Albanian j. agric. sci. 2013;12 (3):449-453 *Agricultural University of Tirana*

RESEARCH ARTICLE **(Open Access)**

Morphological characterization of some maize landraces

FETAH ELEZI[1*], KOSTANDIN HAJKOLA[2], ALBAN IBRALIU[3]

[1*]Center for Genetic Resources, Agricultural University of Tirana, Rr. Siri Kodra, Tirana, ALBANIA

[2]Agricultural Technology Transfer Center, Shkodër, ALBANIA

[3]Department Plant Production Agricultural University of Tirana, Kodër Kamëz, Tirana, ALBANIA

Abstract

Working group of Agricultural University of Tirana, supported by Seednet Project, collected some local maize populations during 2009-2010 in different areas of Albania. The genetic material need to characterization and evaluation for preservation at Gene Bank. The evaluation process involved the following elements: to male flowering, female flowering, during of plant period, plant height, ear height, stay green, number of leaves above the uppermost ear including ear leaf, stem color, tassel type. The results showed that the evaluated landraces have difference from our investigation, it emerged that the difference between the male flowering and female flowering was 2-9 days and the plant period was short in most part of the populations. The short vegetative period made possible the increase of their cultivation in the hill and mountain areas and in areas without irrigation. The statistical cluster analyses was accomplished the data collected on morph biological descriptors, processed through by Hierarchical Clustering Method and identified three varietal groups characterized according to metrical parameters and the locations of origin are identified.

Key Words: descriptors, metrical parameters, populations, tassel.

1. Introduction

Maize (*Zea mays* ssp. mays), this cultivated plant is very important in Albania. During the last decade, although the cultivated area has not changed, the production has increased around 60%. This is realized by means of yield increase from 3. 58 t/ha in 2000 to 5. 27 t/ha in 2010, [10]. Recently, in our country, there is an increase of cultivation of local maize populations for some special values they possess. Preservation of the genetic resources in the country is associated with the characterization and evaluation of the genetic diversity and therefore maize germplasm is studied [13]. However, due to the continuous regeneration and the limited number of the individuals for accessions, the collection is damaged because of the genetic erosion [4]. Today, the variability of the agricultural crops has been massively lost as result of the commercial varieties use. For example, only about 5% of maize germplasm is used for commercial purposes [8]. The plant genetic resources are considered as the main source for the conservation of the biological diversity and long-term sustainability of human life. Identification of the genetic variability by means of the morphological indicators also helps for the determination of the duplicate accessions. The size and the number of maize collection make the bank management difficult and raise heavily the costs. The various autochthonous populations represent specific features in the morphological and agronomic point of view [2, 7]. The Genetic Bank should establish the standards that the collection can be representative and available for the plant selectors [11]. The purpose of this research is to explore the relationship between the recollected maize populations with those in the collection and to give a preliminary classification of the valuable populations providing in this way a rational and effective utilization of these genetic resources in genetic improvement programs.

2. Material and methods

The genetic material used in this study consists of 13 local maize populations collected during 2009 - 2010 in different areas of Albania (Table 1).

The field tests were carried out in the Agricultural Technologies Transfer Center, Shkoder. The assessment is based on the analysis of twenty plants for each population and is committed in conformity with the IBPGR indicators [9]. The studied characters were: the number of days until male and female flowerings, the plant height, the height of the first ear, the number of leaves per plant, stem color in flowering, preservation of greenness until maturing. In regard to the ear data, it was evaluated: ear

Correspondence: Fetah Elezi, Center for Genetic Resources, Agricultural University of Tirana; Email: elezi_fetah@yahoo.com
(Accepted for publication 20 June 2013)
***ISSN**: 2218-2020, © Agricultural University of Tirana*

covering, ear damage rate, the number of rows on the cob, grains order in a row, grains type, grains color, weight of 1000 grains etc. The analysis use for similar morphological average is valuable for the study of the populations [6]. The same recommendation is also given by Camussi A., **[3]** in order to determine the taxonomy of the Italian maize populations based on quantitative features. The data obtained were processed statistically with the program (SAS) for the variance, correlation and PCA (Principal Component Analysis).

