

Short Communication

**Variation for Proline Content Among Accessions of *Prosopis cineraria* (L.) MacBride**

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Moisture deficiency is the chief limiting factor for the establishment of plants in the Indian arid zone and it plays the most significant role in their growth and development. Accumulation of free proline in leaves has been shown to be an adaptive mechanism for resistance to stress (Levitt, 1972). Crop plants have been extensively studied for proline accumulation under water stress conditions (Pandey, 1982; Janagaudar *et al.*, 1983; Biswas and Choudhuri, 1984), but little is known of proline accumulation in desert plants which are continuously exposed to the full impact of the conditions of the drought. Differences in proline accumulation in different species of *Acacia* (Babu *et al.*, 1987) and seed sources of *Acacia nilotica* (Bagchi and Singh, 1994) have been reported. Little is, however, known about proline accumulation and variability that exists for this trait in *Prosopis cineraria*, a multi-purpose tree species of the Indian arid zone. The present study deals with the study of variability for proline accumulation in leaves of different accessions of *Prosopis cineraria* and its possible role in its growth and development.

Forty accessions of *Prosopis cineraria* (L.) MacBride, from different districts of Rajasthan, Haryana and Gujarat, were sown in March 1993, in randomized complete block design with three replications. Thirty bags of each accession were seeded and irrigated daily in summer, and as and when required in rainy and winter seasons. Proline, both under normal (without stress) and moisture stress, was estimated following method of Bates *et al.* (1973). Leaf samples for proline estimation under normal conditions were collected in June 1993, in the morning before regular daily irrigation to the experiment. For creating soil moisture stress, irrigation was stopped for 3 days and leaf samples were collected in the morning of the fourth day, as the plants started showing signs of leaf burning. Seedlings were harvested in April 1994. Dry shoot weights were recorded after drying samples in oven at 60°C. Data were subjected to analysis of variance.

Highly significant differences were observed among the genotypes for proline under normal as well as under stress. Significant differences for proline accumulation among different seed sources of *Acacia nilotica* has also been reported by Bagchi and Singh (1994). The proline content in the leaves of different genotypes of *Prosopis*

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Table 1. Analysis of variance for leaf proline content in *Prosopis cineraria*

Source	df	Mean squares	
		Proline (N)	Proline (FS)
Replications	2	0.52	1.23
Genotypes	39	1.48**	0.67**
Error	78	0.40	0.07

\*\* = significant at  $P = 0.01$ ; N = normal conditions; FS = following stress.

varied from 1.03 to 4.27  $\mu\text{mol g}^{-1}$  fresh weight. Maximum (4.27  $\mu\text{mol g}^{-1}$ ) proline was observed in case of Hansot, followed by NIC-1931 (3.57  $\mu\text{mol g}^{-1}$ ). Minimum proline (1.03  $\mu\text{mol g}^{-1}$ ) was recorded in case of NIC-1868.

An increase in free proline content in the leaves of *P. cineraria* was observed following soil moisture stress. Proline following stress varied from 3.93 to 5.79  $\mu\text{mol g}^{-1}$ . This range was narrower than the range of proline without stress. NIC-1878 had the maximum free proline and was followed by NIC-13549, NIC-1888 and NIC-1868, while IC-104199 showed the lowest proline content following stress. Earlier, Mohammed and Sen (1987) reported 4.81  $\mu\text{mol g}^{-1}$  fresh weight of proline in stressed plants of *Prosopis cineraria*.

The percentage increase in proline following stress over control varied from 15.34% (NIC-1965) to 429.12% (NIC-1868). It was observed that generally genotypes having low proline content under normal conditions showed greater increase in proline following stress. NIC-1868, which had the lowest proline without stress, showed high proline following stress. Proline content in this genotype increased from 1.03 to 5.45  $\mu\text{mol g}^{-1}$ . Similar trend was observed for NIC-1840, NIC-1908,

NIC-1920, NIC-13570, NIC-1950, NIC-1959 and NIC-1921.

Grouping of genotypes showing  $\leq 100\%$ , 100% to 200% and  $\geq 200\%$  increase in proline following stress, and comparison of the mean dry shoot weight of genotypes constituting these groups revealed that genotypes registering  $\geq 200\%$  increase in proline following stress produced higher dry shoot weight (4.17  $\text{g plant}^{-1}$ ), as compared to genotypes recording  $\leq 100\%$  increase in proline, which showed lower dry shoot weight (3.70  $\text{g plant}^{-1}$ ).

A study of association among proline without stress, proline following stress, increase in proline *per se*, per cent increase in proline over control and dry shoot weight revealed that all traits, except per cent increase over control, did not show any association with dry shoot weight, while a positive and significant association (0.3918) existed between per cent increase in proline under stress and dry shoot weight. This confirmed the finding that genotypes registering higher per cent increase in proline after stress over proline in control produced more plant biomass, possibly because of their higher tolerance to moisture stress. This criterion can thus be used for selecting genotypes capable of performing better under moisture stress conditions. Some of the promising genotypes identified on the basis of this criterion were NIC-1868, NIC-1840, NIC-13570, NIC-1878, NIC-1908 and NIC-1921. Interestingly, genotypes selected on this basis included genotypes which ranked first, second and fourth on dry shoot weight basis.

Phenotypic (PCV) and genotypic (GCV) coefficients of variation, heritability and

Table 2. Phenotypic (PCV) and genotypic (GCV) coefficients of variation, heritability ( $h^2$ ) and genetic advance (GA) expressed as per cent of mean, for proline content in *P. cineraria*

Variance component	Proline ( $\mu\text{mol} \cdot \text{g}^{-1}$ fresh weight)	
	Without stress	Following stress
Mean	2.38	4.86
Range	1.03-4.27	3.93-5.79
PCV	36.62	10.62
GCV	25.21	9.21
$h^2$	0.47	0.75
GA	35.60	16.43

genetic advance (GA) for proline under normal and proline following moisture stress have been given in Table 2. Proline under normal conditions had higher PCV, GCV and GA as compared to proline following stress. Heritability in broad sense was, however, higher for proline following stress. Therefore, genotypes capable of producing higher proline following stress could be reliably selected.

## References

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