Paclobutrazol Affects Growth and Flower Bud Production in Gardenia under Different Light Regimes

A.P. Kamoutsis1 and A.G. Chronopoulou-Sereli2
Department of General Sciences, Agricultural University of Athens, Iera Odos 75-Athens 118 55, Greece

E.A. Paspatis1
Benaki Phytopathological Institute, S. Delta 8-Kiphissia 145 61, Greece

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Abstract. The effects of several shading materials on the response of Gardenia jasminoides Ellis to paclobutrazol were investigated under greenhouse conditions. The three main plot treatments were shading (0%, 67%, 98%), and paclobutrazol (0.0, 0.5, 1.0, and 2 mg/pot) was applied as a soil drench in each main plot after pinching the plants. Both plant size and the number of flower buds per plant decreased as the rate of paclobutrazol increased at all levels of shading. The efficacy of paclobutrazol, however, was generally less under heavy shade, as both translocation of the growth retardant and photosynthesis were reduced. Moderate shading (67%) did not affect the size of plants receiving 0.0 or 0.5 mg of paclobutrazol per pot, but plants grown under heavy shade (98%) were 74% as large as similarly treated nonshaded plants. Medium shade reduced the size of plants receiving 1 and 2 mg paclobutrazol 4% and 6%, respectively, relative to that of similarly treated nonshaded plants, whereas heavy shade reduced plant size 11%. The number of flower buds per plant was reduced 36% by moderate shading, 90% by heavy shading. Significant quadratic relationships between the rate of paclobutrazol applied and (1) plant size, and (2) the number of flower buds per plant. Chemical name used: R→(1,2,4-triazol)-1-ethyl-α-(1,1-dimethyl)-1H-(1,2,4-triazol)-1-ethan-ol (paclobutrazol).

Materials and Methods

The experiments were carried out during June to Nov. 1994 in a greenhouse in Attica, Greece. The experimental design was a split-plot and included three main plots. Different levels of shading (0%, 67%, 98%) were achieved in each main plot by the use of a black polyethylene net (Vellinet, Vellis AE, Greece) and an opaque, white-black plastic sheet (with the black side facing the ground); control plants were not shaded. Daytime photosynthetic photon flux (PPF) for the unshaded plot ranged from ~380 to 1200 μmol·m–2·s–1. Rooted gardenia cuttings were transferred from a mist propagation room into 1.5-L plastic pots (one cutting/pot) containing a mixture of 5 Russian peat moss: 1 perlite (v/v) in a greenhouse. Fourteen weeks later the plants were pruned and placed inside the experimental area. After 3 weeks (24 June 1994), before flower primordia had formed, the plants were pinched at the second internode from the apex. Paclobutrazol was applied as a soil drench 4 d after pinching at 0.0, 0.5, 1.0, or 2.0 mg/pot a.i. to the plants of each main plot (six single-plant replicates per treatment per plot). The plants were not watered for 48 h after treatment, and a liquid fertilizer (12N–4P–6K) containing trace elements (ComplexFluor-AgrEvo; Hellas Co., Athens, Greece) was applied every 20 d at a rate of 0.2 mL/pot. Data taken on 8 Nov. 1994 included plant height and maximum diameter. Height was recorded by measuring the tallest shoot of each plant from the rim of the pot. Plant size was expressed by summing plant height and maximum diameter and dividing the result by 2. Paclobutrazol subplot effects within each main plot were analyzed using regression techniques. In addition, analysis of variance was performed on the data for plant size and number of flower buds per plant.

Results and Discussion

Both plant size and the number of flower buds per plant decreased as the rate of paclobutrazol increased at all levels of shading (Fig. 1). The efficacy of paclobutrazol, however, was generally less under heavy shade, as both photosynthesis and translocation of the growth retardant were reduced. Moderate shading (67%) did not affect the size of plants receiving 0.0 or 0.5 mg of paclobutrazol per pot, but plants grown under heavy shade (98%) were 74% as large as similarly treated nonshaded plants. Plants under medium shade that received 1.0 and 2.0 mg paclobutrazol per pot, however, were 96% and 94%, respectively, the size of nonshaded plants treated with paclobutrazol at the same rates; heavily shaded plants were 89% the size of the similarly treated, nonshaded plants. Wilkins (1986) reported that reducing the natural light intensity in the greenhouse reduced the number of flower buds of gardenia plants. In our experiments, moderate shading reduced the number of flower buds per plant 30%, heavy shading reduced the number 90%. When light exclusion was 67%, the number of flower buds on plants treated with 0.5 mg/pot paclobutrazol was reduced to 59% compared with plants grown without shade. At the same level (67%) of light exclusion, the numbers of flowers per plant treated with 1.0 or 2.0 mg/pot paclobutrazol was similar to that of the nonshaded plants. When light exclusion was 98%, the number of flower buds on plants treated with paclobutrazol at the rates of 0.5, 1.0, and 2.0 mg/pot was very small, mainly due to reduction in photosynthesis. In this experiment, interaction of shading × paclobutrazol and paclobutrazol × shading were both significant. In addition, there were significant quadratic relationships between 1) the rate of paclobutrazol and plant size, and 2) the rate of paclobutrazol and the number of flower buds per plant.

Literature Cited


Fig. 1. Effects of paclobutrazol and shading on (A) gardenia plant size and (B) number of flower buds per plant. Plant size = (height of tallest shoot + maximum width)/2.
