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GENETIC AND PHENOTYPIC VALUE OF PARENTAL COMPONENTS IN SOME MAIZE INBREEDS (*Zea mays L*)

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Abstract

The main objective in this study was investigations of some maize inbred lines with medium maturity originating from Agricultural University of Tirana. The maize inbred lines were investigations for suitability in agroecological conditions of Kosovo. Each maize inbred line had three replicates in a randomized complete block design (RCBD). The seeds were sowing 3-5 cm deep, while the plot sizes were 14 m^2 per each replications x 3 Replications (R) =42 m^2. The combination formula in this study was; 10 inbred lines x 3 Replications x 1 Locality x 2 years x 5 parameters = 300 combination. The statistical differences between maize inbred lines were analyzed by *Duncan's* test. We measured at field for each plot and laboratory the average of ten (10) plants were randomly harvested from one of the four middle rows or 10 plants x 3R= 30 plants x 10 inbred lines =300 plants only for one parameters, or in generally; 5 parameters x 300 plants = 1500 plants. The maize inbred Line 136 for different parameters was characterized with maximum average value; for ear height (EH) on value 56.6 cm and Cob Length (CL) 16.96 cm. The line 236 was determined by lower EH on average value 41 cm, but for others parameters was realised higher value; kernel depth (KD) (1.05cm), and grain yield per ear (GYE) 61.78 g. While inbred line A3 Lot for CL is characterized by low average value (12.26 cm). The data from our investigations for different genetic parameters show that the some inbred lines were characterized significantly higher at p=0.01.

Key words: inbred line, ear height, cob length, ear diameter, grain yield.

INTRODUCTION

Maize(*Zea mays* L) is cultivated worldwide, at latitudes varying from the equator to slightly above 50 degrees north and south, from level to over 3000 meters elevation, in cool and hot climates, and with growing cycles ranging from 3 to 13 months (CIMMYT, 2000). It is the third most crop important crop in the world after rice and wheat, with annual production of 6000 million tons (FAO, 2000). In the last decades of the last century is a relatively small number of biological processes in the plant world that attracted so much attention of many scientists as maize inbriding (Aliu et al, 2009). Genetic and phenotypic evaluation of maize inbreeds lines which has a great impact on plant breeding and is one of the most important research topics Conventional crop breeding techniques emphasize selection for yield or improvement of crop cultivars through different methods (Mock and Pearce,1975). Techniques, have been developed that are used by nearly all maize breeders to produce good seed set by hand pollination (Russel and Hallauer, 1980) cited by Carena (2009).

Maize breeding is the art and science of compromise, most of the economically important traits in maize breeding are inherited quantitatively (Carena M, 2009).

Several types of hybrids are possible in maize; however the most common ones for commercial production are derived from inbred lines (Nass and Miranda, 1995). On the other hand, rightly emphasizes Carena (2009) the basic feature of all plant improvement programs is to increase the frequency of favorable allelic combinations. In maize breeding, this feature is common to all aspects related to maize improvement; Introduction and adaptation of germplasm, improvement of germplasm resources; pedigree selection to develop improved inbred lines. Genetic improvement in traits of economic importance along with maintaining sufficient amount of variability is always the desired objective in maize breeding programs (Hallauer and Scobs , 1973). The activity for development of new hybrids in territory of Kosovo has started during the seventies, and more intensively has been working during the year 1980-1987, this activity has not end up successfully and these research work continue after year 1999 (Aliu et al., 2010). An important objective of maize breeding programs is to develop new inbred lines that combine well to produce higher grain yield and superior agronomic performance in hybrid combinations (Trifunovic et al, 2003).

The experiment reported in this paper was designed to learn genetic and phenotypic parental value in some different maize inbreed lines growth in Agro ecological conditions in Kosovo, and to provide information for selection of superior inbreed maize lines for combining ability patterns of a diallel cross.

MATERIAL AND METHODS

Plant material and experimental design

The basic parental material was comprised of ten maize inbred lines representing with medium maturity, originating from the Agriculture University of Tirana (AUT)-Albania (Table 1). The observation for plant material of the maize inbred lines were planted during vegetation year 2006 (Y1) and 2007 (Y2) at location of Ferizaj, at an altitude of 560 m.a.s.l. The inbred lines were planted in rows, 5m long with 0.70m between rows, and plant to plant spacing was 0.30 m within the rows or 47000 plants per ha^{-1}. Each maize inbred line had three replicates in a randomized complete block design (RCBD). The seeds were sowing 3-5 cm deep, while the plot sizes were 14 m^2 per each replications x 3 Replications (R) =42 m^2. The combination formula in our study was; 10 inbred lines x 3 Replications x 1 Locality x 2 years x 5 parameters = 300 combination and was according to the linear statistical model;

