ISSN 0494-3244

Тутун/Tobacco,Vol.63, N⁰7-12, 15-19, 2013 UDC: 633.71-152.75:631.574

Original Scientific paper

INHERITANCE OF THE LEAF SIZE IN VIRGINIA TOBACCO CROSSES

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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 feature size of the leaves, the objective being the selection of desired genotypes. For this purpose, populations were investigated to P_1, P_2, F_1 and F_2 of six hybrid combinations. Data from hybridological analysis showed that in the studied samples of Virginia tobacco, inheritance of the length and width of leaves of the middle harvesting zone is overdominant and always in direction of the parent with the higher values. Heterosis and transgression appear reliable means of increasing the width of the leaves from the middle harvesting zone in Virginia tobacco. Middle and high values are determined for inheritability, so the selection of this sign will be effective in the early generations**.**

Keywords: Virginia tobacco, size of leaves, genetic analysis, inheritance, hereditability, transgression, heterosis.

НАСЛЕДУВАЊЕ НА СВОЈСТВОТО ГОЛЕМИНАТА НА ЛИСТОВИТЕ КАЈ ВИРЏИНИСКИТЕ КРСТОСКИ ТУТУН

Со примена на хибридолошка анализа, одредувани се природата и степенот на генетски интеракции, како и на извесен број на гени кои се разликуваат од почетните родителски форми и експресиите на хетерозис и трансгресија коишто се однесуваат на својството големина на листот, со цел да се изврши селекција на саканите генотипови. За таа цел, кај популациите беа испитувани P_1, P_2, F_1и F_2на шест хибридни комбинации. Податоците од хибридолошката анализа покажуваат дека кај проучуваните примероци од вирџиниски тутуни, наследувањето на должината и ширината на листовите од средниот бербен појас е супердоминантно и секогаш во правец на родителот со повисоки вредности. Хетерозисот и трангресијата се покажаа како релевантни средства за зголемување на ширината на листовите од средниот појас кај тутунот од типот вирџинија. Средни и високи вредности се одредени за наследноста, па така селекцијата на овој признак ќе биде ефективна во раните генерации.

Клучни зборови: вирџиниски тутун, големина на листовите, генетска анализа, наследност, херитабилност, трансгресија, хетерозис.

INTRODUCTION

The dimensions of the tobacco leaves are crucial for both yield and the percentage of first class (Dyulgerski, 2011; Kochoska and Risteski, 2011). As a result of studies on Virginia tobacco it has been found that the length of the leaves is inherited overdominantlyand dominantly to parent with longer leaves (Chinchev, 1979). Masheva (2007, 2008) found that the length of the leaves successively involves additive, additive-additive and dominant-dominant gene effects, and the sign determiningthe width is a fundamental part of the dominant gene effects. Mehta and others (1985) in his studies of Virginia tobacco found that the expression of the leading signs of leaf size, both length and width are for additive genetic effects. In tobacco for cigars, the inheritance of those signs with the highest proportion are additive genetic effects, both in length and width in succession leaves (Espino and Gill, 1980; Torrecila and Varroso, 1980). Epistacies strong interactions was observed in the inheritance of length of leaf from the middle zone (Dyulgerski, 2011).

Ibrachim and Avratovscukova (1982) and Peksuslu et al. (2002) obtained a high heritability in the broad sense - over 80% in length of the leaves. Amarnath (1987) found higher values for length and width of leaves. Such factors in the broad sense heritability - 83 and 96% for length and width of leaves were reported in other studies (Nizam Uddin and Newaz, 1983).

The aim of this study is through hybridological analysis to determine the nature and extent of gene interaction, number of genes that differ in parental forms, inheritability effect of selection and manifestations of heterosis and transgression concerning the length and width of leaves of middle harvesting zone (13-14 leaf) in tobacco Virginia crosses.

MATERIAL AND METHODS

For realizing the objective in training and experimental field of ITTI - Markovo village in the period 2008-2011, populations of six crosses were investigated to P_1, P_2, F_1 and F_2, including Virginia tobacco varieties introduced from the U.S. In terms of plant height, arithmetic mean ($\bar{x}$), the average error ($\pm \mathbf{S}\bar{x}$), degree of dominance (d/a) were determined by the formula of Mather and Jinks (1985) and the heterosis effect in terms of better parental form (HP) by Omarova (1975). Investigations were made on transgression (Tr), number of genes that differ in parental forms (N), dominance (D), epistacy (E), coefficient of heritability of the trait (h^2), coefficient of efficiency of the selection of genotypes in phenotypic expression of the trait (Pp) by Sobolev (1976).

RESULTS AND DISCUSSION

In our investigations of Virginia tobacco samples, inheritance of both the length and width of leaves is overdominant and always in direction of the parent with the higher values (Table1 and 2).

The manifestation of heterotic effect in the length of the ground leaves is insignificant (Table 1). Heterosis of significant values was observed in the first generation of Hybrid 726 (C 358 x NC 729), where heterosis effect slightly exceeds 5%.

The values of the coefficient of transgression showed insignificant values in terms of length, and its expression has significant values only in Hybrid 726, where in the available homozygous progenies plants may be selected with 1-2 cm greater length (Table 3). Heterosis and related trasngression as genetic phenomena have insignificant influence on its determining ground of leaf length from the middle harvesting zone surveyed in our Virginia tobacco crosses.

Unlike the length to width values of the leaves, significant heterosis was observed in five of the six crosses (Table 2). Most pronounced was it in Hybrid 715 (C 730 x C 358), with over 10%.

Similar results are obtained for the acts of transgression, which in all cases is positive (Table 4). With the exception of Hybrid 725, with other crosses available in homozygous progenies, plants may be selected with 2-3 cm wider leaves. Heterosis and transgression appear reliable means of increasing the width of the leaves from the middle harvesting zone in Virginia tobacco.

