Bulgarian Journal of Agricultural Science, 26 (No 1) 2020, 128–131

Hybridological analysis of the size of the leaves in hybrid combinations Burley tobacco

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Abstract

Dyulgerski, Y. (2020). Hybridological analysis of the size of the leaves in hybrid combinations Burley tobacco. *Bulg. J. Agric. Sci., 26 (1),* 128–131

Studied are the inheritance, coefficient of hereditability and of the teams, the minimal number of genes and the manifestations of transgression and heterosis in terms of length and width of the leaves of mid harvesting belt in Burley tobacco. For this purpose are investigated populations P_1, P_2, F_1 and F_2 seven hybrid combinations. Data from the hybridological analysis showed that studied of us options, inheritance of length and width of leave is overdominantnly and always in the direction of the parent with the higher values of the studies index. Manifestation of heterosis and transgression are relevant only on the width of the leaves. Are established very few and negligible variations in genes influencing determines the size of the leaves. Obtained low values for the coefficient of heritability, which is why the selection by signs a length and width of the sheet 13 to 14 will be effective in later hybrid generations.

Keywords: Burley tobacco; size of leaves; hybridological analysis; inheritance; hereditability; heterosis

Introduction

The size of the leaves in large-leaf tobaccos are crucial for the formation of yield and quality of the ready production (Bozukov, 2012; Bozhinova, 2016; Docheva et al., 2015; Kososka & Risteski, 2011; Korubin – Aleksoska, 2016b; Malinova et al. (2018), Mutafchieva, 2014; Nicolova & Drachev, 2006; Pearce, 2014; Popova et al., 2006; Yonchev et al., 2018; Yonchev & Keranova, 2019).

Stankev (2001) reported for overdominantly and dominantly inheritance in F_1 of the length of the leaves and Palakartcheva & Yancheva (1986) for the width of the leaves. This is according similar studies and the reported by Metha et al. (1985). Number of authors (Moses et al., 1976, Patel, 1976) has been reported for leading not additive gene effects in this feature. Rrasada Sastry and Rao (1980) found that in crosses of Burley type inheritance of this trait resulting in the expression of the trait are dominant genetic effects. According to Espino & Gill, (1980) Torrecila & Barroso (1980); Masheva,2009; Masheva et al., 2009 and Korubin – Aleksoska, 2016a the inheritance of the length of leaves is determined by the additive and dominant gene effects, and the width of single dominant and epistative.

Most authors reported a high coefficient of heritability in terms of the size of the leaves (Ibrachim & Avratovscukova, 1982; Stankev, 2001; Risteski et al., 2012). Peksuslu et al. (2002) establishes high heritability in the broad sense – over 80% of the length of the leaves and Shyu et al. (1975) receives such a width of leaves – 84%. Nizam Uddin and Newaz, (1983) reported for coefficients of heritability in the broad sense – 83 length and 96% width of the leaves.

The aim of the study is through hybridological analysis to determine character and extent of the gene interaction, the number of genes that differ in parental forms, the coefficients of heritability and the effect of the selection and manifestations of heterosis and transgression on the length and width of leaves of medium harvesting belt (13–14 leaf) in Burley

tobacco hybrid combinations in order to use the obtained results in the selection activity.

Material and Methods

For the realization of its objective are tested populations P_1, P_2, F_1 and F_2 of seven hybrid combinations of Burley tobacco, namely: Hybrid 1528 (Line 1383 x Banket 102), Hybrid 1530 (Burley 1344 x Banket 102), Hybrid 1531 (Burley 1344 x Burley 1000), Hybrid 1532 (Burley 1344 x Kentucky 907), Hybrid 1533 (Burley 1344 x Kentucky 8959, Hybrid 1534 (Kentucky 907 x Burley 1317) and Hybrid 1536 (Kentucky 907 x Burley 1000). The investigations are the size of leaves a mid harvesting belt (13–14 leaf) as the representative of Burley tobacco. Biometric measurements are made on 300 plants of option. The experimental work was carried out in the experimental field-study of TTPI – Markovo in the period 2010–2012.

