

Assessment of the Selections Materials of Sugar Beet for their Stability towards the Agent Causing Cercosporosis - *Cercospora Beticola Sacardo*

Svilen Raykov¹, Kulka Uchkunova, Krasimira Tanova^{1*}, Veselin Uchkunov²

¹“Episkop Konstantin Preslavski” University of Shumen - Shumen

² Agricultural Institute – Shumen

k_tanova@abv.bg

Abstract: *During the period of 2013-2015, in the proving grounds of the Agricultural Institute- Shumen was performed an assessment for the agent causing cercosporosis – *Cercospora beticola* Sacardo from 19 selection materials of sugar beet. The assessment is made under natural infectious background, with importing of the leaf fertilizer „Chumustin” (1000ml/ha), as well as without it. For the aims of the examination is performed proving test on the block method scheme, in four successions. The recordings are made based on point scales unified by the Agricultural Institute. The infection index of the cercosporosis is determined and the sorts’ reaction of the tested materials was compared, in order for the materials to be assessed with the stability methodic, which is standard for the country. It was determined that the infection index of the cercosporosis *Cercospora beticola* Sacardo for the sugar beet depends mostly on the stability of the plants and to a lesser extent on the external conditions; the tested selection materials are averagely sensitive and averagely stable; the import of the leaf fertilizer „Chumustin”, in dose 1000ml/ha, under favourable conditions for the development of the cercosporosis, does not affect the infection index values.*

1. INTRODUCTION

The correct choice of stable in the necessary degree or tolerable to the correspondent disease sort plays an important role in the integrated schemes for disease control of the beet. The sorts’ cultivation with good level of stability is a preventive measure, acceptable not only given the economical Information regarding the different sort reaction of the selection materials to the agent causing cercosporosis can be found in number of publication, in Bulgaria and in foreign countries.

In Germany was assessed the stability to the disease of 12 sorts of sugar beet, cultivated in the country. For the plans that are artificially inoculated under greenhouse conditions was found different reaction for the tested sorts (Ulrich – Eberhard, 1996).

For the differences in the stability of the selection materials regarding the economically most important sugar beet leaf disease, there is information in publication of our and foreign authors. (Varbanov, 1994, Uchkunova et al., 2004, Tanova et al., 2008). According to the selection programs for the stability to the cercosporosis are expected parallel assessments of the stability of the sorts and their parental forms regarding the agent causing cercosporosis. The novelty in the selection programs for stability to diseases in the beet is the assessment of the materials regarding their reaction to the complex of agents. The idea is to find complex stability to two or more pathogens that parasites the leaves (cercosporosis, phimosi, powdery mildew, virus diseases – yellow vein virus, jaundice). There is information about results from test made for determination of the stability level to these agents of selection materials of sugar beet (Burenin, 2001, Royk and Nurmuchamedov, 2001, Harveson, Gary, Smith, Wilson 2001, Takenaka et Mitsuru, 2002).

The aim of the present research is assessment of the reaction of the selection materials of sugar beet regarding the most common sugar beet leaf disease in the country – the cercosporosis, with causing agent *Cercospora beticola* Sacardo.

2. MATERIALS AND METHODS

2.1. Test Schemes and Recording Methodic

The examinations are performed in the Agricultural Institute – Shumen, for the period of 2013 – 2015. The assessments are made under proving grounds conditions with natural infection background for the

cercosporosis and with two backgrounds of fertilization: with leaf fertilizer “Хумустин”, in dose 1000 ml/h imported through the phase „formed leaves”. The recordings for the infection index for the disease are performed with the suggested by Varbanov (2004) and Tanova (2003) 6 – points scale (from 0 to 5 points) or 5 – points scale (from 0 to 4 points), depending on the phenophase of the development at the moment of recording. There are 2 recordings made – 14 days after the import of the leaf fertilizer and 10 days after the first recording. The disease infection index is recorded, calculated with the Mc. Kinny’s formula (Popkova, 1987):

$$I = \frac{\sum(a \cdot b) \cdot 100}{NK}, \text{ where: } I - \text{infection index in \%}; \sum(a \cdot b) - \text{total amount of the product of the number of infected plants (a) and the correspondent value points of infection (b)};$$

N – number of recorded plants; **K** - the highest value point in the scale.

The categorization of the testes material is made in accordance with the methodic of the Executive Agency of Variety Testing Field Inspection and Seed Control (Uchkunov, 2008). The examination was performed in parcel attempts, on block method in 4 successions and size of the parcel 10.8 м² including: for sugar beet – total 18 selection materials (cross – fertilization of male sterile lines and their generations) and the sugar beet „Пещера”. The results from the proving grounds recordings are processed on the statistical methods for the proving grounds test (Zaprianov, 1983) and are shown in tables.

