UDC 633.71
Тутун/Tobacco, Vol.60, N^{o} 1-6, 07-11, 2010
University "St. Kliment Ohridski" - Bitola
Scientific Tobacco Institute – Prilep, R. Macedonia

ISSN 0494-3244

UDC: 633.71-248.114.4:632.938
632.938:633.71-248.114.4
Original scientific paper

TRANSMISION OF RESISTANCE TO TOBACCO MOSAIC VIRUS (TMV) IN SOME ORIENTAL TOBACCO VARIETIES

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ABSTRACT

The aim of investigation was to study the transmission of TMV resistance in some commercial varieties of oriental tobacco by the method of backcross hybridization. Investigation included resistant introduced oriental varieties (AA) and one susceptible variety (aa). In relation to other qualitative and productional characteristics, the latter variety was good for buyers. In F_1, resistant heterozygous progeny (Aa) was obtained, which was back-pollinated with pollen of the recipient variety (aa). In BC_1, as well as in other generations up to BC_4 and BC_5, resistant plants, phenotypically more similar to the recipient variety, were pollinated again with the pollen of this variety. Infective juice from diseased plants was used for inoculation of plants from hybrid generations, using the method of Ternovskiy.

Key words: tobacco, oriental varieties, transmission of TMV resistance, backcrossing

ПРЕНЕСУВАЊЕ НА ОТПОРНОСТА КОН ОБИЧНИОТ МОЗАИК ВИРУС (TMV) КАЈ НЕКОИ ОРИЕНТАЛСКИ СОРТИ ТУТУН

Целта на овие истражувања е да се проучи и прикаже начинот на пренесување на својството отпорност кон обичниот мозаик вирус (TMV) кај некои комерцијализирани ориентални сорти тутун по методот на повратно вкрстување. Како почетен материјал при вкрстувањето се користени странски ориентални сорти отпорни на вирусот (АА) и неотпорни сорти-примачи на својството отпорност (аа), кои во однос на другите квалитетни и производни својства се добри за откупувачите. Во F_1 е добиено отпорно хетерозиготно потомство (Аа), кое повратно се наситува со полен од сортата примач (аа). Во првата повратна генерација (BC_1), како и во останатите генерации до BC_4 и, BC_5, земани се отпорни растенија кои по својот фенотип се поблиску до сортата-примач и повторно беа наситувани со полен од сортата-примач на ова својство. За инокулација на растенијата од одделните хибридни генерации се користеше инфективен сок од мозаични тутунски растенија, а заразувањето е извршено по методот на Терновский.

Клучни зборови: тутун, ориентални сорти, пренесување на отпорност на TMV, повратно вкрстување

INTRODUCTION

Tobacco diseases, regardless of the pathogen origin (viruses, bacteria, fungi) cause severe loses in tobacco yield and quality each year. Tobacco mosaic is the most widely spread viral disease in the world. When infestation occurs immediately after transplanting, in some plots it can attack 50 - 100% of plants, reducing the yield for 30% and total value of tobacco for 50% (13, 9). The adaptability, thermoresistance, unusual ability for change and rapid multiplying in leaf tissue make this virus hard to control (14). In addition, the disease appearance can not be prevented by chemical products. The problem can be solved only by creation of new resistant varieties and their implementation in mass production (5, 8, 12,14).

Having in mind that commercial oriental varieties of the type Prilep are susceptible to tobacco mosaic virus (TMV), the aim of these investigations was to study the transmission of resistance to the virus in variety Prilep 65/94, using the backcross method.

MATERIAL AND METHODS

Trials were set up in field and Biolaboratory of Tobacco Institute-Prilep, in the scope of the project "Creation of TMV resistant oriental tobacco varieties", financed by the Ministry of Education and Science of Macedonia, Dimitrieski et al.(4).

