ISSN 0494-3244

Тутун/Tobacco,Vol.64, N^{0}1-6, 12-18, 2014 UDC: 633.71-152.75:575.22(497.2)

Original Scientific paper

ANALYSIS OF GENE EFFECTS AND INHERITANCE OF SOME QUANTATIVE PARAMETERS IN ORIENTAL TOBACCO VARIETIES

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ABSTRACT

The generation, P_1, P_2, F_1, F_2, BCP_1 and BCP_2 of each of the crosses (Plovdiv 50 x basma Xanti 101) and (Krumovgrad 90 x Basma Xanti 101) were used for estimation of gene effects, for plant height, number of leaves per plant, and flowering time. The trial was set up in a randomizet block design with four replications in the experimental field of TTPI in 2009-2011. The observations were recorded on 80 plants from the P_1, P_2 and F_1 generations and 160 plants from F_2, BCP_1 and BCP_2 generations. The varieties used were divergent for all the characters.

In cross (Plovdiv 50 x Basma Xanthi 101) the presence of additive and non additive gene effects (plant height and flowering period) suggested the feasibility to evolve homozygous elite genotypes by cyclic method and inter se crossing among the desirable recombinants keeping adequate population size. Additive effects were predominant in the expression of leaves number and suggests that it be easier to isolate desired tobacco genotypes from this population by Pedigree method of selection.

In cross (Krumovgrad 90 Basma Xanthi 101) Involvement additive as well as epistatic (additive x additive and additive x dominance) effects of plant height, number of leaves and flowering period to conserve additive as well as nonadditive gene effects - cyclic method of breeding would be more effective.

Keywords: tobacco, gene effects, plant height, number of leave, flowering time

АНАЛИЗ НА ГЕННИТЕ ЕФЕКТИ И НАСЛЕДЯВАНЕ НА НЯКОИ КОЛИЧЕСТВЕНИ ПРИЗНАЦИ ПРИ СОРТОВЕ ОРИЕНТАЛСКИ

За оценка на генни ефекти по признаците височината на растенията, брой листа и вегетационен период са изследвани родителските сортове P_1, P_2 и F_1, F_2, BCP_1 и BCP_2 на хибридните комбинации (Пловдив 50 х Басма Ксанти 101) и (Крумовград 90 х Басма Ксанти 101). Опитът бе изведен в четири повторения в опитното поле на ИТТИ през периода 2009-2011. Броят на биометричните измервания е 80 растения за родителските сортове и F_1 и 160 растения за F_2, BCP_1 и BCP_2. Използваните сортовете ясно се различават по изследваните признаци.

В хибридната комбинация (Пловдив 50 х Басма Ксанти 101) установените адитивни и неалелни взаимодействия за признаците (височината на растенията и вегетационен период) предполагат възможност за отбор на хомозиготни елитни генотипове чрез периодичен метод на отбор сред желаните рекомбинанти като се запазва адекватен размера на популацията.

В експресията на признака брой листа адитивните генни ефекти са определящи, което позволява селекционната работа да се провежда чрез метода Pedigree.

В кръстоската (Крумовград 90 х Басма Ксанти 101) при наследяване на изследваните признаци участие вземат адитивни и епистатни генни ефекти (доминантни х доминантни и адитивни х доминатни). За запазване на алелните, както и неалелните генни ефекти – реципрочния периодичен отбор ще бъде по-ефективен.

Ключови думи: тютюн, генни ефекти, височина на растенията, брой листа, вегетационен период

INTRODUCTION

Optimization of the selection process to create new varieties of oriental tobacco is done by applying various models to describe processes that occur in inheritance in the hybrid generation (Yankulov, 1996; Manolov, 1985). Quantitative traits in tobacco are controlled by both alleles and by not alleles interactions that occur between genes. (Kurteva 1996, Petrova 1996).

The additive interaction among the alleles plays an essential role in nature as it provides flexibility environment (Petrova 1996, Stankev 1988, Metha et al., 1985). The degree of trait variation depends both on plant genotype and environment as well as on the interaction between them. In the selection of oriental tobacco, there are a number of quantitative indicators playing a role in the evaluation of new varieties.

Productivity, cigarette yield and homogeneity of the tobacco stuff are traits of great economic importance for tobacco varieties, but the results of genetic analysis are not always unidirectional, due to the large number of genes that are affected by each of them (Petrova1996, Kurteva 1996). The genotype plays a decisive great role on the expression of most important economic traits of Burley and oriental tobacco (Dyulgerski et al., 2013, Taskova et al., 2005).

