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Comparative morphological study of new Burley tobacco lines

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2Tobacco and Tobacco Products Institute, Markovo, Bulgaria

Abstract. The variation degree of the basic morphological characteristics in 15 new perspective lines of the Burley tobacco variety group was established and analyzed. Detailed morphological characteristic of the studied tobacco samples was developed. For the plant height, leaf number and size, the differences between the studied lines are in statistical error, which is an indication of breeding success. The highest variability of the descriptive characteristics was established for the flower panicle width and the size of the leaf auricle. Referring to descriptive characteristics, the greatest diversity in the studied lines was reported for the shape and surface of the leaf blade, as well as for the angle of leaf divergence from the stem. The developed morphological characteristics showed that all the studied lines had optimal quantitative and qualitative characteristics complying with the requirements to Burley tobacco variety group.

Keywords: Burley tobacco, morphological characteristic, variation coefficients, quantitative and qualitative characteristics.

Introduction

Morphological characteristics of the plants showed a high degree of variability under the influence of the ecological factors (Fedorov and Artushenko, 1975; Ganusheva et al., 2004). Compared to the other agricultural crops, tobacco varieties are closely related to the environmental conditions (Dimanov et al., 2012; Griffing, 1956). At the same time, morphology of tobacco plants is the basis of the breeding process (Stoeva, 2006; Mutafchieva, 2005; Pethyng and Sussex, 1985; Douglas et al., 1981; Pirrie and Powe, 1988; Tsuka, 2003).

When growing the new genetic lines under similar climatic and agrotechnical conditions, it would be of interest to establish which of the morphological traits vary to the highest degree. For taking technological decisions, it is of great importance to know the variation amplitude of the phenotypic expression of the basic morphological, biological and economic characteristics (Naumovski, 1985).

The aim of the present study was to make a comparative analysis of the morphological characteristics of 15 new perspective lines of Burley tobacco type with the aim of increasing the efficiency of the breeding process.

Material and methods

The research was carried out in the experimental fields of the Institute of Tobacco and Tobacco Products, village of Markovo, in the period 2010–2012. The field trials were set by the methods of Zapryanov and Dimova (1995), the same growing technology being applied for all the variants. Fifteen perspective consolidated lines bred by our team, were included in the study: L 1393; L 1409; L 1449; L 1461; L 1462; L 1472; L 1499; L 1500; L 1386; L 1399; L 1481; L 1531; L 1540; L 1543; L 1546.

The data obtained in result of the observations on the morphological characteristics of the studied lines, done during the vegetation period, were divided into two groups:

1. Morphological characteristics with definite measurable values of variation (metrical): plant height (cm), stem height (cm), number of leaves, length and width of 7*8, 13*14 and 20*21 leaf (cm) – as most representative for the lower, medium of top whorl of leaves, size of the leaf auricle (cm), raceme length and width (cm), number of fruit capsules;

2. Analytical (descriptive) morphological characteristics describing the flowers, raceme, leaves, stem and root of the studied lines (Table 2).

Results and discussion

In performing the single-phase dispersion analysis (SPSS), the results about all tested variants on the indication of height of the plants are optimal for the oriental tobacco limits. Statistically proven differences are not reported. Lines 1409 and 1393 are distinguished for the smallest height of the stem, and L 1481 and L 1546 are with the highest stems (Table 1).

The number and size of the leaves are morphological indications that have direct importance for the formation of the yield. The results about the number of the leaves are to a great extent similar to the data on the height of the plants that confirm the high level of correlative dependence between the two indices (Dyulgerski and Radoukova (in press)). In lines 1393, 1499 and 1409 are given the lowest values, and in L 1461 and L 1546 is given the maximum number of leaves (Table 1). The received differences are with low level of proved statistics. According to the size of the leaves of the medium harvest zone, with the most significant difference is L 1499, where the highest values both in length and in breadth are accounted for, 76.3 cm and 36.1 cm, respectively (Table 1). In L 1500 for the same index minimum values are accounted for, as in the two cases the difference is statistically not proved.

The size of raceme and the number of fruit-bearing capsules are factors that have no direct relation to improving the economic quality – production and category, and are comparatively poorly included in the realization of the selection process, but their
identification is important for characterizing the selection materials (Dyulgerski, 2011). Proved differences in the length and breadth of the raceme are accounted in L 1393 and L 1386 (minimum value), L 1481 (maximum value). In line with the smaller size of the raceme in L 1393 minimum number of the fruit-bearing capsules (130) is also accounted for, while in L 1403 and L 1481 the number of the fruit-bearing capsules is the largest.

The comparative analysis, in relation to the metric from high (in 1 line), medium (in 6 lines), to low (in 5 lines). The character of folding ranges from fine (in 9 lines) to rude (in 3 lines). A number and size of leaves as factors that have direct relation to the formation of production is a success for the selection work (Tomov, 1972). In relation to the descriptive morphological characteristics similar in the fifteen observed lines are: Raceme location – high; Resin content in the leaf blade – medium; Development of ears; Shade of corolla – pink (Table 2). The means of choice in these indications are limited.

