GERMINATION OF TWO-YEAR-OLD SEEDS OF *Sinapis arvensis* AND *Papaver rhoeas* ORIGINATING FROM A ZEMUN POLJE SITE

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INTRODUCTION

Germination is a crucial process in the life cycle of a plant because the time of germination determines the environment in which that plant will develop, and eventually the plant's fitness. The time of germination can determine when reproduction and fruit ripening will occur.

Wild mustard (*Sinapis arvensis* L.) and corn poppy (*Papaver rhoeas* L.) are relatively common weed species in Serbian fields. Sporadic germination even under optimal conditions is an important feature of *Sinapis arvensis* seeds, which ensures that many years will elapse before all seeds present in a soil have germinated. Matured seeds are dormant and ready to germinate only at a very low percentage, no more than 1-2%. After winter stratification, their germination capacity increases up to 75%. In the laboratory, seeds kept at room temperature have demonstrated a germinability that was slowly rising over a period of several years

Seeds of *Papaver rhoeas* L. are dormant at maturity, and dormancy is not easily broken. They are small-sized and consequently tend to get buried deeper into the soil, which delays their germination. As a consequence, they often make large contribution to a seed bank without being observed in the extant vegetation. They are able to survive at least five years in soil. Germination of seeds stored dry in the laboratory was 56% after one, 79% after five and 3% after 10 years (Kjaer, 1940, 1948, cited by Buhler and Hoffman, 1999).

The present study examined the interaction of light effect and duration of stratification on the germination of two-year-old seeds of wild mustard (*Sinapis arvensis* L.) and corn poppy (*Papaver rhoeas* L.), both collected from a site at Zemun Polje.

MATERIALS AND METHODS

Seeds were collected at Zemun Polje, Belgrade, in May and June 2010. Seeds were kept at room temperature until the experiment began.

Batches of 50 seeds were placed into 6 cm petri dishes containing 2 ml of distilled water. Three petri dishes were used to test each experimental treatment.

The seeds were stratified for one or four weeks at 4±1 °C.

The seeds were germinated at an alternating temperature of 30 °C for 14 h and 20 °C for 10 h, and were illuminated with white neon light during the longer interval. The illuminated seeds were kept in the same growth chamber with those germinating in the dark. The latter were in petri dishes covered with tin foil over the initial 7-8 days after stratification, and the foil was then removed. The illuminated seeds that germinated were counted and removed daily or every other day. Seed counting was terminated three weeks after stratification.

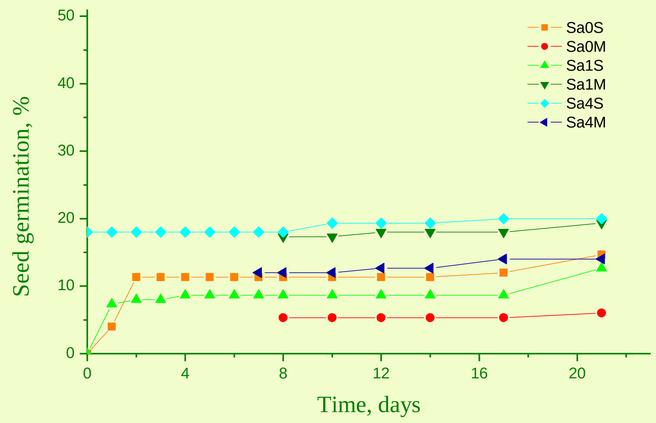

Figure 1. Germination of wild mustard (*Sinapis arvensis*) seeds in light and in the dark, at alternating temperature of 30 °C for 14 h and 20 °C for 10 h and were illuminated during the longer period following one and four weeks of stratification (4±1 °C) or without stratification.

Legend: Sa0S – unstratified seeds germinating in light from the beginning; Sa0M – unstratified seeds germinating in the dark during the initial 8 days, then in light; Sa1S – seeds stratified for one week, germinating in light from the beginning; Sa1M – seeds stratified for one week, germinating in the dark during the initial 8 days, then in light; Sa4S – seeds stratified for four weeks, germinating in light from the beginning; Sa4M – seeds stratified for four weeks, germinating in the darks during the initial 7 days, then in light.

