

BIOCHEMICAL DIFFERENTIATION OF SUNFLOWER VARIETIES AS A RESULT OF INBREEDING

P. IVANOV
(Bulgaria)

A sunflower variety is a population of individuals differing in their heredity. The creation of inbred lines necessary for heterosis selection leads to the decomposition of the population into different relatively homozygous genotypes. That is why the investigation of the inbred lines in search for new forms with valuable economic features is theoretically well-reasoned by the fact that selfing causes the appearance of many new characters in homozygous state never found before within sunflower varieties.

The subject of this study is related to some chemical indices: the oil content in the kernel and its fatty acid composition as well as protein content and the quantity of lysine, methionine and triptophan in the protein.

The studied inbreds were in the sixth selfing generation. The degree of selfing is suitable for a study of this kind because the homozygotes in each loci are more than 99 per cent already. This was confirmed by the results of the morphological studies carried out by Stoyanova (1972) with sunflower inbred lines.

The investigated lines were developed from 2-19-IZR, Donskoy, Mayak and Peredovik varieties and from a group of varieties of different geographic origin. The Rushkovsky method (1975) was used for oil content determination. Oil was extracted with petroleum ether and methyl esters were prepared with the help of sodium methylate. The esters obtained were separated with a gas chromatograph.

Protein was determined by Kjeldahl method using 6.25 as a coefficient for calculating nitrogen content in protein. Lysine quantity was determined by Musiiko-Svesoev's method (1970). Triptophan was determined by the method of Ermakov and others (1967), and methionine — by the not-yet published method of Ivanov-Rachinska. The quantity of the determined amino-acids is expressed in percentage of the protein content.

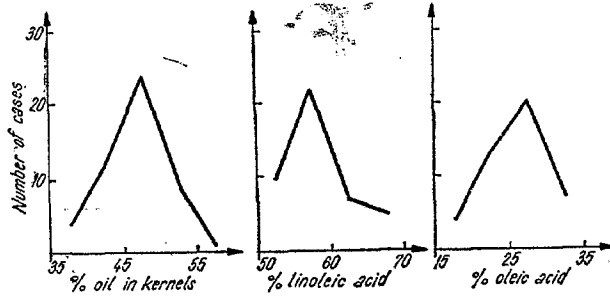


Fig. 1 — Variation in oil content and fatty acid composition.

The results of the analyses are graphically represented in figures 1 and 2. In table 1 the data of the most wide-spread variety in this country Peredovik are compared with the intervals in which the maximum of distributive curves are disposed.

It is obvious that most of the analysed lines are similar to the standard in their chemical composition and tryptophan content in protein even exceeds it and this could be reckoned as a positive point in our selection work.

The results are presented in table 2 for each variety in comparison with Peredovik and the extremes of the studied characteristics are given. It appears that the inbred lines from Donskoy and Peredovik

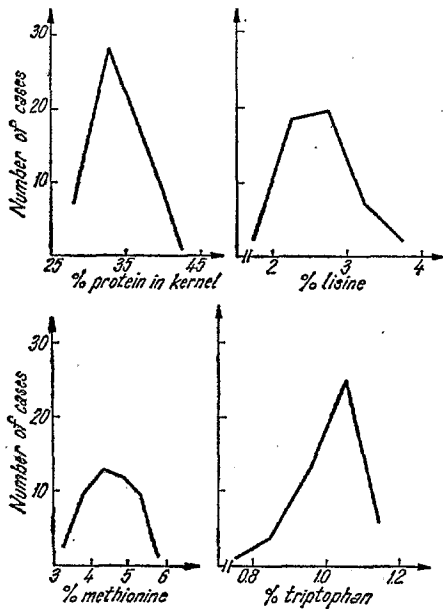


Fig. 2 — Variation in protein content and amino-acid composition.

