

MORPHOLOGICAL STUDIES OF THE LEAVES IN SOME AUTOCHTHONOUS AND COMMERCIAL TOBACCO VARIETIES IN THE REPUBLIC OF MACEDONIA

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ABSTRACT

Investigations were carried out with five aromatic autochthonous oriental tobaccos of the types: Prilep (P 10–3/2 and P 12–2/1), Djebel (Dj № 1) and Yaka (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), to study the number, length, width and area of the middle belt leaves per stalk. The trial was set up in the Experimental field of Tobacco Institute–Prilep in 2013 and 2014, in randomized block design with three replications, using traditional agricultural practices.

The aim of the investigation is to study some autochthonous varieties and new commercial varieties for the stated quantitative traits, and with analysis of variance to estimate the significance of differences between varieties and between years, which will improve our knowledge on stability of the traits, genotypical homogeneity and progress in selection of oriental tobacco in the Republic of Macedonia.

Differences in leaf number and size among genotypes in the two-year investigations are highly significant, which is genetic indicator of their mutual differences. The error of the mean value is low, indicating stability and homozygosity of the genotypes. The variety P–66–9/7 is characterized with the highest number of leaves (60) and it has 33 leaves more than YK 7–4/2 and Dj № 1. The largest leaf size was measured in P–79–94 (23,3cm – length, 12,1 cm – width, 179 cm² – area). It has 4,8 cm longer, 3,2 cm wider and 74,5 cm² larger leaves than YK 7–4/2, which is characterized by the smallest leaves. These data point out to a successful breeding activity of the Tobacco Institute in the selection of oriental aromatic tobaccos. Through evaluation of stability of varieties, the breeder improves its knowledge on their homozygosity and higher security in the choice of parental pairs for implementing selection programs.

Keywords: tobacco (*Nicotiana tabacum L.*), old varieties, commercial varieties, quantitative traits, analysis of variance.

МОРФОЛОШКИ ПРОУЧУВАЊА НА ЛИСТОВИТЕ КАЈ НЕКОИ АВТОХТОНИ И КОМЕРЦИЈАЛНИ СОРТИ ТУТУН ВО РЕПУБЛИКА МАКЕДОНИЈА

Испитувани се пет ароматични автохтони ориенталски тутуни од типовите: прилеп (П 10–3/2 и П 12–2/1), дџебел (Д бр.1) и јака (ЈК 7–4/2 и КЈ) и пет комерцијални ориенталски сорти од типот прилеп (П–23, П–84, НС–72, П–66–9/7 и П–79–94), за бројот на листови по страк и должината, ширината и површината на листовите од средниот појас. Опитот беше поставен на експерименталното поле во Научниот институт

за тутун–Прилеп во 2013 и 2014 година, по случаен блок–систем во три повторувања, со примена на вообичаени агротехнички мерки.

Целта на истражувањата е да се проучат автохтоните сорти и новите комерцијални сорти за наведените квантитативни својства, а со анализа на варијансата да се процени важноста на разликите помеѓу сортите и годините, со што ќе се добие визија за стабилноста на својствата, генотипската хомогеност и напредокот на селекцијата на ориенталски тутуни во Република Македонија.

Разликите во бројот и димензиите на листовите помеѓу генотиповите во двегодишните проучувања се високосигнификантни, што е генетски показател за нивната меѓусебна различност. Грешката на средната вредност за сите податоци е ниска, што е знак за стабилноста и хомозиготноста на генотиповите. Сортата П–66–9/7 се одликува со најголем број листови (60). Таа има 33 листови повеќе од ЈК 7–4/2 и Ц бр.1. Што се однесува до димензиите на листовите предничи П–79–94 (23,3cm – должина, 12,1 cm – ширина, 179 cm² – површина). Таа има за 4,8 cm подолги, за 3,2 cm пошироки и за 74,5 cm² поголеми листови од ЈК 7–4/2 која има најмали ливчиња. Овие податоци кажуваат за успешната облагородувачка дејност на Институтот за тутун во областа на селекцијата на ориенталски ароматични тутуни. Преку евалуација на стабилноста на сортите, селекционерот добива поголемо сознание за нивната хомозиготност и поголема сигурност во изборот на родителски парови за имплементирање на селекционите програми.

