INVESTIGATIONS OF SAME MORPHOLOGICAL AND AGRONOMY TRAITS IN ORIENTAL TOBACCO GENOTYPES

Ana Korubin – Aleksoska[1], Milan Mitreski[1], Jane Aleksoski[2]

[1]Scientific Tobacco Institute – Prilep, R. Macedonia

[2]Bis Promet Agrocentar – Bitola, R. Macedonia

Abstract

Two oriental tobacco varieties and eight newly created lines were investigated for some major morphological and agronomic traits: height of the plant with inflorescence, leaf number per plant, length of the middle belt leaves and dry mass yield per plant. The trial was set up in the Experimental field of Scientific Tobacco Institute – Prilep in 2016 and 2017, in randomized block design with four replications, using traditional agricultural practices. Measurements of the first three traits were made in the stage of the beginning of flowering, while the dry mass yield was recorded during the treatment of cured tobacco. The results were statistically processed.

The aim of the research is to investigate the morphological traits and yield of Oriental genotypes, to determine the stability of the genotypes through their variability and to stand out the best among the selected material.

From the kit of genotypes we selected three superior lines with a high degree of homogeneity (one of the type Prilep and two of the type Yaka). The coefficient of variation of quantitative traits in these lines was lower than 10%, which is a sign of their stability. After their acceptance by the Commission for recognition and approval of varieties within the Ministry of Agriculture, Forestry and Water Economy of Republic of Macedonia, these genotypes will be released into circulation.

Key words: *tobacco, oriental genotypes, morphological traits, agronomy trait, variability*

INTRODUCTION

Selection is a creative activity in which the breeder directs his creativity towards creating varieties more superior than the existing ones. At the Scientific Tobacco Institute - Prilep there is a centuries-old tradition of continuous successive selection work of tobacco varieties of different types, but generally of types Prilep, Yaka, Dzebel and Basmak - more recently. By 2014, the institute owns 10 varieties of Prilep type, 4 varieties of Yaka type, 4 varieties of Dzebel, 3 varieties of the type Otlya, 1 of the type Virginia and 3 of the type Burley (Kotubin - Aleksoska, 2004). Today, the variety fund is drastically increased and exceed the number of about 60 varieties.

The breeders from the Institute have published a number of papers on the topic of tobacco breeding, So for example Aleksoski and Korubin-Aleksoska (2011), studied the mode and level of inheritance of green and dry mass yield per stalk in four parental genotypes (Burley - B 2/93, Suchum - S1, Suchum - S2 and Prilep - P-84) and in their six diallel F1 hybrids, and found positive and negative heterosis. The higher heritability index of both types was recorded for dry mass yield. Mitreski (2012), studied height of the stalk with inflorescence in six oriental tobacco varieties of the type Prilep: P-23, P 12-2/1, NS-72, P 66-9 /7, P-79-94 and Prilep Basma 82. The average values for the trait ranged from 59,3 cm in Prilep P 12-2/1 to 148,1 cm in Prilep Basma 82. The same author in co-authorship with Korubin-Aleksoska (2014), made tasting of the cigarettes composed from the same varieties and informed that they have good degustational properties that are typical for oriental tobaccos. The authors (2015) of the same varieties examined some morphological traits and announce that Prilep Basma 82 had the highest average leaf number, and the lowest length and width of the middle belt leaves. Korubin-Aleksoska and Aleksoski (2013), presented investigations on the inheritance of length, width and area of middle belt leaves in oriental tobacco varieties Prilep (P0 10-3/2), Djebel (Pobeda P-2) and Yaka (YK 48), and the semi-oriental Forchheimer Ogrodowny - FO, including their

