Attempts to produce transgenic *Beta vulgaris* L. plants via combined gene transfer methods

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**ABSTRACT** We have started to elaborate a general transformation and plant regeneration system for *Beta vulgaris* L. using combined gene transfer procedure. Three methods were tested: particle bombardment with pure wolfram micro-carriers prior to *Agrobacterium* treatment, vortexing and infiltration of explants in *Agrobacterium* suspension, halving of explants. The histochemical analysis of transient and stable gus-gene expression showed the beneficial effect of explant halving and infiltration in *Agrobacterium* suspension.

**KEY WORDS**
combined gene transfer  
*Beta vulgaris* L.  
*Agrobacterium tumefaciens*  
gus-gene expression

Recent research activities in the field of traditional and molecular genetics, plant physiology, *in vitro* plant cell cultures and plant breeding make it possible to improve the characteristics of sugar and fodder beets (*Beta vulgaris* L.) with a complex procedure. To produce an “ideal” genotype of sugar and fodder beets with classical breeding methods nearly impossible or a real time consuming work. This genotype should be resistant against different diseases, should have a high, at least 17.5-19.0 %, sugar content and biomass. Synchronized flowering and monogermity, as well as high germination rate (at least 90-95 %) are also demands from crop producers. The characteristics of today’s breeding methods used in beets, such as low-rate *in vitro* propagation, limited application of species and genus crosses, unsuccessful induced mutagenesis, shortage of *B. vulgaris* gene resources did not lead to any proper result. The above mentioned conditions have justified the attempts on plant biotechnology (*in vitro* mutagenesis and genetic transformation to widen the genetic resources) in sugar and fodder beet breeding.

The aim of our work was to start the elaboration of a general transformation and plant regeneration system for *Beta vulgaris* L. using combined gene transfer procedure. The rapid and effective transformation with valuable gene constructs of these species via this system will serve as a tool for the improvement of some characteristics which are important in crop production and processing industry.

**Materials and Methods**

Plant material: cotyledon and hypocotyl explants from *in vitro* grown seedlings of two beet varieties (“Aranymono” and “Vöröshenger”) derived from BETA Research Ltd. (Sopronhorpács) were used.

Culture conditions: the explants were cultured on the surface of solidified MS (Murashige and Skoog 1962) medium, supplemented with 5 mg/l BAP. Gene transfer took place after three days of cultivation.

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enhanced neither transient nor stable gus-gene expression comparing to the conventional Agrobacterium transformation system.

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**References**


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**Table 1.** The effect of different transformation and explant-wounding methods on penetration of Agrobacterium suspension and transgene integration from bacteria into the target beet tissues.

<table>
<thead>
<tr>
<th>Explant preparation</th>
<th>No. of transformed explants</th>
<th>Explants with callus development on selective medium</th>
<th>Resistant callus tissues (%)</th>
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<tr>
<td>Halved explants</td>
<td>339</td>
<td>25</td>
<td>7.37</td>
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<tr>
<td>Vortexed explants</td>
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<td>7.14</td>
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<td>Halved and vortexed explants</td>
<td>273</td>
<td>21</td>
<td>7.7</td>
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<td>Halved and infiltered explants (5 min)</td>
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<td>2</td>
<td>14.3</td>
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<td>Halved and infiltered explants (10 min)</td>
<td>929</td>
<td>83</td>
<td>8.9</td>
</tr>
<tr>
<td>Halved and infiltered explants (20 min)</td>
<td>26</td>
<td>3</td>
<td>11.5</td>
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