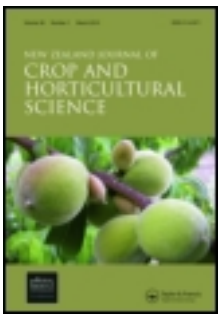

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Silver thiosulphate reduces ethylene-induced flower shattering in Thalictrum delavayi

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Short communication

Silver thiosulphate reduces ethylene-induced flower shattering in *Thalictrum delavayi*

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Abstract Prevention of ethylene-induced flower shattering in stems of *Thalictrum delavayi* Franch. 'Hewitts' Double', a new cut flower crop, was investigated. Three days after exposure to 10 μl/litre ethylene, 41% of flowers had shattered on stems pulsed in distilled water, resulting in a vase life of 4 days. In the presence of ethylene, stems pulsed with silver thiosulphate (STS) at concentrations of $Ag^+ \geq 0.2$ m*M* exhibited 36% less flower shattering than control stems, resulting in a vase life of 11 days. The proportion of flowers exhibiting Ag^+ phytotoxicity increased with concentration, but at 0.2 m*M* Ag^+ the incidence was not different from stems pulsed in distilled water. Pulsing cut stems of *T. delavayi* 'Hewitts' Double' with STS solutions containing 0.2 m*M* Ag^+ should reduce ethylene induced flower shattering and extend vase life.

Keywords cut flower; phytotoxicity; vase life; postharvest quality

INTRODUCTION

Thalictrum delavayi Franch. 'Hewitts' Double' has considerable potential for the New Zealand cut flower industry in overseas markets. This potential is hindered however, by a loss in market quality and vase life caused by premature shattering of flowers. Flower shattering has been induced on stems of *T. delavayi* 'Hewitts' Double' by exposure to 10 μl/litre ethylene (Hansen unpubl. data), a similar concentration to that encountered in the market chain for other cut flowers (Maxie et al. 1973). Pulsing stems with silver ions (Ag^+) in formulations of silver thiosulphate (STS) reduced flower shattering in cut stems of *Antirrhinum majus* (Farnham et al. 1980) and increased vase life of *Dianthus caryophyllus* (Halevy & Kofranek 1977). We, therefore, investigated whether pulsing flower stems of *T. delavayi* 'Hewitts' Double' with STS would reduce ethylene-induced flower shattering.

MATERIALS AND METHODS

The experiment was a completely randomised design with a factorial arrangement of four STS concentrations (0, 0.2, 0.4, or 0.6 m*M* Ag^+), with or without subsequent exposure to ethylene. Each treatment contained 10 individual stem replicates. Stems with 153 ± 11 flowers (59 ± 5 open flowers) were pulsed in STS treatment solutions for 20 min at 16 ± 1°C. After pulse treatment, stems were stood in individual tubes containing distilled water. Stems from each STS treatment were randomly placed into one of two sealed 150-litre chambers. A 1.5 ml volume of ethylene was injected into one chamber to give an estimated 10 μl/litre. After 24 h exposure at 16 ± 1°C, the ethylene concentration in the treated chamber was determined to be 8 μl/litre, while 4×10^{-3} μl/litre was detected in the control chamber. Stem quality and vase life were evaluated subsequently by placing stems under constant conditions of 20 ± 2°C, 60 ± 10% relative humidity,

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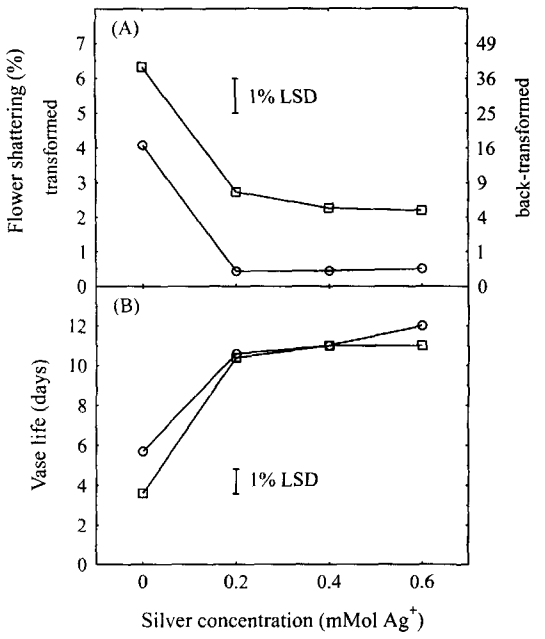

