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MONOHYBRID RECESSIVE INHERITACE OF THE LENGTH OF GROWING PERIOD IN SOME ORIENTAL TOBACCO VARIETIES

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ABSTRACT

Inheritance of length of growing period (days from transplanting to the beginning of flowering) was investigated by crossing Basma tobacco variety with shorter growing period and Veliki Hercegovac variety with longer growing period.

It could be stated that all plants in F1 generation began their flowering in the same time with parental variety with shorter growing period. From the self-pollinated hybrid individuals of F_1 generation, 3/4 of plants in F_2 generation had short growing period (under the influence of dominant allele) and 1/4 of plants had long growing period under the influence of recessive allele. Split ratio was 3:1 and frequencies distibution was assessed by X2 (chi-square) test.

Knowing that breeding work often imposes the use of characters inherited in a monohybrid recessive mode, we made efforts to use this type of inheritance in creation of new, more productive tobacco genotypes with longer growing period compared to the early maturing variety, preserving in the same time its quality features.

Keywords: production, monohybrid,growing period, tobacco, oriental

МОНОХИБРИДНО РЕЦЕСИВНО НАСЛЕДУВАЊЕ НА ДОЛЖИНАТА НА ВЕГЕТАЦИОНИОТ ПЕРИОД КАЈ НЕКОИ ОРИЕНТАЛСКИ СОРТИ ТУТУН

Со овие истражувања е проучувано наследувањето на должината на вегетациониот пери-од (денови од расадување до почеток на цветање), при вкрстување на една сорта тутун од типот басма (со кратка вегетација) и сортата Велики Херцеговац(со долга вегетација). Во F_1генерацијата е констатирано дека сите растенија започнуваат да цветаат истовремено со родителската сорта со кратка вегетација.

Од самоопрашените хибридни индивидуи од F_1 генерација, во следната F_2 генерација се добиени околу 3/4 од растенијата со кратка вегетација (условени од влијанието на доминантниот алел),а 1/4 од растенијата се со долга вегетација (условени од рецесивниот алел). Цепењето е во сооднос 3:1, а соодветноста на фреквенциите е тестирана по критериумот на X^2 (хиквадрат) тестот.Имајки го предвид фактот дека во селекционата работа често пати се налага потребата од искористување на својствата кои се наследуваат монофакторијално рецесивно, си поставиовме за цел овој начин на наследување да го примениме при создавањето на нови попродуктивни генотипови тутун со подолг вегетационен период од родителската раностасна сорта, а притоа задржувајки ги нејзините квалитетни својства.

Клучни зборови: производство, монохибридно,вегетационен период,тутун, ориенталски.

INTRODUCTION

In hybridization process, genetically stable parental components, according to Mendel, always have allelomorphic, i.e. allelic characters, which are homozygous and have AA or aa alleles (Borojevic S., Borojevic K., 1976; Stojkovski C., Ivanoska S., 2002, etc). These organisms produce one type of gametes. By merging the gametes with different alleles from both parents, the first hybrid generation (F_1) is obtained, the progeny of which is heterozygous (Aa). Hybrid units of this progeny are equal with regard to the character investigated, in accordance with the First Mendel's Law, i.e. the principle of uniformity of F_1 individuals. F_1 hybrid self-pollinate to create F_2 generation, in which segregation of characters in certain phenotypic and genotypic ratio is made, in accordance to the Second Mendel's Law on segregation in F_2 generation (Genchev 1980, Marinkovic 1982, Gershenson 1983, Ayala F. J., Kiger J.A.1984 etc.).

In modern selection, hybridization is the most appropriate method for creation of the necessary diversity of initial breeding material from which new varieties of plants can be created and stabilized.

Inselection work and hybridization, sometimes it is necessary to preserve some properties that have a recessive character. The goal of our investigations was to show practically the model of monohhybrid recessive inheritance and stabilizationof the character length of growing period in hybridization of the oriental variety Basma (with short growing period) and the variety Veliki Herzegovac (with long growing period).

