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QTL mapping for germination of seeds obtained from previous wheat generation under drought

Research Article

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Abstract: The QTLs controlling germination and early seedling growth were mapped using seeds acquired from mapping population and parental lines of Chinese Spring and SQ1 grown under water-limited conditions, severe drought (SDr) and well-watered plants (C). Germination ability was determined by performing a standard germination test based on the quantification of the germination percentage (GP24) of seeds incubated for 24 h at 25°C in the dark. Early seedling growth was evaluated on the basis of the length of the root and leaf at the 6th day of the experiment. QTLs were identified by composite interval mapping method using Windows QTLCartographer 2.5 software. For the traits studied, a total of thirty eight additive QTLs were identified. Seventeen QTLs were mapped in C on chromosomes: 1A, 2A, 7A, 1B, 2B, 3B, 4B, 5B, 6B, 7B, 2D, 3D, 4D and 6D, while twenty one QTLs were identified in SDr on chromosomes: 1A, 2A, 5A, 2B, 3B, 4B, 5B, 6B, 7B, 3D, 5D and 6D. Most of the QTLs for GP and early leaf growth parameters were clustered on chromosome 4B (associated with the *Rht-B1* marker) both in C and SDr plants. The results indicate the complex and polygenic nature of germination.

Keywords: *Germination • Leaf • Root • Quantitative trait loci • Triticum aestivum L.*

Abbreviations:

QTL – quantitative trait loci,
DH – double haploid,
C – control (well-watering),
SDr – severe drought.

1. Introduction

Periodic water deficit is one of the major factors that limits the yield of cultivated plants, particularly spring crops, which do not benefit from the winter reserves of water in the soil [1,2]. Drought is one of the environmental factors affecting the life cycle of plants, which can lead to irreversible damage to the plant's functioning or even to its death [3]. It is also one of the major problems in agriculture, which struggles with insufficient resistance of plants to adverse environmental conditions.

The germinability of seeds can be one of the earliest indicators to assess seed viability [4]. It is a parameter of the sowing value of seeds, serving to determine the potential of germination [5]. There are many factors which may lead to adverse structural and metabolic changes in seeds, resulting in either the low-level or absence of activation of the seed embryo, causing poor growth of seedlings or even complete inhibition of growth. The process of germination is extremely complex and subject to the effects of many physiological factors [6]. The germination potential is a quantitative trait, probably controlled polygenically [7,8] that is also affected by external factors. Therefore, measurable results can be expected from quantitative

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