Pak.J.Bot., 27(1): 139-141, 1995.

EFFECTS OF PLANT GROWTH REGULATORS ON NEUROTOXIN CONTENT IN LEAVES OF *LATHYRUS SATIVUS*

A. BANO AND M. SANAULLAH

Department of Biological Sciences,
Quaid-i-Azam University, Islamabad, Pakistan.

Abstract

Effects of abscisic acid (ABA) and gibberellic acid (GA) on accumulation of Beta N-oxalylamino-L-alanine (BoAA) in leaves of *Lathyrus sativus* L., cvs. K 424 and K 280 under drought stress was examined. Simultaneous application of ABA and drought was inhibitory to BoAA accumulation under drought as compared to ABA application after 12 days of drought period. Simultaneous application of GA and drought was stimulatory to BoAA accumulation than that of GA applied after 12 days of drought stress. Indigenous variety K 280 having higher BoAA content than the exotic variety K 424 showed low percentage of BoAA under drought stress. Rewatering of stressed plants of K 424 reduced BoAA whereas rewatering of K 280 increased BoAA as compared to drought stress treatment. Reduction in BoAA following simultaneous application of ABA and drought may be due to favourable effect of ABA in water conservation mechanism.

Introduction

Seeds of *Lathyrus sativus*, a cheap source of protein (20%), is extensively used as staple food, its leaves are used as vegetable and also for cattle feed. Consumption of *L. sativus* seeds in quantities more than 30% of the diet causes a paralytic disease, *Lathyrism* which produces irreversible paralyses of both legs. The seeds have been reported to contain a neurotoxin, *Beta N-oxalylamino-L-alanine* (BoAA) (Lal *et al.*, 1985). There does not appear to be any report on the presence of BoAA in *L. sativus* leaves.

During water stress, one of the plant growth retardant, abscisic acid (ABA) is reported to increase rapidly and plays a significant role in water conservation mechanism during drought (Davies & Zhang, 1991). The present paper describes the effects of ABA and GA growth regulators on BoAA content of *Lathyrus sativus*.

Materials and Methods

Seeds of *Lathyrus sativus* L., axotic cv. K 424 and indigenus cv. K 280 were sown in 13 cm diam., plasitc pots containing a mixture of sand and soil in 1:3 ratio with some organic manure. The plants were grown in controlled environment growth room maintained at 20-25°C, 75-80% R.H. and 16 h photoperiod. A group of plants were regularly watered and kept as control. In another set the plants were subjected to water stress by withholding the supply of water upto 60 days after sowing. A set of water stressed plants were sprayed with aqueous solution of abscisic acid (ABA) @ 10^{-6}M or aqueous solution of gibberellic acid (GA) @ 10^{-6} M on the day of the initiation of drought and after 12days of drought stress. Plants subjected to water stress with or without application of ABA or GA were rewatered after 13 days period. Plants from all the treatments were harvested after 15 days interval and 5-7 leaves from top of the plants of each treatment were analyzed for BoAA content by Wet chemistry method (Rao, 1978).

Results and Discussion

In the exotic variety K 424, drought stress showed an increase in the % BoAA in leaves and rewatering of the drought stress plants showed a 7% reduction in BoAA over the control (Table 1). Application of ABA at the initiation of drought reduced the BoAA in plant leaves whereas application of ABA after 13d of drought stress did not reduce the BoAA accumulation in leaves as compared to control, although the BoAA percentage was 0.02% lower than the drought stressed plants. Rewatering of these plants did not show any reduction in BoAA content.

Foliar application of GA at the initiation of drought showed a 4.6% increase in BoAA whereas GA application to 12d drought stressed plants resulted in considerable reduction in BoAA content. Rewatering of water stressed plants with and without treatment with ABA showed an increase in BoAA over control whereas rewatering of water stressed plants with GA treatment showed a reduction in the BoAA.

The indigenous variety K 280 having relatively high BoAA content than K 424 appears to be relatively drought resistant. This variety showed low BoAA % accumulation during drought. However, the response of plants to plant growth regulators were similar as that of the exotic variety K 424. ABA application at initiation of drought had BoAA % less than that of control whereas, ABA treatment after 12 days of drought stress was not much effective in reducing BoAA. Rewatering of drought stressed plants further increased the BoAA. GA application at the initiation of drought, had low BoAA % as compared to control but higher than that of ABA applied at the initiation of drought. However, the application of GA after 13 days of drought stress showed marked reduction in BoAA content. Rewatering of drought and ABA treated plants further increased the % BoAA as compared to ABA treatment alone.

Table 1. Effects of plant growth regulators on % BoAA in *Lathyrus sativus* subjected to water stress. Average of 6 plants per treatment.

	Tratments	Variety K-424 BoAA (%)	Variety K-280 BoAA (%)
C	Control	0.56	0.92
T_1	Water stress	0.75	0.75
T_2	Foliar spray of ABA followed by water stress	0.66	0.73
T_3	Foliar spray of GA followed by water stress	0.82	0.81
T_4	Water stressed plants specified with GA	0.57	0.62
T_5	Water stressed plants specified A-Bot	0.73	0.86
T_6	Water stress plants rewatered	0.63	1.09
T_7	ABA + Rewatering	0.78	0.96
T_8	GA + REwatering	0.77	0.73

The reduction in BoAA following ABA application at the initiation of drought and not after prolong drought (12 days) may be due to favourable effect of ABA in water conservation mechanism which provide better tolerance to plants against water shortage (Glinka, 1971; Bano *et al.*, 1993). Further work is needed to evaluate the role of GA in the biosynthetic pathway of BoAA and other related neurotoxins. There is need to evaluate the role of GA in the biosynthetic pathway of BoAA and other related neurotoxins.

References

Bano, A., K. Dorffling, D. Bettin and H. Hahn, 1993. Abscisic acid and cytokinin as possible root-to-shoot signals in xylem sap of rice plants in drying soil. *Aust. J. Plant Physiol.*, 20: 109-115.

Davies, W.J. and J. Zhang, 1991. Root signals and the regulation growth and development of plants in drying soil. *Annual Review of Plant Physiol. and Mol. Biol;* 42: 55-76.

Lal, M.S., I. Agrawal and M.W. Chittale. 1985. Genetic improvement of chickling vetch *Lathyrus sativus* L. in Madhya Pradesh, India. In: *Lathyrus* and *Lathyrism*. Proceeding of Colleque *Lathyrus*. 1985 (Eds.) A.K. Kaul and L. Cambes. pp 146-160.

Rao, S.L.N. 1978. A sensitive and specific colorimetric method for the determination of a, B-diaminopropionic acid and the *Lathyrus* neurotoxin. *Analytical Biochem.*, 86: 386-395.

Glinka, Z. 1977. Effects of ABA and of hydraulic pressure gradient on water movement through excised sunflower roots. *Plant physiol.*, 69: 1353-1355.

(Received for Publication 24 November 1994)