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MORPHOLOGICAL ASPECTS ABOUT GERMINATION OF *Vulpia myuros* (L.) C.C. Gmel. CARYOPSIS

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Abstract

Caryopsis harvested in 2014 from a population of Vulpia myuros, invasive in a rape seed crop, were tested for germination over 3 years and a half after harvesting (2015-2018). The germination tests were done on paper moistened with distillate water in Petri dishes, in several variants with Vulpia caryopsis and seeds of different species - Triticum durum, Brassica napus, Helianthus annuus. Viability of the seeds of the Vulpia population, stored under laboratory conditions, was preserved during all this time. The germination of the Vulpia caryopsis was simulated in the presence of germinated seeds of the other species. Germinated caryopsis of Vulpia myuros showed a hairy coleorhiza which allowed high adherence of the seedling to the soil surfaces.

Key words*: Vulpia myuros, caryopsis, germination, hairy coleorhiza.*

INTRODUCTION

An early and/or faster germination, broader germination requirements, and exploitation of germination niches are some of the traits, described by Gioria and Pyšek (2016) that explain the success of species becoming invasive in non-native habitats. To *Vulpia myuros* (annual fescue, rattail fescue), for example, the higher rate of germination in darkness or light has represented an advantage in conquering new spaces, unlike its less invasive congener, *V. bromoides* (Gioria and Pysek, 2016). According to Richardson's definition (Richardson et al., 2000), *V. myuros* can be considered an invasive species only in non-native natural areas. But, for agricultural crops it has acquired the character of a highly competitive weed, associated with minimal soil disturbance (no-till cropping systems) (Ball et al., 2007); its incidence is rising rapidly, such that in some regions it has emerged as a new weed (Georgescu et al., 2016).

Integrated weed management (IWM) strategies include measures based on seed and germination information under field conditions, such as seed production and their viability, dormancy and vernalization requirements, specific demands for seed germination and plant growth (Ball et al., 2008). Results of various experiments on seed and seed germination, conducted in the laboratory or in the field, registered the behaviour of rattail fescue both in the field crops and in grass plots: *V. myuros* is a rapidly germinating species whose seeds have persisted for more than a year in the soil (Peco et al., 2003), but no more than 2-3 year (Ball et al., 2008); it can germinate in both darkness and light, but the light has doubled the temperature range in which this species is able to germinate; when the seeds have been buried under the surface depth, the plants occurrence has been delayed (Dillon and Forcella, 1984). With a high seed production and a 2-3-month dormancy period, *V. myuros* is able to survive in summer and germinate in autumn when soil moisture is favorable (Dowling, 1996); in a California field experiment, increasing seeding density did not affect the density of the *V. myuros* plants, instead it has reduced the density of native perennial herbs and weeds (Brown and Rice, 2000).

Testing allelopathic potential on several plants, Kato-Noguchi et al. (2010) have showed that extracts of *V. myuros* inhibited the growth of the roots and shoots in different species; seed germination and growth of the wheat coleoptile and radicle were inhibited by the aqueous

extracts from annual fescue (Min et al., 1993); it is worth noting that compounds from aqueous extracts of some wheat genotypes showed allelopathic activity against other grass species, the ryegrass (Petcu et al., 2017).
Our aim in this study is to highlight the seed germination observations of *Vulpia myuros*, stored under laboratory conditions, over 3 years after harvesting; there are also descriptions for the morphology of the caryopsis of rattail fescue, before and after germination.

MATERIALS AND METHODS

Caryopsis harvested in 2014 from a population of *Vulpia myuros*, weed in a rapeseed crop (Georgescu et al., 2016), were stored in paper bags under laboratory conditions. The germination tests were done on paper moistened with distillated water in Petri dishes, in the following variants: i) 2015 - October: *V. myuros;* ii) 2016 - July: *V. myuros;* iii) 2017 - December: *V. myuros*, *Triticum durum*, *Brassica napus* and, respectively, *Heilanthus annuus*, sown together; the germination was verified separately for each species, under the same conditions; iv) 2018 - January: *V. myuros*, *T. durum* and *B. napus* sown at a 3-days interval, on the same Petri dish.
For each variant 10 caryopsis or seeds/Petri dish were used, in 3 repetitions (replicates), for observing the germination status. All the grains used have had 100% of germination.
The aspects of all types of germinations were observed and the results have had recorded from the first day after sowing, using the S8APO stereomicroscope. Images of the micro-morphology of the caryopsis before and after germination were obtained at SEM FEI Inspect S 50. The experiments were carried out in the Research Center for Studies of Food Quality and Agricultural Products from UASVM Bucharest, Laboratory of microscopy and plant anatomy.

