Development of Gray Mold of Poinsettia and Powdery Mildew of Begonia and Rose Under Split Night Temperatures

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ABSTRACT

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Under four different regimes of split night temperatures (10 C night minimum, 17 C day minimum) and continuous temperatures of 17 C, no significant increase in incidence of gray mold of poinsettia (caused by *Botrytis cinerea*) occurred and no significant change in severity of powdery mildews of rose and begonia (caused by *Sphaerotheca pannosa* and *Erysiphe cichoracearum*, respectively) occurred. At continuous 10 C, incidence of gray mold was significantly higher, severity of begonia powdery mildew was significantly lower, and severity of rose powdery mildew was unchanged compared with continuous 17 C.

Methods currently under evaluation to conserve energy in greenhouse operation involve changes in structure, equipment, energy sources, and growing practices (9). Reducing greenhouse temperatures from 18 to 13 C provided an estimated 26% fuel savings when the outside temperature was −2.2 C (9). However, lowered growing temperatures can increase production time, particularly when they are maintained throughout the night (2). An alternative method involving split night temperature (lowering the temperature for a portion of the night) has been suggested to be more economically feasible because the growth of many plants is not significantly affected by this energy-saving technique (2,6). However, the effects of such a regime on disease development have not been assessed for many crops and could potentially change the overall economic outcome of greenhouse crop production.

The objective of this work was to determine the effect of split night temperatures on the incidence of gray mold of poinsettia (*Euphorbia pulcherrima* Willd.) caused by *Botrytis cinerea* Pers. ex Fr. and on the severity of powdery mildew on rose (*Rosa hybrida* L.) and begonia (*Begonia* × *hiemalis* Fotech.) caused by *Sphaerotheca pannosa* (Wallr.) Lév. and *Erysiphe cichoracearum* DC., respectively. Some effects of lower night temperatures on plant growth and development have been documented (2,4–6).

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MATERIALS AND METHODS

Six greenhouse temperature regimes were established in the winter of 1979–1980 within the limits permitted by prevailing weather. Heating or solar radiation provided the minimum temperatures, and thermostats were set to control heating at the times and temperatures listed in Tables 1 and 2. No attempts were made to control the relative humidity (RH), which generally increased as temperatures decreased.

Plants of each species were grown in plastic pots in a medium of peat, perlite, vermiculite, and sandy loam (2:1:1:1 by volume) amended with fritted trace elements at 2.6 g/m^3 and limed to pH 6.5. Fertilization, watering, and insect control were consistent with procedures in use for commercial production of the crop (4).

Plants of Annette Hegg Top Star poinsettia, potted in 12.5-cm pots and grown for 8 wk under standard production temperatures, were placed under the different temperature regimes. Leaves and bracts were inoculated by spraying to runoff with a conidial suspension of *B. cinerea* (1.4–1.6 × 10^6 conidia per milliliter of 0.04% aqueous solution of Tween 20) prepared from cultures grown on potato-dextrose agar. Gray mold incidence at the end of 4, 14, 28, and 63 days was determined by estimating the percentage of leaves and bracts showing disease symptoms.

Young plants of Nixe begonia were transplanted from 6-cm to 12.5-cm pots. After 2 wk under standard production temperatures, plants were inoculated by spraying with a conidial suspension of *E. cichoracearum* (0.8–4.0 × 10^5 conidia per milliliter of 0.04% Tween 20) obtained from infected begonias. Plants were subjected to low-pressure, intermittent mist at 21 C for 24 hr, and then placed under the different temperature regimes. Severity was rated

Table 1. Effects of split night temperatures on incidence of *Botrytis cinerea* on the leaves and bracts of *Euphorbia pulcherrima* cv. Annette Hegg Top Star at four time intervals after inoculation

Temperature regime		Incidence[z]			
		Days after inoculation			
Minimum temperature (C)	Hours of day	4	14	28	63
17	0000–2400	0 a	0 a	7 a	22 a
17 10	0900–0200 0200–0900	1 a	3 a	5 a	15 a
17 10	0900–2300 2300–0900	0 a	1 a	6 a	9 a
17 10	0900–2000 2000–0900	0 a	1 a	5 a	11 a
17 10	0900–1700 1700–0900	0 a	3 a	7 a	16 a
10	0000–2400	3 a	9 a	24 a	44 b

[z] Incidence is percentage of leaves and bracts showing disease symptoms. Means in a column followed by the same letter are not significantly different according to Student-Newman-Keuls test (8), $P = 0.05$.

Table 2. Effects of split night temperatures on severity of powdery mildew on *Begonia* × *hiemalis* cv. Nixe at three time intervals after inoculation with *Erysiphe cichoracearum*

Temperature regime		Severity[z]		
		Weeks after inoculation		
Minimum temperature (C)	Hours of day	2	4	6
17	0000–2400	4 c	6 bc	6 b
17 10	0900–0200 0200–0900	2 a	5 b	6 b
17 10	0900–2300 2300–0900	3 b	6 bc	6 b
17 10	0900–2000 2000–0900	4 c	5 b	6 b
17 10	0900–1700 1700–0900	1 a	3 a	5 b
10	0000–2400	1 a	3 a	4 a

[z] Severity rating scale of estimated percentage of leaf area covered by conidia and conidiophores: 1 = 0–2%, 2 = 3–5%, 3 = 6–10%, 4 = 11–25%, 5 = 26–50%, 6 = 51–100%. Means in a column followed by the same letter are not significantly different according to Student-Newman-Keuls test (8), $P = 0.05$.

visually at the end of 2, 4, and 6 wk as the estimated percentage of leaf area covered by conidia and conidiophores: 1 = 0–2%, 2 = 3–5%, 3 = 6–10%, 4 = 11–25%, 5 = 26–50%, and 6 = 51–100%.

Dormant budded plants of rose cultivars Forever Yours, Pink Perfection, Volare, and White Satin grown in 30-cm pots in the greenhouse for 6 mo or longer were inoculated by spraying to runoff with a conidial suspension of *S. pannosa* ($0.6–2.0 \times 10^5$ conidia per milliliter of 0.04% Tween 20) obtained from infected rose leaves. Plants were subjected to low-pressure, intermittent mist at 21 C for 24 hr, and then placed under the different temperature regimes. Mildew severity was estimated as for begonia at 3, 5, and 6 wk after inoculation.

Treatments were replicated four times, and each experiment was repeated at least once.

RESULTS AND DISCUSSION

Poinsettias grown under split night temperature regimes showed no significant difference in incidence of gray mold on leaves and bracts compared with a continuous higher temperature (17 C) (Table 1). Only when the 10 C minimum was extended to 24 hr per day did the incidence of gray mold show a significant increase after several weeks. Increased RH at the cooler temperatures may explain the increased incidence of *B. cinerea* on poinsettia production would not be feasible at such low minimum day temperatures (7), this result is not significant in the commercial greenhouse production of poinsettia.

Powdery mildew severity was significantly decreased on begonias grown under the regime of 16 hr of 10 C and when the 10 C minimum was extended to 24 hr per day (Table 2).

No significant differences existed in the severity of powdery mildew of roses among the temperature regimes, and data are not presented. This result is consistent with known effects of temperature and RH on rose mildew (1).

In conclusion, this work indicates that increased disease would not be expected with gray mold of poinsettia or powdery mildew of rose and begonia if similar split night temperatures were used to reduce fossil-fuel costs in greenhouse operations.

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