 38:129-136.