$Y_{ijw} = \mu + t_i + r_j + e_{ijw}$, where,

Y_{ijw} - is a single observation,
μ - is the general mean of the treatments,
t_i - is a line effect,
r_j - is the random effect of replication and
e_{ijw} - is the error effect of plots.
The mean, average, is the sum of all the elements divided bz the number of elements in the investigation. The formula for calculating the mean is therefore;

$$\mu = \frac{\sum X}{N}$$ and

$$X = \frac{\sum X}{n}$$

$\sum$- is the sum so that $\sum x = x_1 + x_2 + x_3 + \ldots x_n$

Under the growing conditions of these experiment to determine phenotypic traits; Ear height (EH), Cob Length (CL), Ear diameter (ED), Kernel depth (KD), and grain yield per ear (GYE) with moisture 14%. We measured at field for each plot and laboratory the average of ten (10) plants were randomly harvested from one of the four middle rows or 10 plants x 3R= 30 plants x 10 inbred lines =300 plants only for one parameters, or in generally; 5 parameters x 300 plants = 1500 plants.

Table 1.

The investigated materials of maize inbred lines

Number	**genotypes**	**Line Symbol**
1	Line 136	L-136
2	Line 236	L-236
3	Line 146	L-146
4	Line A3LoT	L-A3LoT
5	Line 46W	L-46W
6	Line 66	L-66
7	Line 227	L-227
8	Line 130	L-130
9	Line 40A	L-40A
10	Line sintetica 246	L-S 246

Statistical Analysis

The data for all the trials were analysed by ANOVA. Differences for means of various characters were computed using least significance differences (LSD) at 0.05 and 0.01 of probability. Mean separation was achieved using Duncan's multiple range test. The following biometrical parameters were estimated; average means, coefficient of variation and Pearson correlation was calculated using statistical model analyses (SMA) package were conducted program MINITAB version 14, SASS-JMP-IN 5.1.2 (2004) and Excel.

RESULTS AND DISCUSSION

Obtained results showed a significant effect of mean squares of genotypes. The year (B) as excepted, had a strong influence on the Ear diameter (ED) and Ear height (EH), also the impact of genotypes was with higher influence on the different traits. (Table 2). The analysis of results indicates, as excepted, a significantly higher at the relevant parameters. The average value μ for ear height (EH) was 47.08 cm. The maize inbred line 136 realised maximal values for EH (56.66 cm) while lowest value was recorded in the maize inbred line 236 (41 cm). The difference between inbred lines was +15.66 cm or with genetic variability 33.26% including both directions (positive and negative). A comparison of the grand mean between line which had a maximum value and line which had lowest value indicated that the means for EH were shifted positively (+9.58 cm or 20.34%) and negatively (-6.08 cm or 12.91%). Results are presented in Table 3. Different researchers have reported significant amount of variability in different maize inbreed lines (Aurelio et al., 2003, Augusto, et al (1980). Similar findings were reported by Aliu et al (2009) which had investigated in some different maize inbred lines growth in agro ecological condition realised results on variation from 60.72 – 60.2 cm.

Table.2.

Mean square of morphological quantitative traits in maize inbred lines

Sources of variation	EP	CL	ED	KD	GYE
(A) Genotype	10.70**	1.53**	24.98**	13.46**	4.91**
(B) Year	4.35*	$3.77^{N.S}$	11.36**	$1.88^{N.S}$	$1.90^{N.S}$
A x B	$0.62^{N.S}$	$1.30^{N.S}$	$0.81^{N.S}$	$1.28^{N.S}$	$2.36^{N.S}$
CV (%)	11.86	9.24	12.32	11.81	26.22

*, ** is significant at p=0.05 and p=0.01, respectively. N.S- is non significant

The linear regression for EH was $y= 6.91+157^{*}x$, while Pearson correlation between for EH and GYE was with negative value (r= -0.047). Among the tested genotypes, maize inbred line 136 had the maximum cob length (CL) 16.96 cm, while the genotype A3LoT showed minimum CL (12.26 cm).The differences between genotypes which had realised maximum and minimum average values were 4.7 cm or with genetic variability 32.82%, significantly higher at *p*=0.01. Comparisons of extreme values for CL among grand mean (14.32 cm) the results showed statistical significance with positive difference + 2.64 cm or 18.43% and negative value – 2.06 cm or 14.38 %. Results are presented in Table 3. Several researches were reported by Turi et al (2007), Augusto, et al (1980) which had obtained different results for cob length from 11 to 16 cm.

Table. 3.

Average values for quantitative parameters in maize inbreed lines.

