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HETEROSIS EFFECT IN PARTHENO CARPIC FIRST GENERATION CUCUMBER HYBRIDS

Autor:¹V.F. GOROKHOVSKY, ²E.A. SHULYAK, ¹T.I. MOKRYANSKAYA
*1State Unitary Enterprise "Pridnestrovian Research Institute of Agriculture"
Tiraspol, Republic of Moldova
2T.G. Shevchenko Pridnestrovian State University, Tiraspol, Republic of Moldova*

Abstract: In 2022-2023, six hybrid combinations of parthenocarpic cucumber, created on the basis of the maternal form of FL-85, were evaluated according to a set of basic useful characteristics (early, total and yield of standard fruits). A high positive competitive heterosis over the years was revealed in three hybrid combinations when grown in a film greenhouse and open field. According to the research results, the most promising and competitive samples for the main economically valuable characteristics are parthenocarpic heterosis hybrids of universal purpose F1 85 x 101, F1 85 x E-23 and F1 85 x 103.

Introduction

Cucumber occupies one of the leading places in global production. It is traditionally one of the most beloved cultures among the people. The constant increase in the area under this crop is facilitated by its relative precocity, universality, rent, as well as the constant demand for fruits among the population, which guarantees a hundred-mile market [1]. Currently, the most pressing issue in the field of selection, seed growing and agricultural technology of cucurbits crops, in particular cucumber, is the creation of new hybrids that combine high yield of fruits and seeds, complex resistance to diseases that have high-quality products [2, 3, 4] and for parthenocarpic hybrids – and a high degree of parthenocarpic [5]. One of the most important directions in plant breeding is heterosis, a complex biological phenomenon observed in the first generation after crossing various varieties and plant lines. The nature and degree of expression of heterosis in each specific case depends on the conditions for growing a particular culture [6]. The level of heterosis changes on average over the years of research [7]. Breeding science does not yet have a more powerful means of increasing the yield of cucumbers, and many other cucurbits crops, than using heterosis, which appears in first-generation hybrids [8]. Many foreign scientists in their works pay great attention to the study of the degree and nature of the expression of various types of heterosis (true, hypothetical and competitive), assessing the main economically valuable characteristics, in particular, the early, total and commercial (standard) yield of cucumber [9, 10, 11, 12, 13, 14, 15, 16].

Material and method

The scientific work was carried out at the Pridnestrovian Research Institute of Agriculture in 2022-2023. The research was carried out in film greenhouses with solar heating and open field. For two years, during the entire growing season (from april to september), the climatic conditions for growing cucumbers both in a film greenhouse and in the open field were not entirely favorable. The growth and development of cucumber was strongly influenced by night and daytime temperature fluctuations, uneven precipitation, and hence low humidity. The main selection material for the work was samples obtained in the laboratory of cucurbits of the Pridnestrovian Research Institute of Agriculture – the maternal form of FL-85 and six paternal lines – 79, 81, 84, 101, 103, E-23. The control sample was FL-85 (super-superelite) on the basis of which all six hybrid combinations were created. Evaluation of F1 hybrids was carried out according to parthenocarpic, early, total and yield of standard fruits. The degree of expression of parthenocarpic was calculated according to the Cucumber Selection Guidelines [19]. Crop counting was carried out after one day, early yield was determined for the first 15 days of fruiting [20]. The degree of expression of competitive heterosis by economically valuable characteristics was determined according to D.S. Omarov [21]. Mathematical processing of the obtained experimental data was performed by methods of analysis of variance according to B.A. Dospekhov [22].

Results and discussions

Currently, there is a fairly large assortment of short-fruited parthenocarpic cucumber hybrids for universal use in production, that is, intended for cultivation both in the open field and under temporary film shelters. The task of modern heterosis breeding is to obtain competitive parthenocarpic cucumber hybrids with a complex of economically valuable traits and properties. In 2022-2023, six parthenocarpic hybrid combinations based on the maternal form of FL-85 were evaluated in a film greenhouse and open field. As the obtained research data show (Table. 1), in a film greenhouse, according to the degree of expression of parthenocarpic, only two hybrid combinations (85 x E-23 and 85 x 101) significantly exceeded the original form of FL-85, respectively, by 6 and 8%, two were at the level, and the rest were inferior.

