Studii şi Cercetări	Martie 2015	Biologie	24/1	78-81	Universitatea"Vasile Alecsandri" din Bacău

STUDY REGARDING THE EVALUATION OF A SWEET CORN LOCAL GERMPLASM FUND

Petre Marian Brezeanu, Creola Brezeanu, Silvica Ambăruş, Teodor Robu, Aurelia Dobrescu, Tina Oana Cristea, Maria Calin

Key words: *Zea mays, cold test, MMB*

INTRODUCTION

Reconsideration of assessment and use of sweet corn genetic resources represented by old local populations, insufficiently investigated, represent an opportunity for successful breeding. In all improvement programs local germplasm plays an important role both in creating lines and hybrids and also in local populations' improvement. Local populations of sweet corn are distinguished by high adaptability and strong quality traits (Mureşan, 1972; Căbulea et all. 1975; Hallauer and Miranda, 1981). Sweet corn germplasm used by breeders becomes valuable when it meets two basic conditions: genetic variability and its performance (quality and quantity).

One of our major concerns is to identify ancient populations that are valuable thanks to their agronomic characters, and to introduce them in a pre-breeding program. Currently, the unanimous opinion of experts is that the genetic resources represented by local populations of sweet corn from different areas, are important reservoirs of genes useful for improving the species. Exploiting these reserves is possible through studies and complex measures that may lead to the preservation of biodiversity and increase its efficiency.

Field corn has been used extensively to improve sweet corn, and successful sweet corn populations (Tracy, 2001). Many studies have shown the potential of flint have been developed in temperate areas using this strategy and dent temperate corn germplasm for improving sweet corn, agronomic value, adaptation to cold areas with short growing seasons (Cartea *et al*., 1996a,b; Malvar *et al*., 1997; Revilla *et al*., 1998), yield plus agronomic and quality traits (Tracy, 1990), and for breeding new sweet corn patterns (Davis *et al*., 1988; Revilla *et al*., 2000; Velasco *et al*., 2002).

MATERIAL AND METHODS

Our investigation used as starting point the characterization of germplasm fund represented by ten local sweet corn populations originated from different regions of Romania. The study had two objectives:

- Morphological assessment for detection of interest traits to be exploited in wet and cold lands condition in Romania;
- Identification of useful resources for improving production capacity, the precocity, resistance to low temperatures, resistance to breaking and falling.

Morphological assessment was conducted in field and laboratory condition, by phenological observations, biometrical measurements and determinations. Also in laboratory condition the index of cold test was investigated (method Debbert, 1988) in order to assess the resistance of plants to low temperature. Under this method each variant was established in two samples: sample for testing at low temperatures and control sample. For this sowing was done for each type of genetic resource in two containers (30 seeds each). After emergence were allowed 25 plants that were grown under optimal conditions artificial laboratory ($t^0 = 25^0$C, 10-15 thousand lx light, 14 hours day, 10 hours at night) for 14-15 days to third leaf development. At this stage, one casserole of each genetic resource was transferred to the growth chamber.

Here, the pair genetic resources have undergone laboratory for 7 days in the same artificial, but with two temperature regimes: 4-5^{0}C by night, 8-9^{0}C by day. Camera growth in an automated successive cycle of day – night, with scheduled parameters as, light, temperature and humidity.

After 7 days of treatment with low temperature trays from the growth chamber were again transferred to the laboratory for another 6-7 days along with trays pair. Finally were cut by 20 seedlings from experience (seedlings subjected to cold in the growth chamber) and 20 of the control seedlings (seedlings grown under optimum conditions laboratory). All samples were dried in an oven to constant weight. Cold test Index appreciated by dry mass accumulation calculated as Ki = the dry mass of sample to sample experimental control using the following scale: resistant genotypes> 80%; genotypes of semi 60 -79%; weak genotypes resistant 40 -59%; sensitive genotypes <40%.

RESULTS AND DISCUSSIONS

Sweet corn represents a type of corn or maize (*Zea mays*) distinguished by one or more mutations that increase sugar or polysaccharide content. Sweet corn has traits that make it both easy and challenging to breed. For example, in general corn is easy to both cross- and self-pollinate, providing flexibility in breeding. On the other hand, certain challenges arise because sweet corn flavor, tenderness, and other ear-related traits need to be evaluated after pollination has occurred. (Zystro 2014)

Plant's descriptors are related with plant architecture and cob's descriptors provide information on yield capacity of investigated germplasm. As precocity feature we investigated the amount of useful degrees till corn silk appearance. Plant resistance to breaking and the percentage of broken and fallen plants at harvest, represent an important physiological feature. By screening of biological material (10 populations) have been identified two local populations valuable for our breeding interest. Due to the lack of a dedicated genotype as control in terms of resistance to low temperature we performed analysis of variance and differences, establishing limits for highlighting the significance of differences from the average genotypes considered as control.

