Genetical studies on some cucumber hybrids (Cucumis sativus L.)

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SUMMARYThe present studies included heterosis, combiningabilities over environments and genetic behaviour ofsome characters in cucumber (Cucumis sativus L.) wereconducted at Kaha Experimental station, Hart. Res.Institute, Agricultural Research Center, Giza, duringthe years 1987-1990.The experimental material consisted of six crossesand four inbred Lines. The parental lines were 1909,Marbosan, Beit alpha and Chinese Long and data wereobtained on the parents, F1, Fz' BCl and BCz populations.Data were recorded on, number of days to open the firstfemale flower, the nodal pasition to open first femaleflower on the main stem, number of pistillate flower perplant, number of fruits per plant, number of nodes perplant on the main stem and plant height in open fieldsummer and Nili seasons 1989 and under fiberglass housein winter 1989-1990. Results were summarized as follows:Genetic differences among the genotypessignificant for all the character studied.Female flowering time:Potence ratio exhibited partial dominance for earlyflowering in all crosses studied except two [(1909 xMarbosan) and (Marbosan x Chinese Long)].wereHeterosis compared withinsignificant negative values inexcept two (1909 x Marbosan) andLong) .mid-parentall crosses(Marbosan xshowedstudiedChineseInbreeding depression percentage showedinsignificant positive values in the cross (1909 xMarbosan), (Marbosan x Beit alpha) and (Marbosan xChinese long) which may be due to heterozygosity in theF2 generation. While, the significant negative values inthe other three crosses, indicating, heterozygosity inmost factors influencing date to female flowering.Narrow sense heritability gave values more than 62%in the crosses (1909 x Beit alpha), (1909 x Chineselong) and (Marbosan x Beit alpha) indicating, selectionwould be effective for early flowering time in thesecrosses. Broad sense heritability in all crosses showedvalues above 73% suggesting that the total geneticcomponents were larger than the environmentalcomponents.The results for testing the goodness of fit of theadditive and dominance model showed that the model wasnot adequate to interpret gene effects. Meanwhile,estimates of gene action parameters using method ofGamble showed that the additive x dominance gene effectwas the most important part in one cross only (1909 xChinese long).2. The nodal position of the first pistillate flower:The result of potence ratio indicates absence ofdominance in the cross Marbosan x Beit alpha, partialdominance in the cross (Beit alpha x Chinese long),complete dominance in the cross (Marbosan x Chineselong) and over dominance in the other three crosses i.e.(1909 x Marbosan), (1909 x Beit alpha) and (1909 xChinese long).The mid-parent heterotic values were significant andnegative in the crosses (1909 x Beit alpha) and (1909 xChinese long), Better parent heterosis showed alsosignificant negative value in the cross (1909 xMarbosan) , indicating that these crosses were lower onnodal position in producing female flower on the mainstem than parents and better-parent, respectively.Narrow sense heritability was high in the cross(1909 x Beit alpha). Broad sense heritability gavevalues above 52% in all crosses studied.The additive-dominant model was not adequate toassume that genes which control this character actedonly dominantly and/or additivelY· However, theestimates of gene action parameters using method ofGamble (1962) showed that insignificant values for allparameters of gene effects in all crosses studied.3. Number of females flowers per plant:The results of potence ratio showed over-dominanceof high over low number of female flowers per plant inthe crosses (1909 x Marbosan), (Marbosan x Beit alpha)and (Beit alpha x Chinese long) which means, thebreeding plan should turn toward inbreeding with theobjective of producing hybrids.The

mid-parent heterosis values were significant and positive in all crosses studied except one and the inbreeding depression was less than heterosis, indicating, the F1 crosses produced higher number of female flowers per plant than their parents and the importance of additive x additive gene action in heterosis. The Fl mean did not differ significantly than mid-parent in the crosS (1909 x Chinese long) which confirms that approximately all the genetic variance is due to additive component. Meanwhile better-parent heterotic values were significant and positive and values of inbreeding depression were less than that of heterosis in the crosses (1909 x Marbosan) and Beitalpha x Chinese long). All crosses had values above 80% and 66% of narrow and broad sense heritabilities, respectively, indicating that the greater part of phenotypic variance was due to genetic variance components. However, the results for testing the goodness of fit of the additive and dominance model confirmed the model was not adequate and there was beyond additive and dominance gene effects in all crosses studied except one. The calculated X 7. in the croSS (1909 x Marbosan) was insignificant, which indicated the adequacy of the model. The estimates of gene action parameters using method of Gamble in all crosses studied indicated insignificant values for all parameters of gene effects. 