

TOBACCO ETCH VIRUS-TEV ON TOBACCO IN BULGARIA

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ABSTRACT

This paper presents scientific communication on the presence of Tobacco etch virus (TEV) on tobacco in Bulgaria.

Immunological investigations were carried out in 2011 to identify the presence of TEV on tobacco in Bulgaria. Samples were taken from 12 tobacco plants (5 of Virginia tobacco and 7 of the type Burley) from the trial field of Tobacco and Tobacco products Institute Plovdiv (Markovo). ELISA test was performed on the isolates for serological diagnostification of PVY and TEV viruses, which give similar symptoms in tobacco plants

Three isolates of the Virginia tobacco showed positive serological results on both PVY and TEV viruses. One isolate of the Virginia type showed (+)(-) reaction to TEV and negative reaction to PVY. In one isolate of the Burley type negative reaction to both viruses was recorded.

Elimination of weeds surrounding the tobacco fields and due and timely application of insecticides against aphids is recommended for successful control of this disease.

Key words: Tobacco etch virus (TEV), ELISA-тест, tobacco, virginia, burley

ВИРУС НА ГРАВИРАНИОТ МОЗАИК (TOBACCO ETCH VIRUS-TEV) НА ТУТУНОТ ВО БУГАРИЈА

Во овој труд е дадено научно соопштение за присуство на вирусот на гравираниот мозаик на тутунот во Бугарија.

Во текот на 2011 година се изврши имунолошки истражувања за докажување на присуството на вирусот на гравираниот мозаик (TEV) на тутунот во Бугарија. Земени се проби од 12 тутунски растенија, и тоа 5 од типот вирџинија и 7 од типот берлеј, од опитното поле од Институтот за тутун и тутунски производи од Пловдив (с. Марково). На изолатите е извршен ELISA-тест (имунолошки тест) за серолошко дијагностицирање на PVY и TEV вирусот, кои предизвикуваат слични симптоми на тутунските растенија.

Три изолати (проби) од типот вирџинија покажаа позитивни серолошки резултати и на двата вируса, PVY и TEV. Еден изолат од типот вирџинија покажа реакција (+)(-) кон TEV и негативна кон PVY. Еден изолат од типот Берлеј негативно реагира на двата вируси.

Во борбата со ова заболување се препорачува уништување на плевелите околу тутунските површини и навремена борба со инсектициди против лисните вошки.

Клучни зборови: вирус на гравираниот мозаик-ТЕВ, Елиса-тест, PVY, вирџинија, берлеј

INTRODUCTION

Viruses pose a serious threat to tobacco crop and can cause severe damages to tobacco production. Very often, losses caused by them make the tobacco production unprofitable and even impossible.

CORESTA investigations so far have determined 16 viruses attacking tobacco, eight of which are of economic importance: Tobacco mosaic virus – **TMV**, Potato virus Y - **PVY**, Cucumber mosaic virus - **CMV**, Tomato spotted wilt virus - **TSWV**, Tobacco etch virus –**TEV**, Tobacco leaf curly virus - **TLCV**, Tobacco vein mottle virus – **TVMV** and Beet curly top virus –**BCTV**.

Tobacco etch virus (TEV) was reported for the first time in Kentucky, USA, by Valleau and Johnson (9). After that, its symptoms were also reported in Canada, Nicaragua, India, Japan, Russia and Germany.

According to Atanasov and Gabrovska (1), the virus has not been recorded on tobacco

in Bulgaria. Kovacevski et al. (3) reported occurrence of the disease on tomato and jimson weed (*Datura Stramonium L.*), but not on tobacco. According to Mickovski (4), the disease is not spread on tobaccos grown in the Balkan Peninsula.

Various methods were used for determination of the causing agents of diseases according to various parameters: disease symptoms (symptomatic diagnostics); the type of cell elements specific for each virus (microscopically determined); the specific reaction for virus identification with indicatory plants, by immunity test (ELISA – serological identification) or through by molecular techniques with radioisotopic markers.

The presence of Tobacco etch mosaic virus (TEV) on the basis of symptomatic diagnostics was reported by Dimitrov and Bozukov in 2004 (2).

MATERIAL AND METHODS

During 2011 immunological investigations were carried out in order to determine the presence of TEV in Bulgaria. Fresh material (tobacco leaves) with similar symptoms typical for TEV was supplied for the investigation. Selection of isolates for the study was made on the basis of visual and symptomatic determination. Samples were taken from 12 tobacco plants – 5 of the type Virginia and 7 of Burley. Isolates were taken from the trial field of Tobacco and Tobacco Products Institute-Plovdiv (Markovo village).

ELISA test was applied for serological diagnostics of PVY and TEV, which produce similar symptoms on tobacco plants.

The test was performed by the Double Antibody Sandwich-Enzyme Linked Immune Sorbent Assay (DAS ELISA) for PVY and by the Triple Antibody Sandwich-Enzyme Linked Immune Sorbent Assay (TAS ELISA) for TEV, in the laboratories for investigation of immunity to virus diseases at the Institute of Horticulture in Maritza.