Regarding the height of the plants and the number of leaves are determined: the arithmetic mean ($\bar{x}$), the average error of the arithmetic mean ($S\bar{x}\%$), degree of dominance (domination extent) (d/a) in the formula of Mather & Jinks (1985), heterosis effect to better parental form (HP) in Omarov (1975). Also are identified: an indicator of transgression (Tn), the minimal number of genes that differ in parental forms (N), dominance (D), epiztaz (E) coefficient of heritability (H^2), coefficient of effective selection by genotypes in phenotypic expression of the trait (Pp) by Sobolev (1976).

Results and Discussion

In the studied of us samples Burley tobacco in the first generation, the inheritance of the length of the leaves is overdominantly, the strongest is expressed in Hybrid 1534 (Ky 907 x B 1317). The inheritance is always in the direction of the parent with the higher values (Table 1).

Negligible is the manifestation of heterosis effect on the signs length of leaves of medium harvesting belt (Table 1). Heterosis of significant figures is observed only in the first generation of crossing Hybrid 1428 (L 1383 x B 102) and Hybrid 1530 (B 1344 x B102), where heterosis effect of the limit of significance.

The inheritance of width of the leaves in the studied hybrid combinations is also over dominantly especially in Hybrid 1531 (B 1344 x B 1000). The direction of inheritance is always in relation to the parent with higher values of the width of the leaves.

Unlike the length to the width of the leaves, significant heterosis was observed in all seven researches crosses (Table 2). Especially pronounced when it is Hybrid 1428 (L 1383 x B 102) and Hybrid 1530 (B 1344 x B 102), where its value exceeds 10%. And the length and width of leaves heterosis with the highest values obtained when the hybrid variety combinations involved Banket 102 variety.

Coefficient values of transgression are negligible on the length of the leaves, and its expression has significant values only in Hybrid 1428 (L 1383 x B 102) and Hybrid 1530 (B

Table 1. Biometric data of length of 13–14 leaf /cm/

Crosses	P_1	P_2	F_1	F_2	d/a	HP
	$\bar{x}\pm S\bar{x}\%$	$\bar{x}\pm S\bar{x}\%$	$\bar{x}\pm S\bar{x}\%$	$\bar{x}\pm S\bar{x}\%$		
Hybrid 1528	57.8±0.21	59.2±0.23	63.6±0.19	61.9±0.28	4.4	107.4
Hybrid 1530	61.6±0.17	59.2±0.23	64.8±0.17	62.6±0.26	6.3	105.2
Hybrid 1531	61.6±0.17	60.5±0.22	62.5±0.20	61.4±0.28	1.7	101.5
Hybrid 1532	61.6±0.17	59.7±0.21	64.3±0.14	63.3±0.27	3.8	104.4
Hybrid 1533	61.6±0.17	58.1±0.25	63.8±0.18	62.5±0.27	2.3	103.6
Hybrid 1534	59.7±0.21	59.1±0.26	62.1±0.22	61.5±0.29	9	104
Hybrid 1536	59.7±0.21	60.5±0.22	63.0±0.19	61.8±0.26	2.5	104.1

Table 2. Biometric data of width of 13–14 leaf /cm/

Crosses	P_1	P_2	F_1	F_2	d/a	HP
	$\bar{x}\pm S\bar{x}\%$	$\bar{x}\pm S\bar{x}\%$	$\bar{x}\pm S\bar{x}\%$	$\bar{x}\pm S\bar{x}\%$		
Hybrid 1528	29.9±0.18	30.2±0.21	33.7±0.13	32.2±0.23	3.5	111.6
Hybrid 1530	31.8±0.13	30.2±0.21	35.3±0.12	33.2±0.25	5.4	111
Hybrid 1531	31.8±0.13	31.4±0.18	34.4±0.11	32.6±0.26	14	108.2
Hybrid 1532	31.8±0.13	30.4±0.20	34.8±0.10	33.1±0.25	5.3	109.4
Hybrid 1533	31.8±0.13	29.6±0.22	33.9±0.12	31.9±0.26	2.9	106.6
Hybrid 1534	30.4±0.20	29.3±0.21	32.5±0.16	31.3±0.28	4.8	106.9
Hybrid 1536	30.4±0.20	31.4±0.18	33.3±0.15	32.4±0.27	1.9	106

