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DATA NOTE

Germination rates of four Chilean forest trees seeds: *Quillaja saponaria*, *Prosopis chilensis*, *Vachellia caven*, and *Caesalpinia spinosa*

[version 1; peer review: 2 approved, 1 approved with reservations, 1 not approved]

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Abstract

Data on the germination rates of four tree species, natively founded in the Chilean Mediterranean-climate zone, were determined by germination in crop chambers. The obtained data were used to interpolate or extrapolate the time taken for 50% of seeds to germinate in each case. These results are useful for regional native forest research and, in a broad sense, for its use in models to study germination dynamics in Mediterranean-climate zones.

Keywords

germination; native forest; Mediterranean-climate zone



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Open Peer Review

Approval Status

	1	2	3	4
version 1				
10 Sep 2018	view	view	view	view

- Gabriela Saldías**, Universidad Central de Chile, Santiago, Chile
- Madelaine Quiroz Espinoza**, University of Santiago, Chile (Usach), Santiago, Chile
- Diana Soriano**, Universidad Nacional Autónoma de México, Mexico City, Mexico
- Rafael Rubio de Cases** , Universidad de Granada, Granada, Spain
Diego Escobar , Sao Paulo State University-UNESP FCAV, Sao Paulo, Brazil

Any reports and responses or comments on the article can be found at the end of the article.

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Author roles: **Plaza A:** Conceptualization, Data Curation, Formal Analysis, Methodology, Validation, Visualization, Writing – Original Draft Preparation; **Castillo M:** Project Administration, Resources, Supervision, Writing – Review & Editing

Competing interests: No competing interests were disclosed.

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The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

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Introduction

Knowledge of the germination rates of a species means that future determination of this rate is unnecessary, preventing the waste of time and seeds.

Quillaja saponaria and *Vachellia caven* are two of the most representative trees in the Chilean Mediterranean forest (Perez-Quezada & Bown, 2015), so information about these species will be useful for ecological investigation and restoration. *Prosopis chilensis* is vulnerable in the wild and is a key species of its community (Valdivia & Romero, 2013); data about its propagation is important for conservation biologists.

In this article, we present the germination rates of seeds of *Q. saponaria*, *P. chilensis*, *V. caven*, and *Caesalpinia spinosa*. Dataset 1 contains the raw data from which these germination rates are calculated (Plaza & Castillo, 2018).

Methods

Samples

All seeds were collected from adult trees. *Q. saponaria* seeds were collected in VIII Región, Chile; seeds from *V. caven*, *C. spinosa* and *P. chilensis* were from Región Metropolitana, Chile. The seeds were collected between February and April 2017. Information about collection was obtained from the seed provider, CESAF Antumapu, <http://cesaf.forestaluchile.cl/>.

Table 1 and Table 2 specify the initial number of seeds per plate and the percentage of germinated seeds in some days are shown. Figure 1 shows the obtained values of time taken for 50% of seeds to germinate (TG50).

Pretreatment

Pretreatment conditions were suggested by the provider. Briefly, seeds of *Q. saponaria* were hydrated in tap water overnight. Seeds of *P. chilensis* were scarified in 95–97%, analytical grade H_2SO_4 for 10 minutes and then hydrated in tap water overnight. Seeds of *V. caven* were scarified in 95–97%, analytical grade H_2SO_4 for 90 minutes and then hydrated in tap water overnight. Seeds of *C. spinosa* were scarified in 95–97%, analytical grade H_2SO_4 for 30 minutes and then hydrated in tap water overnight.

Germination

Activated seeds of *Q. saponaria*, *P. chilensis*, *V. caven*, and *C. spinosa* were placed in Petri plates over a filter paper bed (3 plates per species). Filter paper was then hydrated with distilled water. All plates were incubated in a crop chamber at 20°C, with light/dark cycles of 9 h/15 h. Germination is conditioned by temperature, so altering this factor could completely change the germination rates (Giuliani *et al.*, 2015).

Plates were monitored periodically to count the germinated seeds and refill distilled water. *Q. saponaria* and *P. chilensis* plates were monitored until day 19 (Table 1). After that, fungal development made it difficult to check the plates, and a tactile examination of seeds indicated that most of them were rotten.

Plates containing *V. caven* and *C. spinosa* were more resistant to contamination and could be monitored until day 22. After this point, germination was too slow, and it was decided to end the experiment. Results are shown in Table 2.

Table 1. Percentage of germinated seeds of *Q. saponaria* and *P. chilensis* incubated for 19 days.

	Initial seeds per plate, n	Seeds germinated, %				
		Day 0	Day 2	Day 5	Day 13	Day 19
Q. saponaria (n=3 plates)						
Average	100	0.0	0.0	52.0	68.3	68.6
Standard Error	10	0.0	0.0	4.3	5.4	5.6
P. chilensis (n=3 plates)						
Average	96	0.0	58.1	61.5	65.3	67.4
Standard Error	4	0.0	2.6	2.6	2.5	2.4

Table 2. Percentage of germinated seeds of *V. caven* and *C. spinosa* incubated for 22 days.