Клучни зборови: тутун (*Nicotiana tabacum L.*), стари сорти, комерцијални сорти, квантитативни својства, анализа на варијанса.

INTRODUCTION

Tobacco is a crop that is grown for its leaf and all breeding activities are directed to increasing its yield and quality. Many authors consider leaf size (length and width) as an important parameter in determination of tobacco quality. During the evaluation, dry oriental tobacco leaves which length exceeds 20 cm are classified as additional tobacco because they have very little or no aroma. Scientific Tobacco Institute - Prilep dates from 1924 and its main activity is the selection of oriental, small-leaf, aromatic tobaccos.

Atanasov (1972) reported that the leaf number in selected varieties is of approximately constant size. According to Uzunoski (1985), leaf number varies depending on agro-ecological conditions and it is important character, since it greatly determines the yield of tobacco. Dimitrieski, Miceska (2011) reported that the newly created variety P-66-9/7 in 2010 accounted for 70-80% of the primary production of tobacco type Prilep. The average leaf number of this tobacco was 52, with an average length of 16-18 cm for the middle and 8 - 10 for the top leaves. Aleksoski (2013) in his three-year

investigations on a diallel cross with four parental genotypes of P-84 (bred for higher yield), received about 52 leaves per stalk and the leaf area of the middle belt was 146 cm² in 2007, 138 cm² in 2008 and 142 cm² in 2009. Korubin-Aleksoska, Aleksoski (2013) in the two-year investigations of six tobacco varieties and their diallel crosses in F1 and F2 generations reported that the variety P-23 showed low variability of number of leaves per stalk, which confirms the homozygosity of the variety i.e. its stability and uniformity. Miceska et al. (2014) in the two-year biometric investigations of autochthonous tobacco varieties in the Republic of Macedonia for the leaf number per stalk reported that the obtained parameters of variability are low, which indicates high genetic homogeneity.

The aim of the study is to investigate and compare the number of leaves per stalk and size of the middle belt leaves in some old domestic varieties and new commercial varieties, in order to get a better knowledge and more successful selection of oriental tobacco in Macedonia.

MATERIAL AND METHODS

Two-year investigations were made on the number of number, length, width and area of the middle belt leaves in five old domestic varieties of the types: Prilep (P 10–3/2 and P 12–2/1), Djebel (Dj № 1) and Yaka (YK 7–4 / 2 and KY – Kishinska Yaka), and five new commercial varieties of the type Prilep: P–23, P–84, NS–72, P–66–9/7 and P–79–94. The traits were measured during tobacco growth in the field. The leaf area (relative area) was calculated by multiplying the length by the width, using the coefficient $k = 0,6354$ (Gornik, 1973). Each

amount represents the arithmetic average for the examined property that is accompanied by error of the mean value (Najceska, 2002).

During tobacco vegetation in field (May - September) in 2013, mean monthly temperature was 19,40C, number of rainy days 34 and total precipitation amount 153 mm. In the same period in 2014 mean monthly temperature was 18,30C, number of rainy days 33 and total precipitation amount 223 mm.

General characteristics of the old domestic tobacco varieties

The cultivation of old tobacco varieties in this region began long ago, during the Ottoman Empire. The centuries–long presence led to their adaptation to the present agro–ecological conditions. Through successive natural selection they have acquired resistance to drought and diseases and can rightly be called autochthonous. Today, the old varieties make a valuable material for breeding activity in the Institute.

Prilep P 10–3/2 – characterized by cup-like habitus, average stalk height 50cm, with 30-36 sessile leaves, dry mass yield averages 1200 kg/ha (Fig.1).