Fig. 1 Influence of Ag^+ concentration and exposure to ethylene (○ = 0 µl/litre; □ = 10 µl/litre) on: **A**, proportion of flowers shattered after 3 days; and **B**, vase life of cut stems of *Thalictrum delavayi* 'Hewitts' Double'. Each data point represents the mean of 10 stems. The LSD in **A** represents the square-root transformed data.

and a 12-h photoperiod with an irradiance of 2.14 µmol/m^2 per s at bench level from Osram® cool-white fluorescent tubes. Vase life was determined as the number of days before ≥ 50% of the total flower number had shattered, or exhibited Ag^+ phytotoxic symptoms, or both. Flower shattering was defined as petal abscission to expose receptacle tissue. Phytotoxicity was defined as the percentage of flowers showing blackening of petals.

Flower shattering and phytotoxicity data were square root transformed to stabilise variance. Data were subjected to an analysis of variance using the general linear models procedure of SAS (SAS Institute 1988). Means reported are based on the back-transformed data.

RESULTS AND DISCUSSION

Ethylene exposure significantly ($P < 0.01$) increased flower shattering on stems pulsed in distilled water, reaching 41% after 3 days (Fig. 1A). In the presence of ethylene, stems pulsed with STS exhibited 36% less flower shattering than control stems ($P < 0.01$). Concentrations of $Ag^+ \geq 0.2$ m*M* did not further reduce the incidence of flower shattering. Farnham et al. (1980) working with *A. majus*, reported that a 1 h pulse in a ≥ 0.1 m*M* STS solution prevented flower shattering. Similar reductions in flower shattering were achieved in this study with a 20 min pulse in 0.2 m*M* Ag^+ as STS.

Incidence of Ag^+ phytotoxicity was unaffected by ethylene exposure ($P < 0.01$), therefore data were pooled. At 0.2 m*M* Ag^+ the incidence was not significantly different from stems pulsed in distilled water ($P > 0.01$). The proportion of flowers exhibiting phytotoxicity increased linearly over concentrations of 0.2–1.8 m*M* Ag^+, with 27% phytotoxicity occurring at 3.8 m*M* Ag^+ (Hansen unpubl. data). At 0.6 m*M* Ag^+, 2% of flowers (c. 3 flowers/stem) exhibited phytotoxic symptoms. Reid et al. (1980) encountered Ag^+ phytotoxicity with *D. caryophyllus* when stems contained ≥ 5 µmol Ag^+. In our investigation, estimates of Ag^+ content (Reid et al. 1980), based on an uptake rate per stem of 7.5 × 10^{-3} litres/h, resulted in concentrations of c. 0, 0.5, 1, or 1.5 µmol Ag^+ per stem for each of the four treatments, respectively. Hence Ag^+ phytotoxicity was encountered at concentrations as low as 0.5 µmol per stem, suggesting that *T. delavayi* is more sensitive to Ag^+ than *D. caryophyllus*.

Exposure to ethylene reduced vase life of control stems by 2 days ($P < 0.01$; Fig. 1B). Pulse treatment with STS increased vase life to 11 days, even in the presence of ethylene ($P < 0.01$). Vase life was not increased ($P > 0.01$) further by concentrations of $Ag^+ \geq 0.2$ m*M* (≈ 0.5 µmol Ag^+ per stem). Reid et al. (1980) similarly noted that a minimum Ag^+ concentration of 0.5 µmol per stem was necessary to prolong the vase life of *D. caryophyllus*.

Pulsing cut stems of *T. delavayi* 'Hewitts' Double' with STS solutions containing 0.2 m*M* Ag^+ should reduce ethylene-induced flower shattering and extend vase life.

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