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Short Communication

Abscisic Acid Accumulation in *Phaseolus vulgaris L.* with Different Growth Habits*

M. T. Rodríguez and A. Larqué-Saavedra

Centro de Botánica, Colegio de Postgraduados, 56230 Chapingo, México. Mexico

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Abstract. Four cultivars of *Phaseolus vulgaris* L. having different growth habits were studied to determine their capacity to accumulate abscisic acid (ABA). Detached leaves were desiccated to 90% of their original weight, equivalent to water potentials of −8 to −10 bars. After 8 h, the ABA content was estimated. Two cultivars were significantly different from the other two, but the differences were not related to their growth habit.

Abscisic acid (ABA) has been reported to occur throughout the plant kingdom (Milborrow 1974, Walton 1980), and its relevance in different physiological processes such as seed germination, dormancy, and water stress is well documented. There is a differential ability to accumulate ABA within and among species under water stress for maize, sorghum, wheat, rice, and pearl millet (Larqué-Saavedra and Wain 1974, 1976, Quarrie 1982).

There are no reports of similar studies using different cultivars of beans. *Phaseolus vulgaris* L. possesses cultivars with different growth habits that have been classified in four major groups: determinate bush types (type I), indeterminate bush types (type II), and indeterminate climbing types (types III and IV) (Solorzano 1982).

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Most of the work on ABA in beans has been done in type I cultivars: Mecosta (red kidney), Kinghorn, and Canadian Wonder (Hiron and Wright 1973, Harrison and Walton 1975, Zeevaart and Milborrow 1976, Walton et al. 1977, Pierce and Raschke 1980, 1981, Eze et al. 1981).

In *Phaseolus vulgaris,* ABA accumulation is the result of synthesis rather than derivation from a conjugated form or inhibition of its metabolism, and this synthesis is at its highest 2.5–5.0 h after turgor is lost (Pierce and Raschke 1981). Synthesis rate, rather than total ABA, regulates stomatal closure (Walton et al. 1977). The ability to produce high levels of ABA is associated with rapid leaf growth (Eze et al. 1981). A water loss equivalent to 5–10% of fresh weight is sufficient to initiate ABA accumulation in young leaves (Eze et al. 1981).

The present study was carried out in order to investigate the relevance of growth habit to the accumulation of ABA after a dessication period. Four cultivars of *Phaseolus vulgaris* with different growth habits were selected for this purpose.

Materials and Methods

Seeds of Cacahuate 72 (type I), Michoacán 12-A-3 (type II), Flor de Mayo X-16441, and Negro 150 (type IV) were planted in pots containing compost and were grown under well-watered conditions in a greenhouse. As they developed, the primary leaves were measured daily in length and width until no change was detected and were then harvested early in the morning. The detached leaves were weighed and transferred to a sheet of dry filter paper. Warm air (30–33°C) was directed across the leaves until a 10% water loss had occurred. The stressed leaves were maintained for 8 h in darkness in a glass chamber with moistened filter paper to prevent weight changes. After this time, disc samples from the leaves (from three plants of each cultivar) were taken and their water potential ($\psi\omega$) psychrometrically determined (Chamber 52 Wescor, Inc.). The leaves were immediately frozen in liquid nitrogen and then lyophilized.

The ABA determination was carried out as suggested by Quarrie (1978) for stressed tissues. Ninety mg of lyophilized tissue was sonicated (B-30 from Branson Sonic Power Co.) during 12 min in acetone at 90%. The acetonic fraction was collected after centrifugation (3250 rpm, 15 min) and its volume, adjusted to 7 ml. An aliquot of 300 µl was run in TLC (GF_{254} 0.25 mm thickness) in ethyl acetate. The band corresponding to ABA standards was located under UV and was removed from the plate and methylated with diazomethane. The quantitative determination of ABA was carried out by GLC adapted with an ECD.

Results and Discussion

There were intraspecific differences in the ABA content, as is known for other species (Fig. 1). However, the content of ABA does not correlate with growth

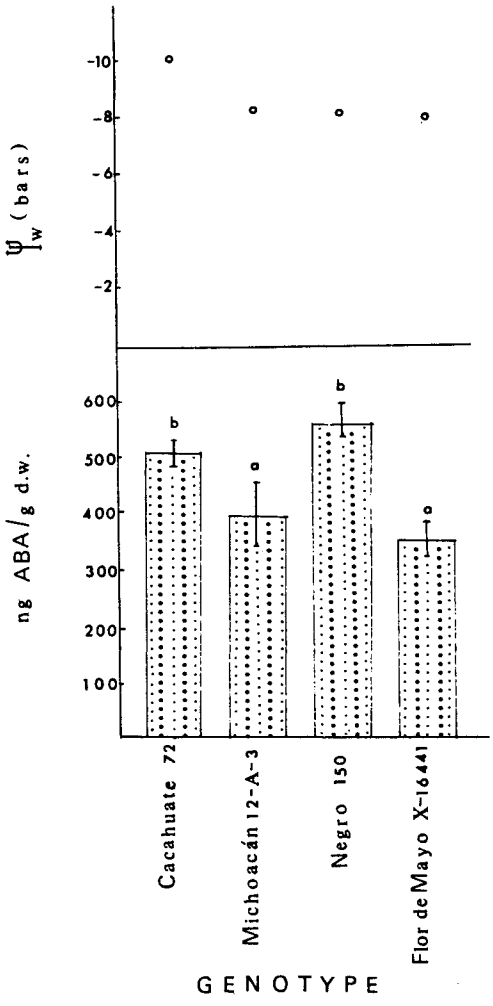

Fig. 1. ABA accumulation and $\Psi\omega$ attained in four different cultivars of *Phaseolus vulgaris*. Each value of ABA is the mean of six replicates ± standard error. Means with the same letter are not significantly different at 0.05. (Tukey). Each value of $\Psi\omega$ (O) is the mean value of three leaf samples.

habit. The highest and lowest ABA contents were found in the indeterminate climbing growth habit (type IV). Negro 150 had 557 ng/g dw of ABA, while Flor de Mayo X-16441 had 38% less. The other cultivars accumulated 30% (Michoacán 12-A-3) and 9% (Cacahuate 72) less ABA than Negro 150.

It is noteworthy that the 10% desiccation treatment gave $\Psi\omega$ values between -8.0 and -8.5 bars for three of the cultivars. However, the leaves of Cacahuate 72 showed a $\Psi\omega$ of -10 bars. These results obtained for Cacahuate 72 should be redetermined for a $\Psi\omega$ of approximately -8 bars, in order to define this cultivar with respect to ABA accumulation at a given $\Psi\omega$, rather than at 10% desiccation. Work is in progress in this laboratory to determine the drought resistance characteristics of these cultivars and to achieve a more intimate knowledge of their ABA–water relations.

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