Prilep P 12–2/1 – characterized by cup-like habitus, average stalk height 55cm, with 34-38 sessile leaves, dry mass yield averages 1500 kg/ha (Fig.2).

P 10-3/2 and P12-2/1 are put into production in the 30-ies of the last century; phenotypic and genotypic are very similar; originating from the local tobacco variety Djumaj–bale from Gorna Djumaja – Bulgaria.

Djebel Dj № 1 – released in the first half of the last century; Originated from the local variety Xanthian Yaka grown in the Djebel tobacco producing region in Bulgaria; char-

acterized by a cylindrical habitus, average stalk height 80cm, 26–30 sessile leaves erected toward the stalk, dry mass yield averages 1000 kg/ha (Fig.3).

Yaka YK 7–4/2 – released in mass production in 1932. Originated from Xanthian Yaka originating from Xanthi – Greece; a plant with narrow, spindle shaped–elliptic habitus; average stalk height 100 cm, with 26–32 sessile leaves, dry mass yield averages 1000 kg/ha (Fig.4).

These four domestic varieties were created in the Tobacco Institute–Prilep by Rudolf Gornik (Gornik, 1973). by individual selection.

KY (Kishinska Yaka) – According to some unconfirmed reports, this variety originates from village Kishino in the region of Veles, Republic of Macedonia. According to other sources it was transmitted in the past from Moldova (Uzunoski, 1985). Environmental conditions had a great influence on the morphology and chemistry of this genotype and with multi–decades selection a uniform and stable variety was formed. It is characterized by elongated–elliptic habitus with about 40 sessile leaves (Fig.5).

General characteristics of the new commercial tobacco varieties

The new commercial oriental sun-cured varieties created in the Scientific Tobacco Institute–Prilep present a high quality raw material for the domestic and world market. Due to their pleasant aroma and harmonious chemical composition they enter in the mixtures of the highest-quality cigarette brands.

Prilep P–23 – created by Kostadin Nikoloski and Milan Mitreski, through hybridization and selection in Tobacco Institute – Prilep; recognized by the Ministry of Agriculture, Forestry and Water Management of the Republic of Macedonia in 1995 (Korubin – Aleksoska A., 2004). It has elliptical–conical habitus, average stalk height 65 cm, with about 55 densely arranged leaves, dry mass yield 2000–2500 kg/ha (Fig.6).

Prilep P–84 – created by Kiril Naumovski and Ana Korubin – Aleksoska, through hybridization and selection; recognized in 1988 in former Yugoslavia, as one of the first varieties of the type Prilep. Characterized by cylindrical – elliptical habitus, average stalk height 65 cm, with approximately 40 – 42 sessile leaves, elliptical in shape, dry mass yield 2500–3200 kg/ha (Fig.7).

Prilep NS–72 – created by Dushko Boce-ski and Simeon Karayankov; recognized

in 1984 in former Yugoslavia as one of the first varieties of the type Prilep obtained by crossing (Korubin–Aleksoska A. et al., 2012); characterized by cylindrical–elliptical habitus, average stalk height 75 cm, with approximately 50 sessile leaves, elliptical in shape, dry mass yield 2800–3300 kg/ha (Fig.8).

Prilep P–66–9/7 – created in Tobacco Institute–Prilep by Miroslav Dimitrieski and Gordana Miceska; recognized by the Ministry of Agriculture, Forestry and Water Management of R. Macedonia in 2004 (Korubin–Aleksoska A. et al., 2012); characterized by elliptical–conical habitus, with 54–60 ovate leaves, sessile and evenly distributed on the stem, dry mass yield 3000–3600 kg/ha. It has been the most represented tobacco variety in our country in recent years (Fig.9).

Prilep P–79–94 – created in Tobacco Institute–Prilep by Milan Bogdanceski; recognized by the Ministry of Agriculture, Forestry and Water Management of R. Macedonia in 2001 (Korubin – Aleksoska A., 2004); characterized by cylindrical–elliptical habitus, average stalk height 75 cm, with about 55 sessile leaves densely distributed, especially in the upper part of stem, dry mass yield 2500–3000 kg/ha (Fig.10).



