

## PRODUCTION CHARACTERISTICS OF SOME ORIENTAL TOBACCO LINES RESISTANT TO BLACK SHANK (*Phytophthora parasitica* var. *nicotianae*)

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### ABSTRACT

The aim of investigations was to evaluate morphological, production and qualitative traits of 4 newly created fertile inbred lines and their resistance to black shank disease (*Phytophthora parasitica* var. *nicotianae*), compared to the susceptible standard variety YV 125/37. The investigated lines were obtained by intraspecific hybridization. The breeding process started by crossing of introduced oriental tobacco varieties with stable domestic inbred resistant to black shank (AA) which were used as mother components and susceptible lines and varieties (aa), used as father components. Selection of hybrid progenies was made using the Pedigree method. The investigated lines were also stable in plant height and number, shape and size of the leaves. According to the results of field experiments, the newly created resistant lines have higher leaf number per plant (45-53 leaves) as compared to the standard variety YV 125/37 (37 leaves). They also achieved higher yields (33.66% - 68.80%), higher purchase price (14.31% - 27.7%) and greater economic effect (41.0% to 81.28%). Black shank is economically important disease of oriental tobacco throughout the world. In favorable conditions for its occurrence it can also cause severe damage in some micro regions with mass production of Yaka tobacco. The tobacco varieties and lines were investigated for their resistance to the causing agent of *Phytophthora parasitica* var. *nicotianae* during 2010, with artificial inoculation in glasshouse conditions (Biological laboratory) of Tobacco Institute - Prilep. Of the four lines investigated, three were evaluated as highly resistant to black shank and they can be included not only in commercial production but also as sources of resistance in breeding programs.

Key words: tobacco, disease, black shank, oriental tobacco varieties, lines, Yaka type

### MATERIAL AND METHODS

Subject of this research were four newly created tobacco lines resistant to black shank: YK 1. 123-82, YK 1. 20-23/10, YK 1. 22-82/10, YK 1.301/23 and standard YV 125/37.

The newly created resistant lines were obtained by intra species hybridization, using foreign resistant varieties and domestic non-resistant oriental varieties and lines as its components. They are genetically stable and consolidated in terms of plant height and leaf number, shape and size.

In 2010 comparative trial was set up in randomized block design with four replications and transplanting was done at 40cm x 12cm spacing. Usual cultural practices, necessary for normal growth and development of oriental tobacco were applied on transplanted tobacco in field. The necessary morphological measurements and phenological observations were also carried out. The quality of harvested and cured tobacco was estimated according to the Rulesbook for furu measures for assessing the quality of raw tobacco.

Resistance of investigated tobacco varieties and lines to the causing agent of black shank disease was studied under conditions of artificial inoculation in a protected area (Biological Laboratory) of Tobacco Institute. In 2010, tobacco plants were transplanted in pots on 14.08.2010, with 24 plants for each cultivar.

Pure culture of the fungus *Phytophthora parasitica* var. *nicotianae* obtained from naturally infected tobacco plants was used as inoculum. The fungus was sown on potato-dextrose agar and incubated at a temperature of 25°C in a period of 15 days.

Isolate P25, race of the pathogen was used in the trial. Tobacco plants were inoculated with suspension prepared from the fungus culture of one petri-dish, mixed in 100ml distilled water.

Each plant was injured in the root system prior to inoculation. For easier infection, a knife was used to cut soil and root system around the stalk (Tashkoki, Pejcinovski 2002). After that, 30ml of the prepared suspension was added to each plant by watering, and 30ml distilled water was added to control plants. Inoculation was performed on 13.07.2010.

First symptoms of the disease, expressed through wilting of the leaves, appeared 4 days after inoculation. During the vegetation, several readings of the infected plants were made, and the last assessment was done on 01.09. 2010. The ratio between the number of infected plants and the total number of observed plants was used to assess disease intensity of each cultivar, expressed in percentage. The index of disease in investigated cultivar and in the check was used to calculate the index of resistance according to Abbott's formula. Based on this index and by the scale of Kutova (cited by Trancheva, 2000), with minor corrections, all varieties are classified into categories:

- 0 - highly resistant- no viable infection
- 1 - resistant- 10% infected plants
- 2 - moderately resistant- 40% infected plants
- 3 - susceptible- 80% infected plants
- 4 - highly susceptible- 80% - 100% infected plants



