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Effect of Light on Seed Germination of Succulent Species from the Saharanpur

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ABSTRACT

Light requirements for cactus seed germination have been considered to be associated with their life-from, but this has not been thoroughly studied for other succulent species. In this study, we performed a light and darkness experiments in 11 species: seven rosette species (Agavaceae) and two columnar, one barriliform and one globose species (Cactaceae) from Saharanpur. The response variables were seed germination percentage of germinability and relative light germination (RLG). Following germinability analyses, only the barriliform cacti E. platyacanthus was positive photoblastic. All other species were neutral photoblastic, although we found three response patterns: species having similar seed germination in light and darkness conditions, species showing higher seed germination in darkness than in light and species showing higher germination in light than in darkness. However, following the relative light germination (RLG) analyses, two columnar species had higher RLG than the other species, seven species showed intermediate RLG (RLG 0.49-0.67) and two species had low RLG, which indicates that they germinated best in darkness. Our results do not support the suggestion that columnar cacti are neutral photoblastic and that globose cacti are positive photoblastic. We suggest that RLG is a better expression of the species light requirement than seed germination percentage.

INTRODUCTION

In to gain knowledge on the seed photosensitivity from the species belonging to several succulent life- forms, we performed a light and darkeness experiment in *Agavaceae* (seven rosette species) and *Cactaceae* (two columnar, one barriliform and one globose species) from Saharanpur. In order to better understand the expression of species light requirement, two response variables were tested: germinability and relative light germination (RLG). RLG represents a range of value varying from 0 (germination only in darkness) to 1 (germination only in light), and it is relatively unaffected by dormancy level (Milberg et al. 2000).

MATERIALS AND METHODS

We collected seeds of at least 10 individuals from each species. All studied species (Table 1) were from Saharanpur. Seeds were collected from mature fruits and stored in paper-bags at room temperature.

Table 1. List of species and their life-from and family Species	**Life form**	**Family**
Agave filifera Salm	Rosette	*Agavaceae*
Agave lechuguilla Torr	Rosette	*Agavaceae*
Agave salmiana Otto ex Salm	Rosette	*Agavaceae*
Agave striata Zucc.	Rosette	*Agavaceae*
Coryphanta delicate L. Bremer	Globose	*Cactaceae*
Echinocactus platyacanthus Link&Otto	Barriliform	*Cactaceae*
Myrtillocactus geometrizans (Mart. ex Pfeiff.) Console	Columnar	*Cactaceae*
Stenocereus queretaroensis (F.A.C. Weber) Buxb.	Columnar	*Cactaceae*
Yucca carnerosana (Trel.) McKelvey	Rosette	*Agavaceae*
Yucca elata (Engelm.)	Rosette	*Agavaceae*
Yucca filifera Chab.	Rosette	*Agavaceae*

We evaluated seed germination under two conditions: a 14-h daily photoperiod (hereafter light) and continuous darkness at 25^0c. This temperature was used following *Nobel* (1988). Seeds were placed in Petri dishes containing filter paper for 30 days. There were five replicates per treatment, with 20 seeds in each replicate. For incubation in darkness, Petri dishes were wrapped in double aluminium foil (Baskin and Baskin, 1998). All dishes were placed in a germination chamber. To reduce temperature fluctuations, fluorescent lamps and air ventilation were used. A green safe light was used to examine the dark-incubated seeds (*Baskin and baskin*, 1998; 2002). Seeds were watered daily with distilled water and germination (radical protrusion) was monitored daily. From these observations we determined final germination percentages or germinability (*Flores and Briones*, 2001; *Flores et al.* 2005) and relative light germination (RLG) (*Milberg et al*. 2000). The RLG= (Gd/Gl); where GI= the germination percentage in light, and Gd= the germination percentage in darkness.

RESULTS

Germinabiligy or seed germination (%)

There was a significant of species (DF=10; F=29.27; p<0.0001) and light (DF=1; F=86.71; p<0.0001) treatments, as well as the interaction of both factors (DF= 21; F= 29.48; p<0.0001). All species had at least 63% germination in light, so they were not considered dormant (Table 2).

