COMPARATIVE WATER RELATIONS OF WILD AND CULTIVATED *PHASEOLUS* SPECIES GROWN UNDER SALINE CONDITIONS

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Tepary bean, *Phaseolus acutifolius* A. Gray and *P. filiformis* Bentham, are adapted to hot arid and saline conditions and might be a valuable source of genes to improve the drought and salinity tolerance of *P. vulgaris* L. We examined the effects of salinity on water relations of two wild (*P. acutifolius* and *P. filiformis*) and two cultivated (*P. acutifolius* and *P. vulgaris*) species.

MATERIALS AND METHODS

The experiment was conducted with accessions of different salt tolerance: two wild accessions representing two species (*P. acutifolius*, G40169, sensitive and *P. filiformis* PI535309, tolerant) and two cultivated accessions (*P. acutifolius* G40142, tolerant.and *P. vulgaris* G04017, sensitive) were used. Plants were grown in nutrient solution under greenhouse conditions at Universidad Michoacana de San Nicolás de Hidalgo, Mexico between May and August 2005. Seedlings were allowed to grow with no salinity stress until the emergence of the first trifoliate leaf, when several NaCl treatments were added to the solutions (0, 30, 60 and 90 mM). A randomized complete block design with a split-plot arrangement of salt treatments and four replications was used. Predawn water potential (Ψ_w) at 9, 14 and 19 days after transplanting was measured with a pressure chamber. Leaf solute potential (Ψ_π) was measured with a Wescor-5500 vapor pressure osmometer. Readings were converted to pressure units by using the van't Hoff equation. Turgor potential (Ψ_p) was determined using the relationship: $\Psi_p = \Psi_w - \Psi_\pi$. Plants were harvested at 10, 15 and 20 days after transplanting and separated into roots, stem and leaves. Data were analyzed using the GLM procedure (SAS Institute, Cary, NC, 1985). Four replicates per salinity treatment per species per harvesting date were used for growth analyses and water relations. Two-way analysis of variance was used to determine significant differences among accessions for various traits. Treatment means were compared using protected LSD test at $P \leq 0.05$.

RESULTS AND DISCUSSION

Salinity significantly affected leaf water, osmotic and water potentials (Fig. 1). Differences among cultivated and wild accessions were significant at any salt concentration. Overall, wild species *P. acutifolius* G40169 and *P. filiformis* PI535309 had less negative values of water potential at 0, 30, 60 and 90 mM NaCl than cultivated accessions. Salinity decreased leaf osmotic potential in all species (Table 1). Differences among species were highly significant at 90mM NaCl. Wild *P. acutifolius* G40169 was unique in that it reached the highest osmotic potential, -1.14 MPa, at 90Mm NaCl; whereas the osmotic potentials of the other species ranged between –0.50 to –0.98 MPa at the same salt concentration. Leaf turgor potential was unaffected by 30 and 60 mM NaCl, but was increased between 0.5 and 0.89 and 0.52 to 1.14 MPa at 60 and 90 mM NaCl, respectively. Leaf water potential (Ψ_w) gradually declined during the first 14 days after salinization (-0.43 to –0.79 MPa), thereafter, a steady state was attained, and except at 90 mM NaCl, which decreased Ψ_w further. Salinity also decreased leaf osmotic potential. This difference was reflected in average turgor potentials, which increased at 90 mM NaCl, particularly for wild *Phaseolus* species. Our data indicate that the decrease in leaf osmotic potential always exceeded that of leaf water potential. This resulted from the fact that plants adjusted osmotically. Under salinity, it can achieved either from the accumulation of high levels of inorganic ions, predominantly Cl^-, Na^+ and K^+ in their leaves (Bayuelo-Jiménez et al., 2003) or from net solute accumulation (Lazcano and Lovatt, 1997). In many plants net accumulation of osmotically active solutes allows turgor-dependent processes to continue to some extent under salt stress conditions.

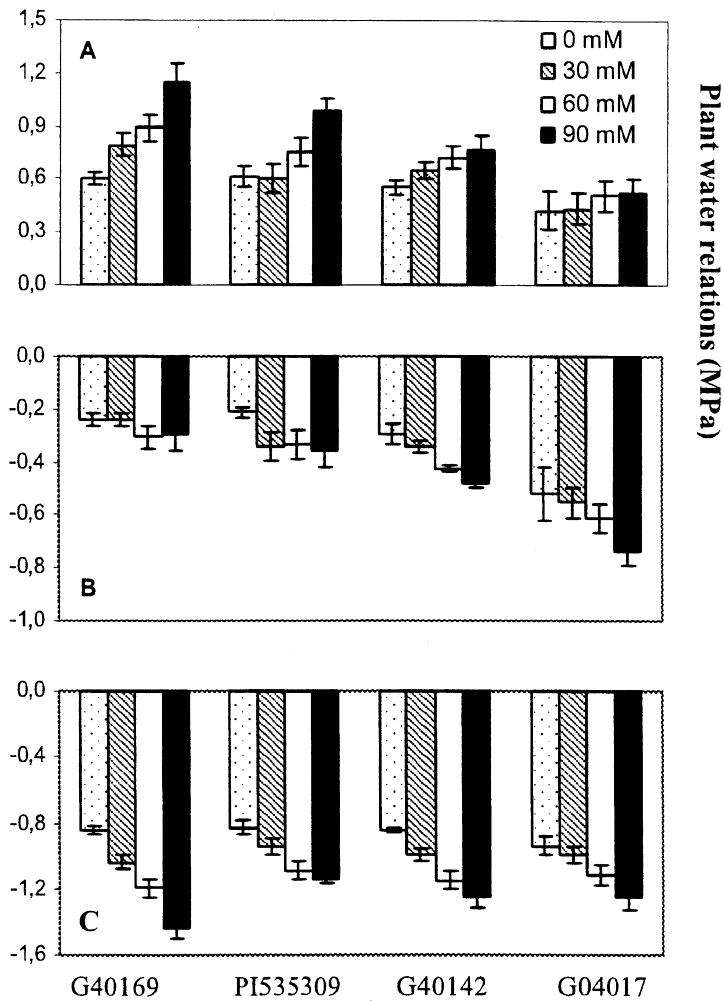

Fig. 1. Effects of increasing NaCl concentrations in the growth medium on leaf turgor potential (Ψ_p) (A); water potential (Ψ_w) (B), and osmotic potential (Ψ_π) (C) (in MPa) of *Phaseolus* species. Data correspond to the average of four measurements on different individual plants. Standard errors, when larger than symbols, are shown as vertical bars.

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