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BREEDING SUNFLOWER RESISTANT TO NEW RACES OF BROOM RAPE

An important economic trait of sunflower varieties is their resistance to broom rape (Orobanche cumana Wallr.), along with their high productivity and oil content. According to a number of researches (L.A. Zhdanov, 1935; V. S. Pustovoit, 1966) broom rape severly attacked sunflower even at the turn of the century, causing complete destruction of sunflower crops.

Academician V.S. Pustovoit noted that in the history of sunflower growing broom rape had spread widely twice, leading to a drastic decrease of yield and reduction of areas under the crop. That is why the development of highly resistant varieties was one of the main objectives in sunflower breeding (V.S. Pustovoit, G.V. Pustovoit, 1963; V.I. Shcherbina, G.T. Romanyuk, 1963; K.I. Prokhorov, 1963).

Academicians V.S. Pustovoit and L.A. Zhdanov found the degree of the disease's virulence, its dissemination, complex composition of its races, and methods of evaluating resistance to this pathogen, they also worked out methods of breeding sunflower varieties completely immune against broom rape. Widely zoned sunflower varieties have for more than thirty years been resistant to broom rape, forming a diversified genetic stock for breeding highly productive sunflower varieties with high resistance to new aggressive strains of broom rape.

Recently in some regions of the Ukraine and Moldavia resistant varieties have been seriously affected by this pathogen. New broom rape strains, formerly unknown in breeding practice, were identified on sunflower plants.

In this connection plant breeders of the Armavir Experimental Station resumed their

work on obtaining initial stock characterized by complete field resistance to the new strains of broom rape.

Theexperimental work was mainly carried out under field conditions, where breeding stock was estimated on special infected plots. The best entries were multiplied on an isolated plot infected with broom rape seeds which were taken from different regions of the Soviet Union, such as the Krasnodar Territory the Ukraine and Moldavia. The breeding stock was therefore evaluated for resistance to all broom rape strains.

At the initial stages of selection all the commercial and promising varieties were tested to identify broom rape resistant forms. It turned out that all the commercial varieties investigated were highly susceptible to broom rape on infected plots, where damage varied from 74 to 100%, depending on varieties (Table 1). Yielding capacity was reduced 2-3 times. At the same time there were completely immune plants identified within each variety.

Seed reserves from the first and the second year selection nurseries were sown in 1967 for evaluation of their resistance. It turned out that only one from 700 families possessed complete resistance to this pathogen and the rest were susceptible to a different extent. This family (No. 16693) derived from Armavirsky 3497 variety served as a source for obtaining a broom rape resistant variety. Reserve seeds of the family were tried out again on an infected plot for precise evaluation of resistance degree. The seeds were sown on feeding area of 140x140 cm with one plant per hill.

Selection of the most valuable biotypes was effected by selfing in 1968. The best plants selected had complete broom rape resistance during the whole period of vegetation. Next year self-pollinated lines were evaluated for broom-rape resistance on an in-

Table 1

Affection of Commercial Varieties by Broom Rape under Artificial Inoculation

Variety	Broomrape affection, %	Affection degree	Number of broom rape floriferous shoots per 100 sunflower plants
Armavirsky 3497 improved	86.0	18.0	1548
VNIIMK 1646 improved	86.0	18.4	1582
Armavirsky 15	74.3	14.5	1077
Mayak	100.0	34.2	3420
Peredovik improved	85.1	18.3	1557
VNIIMK 8931 improved	96.2	28.5	2741

Table 2

Results of Competitive Test of Broom Rape Resistant Variety Start

Variety	Broom-rape affection, %	Seed yield, c/ha			Oil content, %	Oil yield, c/ha
		1974	1975	mean		
Armavirsky 3479 (check)	94.0	29.9	40.0	30.1	48.8	13.6
Start	2.3	31.5	32.1	31.8	51.1	14.8
S x% =		3.40	2.73			
LSD 0.95 =		2.06	1.64			

fected plot. Only 180 out of 540 sown lines came out to be completely immune against this parasite. Though their productivity was somewhat reduced due to self-pollination, some of them possessed high yield, oil content and other valuable traits.

A group of 55 best lines was formed and their seeds were sown simultaneously with broom rape seeds in the spatially isolated plot to get a varietal population. Plants with undesirable traits were four times sorted off for the whole vegetation period. 222 broom-rape resistant entries were singled out as a result and tested on an infected plot during 1971 and 1972. 30 entries showed complete resistance to the pathogen and the rest possessed a low affection degree ranging from 1.5 to 6.8.

120 highly productive and resistant families were singled out by recurrent selection in the directed interpollination nursery. About 40% of the plants showed complete resistance on the infected plot. The best families created by this method were used for breeding a variety.

The most interesting family No. 114 was used for breeding broom-rape variety Start, with resistance rate of up to 97.7% (Table 2).

This variety has seed yield equal to that of the check and exceeds it in oil content by 2.3%.