Seed germination studies of *Sarcopoterium spinosum* (L.) Spach (*Rosaceae*)

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Introduction

Sarcopoterium spinosum (L.) Spach (*Rosaceae*) is a dwarf shrub, 30–60 cm in height, with branches ending in dichotomous, leafless thorns (1), that recruits both sexually and clonally (Figure 1, 2). It dominates eastern-mediterranean shrublands known as "bathah" in Israel and "phrygana" in Greece (2). Its southern distribution is in the Northern Negev of Israel. In semi-arid ecosystems, shrublands dominated by *S. spinosum* are often formed following recolonization of old-fields (1). In the W-Mediterranean basin the species occurs in locations on the Balkan Coast, in Italy and in Tunisia (Djerba); in addition, a small population of *S. spinosum* is also recognizable in Malta (3).

The **germination behaviour of three populations** (Sardinia - Italy, Chios – Greece and Malta) of *Sarcopoterium spinosum* was investigated under controlled laboratory conditions at the Sardinian Germplasm Bank (BG-SAR). **Chios** population is situated in the central part of the distribution area, while **Malta** and **Sardinia** represent two disjunct populations at its western margin (Figure 3). The seed germination occurs inside the fruits (1,4). Each fruit contains several seeds but usually produces one seedling (1,4).

Aim of this work was to study **seed viability and germination** of *Sarcopoterium spinosum* and also to compare the germinative behavior of **central and border populations**.

Figure 1. *Sarcopoterium spinosum* shrub.

Figure 2. *Sarcopoterium spinosum* flowers and fruits.

Figure 3. Distribution of *S. spinosum*; collection sites are marked.

Population	Code	Date collection	Seed weight (g)
Cagliari, SARDINIA, ITALY	SA1	22/11/2006	0,00321
Cagliari, SARDINIA, ITALY ("fresh")	SA2	16/06/2007	0,00584
Karfas, CHIOS, GREECE	CH	27/07/2006	0,00358
Pembroke, MALTA	MA	19/11/2006	0,00403

Table 1. Collections data.

Materials and methods

Fruits (thereafter seeds) of *S. spinosum* were collected from Chios (CH), Malta (MA) and Sardinia (SA1) in summer/autumn 2006; from Sardinian population the collection was replied in summer 2007 (SA2) (Table 1). Comparative germination tests among the three populations started in June 2007 and were carried out for 3 months; *S. spinosum* seed germination in fact starts after ten days and is slow, does not reach the maximum before 2 months have elapsed.(1).

Viability and germination of each population was checked and compared by calculating the number of **germinated, viable not germinated and empty seeds**. The effects on germination of two sowing mediums (**germination paper and agar water 1%**) and a pre-treatment (**chipping** by scalpel) were analysed on seeds from Sardinia (SA2) at a selected temperature (20°C).

At the same temperature, germination of "fresh" collected seeds, after 80 days of storing in the dry room (15°C and 15% r.h) and after a storage period (3 months in the dry room and + seven months of storage at 5°C) was also investigated to verify the presence of **physiological dormancy** (PD), as previously reported by Vahl (5) and Litav & Orshan (1) on seeds belonging to the Middle East region. A comparison was made between Chios and Sardinian populations (SA1), testing the germination at 10, 15, 20, 25°C with a photoperiod of 12 hours light/12 hours darkness. Final germination percentages were calculated on the basis of filled seeds. Statistical analysis were carried out by using R package (v. 2.4.1) for Windows.

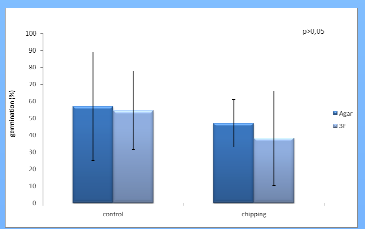

Figure 4. Cumulative germination at 20°C with a photoperiod of 12/12 in two different substrates for the seeds belonging to the SA2 population, with and without chipping. Data are the mean of 4 replicates (± standard deviation). p > 0.05 by two ways ANOVA.

