COMBINING ABILITY AND HETEROSIS OF SOME PUMPKIN INBRED LINES

By

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B.Sc. Agric. Sc. (Horticulture), Ain Shams University, 2000

M.Sc. Agric. Sc. (Vegetables), Ain Shams University, 2007

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ABSTRACT

Amani Hafez Abdallah Mahmoud Gharib: Combinig Ability and Heterosis of Some Pumpkin Inbred Lines. Unpuplished Ph.D. Thesis Dept., of Horticulture (Vegetable Crops), Faculty of Agriculture, Ain Shams University, (2015).

The study was conducted to assess the magnitude of heterosis in pumpkin (*Cucurbita moschata* Duch. ex Poir.) during the period from 2011 to 2013 at the vegetable research farm of Horticultural Research Institute, Agricultural Research Center (A.R.C.), Kaha, Kalubia Governorate, Egypt. The genetic materials consisted of four parents pumpkin (*cucurbita moschata* viz), Long Island Cheese (P_1), Tan Cheese (P_2), Golden Hubbard (P_3), Waltham Butternut (P_4) and twelve hybrids. Parents received from Holland as inbred lines. Heterosis and performance of hybrids were estimated for several characters, such as vine length, number of branches/vine, number of leaves, number of fruits/vine, average fruit weight, fruit length, fruit diameter, cavity length, cavity diameter , flesh thickness and yield/vine. The results revealed that parents P_3 and P_4 recorded the highest and significant performance for number of branches, number of leave, fruit weight, flesh thickness and yield/vine. Parents P_2 and P_4 exhibited high number of fruits/plant, in addition to a small cavity. Crosses $P_1 \times P_4$ and $P_4 \times P_2$ recorded the highest performance for number of fruits/plant, crosses $P_1 \times P_4$ and $P_3 \times P_1$ gave the best performance for fruit weight and yield/vine, respectively. The maximum significant mid parent (MP) heterosis values (164.65%) for number of leaves /vine , (134.85%) for yield /vine, (62.17%) for flesh thickness,

(54.83%) for fruit length, (41.75%) for number of fruit, (41.75%) for number of branch and (39.25%) for fruit weight. The general combing ability (G.C.A.) effects and specific combing ability (S.C.A.) effects were estimated for four parents and 4 x 4 complete diallel crosses with reciprocals respectively.
Key words: Pumpkin, *Cucurbita moschata*, inbred line, diallel- cross, heterosis, combining ability.

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Amani H. A. M. Gharib, Ph.D., 2015

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I. INTRODUCTION

Pumpkin (*Cucurbita moschata* Duch. ex Poir.) is an important commercial cucurbit belonged to the family *Cucurbitaceae*, genus *Cucurbita.* The fruits are pickled, canned and dehydrated. Numerous medicinal properties of nearly all parts of the plant have been reported. The fruits are used as tonic, purgative, stomachic carminative, antihelminthic, anti-inflammatory, febrifuge, vulnerary, stimulant, thermogenic, antidiabetic etc. **Longman (1995)**. Therefore, pumpkin as vegetable is becoming important ingredient in daily diet.

One of the methods to improve yield and quality is heterosis breeding. The importance of heterosis breeding has been recognized widely in many vegetable crops. The term heterosis was first coined by **Shull (1910)** using two Greek words 'hetero' meaning different and 'oisis' means condition. Heterosis signifies increased or decreased vigour of the F_1 hybrids over the parents. **Shull (1908)** referred this phenomenon as the stimulus of heterozygosis.

The expression of heterosis may be due to factors such as heterozygosity, allelic interaction such as dominance or over dominance, non-allelic interaction or epistasis and maternal interactions. Marked heterosis has been reported for many of the economical attributes in

pumpkin **(Mohanty and Mishra 1999; Pandey *et al*. 2002a, b; Bairagi *et al.*, 2005 and Pandey *et al.*, 2004).**

The hybrid vigour or the superiority of the hybrids over parents may be manifested in terms of high productivity, uniformity, improved quality, built in resistance, environmental adaptations, earliness etc. however, it never happens that each hybridization is accompanied by manifestation of hybrid vigour. The combining ability studies like diallel analysis provide information in this direction. The general combining ability (G.C.A.) effects helps in selection of superior parents and specific combining ability (S.C.A.) effects helps in selection of superior hybrids. The information generated in the process will be helpful to understand the magnitude of heterosis in F_1 hybrids. Therefore, the present investigation on heterosis and combining ability in pumpkin was undertaken by using diallel crossing with reciprocals for the following objectives:

- Estimation of heterosis for yield and other traits.
- Estimation of combining ability effects and variance for yield and other traits.
- Identification of the best hybrid combination.