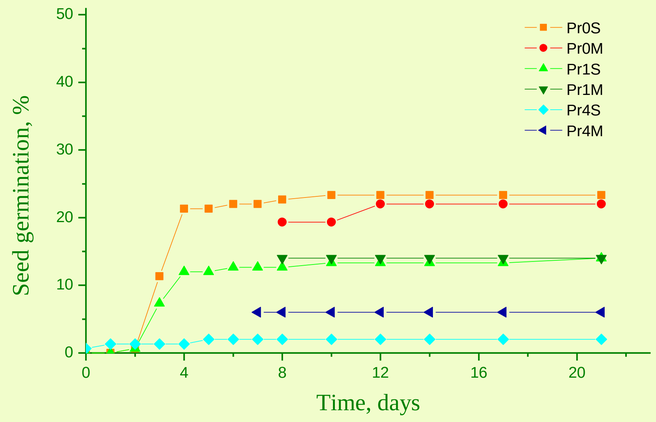

Figure 2: Germination of corn poppy (*Papaver rhoeas*) seeds in light and in the dark, at alternating temperature of 30 °C for 14 h and 20 °C for 10 h and were illuminated during the longer period following one and four weeks of stratification (4±1 °C) or without stratification.

Legend: Pr0S – unstratified seeds germinating in light from the beginning; Pr0M – unstratified seeds germinating in the dark during the initial 8 days, then in light; Pr1S – seeds stratified for one week, germinating in light from the beginning; Pr1M – seeds stratified for one week, germinating in the dark during the initial 8 days, then in light; Pr4S – seeds stratified for four weeks, germinating in light from the beginning; Pr4M – seeds stratified for four weeks, germinating in the dark during the initial 7 days, then in light.

RESULTS AND DISCUSSION

Germination of *Sinapis arvensis* seeds was not significantly affected by the duration of stratification (one or four weeks), having reached between 6% and 20% over the 21-day period of germination (Figure 1). Germination of *Sinapis arvensis* seeds under relatively similar conditions in another study, i.e. at a constant temperature of 25 °C and a daily illumination period of 16 h, ranged from 0% to 10% (Luzuriaga et al., 2006). Similar data have been reported from other studies as well (Andersson and Milberg, 1998).

Light was not found to influence the percentage of germinating seeds in our study. Kolk (1947), cited by Fogg (1950) reported that *Sinapis arvensis* seeds germinated best under weak light or in the dark. It was probably the rather low germination percentage in our experiment that prevented us from observing a significant statistical difference between germination in the dark and under illumination.

Germination timing has a crucial contribution to life-history traits and reproduction of a plant and eventually on the establishment of competitive hierarchies in the plant community. In our experiment, the illuminated seeds of *Sinapis arvensis* that were stratified for one week reached a germination plateau already after the first day of germination, while unstratified seeds reached it after two days. Evidently, low temperature enhances the germination process of *Sinapis arvensis* seeds, a fact which may be important for germination of the surviving seeds after the winter period.

The duration of stratification had a negative effect on the germination of *Papaver rhoeas* seeds under the experimental conditions (Figure 2). The low percentage of germinated seeds stratified for four weeks was statistically different, compared to both other groups. Light was not found to have any effect on germination. Baskin et al. (2002) reported that after physiological dormancy was broken, *P. rhoeas* seeds required light for embryo growth (i.e. for loss of morphological dormancy) and consequently for germination. However, unless seeds have come out of physiological dormancy, light has no promotive effect on embryo growth and germination. As light had no effect on the germination of *P.rhoeas* seeds in our experiment, morphological dormancy was presumably partially lost after two years of storage, even in dry conditions, so that germination exceeded 20%. Stratification caused the seeds to enter a conditional dormancy.

Germination of unstratified seeds and of those stratified for a week increased abruptly the third and fourth day of germination, and almost stopped after that. A similar dynamic could not be detected in seeds stratified for four weeks because of their very low germination percentage.

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