six F1 and six F2 hybrids. The regression graphs reveal partially dominant type of inheritance of the characters and absence of interallelic interaction. Dimitrieski and Miceska (2015), offer information about new prospective variety of the oriental Yaka tobacco, and as the most perspective point out Yaka b 65 - 82/1. Korubin – Aleksoska (2016), explores heredity of the more important quantitative traits of four parental genotypes (Prilep P 10-3/2, Djebel A 42/3, Yaka YV 125/3, Floria FL-1) and their dialectic F1, F2 and BC1 generations, through genetic components of variance. The heritability is very high, indicating that the studied traits are highly heritable. Korubin – Aleksoska and Ayaz (2016), investigated height of the stalk with inflorescence, leaf number, length of the middle belt leaves and dry mass yield per stalk in five autochthonous tobacco varieties of types: Prilep (P 10-3/2 and P 12-2/1), Djebel (Dj No 1) and Yaka tobaccos (YK 7-4/2 and KY), and five commercial oriental varieties of Prilep tobacco (P-23, P-84, NS-72, P-66-9/7 and P-79-94). Differences between the genotypes in the investigation period were highly significant, which is a sign of their mutual genotypic and phenotypic diversity. The same authors (2016), studied ten oriental tobaccos of the types: Basmak (MK-1, MK-2, MB-2, MB-3, MS-8/1, MS-9/3 and YZ-7), Prilep (Prilep Basma-82), Djebel (Xanthi Djebel-1) and Yaka (YV 125/3), for some more important quantitative traits, and gave precise knowledge of the new type Basmak in Macedonia and the Balkans from genetic, morphological and agronomic aspects. All Basmak varieties are characterized by stability and uniformity as a result of their homozygotness. Dimitrieski, Gveroska (2017), studied some morphological traits, length of the growing season and resistance to powdery mildew disease in some oriental tobacco varieties and lines of the type Prilep. Miceska (2017), investigated some morphological, productional and quality characteristics in four new lines of the type Prilep obtained by generative hybridization (P .l. 14-65/1,P.l.14-66/7, P.l. 123-82/2,P.l. 14-67/7) and the variety P12-2/1 as a standard. Regarding the morphological properties (plant height, leaf number, largest leaf size), all lines showed very low variability, which is an indication of morphological uniformity and stability. Korubin – Aleksoska (2017), studied the oriental varieties in order to obtain data on their tolerance to drought. The highest degree of tolerance to drought was observed in genotypes P - 84 (type Prilep) and P - 2 (type Dzebel). These genotypes can be included in the programs for improvement of the investigated trait.

The aim of this paper is to show the way of assessment the stability of newly created lines of the Prilep and Yaka types, and then selecting the best for placing them in a comparative trial for varietal confirmation by the Commission for recognition and approval of varieties at the Ministry of Agriculture Forestry and Water Economy of R. Macedonia. The recognized varieties can be put into circulation.

MATERIAL AND METHODS

As a material for work, two oriental varieties were taken from which one of the type Prilep (P-66-9/7 – Fig. 1) and another of the type Yaka (YK-48 – Fig. 2), as well as eight newly created genotypes, of which four are of the type Yaka (L1 - Fig. 3, L2 - Fig. 4, L3 - Fig. 5 and L4 - Fig. 6), and four of the type Prilep (L5 - Fig. 7, L6 - Fig. 8, L7 - Fig. 9 and L8 - Fig. 10). The variety P-66-9/7 due to its mass application in tobacco production in Macedonia is taken as a control for comparison with line of the type Prilep. YK-48 is a control for lines of the type Yaka.

The experiment was set up in 2016 and 2017 on the Experimental Field of the Scientific Tobacco Institute - Prilep after a random block system in four repetitions. From the complete measurements, for this paper are separated: the height of plants with inflorescence, the number of leaves per plant, the length of the middle-belt leaves, and dry mass yield per plant. The obtained data are statistically processed through parameters of variability of traits and variance analysis (Najceska, 2002).

Figure 1. Prilep, P-66-9/7

Figure 2. Yaka, YK-48

Figure 3. L1 – type Yaka

Figure 4. L2 – type Yaka

Figure 5. L3 – type Yaka

Figure 6. L4 – type Yaka

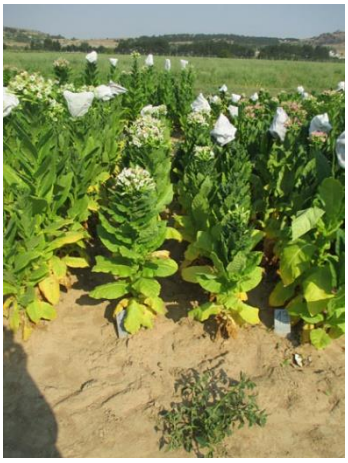

Figure 7. L5 – type Prilep

Figure 8. L6 – type Prilep

Figure 9. L7 – type Prilep

Figure 10. L8 – type Prilep

RESULTS AND DISCUSSION

In order to get acquainted with the genetic stability of the newly created lines, measurements of the quantitative traits were made and on the basis of the obtained values and analysis and their ranking was performed.