Table 1. List of populations studied in field trial in ATTC QTTB Shkoder

Nr. samples	*Code*	*No accessions*	*Local name*	*Collection village*	*Region*
M01	KO-1-08	159	Reçi	Dukaj	Malsi e Madhe
M02	KO-3-08	160	Reçi bardhe	Reçi Poshtëm	Malsi e Madhe
M03	KO-5-08	161	Reçi bardhe	Reçi Poshtëm	Malsi e Madhe
M04	KO-7-08	162	Reçi Shkrelit	Qafgrade	Malsi e Madhe
M05	KO-8-08	163	Reçi vendit	Reçi Sipërm	Malsi e Madhe
M06	M-1-08	164	I bardhi i Gjalishit	Gjalish	Mat
M07	M-2-08	165	Mati bardhe	Lis	Mat
M08	M-3-08	166	Mati bardhe	Shelli	Mat
M09	M-4-08	167	Mati	Gjalish	Mat
M10	Di-1-08	168	Bardhe vendi	Terbaç	Diber
M11	Di-3-08	169	bardhi	Viçisht	Diber
M12	Di-08	170	Yzberish	Zall Sopot	Diber
M13	Lu-1-08	171	Sulova	Biçakaj	Lushnje

3. Results and discussion

According to Sanchez [14], determination of the features is important for the evaluation of the maize populations, as basic features to determine the population diversity. The results are presented on average data for each feature. The plant vegetation data (Table 2) indicate significant differences among the studied populations.

The number of days until male flowering is presented with a shorter period of 46 days at M01 and more extended at M07 with 65 days, while the majority has a period of 57 - 63 days. The number of days until female flowering is presented with 49 - 73 days. The differences between male and female flowering is 2 - 9 days. This result coincides with the definition of Fonesca and Westgate, [5] and Ali et. al [1], that a corn/maize flowering can keep pollen 2 - 10 days, depending on the genotype and the environmental conditions. The plant height is in direct correlation with the vegetative period and the amount of production but in indirect correlation with the downfall. The evaluation of this indicator is made based on the six classes system and the genotypes are grouped into two classes: the fourth class (with 150-175 cm height) includes seven populations and the fifth class (with height above 175-200 cm) includes eight populations. The first ear height in the plant is 45 - 60 cm at 10 populations and 60 - 70 cm at three other populations. In relation to the number of leaves, the majority of the populations are included in the group of maize with limited number of leaves with 5. 3 - 6. 9 leaves per plant. Leafing (the average of leaves in the plants observed after milk stage) varies from low to high (with degree 3-7). Out of the assessment, it shows that 1/3 of the populations studied preserve green leaves until maturing. Stem color in flowering appears: green, light red, red and purple. Tassel type is presented with tertiary branching at all populations. From the assessment of ear indicators (Table 2), it is found significant differences among the populations. Ear covering in the majority of the populations is moderate and good (degree 5-7). The ear damage rate from decay/or insects is considered low in 10 populations; median in one and high in two of them (populations). The grains order in the row appears: in three populations with clear lines and set straight, while in 10 populations with irregular lines. The number of rows in the cob results: in 4 populations with 8 rows, in 8 others with 10 rows and only in one population with 14 rows. Ear length appears to be short and very short. Regarding the cob diameter, nearly in 50% of the populations, we have a thin cob. In the other part, the cob diameter appears thin and average. Regarding the cob color in all the populations studied, it results to be a white. The grains type is estimated to be half hyaline in nine populations and glassy/ hyaline in four others. The grain color appears white in all genotypes. The weight of 1000 grains (g) varies from 297g at M13 to 391 g at M12.

