USE OF MOLECULAR MARKER TECHNIQUES FOR SELECTION OF ‘SIMILAR VARIETY’ ABOUT ‘CANDIDATE VARIETY’

Document prepared by an expert from the Republic of Korea

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The Annex to this document contains a copy of a presentation “Use of Molecular Marker Techniques for Selection of ‘Similar Variety’ about ‘Candidate Variety’” made at the fourteenth session of the Working Group on Biochemical and Molecular Techniques and DNA-Profiling in particular (BMT).

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[Annex follows]
Use of Molecular Marker Techniques for Selection of ‘Similar Variety’ in DUS Testing

BMT 14th session
November 2014
Kyoung-In Seo

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- What to use for the molecular markers in KSVS?
- Use of molecular markers in the DUS testing for the selection of similar variety
- Cases for similar variety selection by molecular markers
What to Use for the Molecular Markers in KSVS?

- To Protect Breeder’s Rights (Infringement)
- To Resolve Seed Disputes in Market
- For Comparison between ‘Similar Variety’ and ‘Candidate Variety’
- To Screen Genetic Purity from National Certified Seeds

Overview of Molecular Marker Database for Variety Identification

- Consolidated List of Species and Varieties

<table>
<thead>
<tr>
<th>Category</th>
<th>Crop</th>
<th>Techniques</th>
<th>Number of varieties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetables</td>
<td>Fridge</td>
<td>SSR</td>
<td>672</td>
</tr>
<tr>
<td></td>
<td>Watermelon</td>
<td>SSR</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>Onion</td>
<td>SSR</td>
<td>113</td>
</tr>
<tr>
<td></td>
<td>Strawberry</td>
<td>SSR</td>
<td>110</td>
</tr>
<tr>
<td></td>
<td>Cabbage</td>
<td>SSR</td>
<td>306</td>
</tr>
<tr>
<td></td>
<td>Oriental melon</td>
<td>SSR</td>
<td>108</td>
</tr>
<tr>
<td></td>
<td>Pumpkin</td>
<td>SSR</td>
<td>107</td>
</tr>
<tr>
<td></td>
<td>Radish</td>
<td>SSR</td>
<td>280</td>
</tr>
<tr>
<td></td>
<td>Lettuce</td>
<td>SSR</td>
<td>171</td>
</tr>
<tr>
<td></td>
<td>Cucumber</td>
<td>SSR</td>
<td>175</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total(24 crop)</td>
<td></td>
<td></td>
<td>4,739 varieties</td>
</tr>
</tbody>
</table>

(2014.11)
### Application of SSR Marker For Selection of ‘Similar Variety’

#### List of Species and Varieties Fingerprinted in 2014

<table>
<thead>
<tr>
<th>Category</th>
<th>Crop</th>
<th>Varieties Fingerprinted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetables</td>
<td>Pepper</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Chinese Cabbage</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>Squash</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Cucumber</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Watermelon</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Melon</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Lettuce</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Tomato</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td><strong>Vegetables</strong></td>
<td><strong>14</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Citrus</strong></td>
<td>14</td>
</tr>
<tr>
<td></td>
<td><strong>Peach</strong></td>
<td>13</td>
</tr>
<tr>
<td></td>
<td><strong>Pear</strong></td>
<td>33</td>
</tr>
<tr>
<td></td>
<td><strong>Grains and Oils</strong></td>
<td><strong>20</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Soybean</strong></td>
<td>22</td>
</tr>
<tr>
<td></td>
<td><strong>Rice</strong></td>
<td>30</td>
</tr>
</tbody>
</table>

Total: 14 crops / 268 varieties

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### Applications of SSR Marker in Selection of ‘Similar Variety’ about ‘Candidate Variety’

![Graph showing the number of fingerprinted crops per year from 2010 to 2014. The graph indicates an increasing trend from 2010 to 2013, followed by a slight decrease in 2014.](image-url)
The Selection of ‘Similar Varieties’ for ‘Candidate Varieties’

- Clues to Selecting -

- Parent varieties
- Varieties bred from the same parent variety
- A series of varieties
- Registered varieties
- Broadly distributed varieties
- Well-known varieties

Closely clustered (with high genetic similarity) varieties with candidate variety

The Cases for Selecting ‘Similar Varieties’ by Genetic Analysis

- Case 1
  - Watermelon

- Case 2
  - Cucumber

- Case 3
  - Tomato
Use of Molecular Markers for the Selection of ‘Similar Varieties’

Case 1. Selection of Similar Varieties by Genetic Analysis

UPGMA dendrograms showing phylogenetic relationships among the watermelon candidate varieties and similar varieties analyzed by 38 SSR markers.

The “DUS Test” (Field Trials)
- The variety with high genetic similarity through DNA pre-screening did not distinguished for morphological characteristics.
Use of Molecular Markers for the Selection of ‘Similar Varieties’

Case 2. Selection of Similar Varieties by Genetic Analysis

[Genetic Relationship for Cucumber]

UPGMA dendrograms showing phylogenetic relationships among the cucumber candidate varieties and similar varieties analyzed by 32 SSR markers

The “DUS Test” (Field Trials)

- The variety with high genetic similarity through DNA pre-screening did not distinguish for morphological characteristics in the DUS test.
Use of Molecular Markers for the Selection of ‘Similar Varieties’

Case 3. Change Case of ‘Similar Variety’ about ‘Candidate Variety’ according to the Results of Genetic Analysis

[Genetic Relationship for Tomato]

UPGMA dendograms showing phylogentic relationships among tomato candidate varieties and similar varieties analyzed by 30 SSR markers

The “DUS Test” for Tomato (Field Trials)

2nd Year Results of DUS Testing

- Distinctness
- Uniformity
- Stability

DUS
Outlook

- We need to:
  - Application for selection of similar varieties about DB crops.
  - Development and use of gene-specific markers directly linked phenotypic characteristics.
  - Expansion of DNA fingerprint database for newly developed commercial varieties.

Thank you for your attention!!

Please visit KSVS website at:
http://www.seed.go.kr/

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[End of annex and of document]