From the results shown in Table 1, the highest height of the plant with inflorescence was observed at the oriental line of the type Yaka L3 (137.5 cm - 2016; 135.7 cm - 2017). This line is higher than the control variety YK-48 (127 cm - 2016; 126.8 cm - 2017), and the difference between them is significant of 5%. The line L2 had a significantly lower value. Differences between the other variants have no significance. The smallest height is distinguished in oriental line L6 from type Prilep (67 cm - 2017). The newly created genotypes L5 and L7 are higher, and the differences are highly significant. All average values in 2017 are lower compared to those in 2016, due to the fact that 2017 was extremely dry during the vegetation.

The investigations on the variability of the trait in varieties and lines showed low values. The coefficient of variability (CV) ranges from 2.32% (2017) in P-66-9/7 to 7.40% (2016) in L4. The higher values of lines L4 and L5 point to the fact that they need additional successive selection which will enable their homogenization and stabilization. Lower values in 2017 are a sign of proper selection, directed to the stabilization of new genotypes. There is an exception in the populations of L4 and L7, but the difference is minimal and due to undefined environmental factors.

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

Genotypes	n	2016			2017		
		$\bar{x} \pm S\bar{x}$ (cm)	σ	CV (%)	$\bar{x} \pm S\bar{x}$ (cm)	σ	CV (%)
1. P-66-9/7 Ø	20	79.60 ± 0.53	2.37	2.98	71.88 ± 0.37	1.66	2.32
2. JK-48 Ø	20	127.00 ± 1.46	6.55	5.16	126.80 ± 0.73	3.27	2.58
3. L1	20	126.30 ± 1.11	4.87	3.94	122.50 ± 0.97	4.33	3.53
4. L2	20	122.00 ± 0.56	6.96	5.71	118.00 ± 0.74	3.32	2.81
5. L3	20	137.50 ± 1.09	4.87	3.54	135.70 ± 0.16	5.18	3.82
6. L4	20	132.50 ± 2.19	9.81	7.40	127.50 ± 2.11	9.42	7.39
7. L5	20	92.25 ± 1.25	5.58	6.04	89.10 ± 1.19	5.31	5.96
8. L6	20	76.20 ± 0.72	3.22	4.22	67.00 ± 0.73	3.26	4.86
9. L7	20	102.80 ± 1.10	4.91	4.78	95.65 ± 1.19	5.31	5.55
10. L8	20	72.90 ± 0.74	3.30	4.53	69.25 ± 0.51	2.30	3.32
		$LSD_{0.05}$ = 9.10 $_{0.01}$ = 16.39			$LSD_{0.05}$ = 7.84 $_{0.01}$ = 14.11		

The highest number of leaves per plant has L3 from type Yaka (59.35 - 2016; 57.85 – 2017), which can be seen from Table 2. The least leaves have the standard variety YK-48 (42.30 – 2016; 42 – 2017). Also, the higher number of leaves in the lines L4 from the Yaka type is highly significant. From the analysis of the number of leaves per plant in the two years of investigation, small differences can be observed, which points to the fact that it is a high-hereditary trait. The greatest difference occurs in P-66-9/7, from which can be conclude that this variety is sensitive to drought stress, and for its successful cultivation is necessary timely watering.

The values of the variability of the traits in the investigated genotypes are very low. The highest coefficient of variability has line L4 (6.16% - 2016; 6.11% - 2017), and the lowest L8 (2.40% - 2016) and YK-48 (2.61% - 2017). In nearly everyone newly created variants, the variability in the number of leaves per plant in 2017 is lower than in 2016, which is another confirmation of the proper selection aimed at stabilizing them.

Table 2. Number of leaves per stalk

Genotypes	n	2016			2017		
		$\bar{x} \pm S\bar{x}$ (cm)	σ	CV (%)	$\bar{x} \pm S\bar{x}$ (cm)	σ	CV (%)
1. P-66-9/7 Ø	20	57.25 ± 0.40	1.78	3.12	54.00 ± 0.56	2.51	4.65
2. JK-48 Ø	20	42.30 ± 0.35	1.58	3.74	42.00 ± 0.24	1.09	2.61
3. L1	20	45.20 ± 0.27	2.11	4.67	44.10 ± 0.33	1.48	3.36
4. L2	20	44.20 ± 0.40	1.78	4.02	42.65 ± 0.36	1.62	3.80
5. L3	20	59.35 ± 0.69	3.07	5.17	57.85 ± 0.50	2.24	3.88
6. L4	20	54.75 ± 0.75	3.37	6.16	53.85 ± 0.74	3.29	6.11
7. L5	20	51.20 ± 0.56	2.50	4.89	50.15 ± 0.48	2.15	4.29

