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Mediterranean plant germination reports – 5

Abstract

Salmeri, C. (ed.), Bacchetta, G., Barone, G., Calvia, G., Deplano, M., Di Gristina, E., Estrelles, E., García-Martínez, E., Martínez-Oliver, Mirabile, G., L., Porceddu, M., Prieto-Mossi, J., Scafidi, F., Villaluenga, E. I. & Magrini, S. (ed.): Mediterranean plant germination reports – 5. — Fl. Medit. 33: 279-297. 2023. — ISSN: 1120-4052 printed, 2240-4538 online.

This is the fifth issue of the series of germination reports from Mediterranean areas (sensu Med-Checklist). It comprises germination protocols for 18 taxa: *Hieracium* and *Pilosella* from South Italy by Di Gristina & al. (Nos. 103-106); *Genista* from Sardinia by Deplano & al. (No. 107); *Antirrhinum*, *Anthyllis*, *Digitalis*, *Echium*, *Jasione*, *Nothoscordum*, *Silene* and *Verbascum* by Martínez-Oliver & al. (Nos. 108-116); *Dianthus*, *Helichrysum* and *Silene* from Sicily by Scafidi & Salmeri (Nos. 117-120).

Key words: endemic species, *ex-situ* conservation, monumental populations, protocols, Sardinia, seeds, Sicily, Valencia.

Introduction

This fifth issue of the series of germination reports from Mediterranean areas (sensu Med-Checklist) examines the germination protocols of 18 taxa belonging to seven dicot and one monocot plant families, namely *Asteraceae* (5), *Caryophyllaceae* (4), *Fabaceae* (3), *Plantaginaceae* (2), *Boraginaceae* (1), *Campanulaceae* (1), *Scrophulariaceae* (1) and *Amaryllidaceae* (1). Seven out of 18 taxa are endemic to Italy, five of which are strictly endemic to NW Sicily, other five taxa are endemic to Spain, and one subendemic (SE Spain and NW Africa), while the remaining three taxa have a wider distribution in the Mediterranean. Overall, these reports contribute to improving the knowledge on the germination behaviour of the Mediterranean plants pivotal to both *in situ* and *ex situ* conservation actions and further implement the checklist of the Mediterranean germination reports available in the RIBES website (<https://www.reteribes.it>).

103. *Hieracium lucidum* subsp. *cophanense* (Lojac.) Greuter (*Asteraceae*)

Accession data:

Si: Trapani, Cornino, Mt Cofano (WGS84: 38.108889°N, 12.659722°E), limestone rocks, 185 m a.s.l., 9 Nov 2021, *E. Di Gristina* (SAF 100112).

Germination data

Pre-treatments: No treatment. Only manual removal of pappus.

Germination medium: Petri dishes with 2 sheets of sterilized Whatman 40 filter papers, imbibed in sterilized distilled water or 10^{-3} M gibberellic acid (GA_3) water solution⁽¹⁾.

Sample size: 80 seeds for each test (20 × 4 replicates).

Germination	Thermoperiod	Photoperiod [light/dark]	T ₁ [d]	T ₅₀ [d]	T _{max} [d]	MTG [d]
92% ⁽¹⁾	constant 20°C	0/24h	5.0	10.1	16.0	12.0
90%	constant 20°C	0/24h	6.0	10.6	16.0	12.0

Observations

Hieracium lucidum subsp. *cophanense* is a chasmophytic hawkweed endemic to Sicily, recorded only for Mt Cofano (Natural reserve of Monte Cofano, NW-Sicily) and Mt Passo del Lupo (Natural Reserve of Zingaro, NW-Sicily). It is closely related to *H. lucidum* subsp. *lucidum*, an endemic Sicilian taxon, which, according to Pignatti (2018), ascribes to Sicily the interesting role of the likely differentiation center of the genus. Although *H. lucidum* subsp. *cophanense* grows on rocks and vertical cliffs, the recurrent presence of fire is progressively reducing the number of individuals and, according to the recent conservation status assessment of the endemic *Hieracium* s. str. occurring in Sicily (Di Gristina & al. 2022), the taxon can be classified as Critically Endangered (CR): C2a(i). *H. lucidum* subsp. *cophanense* matures and disperses its seeds from November to early December.

Germination tests were carried out 3 months after seed harvesting, using the constant temperatures of 15°C, 20°C, and 25°C in continuous darkness, and alternating temperature of 30/15°C (16h/8h, light/dark). The obtained results showed that *H. lucidum* subsp. *cophanense* produces non-dormant seeds, with a high percentage of germination at all tested thermoperiods. This can be due to a strategy aimed at allowing populations living in unfavourable ecological conditions, such as chasmophytic environments, to increase the probability of dispersion and affirmation of the progeny (Di Gristina & al. 2020). The optimal germination temperature was 20°C (90%). Germination tests carried out in 10^{-3} M gibberellic acid (GA_3) provided slightly higher germination percentages (92%). No germination data are present in the literature for this taxon.