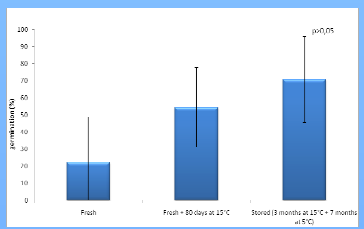

Figure 5. Cumulative germination at 20°C with a photoperiod of 12/12 for the seeds belonging to the SA1 (Stored) and SA2 (Fresh and Fresh +80 days at 15°C) populations. Data are the mean of 4 replicates (± standard deviation). p > 0.05 by one way ANOVA.

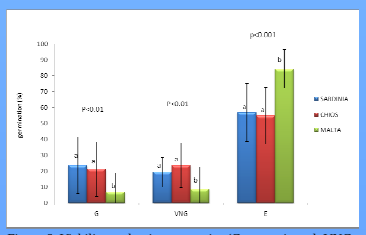

Figure 6. Viability evaluation categories (G = germinated; VNG = viable not germinated; E = empty) of the three populations. Data are the mean of 16 replicates (± standard deviation). For each category bars with the same letter are not significantly different at p > 0.05 (One-way ANOVA followed by Tukey's post-hoc test).

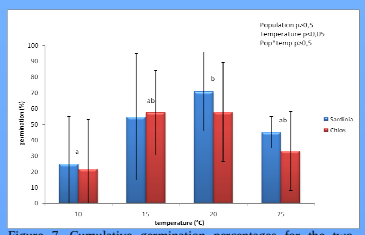

Figure 7. Cumulative germination percentages for the two populations (Sardinia and Chios) at the tested temperatures. Data are the mean of 4 replicates (± standard deviation). Couples of bars with the same letter are not significantly different at p > 0.05 (One-way ANOVA followed by Tukey's post-hoc test).

Results

The trials with **different sowing mediums and mechanical scarification showed similar results** (control test in agar 57.14% ± 31.98; control test in filter paper 54.52% ± 23.14; chipping in agar 47.14% ± 14.00; chipping in filter paper 38.21% ± 27.96); statistical analysis showed that the differences among these conditions were not significant (p>0,05 by Two-ways ANOVA) (Figure 4).

The comparison between "new" and "old" seeds of Sardinian population demonstrated an **increasing of germination with the storing**: fresh collected seeds reached 22.50% ± 26.30, after 80 days of storage reached 54.53 ± 23.14 and after a longer storage period (10 months) reached 70.83 ± 25.00. These differences were not statistically significant (p > 0.05 by one way ANOVA) (Figure 5).

Comparing the different populations, **a low viability was detected for the seeds belonging to Malta** population; for this population, the number of germinated (6.87% ± 11.95), as well as the number of viable (8.75% ± 14.08) and empty seeds (84.35% ± 12.09) were significantly different (p<0,05 by One-way ANOVA, followed by Tukey's post-hoc test) if compared with the others two populations (Figure 6) (Sardinia: 23.75% ± 17.84 germinated, 19.37% ± 9.28 viable, 56.87% ± 18.15 empty; Chios: 21.25% ± 17.07 germinated, 23.75% ± 14.08 viable, 55.00% ±17.88 empty).

Chios and Sardinia populations (Figure 7) **demonstrated a similar response to temperature** (p>0,5 by One-way ANOVA): both populations preferred 20°C, being the relative values significantly different from those reached at the others temperatures (p<0,05 by One-way ANOVA, followed by Tukey's post-hoc test).

Conclusions

Our data showed that *S. spinosum* has a very low seed viability, the **majority of the fruits being empty**. In particular the population of Malta, showed the highest percentage of empty seeds due, probably, to **inbreeding phenomena**. The increasing of germination with the storage (even if not statistically significant; Figure 5) suggests the presence of **physiological dormancy** for the seeds of this species, as previously reported in literature. The two populations of Sardinia and Chios showed the same responses to temperature (Figure 7), with a **preference for a higher temperature (20°C)** than the "typical" Mediterranean germination range (5-15°C; Thanos et al., 1995). It's important noticing that Sardinian population (unlikely that of Malta) even if border and disjunct, showed a seed viability and a seed germination behavior very similar to that of Chios (Figure 6), that is located in the central part of the species areal.

References

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Acknowledgements

The Sardinian Germplasm Bank (BG-SAR) is supported by the Provincia di Cagliari-Assessorato Ambiente e Difesa del Territorio. M. Porceddu (CCB) helped with using R package.