	Initial seeds per plate, n	Seeds germinated, %						
		Day 0	Day 2	Day 5	Day 7	Day 13	Day 19	Day 22
V. caven (n=3 plates)								
Average	56	0.0	20.0	66.6	69.9	71.7	74.2	74.2
Standard error	5	0.0	3.3	1.9	1.4	1.5	1.9	1.9
C. spinosa (n=3 plates)								
Average	61	0.0	0.0	17.1	32.5	44.8	48.0	48.5
Standard error	3	0.0	0.0	5.8	4.5	4.7	2.9	2.5

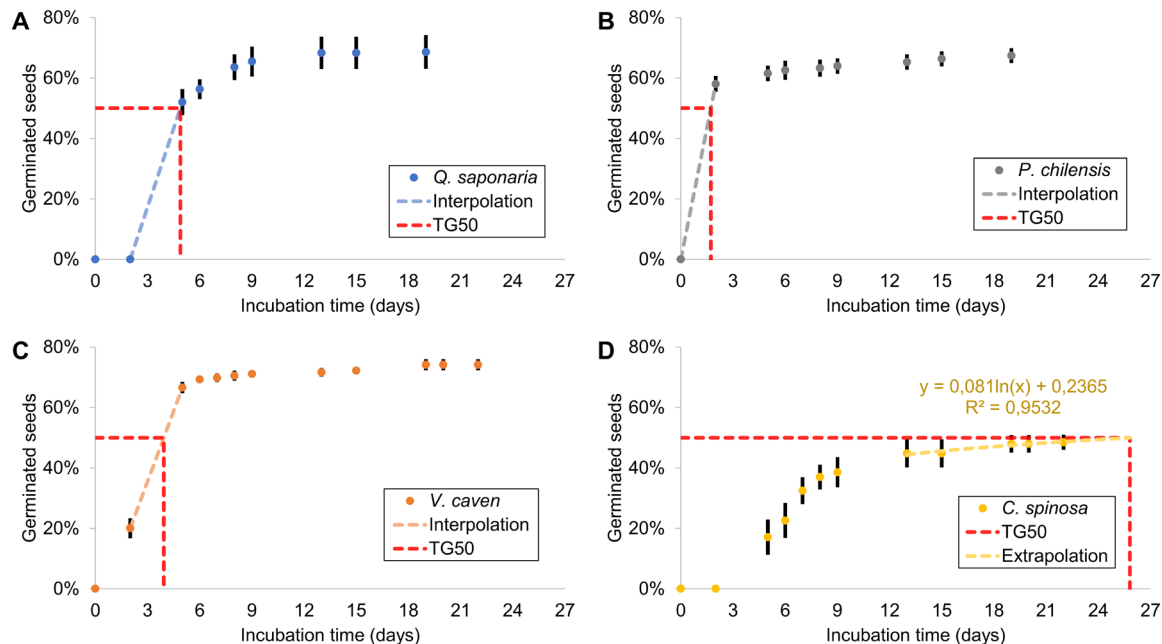


Figure 1. Time taken for 50% of seeds to germinate (TG50) for each species. Interpolation of *Q. saponaria* (A), *P. chilensis* (B) and *V. caven* TG50 (C), and extrapolation of *C. spinosa* TG50 (D).

The sample size, provided in the tables, is considered important for the replicability of a germination assay (Ribeiro-Oliveira & Rana, 2016).

TG50 calculation

For *Q. saponaria*, *P. chilensis* and *V. caven*, the TG50 was linearly interpolated from the two closest points (Figure 1A–C). *C. spinosa* didn't reach the 50% germination during the assay, so this was extrapolated using the last five points (Figure 1D). The TG50 of *Q. saponaria* was 4.9 days. *P. chilensis* had the fastest germination (TG50 = 1.7 days); *V. caven* had a TG50 of approximately 3.9 days, and the TG50 of *C. spinosa* was estimated to be 25.8 days.

Dataset 1. Raw number of germinated seeds for each species, each repeat plate and each time point

<http://dx.doi.org/10.5256/f1000research.16091.d216429>

Also included are cumulative number of germinated seeds, percentages of germinated seeds and calculation of the TG50 for each species.

Data availability

Dataset 1. Raw number of germinated seeds for each species, each repeat plate and each time point. Also included are cumulative number of germinated seeds, percentages of germinated seeds and calculation of the TG50 for each species. DOI: <https://doi.org/10.5256/f1000research.16091.d216429> (Plaza & Castillo, 2018).

Grant information

This work was supported by CONAF project 008/2016 “Pautas de terreno para la restauración de formaciones esclerófilas afectadas por incendios forestales. Regiones V, Metropolitana, VI y VII”, and CONICYT-PCHA/Magister Nacional/2016 – 22161077.

