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Seed germination reports for five species of the genus *Silene* (*Caryophyllaceae*)

Abstract

Brullo, C. & Salmeri, C.: Seed germination reports for five species of the genus *Silene* (*Caryophyllaceae*) [In Magrini, S. & Salmeri, C. (eds), Mediterranean plant germination reports – 4]. Fl. Medit. 32: 220-226. 2022. <https://doi.org/10.7320/FIMedit32.220>

In this contribution, new germination data for five *Silene* taxa coming from the natural habitats of Sicily and Calabria are given. The investigated taxa are: the threatened endemic *S. calabra* and *S. crassiuscula*, together with *S. colorata*, *S. fruticosa*, and *S. nicaeensis* from Sicilian sites. Seed germinations were tested at the Catania Germplasm Bank (BGS-CT), at constant temperatures (from 5 to 30°C), under both light (12/12h photoperiod) and total darkness conditions. The results emphasized a high germination ability and rate in all examined species.

Key words: Calabria, endemic, Italian flora, threatened plants, Sicily.

Introduction

Silene L. is a genus of *Caryophyllaceae* including about 700 species and may be considered one of the largest genera of this family worldwide (Morton 2005; Iamónico 2018). The Mediterranean basin and SW-Asia are considered its main centres of species diversity (Greuter 1995; Oxelman & Lidén 1995). According to Pignatti (2017), the total number of *Silene* taxa occurring in Italy is 86, many of which are endemic (ca. 35%).

In this contribution, the germination protocols of five different species of *Silene* were investigated, two of which are Italian endemics, both included in the Italian Red List of threatened vascular plants (Rossi & al. 2020). These are *S. calabra* Brullo, Scelsi & Spamp., endemic to SW Calabria, and *S. crassiuscula* Brullo, C. Brullo, Cambria, Bacch., Giusso & Ilardi, endemic to NW Sicily, while the other studied taxa are represented by Sicilian populations of *S. colorata* Poir., a widespread Mediterranean therophyte, *S. fruticosa* L., growing in rupestrian sites of the Central and Eastern Mediterranean area, and *S. nicaeensis* All., a quite rare CW Mediterranean psammophyte.

The germination tests were carried out at the Catania Germplasm Bank (BGS-CT), using different constant temperatures (from 5 to 30°C), under both light (12/12h photoperiod) and full darkness conditions. First germination reports are provided for the two endemic species, as well as for the remaining taxa in the Sicilian territory.

98. *Silene calabra* Brullo, Scelsi & Spamp. (*Caryophyllaceae*)**Accession data**

It: Calabria, Pentidattilo, (WGS84: 37.946472°N, 15.758747°E), conglomerate rocks, ca. 130 m a.s.l., 10 Sep 2004, *A. Crisafulli & F. Rossello* (123AC/FR/04, BGS-CT Catania Germplasm Bank).

Germination data

Pre-treatments: no treatment

Germination medium: 3 sheets of sterilized filter paper (Whatmann No. 1), imbibed with 5 ml of sterilized distilled water

Sample size: 60 seeds for each test (15 × 4 replicates)

Germination	Thermoperiod	Photoperiod [light/dark]	T ₁ [d]	T ₅₀ [d]	T _{max} [d]	MTG [d]
98%	constant 15°C	0/24h	-	-	-	-
97%	constant 15°C	12/12h	2	5.2	7	4.4

Observations

Silene calabra is a rupestrian species endemic to the Ionian slope of Mt. Aspromonte (SW Calabria), where it grows in conglomerate, calcarenite and limestone cliff habitats at 100-800 m a.s.l. (Brullo & al. 1997). Seeds of *S. calabra* showed successful germination at the constant temperature of 15°C, both in light and full dark conditions.

Due to the poor number of available seeds, no other germination conditions could be tested so far, though other optimal thermal ranges (mainly 10-25°C) are expectable also for this species, similarly to other taxa of *Silene* characteristics of dry climates (GENMEDOC 2006; Murru & al. 2017; Zani & Müller 2017; Magrini & al. 2019; Carruggio & al. 2021).

99. *Silene colorata* Poir. (*Caryophyllaceae*)**Accession data**

Si: Siracusa, Priolo Gargallo, Saline di Priolo (WGS84: 37.142500°N, 15.219444°E), maritime sand dunes, 4 m a.s.l., 27 Mar 2017, *G. Giusso & S. Sciandrello* (UNICT_340, BGS-CT Catania Germplasm Bank).

