ISSN 1110-0419

*Annals Of Agric. Sc., Moshtohor,*
*Vol. 43(2): 517-526, (2005).*

# COMPONENTS OF GENETIC VARIANCE AND THEIR INTERACTIONS WITH YEARS IN ONE MAIZE POPULATION

**BY**

**Nawar, A.A,[*]; El-Ahsawy, E.A.[**] ; El-Shamarka, Sh. A.[*] and Abd-El-Sattar Ahmed, M[***]**

* Agronomy Dep., Fac. Agri., Minufiya University

** Genetic Engineering and Biotechnology Research Institute, Minufiya University

*** Agronomy Dep., Fac. Agri., Alexandria University

## ABSTRACT

This investigation aims to study the magnitude of the genetic variance components and heritability and their interactions with years in a $Pop_{59}$ yellow maize population, using Design- II mating scheme for yield and its components traits. The data at second year showed highest mean values than the first year. The error variances ($\sigma^2e$) were higher for most studied traits at the first year than the second one. The coefficient of variability (C.V.%) was higher in the first year than the second one for most studied traits. Estimates of males, females, female x males and their interactions with years were highly significant for all studied traits except ear diameter for males in the first year; and for females, female x males and their interactions in the two growing seasons and the combined data . Most values of ($\sigma^2D$) were more important and significant than those of ($\sigma^2A$) at two years and their combined data. Most values of degree of dominance (à) were in the over dominance range except ear diameter, which showed no dominance at the combined data only. Design-II was more effective in detecting the dominance genetic variance. Generally, the genetic variance components and their interactions showed that $\sigma^2D$ and $\sigma^2$ D x y were the predominant components in the inheritance of most studied traits. In the second year, high heritability values ($h^2$%) in broad and narrow sense were detected in most cases. The broad sense at the first year ranged from 79.90% for days to tasseling to 95.74% for plant height. In the second year, it ranged from 94.84% for the two flowering dates to 99.54% for ear length. In narrow sense at first year, it ranged from 0.00% for ear length and the two flowering dates to 79.59% for plant height, while in the second year ranged from 0.00% for the two flowering dates to 93.52% for ear length. In the combined data the broad sense, they were higher than in narrow sense for most studied traits; the values in broad sense ranged from 0.00% for the two flowering dates to 50.59 for grain yield/plot; and the narrow sense it ranged from 0.00% for 100-kernel-weight and two flowering dates to 30.32% for plant height.

## INTRODUCTION

Maize *(Zea mays L.)* is considered one of the most important cereal crops in Egypt.Advances in statistical genetics have provided several designs to study the type of gene action. Except for the diallel, Design-I and Design-II probably have been used more frequently in maize than any of the other mating designs (Hallaur and Miranda, 1981). North Carolina design-II is one of two factors designs suggested by Comstock and Robinson (1948) for estimating the additive and dominance variances within random- mating populations. This design provides a direct estimate of additive and dominance variances in the individual populations (Holthaus and Lamkey, 1995a). EL–Rouby *et al.* (1979), used design-II to estimate the genetic variance components in "American Early" variety under three locations and two years. They concluded that the additive genetic variance ($\sigma^2A$) was significant and greater than the dominance genetic variance ($\sigma^2D$) for grain yield and its components traits. The total genetic variances were insignificant for plant and ear heights. The dominance genetic variances ($\sigma^2D$) were insignificant for all the studied characters.

Several studies have described the magnitude of genotype - environmental interactions in maize (Holthaus and Lamkey, 1995b and Minglu *et al.*, 2003)

Comstock and Moll (1963), described the genotype –environmental interaction as the different response of phenotypes to the change by environments. They classified the environments into two categories, macro-and micro-environmental variations. Macro –environmental variation is caused by the flactuation in variable which have large and easily recognized variation such as years, locations, fertility levels, planting dates and plant densities, whereas micro-environmental variation arises from plant to plant variation within macro-environments.

