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Impact of osmotic stress on seed germination of ornamental and invasive species

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Abstract

Invasive plant species spread mainly through deliberate introductions for ornamental purposes. For this reason, a large number of ornamental species have become invasive especially in the last decades, due to the intensification of climatic changes. In the present study, 15 ornamental species were selected, some of which are already listed as worldwide aggressive invasive (*Bidens pilosa*, *Cortaderia selloana*, *Pennisetum clandestinum*, *Nicotiana glauca*). Others are reported as invasive only in some geographical areas, such as *Centaurea cyanus* in North America and Asia. There are no reports on the invasiveness of other species included in the study, such as *Tagetes patula* “Nana”, *Limonium sinuatum* and *Coreopsis tinctoria*. This study focuses on seed germination, as this is the most common mechanism of plant propagation. Germination, on the other hand, represents the bottleneck of the plant life cycle, as it is the stage most susceptible to environmental constraints, including both abiotic and biotic factors.

Seeds of all species were germinated in Petri dishes on filter paper moistened with distilled water in the control treatment and with increasing concentrations of PEG 6000 (polyethylene glycol), -0.25 MPa, -0.5 MPa, -0.75 MPa, -1.0 MPa. For each species 100 seeds were placed in 4 Petri dishes per treatment. Germination was recorded daily for a period of one month. Final germination percentages were arcsine transformed and data were analysed by ANOVA. Differences between species and between treatments were significant. The most tolerant to osmotic stress were *Cortaderia selloana*, *Pennisetum alopecuroides* and *Pennisetum clandestinum*, and the most susceptible were *Aquilegia hybrida* and *Eschscholzia californica*. PEG germination was mainly related to the ecological requirements of the plants, those of arid areas tolerating better the osmotic stress.

All invasive species showed a very high germination rate in the control and at least at some of the PEG concentrations, such as *Oenothera biennis*, which grows in humid environments and did not germinate at -1.0 MPa, but had a germination rate of more than 80% at the other concentrations.

This study helps identifying the risks of some ornamental species becoming invasive, as well as highlighting the constraints of the germination process under drought conditions.

Keywords: Germination, invasive species, ornamental species, osmotic stress