Photo 1. YV 125/37



Photo 2. Yaka 1. 301/23

### INTRODUCTION

The need for creating and introducing new productive oriental tobacco varieties with improved quality traits in comparison with the existing standard varieties is permanently growing and studies of this kind have a continuous character. In our country, however, little work has been done on creation of oriental tobacco varieties resistant to economically important diseases. The black shank (*Phytophthora parasitica*) is economically very important disease on oriental tobaccos, which in the years with favorable conditions for its occurrence can cause a serious damage to the mass production of tobacco. A number of authors point out that in many areas the disease resolved epiphytotic dimensions and caused serious losses to tobacco industry (Mickovski 1984, 1988, Trancheva 2001, Tashkoki 2008, Dimitrieski et al. 2011, etc). The pathogen ability to persist in soil for a long time complicates the application of chemicals in control of this disease. Current world tendency is to reduce the use of chemicals by introducing resistant varieties in tobacco production (Palakaracheva 1988, cited by Trancheva 2000). Reducing the serious threats of black shank and the damages it causes in certain areas, our research in recent years has been focused on creation of new resistant oriental tobacco varieties and lines (Dornik 1973, Trancheva 2001, Dimitrieski et al. 2012). Thereby, several oriental lines with high resistance to black shank were obtained. Four of these lines of the type Yaka, in combination with the standard variety YV 125/37, were chosen to be the subject of our investigations on morphological and productive traits and the resistance to black shank.

### RESULTS AND DISCUSSION

Table 1. Morphological characteristics of investigated lines and the standard variety

Varieties Lines	Plant with inflorescence height cm	Leaf number per plant	Largest leaf size	
			Length	Width
Yv. 125/37	98	37	19,7	9,5
Yk 1.123-82	103	45	20,9	10,3
Yaka 1.20-23/10	118	53	20,9	9,5
Yaka 1.22-82/10	112	53	21,4	11,8
Yk. 1.301/23	103	47	25,1	11,7

Table 2. Production characteristics of investigated lines and the standard variety

Varieties Lines	Yield kg/ha	%	Average purchase price		Average economic effect	
			€/kg	%	€/ha	%
Yv. 125/37	1628	100,00	1,86	100,00	3.028,08	100,00
Yk. 1.123-82	2176	133,66	1,96	105,38	4.264,96	140,85
Yaka 1.20-23/10	2748	168,80	2,00	107,52	5.496,00	181,50
Yaka 1.22-82/10	2259	138,76	2,08	111,82	4.698,72	155,17
Yk. 1.301/23	2613	160,50	1,98	106,44	5.173,74	170,86

LSD p=0,05 - 143 kg/ha  
p=0,01 - 203 kg/ha

LSD p=0,05 - 1015 €/ha  
p=0,01 - 1424 €/ha

Table 3 Tobacco cultivars inoculated with a culture of *Phytophthora parasitica* var. *nicotianae* - greenhouse 2010

Cultivars-lines	Inoculated plants	Total No. of infected plants	Infestation, %	Level of resistance	Index
YV 125/37	24	21	87,50	12,50	4
Yk. 1.123-82	24	4	16,66	83,34	2
Yk. 1.20-23/10	20	0	0,00	100,00	0
Yk. 1.22-82/10	24	0	0,00	100,00	0
Yk. 1.301/23	20	0	0,00	100,00	0

- 0 - highly resistant - no viable infection
- 1 - resistant - 10% infected plants
- 2 - moderately resistant - up to 40% infected plants
- 3 - susceptible - up to 80% infected plants
- 4 - highly susceptible - over 80% infected plants

### CONCLUSIONS

- According to the analyzed morphological proportions, the newly created lines are typical for Yaka tobacco. Plants of the new resistant lines are some what higher compared to those of the standard variety.
- The highest number of leaves per plant (53) was achieved in lines Yaka 1. 20-23/10 and Yaka 1. 22-82/10, but also in the other two lines the leaf number was higher compared to the standard YV 125/37 (37), which dimensions are adequate for this tobacco type.
- The investigated lines achieved higher yield per hectare, in relative amount it is 33.66% - 68.80% higher compared to the standard variety.
- The purchase price (den/kg) and economic effect (den/ha) in newly created varieties was 41.01% - 81.28% higher compared to the standard variety YV 125/37.
- In conditions of artificial inoculation, three of the four investigated lines of Yaka tobacco (Yaka 1. 20-23/10, Yaka 1.22-82/10 and Yaka 1. 301/23) showed high resistance to black shank (index 0) and one line showed medium resistance (Index 2), compared to the highly susceptible standard variety (Index 4).
- A common conclusion can be drawn that 3 of the newly created lines of Yaka tobacco developed high resistance to black shank. Beside their application in production, they can be used as sources of resistance in selection of new varieties resistant to the disease.