Statistical interpretation of the results on sweet corn population's resistance at low temperatures determined in the laboratory by cold test index reveals the following:

- The average value of 74.60% for cold test index, placed investigated germplasm in group of semi resistant genotypes at low temperatures;
- Statistical differentiation between analyzed populations reveals the existence of populations with very high values of cold test index provided very significant and therefore a good low temperature resistance; (PL 1 and PL 2).

Two populations (PL 1 and PL 2) showed good resistance to low temperatures, provided by very significant and positive significantly distinct resistance comparing to the average of experience. Populations that have achieved the highest index values of cold test (greater than 80% and especially those greater than 90%), may be selected for purpose of low temperature resistance improvement (Figure 1).

The value of plant height varied between 155 cm at PL8 and 198 cm at PL7 (figure 2). Usually the plant height can be correlated with internodes number and the total period of vegetation. A longest vegetation period is similar to the highest number of internodes.

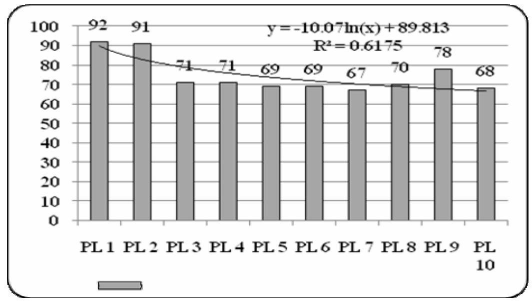

Fig. 1. Colt test index

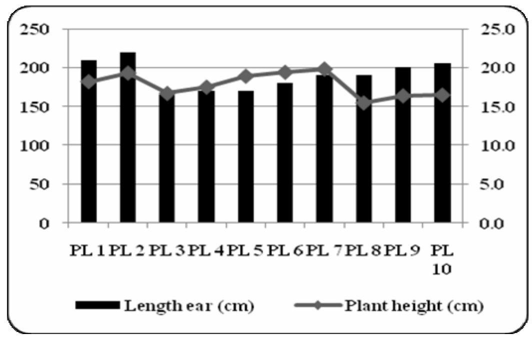

Fig. 2. Variation of plant height and ear length

Figure 3 presents the value of MMB and total weight grains per cob. These items are important in yield evaluation. The value of MMB varied from 215 g at PL5 to 221 g at three different genotypes: Pl1, Pl2 and PL3. All investigated genotypes registered more than 90 g grains per cob. The highest value was in case of PL 1. 96.4 g.

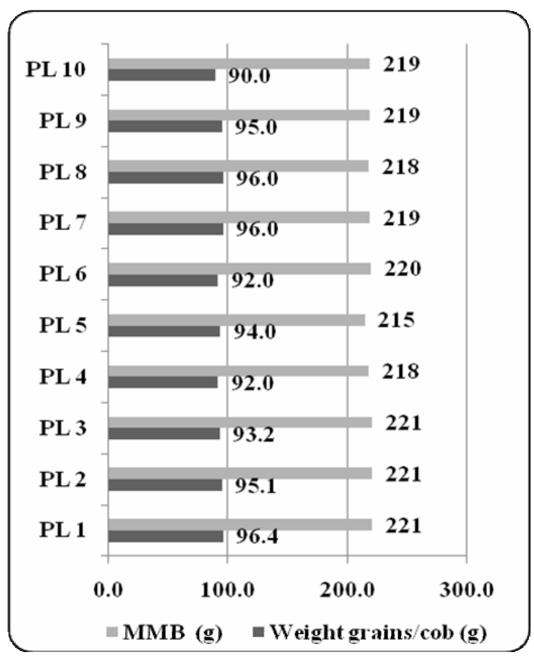

Fig.3. MMB and weight grains

All genotypes required a specific value of degrees in order to develop silk. In our experiments the needed amount degrees varied between 555.9 ^{o}C at PL2 and 602.5 ^{o}C at PL7

In terms of fallen resistance variation was between 30.3% at Pl2 and 45.2% at PL7 (Table 1).

The importance of pre breeding activity is huge in purpose to develop new genotypes.

Table 1 Descriptors values morpho physiological sweet corn populations identified as valuable for improving resistance to low temperatures

Name of investigated population	Amount degrees till set up up the silk (^{0}C)	Fallen (%)
PL 1	557.1	35.2
PL 2	555.9	30.3
PL 3	565.9	39.4
PL 4	569.6	40.3
PL 5	586.4	41.2
PL 6	595.2	42.4
PL 7	602.5	45.2
PL 8	579.8	38.5
PL 9	584.3	36.9
PL 10	595.2	38.2

"Dulce de Bacau" is a genotype created at VRDS Bacau. Some morphological investigations are presented in figure 4.

