Variability of selected traits in meadow fescue (*Festuca pratensis* Huds.) plants with different susceptibility to seed shattering

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INTRODUCTION

In certain species of the grass family, such as wheat or rice, domestication and breeding practices had a positive effect on many usable traits, including the seed shattering tendency. While in wild species seed shattering is a condition for spreading seeds, in domesticated species it is a very unfavourable and loss-making phenomenon [1].

In meadow fescue (*Festuca pratensis* Huds.) a heavy seed shattering already begins in partially green panicles. The occurrence of one caryopsis in a spikelet is enough to induce the formation of the abscission layer which causes the separation of the caryopsis from the pedicel and its falling out of the spikelet [2].

AIMS

The main objective of the research was to compare two subpopulations of meadow fescue obtained via divergent selection, differing in the tendency to seed shattering, in respect of the variability of the heading and flowering stages, morphological traits, such as plant height and panicle length. An additional aim was to evaluate the changes undergoing at the site of the bonding between the caryopsis and the spikelet pedicel which result in seed shattering with the use of scanning electron microscopy.

MATERIAL AND METHODS

Field experiments were carried out in the years 2008-2017 at the Experimental Station of the University of Agriculture in Prusy near Kraków, Poland (N 50°07'03'' and E 20°05'13''). The initial material for performing the divergent selection for low and high seed shattering tendency included meadow fescue (*Festuca pratensis* Huds.) cultivars: Cykada, Skawa, Skiba and Skra (Małopolska Hodowla Roślin HBP Sp. z o.o., Poland).

The divergent selection was performed on the base of the susceptibility to seed shattering determined under laboratory conditions [3]. The plants in which seed losses exceeded 20% were defined as the plants susceptible to seed shattering, while plants in which seed shattering was lower (losses <20%) were ranked among the group of plants with a low seed shattering tendency (Fig. 1). Field observations were carried out till the year 2017. Over the entire research period, in accordance with the OECD methodology (2012), the following observations were performed: starting dates of the heading and flowering stages were determined, and one weak after the beginning of the flowering stage plant height and panicle length measurements were taken.

Scanning electron microscopy (SEM)

The site of the bonding between the caryopsis and the spikelet pedicel was observed using SEM (JEOL JSM 5410, Japan). Starting with the 18th day after the beginning of the flowering stage, at four dates (from the 14th till the 25th of June 2012), from the second branch of panicles samples of spikelets were taken.

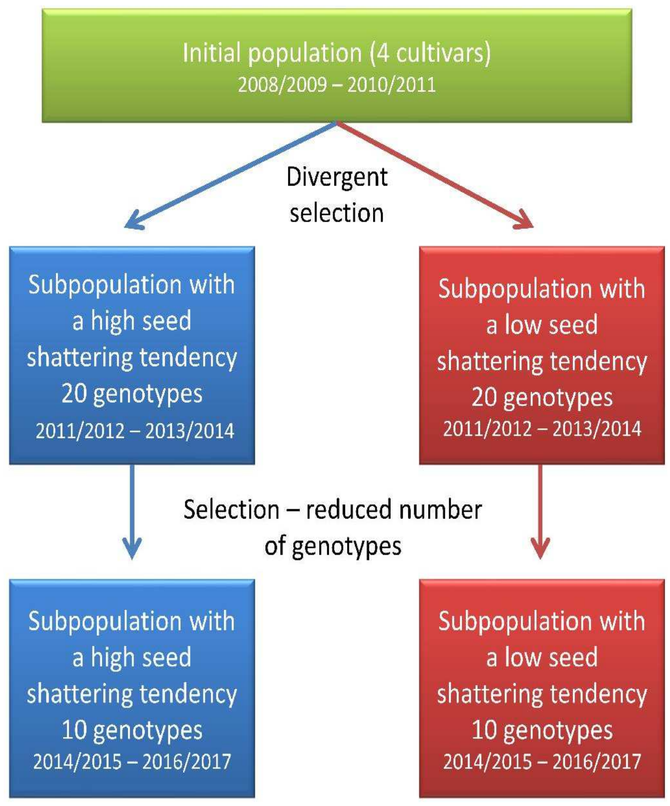

Figure 1. Outline of the selection for a varied seed shattering tendency carried out on meadow fescue plants

RESULTS

The research showed the narrowing of the range of variability in the heading and flowering dates, as well as the height of plants and length of panicles in meadow fescue subpopulations obtained through divergent selection. In the first growing year, in the subpopulation with a low seed shattering tendency, the beginning of the heading and flowering stages was 2-3 days late (Fig. 2). Both the subpopulations showed good synchronization of the flowering stage, the variability of which was several times lower as compared with the heading stage. The plants with a higher seed shattering tendency were 7 cm shorter, while the length of panicles was similar in both the subpopulations.