Table 3.Genetic characteristic of length of 13–14 leaf

Crosses	Tn	N	D	E	H^2	Pp
Hybrid 1528	1.27	2.44	14.77	-25.74	0.331	0.922
Hybrid 1530	0.98	2.73	9.38	-13.42	0..286	0.748
Hybrid 1531	0.22	3.13	7.86	-11.62	0.357	0.935
Hybrid 1532	0.41	2.85	8.44	-13.6	0.448	1.453
Hybrid 1533	0.26	2.18	11.08	-15.86	0.297	0.801
Hybrid 1534	0.36	2.91	14.13	-23.23	0.365	1.043
Hybrid 1536	0.34	3.06	10.5	-14.33	0.409	1.228

Table 4. Genetic characteristic of length width of 13–14 leaf

Crosses	Tn	N	D	E	H^2	Pp
Hybrid 1528	1.27	2.44	14.77	-25.74	0.331	0.922
Hybrid 1530	0.98	2.73	9.38	-13.42	0.286	0.748
Hybrid 1531	0.22	3.13	7.86	-11.62	0.357	0.935
Hybrid 1532	0.41	2.85	8.44	-13.6	0.448	1.453
Hybrid 1533	0.26	2.18	11.08	-15.86	0.297	0.801
Hybrid 1534	0.36	2.91	14.13	-23.23	0.365	1.043
Hybrid 1536	1.38	1.88	0.8	-3.37	0.01	-0.124

1344 x B 102) where available in homozygous offspring may be selected plants with 1 cm greater length of leaves (Table 3).

To the feature width of the leaves acts of transgression in all hybrid combinations is a significant positive value (Table 4). In homozygous offspring available in Hybrid 1428 (L 1383 x B 102) and Hybrid 1530 (B 1344 x B 102) may be selected plants 2 cm width greater leaf from baseline parental forms, others five hybrid combinations of 1 cm. The results indicate that heterosis and transgression and genetic events can be used in the selection Burley tobacco to increase the width of the leaves.

Manifestations of transgression are related to acts of heterosis in all tested samples tobacco in both and observed signs.

Data from the hybridological analysis show that the minimal number of genes that differ in parental forms and influencing the manifestation of the trait length of leaves is small and varies in a very narrow range – 2 or 3 (Table 3). On the manifestation of the signs strongly influencing by dominant genes whose phenotypic expression is significantly reduced by negative epistative interactions. The more pronounced is the influence of dominant genes more highly expressed and negative epistaz.

The minimal number of genes and influencing the manifestation of the trait leaf width is small and varies slightly – one or two (Table 4). Manifestation of dominant gene effects is negligible. Although with less impact than the trait length of leaf negative epistative interaction have a significant influence on manifestation the width of the leaves.

Regarding the length of the leaf values of the coefficient of heritability range from low to medium (Table 4). This indicates a low share of the impact of genotype on manifestation research signs. Assume the selection will be effective in the later hybrid generations ($F_4 – F_5$).

In terms the trait the width of leaves are established even lower values of the coefficient of heritability. This suggests that environmental conditions strongly influence on the manifestation of the trait. In this case, the selection will be more effective in even later generations ($F_5 – F_6$), which seriously hampers the selection work.

Conclusion

In the studied of us hybrid combinations Burley tobacco, inheritance of the length and width of leaves of middle harvesting belt is over dominantly always in the direction of the parent with the higher values of the researches indicator.

Heterosis and transgression showed significant values for the width of the leaves, which is a prerequisite for their use in the selection of Burley tobacco.

Few or negligible variations are established in genes influencing the trait determines the size of a middle harvesting belt.

The selection in terms of length and width of leaves especially be effective in later hybrid generations, due to be low values of the coefficient of the heritability.

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Received: December, 13, 2018; *Accepted:* January, 16, 2019; *Published:* February, 29, 2020