E. Di Gristina, G. Mirabile & G. Barone

104. *Hieracium racemosum* subsp. *lucanum* Di Grist., Domina, Gottschl. & Scafidi (*Asteraceae*)

Accession data:

It: Basilicata, Potenza, Lauria, Timpa Rossa (WGS84: 40.107361°N, 15.934836°E), quartzarenitic stony slopes, 846 m a.s.l., 18 Aug 2021, *E. Di Gristina* (SAF 100113).

Germination data

Pre-treatments: No treatment. Only manual removal of pappus.

Germination medium: Petri dishes with 2 sheets of sterilized Whatman 40 filter papers, imbibed in sterilized distilled water or 10^{-3} M gibberellic acid (GA_3) water solution⁽¹⁾.

Sample size: 80 seeds for each test (20 × 4 replicates).

Germination	Thermoperiod	Photoperiod [light/dark]	T ₁ [d]	T ₅₀ [d]	T _{max} [d]	MTG [d]
90% ⁽¹⁾	constant 20°C	0/24h	6.0	13.4	19.0	14.0
85%	constant 20°C	0/24h	7.0	14.1	20.0	15.0

Observations

Hieracium racemosum subsp. *lucanum* is a pseudorosulate hemicryptophytic hawkweed endemic to Basilicata (S Italy) (Di Gristina & al. 2019). This taxon belongs to the collective species *H. racemosum* Willd. which is one of the most polymorphic aggregates in the genus *Hieracium* L. s. str. Indeed, it includes 40 infraspecific taxa with the center of their distribution in Italy and the Balkan Peninsula (Di Gristina & al. 2019). *H. racemosum* subsp. *lucanum* matures and disperses the seeds from August to early September (Di Gristina & al. 2019).

Germination tests were carried out 3 months after seed harvesting, using the constant temperatures of 15°C, 20°C, and 25°C in continuous darkness, and the alternating temperature of 30/15°C (16h/8h, light/dark). In water, a high percentage of germination was obtained at all tested thermoperiods, the highest (85%) and with high germination speed (T₅₀: 14.1, MTG: 15.0) at the constant temperature of 20°C. Germination tests carried out in 10^{-3} M gibberellic acid (GA_3) provided a bit higher germination percentage (90%). Here we report the first germination data for this taxon and the *H. racemosum* aggregate.

E. Di Gristina, G. Mirabile & G. Barone

105. *Hieracium umbrosum* subsp. *abietinum* (Boiss. & Heldr.) Greuter (*Asteraceae*)

Accession data:

It: Basilicata, Potenza, Terranova di Pollino, Passo delle Ciavole (Pollino National Park) (WGS84: 39.907222°N, 16.214167°E), calcareous stony slopes, 1,722 m a.s.l., 14 Aug 2021, *E. Di Gristina* (SAF 100114).

Germination data

Pre-treatments: No treatment. Only manual removal of pappus.

Germination medium: Petri dishes with 2 sheets of sterilized Whatman 40 filter papers, imbibed in sterilized distilled water or 10^{-3} M gibberellic acid (GA_3) water solution⁽¹⁾.

Sample size: 80 seeds for each test (20 × 4 replicates).

Germination	Thermoperiod	Photoperiod [light/dark]	T ₁ [d]	T ₅₀ [d]	T _{max} [d]	MTG [d]
90%	constant 15°C	0/24h	7.0	14.8	19.0	15.0
90% ⁽¹⁾	constant 15°C	0/24h	6.0	13.3	19.0	14.0

Observations

Hieracium umbrosum subsp. *abietinum* is a pseudorosulate hemicryptophytic hawkweed, first considered endemic to Greece, recently noted in the Pollino National Park (S Italy) (Gottschlich & al. 2017a). The presence in Southern Italy is an important extension of its distribution range and it represents a highly interesting case of an amphi-Adriatic disjunction, known also from other plant groups or zoological investigations (Di Gristina & al. 2014, 2015a, 2015b, 2016a, 2016c; Gottschlich & al. 2017a, 2017b). *H. umbrosum* subsp. *abietinum* matures and disperses its seeds in August (Gottschlich & al. 2017a).

Germination tests were carried out 3 months after seed harvesting, using the constant temperatures of 15°C, 20°C, and 25°C in continuous darkness, and the alternating temperature of 30/15°C (16h/8h, light/dark). The seeds of *H. umbrosum* subsp. *abietinum* showed no dormancy and the highest germination (90%) at the temperature of 15°C in continuous darkness. High germination was also obtained at 20°C reaching a value of 82%, while the alternating temperature of 30/15°C only reached 64%. These results suggest that the seeds of *H. umbrosum* subsp. *abietinum* prefer constant, cool or medium temperatures, for germination. Tests carried out in 10^{-3} M gibberellic acid (GA_3) provided similar germination percentages. Here we report the first germination data for this taxon and the *H. umbrosum* aggregate.

