



PHENOTYPIC AND GENETIC VARIABILITY OF LOCAL MAIZE GERMPLASM FROM TRANSYLVANIA

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INTRODUCTION

The continued and significant loss of genetic variability in most crops, observed in recent years, has stimulated increasing interest in biodiversity conservation.

In almost all European countries that cultivate maize, the spread of hybrids with high grain yields has led to a gradual replacement of local populations. (Lavergne et al., 1991; Has et al., 2007, 2009; Berardo et al., 2009).

As a result, the genetic variability of cultivated maize germplasm has been reduced, both in terms of the number of alleles and the genetic diversity between hybrids (Reif et al., 2005).

Traditional (local) germplasm represents a good source for exploring the genetic variability of grain quality and a valuable material for improving production quality.

OBJECTIVES

- Collection, study and conservation of local maize germplasm.
- Study of phenotypic variability and genetic potential of local germplasm.
- Study of the genetic variability of local indurata germplasm, both by testing on male-sterile cytoplasm of different types and with the help of SSR molecular markers.

COLLECTION OF LOCAL POPULATIONS

- ✓ 1957-1964, at A.E.S. Turda, with the participation of C. Grecu, V. Tătaru, I. Căbulea, Laura Ciorlăuș, Lucia Roman over 1200 local populations were collected and then studied, from the Transylvanian Plateau area and the Mureș and Târnave basins area (Căbulea și colab., 1975);
- ✓ 1977, the action of collecting local populations in the Maramureș area, in the Mara, Iza and Lăpuș valleys, was resumed, with the participation of I. Căbulea, C. Grecu, Pompilia Ardelean, I. Haș.
- ✓ in 1990, several populations were received from USAMV of Banat Timișoara (Prof. Dr. Gallia Butnariu);
- ✓ in 2007, 165 local populations were received from A.R.D.S. Suceava and the Gene Bank - Suceava, within a CEEEX project (Dr. ing. Marius Murariu).
- ✓ After 2000, the collection was completed with new populations (over 120) through the concern of colleagues, but especially with the support of students from USAMV Cluj-Napoca.

Provenance of local populations, existing in 2024 (591 provenances), in the ARDS Turda germplasm collection

From the old collection, of over 1200 provenances (1961-1964), after selection, about 423 remained (1969), the rest being eliminated due to phenotypic similarity or some of them were included in the over 20 synthetic populations, created at ARDS Turda (I. Haș, 1987).

Table 1

Germplasm type	Provenance number/year:									
	2006		2015		2024					
Local populations	278		391		591					
Transylvania = 416										
CJ	BN	AB	MS	HD	SB	HG	BV	SJ	CV	
117	61	72	56	49	19	15	15	11	1	
Maramureș = 74	MM = 49 SM = 25									
Moldova = 78	SV = 69 + 9									
West +S-V: = 17										

Synthetic populations obtained from local populations

Table 2

Synthetic population	Local germplasm component
1.Tu Syn 1	12 early local populations, conv. indurata microsperma , from Transilvania
2.Tu Syn 2	Early synthetic indurata macrosperma
3.Tu Syn 3 (per se) (1)	Local populations, conv. indurata semi-early, long ear , from Transilvania
4.Tu Syn 4	Sintetic I x D early
5.Tu Syn 5	Synthetic, conv. Dentiformis , white cob
6.Tu Syn 6	Synthetic, conv. dentiformis resistant to low temperatures
7.Tu Syn 7	Synthetic, conv. indurata with long ear
8.Tu Syn 8	Local populations conv. indurata, orange kernels and large rows no , from Transilvania and Moldova
9.Tu Syn 9	Synthetic, conv. indurata prolific
10.Tu Syn Mara	Local populations (8) from Mara valley (HAȘ, 1992)
11.Tu Syn. Gutin	Local populations (8) from Gutin valley-Maramureș (HAȘ, 1992)



Figure 1. Synthetic populations obtained from local populations

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Phenotypic variability of some local maize populations from the Transylvanian area, existing in the germplasm collection from A.R.D.S. Turda

Table 3

Vegetative characteristics of the plant	Parameter			
	C.V. (%)	Average	Minimum value	Maximum value
Plant traits (cm)	12	216	137	293
Plant height (cm)	22	71	31	133
No leaves/plant (nr)	12	11.6	6.5	18.3
No leaves above main era(nr)	11	5.0	3.5	8.1
Tassel ramifications (nr)	24	19	4	30
Growing period from.(Σ°Ctu) from:				
	7	532	423	668
- sowing - flowering	8	530	423	710
- sowing - silking	5	988	788	1194