High level of variations is accounted for in the leaf blade surface area, that is smooth (in 3 lines), or with different level of curliness – from strong (in 2 lines) through medium (in 7 lines) to light (in 5 lines), and, from finely to largely

<table>
<thead>
<tr>
<th>Line</th>
<th>Plant height, cm</th>
<th>Number of leaves</th>
<th>Size of the medium whorl leaves, cm</th>
<th>Size of the raceme, cm</th>
<th>Number of fruit capsules</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>length</td>
<td>width</td>
<td>length</td>
</tr>
<tr>
<td>L1393</td>
<td>160.3</td>
<td>25</td>
<td>70.2</td>
<td>35.3</td>
<td>20.8*</td>
</tr>
<tr>
<td>L1409</td>
<td>150.1</td>
<td>26</td>
<td>60.2</td>
<td>35.3</td>
<td>25.1</td>
</tr>
<tr>
<td>L1449</td>
<td>180.0</td>
<td>28</td>
<td>61.1</td>
<td>34.5</td>
<td>28.0</td>
</tr>
<tr>
<td>L1461</td>
<td>165.5</td>
<td>33</td>
<td>63.3</td>
<td>31.7</td>
<td>24.2</td>
</tr>
<tr>
<td>L1462</td>
<td>175.4</td>
<td>30</td>
<td>60.1</td>
<td>29.9</td>
<td>25.4</td>
</tr>
<tr>
<td>L1472</td>
<td>177.7</td>
<td>27</td>
<td>61.4</td>
<td>30.0</td>
<td>27.3</td>
</tr>
<tr>
<td>L1499</td>
<td>175.3</td>
<td>25</td>
<td>75.3</td>
<td>36.1</td>
<td>25.1</td>
</tr>
<tr>
<td>L1500</td>
<td>175.4</td>
<td>29</td>
<td>57.6</td>
<td>27.5</td>
<td>25.4</td>
</tr>
<tr>
<td>L1386</td>
<td>178.5</td>
<td>28</td>
<td>66.1</td>
<td>32.4</td>
<td>34.1*</td>
</tr>
<tr>
<td>L1399</td>
<td>180.1</td>
<td>28</td>
<td>64.4</td>
<td>34.5</td>
<td>25.6</td>
</tr>
<tr>
<td>L1481</td>
<td>190.2</td>
<td>28</td>
<td>58.9</td>
<td>33.3</td>
<td>31.1*</td>
</tr>
<tr>
<td>L1531</td>
<td>165.7</td>
<td>28</td>
<td>65.4</td>
<td>37.4</td>
<td>25.8</td>
</tr>
<tr>
<td>L1540</td>
<td>175.8</td>
<td>30</td>
<td>67.5</td>
<td>33.7</td>
<td>25.3</td>
</tr>
<tr>
<td>L1543</td>
<td>180.3</td>
<td>29</td>
<td>68.3</td>
<td>34.7</td>
<td>25.9</td>
</tr>
<tr>
<td>L1546</td>
<td>185.6</td>
<td>33</td>
<td>59.7</td>
<td>33.8</td>
<td>25.6</td>
</tr>
</tbody>
</table>

* p≤0.05

<table>
<thead>
<tr>
<th>Line</th>
<th>Number of leaves</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1462</td>
<td>In 14 Lines</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Line</th>
<th>Size of the raceme, cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1499</td>
<td>20.9*</td>
</tr>
</tbody>
</table>

Table 2. Descriptive morphological characteristics

<table>
<thead>
<tr>
<th>Flower and Raceme</th>
<th>Globular</th>
<th>Spreading</th>
<th>Centaury</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raceme form</td>
<td>Compact</td>
<td>Friable</td>
<td></td>
</tr>
<tr>
<td>L1399</td>
<td>At 14 Lines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raceme location</td>
<td>Low standing</td>
<td>High standing</td>
<td></td>
</tr>
<tr>
<td>L1399</td>
<td>In 14 Lines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shade of corolla</td>
<td>Red</td>
<td>White</td>
<td>Pale-pink</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corolla - level of accretion</td>
<td>Highly</td>
<td>Middle</td>
<td></td>
</tr>
<tr>
<td>L1543, L1386</td>
<td>In 13 Lines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stigma position</td>
<td>High</td>
<td>Low</td>
<td>Middle</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L1462</td>
<td>In 14 Lines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leaf position</td>
<td>Irregularly</td>
<td>Correctly</td>
<td></td>
</tr>
<tr>
<td>L1386</td>
<td>In 14 Lines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leaf divergence angle</td>
<td>30°</td>
<td>35°</td>
<td>40°</td>
</tr>
<tr>
<td>L1393, L1543</td>
<td>L1499</td>
<td>L1462</td>
<td>L1472, L1449</td>
</tr>
<tr>
<td>L1531, L1389</td>
<td>L1500</td>
<td>L1540</td>
<td>L1409, L1461</td>
</tr>
<tr>
<td>L1399</td>
<td>L1462</td>
<td>L1540</td>
<td>L1386, L1462</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>L1546</td>
</tr>
</tbody>
</table>
Curled. High variability was also reported for the leaf divergence angle. In four of the studied lines it is about 30°, in two lines – about 35°, in other two it is about 40° and in seven lines it is about 45°. That characteristic offers greater possibilities for selection.

From the metric morphological indices, proven differences in characteristic are accounted for the size of racemes and number of fruit-bearing capsules, white in relation to plants and the number and size of leaves, the differences are within the frame of the statistical error.

For identifying the studied tobacco lines, from the descriptive characteristics, the greatest diversity is accounted in the form and surface of the leaf-blade, as well as in the angle of position of the leaves according to the stem.

### Conclusions

From the metric morphological indices, proven differences in the comparative lines are accounted for the size of racemes and number of fruit-bearing capsules, white in relation to the plants and the number and size of leaves, the differences are within the frame of the statistical error.

From the descriptive characteristics, the greatest diversity in the researched lines, is accounted in the form and surface of the leaf-blade, as well as in the angle of position of the leaves according to the stem.
For all of the morphological indications having relation to the economic indices – production and quality of the tobacco inessential differences are accounted that defines the researched lines as fitting to the requirements of the high-quality group tobacco Burley.

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