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Germination requirements of three segetal species of the Italian flora

Abstract

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This study focuses on the germination requirements of three segetal plant species: *Agrostemma githago*, *Bupleurum rotundifolium* and *Xeranthemum inapertum*. Seeds were collected in the Western Alps, Piedmont, and conserved in a cool and dry place at room temperature for a post-maturation period of at least 30 days. Our results show a high germination response for some treatments in all the species.

Key words: *Agrostemma githago*, *Bupleurum rotundifolium*, *Xeranthemum inapertum*, weed, Western Alps.

Introduction

Segetal flora is a characteristic element of the agroecosystems, and it is important for their proper functioning; therefore, the conservation of these weed species is crucial for preserving the agrobiodiversity (Fanfarillo & al. 2020). These species are now rare in Piedmont because of the abandonment of mountain cereal cultivation. In this regard, seeds of *Agrostemma githago* L., *Bupleurum rotundifolium* L. and *Xeranthemum inapertum* (L.) Mill. (three segetal species) were collected in summer 2020, between 700 and 1000 m a.s.l., in the Western Alps, and stored in the Germplasm Bank of Chiusa di Pesio (CN, Italy). In order to introduce seed accessions to the seed bank, germination tests were carried out to establish optimum germination conditions. For each species different photo- and thermo-periods were tested.

60. *Agrostemma githago* L. (*Caryophyllaceae*) (Fig. 1a)

Accession data

It: Valdieri (Cuneo) (WGS84: 44.292467°N, 7.430214°E), rye field, 711 m a.s.l., 7 Aug 2020, *M. Lonati* (NA/21/2294, Piedmont Germplasm Bank).

Germination data
Pre-treatments: seed sterilization in a 70% ethanol-water solution for 3 minutes and in a 5% sodium hypochlorite water solution for 10 minutes (×2) followed by 3-4 rinses in sterilized distilled water.

Germination medium: 2 sheets of sterilized filter paper imbibed with 3 ml of filter-sterilized distilled water.

Sample size: 125 seeds for each test (25 × 5 replicates).

Germination	Thermoperiod	Photoperiod [light/dark]	T_1 [d]	T_{50} [d]	T_{max} [d]	MTG [d]
99.2%	constant 4°C	0/24h	4	2.0	11	6.9

Observations
Agrostemma githago belongs to the *Caryophyllaceae*, which have a complete embryo at the maturation of the seed and an expected simple physiological seed dormancy (Finch-Savage & Leubner-Metzger 2006). Low temperatures for a short period encourage the overcoming of seed dormancy as already described for other species within *Caryophyllaceae* (Fišer Pečnikar & al. 2018). In our experiments, seed germination was optimal (99.2%) at 4°C and under full dark conditions. Very lower germination percentages were obtained when *A. githago* seeds were incubated directly at 25/15°C in a 12/12h photoperiod (58.4%) or when the warm treatment (30 days) preceded the cold stratification (51.2%).

61. *Bupleurum rotundifolium* L. (*Apiaceae*) (Fig. 1b)

Accession data

It: Oulx (Torino) (WGS84: 45.032785°N, 6.832038°E), rocky debris in former terraces, 1085 m a.s.l., 6 Jul 2020, *M. Lonati* (NA/21/2292, Piedmont Germplasm Bank).

Germination data
Pre-treatments: seed sterilization in a 70% ethanol-water solution for 3 minutes and in a 5% sodium hypochlorite water solution for 10 minutes (×2) followed by several rinses in sterilized distilled water. 1) Cold stratification at 4°C for 30 days.

Germination medium: 2 sheets of sterilized filter paper imbibed with 3 ml of sterilized distilled water.

Sample size: 125 seeds for each test (25 × 5 replicates).

Germination	Thermoperiod	Photoperiod [light/dark]	T1 [d]	T50 [d]	Tmax [d]	MTG [d]
92.8%	constant 4°C	0/24h	31	4.7	80	32.8
84.8%[1]	alternating 25/15°C	12/12h	31	4.5	44	32.1

Observations

Results showed that *B. rotundifolium* seed germination is improved by a short treatment at low temperatures. The highest germination percentages were obtained at 4°C (92.8%) and when a cold stratification was given before rising the incubation temperature (84.8%). Seeds have a small embryo as typical of the *Apiaceae* family (data not shown) pointing to the presence of a morphological dormancy (Finch-Savage & Leubner-Metzger 2006).

