

SUNFLOWER RESISTANCE TO RACE G OF BROOMRAPE: THE DEVELOPMENT OF THE LINES AND THE STUDY OF INHERITANCE

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The map of spreading of the highly virulent biotypes G of broomrape (*O. cumana*), parasitizing on sunflower on the territory of the Russian Federation





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The purpose of our research

- ✦ to search for possible sources of resistance, the development on their basis sunflower lines that are not affected by race G of broomrape
- ✦ the determination of genetic control of this trait



✦ The material for research were over 1000 samples of cultivated sunflower from the collection of the Kuban Experimental Station VIR, the collection of VNIIMK of cultivated sunflower of various origin, as well as the breeding lines VK 551, VK 678 B, VK 678 A, VK 1 IMI B, VK 1 IMI A, VK 301, VK 580 and PRO2, susceptible to broomrape.

✦ Seeds of broomrape were collected on the fields of the Bokovskiy district of the Rostov region. The identification of their racial belonging with the help of the known differentiation lines: 202A (C), LC1002 (D), LC1003 (E), LC1093 and P96 showed that the seeds belong to the race G.

✦ A greenhouse evaluation of resistance to broomrape was carried out by the method of A.Y. Panchenko



The degree of infestation by race G of broomrape (*O. cumana*) of some samples of cultivated sunflower of VIR collection

Catalog No.	Origin	Number of evaluated plants, pcs.	Infested plants, %	Degree* of infestation
667	Kabardino-Balkaria	30	23.3	2
769	Armenian SSR	30	23.3	1
3300	The Krasnodar region, line VIR-221	30	33.3	4
3475	The Krasnodar region, line VIR-665	30	10.0	2
3301	The Krasnodar region, line VIR-222	30	50.0	3
2005	The Primorsk region	26	26.9	2
3109	Bulgaria	23	17.4	2
3046	Argentina	22	9.0	2
2982	Spain	30	100	121
3080	Mexico	30	100	115
3015	Hungary	30	100	65
Susceptible control	Russia	30	100	115

* - number of broomrape specimens per one affected plant

On the basis of the obtained non-affected forms from all the studied collections, 6 lines resistant to race G were developed using inbreeding method. Genetic control of the resistance of one of them, line RG, has been studied.



THE DEGREE OF INFESTATION BY BROOMRAPE OF FAMILIES OF HYBRID COMBINATIONS OF SUNFLOWER IN F₁ FROM THE CROSS-BREEDINGS OF RESISTANT LINE RG WITH SUSCEPTIBLE LINES

Hybrid combination	Number of evaluated families	Plants infested, %	The average number of broomrape tubercles per one plant, pcs.	
			affected	accountable*
RG × VK 580	3	43.0	2	1.2
RG × VK 551	8	56.5	5.1	4.7
VK 551 × RG	6	97.5	11.5	11.4
RG × VK 301	5	26.0	1	0.2
VK 301 × RG	6	67.0	4.8	3.2
RG × VK1-imi	7	51.0	2.3	1.4
VK1-imiB × RG	5	62.0	2.6	1.6
VK1-imiA × RG	6	74.0	3	2.2
RG × VK 678 B	8	89.0	3	2.8
VK 678 B × RG	6	88.0	3.8	3.3
VK 678 A × RG	8	83.6	4.4	3.6
PRO2 × RG	3	55.2	2.4	1.6
Susceptible control	-	100	95	95

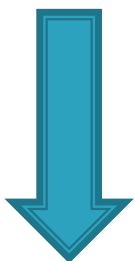
THE DEGREE OF INFESTATION BY BROOMRAPE OF FAMILIES OF RECIPROCAL HYBRID COMBINATIONS FROM THE CROSS-BREEDINGS OF RESISTANT LINE RG WITH SUSCEPTIBLE LINES

Hybrid combination	Number of evaluated families	Plants infested, %	The average number of broomrape tubercles per one accountable plant, pcs.
RG × VK 1IMI B	7	51	1.4
VK 1 IMI B × RG	5	62	2.3
SSD ₀₅		11.14	1.09
RG × VK 678 B	8	89	2.80
VK 678 B × RG	6	88	3.30
SSD ₀₅		3.72	0.89
RG × VK 551	8	56.5	4.7
VK 551 × RG	6	97.5	11.4
SSD ₀₅		11.91	7.5
RG × VK 301	5	26	0.2
VK 301 × RG	6	67	3.2
SSD ₀₅		16.01	3.3

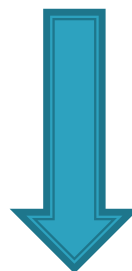
Depending on the degree of infestation, sunflower plants were divided into 3 groups

intermediate

resistant

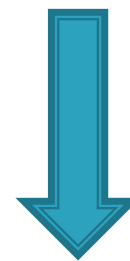


No healthy tubercles or sprouts were found on sunflower roots, but there were numerous necroses of cells in the area of broomrape penetration and dead tubercles



Sunflower plants having five and less broomrape tubercles on the roots

susceptible



More than 5 tubercles or formed broomrape sprouts on sunflower roots





THE INHERITANCE OF RESISTANCE OF SUNFLOWER TO THE RACE G OF BROOMRAPE IN F₂ POPULATIONS FROM THE CROSS-BREEDINGS OF RESISTANT LINE RG WITH SUSCEPTIBLE LINES

Cross-breeding	Number of plants, pieces			Expected segregation ratio	χ^2	df	P
	resistant	intermediate	susceptible				
RG × VK 678 B	26	65	35	1:2:1	1.40	2	0.50-0.30
RG × VK 1IMI B	25	81	38	1:2:1	4.57	2	0.20-0.10

THE INHERITANCE OF RESISTANCE OF SUNFLOWER TO THE RACE G OF BROOMRAPE IN BC1 POPULATIONS FROM THE CROSS-BREEDINGS OF RESISTANT LINE RG WITH SUSCEPTIBLE LINES

Cross-breeding	Number of plants, pieces			Expected segregation ratio	χ^2	df	P
	resistant	intermediate	susceptible				
(VK 678 B × RG) × VK678B	0	16	17	1:1	0.03	1	0.90-0.80
(VK1B × RG) × VK1B	0	12	11	1:1	0.04	1	0.90- 0.80
(VK 680 B × RG) × RGI	55	59	0	1:1	0.14	1	0.70
(PRO2 × RG) × RG	36	32	0	1:1	0.24	1	0.70



In conclusion

- ✦ 6 sunflower lines resistant to race G were developed.
- ✦ It is established that the resistance of one of them (RG line) is inherited monogeneously with incomplete dominance of the trait.
- ✦ In cross-breedings, the presence of the reciprocal effect and the dependence of resistance on the genotype of some susceptible parental line are established. There is not evidence of a reciprocal effect for the VK 1 IMI B and VK 678 B lines.
- ✦ Five non-affected lines of another origin are in the process of hybridologic analysis to determine the genetic control of their resistance.



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*Thank you
for your attention !*