8. L6	20	48.60 ± 0.47	2.08	4.29	47.35 ± 0.49	2.20	4.64
9. L7	20	46.90 ± 0.33	1.48	3.15	44.50 ± 0.39	1.75	3.92
10. L8	20	42.40 ± 0.23	1.02	2.40	44.50 ± 0.39	1.75	3.92
		$LSD_{0.05}$ = 1.76 $_{0.01}$ = 3.17			$LSD_{0.05}$ = 1.52 $_{0.01}$ = 2.73		

With the longest length of middlebelt leaves, in both years of investigation, the line L7 is characterized (Table 3). The average value of the trait in 2016 is 31.50 cm, and in 2017 it is 30.90 cm, and the difference in comparison with the control variety P-66-9/7 is highly significant. The difference between the genotypes from type Yaka is very small. From the results in the two years of investigations can be seen that the differences are minimal, which is a sign of the high inheritance of the trait.

Low variability of the length of middlebelt leaves is an indicator of the stability of the trait, i.e. the low impact of environmental factors on its magnitude. The highest coefficient of variability has P-66-9/7 (9.61% - 2016; 7.07% - 2017), and the lowest JK-48 (4.97% - 2017). In nearly everyone newly created lines in 2017 have lower variability than those in 2016, which is an indicator of improving their stability.

Table 3. Length of the leaves from the middle belt (cm)

Genotypes	n	2016			2017		
		$\bar{x}$ ± S$\bar{x}$ (cm)	σ	CV (%)	$\bar{x}$ ± S$\bar{x}$ (cm)	σ	CV (%)
1. P-66-9/7 Ø	20	20.40 ± 0.44	1.96	9.61	20.00 ± 0.32	1.41	7.07
2. JK-48 Ø	20	21.65 ± 0.40	1.80	8.30	21.35 ± 0.24	1.06	4.97
3. L1	20	21.55 ± 0.33	1.50	6.96	21.10 ± 0.29	1.30	6.16
4. L2	20	20.50 ± 0.30	1.36	6.63	20.00 ± 0.28	1.26	6.32
5. L3	20	19.80 ± 0.23	1.03	5.20	19.50 ± 0.28	1.24	6.38
6. L4	20	20.70 ± 0.32	1.45	7.02	20.15 ± 0.28	1.24	6.13
7. L5	20	21.60 ± 0.30	1.36	6.28	21.05 ± 0.25	1.12	5.31
8. L6	20	21.55 ± 0.37	1.66	7.69	21.25 ± 0.28	1.26	5.93
9. L7	20	31.50 ± 0.45	2.01	6.39	30.90 ± 0.40	1.79	5.78
10. L8	20	21.15 ± 0.28	1.24	5.84	20.00 ± 0.33	1.48	7.42
		$LSD_{0.05}$ = 0.85 $_{0.01}$ = 1.52			$LSD_{0.05}$ = 1.21 $_{0.01}$ = 2.18		

The highest yield on the dry mass per plant among the parental genotypes has P-66-9/7 (20.15 g - 2016; 19.25 g - 2017), while between the newly created genotypes L7 (22.70 g - 2016; 21.48 g - 2017). The difference in values between the control of Prilep type and the line L7 is high-significant in both years of investigation. Between the lines of Yaka type, significantly higher yield have L1, L3 and L4. The yield of the whole genotype set in 2017 is lower than that in 2016. The data of the dry mass yield in the two years of investigations are shown in Table 5.

Table 4. Dry mass yield per plant (g)

Years	Genotypes									
	P1 Ø	P2 Ø	L1	L2	L3	L4	L5	L6	L7	L8
2016	20.15	17.74	20.28	17.52	21.12	19.75	19.80	19.01	22.70	17.80
2017	19.25	17.49	19.83	17.24	21.10	19.40	19.54	18.92	21.48	17.70
	2016: $LSD_{0.05}$ = 0.51 $_{0.01}$ = 0.91									
	2017: $LSD_{0.05}$ = 0.41 $_{0.01}$ = 0.75									

