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ESTIMATION OF RESISTANCE OF BREEDING NUMBERS OF SUGAR BEET TO LEAF DISEASES

The article deals with the resistance of CMS hybrids, tetraploid and diploid forms of sugar beet to cercosporosis and erysiphosis. There was determined that diploid materials are less resistant than tetraploid ones, and variability in diseases degree was estimated during several years. Perspective materials for hybrids which can be used in bio-adaptive technology were selected.
***Keywords**: cercosporosis, erysiphosis, hybrids, diploid and tetraploid materials*

Introduction. Growing up cytoplasmic male sterile (CMS) hybrids of sugar beet by bio-adaptive technology foresees use of hybrids which combine high productivity, good germinating activity, good adaptive ability to different soil-climatic conditions and high resistance to leaf diseases such as cercosporosis and erysiphosis .

Last years the tendency to global heating of the climate in all zones of sugar beet growing which in combination with higher humidity in June – August, essentially in zones with normal humidity, and intensive spreading of diseases pathogenes brings to intensive use of chemical plant protection methods in sugar beet growing , and therefore to environment spoiling and yield losses [1, 2].

Cercosporosis and erysiphosis are essentially damaging diseases of sugar beet leaves. Cercosporosis makes great damages to springs. The disease shows light-brown spots on leaves, and then it brings to drying and untimely dying of leaves. The disease mostly progresses under conditions of high humidity and temperature. Yield losses are essential - sugar yield is less by 5 to 10 %, and 30 to 70 % in years of epiphytoty , in time all quality characteristics are grow worse such as technological quality, level of mineral nitrogen and juice quality, roots are worse stored.

Agro-technical methods and chemical use are effective in sugar beet plant protection but more rational is the use of cercosporosis resistant varieties. In the fields of former USSR resistant to cercosporosis varieties were grown: Kuban poly-hybrid 9, First May poly-hybrid 10, North Cuacasus monogerm variety 42 etc. These varieties were grown in large areas (about 200 thousand ha) which have more frequent epiphytoties [3-5].

Powder mildew is also damaging disease of sugar beet, it is extended in southern and central regions of Ukraine. This disease shows powder spots first on up then down part of leaves, in the end of vegetation when fungus grow up these spots became light and further dark brown and black. Most intensively the disease grows during hot dry years in the end of summer and it ruins assimilation ability of the plants. High relative humidity, intensive solar lightening and high average daily temperature also promote growth of the disease. Under such conditions the fungus gets more nutrition from the plant and thus brings the plant to death by untimely drying of tissues and lowering of physiological processes, and as a result it decreases the yield. Plant protection chemicals (fungicides) lowers growth of disease by 2 – 6 times, increase yield by 3 – 4 t/ha, sugar content grows by 0,5% and sugar yield by 7 – 15 % [3].

However even use of modern chemicals of system force brings to soil and water pollination. To avoid this now we can use as a part of bio-adaptive technology hybrids with genetic resistance to diseases. Therefore modern scientists between the methods of effective plant protection give first place in the system of plant protection of the crop to the use of resistant to diseases of leaves sugar beet hybrids [6].

The breeders of Yaltushkivska and Bilotserkivska RBS now put the greatest attention to breeding of resistant to this disease initial breeding materials. Peretyatko V.G. noted, that selection during many years under condition of natural infection background makes it possible to select forms with higher resistance to leaf diseases. Resistance of breeding materials to powder mildew was 40 – 50 % in comparison with the standard, to cercosporosis – 1,97 – 4,06 points [7]. The best resistant between cultivated varieties those time (80 -90 years of last century) were Yaltushkivsiy monogerm 30 variety , which was at the same time resistant to cercosporosis and powder mildew, and Bilotserkivskiy monogerm 60, Bilotserkivskiy MS hybrid 11. Also the lines which were used as a source and donors of resistance were created.

Now breeding is based on the creation of CMS hybrids, and the problem of resistance to diseases is of greater value not only from the aspect of bio-adaptive technology, but from genetic aspect too. The hybrids are more homogenic in comparison with varieties, it makes them more damaged when new aggressive race of pathogene appears. Another problem is how to combine in one genotype high resistance to diseases and high economically valuable characteristics that is why complex approach with use of inbreeding and hybridization must be performed.

The aim of our research was to estimate tetraploid materials –pollinators of Bilotserkivska RBS origin, and also hybrids used in Betaintercross program which are resistant to cercosporosis and erysiphosis.

Materials and methods. At Bilotserkivska RBS estimation and selection of tetraploid pollinators resistant to cercosporosis and erysiphosis is carried out for many years.

