

LcSOC1-b2 Gene Involved in Control of Height to First Pod in Lentil (*Lens culinaris* Medik.)

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Abstract

Lentil (*Lens culinaris* Medik.) is very important grain legume crop that have provided essential components of human foods and diets. However, to improve yield of collected seeds, it is important to minimize yield losses during harvesting. Height from the soil at the base of the plant to the first pod, or height to first pod (HFP), is a trait of key importance when using a mechanical combine harvester. Genes *SOC1*, *Suppressor of Overexpression of Constans 1*, members of the MADS-box transcription factor family, control flowering time trait. However, one of these genes in lentil, *LcSOC1-b2*, is involved in the determination of HFP trait. In the present study, two hybrids were used: (#1. ♀ Flip92-36L × ♂ ILL-1552), parents with long and short HFP, respectively; and (#2. ♀ Krapinka × ♂ Flip96-48L) both parents with long HFP. Expression of *LcSOC1-b2* showed differential expression in the paternal genotype ILL-1552 in hybrid 1, with lowest HFP, and mRNA level of the gene was significantly, 2-4-fold, lower compared to the maternal parent Flip96-48L in all three developmental stages used in the experiment (vegetative, flowering and seed development). The three hybrid breeding lines 21/8 showed intermediate expression level. In contrast, no significant differences were recorded for the expression of *LcSOC1-b2* between parents and their breeding lines in hybrid 2, showing constant growing levels of the produced mRNA from vegetative to reproductive stages in lentil genotypes (Figure 1A). Two SNP were identified in the first (and largest) intron, but none in other parts of the gene *LcSOC1-b2* (7g014090), and SNP1 was used for the development of molecular marker *LcSOC1-b2*-SNP1 for plant genotyping (Figure 1B). This molecular marker was used successfully in targeting SNP1 in *LcSOC1-b2* for parents of hybrid 1, Flip92-36L and ILL-1552. Plants of three selected breeding lines 21/8 in the hybrid 1 were all heterozygotes and inherited *LcSOC1-b2* alleles from both parents. The same marker, *LcSOC1-b2*-SNP1, was also used for plant genotyping from the lentil germplasm collection. The genotyping results showed clear distribution of *LcSOC1-b2* alleles for SNP1 (Figure 1C). This research was funded by the Science Committee of the Ministry of Science and Higher Education, Republic of Kazakhstan, AP23489286, entitled 'Marker-assisted selection in lentil accessions from International germplasm collection and hybrid populations for genes controlling flowering time and height to first pod'.

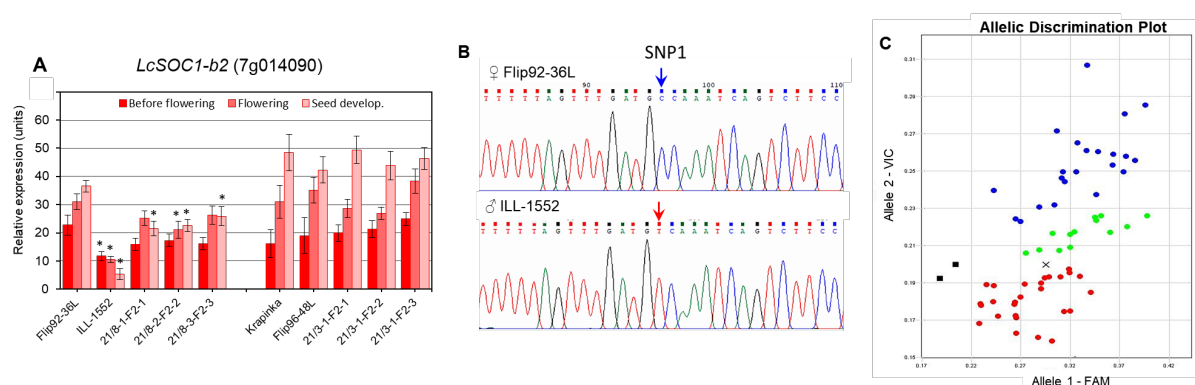


Figure 1. (A) Expression of *LcSOC1-b2* gene in two hybrids of lentil; (B) Identified SNP1 in parents of hybrid 1; and (C) Genotyping of lentil germplasm collection using *LcSOC1-b2*-SNP1 molecular marker

Keywords

Gene expression, height to first pod (HFP), lentil, plant genotyping, *Suppressor of Overexpression of Constans 1* (*SOC1*) gene.