UDC 633.71
Тутун/Tobacco, Vol.60, N^{o} 7-12, 121-126, 2010
University "St. Kliment Ohridski" - Bitola
Scientific Tobacco Institute – Prilep, R. Macedonia

ISSN 0494-3244
UDC: 633.71-238(497.2)"2008/10"
Original scientific paper

EXAMINING THE RESPONSE OF SOME PERSPECTIVE LINES BURLEY TOBACCO VARIETIES TO ECONOMICALLY IMPORTANT VIRAL PLANT DISEASES

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ABSTRACT

The research was carried out during the period 2008–2010 on the experimental fields of Tobacco and tobacco products Institute – Markovo. Eight perspective Bulgarian Burley tobacco lines – 1354, 1478, 3199, 2131, 1435, 3149, 1409, 1421, with different degrees of resistance to viral diseases were included in the study. The line 1354 was used as a control genotype. All samples were tested on a naturally and an artificially infected background . The percentage of infection by Tomato spotted wilt virus (TSWV), Potato virus Y (PVY) and Tobacco mosaic virus (TMV) was calculated on the basis of symptoms observation.

Immunological assessment of the lines reaction to TMV and PVY was made. The results of the research showed that none of the lines studied are resistant to TMV, PVY and TSWV, and the varieties Burley tobacco are attacked to some extent by the viruses.

Key words: tobacco, Burley tobacco lines, TSWV, TMV, PVY, naturally and artificially infected background, percentage of infection, viral diseases.

ИСТРАЖУВАЊЕ НА РЕАКЦИЈАТА ОД НЕКОИ ПЕРСПЕКТИВНИ ЛИНИИ НА ТУТУНОТ ОД ТИПОТ БЕРЛЕЈ ВРЗ ЕКОНОМСКО ВАЖНИ ВИРУСНИ БОЛЕСТИ

Истражувањето беше извршено во периодот од 2008 до 2010 година на опитното поле од Институтот за тутун и тутунски призводи – Марково. Во опитот беа вклучени осум перспективни линии тутун од типот берлеј (1354, 1478, 3199, 2131, 1435, 3149, 1409, 1421), со различен степен на отпорност кон вирусни заболувања. Сортата 1354 беше користена како контролен генотип. Сите примероци беа тестирани на природна и на вештачки заразена површина.

Процентот на инфекција од вирусот на бронзена некроза на тутунот (TSWV), цртичеста некроза на тутунот или т.н. компиров Y вирус (PVY) и мозаикот на тутунот (TMV) се пресметани врз основа на набљудуваните симптоми.

Од добиените резултати на истражувањето се констатира дека ниту една од истражуваните линии не е отпорна на TMV, PVY и TSWV, а сите линии на тутун беа нападнати од вируси до одреден степен.

Клучни зборови: тутун, линии тутун од типот берлеј, TSWV, TMV, PVY, природна и вештачки заразена површина, процент на инфекција, вирусни заболувања.

INTRODUCTION

Tobacco is subject to attacks by a number of viruses, most of which spread every year and turn into epiphytoties. For example, in Bulgaria in 1956 the losses caused by the Tomato spotted wilt virus (TSWV), reached up to 100% in some areas (Gabrovska, 1984; Kovachevski et al, 1999). More devastation was caused by epiphytoties of PVY and TMV in 1983 and 1986, as well as in 1989 in some places.

Tomato spotted wilt virus is one of the most widespread and economically important plant virus (Golbach and Peters,1994, cit. Dimitrov, 2003). The virus infects at least 900 plant species, and number of recorded natural host species is steadily increasing (Peters, 1998, cit. Kaliciak, 2009) – among them are many vegetables and ornamental plants (Mason et al., 2003, cit. Kaliciak, 2009). Data from a study by Dimitrov (2003) about the survival of TSWV during winter period and its persistent spread during the spring season, shows the exceptional role of the *Thrips tabaci Lind* wintering in the soil and the plants' remains. To this day in the world, from 5000 types of trips described, only these 9 kinds are vectors of TSWV: *Franklinella occidentalis; Franklinella schultzei; Franklinella fusca; T. tabacci; Thrips setosus; Thrips moultoni; Franklinella tenicornis; Lithrips dorsalis; Scirtothrips dorsalis* (Zitter, 1989).

