Nano-silver treatment reduces bacterial proliferation and stem bending in cut gerbera flowers: an *in vitro* and *in vivo* evaluation

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Postharvest Biology and Technology, Volume 180, October 2021, 111595

Abstract

Stem bending during vase time is a major problem in many cultivars of cut gerbera flowers. In this study, we focused on the involvement of postharvest bacteria and evaluated the efficacy of nano-silver (NS) in reducing bacterial proliferation and stem bending in cut gerbera 'Real' flowers *in vitro* and *in vivo*. Four species of dominant bacteria, *Pseudomonas* sp., *Acinetobacter junii*, *Bacillus stearothermophilus*, and *Myroides* sp., were isolated from the stem ends of cut gerberas. Exogenous addition of 3–5 $\log_{10}$ colony forming units (CFU) mL^{-1} of each bacterial species resulted in a sharp reduction in vase life, relative fresh weight, and water uptake of cut gerbera flowers. However, *Pseudomonas* sp. had little impact on their vase life and ornamental quality at concentrations of 3–4 $\log_{10}$ CFU mL^{-1}. *In vitro* assessments showed that the minimum inhibitory concentrations (MICs) of NS for both *A. junii* and *Myroides* sp. were 2.5mgL^{-1}, and NS MICs for *B. stearothermophilus* and *Pseudomonas* sp. Were 5 and 7.5mgL^{-1}, respectively. Additionally, compared with the control, pretreatment with 5 and 10mgL^{-1} NS for 24h nearly doubled the vase life of cut gerberas, maintained their relative fresh weight, and improved water uptake. Furthermore, scanning electron microscopy revealed that the NS pretreatment reduced bacterial colonization on the stem ends. Overall, our findings indicate that all four genera of dominant bacterial species isolated from the stem ends of cut gerberas are involved in stem bending, and NS pretreatment effectively alleviated bacteria-induced xylem blockage and improved water uptake, thereby reducing the incidence of stem bending and extending the vase life of cut gerberas.