In 2008 in the field with artificial infestation materials which had resistance to cercosporosis essentially better of the standard P028 or equal were selected [8,9]. In 2010 – 2012 years resistance of posterity of individual selection and hybrids from the Betaintercross program was researched on natural infestation background for cercosporosis, and during 2008-2012 years they were estimated for resistance to erysiphosis.

Results and discussion. Analysis had shown that in 2010 3 numbers (4,2%) had got low level of resistance to cercosporosis (0 – 10%), in 2011 3 pollinators (4.7%) were selected, and in 2012 better results showed 11 numbers , which is 13,1% from all estimated numbers. Level of damage was 11 – 20 % in 28 pollinators (40%) in 2010. in 2011 – 2012 their part was smaller (9,4% and 25,0%), it was determined by condition of the year (*Table 1*).

Table 1

Level of cercosporosis damage of tetraploid pollinators of sugar beet of Bilotserkivska RBS breeding origin, 2010 – 2012 years.

Damage level , %	2010		2011		2012	
	numbers	%	numbers .	%	numbers	%
0 - 10	3	4,2	3	4,7	11	13,1
11 - 20	28	40,0	6	9,4	21	25,0
21 - 30	2	2,9	18	28,1	52	52
31 - 40	21	30,9	21	32,8	-	-
41 - 50	9	12,9	16	25,0	-	-
51 - 70	7	10,0	-	-	-	-
in total	70	100	64	100	84	100

The results show that breeding genofond of tetrapoloid pollinators of Bilotserkivska RBS breeding origin has sources of genes of resistance to cercosporosis, and they are included in the breeding process of components of heterosis hybrids of sugar beet on the basis of CMS [10].

Comparison of damage levels of pollinators of tetraploid and diploid level showed, that diploids are more damaged. So in 2010 2 numbers (2,9%) were damaged by the disease for 21 – 30%, and 21 numbers (30%) were damaged by the disease for 31- 40%, at the time diploids showed 33,3 and 40,0 %, the fact is explained by the peculiarities of polyploidy forms (more solid cuticles, greater leaves etc.).

At Bilotserkivska RBS we have estimated cercosporosis damage in variety tests and in experimental CMS hybrids (458 hybrids) in 2010 – 2012. In 2010 more than 50% damage had 67,9% of hybrids, in 2011 – 94,7% , in 2012 – 75,5% of all tested numbers. It shows that mother components was not well selected, thus there were hybrids tolerant to cercosporosis (11numbers).

Estimation of numbers with different genetic structure for erysiphosis damage showed that hybrids in 2008 were not essentially damaged (93,1% of numbers were damaged only for 5%).

Comparison of tetraploid and diploid numbers showed that main part of tetraploid numbers (77,9) were the same, while diploid numbers (61,1%) were damaged for the level of 5 – 10% (table 2). In 2009 the situation was the same. In 2010 damage was higher because of negative climate conditions. Level of damage 11-20% was in 38,& % hybrids, level 21 – 30 – 37,2 %, some hybrids (2,5%) had higher damage level. We must say that homozigotic lines were more damaged by erysiphosis, that hybrids, diploids were mere damaged than tetraploids.

Table 2

Erysiphosis damage of breeding test of sugar beet in 2008 -2010

Damage level , %	Hybrids		Tetraploid materials (Multigerm pollinators)		Tetraploid materials MS – forms and O-types (diploid forms)	
	numbers	%	numbers	%	numbers	%
2008						
0- 5	201	93,1	66	77,6	27	28,4
6-10	15	6,9	16	18,8	58	61,1
11-20	-	-	3	3,6	10	10,5
in total	216	100	95	100	85	100
2009						
0-5	176	73,9	12	10,7	5	33,3
6-10	49	20,6	78	69,6	6	40,0
11-20	13	5,5	22	19,7	4	26,7
in total	238	100	112	100	15	100
2010						
0-5	8	1,7	3	4,3	-	-
6-10	93	19,9	36	51,4	5	33,3
11-20	181	38,7	21	30,0	4	26,7
21-30	174	37,2	11	14,3	6	40,0
31-40	12	2,5	-	-	-	-
in total	468	100	70	100	15	100

Among best multigerm lines were some lines, which combined high combination ability and high productivity with high resistance to leaf diseases. Such were 1068 and 1006 lines (resistant to cercosporosis), 1069 and 1038 (resistant to erysiphosis). Pollinator 1019 was high resistant to the both diseases

Conclusions. So we can say, that the sources and donors of genes of resistance of Bilotserkivska RBS origin are included to the process of creation and testing of pollinators – components of hybrids on MS basis, which makes possible creation of competitive hybrids with high productivity and good resistance to diseases. Breeding material of tetraploid level have less damage than diploid ones. Show of the cercosporosis and erysiphosis is different if various years of experiments. Perspective breeding materials for creating hybrids which can be used in bio-adaptive technology of crop growing were selected.