2.2. Climatic Conditions

Table1. Precipitation in 2013 -2015 (mm)- standard for period of 50 years (IV-IX) - 310mm

Years	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Annual amount IV-IX
2013	108	46	6	64	145	29	33	40	16	54	27	145	327
2014	49	80	57	37	56	142	54	30	0	-	-	-	319
2015	-	-	-	71	48	28	13	90	26	-	-	-	276
Average	67	57	29	57	83	66	33	53	14	46	36	55	307

Table2. Temperature in 2013-2015(C°)- standard for period of 50 years (IV-IX) - 19.5⁰C

Years	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Average amountIV- IX
2013	-1.1	-3.9	6.3	13.5	18.3	22.1	28.1	23.9	19.3	15.2	8.2	-0.3	17.6
2014	1.5	2.7	6.7	12.3	18.6	21.6	21.6	24.5	20.4	-	-	-	19.8
2015	1.3	2.6	6.9	14.6	20.8	23.6	27.1	28.4	24.3	-	-	-	23.1
Average	-	-	-	13.5	19.2	22.4	25.6	25.6	21.3	-	-	-	21.2

The climatic reference for the regions of the proving grounds trials (tables 1 and 2) shows that during the period of examination they are very favourable for the occurrence and development of the cercosporosis - *Cercospora beticola* Sacardo on the beet (Varbanov, 1987).

3. RESULTS AND DISCUSSION

The results from the recording for the reaction of the sorts and selection material of sugar beet to the recorded disease for the period 2013 – 2015 are shown in table 3. They show the clear difference between the infection index values for the cercosporosis for the recorded selection materials.

The recordings from the first year of examination showed that in six of the tested cross – fertilizations, cultivated with imported leaf fertilizer, the infection index for *Cercospora beticola* Sacardo exceeds the index recorded for the standard sort – „Пещера”. These are the materials - MC222x5319, 4499-4xMM, MC6634x4499, MC6634x5109, MC222x5109, MC201x5109. In two of the selection cross – fertilizations one can observe decrease of this index - MC201x 5319 and MC222x5101. In nine of the selection materials, cultivated without leaf fertilizer, the infection index for the cercosporosis diverts in relation to the standard sort. For the selection materials MC6634-2xmm, MC201x 5319, MC6634x5101, MC222x5101, MC222-2xmm and MC201-2xmm this diversion is negative. For the cross - fertilizations MC6634x5109, MC222x5109 and MC201x5109, was recorded an infection index for the cercosporosis with higher values than the standard sort.

Assessment of the Selections Materials of Sugar Beet for their Stability towards the Agent Causing Cercosporosis - *Cercospora Beticola Sacardo*

Table3. Results of the registration of the attack of varieties and breeding materials of sugar beet by *Cercospora beticola*- 2013-2015