The objectives of this investigation were to estimate the of the magnitude genetic variance components and heritability and their interactions with years in a $Pop_{59}$ yellow maize population using Design-II for yield and its components traits.

## MATERIALS AND METHODS

This study was carried out during the three successive seasons 2001,2002 and 2003, at the Agricultural Experimental Station, Faculty of Agriculture, Minufiya University. The material which was used 50 $S_1$ lines of $Pop_{59}$ yellow maize population which was produced by Agricultural Research Center (ARC). In 2001 season, the $S_1$ lines were assigned to two sets each of 14 lines, seven were designated as males and other seven as females. All possible combinations between males and females within each set were made producing 49 full-sib families per set. The full-sib families were growing during the two seasons of 2002 and 2003 in a randomized complete block design (R.C.B.D.) with three replications. Each full-sib family was designated at random to three ridges, 6m. long and 70cm apart. The distance among hills was 25cm, with two kernels per hill on one side of the ridge. The seedlings were thinned to one plant per hill. Normal agricultural practices of maize were applied during the growing seasons. Data were measured on eight quantitative characters, i.e., grain yield/plot, ear length, ear diameter, 100-kernel-weight, plant height, ear height, days to tasseling and days to silking. Random samples of 10 guarded plants in each plot were taken to measure the previous characters except the yield of ears/plot, which was measured on three guarded ridges of each entry. Grain yield/plot was adjusted based on 15.5% moisture and appropriate shelling percentage. Design-II as suggested by Comostock and Robinson (1948) was used to estimate the genetic parameters within the $Pop_{59}$ maize population under both successive years 2002 and 2003. The combined analysis of the two years was done whenever homogeneity of error variance was not significant.

## RESULTS AND DISCUSSION

Means of the studied traits and their coefficients of variability and error variances resulted from Design-II mating scheme for two sets of $S_1$ lines produced from $Pop_{59}$ maize population under two years and their combined data, are presented in Table (1).

**Table (1): Mean ($\bar{x}$), environmental error ($\delta^2e$) and coefficient of variation (C.V.%) for $Pop_{59}$maize population for all studied traits in design-II at two years as well as the combined analysis.**

| Characters | $\bar{x}$ | | |
|---|---|---|---|
| | Y1 | Y2 | Combined |
| Grain yield/plot (kg.) | 4.82 | 5.65 | 5.24 |
| Ear length (cm.) | 15.09 | 16.71 | 15.90 |
| Ear diameter (cm.) | 5.00 | 5.54 | 5.27 |
| 100-kernel-weight (gm.) | 34.57 | 39.73 | 37.15 |
| Plant height (cm.) | 184.24 | 191.61 | 187.93 |
| Ear height (cm.) | 89.56 | 104.77 | 97.16 |
| Days to tasseling (day) | 54.76 | 51.19 | 52.98 |
| Days to silking (day) | 57.02 | 53.75 | 55.38 |
| | | $\Delta^2e$ | |
| Grain yield/plot (kg.) | 0.71 | 0.47 | 0.59 |
| Ear length (cm.) | 1.87 | 1.77 | 1.82 |
| Ear diameter (cm.) | 0.15 | 0.21 | 0.18 |
| 100-kernel-weight (gm.) | 9.25 | 13.92 | 11.59 |
| Plant height (cm.) | 70.17 | 100.37 | 85.27 |
| Ear height (cm.) | 37.50 | 102.05 | 69.78 |
| Days to tasseling (day) | 10.34 | 1.82 | 6.08 |
| Days to silking (day) | 4.26 | 1.87 | 3.07 |
| | | C.V.% | |
| Grain yield/plot (kg.) | 17.50 | 12.1 | 14.66 |
| Ear length (cm.) | 9.07 | 7.96 | 8.49 |
| Ear diameter (cm.) | 7.62 | 8.27 | 7.99 |
| 100-kernel-weight (gm.) | 8.80 | 9.39 | 9.16 |
| Plant height (cm.) | 4.55 | 5.23 | 4.91 |
| Ear height (cm.) | 6.84 | 9.64 | 8.60 |
| Days to tasseling (day) | 5.87 | 2.63 | 4.65 |
| Days to silking (day) | 3.62 | 2.55 | 3.16 |

