INHERITANCE OF EARLINESS IN CROSSES BETWEEN ZERO-BRANCHING AND NORMAL BRANCHING TYPES OF COTTON

By

MOHAMED SAMIR KAHEEL RADY

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By : Mohamed Samir Kaheel Rady.

Approved by :

Committee in Charge

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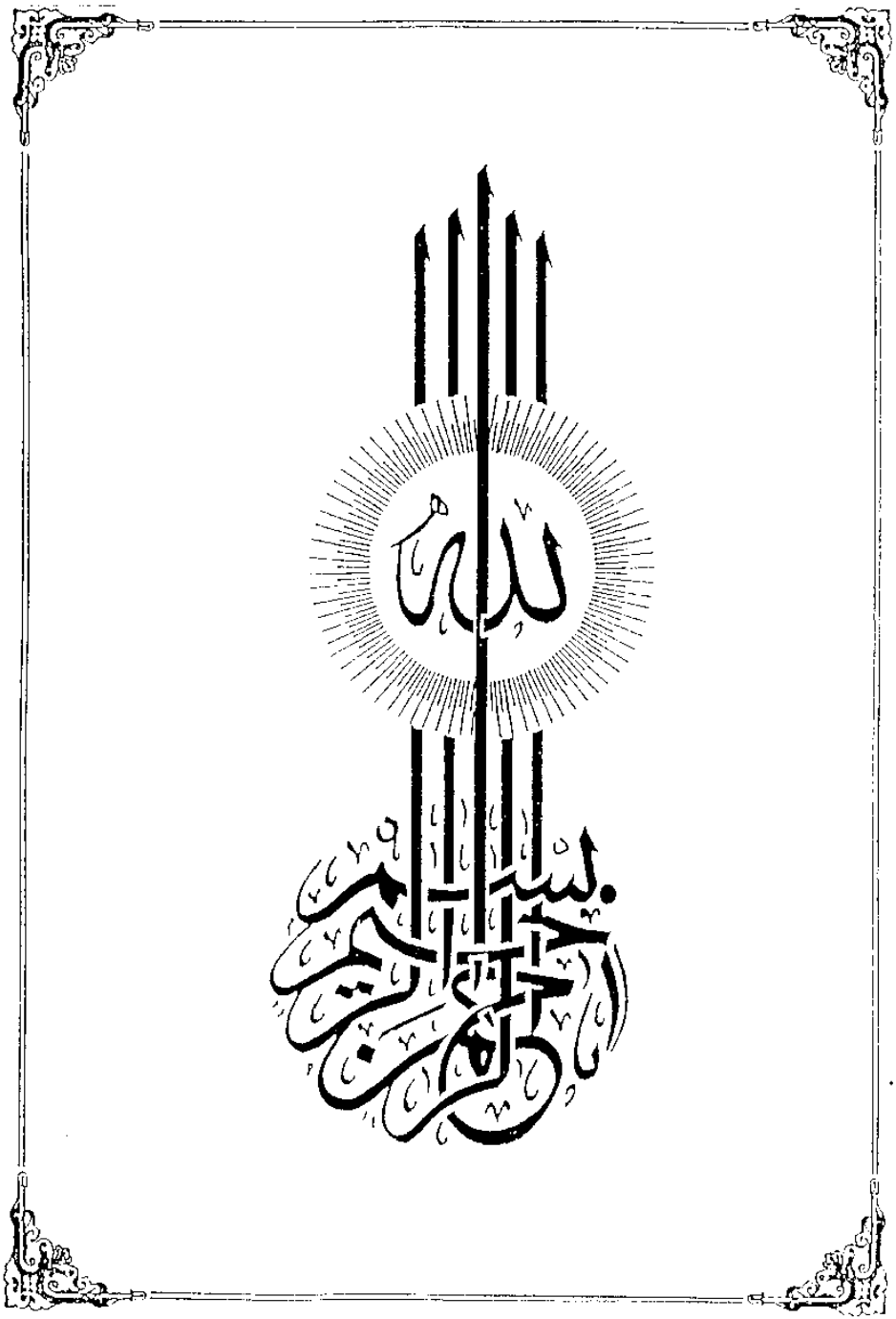

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INTRODUCTION

Earliness in cotton is an important breeding objective the world over. Under conditions of the A. R. E. early maturity means a longer season suitable for the growth of length and thickness and maturation of cotton hairs. It also means the partial or total escape from boll worms and in consequence the saving of much expence expended on control operations in the field as well as insuring a seed cotton crop of better quality.

Up to the present time not much work was done on the inheritance of earliness in cotton in Egypt . Again differences among Egyptian varieties with regard to earliness of maturity are not great. Still, since interspecific crosses are beset with serious difficult, from a breeding stand point, it became necessarily to look for early barbadense varieties to cross to Egyptian varieties in order to study the genetics of earliness against a background of barbadense germ-plasm.