Table 1

The maximum of the distributive curves

Indices	Peredovik	Intervals
Oil in kernel	49.7	45—50
Linoleic acid	61.9	55—60
Oleic acid	25.3	25—30
Protein in kernel	33.8	30—35
Lysine	2.52	2—3
Methionine	4.09	4.0—4.5
Tryptophan	0.79	1.0—1.1

Table 2

Variation of biochemical indices in sunflower inbred lines obtained from different varieties

Variety Indices	2—19—IZR	Donskoy	Mayak	Peredovik	Combined group lines
<i>Oil in kernel, %</i>					
intervals difference	45.3—52.5 7.2	39.9—56.2 16.3	43.6—52.5 8.9	43.1—51.1 8.0	37.1—49.8 12.7
<i>Linoleic acid, %</i>					
intervals difference	53.7—59.8 6.1	57.0—6.68 9.8	52.9—65.1 12.2	51.6—65.3 13.7	51.7—67.7 16.0
<i>Oleic acid, %</i>					
intervals difference	20.5—28.9 8.4	22.4—28.1 5.7	20.8—33.4 12.6	21.2—29.9 8.7	17.1—33.7 16.6
<i>Protein in kernel, %</i>					
intervals difference	29.2—32.1 2.9	25.4—37.3 11.9	26.9—36.3 9.4	30.1—35.6 5.5	31.0—40.3 9.3
<i>Lysine %</i>					
intervals difference	2.08—3.10 1.02	1.96—3.12 1.16	2.07—3.09 0.92	2.15—4.00 1.85	1.88—3.90 2.02
<i>Methionine, %</i>					
intervals difference	3.92—4.95 1.03	3.42—6.02 5.60	3.67—5.36 1.69	4.09—6.25 2.16	3.45—5.61 2.16
<i>Tryptophan, %</i>					
intervals difference	0.85—1.03 0.18	0.89—1.16 0.27	0.98—1.19 0.21	0.79—1.08 0.29	0.94—1.32 0.38

show higher variation compared with those from 2-19-1ZR and Mayak. As supposed, the materials from the combined group were of highest variation.

After analysing the studied indices we can draw the following conclusions :

Inbreds from Donskoy variety have the highest oil content. We found the highest linoleic acid content in the lines of the combined group, while the lowest in lines from Peredovik and Mayak varieties.

The highest oleic acid content was in oils coming from the combined group lines and Mayak variety and the lowest — from lines of the combined group too.

The highest protein content in kernel was found in lines of the combined group and the lowest — in lines from Donskoy variety.

In lines from Peredovik were determined the highest values for lysine and methionine content but the highest value for tryptophan was detected in a line coming from Mayak variety.

Our results concerning the variation of the biochemical indices in the analysed lines enable the evaluation of prospects for finding the wanted forms among the rest of the lines obtained from different varieties.

Table 3 shows the lines with the highest values for each of the studied indices.

Table 3

Inbred lines with the highest investigated indices

Inbreds	% oil in kernel	C 18:2 %	C 18:1 %	% protein in kernel	Lysine%	Methionine %	Tryptophan %
Peredovik	49.7	59.4	26.0	33.8	2.52	4.09	0.79
834	56.2	65.2	22.9	25.4	3.05	5.05	1.16
1726	52.5	59.4	27.3	29.2	2.38	3.99	0.93
2090	42.6	67.7	17.1	31.6	3.23	5.39	1.09
1039	51.5	66.8	22.4	26.8	3.05	6.02	1.16
1593	50.7	54.6	33.4	30.8	2.39	4.55	1.15
1855	46.2	51.7	33.7	36.2	2.20	3.60	1.03
1851	42.3	52.9	30.2	40.3	1.88	3.52	1.05
2034	42.1	59.1	26.7	39.5	2.70	4.16	1.06
928	43.1	55.4	27.5	34.9	4.00	4.66	0.88
1685	37.1	59.7	19.2	33.0	3.90	5.61	1.32
1253	45.1	65.3	23.1	34.0	2.24	6.25	0.94
Mayak	48.9	62.4	27.8	32.9	2.17	4.33	1.19

As for the fatty acid composition the inbred lines 1953 and 1855 are more interesting, having the maximum oleic acid content. Line 928 could be of some interest too as it combines in a good interrelationship all studied indices. Its lysine content in protein is 4 per cent which is 59 per cent higher than that of the standard variety Peredovik.

The inbreds from table 3 will serve as a basis for further selecting genotypes with higher values of the biochemical indices, by analyzing each particular plant.

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