CONCLUSIONS

- The highest average height in the two years of investigation has the newly created line L3 (137.5 cm - 2016; 135.7 cm - 2017). In comparison with YK-48, only the lines L3 are significantly higher. The minimum average height has L6 in 2017 (67 cm). The YK-48 variety and Yaka-type lines have a greater height than P-66-9/7 and lines of the type Prilep. Differences in values between the two years in variants are minimal, which is a sign of a high degree of ecological stability.
- Highest number of leaves per stalk has L3 (59.35 - 2016; 57.85 - 2017). All lines from Yaka type have significantly higher number of leaves than the standard variety YK-48. The lines from Prilep type have significantly lower number of leaves than the control P-66-9/7.
- The highest length of leaves from the middle belt, in the control variants has YK-48 (21.65 cm - 2016; 21.35 cm - 2017), and in the lines has L7 (31.5 cm - 2016; 30.9 cm - 2017). Dimensions for the length of the leaves in the control and the lines of Yaka type are very similar. The newly created L7 line of the Prilep type has significantly longer leaves than the two control varieties.
- With highest yield on dry mass per plant among the standard varieties is P-66-9/7 (20.15 g - 2016; 19.25 g - 2017), while among the lines L7 (22.7 g - 2016; 21.48 g - 2017).
- Two-year investigations for variability of the traits in varieties and lines shows low values. The coefficient of variability (CV) for the height of the plant with inflorescence ranges from 2.32% (P-66-9/7 - 2017) to 7.4% (L4 - 2016), for the number of leaves per plant from 2.61% (YK-48 - 2017) to 6.16% (L4 - 2016), for the length of the leaves from the middle belt from 4.97% (JK-48 - 2017) to 9.61% (P-66-9/7 - 2016). The results indicate high genetic homogeneity, i.e. stability and uniformity of the newly created lines.
- The line L7 from the type Prilep and L1 and L3 from the type Yaka can be entered in the comparative labors for varietal recognition by the Ministry of Agriculture, Forestry and Water Economy of R. Macedonia.

REFERENCES

Aleksoski, J., & Korubin-Aleksoska, A. (2011). Degree of inheritance and heritability of yield in parental genotypes and F_1 hybrids of tobacco. *Journal of Agricultural Sciences*, 56(3), 165–172. DOI: 10.2298/JAS1103165A, UDC: 633.71-152.75:575.22.

Dimitrieski, M., & Miceska, G. (2015). New prospective variety of the Oriental Yaka tobacco. *Tutun/Tobacco*, 65(1–6), 3–7.

Korubin – Aleksoska, A. (2004). *Tobacco varieties from Tobacco Instiute - Prilep*. NITP, Republic of Macedonia: University "St. Kliment Ohridski" – Bitola.

Korubin – Aleksoska, A., & Aleksoski, J. (2013). Graphic analysis of the inheritance of leaf size in some tobacco vatieties and their diallel F1 and F2 hybrids. *Tutun/Tobacco*, 63(1–6), 8–19.

Korubin – Aleksoska, A. (2016). Quantitative genetic investigations on some important traits in tobacco varieties and their diallel one-way and back-cross generations. *Tutun/Tobacco*, 66(7–12), 3–11.

Korubin – Aleksoska, A., & Ayaz, M.A. (2016). Study of the morphological and agronomic traits in some autochthonous and commercial tobacco varieties in the Republic of Macedonia. *IOSR–JAVS (IOSR Journal of Agriculture and Veterinary Science)*, 9(6/1), 27–32. DOI: 10.9790/2380-0906012732

Korubin – Aleksoska, A., & Ayaz, M.A. (2016). Basmak – A New Type of Tobacco in the Balkans. *IOSR-JAVS (IOSR Journal of Agriculture and Veterinary Science)*, 9(8/1), 12–17. DOI: 10.9790/2380-0908011217

Korubin – Aleksoska, A. (2017). Breeding for drought tolerance in tobacco. *Tutun/Tobacco*, 67(1–6), 13–22.

Mitreski, M. (2012). Plant height in some Prilep tobacco varieties. *Tutun/Tobacco*, 62(7–12), 61–67.

Mitreski, M., & Korubin-Aleksoska, A. (2014). Degustational properties of some Prilep tobacco varieties. *Tutun/Tobacco*, 64(1–6), 19–27.

Mitreski, M., & Korubin-Aleksoska, A. (2015). Leaf number and size in some varieties of Prilep tobacco. *Tutun/Tobacco*, 65(7–12), 22–28.

Miceska, G. (2017). New lines of Prilep tobacco and their morphological characteristics. *Tutun/Tobacco*, 67(1–6), 8–12.

Najcevska, C. (2002). *Experimental statistics applied in agricultural and biological research*: *Variability of the properties of living organisms – research and statistical analysis*. Published by Bona–Skopje.