Fig. 1. Prilep P 10–3/2



Fig. 2. Prilep 12-2/1



Fig. 3. Djebel Dj № 1



Fig. 4. Yaka YK 7-4/2



Fig. 5. KY (Kishinskan Yaka)



Fig. 6. Prilep P-23

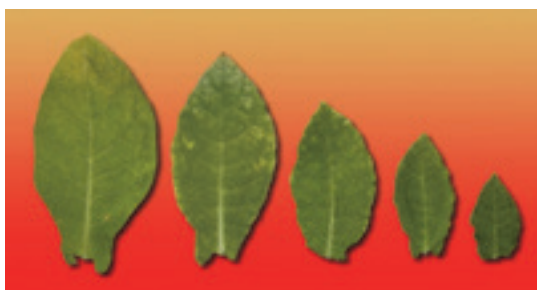


Fig. 7. Prilep P-84

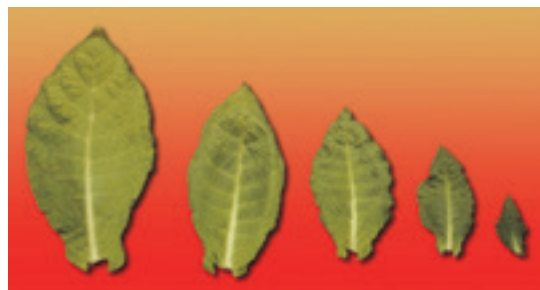


Fig. 8. Prilep NS-72

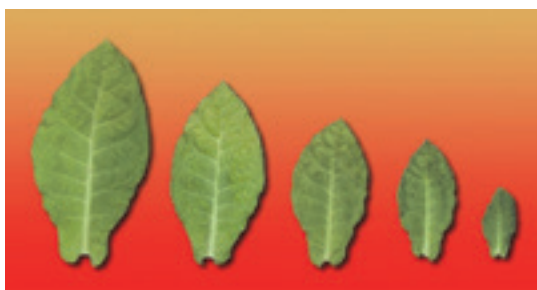


Fig. 9. Prilep P-66-9/7



Fig. 10. Prilep P-79-94

RESULTS AND DISCUSSION

The highest leaf number among the old varieties was found in Kishinska Yaka – KY (36 – 2013, 38 – 2014, i.e. $\bar{x} = 37$) and the

lowest in YK 7-4/2 (26 – 2013, 28 – 2014, i.e. $\bar{x} = 27$) and Dj № 1 (26 – 2013, 29 –

2014, i.e. $\bar{x} = 27.5$). Among the new com-

mmercial varieties, the highest leaf number was found in P-66-9/7 (58 – 2013, 62 – 2014, i.e. $\bar{x} = 60$) and the lowest in P-84 (40

– 2013, 42 – 2014, i.e. $\bar{x} = 41$). The variety

P-66-9/7 has 33 leaves more than YK 7-4/2 and Dj № 1 (Table 1).

Analysis of variance for the number of leaves per stalk showed highly significant differences among the varieties. Only in the combination Dj № 1 – YK 7-4/2 the difference was not significant (Table 2). This is an indication of different genotypes. Differences in leaf number per years are small but significant, as a result of the different conditions in the two years of investigation (Table 6).

The highest leaf length among the investigated varieties was measured in P 12-2/1 and P-79-94 ($\bar{x} = 23$ cm) and the lowest in YK

7-4/2 ($\bar{x} = 18$ cm). The difference in length

of the middle belt leaves between the two varieties is 5 cm (Table 1). The comparison of the middle belt leaf length of the semi-oriental variety Otlja O 9-18/2 – Fig. 11. (32,5 cm – 2013, 33 cm – 2014, i.e. $\bar{x} = 32,75$ cm), with that of the variety

P-79-94 shows that leaves of O 9-18/2 are 9,5 cm longer compared to P-79-94 and 14,3 cm longer compared to YK 7-4/2.



Fig. 11. ОТЛЈА 9 - 18 / 2

The analysis of variance for the length of the middle belt leaf shows highly significant differences among varieties in 82,2% (2013) and 77,8% of the combinations (2014) and 0,05 significance in 6,7% (2013) and 8,9% (2014). No significance was observed in about 12,2% (P 10-3/2 – KY, 10-3/2 – NS-72, P 12-2/1 – P-79-94, KY – NS-72, P-23 – P-84, P-23 – P-66-9/7 and P-84 – P-66-9/7). The significance of differences in about 87% of the combinations indicates that this trait is varietal characteristic (Table 3).

The highest leaf width among the varieties was measured in P-79-94 (11,9 cm – 2013, 12,3 cm – 2014, i.e. $\bar{x} = 12,1$ cm), and the

lowest width in YK 7-4/2 (8,7 cm – 2013, 9,1 cm – 2014, i.e. $\bar{x} = 8,9$ cm). The diffe-

rence in width of the middle belt leaves between these two varieties is 3,2 cm (Table 1). Comparison of width in the middle belt leaves shows that the semi-oriental variety O 9-18/2 (17,5 cm – 2013, 18 cm – 2014, i.e. $\bar{x} = 17,75$ cm) has 5,65 cm wider leaves

than P-79-94 and 8,85 cm wider compared to YK 7-4/2.

The analysis of variance for the width of the middle belt leaves shows highly significant

differences among varieties in 88.9% and 82.2% (2013 and 2014 respectively) and 0.05 significance in 4.4% and 8.9% (2013 and 2014, respectively), while in 6.7% (2013) and in 8.9% (2014), i.e. in only five combinations no significance was observed (P 12-2/1 – P-23, P 12-2/1 – P-84, P 12-2/1 – NS-72, Dj № 1 – KY and P-23 – NS-72). The significance of differences in about 93% of the combinations indicates that the investigated trait is varietal characteristic (Table 4).

The largest area of the middle belt leaves was measured in variety P-79-94 (175,9 cm² – 2013, 183 cm² – 2014, i.e. $\bar{x} = 179$ cm²), and the lowest in YK 7-4/2 (101 cm² – 2013, 108 cm² – 2014, i.e. $\bar{x} = 104,5$ cm²). This

means that P-79-94 has about 74,5 cm² larger leaves than YK 7-4/2 (Table 1). Still, this difference is within the allowed limits for oriental tobaccos. Comparison of the area of

middle belt leaves in the semi-oriental variety Otlja O 9-18/2 (361 cm² – 2013, 377 cm² – 2014, i.e. $\bar{x} = 369$ cm²) shows that it

has 190 cm² larger leaves than P-79-94 and 264 cm² larger than YK 7-4/2, which indicates that they are two different categories of tobacco.

The analysis of variance for the area of the middle belt leaves in 2013 shows highly significant differences among varieties in 66,7%, 0,05 significance in 20% and no significance in 13,3% of the combinations, while in 2014 high significance was assessed in 62,2%, 0,05 significance in 20% and no significance in 17,8%. The significance of differences in about 84% of the combinations indicates that the investigated trait is varietal characteristic (Table 5).

The differences in leaf size by years are small but significant and they appear as a result of various meteorological factors during the growing season in the two years of investigation (Table 6).