Moreover, some of the genes controlling quantitative signs are stable with respect to their phenotypic expression, while others exhibit a large degree of variability. Since most tobacco traits important for successful breeding are of quantitative nature, the estimation of the mode of inheritance contributes to their better understanding (Boturac at al., 2004).

The objective of this study was to estimate mode of inheritance and gene effects and some quantitative traits of Oriental tobacco.

MATERIAL AND METHOD

The material consisted of four oriental varieties Plovdiv 50, Krumovgrad 90 and BasmaXanti 101. Six genetic population P_1, P_2, F_1, F_2, BCP_1 and BCP_2 were grown for each of the crosses (Plovdiv 50 x Basma Xanti 101) and (Krumovgrad 90× Basma Xanti) in a randomized block design with four replication under each cross at the experimental field, Tobacco and Tobacco Products Institute, Plovdiv during 2009-2011. The three varieties were divergent in their morphological characters.

The plants were grown in accordance with the recommended practices for oriental tobacco cultivation. The observations were recorded on ten plants selected at random per plot from the P_1, P_2, F_1 generations and twenty from BC_1, BC_2 and F_2 generations.

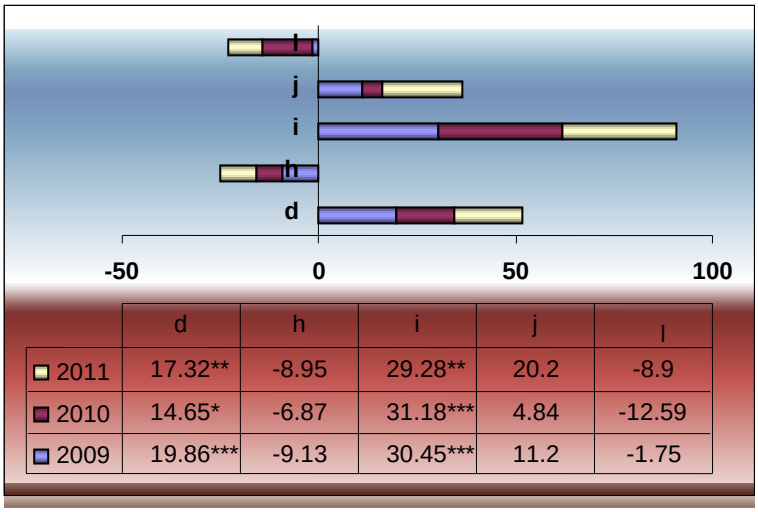
The data were statistically analyzed (Genchev et al., 1975). The gene effects

for all the characters was made after Cavalli L. test (Mather and Jinks, 1985).

RESULTS AND DISCUSSION

Plant height

The estimates of gene effects for plant height in cross (Plovdiv 50 x Basma Xanti101), are presented in fig.1.

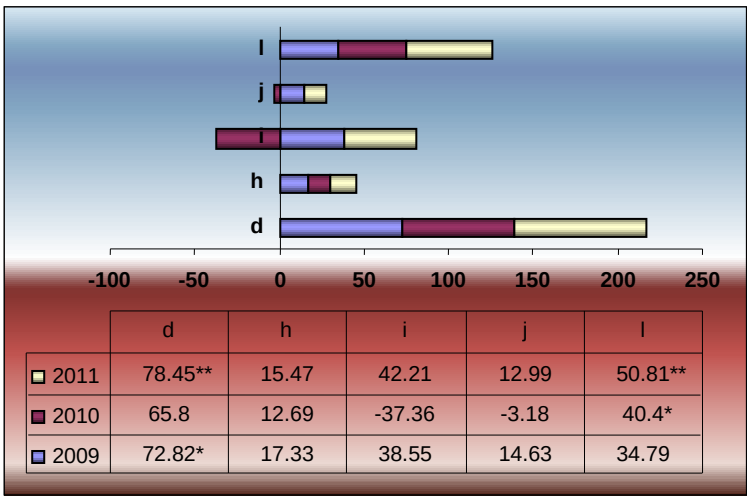


	d	h	i	j	l
2011	17.32**	-8.95	29.28**	20.2	-8.9
2010	14.65*	-6.87	31.18***	4.84	-12.59
2009	19.86***	-9.13	30.45***	11.2	-1.75

Figure1. Gene effects for plant height in cross (Plovdiv 50 x Basma Xanti 101)

Analysis of parameters describing the inheritance of plant height indicated that the additive as well as its higher order interaction (additive × additive) effects, governed the expression of this trait. For the entire period of examinations performed additive and (additive × additive) gene effects were relatively highest density in the formation of height of plants. During the whole period of their values were established at the highest level of probability.