Germination data

Pre-treatments: no treatment

Germination medium: 1% agar

Sample size: 60 seeds for each test (20 × 3 replicates)

Germination	Thermoperiod	Photoperiod [light/dark]	T ₁ [d]	T ₅₀ [d]	T _{max} [d]	MTG [d]
90%	constant 15°C	12/12h	2	2.3	5	3.7
88%	constant 10°C	0/24h	-	-	-	-
85%	constant 25°C	12/12h	1	0.6	7	1.2
85%	constant 25°C	0/24h	-	-	-	-
83%	constant 20°C	0/24h	-	-	-	-
80%	constant 10°C	12/12h	5	3.5	7	5.0

Observations

Silene colorata is a psammophilous therophyte that grows on the sandy coast of the Mediterranean basin. This is the first germination report for the Sicilian territory. Seeds of *S. colorata* showed the best germination rate (90%) at 15°C under light conditions; germination values $\geq 80\%$ also occurred at 10°C and 25°C both in light-dark photoperiod (80% and 85%, respectively) and full darkness (88% and 85%, respectively). Seed germination was somehow negatively affected by light at 10°C (80% at 12/12h vs 88% at 0/24h) and 20°C (72% at 12/12h vs 83% at 0/24h) or light insensitive at 25°C. Conversely, light exposure showed positive effects at 15°C, allowing the highest germination value, while just 72% of germinated seeds were obtained under full darkness.

Reports from Royal Botanic Gardens Kew (2022) partly agreed with our results (90% at 15°C and 69% at 20°C with 12/12h photoperiod), though seed germination at 10°C in light conditions was lower (56%); on the other hand, 100% of germinated seeds were reported at 16°C and 21°C (12/12 photoperiod) and 95-100% under 8/16 photoperiod at 15°C and 20-25°C, respectively. Fully contrasting results were provided by Del Vecchio & al. (2021) for one Venetian population, which achieved very low germination values, ranging from 0% at 5°C under light to max. 36% at 20°C in full darkness, with light negatively affecting seed germination at all temperatures, except 25°C.

100. *Silene crassiuscula* Brullo, C.Brullo, Cambria, Bacch., Giusso & Ilardi (*Caryophyllaceae*)

Accession data

Si: Palermo, Sferracavallo (WGS84: 38.211111°N, 13.281388°E), rocky coasts, 3 m a.s.l., 11 May 2012, *V. Ilardi* (UNICT_113, BGS-CT Catania Germplasm Bank).

Germination data

Pre-treatments: no treatment

Germination medium: 1% agar

Sample size: 60 seeds for each test (20 × 3 replicates)

Germination	Thermoperiod	Photoperiod [light/dark]	T ₁ [d]	T ₅₀ [d]	T _{max} [d]	MTG [d]
100%	constant 10°C	0/24h	-	-	-	-
98%	constant 25°C	12/12h	1	0.6	4	1.2
97%	constant 10°C	12/12h	2	2.7	12	3.6
92%	constant 15°C	12/12h	2	1.9	3	2.4
90%	constant 20°C	12/12h	1	0.6	3	1.7
90%	constant 30°C	12/12h	1	0.7	4	1.5
88%	constant 5°C	0/24h	-	-	-	-
85%	constant 15°C	0/24h	-	-	-	-
85%	constant 25°C	0/24h	-	-	-	-

Observations

Silene crassiuscula is a succulent therophyte endemic to the rocky coasts of NW Sicily, included in the Italian Red List under the NT IUCN category (Rossi & al. 2020). This is the first germination report for the species. The maximum germination rate (100%) was obtained at 10°C in full dark conditions. However, seeds of *S. crassiuscula* showed high germination values (100-85%) in a wide thermal range, from 5°C to 30°C. Light exposure did not particularly affect seed germination, which overall was > 80% both in the light and total dark conditions; some photoinhibition effect occurred at 5°C with a germination decline to 67%.

101. *Silene fruticosa* L. (*Caryophyllaceae*)

Accession data

Si: Messina, Taormina (WGS84: 37.853888°N, 15.283888°E), limestone cliffs, 337 m a.s.l., 21 June 2012, *C. Brullo, S. Brullo, G. Giusso & S. Sciandrello* (UNICT_023, BGS-CT Catania Germplasm Bank).