Table 1. Number and size of the middle belt leaves in autochthonous and commercial tobacco varieties from the Republic of Macedonia

Tobacco varieties	Quantitative traits											
	Number of leaves per stalk			Length of the middle belt leaves (cm)			Width of the middle belt leaves (cm)			Area of the middle belt leaves (cm ²)		
	$\bar{x} \pm s$		\bar{x}	\bar{x}		\bar{x}	\bar{x}		\bar{x}	\bar{x}		\bar{x}
	2013	2014		2013	2014		2013	2014		2013	2014	
Autochthonous varieties												
P 10-3/2	32 0,09	34 0,08	33	22 0,10	22 0,11	22	10,2 0,05	10,5 0,04	10,4	143 1,65	149 1,63	146
P 12-2/1	34 0,10	36 0,11	35	23 0,12	23 0,11	23	10,4 0,07	11,1 0,06	10,8	149 1,83	164 1,70	156,5
Dj № 1	26 0,16	29 0,14	28	19 0,11	20 0,10	20	11,5 0,04	11,8 0,04	11,8	142 1,55	151 1,49	146,5
YK 7-3/2	26 0,17	28 0,15	27	18 0,08	18 0,09	18	8,7 0,08	9,1 0,07	8,9	101 1,59	108 1,52	104,5
KY	36 0,15	38 0,15	37	22 0,12	22 0,11	22	11,6 0,07	11,8 0,05	11,7	161 1,93	166 1,84	163,5
KY	36 0,15	38 0,15	37	22 0,12	22 0,11	22	11,6 0,07	11,8 0,05	11,7	161 1,93	166 1,84	163,5
Commercial tobacco varieties												
P-23	45 0,20	48 0,18	47	20 0,13	22 0,12	21	10,7 0,04	11,1 0,03	10,9	137 1,85	156 1,74	146,5
P-84	40 0,14	42 0,15	41	20 0,10	21 0,09	21	10,5 0,05	10,7 0,03	10,6	136 1,77	145 1,59	140,5
NS-72	43 0,21	45 0,17	44	22 0,17	23 0,15	22	10,8 0,07	10,9 0,06	10,9	149 2,17	158 2,03	153,5

P-66-9/7	58 0,15	62 0,15	60	21 0,12	22 0,14	21	11,2 0,05	11,2 0,04	11.2	149 1,58	153 1,54	151
P-79-94	52 0,14	54 0,15	53	23 0,12	23 0,11	23	11,9 0,06	12,3 0,02	12.1	175 1,69	183 1,62	170.5
LSD _{0,05}				0,581				0,4200,				1635,655
LSD _{0,01}				1,053				0,756				10,179

Table 2. Significance of differences in number of leaves per stalk between varieties (from the values in Table 1)

Differ.	Signi.	Differ.	Signi.	Differ.	Signi.	Differ.	Signi.	Differ.	Signi.
S1 – S2	-2**	S2 – S3	7.5**	S3 – S5	-9,5**	S4 – S8	-17**	S6 – S8	2,5**
S1 – S3	5,5**	S2 – S4	8**	S3 – S6	-19**	S4 – S9	-33**	S6 – S9	-13,5**
S1 – S4	6**	S2 – S5	-2**	S3 – S7	-13,5**	S4 – S10	-26**	S6 – S10	-6,5**
S1 – S5	-4**	S2 – S6	-11,5**	S3 – S8	-16,5**	S5 – S6	-9,5**	S7 – S8	-3**
S1 – S6	-13,5**	S2 – S7	-6**	S3 – S9	-32,5**	S5 – S7	-4**	S7 – S9	-19**
S1 – S7	-8**	S2 – S8	-9**	S3 – S10	-25,5**	S5 – S8	-7**	S7 – S10	-12**
S1 – S8	-11**	S2 – S9	-25**	S4 – S5	-10**	S5 – S9	-23**	S8 – S9	-16**
S1 – S9	-27**	S2 – S10	-18**	S4 – S6	-19,5**	S5 – S10	-16**	S8 – S10	-9**
S1 – S10	-20**	S3 – S4	0.5	S4 – S7	-14**	S6 – S7	5,5**	S9 – S10	7**

Signi. – * - significance for 5%; ** - significance for 1%

Differ. – differences between varieties

Varieties: S1 = P 10-3/2, S2 = P 12-2/1, S3 = Dj № 1, S4 = YK 7-3/2, S5 = KY, S6 = P-23, S7 = P-84, S8 = NS-72, S9 = P-66-9/7, S10 = P-79-94

Table 3. Significance of differences in length of the middle belt leaves between varieties (from the values in Table 1)

Differ.	Signi.	Differ.	Signi.	Differ.	Signi.	Differ.	Signi.	Differ.	Signi.
S1 – S2	-0,65*	S2 – S3	3,1**	S3 – S5	-2,15**	S4 – S8	-3,9**	S6 – S8	-1,2**
S1 – S3	2,45**	S2 – S4	4,45**	S3 – S6	-1,35**	S4 – S9	-2,75**	S6 – S9	-0,05
S1 – S4	3,8**	S2 – S5	0,95**	S3 – S7	-1,05**	S4 – S10	-4,85**	S6 – S10	-2,15**
S1 – S5	0,3	S2 – S6	1,75**	S3 – S8	-2,55**	S5 – S6	0,8**	S7 – S8	-1,5**
S1 – S6	1,1**	S2 – S7	2,05**	S3 – S9	-1,4**	S5 – S7	1,1**	S7 – S9	-0,35
S1 – S7	1,4**	S2 – S8	0,55*	S3 – S10	-3,5**	S5 – S8	-0,4	S7 – S10	-2,45**
S1 – S8	-0,1	S2 – S9	1,7**	S4 – S5	-3,5**	S5 – S9	0,75*	S8 – S9	1,15**
S1 – S9	1,05**	S2 – S10	-0,4	S4 – S6	-2,7**	S5 – S10	-1,35**	S8 – S10	-0,95**
S1 – S10	-1,05**	S3 – S4	1,35**	S4 – S7	-2,4**	S6 – S7	0,3	S9 – S10	-2,1**

Table 4. Significance of differences in width of the middle belt leaves between varieties (from the values in Table 1)

Differ.	Signi.	Differ.	Signi.	Differ.	Signi.	Differ.	Signi.	Differ.	Signi.
S1 – S2	-0,4**	S2 – S3	-0,9**	S3 – S5	-0,05	S4 – S8	-1,95**	S6 – S8	0,05
S1 – S3	-1,3**	S2 – S4	1,85**	S3 – S6	0,75**	S4 – S9	-2,3**	S6 – S9	-0,3**
S1 – S4	1,45**	S2 – S5	-0,95**	S3 – S7	1,05**	S4 – S10	-3,2**	S6 – S10	-1,2**
S1 – S5	-1,35**	S2 – S6	-0,15	S3 – S8	0,8**	S5 – S6	0,8**	S7 – S8	-0,25**
S1 – S6	-0,55**	S2 – S7	0,15	S3 – S9	0,45**	S5 – S7	1,1**	S7 – S9	-0,6**
S1 – S7	-0,25*	S2 – S8	-0,1	S3 – S10	-0,45**	S5 – S8	0,85	S7 – S10	-1,5**
S1 – S8	-0,5**	S2 – S9	-0,45**	S4 – S5	-2,8**	S5 – S9	0,5**	S8 – S9	-0,35**
S1 – S9	-0,85**	S2 – S10	-1,35**	S4 – S6	-2**	S5 – S10	-0,4**	S8 – S10	-1,25**
S1 – S10	-1,75**	S3 – S4	2,75**	S4 – S7	-1,7**	S6 – S7	0,3**	S9 – S10	-0,9**

Table 5. Significance of differences in area of the middle belt leaves between varieties (from the values in Table 1)

