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VARIATION OF MORPHOLOGICAL PROPERTIES IN VIRGINIA TOBACCO TYPES

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Abstract

The properties that identify the type of tobacco, or the variety in one type, are divided into two groups: qualitative and quantitative. Morphological properties belong to the group of quantitative (metric) and are conditioned by a large number of genes with additive effect (minor genes or polygenes**).** These properties are to a largely dependent on the conditions of the external environment and applied agrotechnology during tobacco screening. Tests were performed in 2016 at the Scientific Tobacco Institute - Prilep, on a field experiment in four repetitions with the following varieties: Virginia MV-1 CMS - Control, Virginia McNair-944, Virginia K-394 and a newly prospective line MV-1 / 14 CMS.

The results of the test are processed variationally-statistically through the parameters: mean value ($\bar{x}$), mean error ($S\bar{x}$), standard deviation (S), variation coefficient (CV%), and variation width (WV). The aim of this paper is to present the variation of the more important morphological properties: the height of the plant with the inflorescence, the number of leaves per plant, and the length and width of the largest plant leaf in the varieties concerned. From the studies, we found that the tested varieties are very stable, and they have very little scattering of the morphological properties, since the variation coefficient everywhere showed a value less than 10%. We note that the newly created line MV-1/14 CMS has the slightest variation, while at the same time it has the largest leaves, which is a positive feature in large-scale tobacco of the Virginia type.

Key words: *tobacco, Virginia type, morphological properties, variability*

INTRODUCTION

In the agricultural economy of the Republic of Macedonia, tobacco belongs to the group of strategic cultures. Tobacco cultivation ranges between 12,000 and 15,000 hectares with an annual output of 20 to 25 million kilograms of quality tobacco raw material. From the aspect of the type of representation, over 95% of these areas belong to the oriental types of Prilep and Jaka (type Prilep is most present in our country), while the large (Virginia and Burley), in recent years, are almost encountered in the fields. By the end of the nineties of the last century, although to a lesser extent, they were growing in our country (an average of 1500 tons per year by the Virginia type only), which reduced the import of these tobacco raw materials - the main components in the harmanes for making the more popular "American bland" cigarettes. The type of Virginia in the composition of these cigarettes accounts for 45 to 65% (Mickovski, 2004). According to the author, the largest producers of tobacco of this type in the world are: China, USA, Brazil, Argentina, Italy, Spain, Zimbabwe and Oceania. It is important to point out that in the Republic of Macedonia there are regions with excellent conditions for growing quality tobacco of the type Virginia which is a challenge for its return to production. Having in mind the aforementioned, recent scientists from the Scientific Tobacco Institute - Prilep, create and select varieties that will meet the requirements and needs of the cigarette factories. Therefore, the object and purpose of this study is the variation of the most important

morphological properties of Virgina tobacco type varieties that have good combination skills, which is a condition for creating new, more productive and better quality than existing ones. This would bring back the interest of the producers for this large type of tobacco, which is constantly requested in the world market, after which the financial effects would be positive and guaranteed to the satisfaction of everyone in the tobacco industry of the Republic of Macedonia.

MATERIAL AND METHODS

The tests were conducted on three varieties and a one newly created Virginia-type line: MV-1 CMS as a control variety (Ø), McNair-944, K-394 and the newly created MV-1/14 CMS line. The control variety MV-1 CMS (male-sterile) was created at the Tobacco Institute - Prilep. The Federal Classification Committee of the former Yugoslavia was recognized in 1987. Since then, by the end of the nineties of the last century, it was the only variety of Virginia-type tobacco that was produced in Macedonia and in certain regions in Serbia and Montenegro. The McNair-944 and K-394 varieties are fertile and originate in the United States. In the past, they were fairly represented in Virginia production around the world, and to a lesser extent they are now produced in the home country and some countries in South America. These varieties as well as the control MV-1 CMS are still relevant due to their quality and other positive properties, and are used in the selection for the outward processing of tobacco of this type. The new line MV-1-14 CMS was created at the Scientific Tobacco Institute - Prilep by crossing and selecting Virginia tobacco varieties. The experiment was set in the experimental field of the Scientific Tobacco Institute- Prilep in 2016 on diluvial-colluvial soil in four repetitions. The tobacco is seeded manually at 80x50 cm. For basic fertilization, NPK fertilizer with combination 8:22:20 is used in quantity of 350 kg/ha. During the vegetation, the necessary agrotechnical operations are performed for ensuring normal growth and development of the plants (feeding with nitrogen fertilizer, trapping and treating tobacco according to the program of the Scientific Tobacco Institute - Prilep for protection from diseases, pests and weeds). The tobacco in the experiment is sprinkled 3 times with an average level of 400 m3 / ha water. We note that the 2016 production was assessed as a good year for tobacco production. The studies on morphological properties (height of the plant with inflorescence, number of leaves and length and width of the largest leaf from the middle belt of the plant) were carried out in the field in the "full blossoming" phase of the tobacco by standard methods in the selection, is the mean value ($\bar{x}$), for each property is determined based on 15 randomly selected plants of each variety in the experiment. The obtained data from the measurements are statistically processed through parameters of property variability (Najcevska, 2002), and the results are shown in tables.