Data from hibridological analysis showed that the number of genes that differ in parental forms and influence the manifestation of the trait leaf length varies within narrow limits - from 9 to 13 (Table 3). Manifestation of symptoms is strongly affected by the negative epistacy interactions, which significantly reduces the appearance of dominant genes and their number also fluctuates within narrow limits.

The number of genes and their effect on the appearance of leaf width is too small - from 2 to 4 (Table 4). There is a strong expression of dominant gene effects, while that of epistacy is insignificant**.**

There are high values for inheritability the length of the leaves, indicating that environmental conditions did not strongly influence the determining factors of the trait. In all crosses tested heritability coefficient is above 50% (Table 3). There is therefore a high proportion of the effect of genotype on the manifestation of the studied indicators. Selection of this character will be effective in the early generations.

Lower than those in the length of leaves, but relatively high values of heritability coefficient were obtained with respect to the width of leaves (Table 4). In this case the selection will be effective in the early hybrid generations.

Table 1.Biometric data on length of the 13-14 leaf (cm)

Parents/crosses	**P₁** $\bar{x} \pm S\bar{x}$	**P₂** $\bar{x} \pm S\bar{x}$	**F₁** $\bar{x} \pm S\bar{x}$	**F₂** $\bar{x} \pm S\bar{x}$	**d/a**	**HP**
Hybrid 714 (C 730 x C 254)	61,2±0,17	60,7±0,23	63,8±0,21	62,3±0,26	11,4	104,2
Hybrid 715 (C 730 x C 358)	61,2±0,17	62,3±0,19	64,7±0,24	63,6±0,22	2,4	103,9
Hybrid 719 (RG 8 x C 358)	62,6±0,21	62,3±0,19	63,0±0,18	62,5±0,20	3,67	100,6
Hybrid 725 (C 340 x C 358)	62,1±0,15	62,3±0,19	63,7±0,25	62,4±0,21	1,4	101,8
Hybrid 726 (C 358 x NC 729)	62,3±0,19	61,4±0,14	65,6±0,28	63,7±0,25	8,33	105,3
Hybrid 727 (C 358 x C 254)	62,3±0,19	60,7±0,23	64,2±0,15	63,3±0,20	2,5	103

Table 2.Biometric data on width of the 13-14 leaf (cm)

Parents/crosses	P_1 $\bar{x} \pm S\bar{x}$	P_2 $\bar{x} \pm S\bar{x}$	F_1 $\bar{x} \pm S\bar{x}$	F_2 $\bar{x} \pm S\bar{x}$	d/a	HP
Hybrid 714 (C 730 x C 254)	30,4±0,16	30,8±0,14	33,7±0,18	33,1±0,16	15,5	109,4
Hybrid 715 (C 730 x C 358)	30,4±0,16	31,3±0,17	34,8±0,22	33,7±0,20	3,5	111,1
Hybrid 719 (RG 8 x C 358)	30,5±0,14	31,3±0,17	33,5±0,15	33,1±0,21	2,4	107
Hybrid 725 (C 340 x C 358)	32,1±0,13	31,3±0,17	33,0±0,18	32,4±0,16	3,25	102,8
Hybrid 726 (C 358 x NC 729)	31,3±0,17	31,9±0,19	34,4±0,23	33,6±0,18	2,7	107,8
Hybrid 727 (C 358 x C 254)	31,3±0,17	30,8±0,14	33,9±0,12	33,3±0,16	11	108,3

Table 3. Genetic characteristic of length of the 13-14 leaf

Crosses	Tr	N	D	E	h^2	Pp
Hybrid 714 (C 730 x C 254)	0,48	12,74	6,647	-19,65	0,63	16,86
Hybrid 715 (C 730 x C 358)	0,34	9,11	8,732	-23,38	0,56	13,57
Hybrid 719 (RG 8 x C 358)	-0,19	8,95	5,611	-15,44	0,60	21,44
Hybrid 725 (C 340 x C 358)	-0,42	11,54	8,778	-26,08	0,59	11,93
Hybrid 726 (C 358 x NC 729)	1,78	10,33	11,212	-36,16	0,76	36,41
Hybrid 727 (C 358 x C 254)	0,37	9,80	7,030	-20,54	0,52	8,91

Table 4.Genetic characteristic of width of the 13-14 leaf

Crosses	Tr	N	D	E	h^2	Pp
Hybrid 714 (C 730 x C 254)	2,19	3,46	28,36	0,22	0,47	6,26
Hybrid 715 (C 730 x C 358)	2,81	4,04	37,57	1,23	0,53	8,13
Hybrid 719 (RG 8 x C 358)	1,68	2,92	57,43	-0,66	0,41	5,51
Hybrid 725 (C 340 x C 358)	0,52	4,17	64,62	1,54	0,55	7,34
Hybrid 726 (C 358 x NC 729)	1,76	3,22	43,78	-0,85	0,44	6,03
Hybrid 727 (C 358 x C 254)	1,90	2,87	81,19	1,02	0,46	5,79

CONCLUSIONS

In our investigations of Virginia tobacco samples, inheritance of the length and width of the leaves of the middle harvesting zone is overdominant and always in direction of the parent with the higher values.

Heterosis and transgression appear reliable means of increasing the width of the leaves from the middle harvesting zone in Virginia tobacco.

There are very few genes influencing the determination of the trait width of leaves. The phenotypic manifestation of leaf length is strongly influenced by the negative epistacy interactions.

There are significant values for the heritability coefficient, which is why the investigated traits will be effective in the early generations of the studied crosses of Virginia tobacco.

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