In cross (Krumovgrad 90 x Basma Xanti 101) barring additive and dominance x dominance effects, all kinds of gene effects were nonsignificant.



	d	h	i	j	l
2011	78.45**	15.47	42.21	12.99	50.81**
2010	65.8	12.69	-37.36	-3.18	40.4*
2009	72.82*	17.33	38.55	14.63	34.79

Figure 2.Gene effects for plant height in cross (Krumovgrad 90 x Basma Xanti 101)

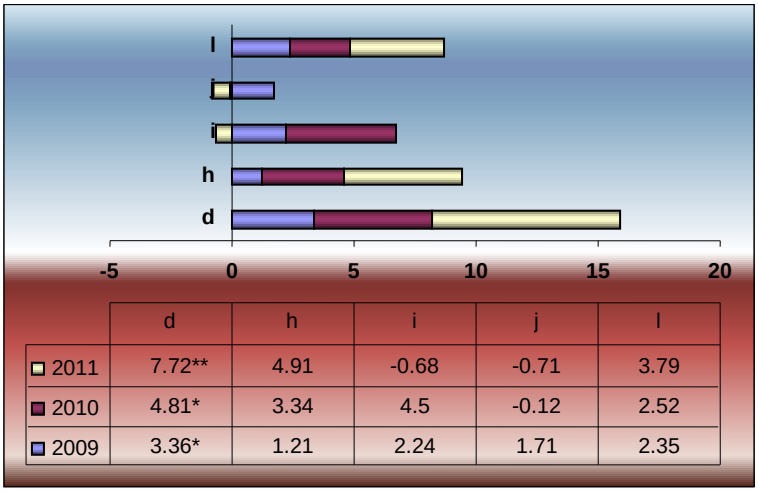
According to the previous investigations, the inheritance of plant height (Shoai Daylami and Honarneja 1996, Butorac et al. 1999) is more influenced by nonadditive variance. Our present results also point to the same conclusion (Masheva, V., 2008).

Number of leaves per plant

Number of leaves per plant is important characters closely related to the yield of tobacco crop. Leaf number is one of the strongly genetically conditioned traits. According to most studies this trait is inherited additively (Petrova 1996, Daylami and Honarneja 1996, Shamsuddin et al. 1980).

The assessment results in this trait indicate that both additive as well as epistatic (dominance x dominance), governed the number of leaves per plant in cross (Plovdiv 50 x Basma Xanti101) (fig.3).

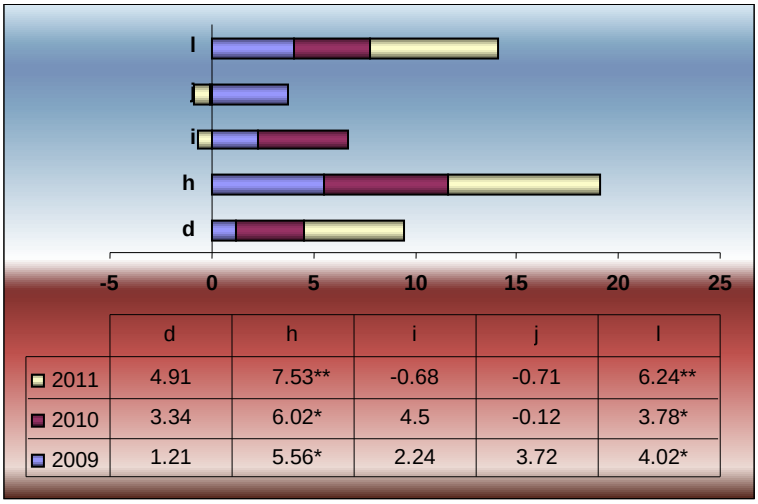
Leaf potential is a direct attribute of yield. The involvement of non additivity (epistasy) along with additive effects for number of leaves suggested that cyclic method of breeding would be more effective for improving this trait in the population of this cross.



	d	h	i	j	l
2011	7.72**	4.91	-0.68	-0.71	3.79
2010	4.81*	3.34	4.5	-0.12	2.52
2009	3.36*	1.21	2.24	1.71	2.35

Figure 3.Gene effects number of leaves in cross (Plovdiv 50 x Basma Xanti 101)