The analysis of the site of the bonding between the caryopsis and the spikelet pedicle, performed with the use of scanning microscopy, showed that the formation of the abscission layer in genotypes with a low seed shattering tendency was 4 days late (Fig 3). In those genotypes, at other sampling dates the crack occurring at the base of the caryopsis was considerably smaller.

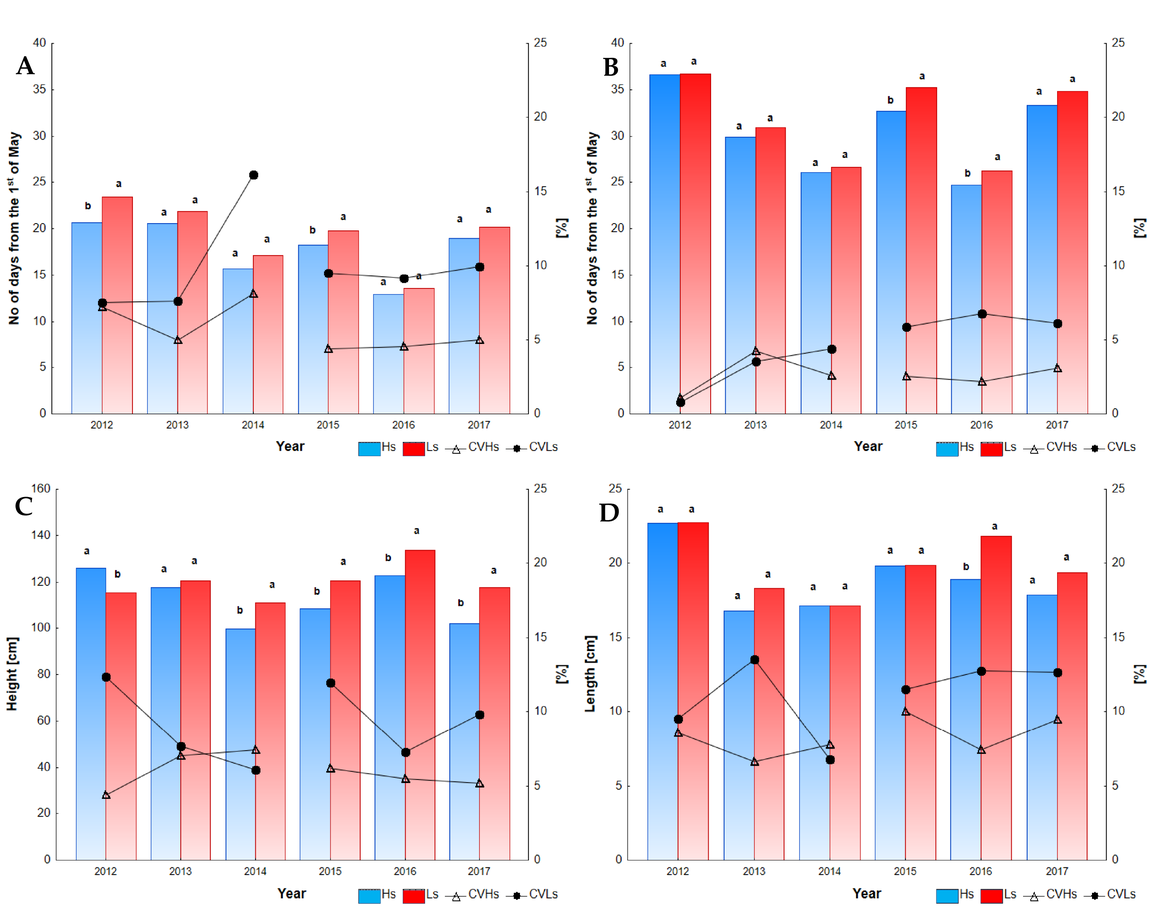

Figure 2. Variability of the starting dates of the heading (A) and flowering (B) stages, as well as plant height (C) and panicle length (D) in meadow fescue clones differing in the seed shattering tendency (Hs – high shattering; Ls – low shattering; CV – coefficient of variation; the bars marked with the same letter in a given growing year present the means which do not differ significantly according to Tukey's HSD test)