In the Soviet Union early barbadense varieties were bred to suite the Soviet Union conditions. One such variety is S.6027 a compact zero type branching

variety, and so it was used in crosses with two Egyptian varieties in order to study the genetics of earliness components as well as the relative importance of each component with regard to that character.

It is hoped that the results obtained would be of value to the cotton breeder in A.R.E.

ining ability. However, Marani (1964) found significant heterotic effects for early flowering in interspecific and intraspecific crosses of G.hirsutum. Baluch and Muhammad (1968) studied seven crosses involving pure strains of local and introduced varieties of G.arboreum and G.hirsutum. G.arboreum intervarietal crosses exceeded the parental means in lateness of flowering but these differences diminished in the F_2. G.hirsutum intervarietal crosses were earlier than the parental means. Both reciprocal crosses between G.hirsutum M_4 and G.barbadense (Karnak) exceeded the parental means in lateness in the F_1 and F_2 generations. The cross M_4 x pima 67 b (G.barbadense) exceeded the parental means in earliness. In a study involving six crosses among four Egyptian varieties Abo-El-Zahab(1969) concluded that only the cross Menoufi x Ashmouni gave positive significant values of 19.3 percent, 0.72 and 0.21 for heritabilities estimated in the bread-sense, regression and correlation coefficient methods. Negative estimates or non-significant positive estimates were obtained in the other crosses. The values of the three dominance estimators showed partial dominance for first

flower date. Non additive genetic effect was postulated. Al-Rawi and Kohel (1969) found highly significant negative heterosis and inbreeding depression for days to first flower. They stated that heterosis was due to the presence of dominance. Their results showed that the additive genetic component was significantly different from zero and greater than the dominance component parameter. The average degree of dominance was 0.81 indicating partial dominance. Heritability as the ratio of the additive, or additive x additive epistatic variance or both to the total phenotypic variance was 0.46 for days to first flower trait. Rady (1969)studied date of first flower in a cross between Giza 63 x 8.8017 (Zero branching type). He reported that this characteristic behaved in a quantitative manner, with a tendency towards the late parent in the F_1 and F_2 generations. Number of genes involved for the parental difference, obtained by different methods, indicated one pair of genes. Estimation of broad sense heritability by different methods resulted in 30, 37.1 and 34.9 percent. Using 4 methods of measuring earliness in interspecific hybrids between G. barbadense L. and G. hirsutum L. Emara (1970) studied F_4, F_5 and F_6 generations of the crosses G.45 x Acala 4.42 ,

G.67 x Acala 4.42, and G.67 x Deltapine 15. The differences among the means of the parental lines for first flower date were significant or approached significance at the 0.05 level. Correlation coefficients between date of first flower and other measures of earliness were highly significant. Heritability estimates for first flower date were 19.35%, 38.61% and 38.61% for F_4, F_5 and F_6 generations, respectively.

Salama (1970) studied the cotton cross (Giza 69 A x Giza 66). He found that the first flower date was a quantitative character and reported a potence ratio of -2.37 for this character indicating hybrid vigour in the direction of early flowering. The nature of gene action was inconclusive. He concluded that 1.58 days between the parents were controlled by one pair of genes. A heritability value of 0.276 for this character was reported. In the cross Giza 45 x Ashmouni Bedair(1971) reported significant genetic variability for days to first flower, significant negative heterosis (-1.92)and significant negative inbreeding depression (-2.95). The F_2 deviation of 1.8 days was highly significant while [illegible] deviation of 2.1 days was also significant. Heritability estimates were 0.38 in both broad and narrow

senses. He calculated expected genetic advance from selecting the desired five percent of the plants to be 2.52 percent.

2. Height of first fruiting node:

The main-stem node at which the first fruiting branch arises above the cotyledonary scars is known as the first fruiting node. Height of the first fruiting node is usually expressed as the number of that node.

Leak and Ram (1914) found, in crosses between monopodial and sympodial types of cotton, that the position of the first fruiting node in F_1 was intermediate. The F_2 plants formed a continuous series between the parents. Harland (1927) reported that the F_1 hybrids between crosses of sympodial barbadense (Sea Island) and hirsutum and monopodial barbadense or purpurascens types was intermediate but close to the low parent. In the F_2 a unimodal curve resulted with the majority of plants possessing low node numbers. In crosses between some varieties of G.herbaceum L., Patel and Patal (1927) found that the node position of the first sympodium appeared to be inherited in a complex

manner. Ware (1930) showed that, in crosses between hirsutum and barbadense, high first node number was dominant over low in F_1. Hutchinson (1936) studied the inheritance of the node position of the first sympodium in three crosses within the species of G. arboreum. All F_2's transgressed the parental limits at either the lower, the higher or both. F_2 plants varied greatly. He concluded that node number is controlled by different sets of factors. Hutchinson, Panse, and Govande (1938) studied the inheritance of node number in three crosses between 3 strains belonging to G. arboreum var. Neglectum (Malvi, Beni, and C 520). The node number of the F_1 was significantly lower than the mean of the parents except in the cross(Beni x C 520) where the difference was not significant. They concluded that low node number was dominant over high, also that genes controlling that character acted in a geometric rather than simple arithmetical manner. Harland (1939) found that the height of the first fruiting node in the F_1 was slightly lower than the high parent with blending, i.e. quantitative inheritance in F_2. Govande and Joshi (1950) studied the inheritance of first fruiting node number in two intervarietal crosses of G. herbaceum