Germination data

Pre-treatments: no treatment

Germination medium: 1% agar

Sample size: 60 seeds for each test (20 × 3 replicates)

Germination	Thermoperiod	Photoperiod [light/dark]	T ₁ [d]	T ₅₀ [d]	T _{max} [d]	MTG [d]
100%	constant 10°C	12/12h	6	6.4	10	6.9
100%	constant 15°C	12/12h	2	2,9	5	3.4

100%	constant 20°C	12/12h	2	2.1	5	2.8
100%	constant 25°C	0/24h	-	-	-	-
98%	constant 25°C	12/12h	2	2.0	10	3.5
95%	constant 15°C	0/24h	-	-	-	-
93%	constant 10°C	0/24h	-	-	-	-
90%	constant 20°C	0/24h	-	-	-	-

Observations

Silene fruticosa is a casmophilous chamaephyte that grows in the calcareous cliffs of Sicily, Malta, Greece, Cyprus, Libya, and Egypt. Seeds of *S. fruticosa* showed high germination rates ($\geq 90\%$) in a wide thermal range (10-25°C). Full germination was achieved at 10°C, 15°C and 20°C under light conditions, while it slightly decreased (90-95%) in total darkness. Seed germination was affected by low temperature, since at 5°C it decreased up to 62%, with 12/12h light-dark photoperiod, while only 5% of germination was reached under total dark conditions, thus revealing a major light stimulation in cold conditions. Conversely, at 25°C full dark conditions allowed 100% of seed germination, which remained slightly lower (98%) under light photoperiod. Such effects of light and temperature on the germination behaviour of *S. fruticosa* somehow agree with the results of Walter & al. (2020). Very similar germination rates were also reported by Royal Botanic Gardens Kew (2022), which indicated 100% and 96% of germination at 15°C and 25°C, respectively, under a 12/12h light-dark photoperiod.

102. *Silene nicaeensis* All. (Caryophyllaceae)

Accession data

Si: Caltanissetta, Gela, Manfria (WGS84: 37.098055°N, 14.142500°E), maritime sandy dunes, 0 m a.s.l., 24 May 2012, C. Brullo, S. Brullo, M. Patanè & D. Torrìsi (UNICT_005, BGS-CT Catania Germplasm Bank).

Germination data

Pre-treatments: no treatment.

Germination medium: 1% agar.

Sample size: 60 seeds for each test (20 × 3 replicates).

Germination	Thermoperiod	Photoperiod [light/dark]	T1 [d]	T50 [d]	Tmax [d]	MTG [d]
100%	constant 25°C	12/12h	1	0.6	3	1.1
100%	constant 25°C	0/24h	-	-	-	-
92%	constant 10°C	0/24h	-	-	-	-

90%	constant 15°C	12/12h	2	3.5	10	4.1
90%	constant 20°C	12/12h	1	1.0	10	1.8
88%	constant 15°C	0/24h	-	-	-	-

Observations

Silene nicaeensis is a psammophilous hemicryptophyte that grows on the sandy coasts mainly of the Central-Western Mediterranean area. Plants of the investigated southmost Sicilian population show a perennial life cycle, which is quite common in the North African plants (*S. nicaeensis* var. *perennis* Maire). Seeds revealed high germination values (88-100%) in the thermal range from 15°C to 25°C, both in the light (12/12h photoperiod) and total darkness, except for 20°C in dark conditions which provided a germination percentage < 80%. The maximum germination rate (100%) resulted at 25°C. Seeds showed marked photosensitivity at 10°C, as germination reached 92% in total darkness, while it dropped down to just 8%, under a 12/12h photoperiod. Moreover, a marked decline in germination was recorded at 30°C, both in light and dark conditions, revealing the occurrence of thermo-inhibition in this population.

Royal Botanic Gardens Kew (2022) reported for this species (not specified provenances) very fluctuating germination data, ranging from 100% to 56%, with the highest responses at 16°C and 26°C (with 12/12h photoperiod), and at 20°C and 25°C (with 8/16h photoperiod), while, the lowest germination rate occurred at 10°C, similarly to our results.

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