MATERIAL AND METHODS

Trials were set upon the Experimental field of Tobacco Institute, Prilep, starting from2008.

Two tobacco varieties were used as starting material for hybridization: Basma (with short growing period) and Veliki Hercegovac (with long growing period). The length of the growing period from planting to the beginning of flowering ranged from 55 daysin Basma variety to over 120 days in Veliki Herzegovac. The length of the growing period from planting to the end of maturation of top leaves ranged from 95 - 110 days in Basma to over 180 days in Veliki Herzegovac (according Uzunoski, 1985).The choice of parental varieties was made on the basis of previous investigations. The crossing was completed in 2008, with Basmavariety as a mother, and Veliki Herzegovacas a father. F_1 progeny was obtained iIn 2009, F1 and F_2in 2010 and F_3 in 2011. The breeding process was carried outafter the method of intraspecies hybridization and Mendel's basic laws on inheritance, applying the pattern of monohybrid recessive inheritance of the investigated character (Scheme 1). Hybrid progenies of F_1, F_2 and F3 generations were grown on suitable area with sufficient number of individuals, complying with the needs of the proposed selection program. The F2 generation was monitored for cleavage (segregation) of the character and the goodness of fit for the frequencies was determined using the chi-squared ($x2$) test (Ayala F.J., Kiger J.A., 1984). Statistical analysis of cleavage in F_2 generation after this test wasobtained from the ratio between the actual (empirical) and theoretical values, according to which the probability P is determines in case when deviation is regular, using the Fisher's

table. In agricultural sciences, the p-valueis conditionally defined to be equal to the value at 0.05.

RESULTS AND DISCUSSION

The process of hybridization started bycrossing the oriental shorter-growing variety Basma (AA) as maternal component and semioriental longer-growing variety Veliki Herzegovac (aa) as paternal component. In hybrid progeny of F1 generation heterozygous, phenotypically uniform individuals (Aa) with respect to the investigated character were obtained.

All hybrid individuals had a short short growing period, i.e. theyflowered almost simultaneously with the parent with shorter growing period, which indicates that this alternative character (allele) is dominant, and the longer growing period is recessive. Gornik (1973) reported thatthe period required for flowering sometimes appears as a dominant and sometimes as recessive character, depending on the varieties taken for hybridization.

Such mode of inheritance of the length of growing period was also stated by other authors. Thus, Chinchev (1979), usingthe top-cross method in his analysis of F1 hybrids, reported the lowest GCA valuefor the character days to flowering in oriental varieties Krumovgrad 988 and Plovdiv 7, as well as in Virginia varieties NC 2326 and Mc Nair 20, i.e. they had a shorter growing period, while longer growing period was observed in Virginia varieties 1349 and Coker 254. Stankev (1987) reported the highest GCA value in varieties Krumovgrad 90, Rila 544 and line 202-1a, i.e. those varieties showed the best GCA, i.e. longer growing period, regardless of the change of varieties that served as a tester. He also suggested that varieties Sandanski 321, No 888, Rila 9, Plovdiv 7 and Struma 75 can be used in cases where shorter growing period is required.

Bogdanceski (1984), in his three-year investigations of various hybrid combinations, reported differences in the inheritance of the character length of the growing period until 50% of flowering. Thus, Prilep x Nevrokop 261 and Prilep x Pazardzik 17 and their reciprocal crossings showed dominant inheritance of this character, i.e. all plants from F_1 flowered simultaneously with the variety Prilep (with shorter growing period), and other hybrid combinations showed intermediate inheritance.

From self-pollinated hybrid individuals of F1 generation, phenotypically different plants were derived in a ratio 3: 1, i.e. 3 plants (75%) are with shorter growing period and 1 plant (25%) is with longer growing period.

The results of statistical analysis (Table 1) of plants with short / long growing period ratio in F_2 progeny showed that theoretically expected segregation (3:1) was obtained.

