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The Effect of Foliar-applied Salicylic Acid on Flowering of African Violet

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Abstract: Sainpaulias are among the most popular flowering plants and there are so many variations in flower shape, size and color. Aqueous solutions of 0 M to 10^{-5} M concentrations of salicylic acid (SA) were foliar-applied on two African violet cultivars to evaluate the influence of different rates of SA on growth and flowering of plants. The solutions were applied to leaves of plants 14, 21, 28 and 35 days after transplanting from culture medium to the soil. Salicylic acid at concentration of 10^{-5} M increased the number of leaves, the rosette diameter, and the number of flower buds compared to control. However, with applying SA at concentration of 10^{-5} M the number of days from planting to anthesis was reduced in comparison with the control.

Key words: African violet, salicylic acid, foliar application, flowering.

INTRODUCTION

African violet *(Saintpaulia ionantha* Wendl.) is a popular flowering houseplant in the Gesneriad family (Gesneriaceae), which is native to Tanzania in East Africa. Because of small size of plants, easy blooming at home and the wide variety of cultivars and hybrids available, the African violet has long been one of the most popular flowering houseplants.

Salicylic acid (2-hydroxybenzoic acid) may help regulate several plant functions, including systemic acquire resistance to pathogens and the formation of flowers (Heitholt, J.J., 2001). Endogenous application of SA was reported to be involved in the flowering process by Cleland and Ajami (1974). Moreover, applied SA to growth medium induced flowering in several species of Lemnaceae (Cleland and Ajami, 1974; Cleland, C.F., 1982; Martin- mex, R., 2005; Oota, Y., 1975). Recent reviews have demonstrated that salicylic acid has a relevant role in the control of several physiological and biochemical processes in plants and it is considered a phytohormone by some investigators (Handro, W., 1997; Raskin, I., 1992). Among the morphogenetic processes affected by salicylic acid were flowering and tuberization. For example salicylic acid enhanced flowering in Lemna (Khurama, J.P.S. and C.F. Cleland, 1992), hastened flower initiation in phaseolus (Handro, W., 1997), induced tuberization in potato (Koda, Y., 1992) and increased flower size in Campanula (Serek, M.).

SA also induced flowering in some angiosperm species (Raskin, I., 1992). This positive effect of SA were attributed to enhanced CO_2 assimilation, chlorophyll concentration, photosynthetic rate and increased mineral uptake by stressed plants treated with SA (Karlidag, H., 2009).

There are relatively few chemical substances capable of inducing flowering in a particular plant. Gibberellins, ethylene and cytokinins are all known to induce flowering in one or more plants (Charles, F.C. and O. Tanaka, 1979), but there is few reports on effects of salicylic acid on plant growth and flowering.

This investigation was carried out to evaluate the influence of different rates of foliar-applied SA on the growth and flowering of two cultivars of African violets.

MATERIALS AND METHODS

Two cultivars of *Saintpaulia* namely 'Standard Purple' cultivar (with pure purple flowers) and 'Fantasy Purple' cultivar (with purple flowers with an overlay of small amount of white color in the form of line) (Figs 1 and 2) were used in this experiment.

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Fig. 1: African violet 'Fantasy Purple' cultivar.

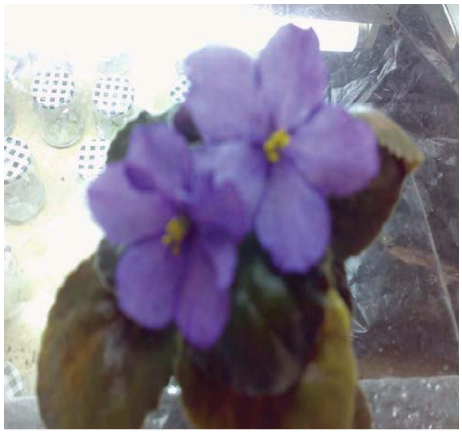

Fig. 2: African violet 'Standard Purple' cultivar.

In vitro cultured plants of two cultivars of African violet were established from leaf tissues grown in culture vessels containing about 25 ml of basic Murashige and Skoog (MS) medium salts without any vitamins and hormones and enriched with 30 g/L sucrose and 7 g/L agar. The same culture medium was used for rooting. All cultures were kept under 16-hr photoperiod of 2500 lux light intensity at 25±1 °C.

Before transferring plants from culture medium to soil mixture, their roots were washed with distilled water to eliminate residues of agar and then transplanted to 4 in. pots containing a 1:1 (v/v) mixture of soil and peat moss. They were then placed in acclimatization room and acclimatized for 2 weeks.

After acclimatization, thirty plants of each cultivar with four leaves and a rosette diameter of 15mm were selected for SA spraying. The concentrations of salicylic acid for this experiment were 0, 10^{-9}, 10^{-8}, 1 0^{-7}, 10^{-6} and 10^{-5} M + a drop of Tween-20 as a surfactant. The solutions were applied for leaves of plants with a manual sprayer 14, 21, 28 and 35 days after transplanting from culture medium to the soil.