RESULTS AND DISCUSSION

Three isolates (samples) of the type Virginia showed positive serological results on both PVY and TEV. One isolate of Virginia tobacco showed (+)(-) reaction to TEV and

negative reaction to PVY. One isolate of the type Burley showed negative reaction to both viruses (Table 1).

Table 1. Serological diagnostics of PVY and TEV

Sample №	Tobacco type	TEV	PVY
1	Virginia	+	+
2	Virginia	+	+
3	Virginia	+	+
4	Virginia	+ -	-
5	Virginia	+ -	+
6	Burley	-	+
7	Burley	-	+
8	Burley	-	+
9	Burley	-	+
10	Burley	-	+
11	Burley	-	+
12	Burley	-	+
Negative control	Tobacco	-	-
Positive control	Tobacco	+	+

Tobacco etch virus was serologically proved in mixed virus infection with PVY in three of the test samples.

According to Holmes (7), susceptibility to the virus was found in about 69 plant species from 11 families, some of which (tomato, jimson weed, potato and tobacco) belonging to *Solanaceae* family.

Disease symptoms vary depending on virus strain, type of tobacco and agroecological conditions.

The virus produces variegation of the upper leaves and changes their colour from light green to green. The symptoms sometimes resemble the Tobacco mosaic virus (TMV), but the chlorotic spotting caused by TEV is much smaller than that caused by TMV.

In field conditions, symptoms usually appear when the stage of tobacco flowering is near. The first signs are lightening of the colour of leaf veins, followed by necrotic lines and

chlorotic variegation between the veins. In lower primings, the venation can turn brown or disappear. Some authors reported that patterns caused by Tobacco etch virus are sometimes resembling those of Tobacco mosaic virus (TMV), but while in TMV the top leaves are variegated, in TEV they are not.

Depending on their reaction to the virus, tobacco types can be divided into two groups:

- Ist - consisting of Burley tobaccos, which react with strongly pronounced symptoms of chlorosis, necrosis and stunted growth, and
- IInd - consisting of Oriental and Virginia tobaccos, which react only with occurrence of chlorotic spots.

The virus can be transmitted mechanically and also spread by several species of aphids (*Aphis*, *Myzus* etc) (6), or by dodder (*Cuscuta* sp.). Nikolov et al. (8) reported on virus transmission by seeds of infested tobacco.



Photo 1. Virginia tobacco infected with Tobacco etch virus (TEV)

Virus particles are cylindrical, asymmetrical, approximately 730-790 nanometers long and 10 -13 nanometers wide. The thermal inactivation point of the virus is 55 - 60 °C. Infection ability is preserved up to 5 days. The virus may persist a dilution of 1:5000 (5), but loses its activity in dry leaves.

The virus enter plants through wounds made by aphids or mechanical injury and the first symptoms appear 7-14 days after the inoculation.

Usually, by infestation of a plant with certain strain of virus, it becomes resistant to other strains serologically related to the same virus, but the infested plants are still susceptible to other viruses. Tobacco etch virus is exception from this rule. Tobacco plants infested with TEV become resistant to Potato virus Y (PVY), too. Contrary to that, tobacco plants infested with PVY do not bear resistance to TEV.

CONCLUSION

The best control of this disease is to destroy the weeds around tobacco plots, since they are serious source of infection. It should be avoided to grow tobacco near the areas planted

with other species of Solanaceae. Since aphids are the main transmitters of the virus, timely treatment with insecticides should be applied.

REFERENCES

1. Атанасов, Д., Габровска И. 1963. Болести по тютюна. „Земиздат”, София.
2. Димитров, А. и Бозуков, Х. 2004. Вирусни болести по тютюна в България и борбата с тях, Български тютюн, кн. 5, 11-18.
3. Ковачевски и др. 1999. Вируси и вирусоподобни болести на културните растения. София.
4. Мицковски, Ј. 1984. Болести на тутунот. Скопје
5. Damirdagh, I.S. and Shepherd, R.J. 1970. Some of the chemical properties of tobacco each virus and its protein and nucleic components, *Virology*, 40.
6. Kennedy, J., Day, M. and Fastor, V. 1962. Conspectus of aphids as vectors of plant viruses. *Comm. Inst. Ent. London*.
7. Holmes, F.D. 1946. A Comparison of the host ranges of tobacco each and tobacco mosaic viruses. *Phytopathology*, 36.
8. Nikolov, P., Bozukov, H. and Tomeva, E. 2005. Possibilities for transmitting of the viruses trough the tobacco seeds. I-st Congress of plant protection, Ohrid, Macedonia, pp. 97-99.
9. Valleau, W.D. and Johnson, E.M. 1928. Some virus diseases of tobacco in Kentucky. *Phytopathology*, 18, 132-133.