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Short Communication

Effects of different temperatures and duration on germination of caper (*Capparis ovata*) seeds

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Abstract: *Caper seed has poor germination because of the seed coat dormancy. Germination of caper seeds are complex traits affected by a wide range of internal and environmental influences. The effects of temperature preconditioning and period on germination of Capparis ovata were examined. Experiments were conducted in order to investigate germination behaviour of caper seeds subjected to different temperature and duration. The experiment revealed that the different temperature treatments were effective on mean germination percentage. The highest mean germination were obtained at 0°C 29.52% and 10°C with 27.17% and the lowest mean germination were obtained at control seeds with 8.39 %. Dry heat treatments effected germination rate, but it was not enough for removing germination obstacle of caper seed completely.*

Key words: *Capparis ovata, Germination, Dormancy, Temperature, Dry-heat*
PDF of full length paper is available online

Introduction

The genus *Capparis* L. (Capparaceae) consists of about 250 species distributed mostly in tropical and subtropical regions (Jacobs, 1965; Mabberley, 1997). In the recent years, capers are important as a commercial crop in Turkey (Toncer and Tansi, 2000). The total of collected caper of almost 5948 tons, accounting to $ 11717 and all of them are exported (EPC, 2006).

Caper plants (*Capparis ovata* Desf. var. *palaestina* Zoh.) are small shrubs, and may reach about one meter upright. However, uncultivated caper plants are more often seen hanging, draped and sprawling as they scramble over soil and rocks. The caper's vegetative canopy covers soil surfaces which helps to conserve soil water reserves. Leaf stipules may be formed into spines. Flowers are born on first-year branches (Alkire, 1998).

Various parts of caper plant that can be used as drugs, cosmetics and foods are also used in different areas for landscaping, control of erosion or animal feeding (Ozcan and Akgul, 1998; Baytop, 1984; Abdel-Mawgood *et al.*, 2005). Flower buds, fresh leaves, roots, fruits of caper are used in culinary uses such as sauces, pizza, fish meats and salads. Young shoots bearing immature small leaves may also be eaten as vegetable. Their healing properties, including antirheumatic, tonic or expectorant activities, have been known since antiquity from numerous tribes of different countries around the Mediterranean sea, and caper plants have been used in folk medicinal remedies for many years. Recent studies have shown the antihepatotoxic activity of caper extracts (Inocencio *et al.*, 2000).

Germination is known to be a complex trait that is affected by interactions between genetic determinants and environmental factors. From the literature it appears that the germination performans of caper seed is poor (Sozzi and Chiesa, 1995). To ensure high germination, temperature, light, pre soaking treatment and scarification of seed coat have been applied in various plant (Soyler and Khawar, 2007; Tansi, 1999; Kyauk *et al*., 1995; Cirak *et al*., 2007; Cicek and Tilki, 2007; Esen *et al.*, 2007; Tilki and Dirik, 2007).

The objective of this study was to assess the influence of different temperature and duration on germination and emergence of *C. ovata* var. *palaestina*.

Materials and Methods

Seeds of *C. ovata* were collected in September 2007, from Diyarbakir in Southeast of Turkey (Elevation 669 m, 37°55′ 58.8″ °N and 40°16′ 32.1°E″). Germination trials were conducted in 9-cm petri dishes lined with fitler papers and moistened with sterile distilled water to ensure adequate moisture for the seeds. Treatments were arranged in a randomized complete block with a split-plot arrangement and three replicates of 50 seeds each.

Main plots were temperature regimes (0, 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100°C) and sub-plots were the duration (10, 20 and 30 min) at different temperation and duration. Seed viability was determined by tetrazolium test using a 400-seed as four replication of 100 seeds. The parts of the seed that are viable were become red, nonviable parts remained white (Toncer and Tansi, 2000). 1000-seed weight of used caper seed as material was 5.33 g.