Potato virus Y (PVY) is a typical member of the Potyviridae family. It has a wide host range and is spread worldwide, causing serious losses in Solanaceous crops (Voster,1990; Chatzivessilion et al, 2004). During the pollination period PVY is spread by more than 50 aphid species in a non-persistent manner. The peach aphid (*Myzus persicae* Sulz*)* has the ability to spread the virus very quickly and is the most efficient vector of the virus (De Box et Hutinga, 1981; Di Fonzo, 1995 cit. Kanavaki, 2006). The PVY is spread by *Acyrthosiphon, Aphis, Myzus, Neomyzus* (Lukas, 1975).

PVY is represented in three major strain groups: ordinary (PVY^0), tobacco veinal necrosis (PVY^n) and aphid non-transmissible stipple streak (PVY^c) (Kaliciak, 2009). In Bulgaria, tobacco strains of PVY belong to two groups: 1) PVY^0 (ordinary form) causing tobacco veinal chlorosis, and 2) PVY^n necrosis strains, causing veinal necrosis (Kovachevski, 1999).

Another worldspread and economically important viral plant disease is the Tobacco mosaic virus (TMV). It is a typical member of the group Tobamovirus. The virus is very unstable in the natural environment, which determines the big number of varieties and strains. Most important of these are: tomato strains, acuba strains, ringspot strains, masked strains (Kovachevski et al, 1999). TMV is economically the most important viral disease for the tobacco plants, because it could reduce the dry tobacco product more then 50 % - the leaves have lower quality and physiological property, reduced fragrance and minimized smoking index (Kovachevski et al, 1999).

Study data of four Bulgarian researchers (Dimitrov and Bosukov, 2004 ; Kovachevski et al, 1999; Stoimenova, 1995) shows that Tobacco-growing in Bulgaria suffers economically most from TSWV, PVY, CMV (Cucumber mosaic virus), TMV and ToMV (Tomato mosaic virus).

The aim of the present research is to investigate the responses of perspective Bulgarian lines of Burley tobacco, naturally and artificially infected, to the economically important viral plant diseases TMV, PVY and TSWV.

MATERIAL AND METHODS

The study was carried out during 2008–2010 on the experimental field of Tobacco and tobacco products Institute – Markovo. The research included eight perspective Bulgarian Burley tobacco lines – 1354, 1478, 3199, 2131, 1435, 3149, 1409 and 1421, with different degrees of resistance to viral diseases. The line 1354 was used as control genotype. All samples were tested on a naturally and an artificially infected background. Immunological assessment of the plants' reaction to TMV and PVY was made. The percentage of infection by economically important plant viral diseases TMV, PVY and TSWV it was detected.

The identification of the viruses accruing in the natural environment was based on observation of the characteristic symptoms through regular monitoring of the fields. As the symptoms of TMV and ToMV do not differ, they are registered together as Tobamoviruses.

The artificial infection was carried in the green houses of Tobacco and tobacco products Institute – Markovo, using the method of mechanical inoculation of Noordam (1973). Serologically tested isolates of TMV and PVY were used, and plants of N. tabacum cv. Samsun NN, Nevrokop 1146, cv. Samsun N`N` were used as indicators, as well as Petunia hybrida, Chenopodium amaranticolor, Solanum nigrum.

The necessary agro-technical measures were taken for the good safekeeping of cultivated tobacco.

The statistic processing of results was made by dispersional analyses. The study looked for detection of significant differences between variants.

RESULTS AND DISCUSSION

The results obtained from the spread of TMV, PVY and TSWV of the Burley tobacco lines on naturally infected background are presented in Table 1 and Figure 1, 2 and 3. They show that under local ecological conditions and the virulence of the strains during the three years of research, all Burley tobacco lines are not affected by the Tobacco mosaic virus.

Infection of PVY was found only on the control genotype line 1354, the rest of the genotypes were not attacked by the virus.

