Volume 55(1):81-82, 2011
Acta Biologica Szegediensis
http://www.sci.u-szeged.hu/ABS

ARTICLE

Root development and drought tolerance of wheat-barley introgression lines

Borbála Hoffmann[1]*, Nikolett Réka Aranyi[1], Márta Molnár-Láng[2]

[1]Department of Plant Sciences and Biotechnology, Georgikon Faculty, University of Pannonia, Keszthely, Hungary,
[2]Agricultural Research Institute, Hungarian Academy of Sciences, Martonvásár, Hungary

ABSTRACT nterspecific hybridization makes it possible to transfer useful traits, such as stress tolerance, earliness and various desirable traits from one species into another. Addition, substitution and translocation lines developed from wheat-barley (*Triticum aestivum* L. x *Hordeum vulgare* L.) hybrids were analyzed to determine how the added barley chromosomes (or segments) influence agronomy traits in wheat. Experiments were carried out at Georgikon Faculty, Keszthely. First we checked the seeds germinating power and the early development of shoots and roots. The drought-tolerance was tested under rain shelter in the field. The morphological and agronomic traits of the introgression lines were studied. Data were obtained for root-shoot ratio (EC: 30-31), heading time (earliness), plant height, morphology and length of ear, components of grain yield. The use of this genetic material in wheat breeding programs can result in new varieties with better adaptation. **Acta Biol Szeged 55(1):81-82 (2011)**

KEY WORDS

interspecific hybridization
germinating power
root-shoot ratio
drought-tolerance
grain yield

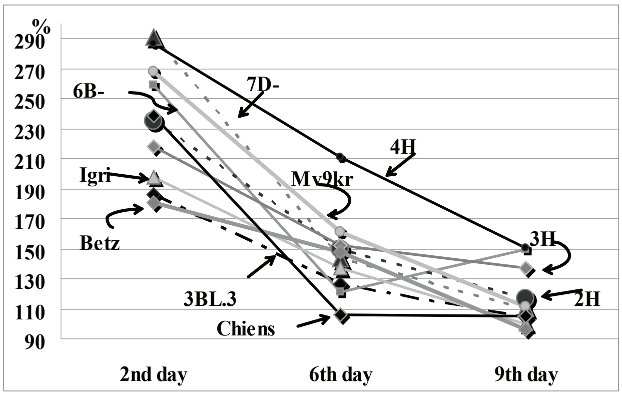
Hybridization between related species makes it possible to transfer various desirable traits from one species into another. The introgression of barley (*Hordeum vulgare* L.) chromosome segments into wheat (*Triticum aestivum* L.) may result in the transfer of new, useful traits like earliness, drought-tolerance or various traits for specific nutritional quality into wheat. Since the first successful hybridization between wheat and barley (Kruse, 1973) only a few wheat-barley translocation and substitution lines have been developed (Koba et al. 1997) and were investigated regarding cytogenetic characteristics and fertility (Molnár-Láng et al. 2000). The aim of our study was to determine how the added barley chromosome (segments) influences characteristics in wheat that are important for drought- tolerance.

Materials and Methods

Wheat-barley disomic addition lines 2H, 3H and 7DL.7DS-5HS translocation were developed from the Mv9 kr1 ×Igri (Mv9 kr1: Martonvásári 9 kr1; Igri: German two-rowed winter barley) hybrid combinations. Translocations 3BL.3HS, 6BS.6BL-4HL and substitution 4H (4D) originates from the crossing (Chinese Spring spring wheat × Betzes spring barley) x Mv9kr1. The experiments were carried out at UP Georgikon Faculty, Keszthely. Germinating power and the early development of shoots and roots were checked. In the field experiment Sowing and harvest was made by hand. Each genotype was sown in a 12m long row. The half length of the

Accepted July 11, 2011
*Corresponding author. E-mail: hoff-b@georgikon.hu

1 A



1 B

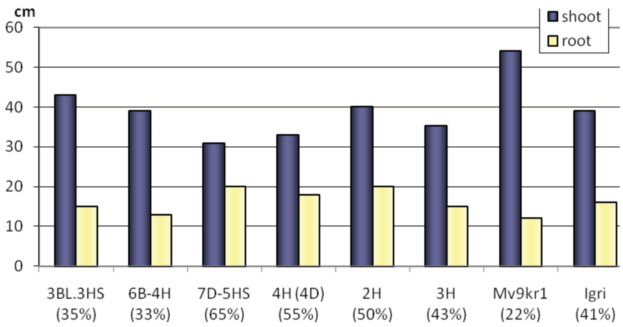


Figure 1. A: Radicle-bud length ratio (%) of wheat-barley derivatives and of parent cultivars on the 2nd, the 6th and the 9th days. B: Root- and shoot length (cm) and root-shoot ratio (in parentheses) of wheat-barley derivates and their parents in the field experiment, 2008.

rows were covered with a plastic folia on 21 April to protect plants from rain indicating 180 mm difference in water supply between control and stress (cowered) treatment. Sowing and harvest was made with hand. Data were obtained for root-shoot ratio, plant height, colour of leaf, morphology and length of ear moreover components of grain yield.

Results and Discussion

The early development of radicle and bud and their ratio is one of the most important traits in terms of the drought tolerance. We measured the highest radical-bud length ratio in case of 4H (4D) at all measurements (Fig. 1A). The radicle-bud ratio decreased during the development of plants. The smallest value was found for Chinese Spring on the sixth day. The radicle-bud ratio of 6B-4H developed interestingly: from a high starting value it decreased to the smallest one discounting Chinese Spring onto the sixth day. After that -opposed to the rest of the examined genotypes- the radical-bud ratio was growing again.

At tillering 6 plants of each genotype were grubbed up and the length and the mass of root and shoot were measured in the field experiment. All wheat-barley derivates had longer roots and shorter shoots than the wheat parent resulting in an even more increased root-shoot ratio (Fig. 1B). The mean of lines was 47%, while the root-shoot ratio of the parents was 22- and 41% for wheat and barley respectively. The most favourable result was measured in case of 7D-5HS (65%) and 4H (4D) (55%).

Grain yield in stress treatment was reduced by 12.4 % in the mean of examined genotypes. The barley parent Igri lost 7% and the wheat parent Mv9kr1 12% of its control's yield. The highest yield loss was measured in case of 6B-4H (27%), while there was no yield decrease in the case of 4H (4D). But it is not enough to consider only the decrease of yield, we have to take into account the absolute values as well to become a more sophisticated conclusion. Lines 3H and 4H (4D) had the smallest yield in both treatment, while 3BL.3HS over yielded the wheat parent, though it has lost 20% of it's controls yield.

Lines developed from wheat-barley hybrids having an added barley chromosome(segment) in wheat background tolerated drought differently and give rise to a scale of variation in all examined traits.

Acknowledgements

This work was financed by the Generation Challenge Programme GCP SP3 G4007.23 and the Hungarian National Research Fund (K 75 381). A part of this study was presented on the 10th Congress of the Hungarian Society for Plant Biology, August 31 - September 2, 2011, Szeged, Hungary.

References

Koba T, Takumi S, Shimada T (1997) Isolation, identification and characterization of disomic and translocated barley chromosome addition lines of wheat. Euphytica 96:289-296.

Kruse A (1973) Hordeum × Triticum hybrids. Hereditas 73:157-161.

Molnár-Láng M, Linc G, Logojan A, Sutka J (2000) Production and meiotic pairing behaviour of new hybrids of winter wheat (Triticum aestivum) × winter barley (*Hordeum vulgare*). Genome 43:1045-1054.