The Inheritance of Oilseed Quality Characteristics in Yellow Mustard (*Sinapis alba* L.)

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ABSTRACT

Yellow Mustard (*Sinapis alba* L.) is receiving considerable attention because this species has shown potential as a new oilseed crop. However, traditional yellow mustard cultivars are not suitable for canola (*Brassica napus* L.) oil or industrial oil production due to intermediate levels of erucic acid in the oil and high glucosinolate content in the seed meal. At present, no yellow mustard cultivar meeting canola or industrial oil quality criteria is available. In addition, there is no knowledge available on the inheritance of fatty acid composition and glucosinolate content of yellow mustard.

In this study, eight parents were crossed in all possible combinations using an 8x8 full diallel design. The eight parents included two breeding lines with low erucic acid composition, 'UI3553' and 'UI3568', two lines with low glucosinolate content, 'UI7003' and 'UI7012', two lines with high erucic acid compositions, 'Mustang' and UIisrael', and two traditional yellow mustard cultivars, 'Gisilba' and 'Kirby'. Fatty acid composition and glucosinolate content of F_1, F_2 and F_3 families from the diallel design were recorded to investigate the inheritance pattern of fatty acids and glucosinolate content, and the relationship among the quality characteristics. Morphological characteristics were also assessed during growth of F_1 and F_2 plants to determine the relationships among agronomic characteristics and quality.

The results showed that effects of general combining ability (GCA) of males, females and specific combining ability (SCA), were all important in determining variation of fatty acid composition and glucosinolate content. No reciprocal effect existed in glucosinolate, erucic or oleic acid content. However, linoleic and linolenic acid content showed a strong reciprocal crossing effect. Glucosinolate content exhibited

a simple inheritance pattern. F_1 seeds from 12 crosses between low and high glucosinolate content and their reciprocal crosses all had the same glucosinolate score as their female parents. At F_2, among ninety-five plants from crosses between low and high glucosinolate content parents, 28 plants had low glucosinolate content, and 67 showed high glucosinolate content. Therefore a single dominant gene model was suitable for explaining glucosinolate content variation. However, the inheritance pattern of fatty acid compositions was more complex. For both erucic acid and oleic acid, additive gene action was more important than other non-additive effects. Highest heritability estimates among the seven fatty acids were for oleic and erucic acids. Therefore, early generation selection is feasible for modifying these two fatty acids. From crosses between low and high erucic acid parents, recombinants with a lower or higher erucic acid content than the parents were found. Therefore, such crossing will be useful for developing high oleic or low erucic acid genotypes because progenies with more than 70% oleic acid, or more than 60% erucic acid, were selected within the progeny of this type of cross. No undesirable correlations among fatty acid, glucosinolates, and agronomic characteristics, were found from this study. Therefore, it is possible to develop canola quality or industrial quality cultivars from existing high yielding cultivars and new germplasm with high oil and seed meal quality.