# INTER AND INTRASPECIFIC DIFFERENCES IN THE VARIABILITY AND CORRELATION OF SEED OIL FATTY ACIDS IN *BRASSICACEAE*

E. RUDLOFF

Federal Centre for Breeding Research on Cultivated Plants, Institute for Crop Breeding, D-18190 Groß Lüsewitz

## ABSTRACT

Each 50 to 60 single seeds of 76 entries from 9 different *Brassicaceae* have been analysed by capillary gas chromatography as to their seed oil composition. It has been observed a great variability in fatty acid content thus providing a good base for selection of lines with different seed oil composition. Great variability occurred for the correlation of several fatty acids, too. The well known negative correlation between C18:1 and C22:1 seems to be the only stable one.All other correlated fatty acids showed clearly a greater variation.

## INTRODUCTION

The change of the seed oil composition is still one of the main objectives in breeding of rapeseed (*Brassica napus* L.) Therefore there is a great interest in all sources useable for the creation of new varieties. One of these sources is the naturally occurring variation of the fatty acid (f.a.) composition of seed oils. Fortunately the *Brassica* family contains a great number of very different genera and species thus providing a sufficient variability for several desired traits, also for f.a.'s . As an amphidiploid species *Brassica napus* shows chromosomal homologies and homoeologies, resp., with other species and genera of the family,resp.. This and the generally good capability of *in vitro* techniques in *Brassica* enable generative and somatic ways of gene transfer into rape. Therefore the knowledge on the variability of f.a.'s in the seed oil as well as their correlations are of great interest for the breeder. This paper reports on some of the first results on variability of f.a. composition and the correlation between several f.a.'s.

## EXPERIMENTAL

### Material and methods

In 1991 we planted an assortment of *Brassicaceae* originating from the gene bank of the Institute for Plant Genetics and Crop Science, Gatersleben and the University of Goettingen, resp.. Out of 230 entries (all of summer type) 76 were chosen to analyse the f.a. composition. They represent 9 species and were distributed as follows: *Brassica napus* (nap.) 14 entries; *B. rapa* (rap.) 15; *B. juncea* (jun.) 12; *B. nigra* (nig.) 9; *B. barrelieri* (bar.) 2; *B. narinosa* (nar.) 3; *B.nipposinica* (nip.) 2; *Sinapis alba* (alb.) 13, and *Camelina sativa* (sat.) 6 entries. For the genetic structure of the entries was widely unknown each 50 to 60 single seeds per entry were analysed by capillary gas chromatography. Here we report on the results of the following f.a.'s : palmitic acid (C16:0), stearic (C18:0), oleic (C18:1), linoleic (C18:2), linolenic (C18:3), arachidic (C20:0), eicosenic (C20:1), behenic (C22:0) , and erucic (C22:1) acid.

Results

In nap. 7 of the 14 entries contain individuals with more than 70% C18:1 (maximum 77,6%). Low levels of C18:3 are to observe in 10 entries (minimum 1,9%); C22:1 doesn't show any unexpected value and varies between 0 and 50,8%. *B. rapa* (rap.) showes similar relations: in C22:1 the maximum is 55,8%, while it is clearly lower in C18:1 (67,1%). The two entries of jun. containing zero erucic individuals are of the same origin. Whereas in nap., rap., and other species the C18:1 is generally dominating the other unsaturated C18 - f.a.'s this seems to be not true for jun. and nig.. Even in the entry with low C22:1 the C18:1 doesn't exeed the C18:2 content. From bar. only two entries have been analysed. C18:3 is obviously the more important of the C18 f.a.'s. Note the high C22:1 content. Nar. and nip. are represented by only 3 and 2 entries, resp.. Whereas the nar. entries are high erucic showing up to 55,3% C22:1 and containing zero erucic segregants the nip. entries are zero erucic with some medium erucic segregants (21,5%). In both species occur high levels of C18:1 (>70%). *Sinapis alba* (alb.) showes the highest C22:1 content in this material (59,2%) and the distribution of segregating populations is very similar to nap. But the C18:1 maximum is with 49,4% distinct lower than in nap. and rap., resp..C18:3 decreases down to 2,2%. *Camelina sativa* (sat.) is known as a species high in C18:3 and low in C22:1. This will be confirmed by our results. High levels of C18:3 (up to 42,0%) are accompanied by low C22:1 (2,4 -5,0%) and higher C16:0 showing an average of 6,5%.

Correlation coefficients (c.c.) are calculated for all possible combinations of f.a.'s, but this paper reports only those c.c.'s between two f.a.'s which are following immediaetely each other in the pathway of biosynthesis. Figure 1 demonstrates the variation occurring in the several correlations. The both given values are the extrema for the certain f.a. pair and species, resp.. It is striking that there is a great variation in the majority of the cases. It ranges from negative to positive significancy over non-significancy to +/- significancy up to only + or - significancy in a certain species and pair of f.a.'s. In the most cases the entries of a certain species vary between non-significancy and + or - significancy. The only exception seems to be the correlation C18:1/C22:1, where all but two entries show the well known negative c.c's. Apparently these two f.a.'s play an important role in the composition of storage lipids in *Brassica*, thus being widely uninfluenced by environmental effects. The extent of variation in the other c.c's is unexpected high. Certainly the environment may have a greater effect on some steps of biosynthsis than on others but it's hardly to think that a variation in the same species from $r = -0.96$ to $r = +0,63$ (nap. C18:1/C20:1) for instance is only due to environment. In this case the breeder would have to take into account a variability difficultly to control. On the other hand the existence of genetical factors affecting the biosynthesis of a certain f.a. may open new ways in the creation of desired fatty acid compositions by breeding. Therefore these studies will be carried on including the investigation in offsprings from halfseeds and of DH-lines of the reported material. Other species as Crambe ssp., Eruca ssp. and Berteroa ssp. shall be included.

ACKNOWLEDGEMENTS

The author thanks Prof. G. Röbbelen from the University of Göttingen as well as Mrs. E. Willner, Brassica Department of the IPK Gatersleben, station Malchow/Poel for the kindly providing of gene bank material. The majority of the GC analyses has been conducted under the supervision of Dr. W. Schumann, now at the Landesforschungsanstalt Mecklenburg/Vorpommern für Landwirtschaft und Fischerei. We have to thank him, too.

Fig.1: Intraspecific variation of correlation between seed oil fatty acids in several ***Brassicaceae*** (critical value of r ( p 0.001; 50 d.f.) = 0.35)