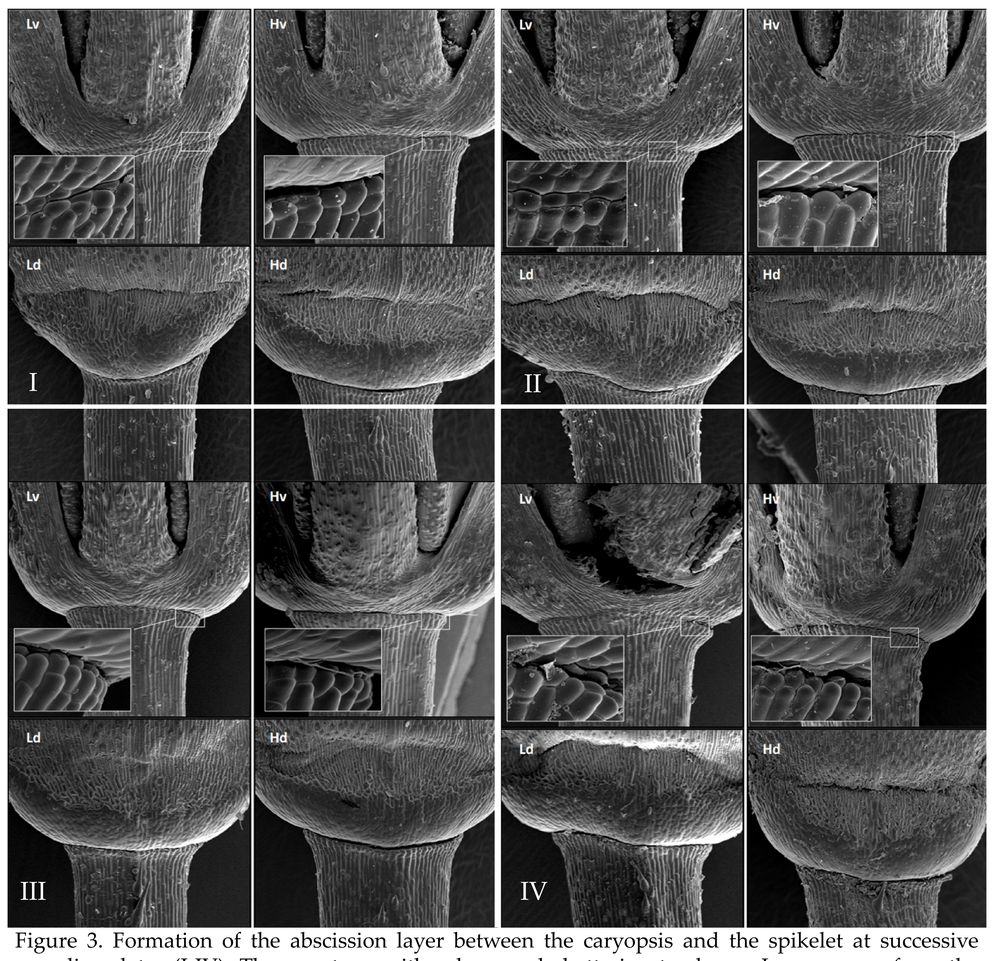

Figure 3. Formation of the abscission layer between the caryopsis and the spikelet at successive sampling dates (I-IV). The genotype with a low seed shattering tendency: Lv - as seen from the ventral side, Ld – as seen from the dorsal side; the genotype with a high seed shattering tendency: Lv – as seen from the ventral side, Ld – as seen from the dorsal side; 150x magnification; magnification of the fragment - 1500x

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