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NOTES

EFFECT OF GIBBERELLIC ACID ON GERMINATION OF SEEDS OF FIVE SPECIES OF CACTI FROM THE CHIHUAHUAN DESERT, NORTHERN MEXICO

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ABSTRACT—We determined the effect of three concentrations of gibberellic acid on germination and photoblastic behavior of five species of Opuntioideae from the Mapimi Biosphere Reserve, southern Chihuahuan Desert, Durango, Mexico. For *Cylindropuntia imbricata*, addition of high concentrations (1,500 ppm) of gibberellic acid gave a 30% germination similar to the control; for *Opuntia rastrera*, medium concentrations (1,000 ppm) gave <40% germination; and for *O. microdasys*, low concentrations (500 ppm) gave 35% germination. High concentrations restricted germination. *Opuntia macrocentra* and *Cylindropuntia leptocaulis* did not differ significantly from the control. *Opuntia macrocentra* required light for germination; addition of gibberellic acid did not substitute for light. For all species, light increased germination and the effect of gibberellic acid is species dependent, rarely better than the control. Species we studied did not seem to have physical dormancy and may have had physiological dormancy that was unaffected by gibberellic acid.

RESUMEN—Determinamos la respuesta fotoblástica y el efecto de tres concentraciones de ácido giberélico en la germinación de cinco especies de Opuntioideae de la Reserva de la Biósfera de Mapimí en el desierto Chihuahuense, México. Para *Cylindropuntia imbricata* con la adición de una concentración alta (1,500 ppm) se obtuvo una germinación de 30% similar al control; para *Opuntia rastrera*, con una concentración media (1,000 ppm) se obtuvo una germinación <40%; y para *O. microdasys*, con una concentración baja (500 ppm) se obtuvo una germinación de 35% y una concentración media inhibió la germinación. *Opuntia macrocentra* y *Cylindropuntia leptocaulis* no difirieron significativamente del control. *Opuntia macrocentra* requirió luz para su germinación y la adición de ácido giberélico no sustituyó el requerimiento de luz. Para todas las especies estudiadas, la luz incrementó la germinación y el efecto del ácido giberélico es dependiente de la especie, y en pocas ocasiones mejor que el control. Las especies estudiadas no parecieron presentar latencia física y posiblemente tuvieron latencia fisiológica que no fue afectada por el ácido giberélico.

In some Cactaceae, recruitment is particularly difficult, either because of low germination (Rojas-Aréchiga and Vázquez-Yanes, 2000) or inadequate establishment of seedlings (Steenbergh and Lowe, 1969; Nobel, 1984; Godínez-Alvarez and Valiente-Banuet, 1998). Therefore, detecting mechanisms that promote germination have important implications; especially, with regard to propagation of species for conservation and management.

Physiological dormancy in seeds of some plants depends on the ratio of levels of growth inhibitor (abscisic acid) and growth promoter (gibberellic acid). This has been tested in species such as *Albizia grandibracteata*, where three concentrations of gibberellic acid promoted germination with respect to the control (Tigabú and Odén, 2001). In seeds of *Arbutus andrachne*, a treatment with 250 or 500 mg/L of gibberellic acid resulted in >80% germination (Karam and