

Research Reports

Breeding/Genetics

Interspecific Hybridization between *Cicer arietinum* and Wild *Cicer* Species

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Some wild annual *Cicer* spp have traits of great economic value (ICRISAT 1988, ICARDA 1990). These wild rela-

tives of chickpea (*Cicer arietinum*) can be exploited by transferring the desirable traits to elite cultigens. Successful crosses between *C. arietinum* and *C. reticulatum* were first reported by Ladizinsky and Adler (1976). Limited success has been reported in crosses with other species due to postfertilization barriers (Ahmad et al. 1988).

The crossing program was conducted in the greenhouse at ICRISAT Center, India. Eight elite *C. arietinum* genotypes [K 850, L 550, ICCV 6 (ICCV 32), ICCV 42, C 235, PRR 1, Annigeri, and Surutato] were used as female parents and six accessions of five wild *Cicer* spp [*C. bijugum* (No. 201), *C. cuneatum* (SL 157), *C. echinospermum* (No. 204), *C. judaicum* (No. 182 and No. 185), and *C. pinnatifidum* (No. 188)] as male parents.

Table 1. Morphoagronomic characters of F₁ interspecific hybrids of *Cicer arietinum* x *C. echinospermum* and their parents grown in the greenhouse at ICRISAT Center, 1990.

Accession number	Date of sowing	GH ¹	NB ²	AC ³	LS ⁴	DF ⁵	FC ⁶	No. of seeds produced	100-seed mass (g)
Parents									
PRR 1	19 Feb	AS	7	l	la	46	P	na ⁷	30.8
ICCV 6	19 Feb	SS	11	n	sm	48	W	na	15.9
Annigeri	19 Feb	SS	7	l	me	50	P	na	22.3
<i>C. echinospermum</i> (No. 204)	10 Jan	PR	30 ⁸	h	sm	100	P	na	15.7
F₁ hybrids									
PRR 1 x No. 204									
Plant 1	02 Mar	S	20	h	me	80 ⁸	P	10	14.1
Plant 2	02 Mar	S	21	h	me	80 ⁸	P	18	17.3
ICCV 6 x No. 204									
Plant 1	20 Feb	S	25	l	sm	69	P	12	18.9
Plant 2	20 Feb	S	24	l	sm	69	P	30	15.8
Plant 3	20 Feb	S	23	l	sm	69	P	25	17.7
Plant 4	20 Feb	S	22	l	sm	69	P	5	11.2
Annigeri x No. 204									
Plant 1	20 Feb	S	19	m	me	59	P	15	6.7
Plant 2	20 Feb	S	25	m	me	59	P	27	8.3
Plant 3	20 Feb	S	21	m	me	59	P	19	5.9
Plant 4	20 Feb	S	22	m	me	59	P	5	7.3

1. GH = growth habit; SS = semi-spreading, PR = prostrate, S = spreading.

2. NB = number of primary and secondary branches.

3. AC = anthocyanin coloration; n = nil, l = low, m = moderate, h = high.

4. LS = leaflet size; la = large, me = medium, sm = small.

5. DF = days to flowering.

6. FC = flower color; P = pink, W = white.

7. na = data not available.

8. Values are approximate.

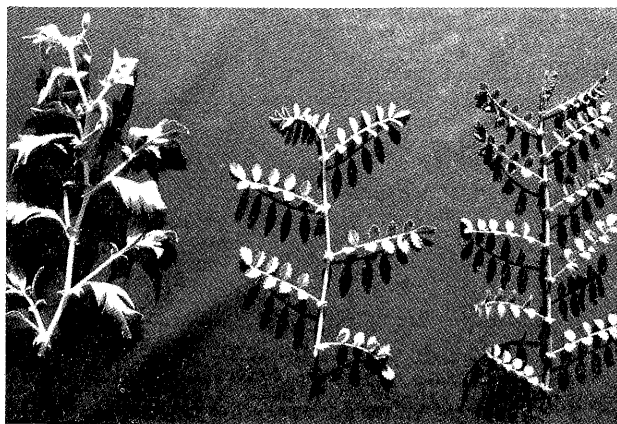


Figure 1. Twigs of PRR 1 (left), *Cicer echinospermum* (No. 204) (right), and the F₁ hybrid, PRR 1 × No. 204 (center) differing in leaf morphology.