Lines	EH ±SE		CL ±SE		ED ±SE		KD±SE		GYE±SE	
L-136	56.66^{a}	±0.66	16.96^{a}	±0.91	5.16^{a}	±0.13	1.00^{a}	±.0.00	35.28^{cd}	±5.78
L- 236	41.00^{c}	±0.50	13.10^{cd}	±0.07	5.13^{a}	±0.15	1.05^{a}	±0.05	61.78^{a}	±4.42
L-146	47.33^{b}	±1.58	13.30^{bcd}	±0.11	4.03^{d}	±0.09	0.80^{bc}	±0.02	46.11^{bc}	±2.91
A3LoT	41.33^{c}	±1.85	12.26^{d}	±0.28	4.05^{cd}	±0.02	0.83^{bc}	±0.04	28.16^{d}	±3.55
L- 46	51.66^{b}	±0.33	14.93^{abc}	±1.32	4.20^{bcd}	±0.07	0.80^{bc}	±0.02	51.30^{ab}	±4.47
L- 66	51.83^{ab}	±3.00	14.03^{bcd}	±0.57	4.95^{a}	±0.10	1.00^{a}	±0.02	42.48^{bcd}	±8.20
L- 227	48.66^{b}	±2.16	14.18^{bcd}	±0.65	3.51^{e}	±0.09	0.75^{c}	±0.00	33.51^{cd}	±4.80
L- 130	41.16^{c}	±1.58	15.16^{ab}	±1.10	4.05^{cd}	±0.10	0.80^{bc}	±0.02	39.15^{bcd}	±8.10
L- 40A	41.50^{c}	±1.52	14.08^{bcd}	±0.41	4.46^{b}	±0.08	0.88^{b}	±0.01	31.60^{cd}	±3.38
S- 246	49.66^{b}	±1.76	15.21^{ab}	±0.14	4.35^{bc}	±0.12	0.86^{b}	±0.01	31.48^{cd}	±3.02
μ	47.08		14.32		4.39		0.87		40.08	
p=0.05 0.01	5.04 6.9		2.01 2.76		0.32 0.44		0.08 0.11		14.18 19.43	

*the same letter are siginificantly different

The coefficient of correlation between CL and ED was with positive value but, not so higher (r= 0.26). The maize inbred line L-136 had the highest positive and highly significant values for ear diameter 5.16 cm. Inbred line 227 had minimum average values only 3.51 cm. Differences between maize inbred line 136 and 227 were +1.65 cm or with genetic variation 37.58%. A comparison of the total mean (4.39 cm) among maize inbred lines which had a maximum and minimum ED, indicated that the differences were +0.77 cm or 17.53% and – 0.88 or 20.04%. There were statistically significant positive correlations (r= 0.96**) between Ear Diameter (ED) and Kernel Diameter (KD). Results are presented in Table 4. Different results have been reported by Sofi and Rather (2006) which had realized significant results for ED (0.25 **). Average values for Kernel depth (KD) ranged from 0.75 for L-227 to 1.05 cm (L-236). Differences between there were 0.3 cm or with genetic variability

34.48%. Comparisons of grand mean (0.87cm) among maize inbred lines L-227 and 236 was with positive variation +0.18 cm or 20.68% and negative variation -0.12 or 13.79%. The correlation between KD and GYE was 0.37. The most important breeding objectives is to improve yield, other major agronomic traits however one of importance in hybrid combinations and have an impact in yield (Trifunovic et al, 2003). Analysis of variance for GYE indicated that differences among genotypes were highly significant. The average value μ of grain yield (GYE) was 40.08 g. The maize inbred line 236 had the highest GYE of 61.78 g per ear, compared with line A3LoT (28.16 g) that had of + 33.62 g or with total genetic variability 83.88%, significantly higher at p=0.01. The L-236 compared on value μ the differences were +21.7g or 54.14%, while differences for A3LoT were -11.92 or 29.74%.

Table. 4

Coefficients of phenotypic correlation among ten maize inbred lines

Traits	**EH (X_1)**	**CL (X_2)**	**ED (X_3)**	**KD (X_4)**	**GYE (X_5)**
EH (X_1)	1.00	0.66*	0.24	0.15	-0.04
CL (X_2)		1.00	0.26	0.11	-0.16
ED (X_3)			1.00	0.96**	0.37
KD (X_4)				1.00	0.37
GYE (X_5)					1.00

*, ** Correlation coefficient significant at the 0.05 and 0.01 probability levels, respectively.

CONCLUSION

The results of the analysis of variance for genetic values show highly significant differences among observed maize inbred line genotypes. Successful maize breeding and production are dependent upon the development of adapted maize inbred line. The field and laboratory investigation suggest that the some maize inbred lines represent higher genetic and phenotypic values which can be good genetic material for breeding program include diallel crossing methods.

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