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General and Specific combining ability for traits associated to grain yield in crosses among argentinean flint landraces and Reid and Lancaster inbred lines.
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Argentine corn production is mainly based on hybrids generated from the combination between materials with different types of grains. The use of divergent heterotic patterns as argentine flint landraces and North American Corn Belt inbred lines could assure the generation of new populations with high genetic variability with good potential for traits associated to grain yield. The objective was to evaluate the combining ability and heterosis among them and to define breeding strategies. 10 flint early landraces obtained from the Germplasm bank at INTA Pergamino, Argentina, were evaluated: ARZM 1151, ARZM 6070, ARZM 12209, ARZM 14049, ARZM 16019, ARZM 17051, ARZM 18033, ARZM 18052, ARZM 18054 and ARZM 19007. They had differences in geographic origin and maturity (MNL 75:36-37, 2001).
A top-cross was used. The landraces, as female parents, were crossed with the inbreed lines B73, Mo17 y B68, used as males. The 30 genotypes (hybrids) and 3 commercial hybrids (checks) were evaluated during two growing seasons (2001-2002 y 2003-2004) at Lavallol, Buenos Aires (34°47'S, 58|27'W). The experiment designed was a randomized complete block with three replications. Plant traits were evaluated: EIH: ear insertion height (in cm) and PH: plant height (in cm); and characters that make up the yield: EL: ear length (cm), KNPR: kernel number per row, RNPE: row number per ear and KDW: kernel dry weight per plant (g).
Statistical analysis consisted primarily in a combined analysis of variance using the two experiments conducted in different environments (years). Griffing genetic model (1956) was applied, in order to estimate the additive effects or general combining ability (GCA) of the landraces (females) and the tester (males) and the epistatic interaction effects or specific combining ability (SCA). The decomposition of the mean squares can estimate the additive and dominant genetic effects as: $\sigma^2_{\ m} = CM_{\ males} - CM_{m*h})/\ hr =$ Cov (H.S.) = $\frac{1}{4}\ \sigma^2_A$;$\sigma^2_{\ f} = (CM_{females} - CM_{m*h})/\ mr =$ Cov (H.S.) = $\frac{1}{4}\ \sigma^2_A$ y $\sigma^2_{\ m} = CM_{\ m*f} - CM_E)/\ r =$ Cov (F.S.) = 2 Cov (H.S.) = $\frac{1}{4}\ \sigma^2_D$
According to the combined analysis of variance the environment and the interactions G x E varied significantly for all variables considered. The second trial (2003-2004 growing season) was conducted in a field with good edaphic characteristics and a rainy period during the development of the trial, which caused higher averages, both for vegetative and reproductive traits. Therefore, these results justified the use of ANOVAS separately for each trial.
Significant differences among genotypes were showed in both trials, except from KDW in the first environment. The commercial hybrids only differed significantly from experimental hybrids for vegetative characters and for the RNPE in the first trial. However, checks differed from genotypes for all the characters evaluated in the second trial.

GCA of the testers was significant for all variables except for KDW in the first trial, and PH in the second trial. The GCA of the landraces was significant for all variables except EL and KDW in the first trial (Table 1). The SCA (Male x Female) was significant only for the variables EL and RNPE in the first trial. However, in the second trial all the variables showed a significant interaction.

Landraces contributed with genes to produce an increase in vegetative variables, especially for ear insertion height and the reproductive one RNPE. The environment affected the magnitude of additive genetic variance and producing a biased behavior for the HP and KDW. The variance of dominance appears to control the inheritance of EL and KDW in both environments, so do not wait for those variable genetic advances during the selection process. The KNPR trait presented a medium additive component, indicating that both populations as lines have favorable alleles for these, although it is also controlled by the effect of heterosis. We can conclude that landraces had a high frequency of favorable alleles for vegetative variables and some reproductive traits, indicating good potential for the use of these landraces in recurrent selection programs. Otherwise, the best crosses could form generate composites which would be used as germplasm source in breeding programs.

