2nd Mediterranean Plant Conservation Week

"Conservation of Mediterranean Plant Diversity: Complementary Approaches and New Perspectives"

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

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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

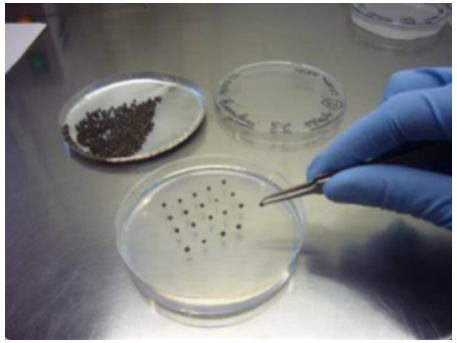
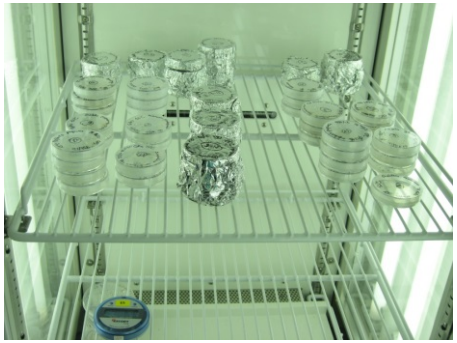
Conversely, the **Mediterranean mountain species**, facing specific environmental and climatic constraints, may need thermal/ physiological requirements that usually promote an early spring germination.

Sardinian Germplasm Bank (BG-SAR)

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.






Learned lessons from Sardinian flora

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

Learned lessons from Sardinian flora

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).

Scrophularia ramosissima Loisel.

Learned lessons from Sardinian flora

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).

Helianthemum caput-felis Boiss.

Learned lessons from Sardinian flora

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

Thermal niche for *in situ* seed germination by Mediterranean mountain streams: model prediction and validation for *Rhamnus persicifolia* seeds FREE

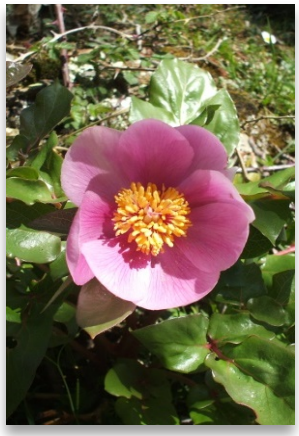
Marco Porceddu, Efisio Mattana ✉, Hugh W. Pritchard, Gianluigi Bacchetta

Annals of Botany, Volume 112, Issue 9, 1 December 2013, Pages 1887–1897, https://doi.org/10.1093/aob/mct238

ANNALS OF BOTANY Founded 1887

Learned lessons from Sardinian flora

Mountain species - Paeonia corsica Sieber *ex* Tausch



Seeds are morphologically dormant (MD)

+

Seeds have a physiological component of dormancy (PD)

+

Seeds 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 Porceddu[1,], Efisio Mattana[1,2], Hugh W. Pritchard[2] and Gianluigi Bacchetta[1]*

Journal of Plant Ecology

Learned lessons from Sardinian flora

Mountain species - Gentiana lutea L. *subsp. lutea*

Seeds are morphophysiological dormant (MPD)

Gentiana lutea subsp. *lutea*

Discovering the type of seed dormancy and temperature requirements for seed germination of *Gentiana lutea* L. subsp. *lutea* (Gentianaceae)

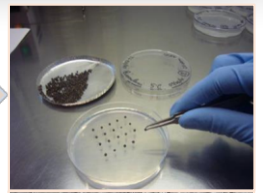
Alba Cuena-Lombraña, Marco Porceddu ✉, Caterina Angela Dettori, Gianluigi Bacchetta

Journal of Plant Ecology, Volume 11, Issue 2, 6 February 2018, Pages 308–316,
https://doi.org/10.1093/jpe/rtx003

Learned lessons from Sardinian flora

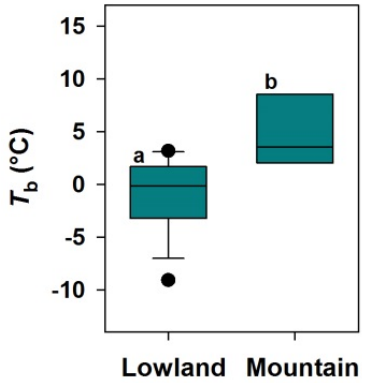
Different studies identified the thermal thresholds for predicting seed dormancy release and germination of Mediterranean species along an altitudinal gradient

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	

Learned lessons from Sardinian flora

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.

Learned lessons from Sardinian flora

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.)

plant biology

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RESEARCH PAPER

Seed traits and germination behaviour of four Sardinian populations of *Helichrysum microphyllum* subsp. *tyrrhenicum* (*Asteraceae*) along an altitudinal gradient

R. Picciau[1,2], S. Serra[1,2], M. Porceddu[1,2] & G. Bacchetta[1,2]

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

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.*

Senecio morisii


Many thanks
for your
attention!