Sinceinour casethe calculated value of $x2$=1.92 does not exceed the Table value for P = 0,05 (3,84), it means that actually obtained segregation is in compliance with theoretically expected 3:1 ratio.

Table 1. Ratio between the plants with short and long growing period in hybrid combination Basma x VelikiHerzegovac

Variants	Number of plants in F^2 generation		χ^2	P
	with short growing period	with long growing period		
Investigated individualsexperimental figures**(e)**	219	87	$\chi^2=\Sigma d^2/t$	0,05=3,84
Expected individualstheoretical figures**(t)**	229,5	76,5	$\chi^2=1,92$	
Deviation (**d**)	10,5	10,5		
d^2	110,25	110,25		
d^2/t	0,4803	1,4411		

Accordingly, it may be concluded that division (segregation) of the investigated character was observed in F_2 generation, where the theoretical ratio of the genotypes (presented on Scheme 1) was: 1AA : 2Aa: 1aa, i.e. 75% of the plants in this hybrid progenyhad short growing period (Aa and AA) and 25% were homozygous, with long growing period (aa).

Most of the plants (75%) of Aa and AA genotype with short growing periodwere not grouped by their time of flowering, because the subject of our investigations was the recessive character long growing period (aa).

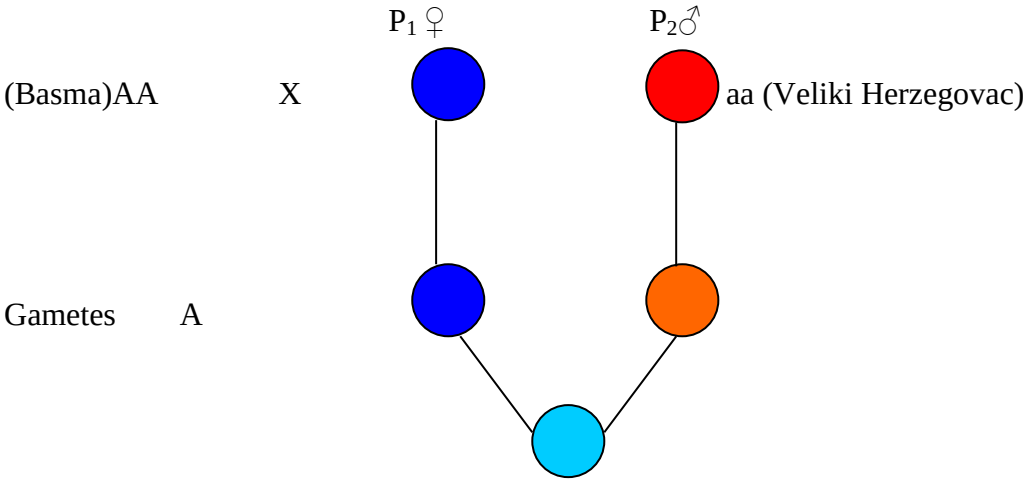
The plants with long growing period obtainedin F_2 (Figure1) progenyun doubtedly indicate that even in this generation we derived homozygous plants in relation to this recessive character. In order to confirm with certainty the resulting genotype with long growing periodin the hybrid population, 6 of the plants were selected and isolated (for self-pollination) in accordance with the intended aim of investigations.

These plants were used to create specific progenies in F_3 (Figure 2) generation and after inspection it was determined that all hybrid individuals of the investigated progenies had a long growing period, which indicates that they are homozygous with respect to this character.

Hence, it can be concluded that this character was permanently incorporated into their genome. Our next goal in selection will be to consolidate these progenies with other desired morphological, productional and qualitative characters.