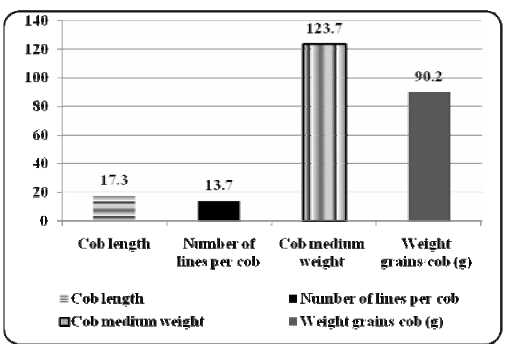

Fig. 4. Morphological investigation on "Dulce de Bacau"

CONCLUSIONS

Regarding the cold tolerance of genetic material studied was found that most populations show a high coldtest index, highlighting in particular populations originating from mountainous and foothill areas of Romania them.

The analysis determined coldtest indices for local populations resulting mainly corn that most of the biological material studied is of semi coldtest having index values between 60-79%. They found local populations but very resistant to low temperatures, such as PL 1 and PL 2. There is mainly a significant number of local populations of corn resistant to low temperatures (coldtest index above 80%), some of them very resistant (Ki> 80%).

ABSTRACT

Our study envisaged a characterization of a germplasm fund represented by ten local sweet corn populations originated from different regions of Romania. The study had as main objectives: (a) - morphological assessment for detection of interest traits to be exploited in wet and cold lands condition in Romania and (b) - identification of useful resources for improving production capacity, the precocity, resistance to low temperatures, resistance to breaking and falling. Morphological assessment was conducted in field and laboratory condition, by phenological observations, biometrical measurements and determinations, in order to detect the most valuable material to be used in breeding. Our study presents some morphological items of "Dulce de Bacau", a genotype created at Vegetable Research and Development Station Bacau. The genotype is distinguished by its yield capacity and its suitability to our climate condition

REFERENCES

1. CĂBULEA I. et all. 1975 - Germoplasma locală de porumb din Transilvania şi utilizarea ei în lucrările de ameliorare. Probleme de Genetică teoretică şi aplicată, vol. VII, no. 1 57-9;
2. CARTEA M.E., MALVAR R.A., REVILLA P., ORDÁS A., 1996[a] - Identification of field corn populations to improve sweet corn for Atlantic European conditions. Crop Sci 36,1506-1512;
3. CARTEA M.E., MALVAR R.A., REVILLA P., ORDÁS A. 1996b - Improvement of early vigor and adaptation of sweet corn to the European Atlantic coast with openpollinated field corn populations. Maydica 41, 119-125;
4. DAVIS D.W., BREWBAKER J.L., KAUKIS K., 1988 - Registration of NE-HY-13A and NE-HY-13B complementary populations of sugary maize germplasm. Crop Sci 28, 381;
5. HALLAUER, A.R. and MIRANDA, J.B. (1981). *Quantitative Genetics in Maize Breeding,* Iowa State University. Press Amer
6. MALVAR R.A., CARTEA M.E., REVILLA P., ORDÁS A., 1997 - Identification of f ield corn inbreds adapted to Europe to improve agronomic performance of sweet corn inbreds. Crop Sci 37, 1134-1141;
7. MUREŞAN A. and CRĂCIUN T.I., 1972- Ameliorarea specială a plantelor. Editura Ceres, Bucureşti, pg .279;
8. REVILLA P., MALVAR R.A., CARTEA M.E., ORDÁS A., 1998 - Identifying open-pollinated populations of field corn as sources of cold tolerance for improving sweet corn. Euphytica 101, 239-247;

9. REVILLA P., VELASCO P., VALES M.I., MALVAR R.A., ORDÁS A., 2000 - Cultivar heterosis between sweet and Spanish field corn. J Amer Soc Hort Sci 125, 684-688.
10. TRACY W.F., 1990 - Potential contributions of field corn germplasm for the improvement of sweet corn. Crop Sci 30, 1041-1045;
11. TRACY W.F., 2001 - Sweet corn. In: Speciality corns (Hallauer, A.R., ed), 2nd ed, CRC Press, Boca Raton, Florida. pp. 155-197;
12. VELASCO P., REVILLA P., MALVAR R.A., BUTRÓN A., ORDÁS A., 2002 - Resistance to corn borer in crosses between sweet and field corn populations. J Amer Soc Hort Sci 127, 689-692;
13. ZYSTRO J., 2014 - Organic Seed Alliance How to Breed Sweet Corn for Organic Agriculture.

AUTHORS' ADDRESS

BREZEANU PETRE MARIAN, BREZEANU CREOLA, AMBĂRUŞ SILVICA, CRISTEA TINA OANA, CALIN MARIA - Vegetable Research and Development Station Bacau, Calea Barladului, No. 220, Bacau, code: 600388, e-mail: brezeanumarian@yahoo.com; creola.brezeanu@yahoo.com; silvia_ambarus@yahoo.com; tinaoana@yahoo.com; maria_calin@yahoo.com

ROBU TEODOR - University of Agricultural Science and Veterinary Medicine, Iasi, Romania Faculty of Agriculture, 3, Mihail Sadoveanu Alley, Iaşi, Romania. e-mail: teorobu@uaiasi.ro

DOBRESCU AURELIA - University of Agricultural Science and Veterinary Medicine, Bucuresti, Romania Faculty of Horticulture, Marasti, Romania, e-mail: