

## STUDIES ON THE INHERITANCE OF THE NUMBER OF LEAVES IN THE CROSSES OF VIRGINIA TOBACCO (*NICOTIANA TABACUM L.*)

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### ABSTRACT

The character and extent of the genetic interactions were determined by applying hybridological analysis as well as by the number of genes differentiating between the initial parent forms and expressions of heterosis and transgression referring to the character number of leaves, the objective being the selection of desired genotypes in six hybrid Virginia tobacco populations, including the best introduced varieties from the USA. The results of the survey of P<sub>1</sub>, P<sub>2</sub>, F<sub>1</sub> and F<sub>2</sub> proved that the character number of leaves in Virginia tobacco crosses is inherited overdominantly, always in the direction of the parent displaying a higher value of the character. The number of genes influencing the manifestation of the studied character which differentiated between the parents varied from 1 to 12. The strongly pronounced positive epistasis reinforces the phenotype expression of the character "number of leaves per plant". Significant positive heterosis was observed in 3 of the crosses.

The high values determined for the inheritance coefficient and for effective mass selection of phenotypes show that the selection of genotypes characterized by higher number of leaves will be more effective in the sooner hybrid generations.

**Key words:** Virginia tobacco, genetic analysis, inheritance, heritability, transgression, heterosis.

### ПРОУЧУВАЊЕ НА НАСЛЕДУВАЊЕТО НА БРОЈОТ НА ЛИСТОВИ КАЈ КРСТОСКИТЕ ТУТУН ОД ТИПОТ ВИРЦИНИЈА

Со примена на анализата на хибридизација во природата се одредува степенот на генетската взаемност, бројот на гените по кои се разликуваат основните родителски форми, како и појавата на хетерозис и трансгресија во однос на бројот на листовите. Истражувањата се изведени со шест хибридни популации тутун од типот вирџинија во кои учествуваат најдобрите интродуцирани сорти од САД. Резултатите од истражувањето на P<sub>1</sub>, P<sub>2</sub>, F<sub>1</sub> и F<sub>2</sub>, покажуваат дека бројот на листови кај тутунот од типот вирџинија секогаш се наследува доминантно во насока на родителот со поголем број на листови. Бројот на гените кои влијаат врз истражуваната појава по која се разликуваат родителските компоненти се движи од 1 до 12. Силно изразената позитивна епистаза ја засилува фенотипската експресија на својството број на листови од растение. Сигнификантен хетерозис е забележан во три од испитуваните крстоски.

Утврдените високи вредности на коефициентите за наследност и за ефикасност на масовниот избор на фенотипови покажуваат дека изборот на генотипови со поголем број на листови ќе биде поефикасен во пораните хибридни генерации

**Клучни зборови:** тутун вирџинија, генетска анализа, наследување, наследност, трансгресија, хетерозис.

## INTRODUCTION

The number of tobacco leaves is important variety characteristic and is of great significance to the yield (Tomov, 1985; 1986; 1991).

The heterosis in Virginia tobacco finds wide application. Heterotic varieties in Bulgaria have been cultivated since 1973. The heterotic varieties still cover big area under this type of tobacco. Virginia 0454 and Virginia 0514 are the basic varieties in Bulgaria.

Some reports on the inheritance of the number and size of leaves in Virginia and Burley tobacco crosses show that these characters are governed by additive genes (Tchintchev, 1979; Chang, E.Y., C.C. Shyu 1976; Legg, P. D., G. B. Collins. 1974; Shyu, C. C., D. C. Lai, E. Y. Chang. 1975). In investigations of dark tobaccos, Torrecila and Barroso (1980) have also pointed out that additive gene effects is of the greatest importance. Sastry and Prasada Rao, (1980) reported that dominant and additive gene effects are of the highest significance. Chang et al. (1980); Sastry and Prasada Rao (1980) noted that dominant gene effects prevails for the number of leaves in Burley tobacco crosses. Noveva et al. (1984) reported that the inheritance in  $F_1$  is overdominant, and the highest influence was

obtained by the epistasis gene effects.

Naumovski (1988) calculated that coefficient of inheritance for the number of leaves was 67 %. Shyu et al. (1975) studied the heritability in flue-cured tobacco and estimated various heritability values for different crosses.

They reported that heritability estimates for the number of leaves were over 84 %.. Studies on tobaccos originating from the Dupnitsa region showed high inheritance rate of the number of leaves and it opens a possibility for selecting elite plants with greater number of leaves (Stankev, 2001). In other studies,, high values of inheritance coefficient (in the broad sense) for the number of leaves was recorded, providing the opportunity for fast stabilization in the following generations (Palakartcheva and Yancheva, 1985; Stankev, 1988 ).

The aim of our investigation was to determine, through hybridological analysis, the character and extent of gene interactions, the number of genes distinguishing the initial parent forms as well as the occurrence of heterosis and transgression in relation to the character number of leaves, for selection of the desired genotypes in the studied hybrid populations of Virginia tobacco.