References

1. Апасов И. В. Устойчивость к церкоспорозу в современных условиях и способы снижения их экологической вредоносности / И. В. Апасов, А. В. Корниенко, О. И. Стогненко, Г. А.Селиванова. – Воронеж, 2007. – 36с.

2. Sumka A. Investigation of the Ukrainian Cercospora beticola isolates.// Reparstvi and sladovnicky jesmen. Sbornik z conference / A. Sumka Praga ceska zemedelska univerzita v Praze. – 2004. – 4racnik. – S. 86-88.

3. Болезни технических культур / В. Ф. Пересыпкин, З. А.Пожар, А. С. Корниенко ; под ред. В. Ф. Пересыпкина. – М. : Агропромиздат, 1986. – 317 с.

4. Корниенко А. С. Современные проблемы защиты сахарной свеклы от болезней при индустриальной технологи возделывания сахарной свеклы / А. С. Корниенко // Интегрированная система защиты сахарной свеклы от вредителей, болезней и сорняков : сб. научн. трудов. – К. : ВНИС. – С. 62-69.

5. Кустовский С. Е. Эффективные меры борьбы с болезнями и вредителями при интенсивной технологии возделывания сахарной свеклы / С. Е. Кустовский, А. А. Бабич, В. Т.Саблук. – К. : ВНИС, 1990. – С. 166-173.

6. Саблук В. Т. Шкідники та хвороби цукрових буряків / В. Т. Саблук, Т. Я. Шендрик, Н. М. Запольська. – К. : Колобіг, 2005. – 448 с.

7. Перетятько В. Г. Особенности селекции сахарной свеклы на устойчивость к болезням / В. Г. Перетятько // Достижения и перспективы в селнкции сахарной свеклы сб. науч. трудов. – К., 1987. – С. 10-22.

8. Роик Н. В. Отбор биотипов,устойчивых к болезням / Н. В. Роик, А. Я. Овчаренко, В. А. Яковец // Сахарная свекла. – 1985. – № 2. – С. 25-27.

9. Петриченко С. Н. Методы создания инфекционных фонов и оценки сахарной свеклы на устойчивость к церкоспорозу / С. Н. Петриченко // Методические указания по созданию инфекционных фонов и оценки сортов сахарной свеклы на устойчивость к болезням. – К.: ВНИС, 1985. – С. 14-16.

10. Мацук М. Б. Тетраплоидные опылители сахарной свеклы белоцерковской селекции как источники генов устойчивости к церкоспорозу / М. Б. Мацук, Л. Н. Чемерис. – Молодежь и инновации: Материалы Международной научно-практической конференции молодых ученых. – Ч. 1. – Горки: Белорусская ГСХА, 2013. – С. 236-237.

Анотація

Чемерис Л,М., Мацук М.Б., Корнєєва М.О.

Оцінка стійкості до листових хвороб гібридів і селекційних номерів цукрових буряків

У статті наведено оцінки стійкості до церкоспорозу і еризіфозу гібридів на основі ЦЧС, а також тетраплоїдних і диплоїдних форм цукрових буряків. Встановлено більша вразливість до листкових хвороб диплоїдних матеріалів порівняно із тетраплоїдними, а також мінливість ступеня ураження за роками досліджень. Виділено перспективні матеріали для формування гібридів, придатних для вирощування за біоадаптивною технологією.

Ключові слова: *церкоспороз, еризіфоз, стійкість, гібриди, ди- і тетраплоїдні матеріали*

Аннотация

Чемерис Л.Н., Мацук М.Б., Корнеева М.А.

Оценка устойчивости к листоыім болезням гибридов и селекционных номеров сахарной свеклы

В статье приведены оценки устойчивости к церкоспорозуи эризифозу гибридов на основе ЦМС, а также тетраплоидных и диплоидных форм сахарной свеклы. Установлена большая подверженность заболеваниям диплоидных форм по сравнению с тетраплоидными, а также изменчивость степени пораженности по годам исследований. Выделены перспективыне материалы для формирования гибридов, выращиваемых по биоадаптивной технологии.

Ключевые слова: *церкоспороз, эризифоз, устойчивость, гибриды, ди- и тетраплоидные материалы*