Seeds were started to count at seven days interval beginning from 7 days after emergence (DAE) until days to emergence 35. In all treatments were moistured with distilled water. To determine the effect of temperature, seeds were germinated at nine temperature regimes (0, 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100°C) by dry-heat and three duration period (10, 20 and 30 min) at a constant

Table - 1: Germination rate of caper seeds with different temperature and duration by dry-heat

Temperature (°C)	Duration (minutes)			Mean
	10	20	30	
0	25.65 $^{c-i}$	30.11 ^{ab}	32.78 ^{a}	29.52 ^{a}
10	27.08 $^{b-h}$	27.62 $^{b-f}$	26.80 $^{b-h}$	27.17 ^{ab}
20	8.983 ^{p}	12.23 ^{op}	14.19 ^{no}	11.80 ^{e}
30	18.18 ^{lm}	20.23 ^{klm}	20.89 $^{j-m}$	19.77 ^{d}
40	25.40 $^{d-i}$	25.81 $^{c-i}$	28.13 $^{b-e}$	26.44 ^{ab}
50	23.28 $^{h-k}$	24.45 $^{e-j}$	27.16 $^{b-g}$	24.96 ^{bc}
60	26.49 $^{b-i}$	28.63 ^{bcd}	28.29 $^{b-e}$	27.80 ^{ab}
70	24.18 $^{f-j}$	24.05 $^{f-k}$	26.33 $^{b-i}$	24.85 ^{bc}
80	26.83 $^{b-h}$	29.35 ^{abc}	23.49 $^{g-k}$	26.56 ^{ab}
90	22.71 ^{ijk}	24.47 $^{e-j}$	21.52 ^{jkl}	22.90 ^{c}
100	25.40 $^{d-i}$	17.62 ^{mn}	13.13 ^{o}	18.72 ^{d}
Control	8.43 ^{p}	9.00 ^{p}	7.74 ^{p}	8.39 ^{f}
LSD (p<0.05)	3.101	Int: 3.861**		
C V	12.22			

** : Significant at p ≤ 0.01

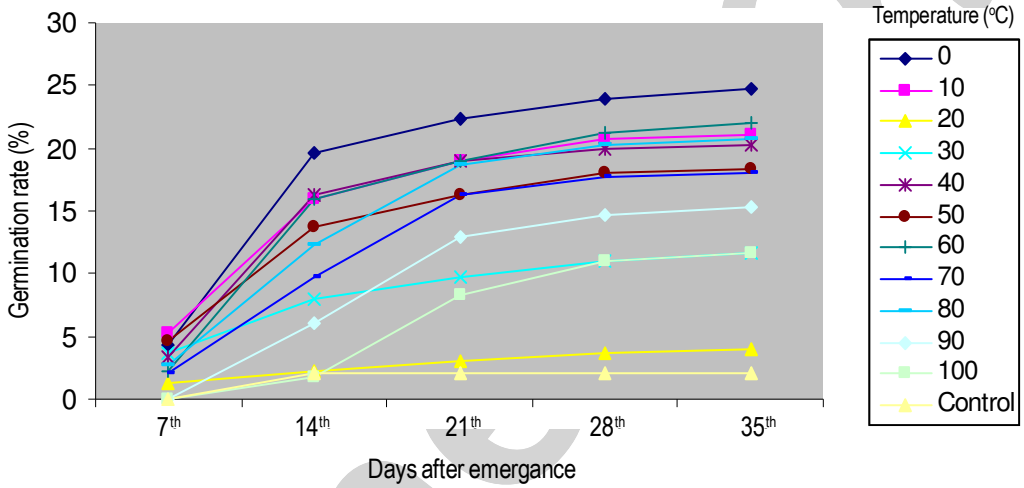

Fig. 1: Germination rates of caper seeds counted at different temperature

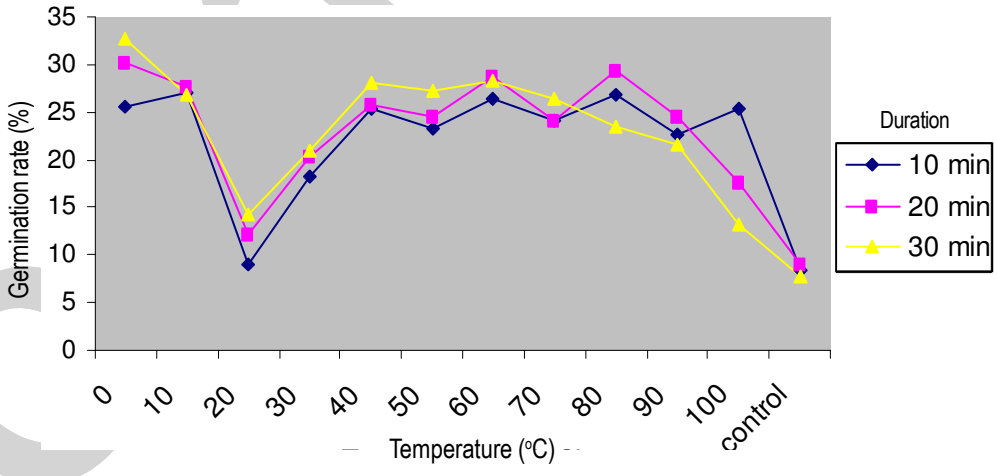

Fig. 2: Germination rate of caper seeds counted at different temperature and duration