Table 2. The data of plant vegetative and metric parameters

Samples	*male flowerings*	*female flowerings*	*plant height*	*Height/ ear*	*leaves*	*leaves /plant*	*stem color*	*ear covering*	*ear damage*	*grains order in row*	*Nr. rows*	*grain type*	*grains color*	*weight 1000 grains*
M01	46	49	162	48	5	6	2	5	7	1	8	6	1	346
M02	62	69	187	58	5	6. 9	2	5	3	3	10	4	1	360
M03	57	61	189	61	5	6. 6	4	5	3	3	10	4	1	380
M04	50	57	164	51	5	5. 5	1	5	5	3	10	6	1	324
M05	49	53	158	47	3	5. 3	1	5	7	3	10	6	1	346
M06	53	59	166	52	3	5. 7	5	5	3	1	10	6	1	317
M07	65	72	197	64	7	6. 8	4	5	3	3	14	3	1	343
M08	62	69	172	55	5	5. 9	3	7	3	3	10	4	1	382
M09	62	65	178	57	7	5. 6	4	7	3	3	8	4	1	377
M10	59	65	174	54	5	5. 5	5	5	3	3	10	3	1	358
M11	63	73	190	68	5	5. 3	1	5	3	3	10	3. 4	1	383
M12	67	73	186	60	7	5. 7	3	5	3	3	8	3	1	391
M13	59	64	163	49	5	6. 1	1	7	3	1	8	4. 5	1	297

Table 3. Correlations between the features for the descriptors evaluated

	Days to male flowerings	*Days to female flowerings*	*plant height*	*Height / ear*	*Foliage*	*leaves /plant*	*stem color*	*Sheath pubescence*	*ear covering*	*ear damage*	*grains order in row*	*Nr. of rows*	*grains type*
Days to female flowerings	0. 97**												
plant height	0. 78**	0. 78**											
Height/ ear	0. 76**	0. 80**	0. 95**										
Foliage	0. 67*	0. 58*	0. 62*	0. 53									
leaves /plant	0. 27	0. 22	0. 51	0. 27	0. 28								
stem color	0. 26	0. 18	0. 31	0. 21	0. 19	0. 18							
Sheath pubescence	0. 03	-0. 09	0. 25	0. 17	0. 19	0. 2	0. 22						
ear covering	0. 26	0. 17	-0. 21	-0. 18	0. 23	-0. 05	-0. 04	0. 03					
ear damage	-0. 82	-0. 82	-0. 63	-0. 63	-0. 4	-0. 29	-0. 48	0. 1	-0. 29				
grains order in row	0. 46	0. 48	0. 54	0. 54	0. 37	-0. 02	0. 04	0. 37	-0. 13	-0. 21			
Nr. of rows	0. 19	0. 28	0. 46	0. 41	0. 03	0. 39	0. 24	0. 35	-0. 37	-0. 17	0. 37		
grains type	-0. 91	-0. 88	-0. 81	-0. 76	-0. 68	-0. 27	-0. 34	-0. 07	-0. 1	0. 72**	-0. 53	-0. 23	
Weight/ 1000 grains	0. 5	0. 46	0. 58*	0. 62*	0. 42	-0. 04	0. 2	0. 18	-0. 04	-0. 24	0. 67*	-0. 06	-0. 58

The analysis of the variance and the phenotypic correlations are presented in Table 3. The calculation of the correlations between the features is carried out for the descriptors evaluated. The maize heritability study requires the phenotypic correlations analysis [12].

The results show that there are very strong positive correlations between the number of days until female flowering with the number of days until male flowering where, r = 0. 97 ** as well as between plant height with days until female flowering with days until tasselling where , r = 0. 78 **. Also, very strong positive correlations appear between the first ear height from the ground, the plant height with r = 0. 95 ** and the days until female flowering with r = 0. 80 ** and days until male flowering r = 0. 76 **. Leafing shows average positive correlation with the days until female flowering r = 0. 67 *; with the days until tasselling with r = 0. 58 * and the plant height with r = 0. 62 *. It is of high importance, the average positive correlations already verified for the weight of 1000 grains with the plant height with r = 0. 58 *; with the first ear height with r = 0. 62 * as well as with the grains order r = 0. 67 *. It is necessary to mention that there is a strong positive relationship and already confirmed in the two levels of ear damage with the grain type where r = 0. 72 **. For the other features, weak or negative correlations appear.

To determine the genetic distance between the populations and to identify the variation within the population, the hierarchical analysis method (Hierarchical Clustering Method = Ward) was applied.