E. Di Gristina, G. Mirabile & G. Barone

106. *Pilosella hoppeana* subsp. *macrantha* (Ten.) S.Bräut. & Greuter (*Asteraceae*)

Accession data:

Si: Palermo, Polizzi Generosa, Monte Quacella (Madonie Regional Park) (WGS84: 37.849167°N, 14.016389°E), carbonate rocky slopes, 1,350 m a.s.l., 20 Jun 2021, E. Di Gristina (SAF 100115).

Germination data

Pre-treatments: No treatment. Only manual removal of pappus.

Germination medium: Petri dishes with 2 sheets of sterilized Whatman 40 filter papers, imbibed in sterilized distilled water or 10^{-3} M gibberellic acid (GA_3) water solution⁽¹⁾.

Sample size: 80 seeds for each test (20 × 4 replicates).

Germination	Thermoperiod	Photoperiod [light/dark]	T _i [d]	T ₅₀ [d]	T _{max} [d]	MTG [d]
90% ⁽¹⁾	constant 15°C	0/24h	6.0	10.9	19.0	12.3
88%	constant 15°C	0/24h	7.0	11.6	20.0	13.1

Observations

Pilosella hoppeana subsp. *macrantha* is a rosulate hemicryptophytic hawkweed distributed from central and southern Europe to the Caucasus (Di Gristina & al. 2013). In Italy, the taxon is recorded only for Umbria, Lazio, Abruzzo, and Sicily (Bartolucci & al. 2018). The *P. hoppeana* (Schult.) F.W. Schultz & Sch. Bip. aggregate includes widespread taxa and also very localized ones (Di Gristina & al. 2013). The latter case includes *P. hoppeana* subsp. *sicula* Di Grist., Gottschl. & Raimondo, an endemic taxon of Sicily (Di Gristina & al. 2016b), recently described based on an integrated morphological, karyological and isoenzymatic study (Di Gristina & al. 2013). *Pilosella hoppeana* subsp. *macrantha* matures and disperses the seeds from June to early July.

Germination tests were carried out 3 months after seed harvesting, using the constant temperatures of 15°C, 20°C, and 25°C in continuous darkness, and the alternating temperature of 30/15°C (16h/8h, light/dark). The results showed no seed dormancy and 15°C as the optimal germination temperature. Tests carried out in 10⁻³ M gibberellic acid (GA₃) provided slightly higher germination percentages (90%). These are the first germination tests for this taxon. The results obtained are similar to those found for *P. hoppeana* subsp. *sicula* (Di Gristina & al. 2020), but not exactly coincident. In fact, in the case of *P. hoppeana* subsp. *sicula* the highest percentage of germination was obtained at the constant temperature of 20°C (Di Gristina & al. 2020).

E. Di Gristina, G. Mirabile & G. Barone

107. *Genista etnensis* (Raf.) DC. (*Fabaceae*)

Accession data

Sa: Berchidda (North-East Sardinia), Riu Mannu loc. Sas Rujas (WGS84: 40.755278°N, 9.146111°E), isolated in pastures, sandy shores and sparse shrublands, 170 m a.s.l., 11 Sept 2022, *G. Calvia*, (BG-SAR 138/22, Sardinian Germplasm Bank).

Sa: Berchidda (North-East Sardinia), Riu Badu Pedrosu between Osseddu and Corrosolis (WGS84: 40.755000°N, 9.191944°E), isolated in pastures, sandy shores and sparse shrublands, 190 m a.s.l., 11 Sept 2022, *G. Calvia*, (BG-SAR 139/22, Sardinian Germplasm Bank).

Germination data

Pre-treatments: scarification with a scalpel.

Germination medium: 1% agar.

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

Germination	Thermoperiod	Photoperiod [light/dark]	T ₁ [d]	T ₅₀ [d]	T _{max} [d]	MTG [d]	Accession code
98.2%	constant 15°C	12/12h	3.4	5.0	7.9	5.9	138/22
92.3%	constant 20°C	12/12h	3.1	3.6	4.5	4.2	138/22
90.3%	constant 10°C	12/12h	7.5	10.7	23.5	13.3	138/22
98.3%	constant 10°C	12/12h	7.0	10.5	12.7	10.8	139/22
95.7%	constant 20°C	12/12h	3.1	3.6	4.2	4.1	139/22
90.6%	constant 15°C	12/12h	3.4	4.3	5.8	5.0	139/22