In cross (Krumovgrad 90 x basma Xanti 101) dominance and dominance x dominance (j) type of epistatic were important. Similar type of observations were recorded by Menta (1985) have reported the presence of both additive as well as nonadditive effects in the expression of leaf number.



	d	h	i	j	l
2011	4.91	7.53**	-0.68	-0.71	6.24**
2010	3.34	6.02*	4.5	-0.12	3.78*
2009	1.21	5.56*	2.24	3.72	4.02*

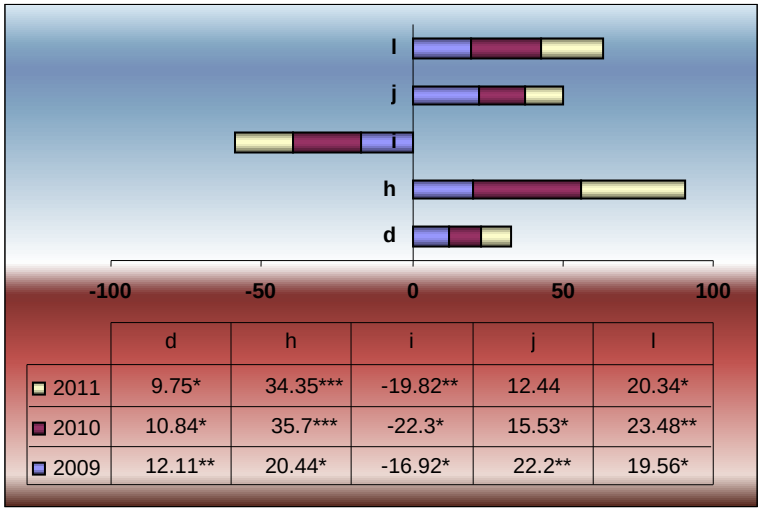
Figure 4.Gene effects number of leaves in cross (Krumovgrad 90 x Basma Xanti 101)

The variety Krumovgrad 90 possessed more number of leaves. When such type of varieties are to be used as donor parents, selection of plants are desirable for increasing the yields. Dominance (h) and interaction component (dominance x dominance) are associate with positive signs. This indicates an increase effect due to their gene action.

Flowering period

The estimates of gene effects for flowering period indicated that in the expression of this trait were involved all kind of gene effects. All parameters studied are presented and demonstrated high values and were significant over the entire period of study.

In fig. 5 are presented results of gene effects for flowering period in cross (Plovdiv 50 x Basma Xanti 101).

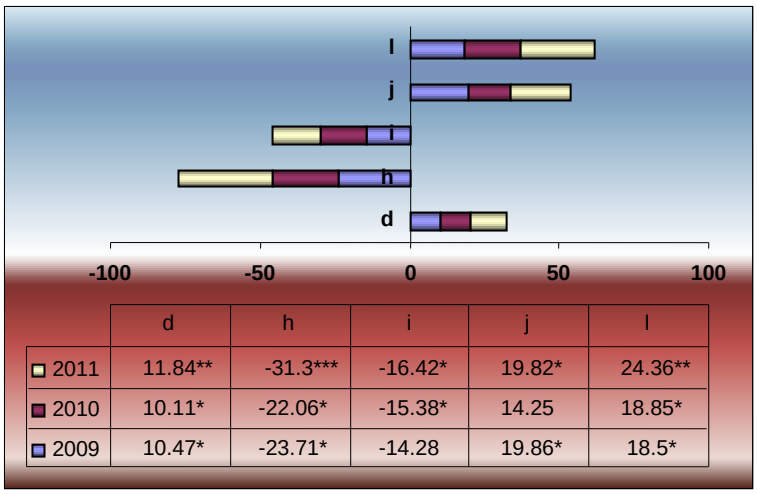


	d	h	i	j	l
2011	9.75*	34.35***	-19.82**	12.44	20.34*
2010	10.84*	35.7***	-22.3*	15.53*	23.48**
2009	12.11**	20.44*	-16.92*	22.2**	19.56*

Figure 5.Gene effects flowering period (Plovdiv 50 x Basma Xanti 101)

All kinds of gene effects significant in the expression of this trait in cross. Dominance and (dominance x dominance) variance were greater in magnitude, next in order being (additive x additive) and (additive x dominance).