The results of the dispersional analyses show that there is a statistically significant difference in percentage of infection by PVY, between the control and other lines – the difference is significant at $P_{0.1\%.}$(Table 1)

During the years, the research was looking at the differences of TSWV attacks. The average percentage of attacks of TSWV in 2008 was 4.2%. The most attacked of this virus lines were line 1478 - 8.8% and line 1399 - 6.7%, while the most weak infection the virus caused on line 1349 - 0.6%. The average percentage of attack of TSWV in 2009 is considerable lower - 1%. The highest percentage of infection was detected in lines 1354 and 1409 - 1.9%.

Year 2010 was characterized with average percentage of attacks 1.4%, as most susceptible to attacks of TSWV is line 1421 - 2.5%. The results of the dispersional analyses show statistically insignificant differences in the degree of infection of TSWV between the control (line 1353) and the other lines included in the study (Table 1).

The results of the immunological tests during the study period, on the artificially infected perspective Burley tobacco lines, are presented in Table 2. They show that the studied genotypes lines 1478; 1399; 2131; 1435; 1349; 1409; 1421 were resistant, while the control (line 1345) was vulnerable to PVY. Lines 1354; 1478; 3199; 1435; 1349; 1409; 1421 reacted with resistance (on the basis of super sensitivity) to TMV, while line 1231 was sensitive to it. Lines 1478; 1399; 1435; 1349; 1409 and 1421 were resistant to both PVY and TMV. Lines sensitive to both viruses have not been found.