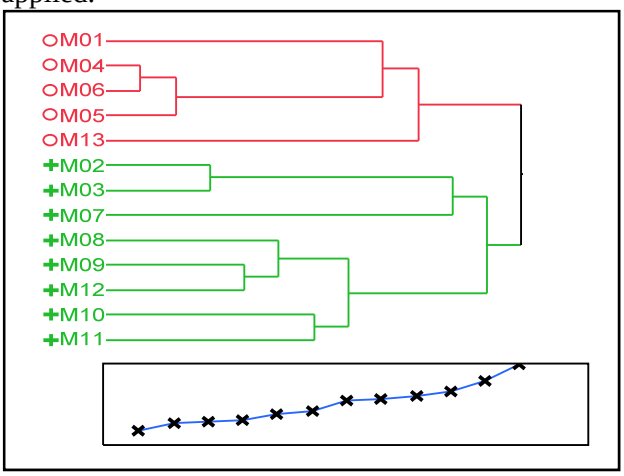

Figure 1. Dendrogram for genetic distance between the populations (Hierarchical Clustering)

Dendrogram (Fig. 1) consists of genotypes average values and shows the hierarchical relationship among and within the genotypes which resulted in three groups. The first group of five genotypes; second of three and the third of five ones. It should be noted that although some populations collected in an area are included in different groups because of the different characteristics they pose.

4. Conclusions

The maize populations collected in some areas of the country and studied for features morph biological features/ descriptors, display genetic variability for the features of plant, ear and grain. In the statistical analysis of the key features, the populations are included in three groups. Some features have positive and lasting functional correlations between them. The identification of some populations of special positive quality can encourage the farmers to cultivate them successfully in hilly and mountainous areas. The data of this study can help in the genetic improvement programs by using them for their specific features they present such as short vegetative cycle and the special qualities of grain.

5. References

1. Aliu S, Fetahu Sh, Rusinovci I, Bislimi K, Zeka D. **Tassel morphology and pollen productivity in some maize (*Zea mays* L.) local populations**. *46th Croatian and 6th International Symposium on Agriculture*, 2010. Opatija. Croatia: 384-387.
2. Brandolini A, A. Brandolini. **Il mais in Italia - Storia natural e agricola**. *CRF Press*, 2005. Bergamo, Italia. 370.
3. Camussi A. **Numerical taxonomy of Italian populations of maize based on quantitative traits**. *Maydica* 1979. (24): 161-174.
4. Fetahu, Sh, Aliu S, Kaçiu S. **Variability and genetic erosion of white landrace of Maize (Zea mays L.) in Kosova**. *Eucarpia, Proceedings of the XVII Eucarpia Genetic Resources Section Meeting. Plant Genetics Resources of Geographical and "other" Island. (Conservation, evaluation and use for plant breeding*, 2005. 265-269.
5. Fonesca A, Westgate M. **Tassel morphology as an indicator of pollen production in maize**. *Crop Management Doi: 10. 1094/CM*, 2003. 0804-01-RS.

6. Goodman M. M, **The races of maize II. Use of multivariate analysis of variance to measure morfological similarity,** 1968. *Crop Sci. 8*: 693-698.

7. Hajkola K. **Ruajtja dhe shtimi i burimeve gjenetike, faktor bazë në përmirësimin e bimës së misrit. Resurset Gjenetike**, *ESHFF Tiranë*, 2003. 74-79.

8. Hoisington D, Khairallah M, Reeves T, Ribaut JM, et al. **Plant genetic resources: what can they contribute toward increased crop productivity.** *Proc. Natl. Acad. Sci. U. S. A.* 1999. 96: 5937-5943.

9. IBPGR, (International Board for Plant Genetic Resources). **Descriptors for Maize**. *CIMMYT, Mexico/IBPGR, 1991*. Rome.

10. MBUMK. **Vjetari Statistikor**, Tirane, 2010.

11. Powell W, C. Orozsco-Castillo, K. Chalmers J, J. Provan, R. Waugh. **Polymerase chain reaction–based assays for the characterization of plant genetic resources**. *Electrophoresis*, 1995. 16: 1726-1730.

12. Rafiq, M, M. Rafique, A. Hussain, M. Altaf. **Studies on heritability, correlation and path analysis in maize (Zea mays L.).** *J. Agric. Res*, 2010. 48 (1): 35-38.

13. Salillari A, Hyso M, Faslia N, Rusinovci I. **Resurset Gjenetike.** *ESHFF*, 2007. Tiranë. 269-276.

14. Sanchez G. J. J, M. M. Goodman, J. O. Rawlings. **Appropriate characters for racial classification in maize**. *Econ. Bot.* 1993. 47: 44-59.