In general for all traits under study except days to tasseling and days to silking which exhibited earlines, the data at second year showed highest mean values than the first year, indicating that the second year was more favorable for all studied traits. The error variances ($\sigma^2e$) were higher for most studied traits at the first year than the second. Consequently, the coefficient of variability (C.V.%) was higher in the first year than the second for most studied traits.

The analysis of variance for each character in each of the two years and their combined analysis are given in Table (2).

Years mean squares were significant for all studied traits indicating that the over all mean was differed from year to another.

Males mean squares were significant for all studied traits at the two years and the combined data except ear diameter at the first year, whereas males x year mean squares were significant at the two years and the combined data.

Mean squares of female, female x male and their interactions with years were significant for all studied traits at the two years and the combined data except ear diameter only.

Mean squares of males x years interactions were significant for all studied traits indicating that the behavior of almost studied traits differed from one year to another. The same trend was detected for most previous results with EL-Absawy (1990) for the two populations, i.e., Corn Belt and Texpuno-17 at two years.

Estimates of additive ($\sigma^2A$), dominance ($\sigma^2D$) genetic variance components and degree of dominance for all studied traits at the two years and their combined data are given in Table (3).

Most values of ($\sigma^2D$) were more important and significant than those of ($\sigma^2A$) at two years and their combined data. Most values of degree of dominance (à) were in the over-dominance range except ear diameter, which showed no dominance at the combined data only. From these results, design-II was more effective in detecting the dominance genetic variance. These results were completely agreed with those obtained by Santos (1967), Hallauer and Miranda (1981), EL-Absawy (1990), Holthaus and Lamkey (1995b) for grain yield in BSSS germplasm and Sahagun-Castellanos (1997) and Nawar *et al.* (1999).On the contrary, the additive genetic variance accounted for the largest portion of the total genetic variance for all traits was previously obtained by Holthaus and Lamkey (1995a).

The higher estimates of ($\sigma^2D$) in this study might be due to the presence of digenic epistasis, where estimate of dominance would be biased upward because Cov. FS-Cov. HSm – Cov HSf showed that we had contribution of (1/8) $\sigma^2AA$ + (1/8) $\sigma^2AD$ + (1/16) $\sigma^2DD$ in the estimate of $\delta^2mf$. Another source of the bias in dominance values was the effect of linkage. Hallauer and Miranda (1981), stated that if a large random mating population is considered, linkage bias probably is minimum, whereas in $F_2$ population created from two inbred lines, linkage disequilibrium may be important. Coupling phase linkage would not be a source of bias in estimates of dominance because $\sigma^2$A and $\sigma^2$D have a positive or upward bias in the population as in linkage disequilibrium, i.e., $\sigma^2$A and $\sigma^2$D are biased but dominance (d) is not. If the genes are in repulsion phase linkage (which is more likely when crossing two inbreds to correct weaknesses in both), the expression could be the same as for over-dominance in the expression of independently segregating gene, although none of the linked genes was individually more than partially dominance to their alleles. Repulsion phase linkages cause an upward or positive bias in the estimate of $\sigma^2$D (same as coupling phase linkage) but cause a downward or negative bias in estimates of $\sigma^2$A. Hence, $\sigma^2$D will be overestimated and $\sigma^2$A underestimated, which results in an overestimate of "d". Also, the down estimated values of $\sigma^2$A obtained from this maize population ($Pop_{59}$) particularly for grain yield and some of its components may be due to the continual succeeding cycles of selection applied in this population, where it led to minimizing the $\sigma^2$A after many cycles of selection.

