Comparative Analysis of Hungarian *Solidago virga-aurea* Populations

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Abstract

Eight wild growing *Solidago virga-aurea* L. populations were examined in order to introduce this species into cultivation in Hungary. The purpose of this research was to select the most adequate taxa with high content of active compounds, which could be effectively cultivated and assure proper base for breeding. Natural habitats were evaluated from coenological and pedological point of view. Investigations also have been started on the analysis of some active substances (flavonglycosides and phenol-carboxylic acids) using thin-layer chromatography (TLC). According to the compounds examined, the populations could be completely distinguished.

INTRODUCTION

Goldenrod species have been well-known medicinal plants for a long time. In the European official medicine especially; the herba of *Solidago virga-aurea* L. is applied as urologicum (Anonymus, 1989, 1996). The production-technology of the species has been partly worked out in Germany (Bohr and Plescher, 1997, 1999). Because of its relatively rare occurrence and low abundance of its populations, common goldenrod could not be gathered economically from its natural habitats in Hungary. Mostly the other two species of American origin – *Solidago gigantea* Ait. and the *Solidago canadensis* L. – with more frequent occurrence are collected, only. In order to obtain the *Solidago virga-aureae* herba from production in the future, investigations have been started at SZIU, Department of Medicinal and Aromatic Plants.

MATERIALS AND METHODS

In the course of our investigations, varieties of *Solidago* representing coenologically and geographically different habitats of the species were evaluated (Kun et al., 2000). Coenological and pedological (CaCO₃ content, pH, humus content) conditions of the habitats were examined during the field-surveying. The results of the coenological and the soil analysis are summarised in Table 1. Active substances of samples of eight populations were analysed. Qualitative and quantitative analysis of some flavonglycosides (rutin, hyperoside, isoquercitrin, cacticin, querctin) and phenol carboxylic acids (chlorogenic acid and caffeic acid derivatives) was done with thin-layer chromatography (TLC). Modifying the methods published in the literature (Wagner et al., 1996) we applied an analytical method improved specifically for the analysis of the goldenrod species.

Conditions of chromatography were as follows: Powdered drug was extracted with methanol on a water bath and then filtered. Reference compounds were rutin (Rf~0.45), chlorogenic acid (Rf~0.5), and isoquercitrin (Rf~0.6). As adsorbent Kieselgel 60 F₂₅₄r-precoated TLC plates (Merck), as solvent system ethyl acetate-formic acid-water (8:1:1 V/V) were used. Constituents were detected in UV-254 nm, quantities were determined with TLC scanner (SHIMADZU).
RESULTS AND DISCUSSION

Fig. 1 shows the quantitative relations and the percentage distribution of the examined constituents of herb (rutin, chlorogenic acid, hyperoside, isoquercitrin, cacticin, quercitrin and caffeic acid). Quantities of rutin, chlorogenic acid and isoquercitrin were outstanding at the population originating from Mecsek (Fig. 2). Rutin content reached the concentration of 6.4 mg/g, while amounts of chlorogenic acid (6.7 mg/g) and isoquercitrin (2.9 mg/g) proved to be quite high as well in relation to other habitats. Drug samples collected in Zemplén could have been characterised by rather low level of examined compounds (rutin 0.5 mg/g, chlorogenic acid 0.6 mg/g, isoquercitrin 0.03 mg/g), lower than one tenth of the values measured the population growing in Mecsek. The habitat of the population originating from the Mecsek Mountains produced outstanding levels of active ingredients. It is possibly owing to its absolutely extreme environmental conditions, when getting out of the forest and exposed to the highest environmental changes both from coenological and pedological (CaCO₃ content, pH) points of view.

Comparing eight wild growing Solidago virga-aurea L. populations, according to the compounds examined, the populations could be completely distinguished. On the basis of our results it is supposed that the quite high accumulation of the active substances could be the consequence of abiotic stress. To determine whether the high accumulation of essential oil is caused by genetic or environmental factors, comparisons of different populations produced under the same environmental conditions must be made.

Literature Cited

ACKNOWLEDGEMENT
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Tables
Table 1. Characterisation of habitats of Solidago virga-aurea L. populations.

<table>
<thead>
<tr>
<th>Num.</th>
<th>Region</th>
<th>Plant association</th>
<th>Soil characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mátra</td>
<td>Oak, turkey-oak forest</td>
<td>pH 5.1 K₄ 2.7 Humus % 2.7 CaCO₃ % &lt;1</td>
</tr>
<tr>
<td>2</td>
<td>Bükk</td>
<td>Hornbeam-oak forest</td>
<td>pH 7.7 K₄ 56 Humus % 1.7 CaCO₃ % &lt;1</td>
</tr>
<tr>
<td>3</td>
<td>Zemplén</td>
<td>Luzulo-Quercetum</td>
<td>pH 5.6 &lt;30 K₄ 1.3 Humus % &lt;1</td>
</tr>
<tr>
<td>4</td>
<td>Dunube-Tisza</td>
<td>Poplar forest</td>
<td>pH 7.0 &lt;30 K₄ 1.0 Humus % &lt;1</td>
</tr>
<tr>
<td>5</td>
<td>Mecsek</td>
<td>Weed community</td>
<td>pH 7.7 K₄ 63 Humus % 1.5 CaCO₃ % 15.9</td>
</tr>
<tr>
<td>6</td>
<td>Balaton-Highland</td>
<td>Broomy oak forest</td>
<td>pH 3.7 K₄ - Humus % &lt;1</td>
</tr>
<tr>
<td>7</td>
<td>Pilis</td>
<td>Grassy sandstone rocks</td>
<td>pH 5.3 &lt;30 K₄ 0.7 CaCO₃ % &lt;1</td>
</tr>
<tr>
<td>8</td>
<td>Buda</td>
<td>Filigani-Vulpietum</td>
<td>pH 5.1 &lt;30 K₄ 2.4 Humus % &lt;1</td>
</tr>
</tbody>
</table>
**Figures**

**Quantitative relations**


**Percentage distribution**

Fig. 2. Comparison based on quantitative analysis according to the standard compounds (Rutin, Chlorogenic acid, Isoquercitrin) 1. Mátra, 2. Bükk, 3. Zemplén, 4. Dunube-Tisza Region, 5. Mecsek, 6. Balaton Highland, 7. Pilis, 8. Buda