2. REVIEW OF LITERATURE

The review of literature will be subdivided under the items vegetative traits, fruit traits and yield traits.

2.1. Vegetative traits of pumpkin

2.1.1. Vine length

Sirohi *et al*. (1986) on pumpkin revealed the importance of over dominance and they added that the dominant alleles were predominant for stem length. **Mohanty and Mishra (1998) and (1999)** revealed in pumpkin that heterosis was significant for vine length. **Mohanty *et al*. (1999)** found dominant genes among parents for vine length. **Abd El-Maksud *et al.* (2003)** found that degree of dominance was 1.14 and the G.C.A and S.C.A were highly significant for plant height of summer squash. **Singh *et al.* (2009)** reported that all hybrids showed positive heterosis (10.31%) and G.C.A. and S.C.A. were significant for vine length. **Kumar *et al.* (2010)** referred that parents and crosses differed significantly with regards to their general and specific combining ability, respectively. The G.C.A. variance were higher than the S.C.A. variance

for vine length and significant heterosis over better parent (33.12%) was revealed in order of magnitude by vine length.

2.1.2. Number of branches per vine

Abd El-Raheem *et al*. (1986) found the G.C.A. and S.C.A. effects were highly significant. **El-Mighawry (1991)** found that the variances due to G.C.A. and S.C.A. were highly significant. **Mohanty and Mishra (1998)** found significant heterosis for number of branches for some hybrids on pumpkin. **Mohanty and Mishra (1999)** on pumpkin revealed that heterosis over the better parent (17.8%) were observed for number of branches per plant. **Mohanty (2000)** revealed that additive genetic variance alone controlled number of branches per plant. **Tewari and Ram (2001)** on bitter gourd found that significant heterosis over better parent (29.00%) was revealed in order of magnitude by number of branches per plant. **Singh *et al.* (2009)** reported that all hybrids showed positive heterosis for number of primary branches per plant, G.C.A. and S.C.A. were significant in vine length and primary branches number per plant.

Kumar *et al.* (2010) referred that number of branches per plant, where G.C.A. variance was lower than the S.C.A. variance may be improved through hybridization (heterosis) indicating the predominance of non-additive gene effects on cucumber, the analysis of variance for combining ability showed significant difference due to treatments for the number of branches per plant, significant heterosis over better parent (29.00%) was revealed in order of magnitude by number of branches per plant.

2.1.3. Number of leaves per vine

El-Gazar (1981) on squash, estimated the G.C.A., S.C.A. and reciprocal effects. The results showed significant values and cleared the

additive genetic variance was large than dominance genetic variance, for the values of broad and narrow sense heritability were 42.50% and 67.37%, respectively. **Kash and El-Diasty (1989)** on squash, obtained low broad and narrow sense heritability values and they found the additive genetic variance was large in magnitude than non additive genetic variance. **El-Mighawry (1991)** on squash found that the variance due to G.C.A. and S.C.A. were highly significant and the ratio of G.C.A. / S.C.A. was 1.013, indicating the equal importance.

2.2. Fruit traits of pumpkin

2.2.1. Fruit diameter

Mighawry (1991) mentioned that variance of G.C.A. and S.C.A. was highly significant, **El-Mighawry (1998)** on summer squash, indicated that the number of genes which controlled of fruit diameter was nearly by one group of genes and exhibited dominance. **El- Gendy (1999)** found that G.C.A. estimate was larger in magnitude than S.C.A. for fruit diameter. **Jha *et al*. (2009)** revealed the equatorial circumferences of fruit had G.C.A. variance lower than the S.C.A. variance indicating the predominance of non additive gene effects and the maximum heterosis equatorial and polar circumferences of fruit and yield per plant may be improved through hybridization. **Kumar *et al*. (2010)** revealed the G.C.A. variance was higher than the S.C.A. variance for equatorial diameter of fruit and significant heterosis over better parent was revealed in order of magnitude by equatorial diameter of fruit (27.30%). **Hatem *et al.* (2013)** on summer squash found that complete dominance for narrow diameter was shown in three crosses. Their estimated average degree of heterosis values, from the low diameter (BP) were not significant for the best parent and the potence ratios for these crosses were - 0.82, -1.00 and-1.29. Partial dominance was shown by the crosses. Since they gave