1-Methylcyclopropene Prevents Bud, Flower, and Leaf Abscission of Geraldton Waxflower

Margrethe Serek¹

The Royal Veterinary and Agricultural University, Department of Agricultural Sciences, Section of Horticulture, Rolighedsvej 23, 1958 Frederiksberg C., Denmark

Edward C. Sisler²

North Carolina State University, Department of Biochemistry, Raleigh, NC 27695

Tsipora Tirosh³ and Shimon Mayak²

The Hebrew University of Jerusalem, The Kennedy-Leigh Center for Horticulture Research, Faculty of Agriculture, P.O. Box 12, Rehovot 76-100, Israel

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Geraldton waxflower (*Chamelaucium uncinatum* Schauer) is one of the major cut flowers in Israel, and is exported to many European countries (Israel Flower Marketing Board—Agrexco, 1994). However, long-distance transport, usually in darkness and without water, with possible exposure to exogenous ethylene during distribution, causes extensive abscission of floral organs (Joyce, 1988, 1989, 1993). Exposure of the sprigs to ethylene causes bud and flower abscission, and the most successful preventive treatment to date is pulsing with the anionic silver thiosulfate complex (STS), an inhibitor of ethylene action (Joyce, 1988, 1989). Recently, a new, nontoxic inhibitor of ethylene action, 1-methylcyclopropene (1-MCP), has been introduced (Serek et al., 1994, 1995; Sisler et al., 1995). This compound appears to act as a competitive and apparently irreversible inhibitor of ethylene binding (Sisler et al., 1995). Treatment with 1-MCP at very low concentrations effectively eliminates the effects of ethylene on ethylene-sensitive potted plants and cut flowers (Serek et al., 1994, 1995; Sisler et al., 1995).

The purpose of these experiments was to evaluate the effectiveness of 1-MCP in preventing abscission of plant organs from flowering branches of Geraldton waxflower.

Plant material. Cut flowering branches of Geraldton waxflower ('Wendy'), with 30% of their flower buds fully opened, were obtained from a local nursery and transferred to our laboratory at the Faculty of Agriculture in Rehovot, Israel. From harvest until initiation of the experiments, the flowers were maintained in deionized water at 21°C.

1-MCP and ethylene treatments. Geraldton waxflower sprigs were held in deionized (DI) water and placed in 130-liter Plexiglass chambers illuminated by cool-white fluorescent lamps (Tadiran, Israel) at an irradiance of 14 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$, at 21°C, and ethylene (2 $\mu\text{l}\cdot\text{liter}^{-1}$) and 1-MCP (200 $\text{nl}\cdot\text{liter}^{-1}$) were injected into the chambers. Treatments were as follows: 1) 13 h 1-MCP then 6 h air; 2) simultaneous 13 h 1-MCP and ethylene then 6 h air; 3) 6 h 1-MCP then simultaneous 13 h 1-MCP and ethylene; 4) 13 h ethylene then 6 h air; 5) 19 h air (control). At the end of the treatments, the sprigs were removed and placed under the light and temperature conditions noted, including 50% to 60% relative humidity (RH). The sprigs were arranged in a randomized complete-block design, with six replications per block. Bud and flower abscission were recorded 1 day after termination of the treatments.

Dry storage. 1-MCP-treated (200 $\text{nl}\cdot\text{liter}^{-1}$ for 6 h) or nontreated (control) sprigs were packed dry in paper bags (six replications per block), and held for 72 h at 21°C and 50% to 60% RH in darkness. Following storage, the stems of the sprigs were recut, placed in DI water under light at 14 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$, 21°C, and 50% to 60% RH. Following 48 h of dry storage, cumulative bud or flower and leaf abscission were recorded.

1-MCP reduced bud and flower abscission in response to ethylene when 1-MCP and ethylene were applied simultaneously and was even more effective when 1-MCP was applied 6 h before ethylene treatment (Table 1). No buds or flowers dropped or senesced from 1-

MCP-treated or nontreated (control) sprigs kept in air.

Bud, flower, and leaf abscission from dry-stored Geraldton waxflower sprigs treated with 1-MCP was reduced by 36, 47, and 28 percentage points, respectively, as compared to the controls (Table 2).

Extensive dehydration may occur during shipment and storage of flowers. Dehydration may elevate ethylene production, leading to abscission of leaves, buds, and flowers. Joyce (1993) reported that bud and flower abscission in waxflower sprigs, induced by water deficit, were reduced by pretreatment with STS. This observation suggests involvement of ethylene in abscission during postharvest handling. In our experiment, 1-MCP, an alternative to STS, strongly reduced bud, flower, and leaf abscission caused by stresses associated with dry storage.

The dramatic inhibition of the effects of ethylene in Geraldton waxflowers by 1-MCP treatment suggests that the use of this simple, nontoxic, organic compound will be a viable replacement for the currently commercially used STS complex.

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Table 1. Effect of ethylene and 1-MCP on bud or flower abscission (%) from freshly harvested Geraldton waxflower.

Treatments	Abscission (%)	
	Bud	Flower
Control	0 a ^z	0 a
1-MCP	0 a	0 a
Ethylene	56 c	40 b
1-MCP + ethylene, simultaneously	14 b	8 a
1-MCP then ethylene	0 a	1 a

^zMean separation in columns at $P \leq 0.05$ by t test probability values for the hypotheses H_0 : LSM(i) = LSM(j).

Table 2. Bud, flower, and leaf abscission from dry-stored Geraldton waxflower sprigs following treatment with 1-MCP.

1-MCP	Abscission (%)		
	Bud	Flower	Leaf
–	55 a ^z	57 a	49 a
+	19 b	10 b	21 b

^zMean separation in columns are statistically different at $P \leq 0.01$ by orthogonal comparisons.

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¹Associate Professor; to whom reprint requests should be addressed.

²Professor.

³Technician.