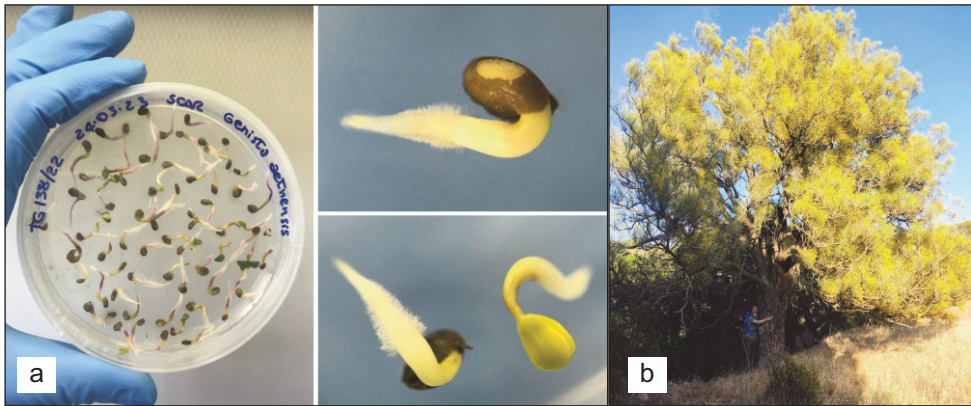


Fig. 1. a) Details of germination tests of *Genista etnensis* after scarification pre-treatment; b) Monumental tree of *Genista etnensis*.

Observations

Different experiments were carried out to find an efficient germination protocol, such as imbibition and germination tests. Due to the presence of impermeable seed coat in seeds of *G. etnensis*, non-scarified seeds showed a very low water imbibition capacity with a poor and slow mass gain, compared to scarified ones (data not shown). The germination test of non-scarified seeds showed weak results as well (accession BG-SAR 138/22: 8.5% at 10°C, 5.6% at 15°C, 1.7% at 20°C; accession BG-SAR 139/22: 3.7% at 10°C, 0.0% at 15°C, 1.7% at 20°C), while the scarified seeds of *G. etnensis* germinated with high percentages and high rates at all tested temperatures (see germination tables and Fig. 1a). This result is comparable with what reported in the SER's Seed Information Database, that indicates a 96% of germination capability obtained in 43 days after scarification treatment with a scalpel (SER, INSR, RBGK, Seed Information Database (SID), 2023). The results obtained with the imbibition and germination tests on non-scarified and scarified seeds confirm that *G. etnensis* has Physical Dormancy (PY), as detected in other *Genista* spp. (see Baskin & Baskin, 2014 and references therein).

In Sardinia, *G. etnensis* does not appear to have particular conservation problems and it is categorized as Least Concern (LC) at the regional level, sensu IUCN, being Not

Evaluated (NE) at the global level (Orsenigo & al. 2018). However, *in-situ* and *ex-situ* conservation actions are needed to preserve Berchidda's monumental population of *G. etnensis* (see Fig. 1b), in agreement with Camarda & Brundu (2021) who pointed out that the system of monumental trees and old-growth forests of Sardinia is a fundamental asset for the study and conservation of Mediterranean biodiversity, history and culture.

M. Deplano, G. Bacchetta, G. Calvia & M. Porceddu

108. *Antirrhinum valentinum* Font Quer (*Plantaginaceae*)

Accession data

Hs: Valencia, Quatretonda, Microrreserva de Flora “l’Ombria del Buixcarró” (WGS84: 39.005916°N, -0.365960°W), 450 m a.s.l., 12 Jun 1996, *J. Riera* (UVEG-JBVAL-BG 78B1996).

Germination data

Pre-treatments: no treatment.

Germination medium: Agar 0.6%.

Sample size: 100 seeds (25 × 4 replicates).

Germination	Thermoperiod	Photoperiod [light/dark]	T ₁ [d]	T ₅₀ [d]	T _{max} [d]	MGT [d]
90.9%	constant 25°C	12/12h	3.8	8.4	15.0	8.8
87.9%	constant 20°C	12/12h	7.0	9.3	14.3	9.9
80.9%	constant 15°C	12/12h	11.0	12.2	21.0	13.7

Observations

Antirrhinum valentinum inhabits shaded crevices and ledges on limestone rock walls. It is a narrow endemic from the province of Valencia. This species is considered vulnerable, according to IUCN (VU B1ab(v)+2ab(v)). At higher temperatures, the germination percentage is lower than 50%. Specifically, we have obtained 32.0% at 30°C.

L. Martínez-Oliver, E. García-Martínez, E. I. Villaluenga, J. Prieto-Mossi & E. Estrelles

109. *Anthyllis cytisoides* L. (*Fabaceae*)

Accession data

Hs: Valencia, Montserrat, Microrreserva de Flora “El Castellet” (WGS84: 39.363764°N, -0.600214°W), 235 m a.s.l., 16 Jul 2020, *P. Soriano & E. Estrelles* (UVEG-JBVAL-BG 15B2020).

Germination data

Pre-treatments: mechanical scarification with sandpaper.

Germination medium: Agar 0.6%.

Sample size: 100 seeds (25 × 4 replicates).