Meanwhile, the lower estimates of dominance variances in this maize population might be due to non-randomness of pollination caused by differences in this population in pollen-shedding and silking date. In this trend, Lindsey *et al.* (1962) showed that the non-randomness of pollination would lead to the positive assortative mating which would increase the variance among females.

Hence, Nawar *et al.* (1999) showed that dominance variance would be under estimate and it might result in negative or low estimates. The bias due to the randomness mating would affect silking date and other correlated traits. Another source of the bias of the genetic variance components was due to the correlation coefficients of males and females under positive assortative mating in the nested design. Govesnard and Gallais (1992), showed that if there was a correlation among females mated to a male, the additive variance was overestimated by $4r\sigma^2f$ and the non-additive variance will be underestimated by $8r\sigma^2f$.

Estimates of the interactions between the genetic variance components and years are given in Table (4).

Estimates of $\sigma^2$Axy were not-significant for some traits including grain yield/plot and some of its components, on the other hand, estimates of $\sigma^2$Dxy were significant for all studied traits. The degrees of dominance x year (á x y) interactions were in the over-dominance range, indicating that the dominance was more sensible to environmental interaction (years).

Generally, the present data of the genetic variance components and their interactions showed that $\sigma^2$D and $\sigma^2$ D x y were the predominant components in the inheritance of most studied traits and that was evident from the degrees of dominance (á and á x y).

**Table (2): Analysis of variance of all traits studied of design-II of $Pop_{59}$ maize Population evaluated at two years.**

| S.O.V. | D.F | | Mean squares | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Grain yield/ plot (kg.) | | | Ear length (cm.) | | | Ear diameter (cm.) | | | 100-kernel-weight | | |
| | Y | Comb. | Y1 | Y2 | Comb. | Y1 | Y2 | Comb. | Y1 | Y2 | Comb. | Y1 | Y2 | Comb. |
| Y | - | 1 | - | - | 101.86** | - | - | 386.95** | - | - | 42.94** | - | - | 3912.72** |
| S | 1 | 1 | 17.95* | 17.62* | 35.56** | 36.44** | 227.99** | 41.07** | 1.18 | 15.50* | 12.61** | 54.17** | 346.13** | 337.08** |
| S x Y | - | 1 | - | - | 0.00 | - | - | 223.36** | - | - | 4.07 | - | - | 63.22** |
| R/s x y | 4 | 8 | 6.61** | 3.09** | 4.85** | 23.08** | 2.60* | 12.84** | 0.90 | 1.14 | 1.02 | 43.13** | 186.99** | 115.06** |
| M/s | 12 | 12 | 4.32** | 2.91** | 4.56** | 11.37** | 86.55** | 53.13** | 0.59 | 4.22** | 2.51** | 54.54** | 223.11** | 152.22** |
| f/s | 12 | 12 | 3.88** | 2.71** | 3.69** | 12.54** | 7.33** | 8.83** | 0.12 | 0.59 | 0.32 | 57.98** | 44.24** | 55.67** |
| Fm/s | 72 | 72 | 3.34** | 1.90** | 3.38** | 11.56** | 7.58** | 12.13** | 0.43 | 0.55 | 0.37 | 40.37** | 59.14** | 73.03** |
| M/s x y | - | 12 | - | - | 2.68** | - | - | 44.80** | - | - | 2.29** | - | - | 125.43** |
| f/s x y | - | 12 | - | - | 2.90** | - | - | 11.05** | - | - | 0.39 | - | - | 46.56** |
| Fm/s x y | - | 72 | - | - | 1.86** | - | - | 7.01** | - | - | 0.62 | - | - | 26.48** |
| Error | 192 | 384 | 0.71 | 0.47 | 0.59 | 1.87 | 1.77 | 1.82 | 0.15 | 0.21 | 0.18 | 9.25 | 13.92 | 11.59 |
| Total | 293 | 587 | - | - | - | - | - | - | - | - | - | - | - | - |