RESULTS AND DISCUSSIONS

Caryopsis morphology before and after germination. The fusiform caryopsis of *V. myuros* is merged to lemma and palea. Lemma, with basal rounded glabrous callus and distal straight awn, up to 15 mm long, is 5-nervate and scabrous (Stace, 2010; Häfliger and Scholz, 1981) (Figures 1, 2, 3).

Figure 1. *Vulpia myuros* caryopsis (stereomicroscope)

Figure 2. Lemma basal callus (stereomicroscope)

Figure 3. Lemma basal callus (SEM)

Caryopsis germination. Hairy coleorhiza can be observed on germinate caryopsis (Figures 4, 5). This peculiar characteristic encountered to some *Poaceae* species, like *Lolium perenne*, *Festuca arundinacea* or *Oryza sativa*, allows a high adherence of the germinate caryopsis to the soil surface. (Morita et al., 1990, 1997; Debaene-Gill et al., 1994).

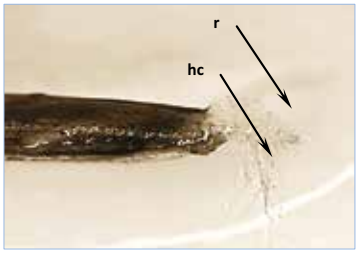

Figure 4. Hairy coleorhiza (hc) and radicle (r) of *V.myuros* germinate caryopsis

Figure 5. Hairy coleorhiza (SEM)

In October 2015 and July 2016, in conditions of light, germination and growing of the seedling were produced over 6 days (Figure 6). All the caryopsis had germinated (100%).

Figure 6. *V.myuros* germinate caryopsis in July, 2016

In December, *V. myuros* caryopsis germinated in dark conditions (coated Petri dishes). 24 hours after sowing in all variants the germination process was initiated both for *V. myuros* and the other species - *T. durum*, *B. napus* and *H. annuus*. In experiments with *V. myuros* only, caryopsis were in the early germination stages, a short hairy coleorhiza and the radicle being observed.

Figure 7. Germinate caryopsis of *V. myuros* of *T. durum* experiment. Coleoptile is present

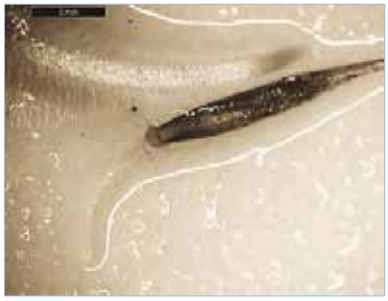

Figure 8. Germinate caryopsis of *V. myuros*. Above, the radicle of rape seed

In experiments with *T. durum*, caryopsis of the *V. myuros* were in an advanced germination stage: radicle has formed root-hairs and coleoptile was obvious in over 50 % of plants. Coleorhiza hairs were longer than those of the *V. myuros* only experiments (Figure 7). Seeds of *B. napus* stimulated, also the *V. myuros* caryopsis germination, but the number of seedlings with the coleoptile was reduced in comparison with the *T. durum* experiment (Figure 8).

Figure 9. Seedlings of rapeseed and *V.myuros* germinated caryopsis

Figure 10. *V.myuros* germinated caryopsis (detail)

Same situation was registered in *V. myuros* and *H. annuus* germination experiments. The germination of *V. myuros* caryopsis was produced at the same rate in the January experiments, even though these were sown after the seeds of *B. napus* or caryopsis of *T. durum* were germinated (Figures 9, 10).

CONCLUSIONS

Viability of the seeds of the *V. myuros* population, stored under laboratory conditions, was preserved during 3, 5 years.

The presence of seeds of other species, despite the time of sowing, accelerate the germination of the *V. myuros* caryopsis.

Germinated caryopsis of *V. myuros* showed a hairy coleorhiza which allowed high adherence of the seedling to the soil surfaces.

Future germination experiments with this populations of *V. myuros* in the fields are suggested.

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