4. Number of parthenocarpic fruits per plant: The value of potence ratio indicated over-dominance of high over low number of parthenocarpic fruits per plant in all crosses, indicating, the breeding plan should turn toward inbreeding with the objective of producing hybrids. However, the high values in the crosses (1909 x Marbosan) and (Marbosan x Chinese long) could be biased by both linkage disequilibrium and epistasis. The mid-parent heterotic values were highly significant and positive. Inbreeding depression values were less than heterosis values in all crosses indicating that variation was mostly due to dominance and the importance of additive x additive gene action in heterosis. Butter parent heterosis showed the same trend in all crosses except three. Inbreeding depression gave highly significant positive values in all crosses studied. This seems to be caused by segregation of genes influencing this characters during selfing of Fl generation. Narrow sense heritability estimate was cross (Beit alpha x Chinese long). heritability gave values above 60% in studied. high in the Broad sense all crosses The values of X2 for testing the goodness of fit of the additive-dominance model were highly significant in all crosses, indicating the model was not adequate and there was beyond additive and dominance gene effects. The estimation of gene effects using methods of Gamble showed that dominance and additive x dominance effects were the most important parameters in the inheritance of number of parthenocarpic fruits per plant in the crosS (1909 x Marbosan) and (Beit alpha x Chinese long), respectively. 5. Number of nodes on the main stem: The value of potence ratio indicated over-dominance in two crosses and partial dominance in another two crosses toward the high number of nodes per the main stem. The highest value in the cross (1909 x Chinese long) (12.06%) could be biased by both linkage disequilibrium and epistasis. The F1 mean did not differ significantly from both mid- and better-parent in all crosses except two, which confirmed that approximately all the genetic variance was due to additive component. The inbreeding depression showed insignificant positive or negative values in all crosses except two, which may be due to heterozygosity in the F2 generations. Narrow sense heritability gave values more than 57% in all crosses except one, indicating, selection would be effective for this character. Broad sense heritability gave values above 47% in all crosses studied. The values of XI for testing the goodness of fit of the additive-dominance model were significant in all crosses. These results confirmed the model was not adequate and there was beyond additive and dominance effects. However, the estimates of gene action parameters using method of Gamble in all crosses showed insignificant values for all parameters of gene effects. 6. Main stem length: Values of potence ratio indicated over-dominance in all crosses except one in direction of increase main stem length. The highest value of the cross (1909 x Chinese long) could be biased disequilibrium and epistasis. by both linkage The mid-parent and better-parent heterosis were significant with positive values and values of inbreeding depression were less than those of heterosis in all crosses except one, indicating that variation was mostly due to dominance and the importance of additive x additive gene action in heterosis. Inbreeding depression gave highly significant positive values in all crosses. This seems to be caused by segregation of genes influencing plant height during selfing of Fl generation. Narrow sense heritability gave values above 67% in all crosses except three. Broad sense heritability gave values above 73% in all crosses. The number of genes controlling this

