

INHERITANCE OF C-18 FATTY ACIDS COMPOSITION
IN SEED OIL ZEROERUCIC WINTER RAPE
/BRASSICA NAPUS L./

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Presented researches on the inheritance of C-18 acids are a continuation of a former work /1/ in which the mechanism of linolenic acid inheritance could not be described, since the zeroerucic lines used in those experiments were not differentiated enough in respect of that acid content.

MATERIAL AND METHODS

Seven inbred lines of zeroerucic winter rape significantly differentiated in respect of oleic, linoleic and linolenic acids content in oil were used for investigations /table 1/. Between these lines crosses in complete diallelic design were performed twice in the following two years. Next, to estimate genetic parameters and to obtain seeds from F_1 plants, field trial in completely randomized block designs, comprising inbred parental lines and hybrids, was sown in three repetitions.

Factor analyses of variance in cross classification according to maternal plants and pollinators were performed for investigated traits of seeds obtained from cross pollination and from F_1 plants. Components of genetic and non-hereditary variability were estimated by factoring of mean squares into expected values /2/.

RESULTS

Results of conducted investigations revealed no significant differences between oleic acid content in seeds obtained from cross- and self - pollination. Significant differences appeared among groups set up according to maternal plants, while groups set up according to pollinators did not differ significantly. Hybrid character regarding oleic acid content appeared in the next generation, that is in seeds collected from F_1 plants. In this generation no differences in

reciprocal crosses were observed. Significant differentiation appeared among groups set up both according to maternal plants and to pollinators /table 2/.

The same phenomenon occurred in case of linolenic acid /table 3/.

In case of linoleic acid, hybrid character of seeds also clearly appears in seeds collected from F₁ plants. However the embryo, not only maternal plant displays certain influence on linoleic acid content what can be stated in seeds produced by cross-pollination. Significant differences occur also among groups set up to pollinators /table 4/.

In oleic and linolenic acid, factoring of mean squares into expected values showed that complete genetic variability in seeds from cross-pollination depends only on maternal plant genotype. Linoleic acid content is considerably influenced by maternal plant genotype but also pollinator genotype has influence which is four times less but significant /table 5/.

Variability analysis conducted for seeds obtained from F₁ plants showed that maternal plant and pollinator significantly affect C-18 acid content in rape oil. Besides, oleic and linoleic acid content is affected significantly by interaction of both parents.

Factoring of mean squares showed approximately equal influence of maternal plant and pollinator on C-18 acid content in oil of seeds collected from F₁ plants, so fatty acid composition of this generation reflected the hybrid character typical for F₁ generation /table 6/. Besides genetic factors, also environmental variability modifies considerably C-18 acid content in rape seed oil.

CONCLUSIONS

- Linolenic and oleic acid content in rape seed oil is determined genetically entirely by maternal plant genotype, and not embryo genotype.
- Linoleic acid content is controlled mainly by maternal plant genotype. Participation of embryo genotype in genetic control of that trait is four times less but significant.
- Information about quality of obtained hybrid in respect of C-18 acid content is received in the next generation. Therefore selection among single seeds collected from F₁ plants cannot be performed efficiently.
- Interaction of genotypes of both parental forms significantly influences oleic and linoleic acid content.
- Environmental variability modifies in high degree oleic, linoleic and linolenic acid content in rape seed oil.

REFERENCES

1. Bartkowiak-Broda I., 1978, Proceedings 5th International Rapeseed Conference, Malmö, Sweden, June 12-16, 1, 119-123.
2. Elandt R., 1964, Statystyka Matematyczna w Zastosowaniu do Doswiadczalnictwa Rolniczego, PWN Warszawa.

Table-1 : Parental lines characteristics C-18 acid composition in percents of oil.

Line	C _{18:1}	C _{18:2}	C _{18:3}
375	55,8	21,1	14,6
736	64,0	16,0	12,6
1198	54,4	24,5	12,7
1200	52,9	25,9	12,7
1261	53,4	22,3	15,5
1265	47,7	25,7	17,1
1266	53,0	22,9	16,1
LSD _{0,05}	6,14	3,90	1,67

Table-2 : Inheritance of oleic acid / %/.

Line	Seeds obtained from self- and cross-pollination			Seeds obtained from F ₁ plants		
	Parental lines	Means for groups according to		Parental lines	Means for groups according to	
		Maternal plants	Pollinators		Maternal plants	Pollinators
375	55,8	56,9	56,2	56,5	57,0	56,8
736	64,0	62,6	57,5	64,8	60,5	60,8
1198	54,4	57,7	54,8	54,5	56,2	55,5
1200	52,9	56,2	54,8	49,6	54,5	53,9
1261	53,4	54,4	56,7	55,1	55,6	55,4
1265	47,8	52,1	56,2	50,0	53,2	54,1
1266	53,0	52,8	56,5	51,1	54,5	54,9
LSD _{0,05}	6,14	3,69	3,69	2,13	1,19	1,19

Table-3 : Inheritance of linolenic acid % / .

Line	Seeds obtained from self- and cross-pollination			Seeds obtained from F ₁ plants		
	Parental lines	Means for groups according to		Parental lines	Means for groups according to	
		Maternal plants	Pollinators		Maternal plants	Pollinators
375	14,6	12,4	14,4	14,2	14,5	14,6
736	12,6	12,5	14,4	13,1	13,9	13,9
1198	12,7	12,5	14,4	12,9	13,5	13,7
1200	12,7	13,2	14,1	13,6	14,0	14,1
1261	15,5	15,5	14,1	15,3	15,1	15,1
1265	17,1	15,7	14,3	17,0	16,0	15,6
1266	16,1	16,1	14,2	16,5	15,5	15,4
LSD _{0,05}	1,67	1,69	1,69	0,84	0,34	0,34

Table-4 : Inheritance of linoleic acid % / .

Line	Seeds obtained from self- and cross-pollination			Seeds obtained from F ₁ plants		
	Parental lines	Means for groups according to		Parental lines	Means for groups according to	
		Maternal plants	Pollinators		Maternal plants	Pollinators
375	21,1	20,6	21,1	20,2	20,1	20,5
736	16,0	16,7	20,1	15,0	17,9	17,8
1198	24,5	21,7	22,9	24,4	22,2	22,5
1200	25,9	22,6	23,3	28,0	23,3	23,7
1261	22,3	21,7	20,2	21,0	21,1	20,2
1265	25,7	23,7	21,4	23,6	21,4	21,7
1266	22,9	22,8	21,2	23,8	21,8	21,5
LSD _{0,05}	3,90	2,02	2,02	1,32	1,19	1,19

Table-5 : Variability components for seeds obtained from cross- and self-pollination /percent of total variability/.

Source of variability	oleic acid	linoleic acid	linolenic acid
Maternal plant genotype	57,10	56,08	54,57
Pollinator plant genotype	2,19	18,44	0,00
Genotypes interaction	0,00	0,00	0,00
Years	2,71	0,00	6,32
Environment + error	38,00	25,48	39,11
TOTAL	100,00	100,00	100,00

Table 6 : Variability components for seeds collected from F₁ plants /percent of total variability/.

Source of variability	oleic acid	linoleic acid	linolenic acid
Maternal plant genotype	34,71	32,28	40,58
Pollinator plant genotype	34,39	38,71	28,50
Genotypes interaction	4,81	11,96	1,45
Environment + error	26,09	17,05	29,47
TOTAL	100,00	100,00	100,00