(Cocanda 45 both and N 6). They reported that low node number was dominant.

Bhat (1957) studied the sympodial habit in F_4 of the cross G.herbaceum 1 A x G.anomalum doubled and twice back-crossed to G.herbaceum. He reported that the sympodial habit was governed by a recessive gene and by another epistatic to the dominant one for sympodial growth. The tendency to develop the first sympodial branch at a lower node appeared to be both partially dominant and polygenic. From a cross between two strains of G.hirsutum Boulanger (1964) concluded that the position of the first fruiting node on the main stem and the number of vegetative branches were the principle factors controlling growth habit. Heritability estimates of the height of first fruiting node in F_2 showed that rapid progress in lowering it could be attained by selection. The continuous variation displayed in the position of the first fruiting node in the F_2 was attributed to environmental influence and to the segregation of a small number of independent genes. In a diallel cross of five selected lines of G.hirsutum White and Kohel (1964) found that the additive and dominance variances were not significant

for first fruiting node number. Studying the hybrids stonville BI 439 x Reba Tk/1 and Novi and Reba 511 Boulanger (1965) concluded that the first fruiting node was important as a criterion of selection for improving earliness in Upland cotton. He found that this character was controlled by a small number of independent genes having equal additive effects and was strongly influenced by environment. Heritability was about 33 per cent.

Ray and Richmond (1966) believe that the first fruiting node is a typical quantitative character. They estimated broad sense heritabilities at 43 to 60 percent for this character. The estimate of additive genetic variance of 0.61 was significantly different from zero while dominance variance was not significant. The average degree of dominance suggested that genes with partial dominance control the first fruiting node trait. Simmonljen (1968) found that the correlations between earliness and height of first fruiting node in the F_2 and F_3 were as high as 0.88. In an interspecific hybrid between G.arboreum and G.mimmulii Balasundaram and Veluswamy (1969) found that the hybrid was similar to that of the cultivated parent with respect to first fruit-

ing node position. El-Enani (1969) studied inheritance of the position of first sympodium in the cross Karnak x Ashmouni. The F_1 showed complete dominance for the lower node position. The F_2 and backcrosses showed that character to be monogenic. Baluch (1969) reported that the first node bearing a sympodial branch tended to " appear late " in intervarietal G.arboreum crosses and in the hybrid G.hirsutum (M_4) x G.barbadense (Karnak), but in intervarietal crosses of G.hirsutum and in the hybrid (M_4) x pima 676 (barbadense)the first sympodial node appeared early compared with the parent.

Emara (1970) estimated heritability of the height of first fruiting branch in interspecific crosses of G. barbadense and G.hirsutum at 30.12%, 32.17% and 48.67% for F_4,F_5 and F_6, respectively. Correlation coefficients between node of first fruiting branch, date of first flower, first boll open and earliness index in all possible combinations were highly significant. Studying some crosses of Egyptian cotton, Nedair (1971) concluded that the first fruiting node showed highly significant heterosis and inbreeding depression effect of -3.33 and -7.27 percent, respectively. No significant epistatic effects were found. Heritability estimate was 40.99 in

both broad and narrow senses in the cross between Giza 45 x Ashmouni. Using mass selection, the expected genetic advance from selecting upper five percent of the individual plants was calculated at 8.88 percent. In a cross between two varieties of G.barbadense Rady et al. (1971) found that the position of the first fruiting node was quantitatively inherited. Both F_1 and F_2 showed absence of dominance. Broad sense heritabilities were 30, 34.9 and 37.1 using different methods. Gad (1972) in an interspecific cross between Upland cotton (Coker 100 w.) and Egyptian cotton (G.45), reported that this character behaved in a quantitative manner. While difference between the parents was not significant, significant genetic variability was obtained in the F_2 population . No significant heterosis was detected whereas inbreeding depression (-5.3) was significant. Negative estimate was obtained for the additive genetic variance. Dominance genetic variance was 0.48. Heritability in broad sense for F_2 generation was 19.66 percent.

3 . Number of vegetative branches:

Boulanger (1964) stated that the number of vegetative branches is one of the principle elements controlling growth habit. He noted that in the F_2 of a cross