RESULTS AND DISCUSSION

The examined morphological features of the Virginia-type tobacco varieties belong to the group of quantitative properties. They are of great importance in the genetics and selection of tobacco because they determine (identify), the type and the varieties they belong to. In addition, the number and size of the leaves determine the yield and quality of tobacco. They are dictated by their own genotype but are also dependent on soil-climatic conditions in the region where it is grown, as well as from applied agrotechnical operation during vegetation. We have mentioned above that we present the results of the researches in tables, especially for each property for better visibility, comparison between the investigated varieties and the new line and drawing appropriate conclusions.

Height of the plant with its inflorescence

The height of tobacco plants is a great feature. Uzunoski (1985), according to this characteristic, divides the tobacco varieties into three groups: 1. Varieties with low growth, the height of which is up to 70 cm (Prilep, low spot); 2. Medium growth varieties with height

of plants with inflorescence, which varies from 70 to 130 cm (Jaka, Dzebel); 3. Varieties of high growth, with a height above 130 cm (Virginia and Burley). Risteski and Kochoska (2004), in their research on 6 varieties of tobacco of the Virginia type, point out that the height of the plant with the inflorescence ranged from 159 cm in the variety V-27/01 to 192 cm in the MV-1 CMS, which was and the highest. The results of our trials for this morphological feature are shown in Table 1.

Table 1. Height of the plant with its inflorescence (cm)

Varieties	n	$\bar{x}$	$S\bar{x}$	S	CV%	WV
MV-1CMS Ø	15	190	1.76	6.81	3.59	180 - 200
McNair-944	15	158	1.18	4.55	2.88	150 - 165
K-394	15	147	1.27	4.93	3.35	140 - 155
MV-1/14 CMS	15	180	1.24	4.81	2.66	170 - 185

The table shows that the average height of 190 cm is the highest control class MV-1 CMS, and with 147 cm the lowest is the K-394. In terms of variation, it can be noted that the varieties tested are stable in this capacity, since the value of the variation coefficient (CV%) is low (everywhere is below 10%) and ranges from 2.66% to the new line MV-1/14 CMS up to 3.59% in control.

Number of leaves on the plant

The number of leaves of the plant depends on the genetic structure of the variety and the conditions of cultivation. It is thought that the number of tobacco leaves is one of the most stable quantitative properties. The number of leaves is a variegated feature and represents a high-yielding quantitative property (Atanasov, 1972). In their research on the number of leaves of 7 Virginia tobacco varieties Risteski and Kochoska (2014), found that the highest number of leaves of one plant is distinguished by the variety V-88/09 CMS, which on average for the two years of examination had 33.3 leaves, while the least leaves has the K-326 variety (28.8 leaves). Since the multi-year research of 5 Virginia tobacco varieties in the Republic of Croatia, it has been determined that the average number of leaves in the three newly created varieties is as follows: Kutjevo (H 30), 23 leaves, Drava (H 31), 22 leaves and Bilogora (H 32), has 22 leaves (Devcic and Triplat, 1982). In our research with the highest number of leaves (Table 2), is the variety MV-1 CMS, where on average we counted 28 leaves of the plant and with at least McNair-944 with 24 leaves.

Table 2. Number of leaves

Varieties	n	$\bar{x}$	$S\bar{x}$	S	CV%	WV
MV-1CMS Ø	15	28	0.32	1.25	4.48	26 - 30
McNair-944	15	24	0.37	1.44	5.97	22 - 27
K-394	15	27	0.30	1.16	4.30	25 - 29
MV-1/14 CMS	15	27	0.23	0.88	3.26	25 - 28

Regarding the variability of this feature, the statistical parameters have shown that it is very small. The coefficient of variation is from 3.26% on the line MV-1/14 CMS to 5.97% in the McNair-944 variety. The standard deviation (S) is also small and ranges from 0.88 to 1.44 leaves.

Length of the biggest leaf of the plant

The length of the leaves in all types of tobacco is an important feature because it is closely related to the quality of the tobacco raw material. In the type Virginia, the larger the leaves the higher the yield and the better the quality is. Boceski (2003), points out that the length and width, and therefore the surface of the leaves during curing, are reduced by 20 to 30%, which is very important in the technology of processing and processing of tobacco. Risteski and Kochoska (2014), examining the length of the leaves in 7 domestic and foreign varieties of the Virginia type, state that with the largest 10 leaves (the 10th leaf is the largest of the plant) is the variety V-79/09 CMS, with the length of

the leaf of 62.4 cm, and with the smallest leaves, with a length of 44.3 cm is the Delcrist variety. The K-394 variety is on the fifth place with an average length of the 10th leaf of 52.5 cm. The results of our measurements and the variability of this property are shown in Table 3.

Table 3. Length of the biggest leaf (cm)

Varieties	n	$\bar{x}$	$S\bar{x}$	S	CV%	WV
MV-1CMS Ø	15	60	0.32	1.22	2.04	58 - 62
McNair-944	15	57	0.34	1.33	2.34	55 - 59
K-394	15	56	0.34	1.31	2.34	54 - 58
MV-1/14 CMS	15	62	0.25	0.96	1.55	60 - 63

The subject varieties have long leaves which are characteristic for large-scale tobacco, including the type Virginia. The longest leaves of the plant have the new line MV-1/14 CMS ($\bar{x}$=62 cm), with the smallest is K-394 ($\bar{x}$=56 cm). The standard deviation is from 0.96 in the new line to 1.33 in McNair-944, with a CV% within 1.55 to 2.34%, so it can be said that the variability is meaningless.

Width of the largest leaf of the plant

The width of the leaves and the length depends on the soil and climate conditions and technical measures during the cultivation of tobacco. Drazic et al. (2012), examining the morphological properties and yield of 12 newly created genotypes (7 in the Republic of Serbia and 5 in Republic of Macedonia), concluded that with the widest leaves the variety Hevesi 9 ($\bar{x}$=36 cm) was standard in the experiment. Of the new genotypes, with an average width of the largest leaf of 34 cm, the V-814 took the second place, while with a width of 24 cm, the genotype V-30/09 was in the last place. From our examinations we obtained the results we present in Table 4.

Table 4. Width of the biggest leaf (cm)

Varieties	n	$\bar{x}$	$S\bar{x}$	S	CV%	WV
MV-1CMS Ø	15	31	0.31	1.19	3.81	30 - 34
McNair-944	15	27	0.30	1.16	4.30	25 - 29
K-394	15	29	0.30	1.16	4.00	27 - 31
MV-1/14 CMS	15	32	0.33	1.28	3.99	30 - 34

The table shows that on the average with the widest leaves is the line MV-1/14 CMS ($\bar{x}$=32 cm) and it is followed by the control with 31 cm, K-394 with 29 cm, while with the narrowest leaves is McNair-944 with width of the largest leaf of 27 cm. The standard deviation ranges from 1.16 to 1.28, while CV% of 3.81 in control to 4.30 at McNair-944.

CONCLUDING REMARKS

The highest altitude is the control type MV-1 CMS ($\bar{x}$=190 cm), and the lowest is K-394 ($\bar{x}$=147 cm). The variation coefficient showed that with the slightest variation in this property is the line MV-1/14 CMS (CV=2.66%).

At least leaves has McNair-944 (an average of 24), while with 28 leaves the control is in the first place. The newly created line and variety K-394 have on average 27 leaves each. The variation coefficient yielded values that show the stability of this feature in the tobacco varieties concerned.

Variation of the length of the largest plant leaf is the lowest in the line MV-1/14 CMS (CV=1.55%).

From the measurements we found that with the widest leaves is the new line ($\bar{x}$=32 cm), and with the narrowest is McNair-944 ($\bar{x}$=27 cm).

The tested Virginia type tobacco types are genetically stable, and the variation of the morphological properties is insignificant (CV is everywhere below 10%), which means they are a good material for the improvement and creation of new varieties. The new line MV-1/14 CMS is stable, with more positive properties, so it is expected to be included in the National Variety List of the Republic of Macedonia.

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ВАРИРАЊЕ НА МОРФОЛОШКИТЕ СВОЈСТВА КАЈ СОРТИ ТУТУН ОД ТИПОТ ВИРЏИНИЈА

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Резиме

Својствата што го идентификуваат типот на тутунот, односно сортата во еден тип, се поделени во две групи: квалитативни и квантитативни. Морфолошките својства спаѓаат во групата на квантитативните (метрички) и се условени од поголем број гени со адитивен ефект (минор гени или полигени). Овие особини во голема мерка се зависни од условите на надворешната средина и применетата агротехника за време на одгледувањето на тутунот. Испитувањата се извршени во 2016 година во Научниот институт за тутун – Прилеп, на полски опит во четири повторувања, со следниве сорти: *вирџинија МВ-1 (ЦМС)* – контрола, *Virginia McNair-944, Virginia K-394* и една новосоздадена перспективна линија *МВ-1/14 – ЦМС*. Резултатите од испитувањето се обработени варијационо-статистички преку параметрите: средна вредност ($\bar{x}$), грешка на средната вредност (S$\bar{x}$), стандардна девијација (S), варијационен коефициент (CV - %)и варијациона ширина (WV).

Целта на овој труд е да го прикажеме варирањето на поважните морфолошки својства: височина на растението со соцветие, број на листови на едно растение и должина и широчина на најголемиот лист на растението кај предметните сорти.

Од истражувањата потврдивме дека испитуваните сорти се многу стабилни, односно варирањето на морфолошките својства им е многу мало, бидејќи варијациониот коефициент секаде покажа вредност помала од 10%. Истакнуваме дека новосоздадената линија МВ-1/14 – ЦМС има најмало варирање, истовремено има и најголеми листови, што е позитивно својство кај крупнолисниот тутун од типот вирџинија.

Клучни зборови: *тутун, тип вирџинија, морфолошки својства, варијабилност*