The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

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Publisher Full Text
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- F1000Research.*
- 2018.
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Publisher Full Text

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Version 1

Reviewer Report 18 December 2018

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Rafael Rubio de Cases 

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Diego Escobar 

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This is a small study, containing very little data.

Sample sizes of only three plates (n=3) per species are insufficient to draw conclusions.

With such a small sample size, all one could hope would be to draw conclusions at the population level, but that is all but impossible since there is almost no information on the populations of origin, and designations such as "VIII Región, Chile" or "Región Metropolitana, Chile" are unintelligible for anyone not familiar with Chilean geography.

Also, some explanation of the pre-treatments would be useful. Why does it need pre-treatment? Why that pre-treatment specifically? Do the authors have data from un-treated seeds?

Chemical scarification is expected to have influenced GT50. Specifically, to shorten it, since scarified seeds germinate faster. Therefore, it is not clear how meaningful these figures are. Moreover, GT50 calculations are a little obscure as presented. Were unviable seeds taken into account? There was a sizeable amount of seeds lost to fungi. Where those discarded? Please specify.

Is the rationale for creating the dataset(s) clearly described?

Yes

Are the protocols appropriate and is the work technically sound?

Partly

Are sufficient details of methods and materials provided to allow replication by others?

Partly

Are the datasets clearly presented in a useable and accessible format?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Plant evolutionary ecology

We confirm that we have read this submission and believe that we have an appropriate level of expertise to state that we do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Reviewer Report 11 December 2018

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Diana Soriano

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Authors present germination data for four species from the Chilean Mediterranean forest. I would like to focus on the first statement of the introduction:

"Knowledge of the germination rates of a species means that future determination of this rate is unnecessary, preventing the waste of time and seeds".

I think this statement is not accurate. Germination rate, especially in wild species, could be different depending on the cohort of seeds, the years of collection and the location. Data showed in this paper are valuable as a single biological replicate of germination behavior of the species used in the studies but it is necessary to add more biological replicates (different years and locations) to have a better understanding of germination behavior of the studied species.

Methods:

1. I would like to know from how many trees seeds were collected.
2. TG50 calculation could be more easily reproduced if the authors fit their data to a model (p/e sigmoid) and calculated first maximum derivate.

Is the rationale for creating the dataset(s) clearly described?

Partly

Are the protocols appropriate and is the work technically sound?

Partly

Are sufficient details of methods and materials provided to allow replication by others?

Partly

Are the datasets clearly presented in a useable and accessible format?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Plant Eco physiology

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 23 November 2018

<https://doi.org/10.5256/f1000research.17571.r39828>

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Madelaine Quiroz Espinoza

Faculty of Technology, University of Santiago, Chile (Usach), Santiago, Chile

The authors conducted germination trials on seeds of four Chilean forest tree species. They indicate that this information could be useful for conservation and restoration studies. Regarding the methodology, the description of pretreatments and germination trials stands out. The study design is appropriate and the work is technically sound. I believe that the authors could increase the number of replicates (Petri plate), but in this case it is correct as a first approximation to determine the germination rates of Chilean forest tree seeds.

The manuscript represents a useful contribution to the theme of the germination of Chilean forest trees seeds and deserves to be indexed.

Is the rationale for creating the dataset(s) clearly described?

Yes

Are the protocols appropriate and is the work technically sound?

Yes

Are sufficient details of methods and materials provided to allow replication by others?

Yes

Are the datasets clearly presented in a useable and accessible format?

Yes

Competing Interests: No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Reviewer Report 08 November 2018

<https://doi.org/10.5256/f1000research.17571.r39829>

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Gabriela Saldías

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The document provides valuable information on the germination rate of four native species. *Quillaja saponaria* and *Vachellia caven* are two of the most representative trees of the Chilean Mediterranean forest, *Prosopis chilensis* is in the category of threat and *Caesalpinia spinosa* adapts well to the conditions of the central zone of the country. The protocols for the collection of fruits and seeds, as well as the applied pre-germinative treatments, were based on methodologies recommended by the *Centro de Semillas de la Universidad de Chile, CESAF Antumapu*. Although they are described in the text, it would be convenient to add the references of Gold *et al.* (2004¹) and INFOR (2015²) that complements the antecedents in pre-germination treatments for the species under study.

With regard to the results obtained, knowing the time required to achieve 50% of seed germination is a useful fact that helps to plan the work of plant reproduction for research and ecological restoration purposes as proposed by the authors.

References

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2. INFOR: Propagación de especies forestales nativas de las zonas áridas y semiáridas de Chile. *INFOR, CORFO, INIA*. 2015; **47**: 135 p. [Reference Source](#)

Is the rationale for creating the dataset(s) clearly described?

Yes

Are the protocols appropriate and is the work technically sound?

Yes

Are sufficient details of methods and materials provided to allow replication by others?

Yes

Are the datasets clearly presented in a useable and accessible format?

Yes

Competing Interests: No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

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