Figure 1 - (Plot 169)

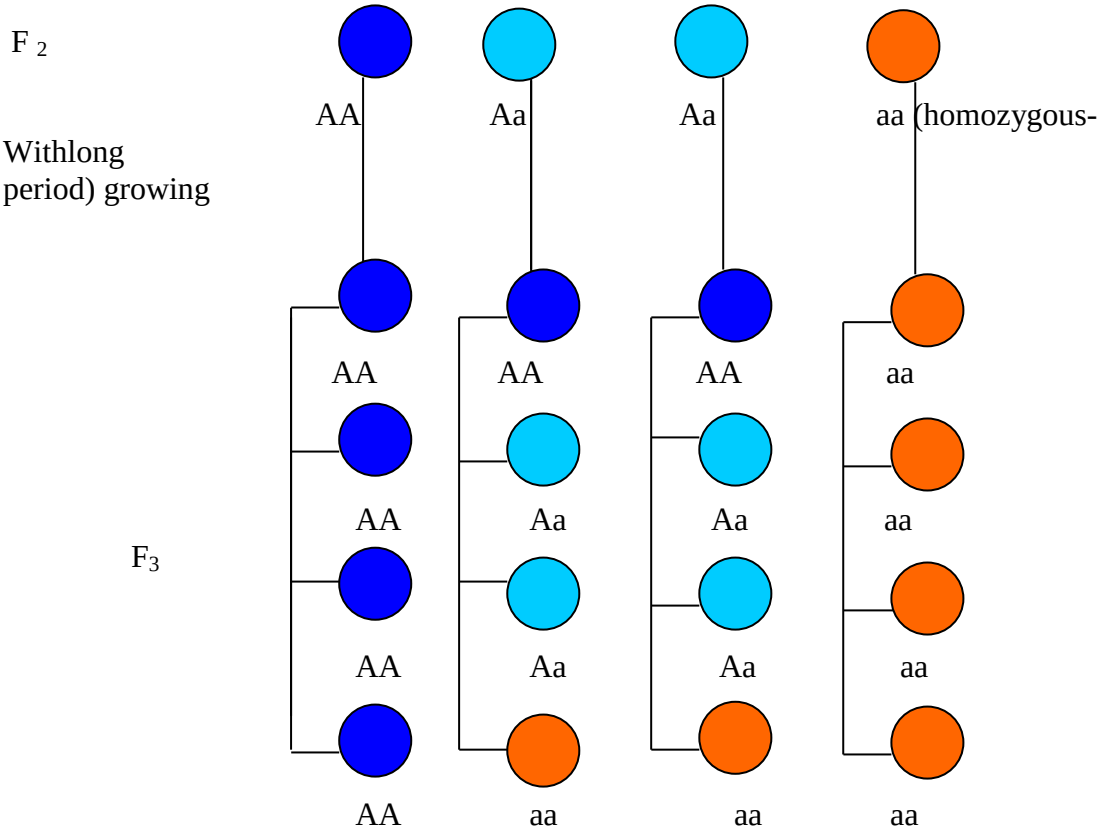
Figure 2 – (Plot 170)



F_1Aa (all plants with short growing period)

Phenotype ratio 3 : 1 (3 plants with short /1 with long gr. per.)

Genotype ratio 1 : 2 : 1



Scheme N° 1 Monohybrid recessive inheritance of the character long growing period in F_1, F_2 and F_3 generation

CONCLUSION

Based on the results on monofactorial inheritance of the character length of growing period, in hybridization performed between the varieties Basma (with short growing period) and Veliki Herzegovac (with long growing period), the following conclusions can be drawn:

The character long growing period has a monohybrid recessive pattern of inheritance.

The recessive nature of the investigated character makes the selection process more complicated because it doesn't appear in F_1 generation. Therefore, it is necessary to transplant more plants (over 150) in F_2 generation, to achieve higher probability for determination of plants-carriers of this character.

In there is a need for creation of new line and varieties with long growing period, the monofactorial recessive inheritance of this character from the parent with long growing period will allow to obtain homozygous plants (aa) as early as F_2 generation, and monitoring of the character is easily controllable because flowering is a visible biological characteristic.

The applied selection scheme is simple and,beside monitoring of the monohybrid recessive character, it allows parallel selection of hybrid individuals with respect to other quantitative and qualitative characters desired.

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