Only one species, the barriliform cacti *E. platyacanthus* was positive photoblastic, with nil seed germination in darkness. All other species were considered neutral photoblasctic. For These we found three response patterns:i) species having similar seed germination in both light and darkness conditions, like the globose *C. delicate*, and the rosette species *A. filfera, A. striata, Y. carnerosana dna Y. filifera ii*) species showing higher seed germination in darkness than in light. *like A. lechuguilla and A. salmiana, and iii*) species showing higher germination in light that in darkness, like the columnar cacti M. *geometrizans and S. Queretaroensis*), and the rosette *Yucca elata*.

Table 2. Seed germination of 1.1 species from Saharanpur 25^0c after light and darkness treatments. Average final germination percentage or germinability (based on five replicates) for each species are shown. For each species, significant differences (p<0.0001) between treatments are indicated by different lower-case letter.

Species Germinability (%)	Light	Darkness	Photoblastism
Agave filifera	68±26.4a	64±9.8a	Neutral
Agave lechuguilla	68±3.5a	80±18.0a	Neutral
Agave salmiana	70±23.8a	94±5.6a	Neutral
Agave striata	90±4.2a	90±4.6a	Neutral
Coryphanta delicate	98±4.8a	99±4.8a	Neutral
Echinocactus platyacanthus	90±7.8a	0 b	Neutral
Myrtillocactus geometrizans	86±9.0a	8±14.9b	Neutral
Stenocereus queretarounsis	88±5.9a	69±39.b	Neutral
Yucca carnerosana	84±9.0a	89±6.5a	Neutral
Yucca elata	68±20.8a	39±8.6a	Neutral
Yucca filifera	88±5.9a	74±18.2a	Neutral

Relative Light Germination (RLG)

Species differed in terms of RLG (DF=10; F= 22.3; p<0.0001; Table 3). Two columnar species had higher RLG than the other species. Seven species showed intermediate RLG (RLG 0.49-0.67) and two species had low RLG, which indicates that they hand higher germination in darkness (*Agave lechuguilla*, RLG= 0.41; *Agave salmiana*, RLG= 0.43).

Table 3. Relative Light Germination (RLG) of 11 species from the Saharanpur at 25^0c after light and darkness treatments. Average RLG (based on five replicates) for each species are shown. Significant differences (p<0.0001) among species are indicated by different lower- case letters.

Species	RLG	Category
Agave filifera	0.48±.06b	Intermediate
Agave lechuguilla	0.41±.06c	Low
Agave salmiana	0.43±.09c	Low
Agave striata	0.48±.03b	Intermediate
Coryphanta delicata	0.50±.02b	Intermediate
Echinocactus platyacanthus	1.00±.000a	high
Myrtillocactus geometrizans	0.98±0.18b	High
Stenocereus queretarounsis	0.62±0.14b	Intermediate
Yucca carnerosana	0.54±0.01b	Intermediate
Yucca elata	0.69±0.6b	Intermediate
Yucca filifera	0.58±.07b	Intermediate

DISCUSSION

Following the seed germination analysis only one species was positive photoblastic (the barriliform *E. platyacanthus*), and seven rosette, one globose and two columnar species were neutral photoblastic. However, following the RLG analyses, *E. platyacanthus* and the columnar *S. queretaroensis* showed higher light dependence to germinate: five rosette, one columnar.

More studies are needed before understanding the implications of photoblastism in seeds from succulent species. These results contribute to understanding the germination biology of cactus and agave species, and could enhance the propagation of large numbers of cultivated individuals outside their habitats, promoting ex situ conservation.

REFERENCES

[1]. Baskin, C.C. and J.M. Baskin, 1998, Seeds: Ecology, Biogeography and Evolution of Dormancy and Germination. San Diego, Academic Press.
[2]. Flores- Martinez. A. G.I. Manzanero-Medina. G.C. Martinez- Hernandez and G.S. Pacheco- Vasquez. 2002. Aspectos sobre la ecologia y reproduction de *Mammillaria kraehenbuehlii* (Krainz) Krainz en la Maxteca de Oaxaca. Mexico, Cactaeas y Suculentas Mexicanas 47:57-68.
[3]. Milberg. P.L. Anderson and K. Thompson. 2000. Large- seeded species are less dependent on light for germination than small seeded ones. Seed Science Research 10:99-104.
[4]. Nobel. P.S. 1988 Environmental Biology of Agaves and Cacti. Cambridge, Cambridge University Press.
[5]. Schutz. W.P Milberg and B.B. Lamont. 2002. Seed dormancy, after ripening and light requirements of four annual Asteraceae in Southwestern Australia, Annals of Botany 90:707-714.