Germination	Thermoperiod	Photoperiod [light/dark]	T ₁ [d]	T ₅₀ [d]	T _{max} [d]	MGT [d]
96.9%	constant 20°C	12/12h	1.3	1.7	4.3	2.4

Observations

This plant is characteristic of thermophilic open scrublands from the west Mediterranean. The seeds, as is common within the family *Fabaceae*, show physical dormancy, thus a previous scarification is needed to reach high germination percentages. Only 14% of seed germination has been obtained from the control.

L. Martínez-Oliver, E. García-Martínez, E. I. Villaluenga, J. Prieto-Mossi & E. Estrelles

110. *Anthyllis lagascana* Benedí (*Fabaceae*)

Accession data

Hs: Valencia, Paterna, La Cañada (WGS84: 39.537234°N, -0.496698°W), 108 m a.s.l., 06 Jun 1996, *F. Marco, J. Riera & E. Estrelles* (UVEG-JBVAL-BG 109B1996).

Germination data

Pre-treatments: mechanical scarification with sandpaper.

Germination medium: Agar 0.6%.

Sample size: 100 seeds (25 × 4 replicates).

Germination	Thermoperiod	Photoperiod [light/dark]	T ₁ [d]	T ₅₀ [d]	T _{max} [d]	MGT [d]
92.5%	constant 20°C	12/12h	3.0	2.9	8.3	4.4

Observations

This species is an endemism from the SE of the Iberian Peninsula and NW Africa (Algeria) that inhabits Mediterranean open scrublands. The seeds, as is common within the family *Fabaceae*, show physical dormancy thus a previous scarification is needed to reach high germination percentages. The seeds without any pretreatment only germinate up to 19%.

L. Martínez-Oliver, E. García-Martínez, E. I. Villaluenga, J. Prieto-Mossi & E. Estrelles

111. *Digitalis obscura* L. subsp. *obscura* (*Plantaginaceae*)

Accession data

Hs: Valencia, Aras de los Olmos, Losilla (WGS84: 39.969119°N, -1.093832°W), 1060 m a.s.l., 03 Aug 2007, *E. Estrelles & A.M. Ibars* (UVEG-JBVAL-BG 114B2007).

Germination data

Pre-treatments: no treatment.

Germination medium: Agar 0.6%.

Sample size: 100 seeds (25 × 4 replicates).

Germination	Thermoperiod	Photoperiod [light/dark]	T ₁ [d]	T ₅₀ [d]	T _{max} [d]	MGT [d]
91.9%	constant 15°C	12/12h	5.0	7.9	17.5	9.3
90.6%	constant 20°C	12/12h	4.5	5.6	17.3	7.1

Observations

This Mediterranean woody *Digitalis*, endemic to the west Mediterranean, does not show seed dormancy, although staggered germination of the seeds is observed, lasting more than three weeks.

L. Martínez-Oliver, E. García-Martínez, E. I. Villaluenga, J. Prieto-Mossi & E. Estrelles

112. *Echium flavum* subsp. *saetabense* (Peris, Figuerola & G. Stübing) Mateo & M.B. Crespo (*Boraginaceae*)

Accession data

Hs: Valencia, Teresa de Cofrentes, El Caroch, prope fuente del Collado (WGS84: 39.093160°N, -0.919929°W), wet grasslands, 1000 m a.s.l., 03 Jun 1997, *F. Marco & J. Riera* (UVEG-JBVAL-BG 43B1997).

Germination data

Pre-treatments: no treatment.

Germination medium: Agar 0.6%.

Sample size: 100 seeds (25 × 4 replicates).

Germination	Thermoperiod	Photoperiod [light/dark]	T ₁ [d]	T ₅₀ [d]	T _{max} [d]	MGT [d]
95.0%	constant 20°C	12/12h	3.0	3.7	5.5	4.2

Observations

This Ibero-Levantine endemic plant does not exhibit seed dormancy after a long period of dry conservation in the seed bank. Due to the successful results obtained, and the small number of seeds preserved in this accession, no other conditions have been tested at the moment.

L. Martínez-Oliver, E. García-Martínez, E. I. Villaluenga, J. Prieto-Mossi & E. Estrelles

113. *Jasione mansanetiana* Roselló & Peris (*Campanulaceae*)**Accession data**

Hs: Castellón, Lluçena, loc. el Salt del Cavall (WGS84: 40.089490°N, -0.278650°W), 450 m a.s.l., limestone rock walls, 28 Oct 1997, *J. Riera* & *E. Estrelles*, (UVEG-JBVAL-BG 112B1997).

Germination data

Pre-treatments: no treatment.

Germination medium: Agar 0.6%.

Sample size: 100 seeds (25 × 4 replicates).

Germination	Thermoperiod	Photoperiod [light/dark]	T ₁ [d]	T ₅₀ [d]	T _{max} [d]	MGT [d]
88.0%	constant 20°C	12/12h	3.3	4.8	10.8	5.7

Observations

This species is a localized endemism to the Castellón province in the East of the Iberian Peninsula. The viability of preserved seeds was tested. No dormancy was detected. This protocol provided the best germination performances.