Oriental variety Nevrokop 1146 (photo 1), created by intervariety hybridization of Nevrokop 261 and Nevrokop B12 in Tobacco Trial Station Goce Delcev – Bulgaria (5), was used as starting material. All these varieties were resistant to TMV. Crossing was made with oriental variety Prilep 65/94 (non-resistant to TMV – photo 2), created in Tobacco Institute-Prilep. Parental varieties were selected on the basis of earlier investigations and the backcross method was used in the selection process. Hybrid progenies of F_1, as well as progenies of backcross generations BC_1, BC_2, BC_3 and BC_4 were grown on sufficient area and with sufficient number of individuals, as required by the selection program. Resistant plants, phenotypically closer to the receiver variety, were selected from F_1 progenies and backcross generations BC_1 – BC_4 and backcrossed with the same variety. In future generations, the trait of TMV resistance was stabilized according to the mode of monohybrid dominant inheritance. Juice from mosaic-infected tobacco plants was used for inoculation, according to the method of Ternovsky 1965, (cit. by Tranceva, 15). The juice from infected leaves was heated for 12 minutes in water bath at 80 0 C, in order to inactivate all other viruses, e.g. cucumber mosaic virus (CMV) and Potato Virus Y (PVY). Observations were made between the 7th and 10th day of inoculation, after the appearance of local necrotic spots on resistant plants and mosaic patterns on the leaves of susceptible plants.

RESULTS AND DISCUSSION

In the process of selection, TMV resistant variety Nevrokop 1146 (AA) was used as maternal component and non-resistant Prilep 65/94 (aa) as paternal component. In hybrid progeny of F_1 resistant heterozygous plants (Aa) were obtained and all hybrids showed necrotic reaction after infestation, indicating that the resistant allele is dominant and the non-resistant one is recessive. The dominant inheritance of this trait was also confirmed by other authors. Holmes, Kostov and Ternovskiy obtained homozygous forms of tobacco (N. tabacum) which succeeded to localize TMV. Holmes was the first to report from genetic aspect that one gene is responsible for localization of the virus, which usually appears as dominant (cited by Kostov, 10).

According to S. Stoyanov, Gelemerov (5), Kostov crossed the resistant form N. tabacum var. viri (N. tabacum x N. glutinosa) with Basma 36 and noted dominant inheritance of this trait (existence of local necrotic reaction). Ternovskiy used TMV resistant gene from N. glutinosa to create the varieies

Dubek 7, Dubek 566, Trapezond 161 etc. He reported that Shabanov, Lulov and Manolov also worked on TMV resistant varieties. Petkova (14) investigated three TMV resistant tobacco varieties which transmitted this trait in F_1 with dominant inheritance. She reported that the same statement was confirmed by Manun (1981). Three well developed plants from F_1 progeny (Aa) with uniform phenotypes were backcrossed with pollen from the receiver variety (aa)..

In BC_1 progeny, 50% TMV resistant heterozygous plants and 50% non-resistant plants were obtained, i.e. the genotypic ratio was 1Aa : 1aa. This is in accordance with one of the basic Mendel's premises, that individuals with Aa genotype form two types of equally represented gametes (Scheme 1). It was confirmed by many other authors and in various crops (2, 3, 11, 4, 1, etc). Adequate number of plants phenotypically closest to the receiver variety were selected from each resistant variety (Aa) and backcrossed with pollen of the same variety (aa).

In BC_2 progeny, resistant and non-resistant plants were obtained after the infestation, just like in BC_1. Three best developed plants from each resistant variety (Aa), phenotypically closer to the receiver variety, were selected and backcrossed with pollen of the same variety (aa).

The same procedure was also applied in progenies of BC_3 and BC_4 generations, with possibility for its further application in eventual backcross hybridizations in future.