Differ.	Signi.	Differ.	Signi.	Differ.	Signi.	Differ.	Signi.	Differ.	Signi.
S1 – S2	-10.5**	S2 – S3	10*	S3 – S5	-17**	S4 – S8	-49**	S6 – S8	-7*
S1 – S3	-0.5	S2 – S4	52**	S3 – S6	0	S4 – S9	-46.5**	S6 – S9	-4.5
S1 – S4	41.5**	S2 – S5	-7*	S3 – S7	6*	S4 – S10	-66**	S6 – S10	-24**
S1 – S5	-17.5**	S2 – S6	10*	S3 – S8	-7*	S5 – S6	17**	S7 – S8	-13**
S1 – S6	-0.5	S2 – S7	16**	S3 – S9	-4.5	S5 – S7	23**	S7 – S9	-10.5**
S1 – S7	5.5	S2 – S8	3	S3 – S10	-24**	S5 – S8	10*	S7 – S10	-30**
S1 – S8	-7.5*	S2 – S9	5.5	S4 – S5	-59**	S5 – S9	12.5**	S8 – S9	2.5
S1 – S9	-5	S2 – S10	-14**	S4 – S6	-42**	S5 – S10	-7*	S8 – S10	-17**
S1 – S10	-24.5**	S3 – S4	42**	S4 – S7	-36**	S6 – S7	6*	S9 – S10	-19.5**

Table 6. Significance of differences for investigated characteristics of varieties between years (from the values in Table 1)

Varieties	Differences between years (2013 - 2014)			
	Number of leaves per stalk	Length of the middle belt leaves	Width of the middle belt leaves	Area of the middle belt leaves
Autochthonous tobacco varieties				
1. P 10-3/2	-2**	-0.3	-0.3**	-6*
2. P 12-2/1	-2**	-0.8**	-0.7**	-15**
3. Dj № 1	-3**	-0.8**	-0.3	-9*
4. YK 7-3/2	-2**	-0.5*	-0.4**	-7*
5. KY	-2**	-0.3	-0.2*	-5
Commercial tobacco varieties				
6. P-23	-3**	-1.9**	-0.4**	-19**
7. P-84	-2**	-0.9**	-0.2*	-9*
8. NS-72	-2**	-1.1**	-0.1	-9*
9. P-66-9/7	-4**	-0.6*	0	-4
10. P-79-94	-2**	-0.2	-0.4**	-25**

* - Significance for 5%;

** - significance for 1%

CONCLUSIONS

Two-year investigations of some old domestic oriental varieties (P 10–3/2, P 12–2/1, Djebel Dj № 1, Yaka YK 7–4/2, KY – Kishinska Yaka) and new commercial varieties (P–23 P–84, NS–72, P–66–9/7, P–79–94) showed a small error of the mean value for the traits: number, length, width and area of the middle belt leaves per stalk, which is an indication of correct setting of the experiment, high genetic stability of the traits and homozygosity of the varieties.

The highest leaf number per stalk was obtained in P–66–9/7 (60), which is 33 leaves more than YK 7–4/2 and Dj № 1 – characterized by the lowest number of leaves. The analysis of variance shows highly significant differences between varieties and no significant differences between the years, which is indication that these are different genotypes and that the investigated trait is highly heritable and varietal characteristic. The highest leaf length and width was

measured in P-79-94 ($\bar{x} = 23,3$ cm length,

$\bar{x} = 12,1$ cm – width), and the lowest length

and width in YK 7-4/2 ($\bar{x} = 18,45$ cm

length, $\bar{x} = 8,9$ cm - width), showing that

the leaves of P-79-94 are 5 cm longer and 3,2 cm wider compared to YK 7-4/2. The significance of 87% for the leaf length and 93% for the width indicates the differences between varieties, suggesting that these traits are varietal characteristics.

The largest area of the middle belt leaves was measured in P-79-94 ($\bar{x} = 179$ cm²),

and the lowest in YK 7-4/2 ($\bar{x} = 104,5$

cm²), which means that P-79-94 has 74,5 cm² larger leaves than YK 7-4/2. The significance of differences between the varieties in about 84% of the combinations confirms that the investigated trait is a varietal characteristic.

Compared to the semi-oriental variety Otlja O 9-18/2 it can be concluded that differences in leaf size among the ten genotypes is within allowed limits for oriental aromatic tobaccos.

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