**Table (2): Cont.**

| S.O.V. | D.F | | Mean squares | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Plant height (cm.) | | | Ear height (cm.) | | | Days to tasseling | | | Days to silking | | |
| | Y | Comb. | Y1 | Y2 | Comb. | Y1 | Y2 | Comb. | Y1 | Y2 | Comb. | Y1 | Y2 | Comb. |
| Y | - | 1 | - | - | 7992.10** | - | - | 34043.49** | - | - | 1867.86** | - | - | 1575.52** |
| S | 1 | 1 | 6077.89** | 115.09** | 2260.12** | 2146.5** | 2634.01** | 12.46* | 69.55** | 8.17* | 15.03** | 147.16** | 0.04 | 71.12** |
| S x Y | - | 1 | - | - | 3932.87** | - | - | 4768.05** | - | - | 62.69*** | - | - | 76.08** |
| R/s x y | 4 | 8 | 1951.36** | 3964.03** | 2957.70** | 1256.11** | 2952.1** | 2104.11** | 8.51** | 5.51** | 7.01** | 31.17** | 14.55** | 22.86** |
| M/s | 12 | 12 | 423.12** | 563.13** | 588.23** | 132.54** | 891.67** | 599.16** | 15.45** | 5.93** | 9.72** | 14.23** | 8.88** | 8.10** |
| F/s | 12 | 12 | 227.85** | 439.55** | 210.78** | 49.93** | 240.60** | 101.11** | 35.50** | 20.06** | 15.88** | 23.72** | 20.17** | 6.95** |
| fm/s | 72 | 72 | 136.61** | 240.28** | 206.78** | 90.31** | 220.99** | 169.76** | 20.62** | 10.16** | 15.00** | 17.47** | 10.48** | 13.71** |
| M/s x y | - | 12 | - | - | 398.02** | - | - | 425.05** | - | - | 11.66** | - | - | 16.01** |
| F/s x y | - | 12 | - | - | 456.62** | - | - | 189.42** | - | - | 39.68** | - | - | 36.95** |
| fm/s x y | - | 72 | - | - | 170.11** | - | - | 141.54** | - | - | 15.78** | - | - | 14.25** |
| Error | 192 | 384 | 70.17 | 100.37 | 85.27 | 37.50 | 102.05 | 69.78 | 10.34 | 1.82 | 6.08 | 4.26 | 1.87 | 3.07 |
| Total | 293 | 587 | - | - | - | - | - | - | - | - | - | - | - | - |

*,** significant at 0.05 and 0.01 levels of probability, respectively.

**Table (3): Estimates of additive ($\delta^2A$), dominance genetic variances ($\delta^2D$) and degree of dominance (a) for Pop$_{59}$ maize population for all studied traits in design-II.**

| Character | $\delta^2A$ | | |
|---|---|---|---|
| | Y1 | Y2 | Comb. |
| Grain yield /plot (kg.) | 0.14 | 0.17 | -0.02 |
| Ear length (cm.) | 0.08 | 7.50* | -0.20 |
| Ear diameter (cm.) | -0.01 | 0.35* | 0.03 |
| 100-kernel-weight (gm.) | 3.03 | 14.2 | -2.72 |
| Plant height (cm.) | 35.98* | 49.73* | -6.14 |
| Ear height (cm.) | 0.18 | 65.74* | 1.40 |
| Days to tasseling (day) | 0.92 | 0.54* | -1.15 |
| Days to silking (day) | 0.29 | 0.77* | -1.71 |
| | $\delta^2D$ | | |
| Grain yield /plot (kg.) | 3.51* | 1.91* | 1.01* |
| Ear length (cm.) | 12.92* | 7.75* | 3.41 |
| Ear diameter (cm.) | 0.38* | 0.45* | -0.17 |
| 100-kernel-weight (gm.) | 41.50* | 60.29* | 31.03* |
| Plant height (cm.) | 88.58** | 186.55** | 24.44** |
| Ear height (cm.) | 70.41* | 158.58* | 18.82** |
| Days to tasseling (day) | 13.71 | 11.12* | -0.52 |
| Days to silking (day) | 17.61* | 11.48* | -0.36 |
| | a | | |
| Grain yield /plot (kg.) | 6.96 | 4.70 | ∞ |
| Ear length (cm.) | 18.51 | 1.44 | ∞ |
| Ear diameter (cm.) | ∞ | 1.60 | 0.00 |
| 100-kernel-weight (gm.) | 5.24 | 2.91 | ∞ |
| Plant height (cm.) | 2.22 | 2.74 | ∞ |
| Ear height (cm.) | 28.34 | 2.20 | 5.19 |
| Days to tasseling (day) | 5.44 | 6.42 | 0.95 |
| Days to silking (day) | 11.10 | 5.46 | 0.65 |