Variants	Infection index-% Processed with „Chumustin”- 1 l/ha,			Average value for the period	Stability	Infection index-% Without „Chumustin”			Average value for the period	Stability
	2013	2014	2015			2013	2014	2015		
„Пещера”- standard	25.4	25.8	23.4	24.9	MR	27.8	26.6	25.4	26.6	MS
5319-4xMM	31.2	31.0	33.5***	31.9*	MS	24.7	25.9	23.8	24.8	MR
MC6634- 2xmm	20.4	19.7	21.1 ⁰	20.4	MR	18.7 ⁰⁰⁰	20.0 ⁰	18.4 ⁰	19.0 ⁰	MR
MC201x5109	35.8**	36.4***	34.2***	35.5***	MS	30.5	32.6	24.5	29.2	MS
MC201x 5319	18.6 ⁰	16.3 ⁰⁰⁰	15.8 ⁰⁰⁰	16.9 ⁰	MR	17.5 ⁰⁰⁰	18.9 ⁰	16.8 ⁰⁰⁰	17.7 ⁰⁰	MR
4499-4xMM	32.7*	34.1*	31.2***	32.6*	MS	30.7	33.6*	27.5	30.6	MS
MC222x 4499	28.5	26.5	25.2*	26.7	MS	27.2	30.6	22.2	26.6	MS
MC6634x4499	32.6*	37.2***	34.2***	34.6***	MS	33.7	38.8***	32.3*	34.9*	MS
MC201x4499	30.6	32.9*	29.2***	30.2	MS	32.7	35.8**	30.5	33.0*	MS
5101-2xmm	22.5	20.7	19.8 ⁰⁰⁰	21.0	MR	20.5	24.8	18.7 ⁰	21.3	MR
MC6634x5101	19.5	17.9 ⁰	16.3 ⁰⁰⁰	17.9 ⁰	MR	19.3 ⁰⁰	17.0 ⁰⁰	17.9 ⁰	18.0 ⁰⁰	MR
MC222x5101	17.6 ⁰	15.5 ⁰⁰	15.8 ⁰⁰⁰	16.3 ⁰⁰⁰	MR	18.0 ⁰⁰⁰	15.7 ⁰⁰⁰	16.0 ⁰⁰⁰	16.6 ⁰⁰⁰	MR
MC201x5101	28.2	29.3	24.6	27.4	MS	25.5	26.9	30.3	27.6	MS
5109-2xmm	24.9	22.9	21.5 ⁰	23.1	MR	22.4	20.0 ⁰	20.7	21.0	MR
MC6634x5109	33.0*	31.7	20.2 ⁰⁰	28.3	MS	34.2*	33.8*	20.8	29.6	MS
MC222x5109	38.3***	40.2***	36.7***	38.4***	MS	37.8***	39.9***	37.1***	37.2***	MS
MC201x5109	36.4**	39.9***	33.6***	36.6***	MS	35.8**	39.1***	33.9*	36.3***	MS
MC222-2xmm	19.8	20.0	17.5 ⁰⁰⁰	19.1	MR	20.3 ⁰	21.4	18.2 ⁰	20.0	MR
MC201-2xmm	20.7	23.2	19.4 ⁰⁰⁰	21.1	MR	20.4 ⁰	22.8	21.0	21.4	MR
GD 5%	6.4	6,7	1.7	5.5		6.4	6,7	6.7	5.5	
GD 1%	8.5	8,9	3.4	8.2		8.5	8,9	9.4	8.2	
P %	9.8	9.2	5.7	11.2		9.8	9.2	5.7	11.2	

Легенда: MR: averagely stable; MS – averagely sensitive; 0-proved lower index than the 1st rank; 00- proved lower index than the 2nd rank;000- proved lower index than the 3rd rank;*- proved higher index than the 1st rank; **- proved higher index than the 2nd rank; ***- proved higher index than the 3rd rank;

During the second year of the examinations period, the selection materials, cultivated with imported leaf fertilizer keep their reaction towards the agent causing the cercosporosis - *Cercospora beticola Sacardo*. Without the leaf fertilzier „Humustim” a tendency was recorded for the increase of the infection index ofor the cercosporosis, in relation with the previous vegetation - MC6634x4499 and MC201x4499, as well as a reverse tendency for the slecion material 5109-2xmm. During the last vegetation from the examination period all selection materials with imported leaf fertilizer, except the cross – fertilization MC201x5101, show diversion in the infection index values in relation to the standard sort. Eight of the materials have positive diversions - 5319-4xMM, MC222x5319, 4499-4xMM, MC222x 4499, MC6634x4499, MC201x4499, MC222x5109 and MC201x5109. For nine of the selection materials are recorded the lowest values of the infection index for the cercosporosis in relation with the standard sort. These are the cross – fertilizations MC6634- 2xmm, MC201x 5319, 5101-2xmm, MC6634x5101, MC222x5101, 5109-2xmm, MC6634x5109, MC222-2xmm and MC201-2xmm.

During the same year, for the materials, cultivated without importing the leaf fertilizer, the diversions in the values of the infection index are recorded for nine selection materials, three of which are positive in relation to the standard - MC6634x4499, MC222x5109 and MC201x5109, and six negative - MC6634- 2xmm, MC201x 5319, 5101-2xmm, MC6634x5101, MC222x5101 and MC222-2xmm.

The generalized results show that for two selection materials the import of leaf fertilizer leads to increase of the infection index for the cercosporosis. These are the cross – fertilizations MC222x5319 and 4499-4xMM. For the rest of the tested material, the import of the leaf fertilizer has not affected the infection index for the cercosporosis. The main development factor for the cercosporosis - *Cercospora beticola* Sacardo under these test conditions is the stability of the selection materials. Regardless from the import of the leaf fertilizer– „Хумустин”, in dose 1000ml/ ha, the tested selection cross – fertilization have clearly shown differences regarding the occurrence of cercosporosis. For five selection materials the infection index is higher than the others, compared to the standard sort „Pechtera”. These are the cross - fertilizations: MC201x 5319, MC6634x4499, MC6634x4499 , MC222x5109и MC201x5109, which are assessed as averagely sensitive (MS). The standard sort „Pechtera” and another six selection materials have the same assessment and their infection index for the cercosporosis is close to the index recorded for the standard - MC201x5109, 4499-4xMM, MC6634x4499, MC201x5101, MC6634x5109 and MC222x 4499. The rest of the selection materials are assessed as averagely stable, i.e. they are with higher stability index tyhan the standard sort. These are the cross - fertilizations MC222x5101, MC6634x5101, MC201x 5319 and MC6634- 2xmm, whose infection index is significantly lower than the value for the standard sort, as well as the materials MC201-2xmm, 5109-2xmm, MC222-2xmm, 5101-2xmm and 5101-2xmm , whose diversion in relation with the standard infection index is also negative.

