Effect of Silver-thiosulfate Pretreatment on Vase Life of Cut Standard Carnations, Spray Carnations, and Gladiolus, after a Transcontinental Truck Shipment

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Abstract. Treatment of ‘Scania’ standard carnations and ‘Elegance’ spray carnations (Dianthus caryophyllus L.) with silver thiosulfate and the biocide Physan before shipment markedly extended shelf life in deionized water after arrival. The treatment extended vase life of ‘Scania’ and ‘Elegance’ 11.5 and 5.2 days, respectively, over controls. Pretreatment of ‘Captain Busch’ gladiolus (Gladiolus X hortulanus L. H. Bailey with silver thiosulfate alone or with a 10% sucrose pulse improved the quality of the spikes but did not extend vase life after shipment.

The adverse effect of ethylene on cut carnation flowers is well established (5, 9, 11) and ethylene is often a serious problem during their storage and transport. The sensitivity of cut carnations to ethylene can be reduced by proper temperature control (10), pulsing with sucrose solutions (9) and impregnating the stems with AgNO₃ (7). These treatments, especially impregnation with AgNO₃ combined with a pulse in 10% sucrose, proved very beneficial for air or truck-shipped flowers (4, 7). Silver ion has been shown to have a very pronounced antiethylene effect on horticultural crops (1) but is not transported up the stems of cut carnations (6).

Veen and van de Geijn (15) showed that the silver thiosulfate complex (STS) moves readily in the stem of carnation flowers, and this material has been used successfully to delay senescence of standard and miniature carnations (12, 13, 15). It is not known to what extent gladiolus flowers are sensitive to ethylene; some beneficial response to STS was found in laboratory experiments (2). The purpose of this study was to test the effect of STS pretreatment and a sugar pulse on the vase life of flowers following an actual or simulated transcontinental truck shipment.

Flowers. ‘Scania’ standard carnation, ‘Elegance’ spray carnation and ‘Captain Busch’ gladiolus flowers were obtained freshly cut in the morning from commercial growers and kept dry at 4°C until they were chemically treated later the same day in Mountain View, CA.

Chemical treatment. STS soln containing 4 mM silver were prepared as previously reported (12). Stems of standard carnations and gladiolus were immersed in the solution for 15 min, those of miniature carnations were immersed for 30 min (13). Control flowers were similarly pretreated in deionized water.

After pretreatment, carnations were transferred either to 200 ppm Physan, a quaternary ammonium compound (3) or to 200 ppm Physan plus 10% sucrose. Gladiolus stems were transferred to a pulsing solution containing 50 ppm silver nitrate, 300 ppm aluminum sulfate and 250 ppm 8-hydroxyquinoline citrate with 10% sucrose (8) or 200 ppm Physan.

All flowers were held for 1 hr at about 26°C and were then transferred to a refrigerator for an additional 15 hr (overnight) at 4.4°C in the various solutions. The flowers were then divided into 2 lots and packed in standard cardboard half-boxes. One box was shipped in a refrigerated truck to Beltsville, Maryland. The temperature at packing was 21°C and the temperature of the flowers gradually fell to 4.4°C during the first 12 hr en route. Temperatures were measured by a Therma-Gard thermorecorder packed in the carton. The second box was brought to Davis, California stored at 5.6°C until the truck shipment arrived. When
the box of flowers arrived at Beltsville 82 hr later, the flowers were removed at both locations and placed in deionized water after cutting the stems. The room temperature at Beltsville was 20° and at Davis was 23°. The continuous illumination at both locations was 1.1 kl from fluorescent lamps. The water was changed on day 4 for gladiolus and carnations and once again on day 10 for carnations only.

**Data records.** The carnations were scored daily. Flowers showing the first visible signs of shriveling petals or browning of the petal edges (of those pretreated with STS) were discarded. Miniature carnations were discarded when these symptoms were visible in the first open flower of a spray (13). Gladiolus spikes were scored on the 4th, 7th and 10th day. The diameter of the 8th floret on day 7 was measured and the total number of open and wilted florets was counted on day 10 before the spikes were discarded.

**Standard and miniature carnations.** A short pretreatment of standard and miniature carnations with STS prior to an 82 hr transcontinental shipment by refrigerated truck had the most beneficial effect on the longevity of these flowers (Tables 1 and 2). STS increased the mean vase life of standard carnations by 11.5 days and that of miniature carnations by 5.2 days. The vase life of pretreated ‘Scania’ standard carnations was almost 3 times that of the controls. Five days after shipment, the untreated ‘Scania’ flowers showed first signs of wilting and they were all discarded by day 8. STS pretreated ‘Scania’ started to wilt on day 14 (10.5%), but 32% were still unwilted on day 20. These results are in agreement with our previous laboratory experiments (12), and are better than any of the silver or pulse treatments employed prior to truck shipment by Haley et al. (7).

The response of miniature carnations to STS pretreatment was very beneficial although less pronounced than that of standard carnations. Most of the untreated ‘Elegance’ flowers were discarded by day 10. STS-pretreated ‘Elegance’ began to wilt on day 9 but by day 13, only 37.5% of the flowers had been discarded. The vase life of treated flowers after shipment was thus more than 60% greater than that of controls. The response of miniature carnations to STS treatment has been reported to be dependent on the cultivar (13) and may require less silver than standard carnations (14).

**Gladiolus.** STS pretreatment and a sugar pulse alone or combined had a slight beneficial effect on the number of open florets, reduction in wilting and floret diameter after 7 days in the vase (Table 3). A previous study (2) showed a small beneficial effect of STS on gladiolus flowers. This response does not appear to be large enough to justify use of STS for gladiolus in commercial practice.

The poor response of the flowers to a sucrose pulse may have resulted from inadequate absorption of the pulsing solution. In these experiments, the flowers were in a sucrose solution 1 hr at 26°C and an additional 15 hr at 4.4°C. In previous test shipments Haley et al. (7) treated flowers in a pulse solution at 22° for 16 hr where the uptake of sucrose may have been greater. For miniature carnations the major benefit of a sugar pulse is the promotion of opening of axillary buds (4). In our experiment the miniature carnation inflorescences (sprays) were discarded when the first floret showed signs of wilting, because a correlation was found between the wilting of the first floret and the longevity of the entire spray (13). The quality factor that affects the total number of open florets of the spray and their longevity should perhaps be considered in future experiments.
Literature Cited


