

MORPHOLOGICAL TRAITS AND VARIABILITY IN SOME FLUE-CURED GENOTYPES

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ABSTRACT

The most important morphological traits for flue - cured tobacco (height of the plant with inflorescence, number of leaves per plant and length and width of leaves from the middle harvesting belt) were studied. The investigations are done in 2016 on experimental field in the Scientific Tobacco Institute in Prilep, with four repetitions with following genotypes: MV-1 (CMS) – control, Virginia K-326 and two newly created perspective lines MV-9-7/1 (CMS) and MV-1/14 (CMS).

The aim of this investigations is to show the variability of the most important flue-cured morphological traits, as well as to determine the uniformity and stability of the newly created lines of Virginia tobacco.

The results from the investigations are processed statistically by these parameters: average value (\bar{x}), average value error ($S\bar{x}$), standard deviation (S) and coefficient of variability (CV). From the research, we have noted that all genotypes are stable enough, the variability is very low because the coefficient of variability is lower than 10% everywhere. However, the newly created lines are with the slightest variation in the tested traits. Among other things, they are on average with the largest leaves, which is a positive characteristic in the creation of tobacco of this type.

Keywords: tobacco, flue-cured, morphological traits, variability.

МОРФОЛОШКИ ОСОБИНИ И ВАРИЈАБИЛНОСТ КАЈ НЕКОИ FLUE-CURED ГЕНОТИПОВИ

Во трудот се прикажани проучувања за најважните морфолошки својства кај flue - cured тутуните (висина на растението со соцветие, број на листови по растение, должина на листовите од средниот појаси и широчина на листовите од средниот појас). 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 K-326 и две новокреирани линии: МВ-9-7/1 (ЦМС) и МВ-1/14 (ЦМС).

Целта на овој труд е да се прикаже варирањето на поважните морфолошки својства кај flue-cured тутуните, како и да се одреди униформноста и стабилноста на новосоздадените линии од типот вирџинија.

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). Од истражувањата потврдивме дека испитуваните сорти се многу стабилни, односно варирањето на морфолошките својства 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 крупнолистниот тутун од овој тип.

Клучни зборови: тутун, flue-cured, морфолошки својства, варијабилност.

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 Virginia 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 METHOD OF WORK

We test were conducted on two varieties (MV-1 CMS – Fig. 1. as a control variety and Virginia K-326 – Fig. 2.) and two newly created Virginia-type line (MV-9-7/1, CMS – Fig. 3. and MV-1/14, CMS – Fig. 4.). 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 K-326 varietie is fertile and originate in the United States. In the past, it was fairly represented in Virginia production around the world, and to a lesser extent it is now produced in the home country and some countries in South America. This varietie 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 lines MV-9-7/1 - CMS and MV-1/14 – CMS were 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.



Fig.1. MV-1 (CMS)



Fig. 2. K-326



Fig. 3. MV-9-7/1 (CMS)



Fig. 4. MV-1/14 (CMS)

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 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-1 (CMS) Ø	15	190	1.76	6.81	3.59	180-200
Virginia K-326	15	155	0.97	4.32	2.79	150-165
MV-9-7/1 (CMS)	15	150	1.46	6.52	4.35	140-160
MV-1/14 (CMS)	15	180	1.24	4.81	2.66	170-185
		LSD 0.05 = 5.47				
		0.01 = 7.68				

The table shows that the average height of 190 cm is the highest control class MV-1 CMS, and with 150 cm the lowest is the MV-9-7/1. 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 4.35% in MV-9-7/1 (CMS).

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 (Devicic 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 K-326 with 25 leaves.

Table 2. Number of leaves

Varieties	n	\bar{x}	$S\bar{x}$	S	CV%	WV
MV-1 (CMS) Ø	15	28	0.32	1.25	4.48	26-30
Virginia K-326	15	25	0.29	1.31	5.23	22-27
MV-9-7/1 (CMS)	15	26	0.27	1.21	4.61	24-28
MV-1/14 (CMS)	15	27	0.23	0.88	3.26	25-28
LSD 0.05 = 0.89						
0.01 = 1.25						

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 5.23% in the K-326 variety. The standard deviation (S) is also small and ranges from 0.88 to 1.31 leaves.

Length of the leaves from the middle harvesting belt 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 leaves from the middle harvesting belt (cm)

Varieties	n	\bar{x}	$S\bar{x}$	S	CV%	WV
MV-1 (CMS) Ø	15	60	0.32	1.22	2.04	58-62
Virginia K-326	15	56	0.27	1.21	2.15	54-58
MV-9-7/1 (CMS)	15	58	0.26	1.19	2.05	56-60
MV-1/14 (CMS)	15	62	0.25	0.96	1.55	60-63
LSD 0.05 = 2.98						
0.01 = 4.18						

The subject varieties have long leaves, which is 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-326 (\bar{x} =56 cm). The standard deviation is from 0.96 in the new line MV-1/14 (CMS), to 1.22 in the control, with a CV% within 1.55 to 2.15%, so it can be said that the variability is meaningless.

Width of the leaves from the middle harvesting belt 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 leaves from the middle harvesting belt (cm)

Varieties	n	\bar{x}	$S\bar{x}$	S	CV%	WV
MV-1 (CMS) Ø	15	31	0.31	1.19	3.81	30-34
Virginia K-326	15	28	0.26	1.18	4.21	26-30
MV-9-7/1 (CMS)	15	30	0.26	1.16	3.85	28-32
MV-1/14 (CMS)	15	32	0.33	1.28	3.99	30-34
LSD 0.05 = 1.26						
0.01 = 1.77						

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, MV-9-7/1 with 30 cm, while with the narrowest leaves is K-326 with width of the largest leaf of 28 cm. The standard deviation ranges from 1.16 to 1.28, while CV% of 3.81 in control to 4.21 at K-326.

CONCLUSIONS

From the research we have got the following conclusions:

- The highest altitude is the control type MV-1 CMS (\bar{x} =190 cm), and the lowest is MV-9-7/1 CMS (\bar{x} =150 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 Virginia K-326 (an average of 25), while with 28 leaves the control is in the first place. The newly created line MV-9-7/1 (CMS) has on average 26 leaves, and MV-1/14 CMS has 27 leaves. 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 MV-1/14 CMS (\bar{x} =32 cm), and with the narrowest is Virginia K-326 (\bar{x} =28 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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