Variability of the phenotypic potential of cob characters, in some local populations, from the germplasm collection, from A.R.D.S. Turda

Table 4

Characters	Parameter			
	C.V. * (%)	Average	Minimum value	Maximum value
Ear weight(g)	23	133	55	255
Grain weight/ear(g)	22	110	46	188
Ear length (cm)	12	16	9	21
No kernels/row(nr)	11	34	22	43
Kernels row no. (nr)	10	13	8	17
Cob diameter (cm)	9	2.4	1.8	3.5
Kernel depth (cm)	11	0.8	0.5	1.0

Inbred lines created from cycle 1 or improved cycle 1 breeding germplasm

Table 5

Inbred lines	Initial Cycle Ior Cycle I-enhanced material
T 20, T 155, T 291	Pop. Ungheni
T 251	Variety - Ariesan
T 21, T 164, T 170	Pop. Batoș
T 22, T 290	Pop. de Cluj
T 23	Pop. de Bălăușari
T 145	ICAR 54 x Romanian by Studina
T 157, T 162	Pop. de Dumbrăvioara
TC 106	Tu Syn. 6 (from populations)
T 139, T 140, T 146, T 147, T 148, T 250,	Portocaliu de Târgu Frumos
T 141	Pop. Coșca Mică
T 172	Pop. de Tiriam
TA 307	Pop. de Dragalina
TB 330	Pop. de Josenii Bărgăului
TB 381	Pop. de Iad
T 235	WA303 x Galben Timpuriu
TB 351	Tu Syn.
TC 336	Josenii Bărgăului x Lo3
TC 248	Tu Syn 1 x T 146
T 442	E2304 x Lăpușneac

The genetic potential of local germplasm

Additive (ĝm, ĝn) and non-additive (Ŝij) genetic effects involved in the determinism of grain production

Table 6

Nr. crt.	Linia ♀	TA 367	TC 344	TC 385 A	TE 356	ĝm
	Linia ♂	Ŝij				
1	TC 316	271.4	564.2	608.2	1397.1**	710.2
2	D 105	-60.8	231.9	276.0	1064.9*	378.0
3	T 291	793.5	1086.3*	110.3**	1919.2**	1232.3**
4	T 141	-928.9 0	-636.1	-592.1	196.8	-490.1
5	T 145	-1175.000	-882.2 0	-838.1 0	-49.2	-736.1
6	T 139	-1141.800	-849.0 0	-804.9	-16.0	-702.9
7	T 157	-253.6	39.2	83.29	872.2*	185.3
8	T 164	-1015.6 0	-722.8	-678.7	110.2	-576.7
	ĝn	-438.9	-146.1	-102.0	686.9	

Evaluation of the heterogeneity of local populations through the interaction with different androsterile cytoplasm: cms-T, cms-C, cms-ES, cms-M

Table 7

Specification	Number of populations/percentage of total(52 populations)			
	cms-T	cms-ES	cms-C	cms-M
Tipul de cms				
Maintenance of male sterility (cms 100%)	16	7	11	17
Restoration of male sterility (Rf 100 %)	1	1	-	5
% populations in genetic equilibrium of cytoplasmic sterility mechanisms (Nrf) and/or genetic restoration factors	17	8	11	22
Maintenance + partial restoration (cms+pRf)	33%	15%	21%	42%
Maintenance + partial restoration + total restoration (cms+pRf+Rf)	1	6	-	3
Maintenance+total restoration (cms+Rf)	7	2	2	8
Total restoration + partial restoration (Rf + pRf)	26	34	37	18
Partial restoration(pRf)	-	2	2	1
Total heterogeneous plants (no.)%/total	-	-	-	-
	35	44	41	30
	67%	85%	79%	58%

CONCLUSIONS

- The maize germplasm from Transylvania presents a highly diversified specificity with the preponderance of inter-varietal hybrid populations indurata x dentiformis, a fact highlighted both by phenotypic studies and by analysis with SSR molecular markers.
- Local germplasm in the form of provenances or derived inbred lines generally exhibit good specific combining capacity for grain production in interaction with elite inbred lines; transmit poor resistance to breakage
- In creating inbred lines from initial material from cycle I, the need for prior processing of local material through appropriate genetic improvement methods is emerging.