Name sample	Signs												Exit standard fruits, %		
	Parteno- carpia, %			Yield, kg/m ² , t/ha											
				early			total								
	years														
2022	2023	average	2022	2023	average	2022	2023	average	2022	2023	average				
Film greenhouse															
FL-85 (super-superelite)	91	88	90	2,9	3,1	3,0	12,0	12,6	12,3	86	83	85	85		
85 x 79	86	92	89	4,4	4,1	4,3	17,3	15,4	16,4	88	85	87	87		
85 x 81	83	80	82	2,5	3,3	2,9	10,1	12,8	11,5	80	85	83	88		
85 x 84	87	81	84	4,3	3,4	3,9	16,1	14,3	15,2	83	88	86	86		
85 x 101	95	98	97	9,6	8,8	9,2	27,0	25,2	26,1	78	80	79	78		
85 x 103	93	92	93	4,2	3,7	4,0	16,5	18,9	17,7	95	93	93	94		
85 x E-23	96	93	95	4,7	4,3	4,5	15,1	17,3	16,2	86	82	84	84		
ESD _{0,05}			3			1,2			3,1			5			
Open field															
FL-85 (super-superelite)				8,8	11,8	10,3	21,2	33,1	27,2	80	83	82	82		
85 x 79				14,7	22,4	18,6	47,5	50,2	48,9	79	77	77	78		
85 x 81				9,4	13,5	11,5	28,4	39,9	34,2	77	83	80	80		
85 x 84				12,3	16,7	14,5	30,7	41,4	36,1	79	80	80	80		
85 x 101				27,7	29,1	28,4	43,1	47,5	45,3	74	75	75	75		
85 x 103				18,8	25,4	22,1	46,3	52,1	49,2	84	88	86	86		
85 x E-23				12,4	19,2	15,8	37,1	49,9	43,5	74	85	80	80		
ESD _{0,05}						4,5			8,2			6			

According to the results of the obtained data (Table 2), in the spring film greenhouse according to data for 2022 and 2023, a positive competitive heterosis on the basis of parthenocarpia was noted, respectively, in 50 and 67% of hybrids of the total number of hybrid combinations; according to the signs of early and total yield, respectively, in 84 and 100% of the total hybrids; according to the yield of standard fruits, respectively, in 33 and 67% of hybrids from the total number of samples. The highest positive competitive heterosis for two years was observed in three hybrid combinations (85 x 101, 85 x E-23, 85 x 103) on the grounds of parthenocarpia, early and total yield and in the combination 85 x 103 – on the yield of standard fruits.

Hybrid combination, F ₁	Parteno- carpia			Signs Yield						Exit standard fruits		
				early		total						
	2022	2023		2022	2023		2022	2023				
Film greenhouse												
85 x 79	-5,5	4,5	51,7	32,3	44,2	22,2	2,3	2,4				
85 x 81	-8,8	-9,1	-13,8	6,5	-15,8	1,6	-7,0	2,4				
85 x 84	-4,4	-7,8	48,3	9,7	34,2	13,5	-3,5	6,0				
85 x 101	4,4	11,4	231,0	183,9	125,0	100,0	-9,3	-3,6				
85 x 103	2,2	4,5	44,8	19,4	37,5	50,0	10,5	12,0				
85 x E-23	5,5	5,7	62,0	38,7	25,8	37,3	0	-1,2				
Open field												
85 x 79				67,0	89,8	124,0	51,7	-1,25	-7,2			
85 x 81				6,8	14,4	34,0	20,5	-3,8	0			
85 x 84				39,8	41,5	44,8	25,1	-1,25	-3,6			
85 x 101				214,8	146,6	103,3	43,5	-7,5	-9,6			
85 x 103				113,6	115,3	118,4	57,4	5,0	6,0			
85 x E-23				40,9	62,7	75,0	50,8	-7,5	2,4			

Conclusions

1. The most promising parthenocarpic hybrids, selected on the basis of the maternal form of FL-85, are three hybrid combinations – 85 x 101, 85 x E-23, 85 x 103. 2. A high positive competitive heterosis in terms of the main economic prices in 2022 and 2023 was noted in the three above hybrid combinations when grown in film greenhouses and open field. 3. The results of the conducted research are confirmed by the works of domestic and foreign scientists.