To promote germination and remove dormancy in seeds of Mediterranean vascular plants: a learned lessons by studying the Sardinian flora

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Supported by:
Mediterranean climate

It is characterised by a considerable unpredictability of temperature and precipitation, with hot dry summers and cold wet winters.

The long periods of drought during summer impose severe abiotic stresses that limit plant growth and subsequently compromise their survival.

Seeds belonging to coastal and mountain species may have different requirements for their germination.
Coastal species
Seed germination of the typical Mediterranean coastal species occurs in the wet season (mid to late autumn), reaching an optimum at relatively low temperatures (5 - 15°C; Thanos et al., 1989).
Mountain species

Conversely, the Mediterranean mountain species, facing specific environmental and climatic constraints, may need thermal/physiological requirements that usually promote an early spring germination.
Different studies were carried out by the researchers of BG-SAR to quantitatively assess the thermal requirements for seed germination of Mediterranean species, endemic taxa, as well as species of conservation interest.
A preliminary analysis of the germination results obtained from Sardinian species, suggests that a seed germination behaviour trend may be present:

From coastal species to mountain species
Coastal species:
In general required short time (< 30 days) for germination being non-dormant or showing physical dormancy (PY).

**Distribution:** endemic species of Sardinia, Corsica, Balearic Islands, France

**Habitat in Sardinia:** coastal sandy areas

**Collection date:** July 2012

**Altitude:** 25 m a.s.l.

**Best germination condition without pre-treatments:** light, at 25/10°C

**Average germination:** 78% (Picciau et al., 2018).
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Coastal species:

In general required short time (< 30 days) for germination being non-dormant or showing physical dormancy (PY).

**Distribution:** SW Mediterranean Basin

**Habitat in Sardinia:** cliffs and slopes on carbonate substrata, marly limestones or sandstone

**Collection date:** July 2012

**Altitude:** 38 m a.s.l.

**PY species:** scarification is needed

**Best germination condition (after scarification and under control conditions):** light, at 20°C

**Average germination:** 92% (Picciau et al., 2018).
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**Mountain species:**

Seeds usually needed long time (> 30 days) to germinate due to the presence of physiological (PD) or morphophysiological dormancy (MPD).

Physiologically dormant (PD) species, with overwintering cold stratification requirement and spring germination.

*Rhamnus persicifolia* Moris

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Mountain species - *Paeonia corsica* Sieber ex Tausch

Seeds are morphologically dormant (MD)

+ Seeds have a physiological component of dormancy (PD)

Seed require cold stratification to break shoot dormancy (epicotyl dormancy)

= Seeds of *Paeonia corsica* are therefore: epicotyl morphophysiological dormant (MPD)

*Paeonia corsica* - flower and fruit

Sequential temperature control of multi-phasic dormancy release and germination of *Paeonia corsica* seeds

Marco Porceddu1,*, Efisio Mattana1,2, Hugh W. Pritchard2 and Gianluigi Bacchetta1

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Mountain species - Gentiana lutea L. subsp. lutea

Seeds are morphophysiological dormant (MPD)

Discovering the type of seed dormancy and temperature requirements for seed germination of Gentiana lutea L. subsp. lutea (Gentianaceae)
Alba Cuena-Lombrana, Marco Porceddu, Caterina Angela Dettori, Gianluigi Bacchetta

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Different studies identified the thermal thresholds for predicting seed dormancy release and germination of Mediterranean species along an altitudinal gradient

Recently, Picciau et al. (2018) identified the thermal thresholds for seed germination of 18 Mediterranean species located in Sardinia along an altitudinal gradient (0-1810 m a.s.l.)

- The effect of different treatments on seed germination were evaluated: Gibberellin, Cold/Warm stratifications, Dry after-ripening
- 24 data-loggers were buried close to the study species: To study the annual trend of soil temperatures
- The soil temperatures reflected the Mediterranean climate: They enabled to distinguish between “Mediterranean lowland” and “Mediterranean mountain” species

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This study revealed significant differences on germination thresholds of Mediterranean lowland and mountain species in relation to the base temperature of germination ($T_b$) and the thermal constant for 50% of seed germination ($S$).

Mediterranean lowland species had lower $T_b$ values compared to the upland ones.

✓ A Mediterranean germination pattern, with an autumn-winter germination was detected for the lowland species;

✓ The high mountain species showed a thermal temperate behaviour with a spring germination.
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In this study we investigated the seed traits and germination of four Sardinian populations of *Helichrysum microphyllum* ssp. *tyrrhenicum* located at different altitudes (from 414 to 1540 m a.s.l.).

Differences in seed traits and germination were detected among the studied populations of *Helichrysum microphyllum* ssp. *tyrrhenicum* (Asteraceae) along an altitudinal gradient.

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Differences in seed traits and germination were detected among the studied populations of *Helichrysum microphyllum* ssp. *tyrrhenicum*. However, these differences were not correlated with altitude.

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Conclusion

In a strategic project management perspective mainly based on plant ex situ multiplication for future reintroduction, the preventive analysis of the species under study and the intervention areas should be taken into consideration applying the lessons learned during previous experiences, especially during the elaboration of a project idea.
Many thanks for your attention!

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