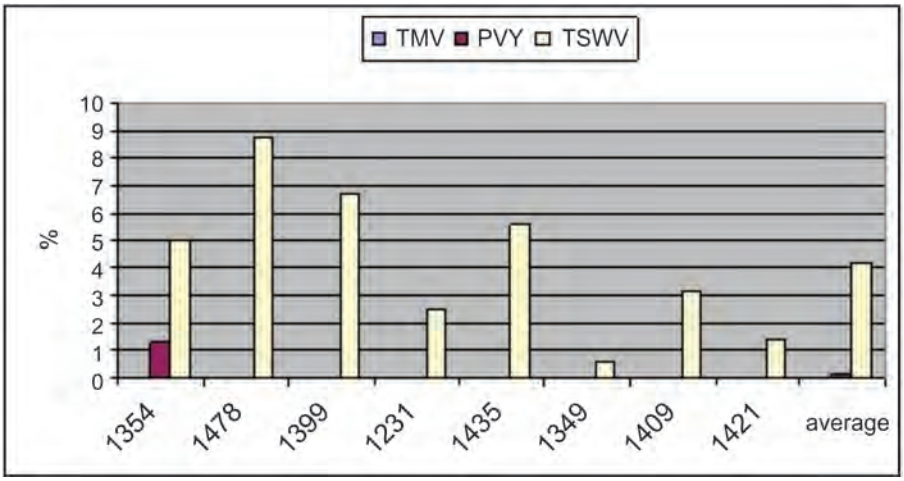

Fig.1 Percent of infection by TSWV, PVY, TMV in 2008

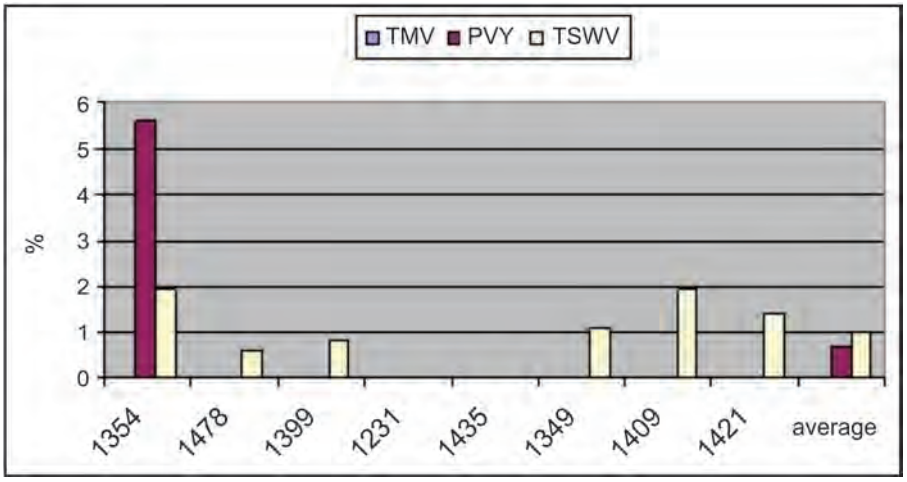

Fig.2 Percent of infection by TSWV, PVY, TMV in 2009

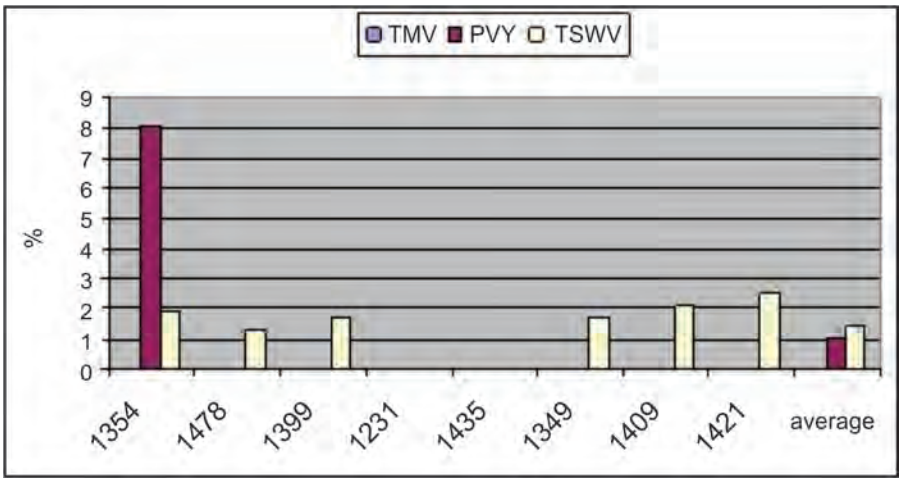

Fig.3 Percent of infection by TSWV, PVY, TMV in 2010

Tab.1 Percent of infection by virus diseases

Genotypes	TMV, %	PVY, %	TSWV, %
lines 1354 Ø	0	5	2.9
lines 1478	$0^{n.s.}$	0^{---}	$3.6^{n.s}$
lines 1399	$0^{n.s.}$	0^{---}	$3.1^{n.s}$
lines 1231	$0^{n.s.}$	0^{---}	$0.8^{n.s}$
lines 1435	$0^{n.s.}$	0^{---}	$1.9^{n.s}$
lines 1349	$0^{n.s.}$	0^{---}	$1.1^{n.s}$
lines 1409	$0^{n.s.}$	0^{---}	$2.4^{n.s}$
lines 1421	$0^{n.s.}$	0^{---}	$1.8^{n.s}$

(n.s.) non – significant differences; (+++) (---) differences are significant at $P_{0,1\%}$

Tab.2 Immunological assessment of the to Burley tobacco lines reaction to economically important viral plant diseases

Genotypes	TMV	PVY
lines 1354 Ø	R	MS
lines 1478	R	R
lines 1399	R	R
lines 1231	MS	R
lines 1435	R	R
lines 1349	R	R
lines 1409	R	R
lines 1421	R	R

CONCLUSIONS

The study found that on both naturally and artificially infected backgrounds, there were distinctive tobacco lines in which no infection to TMV and PVY were found.

During the research period none of the Burley tobacco lines were attacked of Tobacco mosaic virus in the naturally infected background. Line 1231 had reacted to the viruses when artificially infected.

Only the control line was attacked by PVY, while none of the other studied genotypes were affected by the virus in both infection backgrounds.

During the individual years of study, varied differences of TSWV attacks were found. The highest average percentage of infection by the virus was detected in 2008 - 4.2%. During that year the strongest attack was on lines 1478 - 8.8% and 1399 - 6.7%, while the poorest attack was on line 1349 - 0.6%.

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