ABSCISSION IN FITTONIA VERSCHAFFELTII (LEM.) COEM. VAR. ARGYRONEURA (COEM.) NICHOLS

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Abstract. Plants of Fittonia verschaffeltii (Lem.) Coem. var. argyroneura (Coem.) Nichols were exposed to ethylene at 2 temperatures, in light and darkness and with added CO₂. Plants exposed to levels of ethylene at or greater than 5 μl/liter air for 2-4 days abscised 50% or more of their leaves. Plants exposed to 1-10 μl ethylene/liter air for 1 day were not injured. Plants exposed to 5 μl ethylene/liter air in light or darkness abscised similar numbers of leaves. Plants exposed to 5 μl ethylene/liter air abscised fewer leaves at 16° C than at 23.5° C. Plants exposed to 5 μl ethylene/liter air containing an additional 5% CO₂ abscised fewer leaves than plants held in ethylene without additional CO₂.

In 1977, the wholesale value of tropical foliage plants in the United States was about $271 million (2). About 44% of these plants were grown in Florida and shipped to northern and midwestern markets. Typically the plants are placed in cartons, sealed and shipped. During the 2-4-day shipping period plants may be subjected to temperature extremes, ethylene toxicity or other stress conditions. Plants may arrive at their destination in an unsaleable condition and recover slowly (1, 3, 6). Effects of ethylene and other environmental factors have been defined for heart leaf philodendron (8), geranium (7), rose plants (9, 11, 4) and holly (10). In these plants, ethylene toxicity is manifested by leaf abscission, chlorosis, growth retardation or a combination of these symptoms. The nerve plant, (Fittonia verschaffeltii (Lem.) Coem. var. argyroneura (Coem.) Nichols), is a popular foliage species. Only one report has been published on the postharvest handling of this species. Harbaugh et al. (5) reported that Fittonia plants sealed in clear polyethylene packages were marketable for 60 days. There are no published reports on the effects of ethylene in Fittonia.

I now report the effects of ethylene in combination with temperature, light and carbon dioxide on leaf abscission in Fittonia.

Methods and Materials

The general procedures for mixing ethylene and air, distributing gases and maintaining temperatures were similar to methods previously reported (8). Initially, plants were exposed to 0, 1, 5 and 10 μl ethylene/liter air for 1 to 4 days. Subsequently, plants were exposed to 5 μl ethylene/liter air at various environmental regimes (i.e., light or darkness, 16° or 23.5°C, ambient CO₂ or 5% CO₂ added to air).

Fittonia plants, grown in 7.5-cm pots, were obtained from commercial sources and held in a greenhouse (minimum 21-22°C, night temperature) at the Agricultural Research and Education Center, Bradenton until tests were initiated. For each experiment, a group of plants was selected for uniformity in size and leaf number. A minimum of 6 plants were used per treatment. Leaves were counted before and immediately after exposure to ethylene. The plants were then placed in the greenhouse and observed for 1 to 4 days. All ethylene treatments were given in a laboratory maintained at 23.5°C, except when temperature was an experimental variable.

Results

Leaf abscission was the primary symptom of ethylene toxicity in Fittonia, and it occurred in plants exposed to ethylene for 2 days (Table 1). Plants exposed to ethylene (1-10 μl) for 1 day showed no visible symptom of injury and did not abscise any leaves. Plants exposed for 2 days or longer to 5 and 10 μl ethylene/liter air abscised more leaves than plants exposed for corresponding durations to 1 μl ethylene/liter air (Tables 1, 2).

Light had no influence on the number of leaves abscised. Plants held in light or darkness in 5 μl ethylene/liter air for 3 days abscised equivalent numbers of leaves (Table 3).

Table 1. Leaves abscised in Fittonia verschaffeltii exposed to ethylene for 1 or 2 days at 23.5°C in light.

<table>
<thead>
<tr>
<th>Ethylene level (μl/liter)</th>
<th>Exposure time (days)</th>
<th>After exposure (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>0</td>
</tr>
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<tr>
<td>10</td>
<td>2</td>
<td>2.0</td>
</tr>
<tr>
<td>Gase control</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

*1.5 Klx light for 12 hr/day.

Plants held at 23.5 or 16°C in darkness without ethylene did not abscise any leaves. Plants exposed to 5 μl ethylene/liter air at 23.5°C for 3 days abscised 25-3 % times as many leaves as those treated similarly but at 16°C (Table 4).

Plants held in light in air at ambient CO₂ levels or in air with the addition of 5% CO₂ did not abscise any leaves (Table 5). Plants held in 5 μl ethylene/liter air for 2 days abscised most of their leaves in the absence of additional CO₂ and only a few leaves in the presence of 5% added CO₂.

Discussion

Ethylene caused considerable injury in Fittonia, the most severe of which was leaf abscission. The response of Fittonia to ethylene was similar to that of Philodendron (8). Both Fittonia and Philodendron required an exposure of 5 μl ethylene/liter air for at least 2 days for abscission (Table 1) (8), and longer durations caused severe injury (Table 2) (8).
In these tests, *Fittonia* plants responded similarly to ethylene in light and in darkness (Table 3). Plants may respond to ethylene differently in light and darkness, depending on the species. Ethylene-induced leaf abscission in *Philodendron* plants was more extensive in light than in darkness (8), whereas ethylene-induced leaf chlorosis in geranium plants was more extensive in darkness than in light (7).

Low temperature reduced the rate of abscission in *Fittonia*. Plants held in ethylene at 16°C abscised fewer leaves than those held in ethylene at 23.5°C. Similar results have been observed by others working with *Philodendron* (8), roses (11), holly (10), and geranium (7). Marousky and Harbaugh (6, 8) suggested that foliage plants be handled and shipped at 16°C. This temperature is above the chilling level but below that at which the physiological activity of ethylene is optimum (1). *Fittonia* plants packaged, handled and shipped at cool temperatures (i.e. 16°C) are less likely to be injured should the ethylene level increase. Harbaugh et al. (5) reported that *Fittonia* held in sealed clear polyethylene packages in the dark for 4 days at 16°C to simulate shipping had acceptable commercial quality.

High levels of CO₂ inhibit the action of ethylene (1). Plants exposed to ethylene in air abscised most of their leaves, but only a few if they were also exposed to additional CO₂ (Table 5). Similar findings have been reported for a number of ornamental crops (1, 7, 8, 9, 10, 11).

While no specific guidelines can be proposed for the commercial handling, packaging and shipping of *Fittonia* plants on the basis of my study, some suggestions could be made. Plants should be maintained at cool temperatures (16°C, i.e. above chilling level) during the handling and transit periods. Should the level of ethylene rise during these periods, damage would be less likely at low temperatures, for physiological activity of ethylene decreases with decreasing temperature. Also, minimizing the duration in which the plants remain packaged would reduce the potential for ethylene build-up thus, if maintained at 16°C and for the minimum time within packages and in transit, plants should arrive at their destination with maximum quality.

**Literature Cited**