L. Martínez-Oliver, E. García-Martínez, E. I. Villaluenga, J. Prieto-Mossi & E. Estrelles

114. *Nothoscordum borbonicum* Kunth (*Amaryllidaceae*)**Accession data**

Hs: Valencia, Paterna, La Canyada, Lloma Redona (WGS84: 39.528098°N, -0.479038°W), 82 m a.s.l., 27 Oct 2019, *E. Estrelles* (UVEG-JBVAL-BG 99B2019).

Germination data

Pre-treatments: no treatment.

Germination medium: Agar 0.6%.

Sample size: 100 seeds (25 × 4 replicates).

Germination	Thermoperiod	Photoperiod [light/dark]	T ₁ [d]	T ₅₀ [d]	T _{max} [d]	MGT [d]
85.0%	constant 7°C	12/12h	51.0	56.9	58.5	56.5

Observations

This species is considered a naturalized plant. The study of seed response is mainly focused on knowing its competitiveness with respect to the native species. Due to the low velocity, the test of this accession was maintained at 5°C for 60 days. Germination at higher temperatures

was also tested, but poor results were obtained, specifically, 32% at 15°C (MGT = 24.5 days and T_{50} = 18.5 days) and 0% at 20°C, all under light/dark conditions (12h photoperiod).

L. Martínez-Oliver, E. García-Martínez, E. I. Villaluenga, J. Prieto-Mossi & E. Estrelles

115. *Silene diclinis* (Lag.) M. Lainz (*Caryophyllaceae*)

Accession data

Hs: Valencia, Xàtiva, Microrreserva Serra del Castell (WGS84: 38.984063°N, -0.516493°W), 200 m a.s.l., 27 May 1997, *J. Riera & F. Marco* (UVEG-JBVAL-BG 6B1997).

Germination data

Pre-treatments: no treatment.

Germination medium: Agar 0.6%.

Sample size: 100 seeds (25 × 4 replicates).

Germination	Thermoperiod	Photoperiod [light/dark]	T_1 [d]	T_{50} [d]	T_{max} [d]	MGT [d]
97.5%	constant 20°C	12/12h	2.0	1.9	4.5	2.6

Observations

This plant, belonging to the pink family, is a narrow endemic with a highly restricted distribution in the East of Spain, and it is distributed only in the Valencia province (Comunitat Valenciana). Natural habitats are, mainly, grasslands, crop fields and roadsides. It has a preference for disturbed soils, whether calcareous or siliceous.

Silene diclinis is categorized as an endangered species, nationally and globally, according to IUCN criteria (EN, B1ab(iii,v)+2ab(iii,v); C1).

Seeds of this species show dormancy immediately after collecting but germination increased over time with an after-ripening period of several months at ambient conditions (Mira & al. 2011). Therefore, it is advisable to extend the cleaning and preparation time of the seeds to at least four months before freezing them for long-term conservation.

L. Martínez-Oliver, E. García-Martínez, E. I. Villaluenga, J. Prieto-Mossi & E. Estrelles

116. *Verbascum fontqueri* Benedi & J.M. Monts. (*Scrophulariaceae*)

Accession data

Hs: Valencia, Real, Alt de les Canyes (WGS84: 39.292294°N, -0.667832°W), 410 m a.s.l., 28 Jun 1996, *J. Riera & E. Estrelles* (UVEG-JBVAL-BG 141B1996).

Germination data

Pre-treatments: no treatment.

Germination medium: Agar 0.6%.

Sample size: 100 seeds (25 × 4 replicates).

Germination	Thermoperiod	Photoperiod [light/dark]	T ₁ [d]	T ₅₀ [d]	T _{max} [d]	MGT [d]
80.4%	constant 20°C	12/12h	3.5	4.7	13.0	5.9

Observations

This plant inhabits cleared and sunny shrubs, preferably on calcareous soils. It is an Ibero-Levantine endemic, distributed in some mountainous regions from the province of Valencia. *Verbascum fontqueri* is a vulnerable species at the national and global levels, according to IUCN categories (VU B1ac(iii,iv)+2ac(iii,iv); D2). Seeds of this accession do not show dormancy.

L. Martínez-Oliver, E. García-Martínez, E. I. Villaluenga, J. Prieto-Mossi & E. Estrelles

117. *Dianthus borbonicus* Brullo, C.Brullo, Colombo, Giusso, Ilardi & R.Perrone (*Caryophyllaceae*)

Accession data

Si: Palermo, Mezzojuso, Pizzo Morabito, (WGS84: 37.840833°N, 13.448055°E), limestone rocky walls, ca. 1130 m a.s.l., 18 Jul 2023, *F. Scafidi* (096_SF/23; SPGR/PA Sicilian Plant Germplasm Repository, University of Palermo)

Germination data

Pre-treatments: sterilization with a 1% sodium hypochlorite water solution for 2 minutes followed by 2 rinses in sterile distilled water.