**Table (4): Estimates of the interaction between years and the additive ($\delta^2AxY$), dominance genetic variances ($\delta^2DxY$) and degree of dominance (àxY) for Pop$_{59}$ maize population for all studied traits in design-II.**

| Character | $\delta^2AxY$ | $\delta^2DxY$ | àxY |
|---|---|---|---|
| Grain yield /plot (kg.) | 0.18 | 1.70* | 4.39 |
| Ear length (cm.) | 3.98** | 6.92* | 1.86 |
| Ear diameter (cm.) | 0.14** | 0.58* | 2.91 |
| 100-kernel-weight (gm.) | 11.34** | 19.86* | 1.87 |
| Plant height (cm.) | 48.99* | 113.13* | 2.15 |
| Ear height (cm.) | 31.56* | 95.68* | 2.46 |
| Days to tasseling (day) | 1.88 | 12.93* | 3.71 |
| Days to silking (day) | 2.23* | 14.90** | 3.65 |

*,** significant at 0.05 and 0.01 levels of probability, respectively.

Estimates of heritability are presented in Table (5). In the second year, high heritability values in broad and narrow sense were detected in most cases. In broad sense at the first year, heritability ($h^2$%) ranged from 79.90% for days to tasseling to 95.74% for plant height.

**Table (5): Estimates of heritability % ($h^2$%) in the broad and narrow sense for $Pop_{59}$ maize population at two years as well as the combined analysis for all studied traits in design-II.**

| Character | Y1 | |
|---|---|---|
| | broad | narrow |
| Grain yield /plot (kg.) | 95.47 | 28.49 |
| Ear length (cm.) | 95.39 | 0.00 |
| Ear diameter (cm.) | 92.78 | 35.70 |
| 100-kernel-weight (gm.) | 95.34 | 32.63 |
| Plant height (cm.) | 95.74 | 79.59 |
| Ear height (cm.) | 91.51 | 43.70 |
| Days to tasseling (day) | 79.90 | 0.00 |
| Days to silking (day) | 92.53 | 0.00 |
| | Y2 | |
| Grain yield /plot (kg.) | 95.66 | 42.66 |
| Ear length (cm.) | 99.54 | 93.52 |
| Ear diameter (cm.) | 98.86 | 91.44 |
| 100-kernel-weight (gm.) | 98.53 | 79.37 |
| Plant height (cm.) | 95.30 | 69.10 |
| Ear height (cm.) | 97.02 | 84.14 |
| Days to tasseling (day) | 94.84 | 0.00 |
| Days to silking (day) | 94.84 | 0.00 |
| | Combined | |
| Grain yield /plot (kg.) | 50.59 | 10 86 |
| Ear length (cm.) | 15.26 | 6.37 |
| Ear diameter (cm.) | 26.97 | 26.97 |
| 100-kernel-weight (gm.) | 26.23 | 0.00 |
| Plant height (cm.) | 36.65 | 30.32 |
| Ear height (cm.) | 32.06 | 27.42 |
| Days to tasseling (day) | 0.00 | 0.00 |
| Days to silking (day) | 0.00 | 0.00 |

In the second year, ($h^2$%) in broad sense ranged from 94.84% for two flowering dates to 99.54% for ear length.