## MATERIAL AND METHODS

$P_1$ ,  $P_2$ ,  $F_1$  and  $F_2$  were studied in six crosses involving local varieties and Virginia tobacco introduced from the USA: Hybrid 714 (K 730 x K 254), Hybrid 715 (K 730 x K 358), Hybrid 719 (RG 8 x K 358), Hybrid 725 (K340 x K 358), Hybrid 726 (K 358 x NC 729) and Hybrid 727 (K 358 x K 254)

The experimental activities were carried out on the trial field of the ITTP in Markovo. With regard to the number of leaves the following calculations were made: mean arithmetic value

( $\bar{x}$ ), error of the arithmetic mean ( $S_x \%$ ), degree of dominance ( $d/a$ ) using Mather's formula and heterosis effect regarding the better parent form (HP). Sobolev's method (8) was employed to determine the following: transgression index ( $T_{\Pi}$ ), number of genes differentiating between the parent forms ( $N$ ), dominancy (D), epistasis (E), character inheritability coefficient ( $H^2$ ), effectiveness coefficient of the genotype selection using the phenotype expression of the specific character ( $P_p$ ).

## RESULTS AND DISCUSSION

The data in Table 1 show that the number of leaves per plant was inherited overdominantly

in all crosses where the parents possessing higher values of the studied trait were predominant,

respectively K 730 and K358. The heterosis effect with economic importance was established in the following combinations: Hybrid 726 (111%),

Hybrid 714 –(10%) and Hybrid 719 – (9%). Heterosis can be used as a method for increasing the number of leaves in Virginia tobacco.

Table 1. Biometrical data on the number of leaves per plant

Parents/crosses	P <sub>1</sub>	P <sub>2</sub>	F <sub>1</sub>	F <sub>2</sub>	d/a	HP
	x±Sx%	x±Sx%	x±Sx%	x±Sx%		
Hybrid 714 (K 730 x K 254)	25,2±0,63	24,2±0,68	27,7±0,54	28,1±1,04	6	109,9
Hybrid 715 (K 730 x K 358)	25,2±0,63	27,2±0,70	28,2±0,98	28,5±0,90	1,3	103,7
Hybrid 719 (RG 8 x K 358)	26,5±0,89	27,2±0,70	28,9±0,58	29,4±0,81	1,7	106,3
Hybrid 725 (K340 x K 358)	26,0±0,78	27,2±0,70	29,6±0,91	29,7±0,87	2,4	109
Hybrid 726 (K 358 x NC 729)	27,2±0,70	26,7±0,85	30,2±0,99	30,8±0,95	13	111
Hybrid 727 (K 358 x K 254)	27,2±0,70	24,2±0,68	27,5±0,82	28,7±1,01	1,2	101,1

The data from the hybridological analysis (Table 2) show that the number of genes controlling the studied character and differentiating between the parent forms varies from 1 to 12 (Hybrid 714).

The values of the transgression index point to the fact that in the process of generation disintegration of Hybrid 714, Hybrid 725 and Hybrid 726, it was possible to select plants over-numbering the parent leaves by 1 to 2 from the available homozygotic phenotypes. In the cross Hybrid 719, forms possessing a leaf-number close to the parents' would prevail and in Hybrid

715 and Hybrid 727 – forms possessing a smaller number.

The strongly pronounced positive epistasis reinforced the phenotype expression of the character number of leaves per plant. The genetic share in the general phenotypic expression of leaf-number in the most of the studied combinations was relatively high and is above 50 % – an indication for starting the selection in the sooner hybrid generations. Only with Hybrid 725 the selection may start in the later hybrid generations.

Table 2. Genetic characteristics of the leaf number per plant

Crosses	T <sub>ii</sub>	N	D	E	H <sup>2</sup>	Pp
Hybrid 714 (K 730 x K 254)	1,59	11,77	11,22	22,28	-0,53	18,43
Hybrid 715 (K 730 x K 358)	0,51	8,48	8,52	19,48	-0,47	15,19
Hybrid 719 (RG 8 x K 358)	0,96	7,05	-12,16	28,33	-0,59	17,54
Hybrid 725 (K340 x K 358)	1,35	-9,14	-8,73	33,80	-0,36	14,17
Hybrid 726 (K 358 x NC 729)	1,87	11,16	9,46	19,66	-0,57	19,25
Hybrid 727 (K 358 x K 254)	0,44	-5,62	-14,63	25,44	-0,63	23,28

## CONCLUSIONS

1. The character number of leaves in Virginia tobacco crosses is inherited overdominantly, always in direction of the parent displaying a higher value of the character.

2. The number of genes influencing the expression of the studied character and differentiating between the parent components varies from 1 to 12. The strongly pronounced positive epistasis reinforces the phenotype expression of the character number of leaves per plant.

3. Significant positive heterosis was observed in 3 of the crosses, which confirms the heterosis as perspective for the character number of leaves per plant in Virginia tobacco.

4. The high values obtained for the inheritance coefficient and for effective mass selection of phenotypes show that the selection of genotypes characterized by higher number of leaves will be more effective in the sooner hybrid generations.

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