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 (20 × 3 replicates) (Fig. 2A, 3B).

Germination	Thermoperiod	Photoperiod [light/dark]	T ₁ [d]	T ₅₀ [d]	T _{max} [d]	MTG [d]
91.7%	constant 15°C	12/12h	3	7.2	30	7.8
86.7%	constant 15°C	0/24h	4	4.7	23	5.8
81.7%	alternating 25/15°C	0/24h	2	7.2	29	12.4

Observations

Dianthus borbonicus is a rare chasmophyte restricted to north-facing Mesozoic limestone outcrops of Pizzo Morabito in the Ficuzza-Rocca Busambra Natural Reserve (NW Sicily),

where it grows together with other endemic plants, such as *Anthemis cupaniana* Tod. ex Nyman, *Centaurea busambarensis* Guss., *Helichrysum pendulum* (C.Presl) C.Presl (Brullo & al. 2015). No previous germination data occurred for this species. Seeds incubated at a constant temperature of 15°C showed the highest germination percentage (ca. 92 %) under a 12/12h light/dark photoperiod, while under full darkness conditions seed germination was a little lower (ca. 87%) but faster. Alternating daily temperature of 25°/15°C with a 16/8h light/dark photoperiod did not favour seed germination (31.7%, with many imbibed seeds), which conversely increased to 85% under total darkness at the same alternating thermoperiod. Apparently, high temperatures enhance the seed photosensitivity in this species.

F. Scafidi & C. Salmeri

118. *Helichrysum panormitanum* subsp. *latifolium* (Guss.) Maggio, Bruno, Guarino, Senatore & Ilardi (*Asteraceae*)

Accession data

Si: Palermo, Santa Flavia, Capo Zafferano (WGS84: 38.109444°N, 13.538889°E), maritime limestone cliffs, ca. 30 m a.s.l., 16 Jun 2023, *F. Scafidi* (041_SF/23; SPGR/PA Sicilian Plant Germplasm Repository, University of Palermo).

Germination data

Pre-treatments: no treatments.

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 (20 × 3 replicates) (Fig. 3A).

Germination	Thermoperiod	Photoperiod [light/dark]	T ₁ [d]	T ₅₀ [d]	T _{max} [d]	MTG [d]
91.7%	constant 15°C	0/24h	8	11.4	26	12.5

Observations

This taxon shows controversial taxonomic treatments, as it is considered a synonym of *H. pendulum* C.Presl by Peruzzi & al. (2018), together with many other Sicilian endemic taxa of the genus, while other authors (Iamonico & al. 2016; Maggio & al. 2016; Pignatti & al. 2018) treat it as valid taxon within the *H. panormitanum* complex, also based on its phytochemical compounds (Maggio & al. 2016). *H. panormitanum* subsp. *latifolium* is endemic to the coastal capes of north-western Sicily, from Mt. Catalfano to Termini Imerese. This is the first germination report for this taxon. The best germination rate was obtained from seeds incubated in the dark at a constant temperature of 15°C, while 80% of germination was reached under 12/12h light/dark photoperiod at the same constant temperature. Conversely, the alternating regimes of both thermo- (25/15° C) and photoperiod provided poor germination responses, with a percentage ranging from 35%, under full darkness, and 28.3 % under 12/12h light/dark conditions.

F. Scafidi & C. Salmeri

119. *Silene kemoniana* C. Brullo, Brullo, Giusso, Ilardi & Sciandr. (*Caryophyllaceae*)**Accession data**

Si: Palermo, Monreale, Portella Sant'Anna, (WGS84: 38.100833°N, 13.242222°E), clearings among limestone rocks, ca. 800 m a.s.l., 04 Jun 2023, *F. Scafidi* (018_SF/23; SPGR/PA Sicilian Plant Germplasm Repository, University of Palermo).

Germination data

Pre-treatments: sterilization with a 1% sodium hypochlorite water solution for 2 minutes followed by 2 rinses in sterile distilled water.

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 (20 × 3 replicates) (Fig. 2B)

Germination	Thermoperiod	Photoperiod [light/dark]	T ₁ [d]	T ₅₀ [d]	T _{max} [d]	MTG [d]
95.0%	constant 15°C	0/24h	2	4.1	14	5.1
95.0%	constant 15°C	12/12h	2	5.1	23	7.3
85.0%	alternating 25/15°C	16/8h	2	10.0	28	12.9

Observations

Silene kemoniana is a strict Sicilian endemic, only known from two close localities in the Mounts of Palermo (NW Sicily), where it grows in xerophilous garrigues on Mesozoic limestones (Brullo & al. 2012; Cambria & al. 2013). The species is reported as near threatened (NT) in the Red List of the Italian flora (Rossi & al. 2020). This is the first germination report for this species. The best germination protocol provided 95% of seed germination at the constant temperature of 15°C, in both 12/12h photoperiod and full darkness, revealing no seed photosensitivity though seed germination was faster without light exposure. Tests carried out at alternating thermos- and photoperiod (25/15°C, 16/8h light/dark) gave lower germination rates, with 85% of germinated seeds in the light but just 73.3% in total darkness, thus revealing negative effects of high temperature on seed vigour and responses to light.

