Breeding studies on brassica napus L.

Samy Abd El-Aziz Naser Afiah

SUMMAARYThe aim of this investigation was to determine the extent of heterosis and combining ability estimates and their interactions with environments for some agronomic characters, oil seed, and fatty acid composition in some rapeseed varieties and their hybrids. Six parental varieties namely; N.A.24, N.A.50, N.A.60, N.A.69, N.A.71, and N.A.72, representing wide range of variability in most of the studied traits were utilized. Crossing among the parental material by means of diallel system was initiated at 1987/1988 growing season. A half diallel set of crosses involving six parental varieties were evaluated under two different planting dates (early and late plantings) at two separate experiments were used for each of F1 andgenerations. Each experiment was designed in a randomized complete block design with three and two replications for early and late plantings, respectively.Data were recorded on 10 and 20 guarded plantsrandomely sampled from each plot for F1 and respectively. The data obtained for each trait were analysed on individual plant mean basis except, oil seed percentage in the F1- and Fes-generations; and fatty acid composition in the F1-generation for early planting date. where the plot mean basis was used. Eight fatty acids (Lauric, Myristic, Palmitic, Stearic,’ Oleic, Lenoleic, Lenolenic and Erucic)were determined in this study. An ordinary analysis of variance was firstly performed for each experiment and then-after a combined analysis was carried out whenever homogeneity of error variances was realized. Heterosis was computed as mean squares and as the percentage deviation of F1 mean performance from the mid-parent and the better parent average values for individual crosses. General and specific combining ability estimates were obtained byemploying Griffing’s (1956) diallel cross analysis designated as method 2 model 1. The obtained results can be summarized as follows:I. Growth and yield characteristics:A. Analysis of variance, means, heterosis, and inbreeding depression:a). F1 generation:1.Significant planting date mean squares was detected for all of the studied traits, with overall mean values at early planting being higher than the corresponding ones at late planting, except for height of first siliquae.2.Mean squares associated with genotypes were found to reach the significance level in most cases.3.Mean squares due to parents were significant in all cases. Also, significant mean squares due to interaction between parental varieties and planting dates were obtained only for No.of siliquas/branch and 1000-seed weight.4. Mean squares due to crosses were significant for all the studied traits except plant height, height of first siliquae and seed yield/plant in late planting; and No.of seeds/siliquae in both planting dates and the combined. Significant mean squares due to interaction between F1 and planting date were detected for height of first siliquae, No.of racemes/plant, No.of siliquas/branch and 1000-seed weight. The hybrid N.A.50 x N.A.60 gave the highest values for the No.of siliquas/branch, 1000-seed weight and seed yield/plant.5. Significant parents vs. crosses mean squares wereobtained for all cases except for plant height, heihgt of first siliquae, No.of seeds/siliquae and 1000-seed weight in late planting. Also, significant interactions between parents vs. crosses and planting dates were obtained for plant height, height of first siliquae, No.of racemes/plant, 1000-seed weight and seed yield/plant. Almost, all crosses expressed highly significant heterotic effect for seed yield/plant. The heterosis values over two planting dates ranged from 29.66 to 77.51% and from 29.18 to 75.19% over mid-parent and better parent, respectively. Hybrid N.A.50 x N.A.60 had the highest heterotic effect for seed yield/plant.b. Fm-generation:1. Planting date mean squares were highely significant for all the studied traits except, 1000-seed weight.2.Genotype and genotype x planting date mean squares were significant for most of the studied traits.3.Significant F2 hybrids mean squares were detected; for the No.of

racemes/plant, No.of siliquas/branch and 1000-seed weight in both planting dates and their combined, for plant height and height of first siliquae in the early planting, and for seed yield/plant in the early planting and the combined. The hybrid N.A. 50 x N.A. 60 exhibited its superiority for seed yield/plant and some other traits in Fl-generation, and produced the highest seed yield/plant in the F2-generation.4.Mean squares for parents vs. crosses was signifcant for plant height and height of first siliquae in the early planting and the combined analysis; and for No.of racemes per plant, No.of siliquas/branch, and seed yield/plant in both planting dates as well as the combined analysis. Also, highly significant parents vs. crosses and planting dates interaction was detected for plant height, height of first siliquae and No.of racemes/plant. The hybrid N.A.50 x N.A.60 which expressed the highest heterotic effect for seed yield/plant in Fl-generation appeared to be the best hybrid in F2-generation.5.Significant positive estimates for both heterosis and inbreeding depression for seed yield/plant were occurred in most cases. The cross N.A.60 x N.A.72 produced the highestinbreeding depression values of 27.19 and 21.68% in the early planting and the combined analysis, respectively.B. Combining ability:a. Fi-generation:1.The variance associated with general combining ability (gca) was significant for No.of racemes/plant, No.of siliquas/branch and 1000-seed weight in both planting dates and their combined; for plant height in early planting; and for No.of seeds/siliquae in early planting as well as combined analysis.2.Specific combining ability (sca) mean squares were significant for all characters except, plant height, height of first siliquae and No.of seeds/siliquae in late planting. Thus, the non-additive type of gene action was the more important part of the total genetic variability for plant height in the combined analysis as well as height of first siliquae and seed yield/plant. Low gca/sca ratios of less than unity were detected for plant height at early planting as well as 1000-seed weight and No.of racemes/plant at both planting dates and their combined, indicating that the large part of the total genetic variability associated with these traits was a result of non-additive type of gene action. However, high gca/sca ratios which exceeded the unity were obtained for No.of siliquas/branch in both planting dates as well as combined analysis, and for No.of seeds/siliquae atearly planting and the combined analysis, indicating that additive and additive x additive types of gene action were more important than non-additive ones in controlling thesetraits.3.The interaction between planting date and both types of combining ability was significant for all of the studied traits, except, gca x planting date for plant height, height of 1st siliquae, No.of seed/siliquae and seed yield/plant; and for sca x planting date, the No.of seeds/siliquae andseed yield/plant.4.The best combiner was N.A.50 for plant height and No. of seeds/siliquae; N.A.69 for No.of racemes/plant; N.A. 24 for No.of siliquas/branche; and N.A.72 for seed index. The intrinsic performance of parental varieties gave a good index of their (ii) effects in five traits.5.The combinations; N.A.50 x N.A.60, N.A.24 x N.A.71, N.A.60 x N.A.72, N.A.60 x N.A.71, N.A.69 x N.A.71, N.A.50 x N.A.69 and N.A.24 x N.A.69 appeared to be the best promising for breeding to high yielding potentiality.b. F-generation:1. General combining ability mean squares were significant for No.of racemes•per plant, No.of siliquas per branch and 1000-seed weight in the two planting dates and the combined analysis. Significant mean squares for specific combiningability were detected for most of the studied traits. High gca/sca ratio was obtained for No.of siliquas/branch in both planting dates as well as combined analysis; indicating that the additive and aditive x additive types of gene action were responsible for controlling the inheritance of these traits. However, non-additive gene action appeared to be more prevalent in remained of the studied cases.2.Significant interaction effect between planting date and general combining ability was obtained for number of siliquas per branch. whereas, significant sca x planting date mean squares were detected for No.of racemes/plant, No.of siliquas/branch and 1000-seed weight.3.The best combiners for the studied traits in generation were the same for the corresponding traits in Fi-generation.4.The most desirable sca effects for seed yield/plant were obtained for the cross N.A.24 x N.A.71 followed by N.A.24 x N.A.50 then N.A.50 x N.A.60.II. Seed oil content and fatty acids:A. Analsysis of variance:1. Mean squares due to genotypes were significant for oil seed percentage and oil yield/plant in both generations as well as five out of eight fatty acids in the F1-generation.2.Parents mean squares were significant for the seed oil content in both generations and Palmitic, Stearic, Oleic and Erucic fatty acids in the F1-generation. The parental variety N.A.71 which was the second highest parent in producing seed oil percentage contained the lowest value of

Erucic acid (7.86).3.Crosses mean squares were significant for seed oil percentage and oil yield/plant in both generations, and the three fatty acids, i.e. Oleic, Lenoleic and Erucic in the F1-generation. The cross N.A.24 x N.A.69 gave the highest mean value for seed oil content. The cross N.A.24 x N.A.71 had the highest desirable value for each of oil yield/plant and Oleic fatty acid. For Erucic acid, the most desirable value was obtained by the cross N.A.50 x N.A.71 followed by the cross N.A.24 x N.A.71, then, N.A.50 x N.A.72, N.A.60 x N.A.71 and N.A.71 x N.A.72.4.Mean squares for parents vs. crosses were significant for; oil seed content, oil yield/plant, and the three fatty acids, i.e. Stearic, Oleic and Erucic in the F1-generation, and oil yield/plant in the Fm-generation. The hybrid N.A.50 x N.A.60 possessed the highest fourth and sixth negative heterosis in Erucic acid for both mid and better parent, respectively, and it exhibited the best heterotic effect for oil yield/plant and Oleic fatty acid content.5.Significant positive inbreeding depression were detected for oil content and oil yield per plant in eleven and ten Fes-crosses, respectivelyB. Combining ability:1.General combining ability mean squares were significant for seed oil percentage in both generations, and four fatty acids (Palmitic, Oleic, Lenoleic, and Erucic) in the F1-generation.2.Specific combining ability mean squares were significant for seed oil content and oil yield/plant in both generations and four fatty acids (Palmitic, Stearic, Oleic, and Erucic acids) in the F1-generation. High gca/sca ratios which largely exceeded the unity were obtained for seed oil content in both generations as well as three fatty acids (Palmitic, Lenoleic, and Erucic) in the F1-generation, indicating that the largest part of the total genetic variability associated with these traits was a result of additive and additive x additive types of gene action.3.The best combiner was N.A.24 for seed oil content in both generations, N.A.50 for Lenoleic fatty acid, N.A.71 for Oleic and Erucic fatty acids, and N.A.72 for Palmitic fatty acid. The intrinsic performance of parental varieties gave a good index of their (is) effects in all of the studied traits.4.The highest sca values were recorded by the cross N.A.50 x N.A.60 for oil yield/ plant in the F1-generation and the cross N.A.60 x N.A.72 and N.A.60 x N.A.69 for oil seed content and oil yield/plant, respectively, in the F2-generation. Also, the cross N.A.50 x N.A.72 would be so for Oleic and Erucic fatty acids. The two crosses N.A.69 x N.A.72 and N.A.50 x N.A.69 appeared to be most promising for Palmitic fatty acid content.