62. *Xeranthemum inapertum* (L.) Mill. (*Asteraceae*) (Fig. 1c)

Accession data

It: Oulx (Torino) (WGS84: 45.031864°N, 6.830746°E), rocky debris in former terraces, 1085 m a.s.l., 12 Aug 2020, *M. Lonati* (NA/21/2291 NA/21/2292, Piedmont Germplasm Bank).

Germination data

Pre-treatments: seed sterilization in a 70% ethanol-water solution for 3 minutes and in a 5% sodium hypochlorite water solution for 10 minutes (×2) followed by 3-4 rinses in sterilized distilled water.

Germination medium: 2 sheets of sterilized filter paper imbibed with 3 ml of sterilized distilled water.

Sample size: 125 seeds for each test (25 × 5 replicates).

Germination	Thermoperiod	Photoperiod [light/dark]	T_1 [d]	T_{50} [d]	T_{max} [d]	MTG [d]
100.0%	alternating 25/15°C	12/12h	7	4.5	9	7.0
100.0%	constant 4°C	0/24h	7	1.4	21	11.8

Observations

Germination tests carried out on *X. inapertum* seeds provided optimal germinations (100%) under different temperatures, either in a 12/12h dark/light photoperiod or in full darkness. When a 25/15°C alternating temperature was applied, the maximum germination was reached within 9 days, while it took 21 days to the maximum germination when the seeds were incubated at 4°C. At both treatments, the germination delay was 7 days. This species responds positively, in terms of germination, to different temperatures and has no

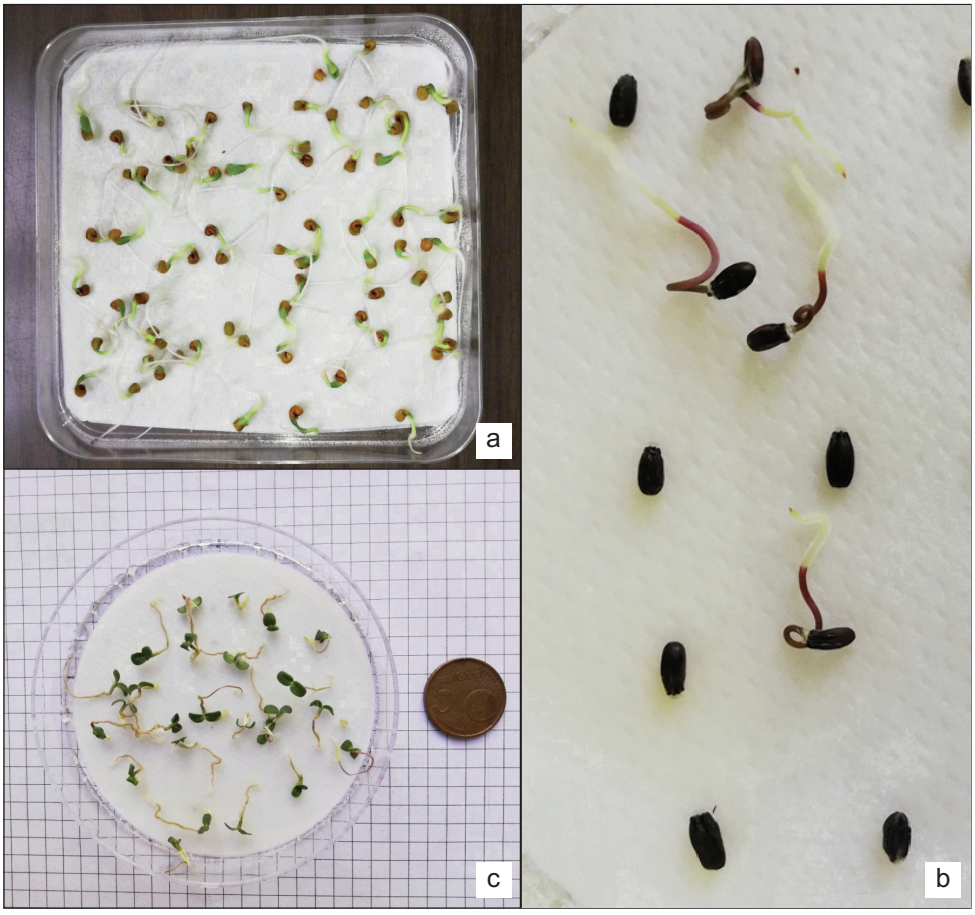

Fig. 1. a) Seedlings of *Agrostemma githago;* b) Some germinated seeds of *Bupleurum rotundifolium;* c) Seedlings of *Xeranthemum inapertum* (photos by A. Cucchietti).

seed dormancy as for many other *Asteraceae* (Baskin & Baskin 2004). The observed germination behaviour seems to be typical of an annual spring species.

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