temperature of 25°C under with a 12 hr daily period at 1500 lux provided by cool white fluorescent lamps (Orphanos, 1983; Sozzi and Chiesa, 1995) in Universal oven Model ULM-800 modified with lamp.

Germination data were transformed (arcsine) before a statistical analysis was performed. Differences between treatments were determined with analysis of varience using MSTATC statistical package (Michigan State University, East Lansing, MI). Significant differences were detected, means were separated using LSD multiple range test at $p<0.01$ and <0.05.

Germination was calculated by Pieper (1952)'s formula;

$$GR = \frac{O\ (n \times t)}{T}$$

GR: Germination rate, n: number of days for each counting of germinated seeds, t: number of germinated seeds in each counting day, T: total number of germinated seeds

Results and Discussion

Caper seeds become dormant and are notably difficult to germinate and therefore require extra treatments to grow (Alkire, 1998). Sozzi and Chiesa (1995) reported that caper seed dormancy is induced by coat structure. Temperature, pre-soaking treatment and light have been performed to improve the germination percentages of caper seeds by different researchers (Olmez *et al*., 2006; Soyler and Arslan, 1999; Sozzi and Chiesa, 1995; Pascual *et al*., 2004; Tansi, 1999; Toncer and Tanvi, 2000).

Tetrazolium test revealed a high viability of untreated seeds, 95%, parallel those cited in the literature (Pascual *et al*., 2004; Tansi, 1999; Sozzi and Chiesa, 1995; Soyler and Khawar, 2007). Germination rate of caper seeds counted in seven days intervals are given in Fig.1. Germination rate speedy increased between 7th and 14th day, decreased between 28th and 35th day, Control and 20°C showed similiar trend to germination rates.

The effects of the different temperature and duration on caper seed germination progress are given in Table 1 and Fig. 2. The experiment revealed that the different temperature treatments were effective on mean germination percentage. The highest percentages of mean germination were obtained at 0°C with 29.52% and 10°C with 27.17%, the lowest percentages of mean germination were obtained at control seeds with 8.39%. However, the highest germination rate was obtained from the seeds which germinated low temperatures (0°C and 10°C) and some high temperatures (40, 60 and 80 °C), and took place same statistical group.

The combination between temperature and duration were significant ($p \leq 0.01$) and some temperatures were affected by durations. According to the combination of different temperature and duration, the highest germination rate were obtained from 0°C with 32.78% in 30 min duration, 0°C with 30.11% in 20 min duration and 80°C with 29.35% in 20 min duration. The lowest of germination rate were obtained at control seeds with 7.74%.

In our research, dry heat temperatures and duration to breaking dormancy were enhance germination percentage and it varied from 7.74 (control) to 32.78% (0°C with 30 min). At the findings were obtained from earlier studies to removing germination obstacle of caper seed by various treatments, enhancing of germination rates changed from 46.33 to 65.1% (Soyler and Arslan, 1999; Koc, 2001; Olmez *et al*., 2004; Olmez *et al*., 2006; Soyler and Khawar, 2007) and were higher than our findings (32.78%). Researchers have been used the seeds of different species were subject to various physico-chemical and hormonal treatments like stratification, acid scarification, potassium nitrate (KNO_3), gibberellic acid (GA_3) and combined treatment with H_2SO_4 and GA_3.

The seed coat dormancy is mainly due to the seed coat that prevents germination (Orphanos, 1983). Pre-treatments are used to help break this dormancy, often simulating natural environmental processes. It is known that temperature indirectly influences germination with water absorbition, enzyme efficiency and the diffusion of mobile substances. Our research also showed that the germination rate was affected by different temperature and duration. Dry-heat treatments positively improved the germination of caper seeds.

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