4. CONCLUSIONS

The results from the performed examinations and recording give reasons for the following conclusions:

The infection index of the cercosporosis - *Cercospora beticola* Sacardo for the sugar beet depends mainly on the stability of the plants and in lesser extent on the external conditions.

The tested selection materials are averagely stable and averagely sensitive.

The import of the leave fertilizer „Chumustim”, in dose 1000ml/ha, under favourable conditions for the development of the cercosporosis does not affect the infection index values.

REFERENCES

- Burenin S., 2001.** The level of resistance to Korneev hybrid forms and self-pollinated lines of beet. Genetic collections ovosuny plants. SPb.191-197.
- Harveson Robert M, Gary H, Smith A., Wilson G., 2001.** Response of sugar beet cultivars to diseases in the *Central High Plains J. Sugar Beet Kes 36.№ 1,72.*
- Lewelen K., 2001,** Inheritance of powdery mildew resistance in sugar beet derived from *beta vulgaris* subsp. *maritima*. *Plant Disease-85 № 6, 627-631.*
- PopkovaV., 1987.** Methods of study of plant pathology. "Kolos". Kiev., 387s.
- Takenakai, Shigehito, Mitsuru Sayama, 2002.** *Soc. Sugar Beet Technol. № 43, 58-64.*
- Tanova K., 2003.** Investigations on the cause of the decay of vegetation roots in sugar beet (*Rhizoctonia solani* Kühn) - dissertation.
- Rouk M.,NurmochamedovN ., 2001.** Resistance breeding materials to Korneev. *Tsukrovi Buriak, 3, 6-7.*
- Ulrich – Eberhard, 1996.** Entwicklung einer Prüfmethode and *Cercospora – Resistenz bei Zuckerrüben* dorten unter Feldbe dinqungen- erst *Ergebniss. Zuckerindustrie 121, № 8, 580 585.*
- Uhcunova K., I.Uhcunov, 2004.** Testing of parental and hybrid forms of sugar beet resistant to powdery mildew and cercospora. *Studies on arable crops. 1-3, 500-504.*
- Varlanov V., 1987.** On some problems of disease control in sugar beet. *Plant protection - 3 11-14.*
- Varlanov V., 1994.** Diseases of sugar beet. *Agriculture 5, 25-26.*

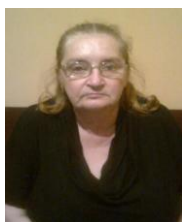
AUTHORS' BIOGRAPHY



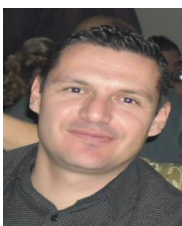
Svilen Penchev Raikov, Associate Professor DR Works in Konstantin Preslavsky University, Shumen, Bulgaria; Faculty of Natural Sciences Department of Agrarian Sciences and Plant Protection.2004 - Associate Professor, Agricultural Sciences and Plant Protection **FIELDS OF INTEREST:** Herbology, general agriculture, organic farming and ecology.



Kulka Stoyneva Uchkunova, Associate Professor DR. Works in Agricultural Institute, Shumen, Bulgaria; Department of plant breeding and Plant Protection **FIELDS OF INTEREST:** Breeding of Beet and Stevia



Krasimira Trifonova Tanova, Associate Professor Works in Konstantin Preslavsky University, Shumen, Bulgaria; Faculty of Natural Sciences Department of Agrarian Sciences and Plant Protection.2008- Associate Professor DR., Agricultural Sciences and Plant Protection **FIELDS OF INTEREST:** Phytopathology, immunity, integrated plant protection, quarantine, microbiology and ecology.



Veselin Iliev Uchkunov, Master Agronomist in Plant Protection in the Agricultural Institute – Shumen, Department of Selection and Plant Protection. **FIELDS OF INTEREST** – selection and plant protection of stevia.