On the other hand, heritability ($h^2$%) in narrow sense at first year ranged from 0.00% for ear length and the two flowering dates to 79.59% for plant height, while in the second year the values ranged from 0.00% for the two flowering dates to 93.52% for ear length.

In the combined data, the values of ($h^2$%) in broad sense were higher than in narrow sense for most studied traits; the values of ($h^2$%) in broad sense ranged from 0.00% for the two flowering dates to 50.59% for grain yield /plot; and in narrow sense, the values ranged from 0.00% for 100-kernel-weight and the two flowering dates to 30.32% for plant height. The differences of heritability in broad sense was caused by genotype- environment interaction, meanwhile the differences of heritability in narrow sense was caused by genotype-environment interaction and/ or additive effect/ A-A epistatic effect (Minglu *et al.*2003).

Generally, our heritability values for yield were in the range of Hallauer and Miranda's report (1981) who showed that the average of heritability values for yield amounted from less than 30%.

## REFERENCES


Comstock, R.E. and Robinson, H.F. (1948): The components of genetic variance in populations of biparental progenies and their use in estimating the degree of dominance. Biometrics, 4:245-266.

Comstock, R.E. and Moll, R.H. (1963): Genotypes-environment interaction. In W.D. Hanson and H.F. Robinson (ed). Statistical genetics and plant Breeding, No.982 P.164-196.

El-Absawy, E.A. (1990): Comparison between some experimental genetic designs in two populations of maize. Ph.D. Thesis, Zagazig Univ., Egypt.

El-Rouby, M.M; Gad,A.M. and Shouman, R.A. (1979): Components of genetic variance and their interactions with locations and years in maize. Egypt J. Genetic and Cytol., 8:107-121.

Govesnard, B. and Gallais, A. (1992): Genetic variance components estimation in a nested mating design with positive assortative mating and application to maize. Crop Sci., 32:5, 1127-1131.

Hallauer, A.R. and Miranda, J.B. (1981): Quantitative genetics in maize breeding. Iowa State Univ. Press, Ames., U.S.A. (First edition).

Holthaus, J.F. and Lamkey, K.R. (1995a): Response to selection and changes in genetic parameters for 13 plant and ear traits in two maize recurrent selection programs. Maydica, 40: 357-370.

Holthaus, J.F. and Lamkey, K.R. (1995b): Population means and genetic variances in selected and unselected Iowa stiff stalk synthetic maize populations. Crop Sci., 35:1581-1589.

Lindsey, M.F.; Lonnquist, F.H. and Gardner, C.D. (1962): Estimations of genetic variance in open-pollinated varieties of corn belt. Crop Sci., 2:105-108.

Minglu, X.; Guangtang, P.; Shiping, H.; MI, Xu.; Pan, G. and Huo, S. (2003): Comparison of mixed linear model analysis and combining ability analysis of genetic effect of main traits in maize. Southwest- China J. of Agric., Sciences, 16: 13-17.

Nawar, A.A.; El-Shamarka, Sh.A.; El-Absawy, E.A. and Khalil, A.N.M. (1999): Comparative studies on estimation of genetic parameters from two mating designs in maize. Annals of Agric.Sc., Moshtohor, 37:27-39.

Sahagun-Castellanos, J.S. (1997): Effect of the inbreeding on the estimation of genetic variances in design-II of North Carolina. Revista Fitotecnia Mexicana, 20:97-110.

Santos, I.S. (1967): Utilization of random homozygous inbred lines to evaluate genetic and environmental variations in an open-pollinated variety of corn. Diss. Abst., 28:521. (C.F.Pl. Breed. Abst., 39:521).