In this experiment, the number of leaves, rosette diameter, the number of days from potting to anthesis and the number of flower buds formed per plant were assayed. The study was conducted using a completely randomized block design with 5 replications and repeated 3 times. The statically analysis was conducted using the MSTAT-C program. The mean data of three times were statistically analyzed and the means subjected to analysis of variance (ANOVA) to compare the effects of SA treatments. The differences between the means were compared using Duncan's new multiple range test (DNMRT) (P<5%).

Results:

The effects of salicylic acid on the growth and flowering of African violet are presented in Tables 1 and 2. Data presented in this study demonstrated that foliar SA applications significantly improved some plant characteristics such as the number of leaves, rosette diameter, the number of days from potting to anthesis and the number of flower buds per plant.

In 'Standard purple' cultivar, the number of leaves formed increased from 7 in control treatment to 10 with the concentration of 10^{-6} M SA and 14 with the concentration of 10^{-5} M SA. In 'Fantasy purple' cultivar the number of leaves increased to 12.4 and 11.8 at the concentration of 10^{-6} and 10^{-5} M SA respectively in comparison with the control. In two cultivars rosette diameter was increased by 37% with the application of SA at the concentration of 10^{-5}M compared to control. SA at any of the concentrations tested induce early flowering from 9 to 19 days in 'Standard purple' cultivar and from 3 to 16 days in 'Fantasy purple' cultivar as compared with the water control plants. In Standard purplecultivar the number of flowers was increased by 41% and 35% with 10^{-6} and 10^{-5} M SA respectively in comparison with that of the control. In 'Fantasy purple' cultivar this characteristic was increased 22% and 27% with 10^{-6} and 10^{-5}M SA respectively compared to control.

Table 1: Effect of salicylic acid on African violet 'Standard purple' cultivar.

Salicylic acid concentration (M)	Rosette diameter (mm)	Number of leaves	Days to flowering	Number of flowers per plant
0	53 e	7.6 c	89 d	17 c
10^{-9}	58.5 d	8 c	80 c	21 ab
10^{-8}	63.5 cd	8.4 c	79 ab	21 ab
10^{-7}	67 bc	7.4 c	74 a	20 ab
10^{-6}	71 ab	10.4 b	78 ab	24 a
10^{-5}	73 a	13.8 a	70 a	23 a

Data are the mean value of 5 replicate plants. Means with the same letters are not significantly different at P< 5%, Duncan's.

Table 2: Effect of salicylic acid on African violet 'Fantasy purple' cultivar.

Salicylic acid concentration (M)	Rosette diameter (mm)	Number of leaves	Days to flowering	Number of flowers per plant
0	39 d	9.6 c	90 c	18 b
10^{-9}	45.5 c	10.8 b	87 bc	19 b
10^{-8}	51.5 ab	11.4 ab	85 b	21 ab
10^{-7}	46.5 c	11.6 ab	78 a	20 ab
10^{-6}	50 b	12.4 a	77 a	22 a
10^{-5}	53.5 a	11.8 ab	74 a	23 a

Data are the mean value of 5 replicate plants. Means with the same letters are not significantly different at P< 5%, Duncan's.

Discussion:

When salicylic acid (SA) applied to the foliage of intact African violet plants, induced positive effects on the biomass of plants. Data showed that values for number of leaves and rosette diameter were higher, in a response to SA treatment. These results confirm the results of other researchers on other plants where an increase in fresh and dry biomass and in the number of branches was registered (Hayat, S. and A. Ahmad, 2007; Martin- mex, R., 2005). In ornamental plants, such as Gloxinia and violet, SA increased the number of leaves formed, and leaf area had values over 10% of that of the control. Similar values were recorded for the diameter of the rosette plants (Hayat, S. and A. Ahmad, 2007; Martin- mex, R., 2005).

In this experiment plants treated with different concentration of SA, flowered early and their floral buds per plants were increased. These results were in agreement with the results obtained for other plants (Hayat, S. and A. Ahmad, 2007; Martin- mex, R., 2005). The effect of salicylates on the flowering process was assessed since it is a parameter that is closely related to the productivity. In this respect, it has been reported that SA is a flower inducting factor in Lemna (Cleland, C.F. and A. Ajami, 1974). Foliar application of SA, however, was later tested and this treatment gave promising results. One of the most conspicuous effects was the induction of flowering. Different experiments clearly established that plants treated with SA flowered earlier than non treated plants (Hayat, S. and A. Ahmad, 2007; Martin- mex, R., 2005). This effect was not linked with any previous hypothesis. Further experiments using different plant species gave similar results although no clear explanation was given for the observation (Hayat, S. and A. Ahmad, 2007; Martin- mex, R., 2005).

Salicylic acid applied to the foliage of intact plants induced positive effects on the bioproductivity of horticultural and ornamental plants. Moreover, in order to get the desired effects it was observed that lower concentrations of SA are needed. The concentrations that proved best are 10^{-5} to 10^{-8} M of SA.

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