characterranged from one to two pair of genes.Moreover, the values of X2 for testing the goodnessof fit of the adequacy of additive and dominance modelwas significant in all crosses indicating, the model wasnot adequate and there was beyond additive and dominanceeffects.The estimates of generation parameters using methodof Gamble showed the additive x dominance gene effectwas the most important part of gene interactions in thecross (Beit alpha x Chinese long).Correlation:The phenotypic and genotypic correlation coefficientwere higher than the environmental correlationcoefficient among the studied characters except betweenfemale flowering time and number of female flowers perplant and between number of female flowers per plant andnumber of nodes on the main stem, indicating most of thestudied characters had not been appreciably affected byenvironmental factors. Also, values of genotypiccorrelation were higher than that of phenotypiccorrelation among all characters studied except betweenfemale flowering time with each of number of femaleflowers per plant and with number of nodes on the mainstem, nodal position of first female flower with each ofnumber of nodes on the main stem and with plant height,No. of female flowers per plant and with No. of nodes onthe main stem, No. of fruits per plant and with No. ofnodes on the main stem, and between No. of nodes on themain stem and with plant height, indicating magnitude ofrG as compared to rp was high for these characters.Values of genotypic and phenotypic correlation wereapproximately equal among all other characters,indicating magnitude of rG was compared to rp was equalfor these characters.The environmental correlation values were highbetween flowering time and No. of female flowers, No. offemale flowers per plant and No. of nodes on the mainstem and between No. of fruits per plant and No. ofnodes on the main stem, indicating, the expression ofthese characters had been appreciably affected byenvironmental factors.The correlation between flowering time and No. ofnodes on the main stem, nodal position of first femaleflower and plant height, and between No. of nodes on themain stem and plant height were significant and rp valuewas higher than rG value, indicating that rp was high inmagnitude than rG and the genetic association betweenthese characters were attributed to non genetic linkage.Combining ability1. The general and specific combining abilities weresignificant at all seasons for all the studies traits.Combined analysis over planting seasons showed thesame trend of significance. This indicated that boththe additive and non-additive type of gene action wereimportant and involved in the inheritance of thesetraits. The ratio of GCA to SCA mean squares wasgreater than one for each of the traits in singleseason analysis as well as in combined analysis exceptthat for main stem length in open field nili seasonand number of fruits per plant over three plantingseasons. This indicated the presence of genotypeenvironmentalinteractions for these studied traits.Therefore, one should bUy attention to diminishenvironmental effects when practicing selection.Moreover, significant genotypes-environment interactionsfor all characters studied, indicated thatmore than one environment are required to obtainreliable information. The significance of GCAtreatmentinteractions showed that GCA effects of theparents (additive effects) were more sensitive by thechanges of the treatments (planting seasons) for alltraits except female flowering time. Furthermore, thesignificance of sCA-treatments interactions showedthat SCA effects of the crosses for all characterswere inconsistent over planting seasons.2. The results revealed that Line 1909 was the bestcombiner for early female flowering and number offemale flowers per plant in single sea~on as well asover three planting seasons. The line Chinese long wasthe best combiner in open field for number of fruitsper plant and plant height. While Line 1909 was thebest combiner under green house as well as in pooledover three planting seasons for number of fruits perplant and plant height under green house condition.3. Among all crosses and under open field summer season,the cross (Marbosan x Chinese long) was the mostpromising one for early female flowering time andhigher number of fruits per plant. Meanwhile, thecross (1909 x Chinese long) was the most promising onefor higher number of female flowers per plant andplant height. Under open field nili season, the cross(1909 x Beit alpha) was the most promis ing one forearly female flowering, higher number of femaleflowers per plant and plant height. While cross(Marbosan x Chinese long) was the most promising onefor higher number of fruits per plant. Meanwhile, thecross (Beit alpha x Chinese long) was the mostpromising one for early female flowering and (Marbosanx Beit alpha) was the most promising cross for theother three characters under the greenhouseconditions. Combining abilities pooled over threeplanting seasons, the cross (Marbosan x Chinese long)was the most

promising one for early flowering time.Meanwhile, the cross (Marbosan x Beit alpha) was themost promising one for higher number of female flowersper plant, number of fruits per plant and plantheight.