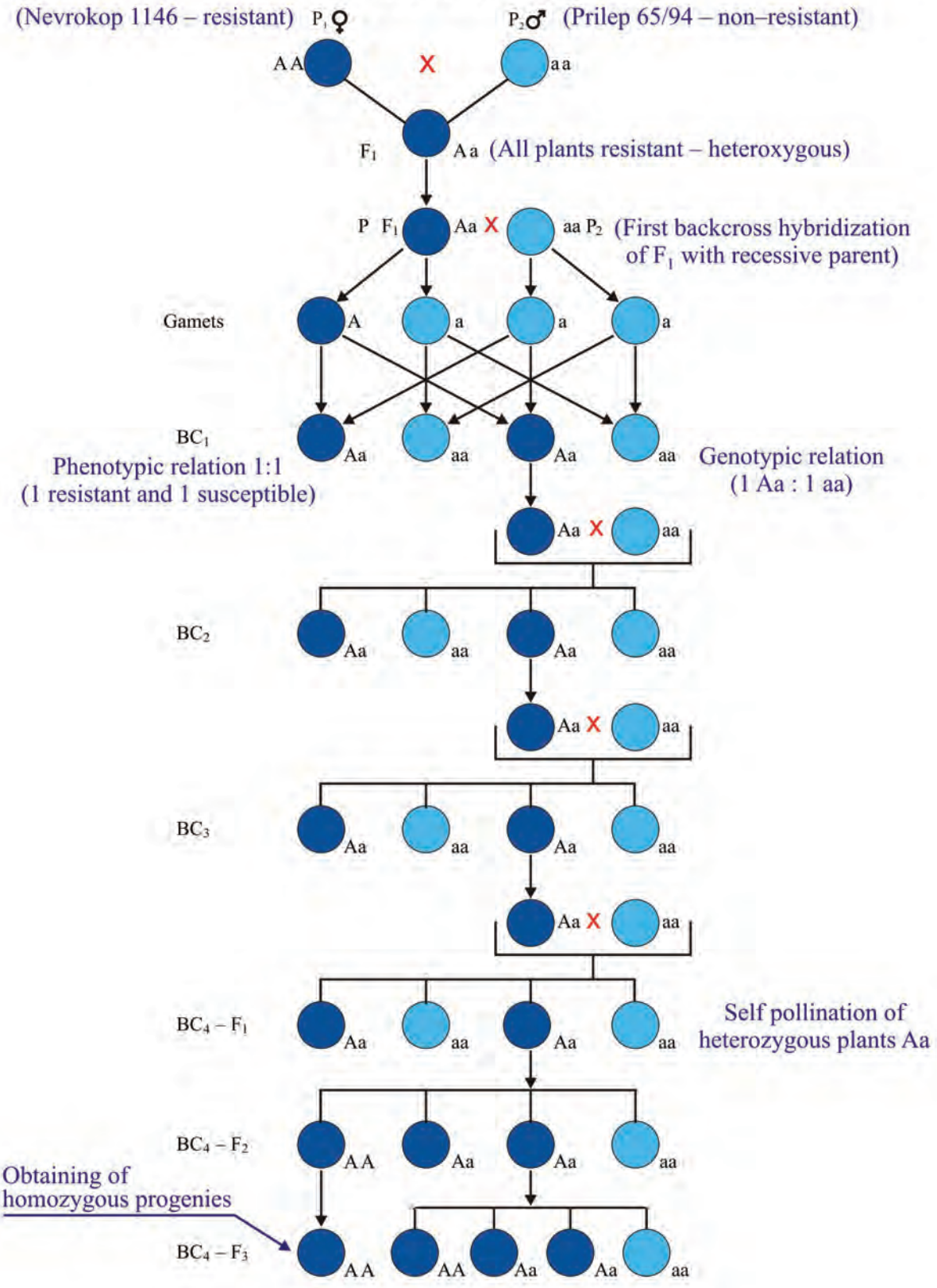
In BC_4 genotype, the receiver variety (aa) is represented five times. With continuous elimination of adverse traits from the donor variety and parallel maintenance of desired traits from the receiver variety, we concluded that this number of backcrossings was sufficient. Therefore, the progeny of this generation was taken as F_1 and two well developed resistant plants, which were the best representatives of the receiver variety, were selected from it. After that, stabilization of the trait resistance to TMV was made according to the scheme of monohybrid dominant inheritance.

According to Gornik (6), the receiver variety can be renewed with less than 6 backcross generations, which depends not only on the plants selected for backcrossing but also on the parents used in investigation. It should be also mentioned that the resistance to diseases to some varieties is more easily transmitted than to others. The same author (quote from Lukas, 1965), reported that only two backcrossings will be enough for transmission of the resistance to blue mold, by further use of the method of individual selection, with obligatory testing of the progenies obtained from the selected resistant plants.

Photo 1. Nevrokop 1146

Photo 2. Prilep 65/94

Shema 1. Transmission of resistance to TMV by the method of backcrossing



CONCLUSIONS

Investigations on transmission of the trait TMV resistance by the use of backcross method in hybridization between some resistant varieties and non-resistant oriental varieties of the type Prilep led us to the following conclusions:

1. Resistance to TMV in F_1 generation is obtained through dominant inheritance.

2. The monohybrid dominant inheritance in oriental tobacco varieties allows complete control and successful transmission of this trait by the backcross method.

3. The selection scheme applied in our investigations proved to be very practical and effective. It can be used for transmission of resistance in all non-resistant commercial varieties without any adverse effect on other qualitative traits as well as for transmission of some other traits inherited by monohybrid dominant mode.

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