In cross (Krumovgrad 90 x Basma Xanti 101) all kinds of gene effects were significant (fig. 6).



	d	h	i	j	l
2011	11.84**	-31.3***	-16.42*	19.82*	24.36**
2010	10.11*	-22.06*	-15.38*	14.25	18.85*
2009	10.47*	-23.71*	-14.28	19.86*	18.5*

Figure 6.Gene effects flowering period (Krumovgrad 90 x Basma Xanti 101)

The dominant (h) effect was significant and the most values. Negative signs of dominant effect indicate that the expression of the trait would be in the direction of a parent with a small length of flowering period. In this event that is very desirable, since a variety Krumovgrad 90 has a relatively long growing season and in years has created problems in the maturation, harvesting and drying of raw material.

Our previous results also point to the same conclusion (Masheva et al., 2009). Many workers like Butorac et al. (1999), Petrova (1996), Mehta et al. (1985) have reported the presence of both additive as well as nonadditive gene effects for this trait.

CONCLUSIONS

The estimation of gene effects of plant height, number of leaves and flowering period showed complex determination of these traits and define effective methods of selection:

- In cross (Plovdiv 50 x Basma Xanthi 101) the presence of additive and non additive gene effects (plant height and flowering period) suggested the feasibility to evolve homozygous elite genotypes by cyclic method and inter se crossing among the desirable recombinants keeping adequate population size. Additive effects were predominant in the expression of leaves number and suggests that it be easier to isolate desired tobacco genotypes from this population by Pedigree method of selection.

- In cross (Krumovgrad 90 Basma Xanthi 101) Involvement additive as well as epistatic (additive x additive and additive x dominance) effects of plant height, number of leaves and flowering period to conserve additive as well as nonadditive gene effects - cyclic method of breeding would be more effective.

REFERENCES

1. Butorac J., J.Beljo, J.Gunjača. 2004. Study of inheritance of some agronomic and morphological traits in burley tobacco by graphic analysis of diallel cross. Plant Soil Environ, *50*, (4): 162–167
2. Butorac J., D.Vasilj, V. Kozumplik, J.Beljo.1999. Quantitative parameters of some burley tobacco traits. Rostl. Výr., *45*: 149–156
3. Dyulgerski Y., S. Kirkova, 2013. Impact of Weather conditions on Economical and Quality Indices of Burley Tobacco Varieties. Journal of Balkan Ecology, vol. 16, №3, 281-287
4. Espino E., Gil M., 1980. Analysis of the quantitative variation in bright tobacco (*N. tabacum L.*) varieties. Cubatabaco, *2*: 31–43.
5. Genchev.G., E. Marinkov, V. Yovcheva, A. Ognianova. 1975. Biometric methods in crop production, genetics and selection. Zemizdat, Sofia.
6. Kurteva G. 1996. Comparative genetic characterization of varieties and dihaploid lines oriental tobacco. Thesis.
7. Manolov A. 1985. Genetic modifications used in inter-hybridization and their use in selection, Bulgarian tobacco, 6, 17-22
8. Masheva V**.**, R.Todorova and D.Dimanov, 2009. Mode of Gene Action of Some Traits in Inter-Varietal Crosses of Oriental Tobacco (*N. tabacum* L.). Genetics and Breeding, vol.38, № 3-4, 129-134
9. Masheva V. 2008. Investigation inheritance of main indications of oriental tobacco (N.tabacum, L.) and possibility for using of praline as stress marker in breeding. Thesis
10. Mather, K. and J. L. Jinks. 1985. Biometrical Genetics. Chap.4.65-82. Chapman and Hall Ltd., London
11. Yankulov, M.1996. Principles and methods for genetic and seed plants improving. Sofia
12. Mehta A., G.J. Patel and B.G. Jaisani. 1985. Genetic Analysis of some agro-morphological Traits of Nicotiana tabacum L. Tob. Res. 11 (2), 148-154
13. Pandeya R.S., V.A.Dirks, G. Poushinsky. 1983. Quantitative genetic studies in flue-cured tobacco (*Nicotiana tabacum*). I. Agronomic characters. Can. J.Genet. Cytol., *25*: 336–345.
14. Petrova K., 1996. Breeder genetic studies in Dzhebel tobacco, Thesis.
15. Shoai Daylami M. and R.Honarneja .1996.Gene effects and combining ability of some quantitative characteristics of tobacco varieties (*Nicotiana tabacum*). Bull. Spec. Coresta, 182.
16. Stankev G., 1988. Inheritance of quantitative attributes events and transgression in heterozis Intervarietal hybrid origin of tobacco Dupnitsa. Thesis.
17. Taskova L., Y. Kochev and M. Kasheva. 2005. Agroecological assessment of yield, quality and adaptability of oriental tobacco variety Kroumovgrad 988. Agricultural University, Plovdiv L, vol. 4, 115-119