F. Scafidi & C. Salmeri

120. *Silene nefelites* C. Brullo, Brullo, Giusso & Ilardi (*Caryophyllaceae*)**Accession data**

Si: Trapani, Erice, Monte Erice (WGS84: 38.035277°N, 12.589722°E), ephemeral meadows, ca. 750 m a.s.l., 07 Jun 2023, *F. Scafidi* (023_SF/23; SPGR/PA Sicilian Plant Germplasm Repository, University of Palermo).

Germination data

Pre-treatments: sterilization with a 1% sodium hypochlorite water solution for 2 minutes followed by 2 rinses in sterile distilled water.

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

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]
93.3%	constant 15°C	0/24h	2	3.2	9	3.8
91.7%	constant 15°C	12/12h	2	4.6	13	5.6
90.0%	alternating 25/15°C	0/24h	2	2.3	30	4.8
81.7%	alternating 25/15°C	12/12h	2	4.2	23	5.0

Observations

Silene nefelites is another strict Sicilian endemic, confined to the top of Mt. Erice, near Trapani. It is a therophyte growing among the ephemeral meadows in calcareous rocky stands (Brullo & al. 2014). The species is reported as Vulnerable (VU) in the Red List of the Italian flora (Rossi & al. 2020). This is the first germination report for this species. Likewise other Sicilian populations of *Silene* species (Brullo & Salmeri 2022), the highest and faster germination rate occurred at the constant temperature of 15°C, with 93.3% of germinated seeds under total darkness conditions. The application of alternating thermo- and photoperiod also provided successful seed germination, reaching 90% in full darkness. Seeds exhibit a slight photosensitivity, which increases at higher temperatures.

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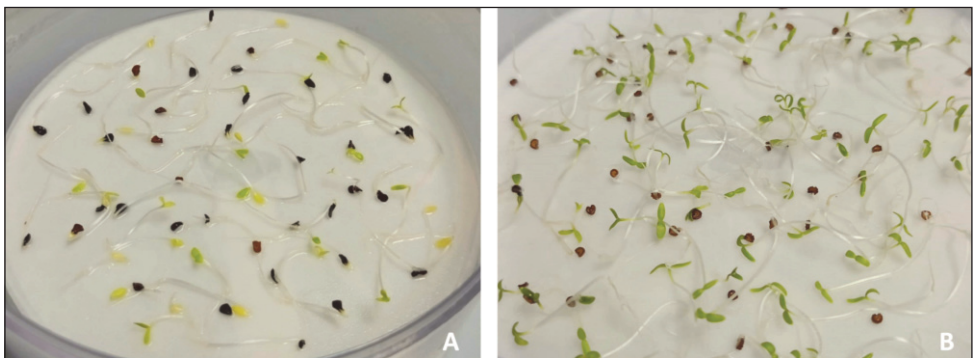


Fig. 2. Seedlings of *Dianthus borbonicus* (A) and *Silene kemoniana* (B).

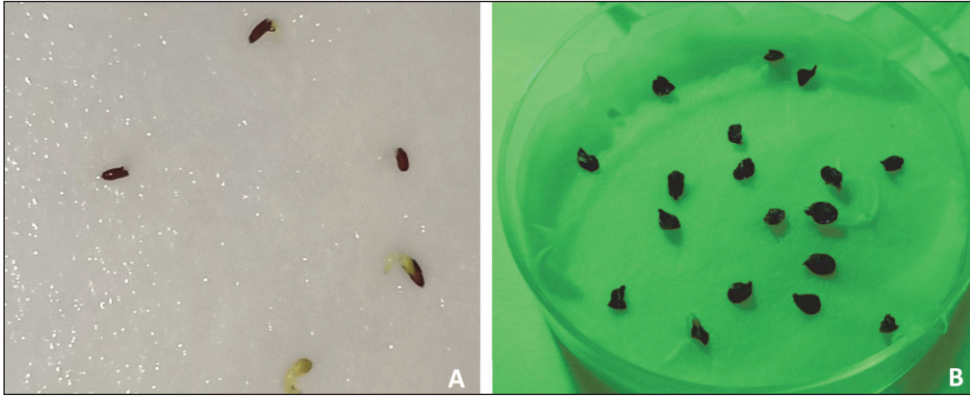


Fig. 3. Germinated seeds of *Helichrysum panormitanum* subsp. *latifolium* (A) and *Dianthus borbonicus* (B). Green light comes from an inactinic lamp for the control of tests under full-dark conditions.

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