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Table 1: Analysis of variance for EIH: ear insertion height (in cm), PH: plant height (in cm), EL: ear length (cm), KNPR: kernel number per row, RNPE: row number per ear and KDW: kernel dry weight per plant (g) of 30 genotypes, obtained by crossing 10 maize landraces and 3 inbred lines, and 3 commercial hybrids (checks).

First Trial							
	Fd	EIH (cm)	PH (cm)	EL (cm)	KNPR	RNPE	KDW (g)
Blocks	2	42.31	194.76	0.37	15.07	2.01	50.95
Hybrids	32	216.05**	266.45**	4.64*	36.94*	5.96**	661.06ns
Genotypes	29	217.42**	262.37**	4.33*	36.25*	5.92**	553.10ns
Males	2	492.06**	1,275.51**	7.04*	114.83**	35.19**	1,180.90 ns
Females	9	523.99**	308.55**	4.26ns	48.39**	7.05**	406.67ns
Males *Females	18	37.12ns	115.42ns	4.59*	23.37ns	2.23**	598.85ns
Checks	2	191.08**	205.93ns	8.11*	65.33*	1.44ns	2,552.33**
Genotypes vs.Checkss	1	226.42*	505.68*	6.63ns	0.006 ns	16.04**	9.50ns
Pooled error	64	33.34	102.99	2.55	19.47	0.88	482.32
Second Trial							
	Fd	EIH (cm)	PH (cm)	EL (cm)	KNPR	RNPE	KDW (g)
Blockss	2	192.24	378.63	5.14	32.07	0.33	1,724.84
Hybrids	32	1,140.31**	786.52**	8.18**	45.40**	5.66**	5,642.80**
Genotypes	29	1,203.18**	802.84**	7.69**	42.87**	4.02**	3,661.19**
Males	2	749.37 **	330.84ns	11.46**	133.90**	14.92**	6,654.3**
Females	9	3,005.49**	1,610.2**	4.55*	34.31**	6.19**	6,387.97**
Males *Females	18	352.45**	451.60**	8.85**	1.37**	1.72**	1,965.23**
Checks	2	7.98ns	65.24ns	0.36ns	2.12ns	7.56**	5,331.17*
Genotypes vs.Checks	1	1,581.49**	1755.66**	37.69**	205.43**	49.43**	63,732.87**
Pooled error	64	124.90	175.92	1.87	10.90	0.70	1,354.16

Table 2: Variance components of males, female and Males * Females and the additive variance of males of females and dominance variance for EIH: ear insertion height (in cm), PH: plant height (in cm), EL: ear length (cm), KNPR: kernel number per row, RNPE: row number per ear and KDW: kernel dry weight per plant (g) at each trial.

First trial	EIH (cm)	PH (cm)	EL (cm)	RNPE	KNPR	KDW (g)
Var. Males	15.16	38.67	0.08	1.10	3.05	22.74
Var. Ad. Males	60.66	154.68	0.33	4.40	12.19	90.94
Var. Females	81.15	32.19	0	0.80	4.17	0
Var. Ad. Females	324.58	128.75	0	3.21	16.68	0
Var. Males * Females	1.00	1.15	0.79	0.51	2.30	63.50
Var. Dom.	3.99	4.59	3.17	2.05	9.20	254.01
Second Trial	EIH (cm)	PH (cm)	EL (cm)	RNPE	KNPR	KDW (g)
Var. Males	13.23	0	0.09	0.44	3.32	156.30
Var. Ad. Males	52.92	0	0.35	1.76	13.28	625.21
Var. Females	442.17	193.10	0	0.75	0.91	737.12
Var. Ad. Females	1,768.69	772.40	0	2.98	3.63	2,948.49
Var. Males * Females	74.32	89.87	2.27	0.34	7.52	418.57
Var. Dom.	297.27	359.50	9.08	1.36	30.08	1,674.28