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Supplementary Material

Generalised seed mortality driven by heat shock in woody plants from Mediterranean Chile

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Table S1. Geographical distribution of the species studied in Chile and general information of the seeds used in the assays.

Scientific name[A]	Code	Species distribution[B]	Collection locality[C]	Collection date	Pretreatment viability (%)[D]	Seeds per replicate
Adesmia microphylla	ADMI	III to V	La Higuera (IV)	2003	84	22
Archidasyphyllum excelsum	DAEX	V to VI	Olmué (V)	2021	10	27
Azara celastrina	AZCE	IV to VIII	El Chiñe (IV)	2020	100	25
*Azara integrifolia***	AZIN	V to XIV	Talca (VII)	2019	72	25
*Baccharis paniculata**	BAPA	III to VIII	Parque Nacional Río Clarillo (RM)	2013	0	25
Cissus striata	CIST	IV to XII	Valdivia Botanical Garden (XIV)	2021	70	28
*Colletia ulicina***	COUL	IV to VIII	Talca (VII)	2019	NA	23
Eccremocarpus scaber	ECSC	V to XIV	Valparaiso (V)	2004	NA	10
Escallonia illinita	ESIL	IV to VIII	Quilpué (V)	2006	50	20
Escallonia pulverulenta	ESPU	IV to IX	Botanical Garden of Viña del Mar (V)	2005	35	20
Eupatorium glechonophyllum	AGGL	II to VIII	Cuesta el Melón (V)	2002	33	22
Eupatorium salvium	ARSA	IV to VIII	Olmué (V)	2021	80	27
Gardoquia gilliesii	GOGI	IV to IX	Botanical Garden of Viña del Mar (V)	2005	80	21
Lobelia polyphylla	LOPO	III to VI	Botanical Garden of Viña del Mar (V)	2004	55	22
*Persea lingue**	PELI	V to X	Futrono (XIV)	2021	39	35
Pleocarphus revolutus	PLRE	III to V	La Higuera (IV)	2006	25	22
Porlieria chilensis	POCH	IV to VI	La Parrita (IV)	2020	76	22
Prosopis chilensis	PRCH	I to VI	Metropolitana Region	2019	85	25
*Senna cumingii**	SECU	III to IV	Ovalle (IV)	2005	100	25
*Solanum crispum***	SOLI	IV to XI	Talca (VII)	2019	100	25
Teucrium bicolor	TEBI	IV to X	Viña del Mar (V)	2004	NA	10

A: Seeds hand-harvested by the authors or their colleagues marked with *. Seeds purchased from Chileflora (http://www.chileflora.com/Shome.htm) marked with **.

B: Chilean administrative regions where the species inhabit (cf. http://catalogoplantas.udec.cl/). RM: Metropolitan Region; II: Antofagasta; III: Atacama; IV: Coquimbo; V: Valparaíso; VI: Libertador Bernardo O'Higgins; VII: Maule; VIII: Bío-bío; IX: La Araucanía; X: Los Lagos; XI: Aysén del General Carlos Ibáñez del Campo; XII: Magallanes; XIV: Los Ríos.

C: Chilean administrative regions between brackets, using the same abbreviations as in the previous column.

D: NA means that pre-treatment viability was not evaluated due to the low quantity of seeds.

Table S2. Statistical evaluation of changes in the probability of survival and germination between control and heated seeds at 100 °C. Only the results for the species for which the models showed a reliable fit of the parameters are given (see "Material and Methods" section for details). Significant p-values between the comparisons are highlighted in bold.

Species	Likelihood ratio test			Overdispersion test		Wald Z test			
	χ^2	*df*	*P*	*Ratio*	$P(\chi^2)$	*Estimate*	*SE*	*Z*	*P*
Viability									
Azara celastrina									
100 °C	16.9	1.0	**<0.0001**	0.9	0.8	-4.2	1.1	-3.8	**<0.0001**
Eccremocarpus scaber									
100 °C	16.4	1.0	**<0.0001**	0.5	1.0	-7.9	2.4	-3.3	**<0.001**
Escallonia pulverulenta									
100 °C	9.9	1.0	**<0.001**	0.8	1.0	-2.8	0.8	-3.6	**<0.0001**
Eupatorium glechonophyllum									
100 °C	13.7	1.0	**<0.0001**	0.9	0.8	-2.8	0.6	-5.0	**<0.0001**
Gardoquia gilliesii									
100 °C	20.3	1.0	**<0.0001**	0.8	0.9	-5.0	0.8	-6.5	**<0.0001**
Pleocarphus revolutus									
100 °C	11.2	1.0	**<0.001**	0.9	0.8	-2.1	0.5	-4.1	**<0.0001**
120 °C	9.6	1.0	**<0.001**	0.9	0.9	-2.0	0.6	-3.5	**<0.0001**
Prosopis chilensis									
100 °C	15.6	1.0	**<0.0001**	1.0	0.5	-2.0	0.3	-6.2	**<0.0001**
120 °C	22.1	1.0	**<0.0001**	1.0	0.6	-5.9	1.1	-5.5	**<0.0001**
Germinability									
Azara celastrina									
100 °C	14.9	1.0	**<0.0001**	0.9	0.9	-4.1	1.1	-3.6	**<0.0001**

Eccremocarpus scaber									
100 °C	16.8	1.0	**<0.0001**	0.6	1.0	-7.0	2.0	-3.5	**<0.001**
Escallonia pulverulenta									
100 °C	9.2	1.0	**<0.001**	0.8	0.9	-2.5	0.7	-3.4	**<0.001**
Eupatorium glechonophyllum									
100 °C	11.7	1.0	**<0.0001**	0.8	1.0	-3.3	0.7	-4.5	**<0.0001**

Table S3. Two-way ANOVAs comparing the effect of the heat-shock (at 100 °C for 5 min) on the time to reach 50% germination (T50) *of Eupatorium glechonophyllum* and *Prosopis chilensis***.**

Source	*df*	*SS*	*MS*	*F*	*P*	Shapiro-Wilk normality test		Breusch-Pagan test		
						W	*P*	*BP*	*df*	*P*
Eupatorium glechonophyllum										
Treatment (100 °C)	1	1144.4	1144.4	23.8	<0.001	0.787	0.010	2.634	1	0.104
Residuals	7	337.0	48.1							
Prosopis chilensis										
Treatment (100 °C)	1	0.01	0.01	27.7	<0.0001	0.954	0.721	0.091	1	0.761
Residuals	8	0.01	0.001							

Table S4. Seed response to heat of all studied species of the woody flora of the Chilean *matorral* ecoregion. Species nomenclature followed Rodriguez et al. (2018).

Scientific name	Family	Heat response[1]	Source[2]
Acacia caven (Molina) Molina	Fabaceae	Tolerant	Gómez-González et al. 2017
Adesmia microphylla Hook. & Arn.	Fabaceae	Inhibited	This study
Archidasyphyllum excelsum (D. Don) P.L. Ferreira, Saavedra & Groppo	Asteraceae	Inhibited	This study
Azara celastrina D. Don	Salicaceae	Inhibited	This study
Azara integrifolia Ruiz & Pav.	Salicaceae	Inhibited	This study
Azara petiolaris (D. Don) I.M. Johnst.	Salicaceae	Inhibited	Gómez-González et al. 2017
Baccharis linearis (Ruiz & Pav.) Pers. subsp. Linearis	Asteraceae	Tolerant	Gómez-González et al. 2017
Buddleja globosa Hope	Scrophulariaceae	Inhibited	Gómez-González et al. 2017
Cestrum parqui L'Hér.	Solanaceae	Inhibited	Gómez-González et al. 2017
Cissus striata Ruiz & Pav.	Vitaceae	Inhibited	This study
Colletia hystrix Clos	Rhamnaceae	Tolerant	Muñoz and Fuentes 1989
Colletia ulicina Gillies & Hook.	Rhamnaceae	Inhibited	This study
Colliguaja integerrima Gillies & Hook.	Euphorbiaceae	Tolerant	Gómez-González et al. 2017
Colliguaja odorifera Molina	Euphorbiaceae	Stimulated	Muñoz and Fuentes 1989; Gómez-González et al. 2017
Cryptocarya alba (Molina) Looser	Lauraceae	Tolerant	Gómez-González et al. 2017
Eccremocarpus scaber Ruiz & Pav.	Bignoniaceae	Inhibited	This study
Escallonia illinita C. Presl	Escalloniaceae	Inhibited	This study
Escallonia pulverulenta (Ruiz & Pav.) Pers.	Escalloniaceae	Inhibited	This study
Eupatorium glechonophyllum Less.	Asteraceae	Inhibited	This study
Eupatorium salvium Colla	Asteraceae	Inhibited	This study
Gardoquia gilliesii Graham	Lamiaceae	Inhibited	This study
Kageneckia angustifolia D. Don	Rosaceae	Tolerant	Gómez-González et al. 2017
Kageneckia oblonga Ruiz & Pav.	Rosaceae	Tolerant	Gómez-González et al. 2017
Lithrea caustica (Molina) Hook. & Arn.	Anacardiaceae	Stimulated	Gómez-González et al. 2017
Lobelia polyphylla Hook. & Arn.	Campanulaceae	Inhibited	This study
Maytenus boaria Molina	Celastraceae	Tolerant	Gómez-González et al. 2017
Muehlenbeckia hastulata (Sm.) I.M. Johnst. var. Hastulata	Polygonaceae	Stimulated	Muñoz and Fuentes 1989; Gómez-

			González et al. 2017
Otholobium glandulosum (L.) J.W. Grimes	Fabaceae	Stimulated	Gómez-González et al. 2017
Peumus boldus Molina	Monimiaceae	Tolerant	Gómez-González et al. 2017
Pleocarphus revolutus D. Don	Asteraceae	Inhibited	This study
Podanthus mitiqui Lindl.	Asteraceae	Inhibited	Gómez-González et al. 2017
Porlieria chilensis I.M. Johnst.	Asteraceae	Inhibited	This study
Prosopis chilensis (Molina) Stuntz	Fabaceae	Inhibited	This study
Quillaja saponaria Molina	Rosaceae	Tolerant	Muñoz and Fuentes 1989; Gómez-González et al. 2017
Retanilla ephedra (Vent.) Brongn.	Rhamnaceae	Tolerant	Gómez-González et al. 2017
Retanilla trinervia (Gillies & Hook.) Hook. & Arn.	Rhamnaceae	Stimulated	Muñoz and Fuentes 1989; Gómez-González et al. 2017
Schinus polygamus (Cav.) Cabrera	Anacardiaceae	Tolerant	Muñoz and Fuentes 1989
Senna candolleana (Vogel) H.S. Irwin & Barneby	Fabaceae	Stimulated	Gómez-González et al. 2017
Senna cumingii (Hook. & Arn.) H.S. Irwin & Barneby	Fabaceae	Inhibited	This study
Solanum crispum Ruiz & Pav.	Solanaceae	Inhibited	This study
Sophora macrocarpa Sm.	Fabaceae	Stimulated	Gómez-González et al. 2017
Teucrium bicolor Sm.	Lamiaceae	Inhibited	This study

[1]**Heat response:** Stimulated: germination after heat-shock (either 100 °C or 120 °C) was significantly higher than that of control seeds; Tolerant: any heat-shock treatment increased germinability, but did not significantly decrease survival; Inhibited: seed survival significantly decreased in (at least) the less intense heat-shock treatment (100 °C).

[2]**References:** Gómez-González S, Paula S, Cavieres LA, Pausas JG (2017) Post-fire responses of the woody flora of Central Chile: Insights from a germination experiment. *PLoS One* **12**, e0180661. Muñoz MR, Fuentes ER (1989). Does fire induce shrub germination in the Chilean Matorral? *Oikos* **56**, 177–181. Rodriguez R, Marticorena C, Alarcón D, Baeza C, Cavieres L, Finot VL, Fuentes N, Kiessling A, Mihoc M, Pauchard A, Ruíz E, Sánchez P, Marticorena A (2018). Catálogo de las plantas vasculares de Chile. *Gayana Botanica* **75**, 1-430.

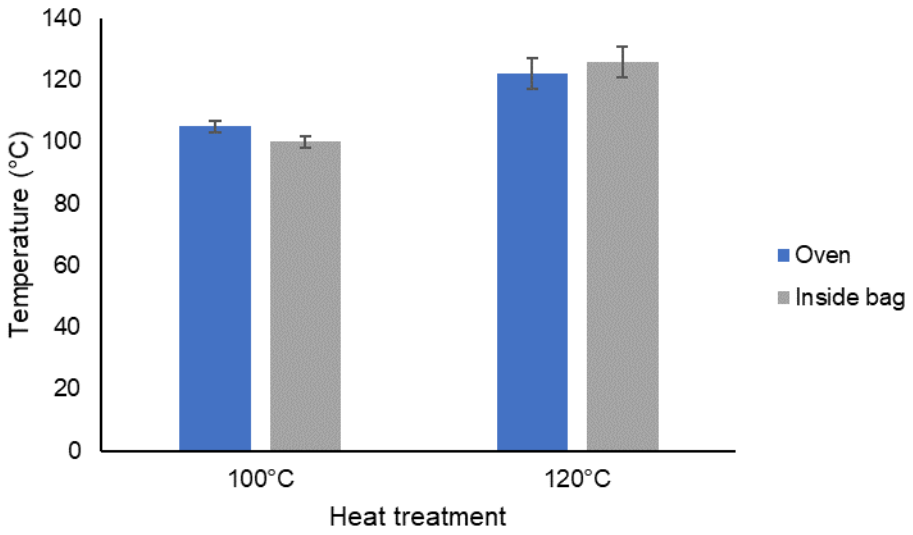

Fig. S1. Mean (±SD) temperature differences recorded in the preliminary runs of the oven used for calibration of the oven's settings for the two heat-shock treatments (at 100 °C and at 120 °C). The temperature was simultaneously measured inside an aluminum bag (in grey) and on the oven rack (in blue).

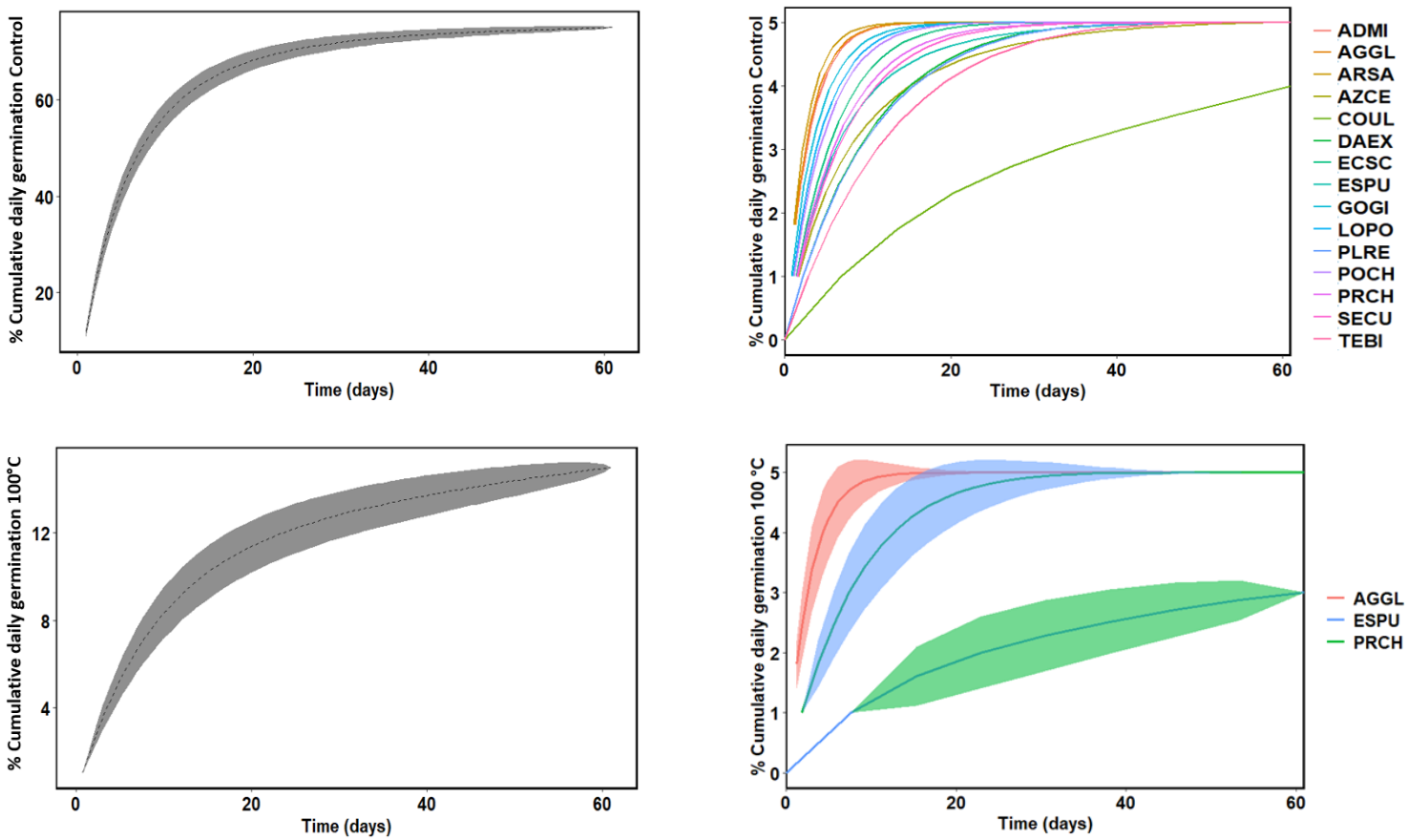

Fig. S2. Cumulative daily germination *versus* the time since sowing (in days) adjusted according to the rarefaction method. The upper panels show the curves for the control treatment and the lower panels those for the 100 °C treatments. In the 120 °C treatment, not enough germinations were obtained to generate rarefaction curves. The left panels show the adjusted curves considering all seeds (irrespective of the species), while the right panels show color-coded curves for those species with sufficient germinations. The species four-letter-codes can be found in Table S1.