# مكونات التباين الوراثي وتفاعلاتها مع مواسم الزراعة في إحدى عشائر الذرة الشامية

عبد الحميد أحمد نوار*، السيد عبد الخالق العيساوي**، شعبان أحمد الشمارقة*، محمد عبد الستار أحمد***

* قسم المحاصيل – كلية الزراعة – جامعة المنوفية.
** معهد الهندسة الوراثية والتكنولوجيا الحيوية جامعة المنوفية.
*** قسم المحاصيل – كلية الزراعة – جامعة الإسكندرية.

أجرى هذا البحث بمحطة التجارب بكلية الزراعة جامعة المنوفية وذلك باستخدام عشيرة صفراء $Pop_{59}$ من الذرة الشامية وذلك باستخدام التصميم الثانى D-II والذى أقترحه (كومستك وربنسون عام ١٩٤٨م)، حيث سجلت النتائج خلال موسمى ٢٠٠٢، ٢٠٠٣م على الصفات التالية: كمية المحصول/ قطعة تجريبية، طول الكوز، قطر الكوز، وزن المائة حبه، طول النبات، ارتفاع الكوز على النبات، ميعاد التزهير للنورة المذكرة وميعاد التزهير للنورة المؤنثة وكانت النتائج المتحصل عليها كالتالي:

- أظهرت النتائج أن المتوسطات للصفات المدروسة كانت ذا تفوق ملحوظ فى الموسم الزراعى الثانى عن الموسم الأول.
- كان تباين الخطأ ($\sigma^2e$) ومعامل الاختلاف (C.V%) مرتفعا فى الموسم الأول عن الثانى لمعظم الصفات المدروسة.
- كان تباين الذكور وتباين الإناث وتباين الإناث × الذكور وتفاعلاتها مع مواسم الزراعة معنوية.
- كان التباين الوراثي السيادى هو السائد والمهم والمتحكم فى معظم الصفات خلال موسمي الزراعة والتفاعل بينهما.
- كانت معظم قيم درجة السيادة فى حدود السيادة الفائقة ماعدا صفة قطر الكوز وذلك عند التحليل التجميعي فقط.
- أظهرت النتائج أن التصميم الثانى أكثر كفاءة فى حساب التباين الوراثي السيادى.
- أظهرت النتائج أن التباين السيادى وتفاعلاته مع مواسم الزراعة هما المكون السائد والمتحكم فى معظم الصفات.
- كانت قيم درجة التوريث بالمعنى الواسع والمعنى الضيق مرتفعة وقد تراوحت قيمها بالمعنى الواسع فى الموسم الأول بين ٧٩,٩٠% لصفة تزهير النورة المذكرة إلى ٩٥,٧٤% لارتفاع النبات، بينما فى المواسم الثانى حققت ٩٤,٨٤% لميعادى التزهير للنورتين المذكرة والمؤنثة إلى ٩٩,٥٤% لطول الكوز.
- بينما حازت قيم درجة التوريث بالمعنى الضيق فى الموسم الأول على قيم تراوحت بين صفر % لصفات طول الكوز ومعيادى التزهير للنورتين المذكرة والمؤنثة إلى ٧٩,٥٩% لصفة ارتفاع النبات، وفى الموسم الثانى تراوحت القيم بين صفر % لميعادى التزهير إلى ٩٣,٥٢% لطول الكوز، وفى التحليل التجميعي سجلت قيما بالمعنى الواسع أعلى عن مثيلتها بالمعنى الضيق فقد تراوحت قيم الكفاءة الوراثية بالمعنى الواسع فى التحليل التجميعي بين صفر % لميعادى التزهير إلى ٥٠,٥٩% لصفة محصول الحبوب/ للقطعة بينما كانت القيم بالمعنى الضيق قد تراوحت بين صفر% لصفة وزن المائة حبة وميعادى التزهير إلى ٣٠,٣٢% لصفة ارتفاع النبات.