Twenty-eight interspecific crosses were attempted in the 1988/89 and 1989/90 growing seasons. Exogenous hor-

mone application of a solution containing 87.5 mg L⁻¹ gibberellic acid (GA₃) + 25 mg L⁻¹ naphthalene acetic acid (NAA) + 5 mg L⁻¹ kinetin (KIN) soon after pollination resulted in good pod and ovule development. Immature pods were harvested 8-28 days after pollination and attempts were made to rescue the hybrid embryos through ovule culture. In addition, 3-5 seeds from mature pods of three crosses between *C. arietinum* (PRR 1, ICCV 6, and Annigeri) and *C. echinospermum* (No. 204) were collected. The F₁ hybrid seeds were sown in pots containing Vertisol and sand mixture (3:1) in a greenhouse. Germination was 100% in ICCV 6 × No. 204, 80% in Annigeri × No. 204, and 67% in PRR 1 × No. 204. The F₁ plants differed in morphoagronomic traits from the parents, indicating that they were true hybrids (Table 1; Fig. 1). The F₂ seeds were distinct from the parental seeds (Table 2; Fig. 2) and were being used in ICRISAT Center. The F₂ seeds of Annigeri × No. 204 were shrivelled, and hence had less seed mass than those from other crosses. The differences in seed characteristics observed between different F₁ plant progenies suggest that there was some heterogeneity in one of the parents.

Table 2. Characteristics of parents and F₂ seed produced by *Cicer arietinum* × *C. echinospermum* hybrids.

Accession number	Size ¹	Color	Shape	Surface
Parents				
PRR 1 (desi)	large	brown	angular	rough
ICCV 6 (kabuli)	medium	beige	owl-head	smooth
Annigeri (desi)	medium	light brown	angular	rough
<i>C. echinospermum</i> (No. 204)	medium	tawny brown	ovoid, faintly beaked	tuberculated, covered with dense white echinate spines
F₁ hybrids (F₂ seed)				
PRR 1 × No. 204				
Plant 1	medium	chocolate brown	angular	wrinkled, covered with white spines
Plant 2	medium	chocolate brown	angular	wrinkled, covered with white spines
ICCV 6 × No. 204				
Plant 1	medium	dark brown	owl-head	tuberculated
Plant 2	medium	chocolate brown	ovoid, beaked	wrinkled, covered with few spines
Plant 3	medium	chocolate brown	ovoid, beaked	wrinkled, covered with few spines
Plant 4	medium	dark brown	owl-head	tuberculated
Annigeri × No. 204				
Plant 1	small	dark brown	angular	wrinkled and tuberculated
Plant 2	small	dark brown	angular	wrinkled and tuberculated
Plant 3	small	dark brown	angular	wrinkled and tuberculated
Plant 4	small	dark brown	angular	wrinkled and tuberculated

1. Based on 100-seed mass: large = >25 g; medium = 11-25 g; small = < 11 g.

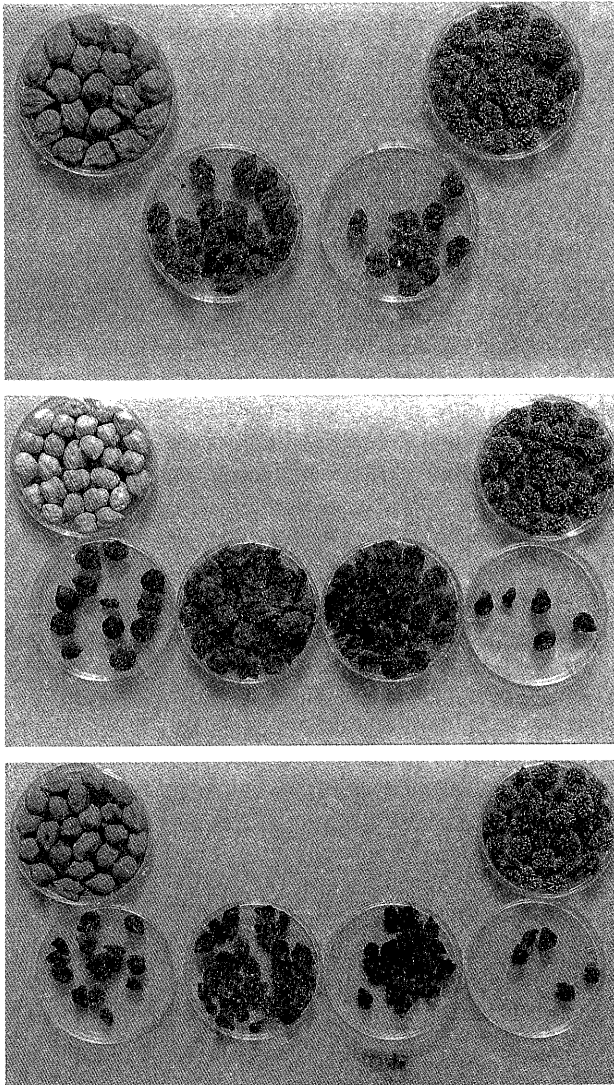


Figure 2. Seeds produced from parents (f = female, m = male) (top row) and individual F₁ hybrid plants (bottom row) of three interspecific crosses between *Cicer arietinum* [PRR 1 (top), ICC 32 (middle), and Annigeri (bottom)] and *C. echinospermum* (No. 204).

Some accessions of *C. echinospermum* are resistant to bruchids, leaf miner, and fusarium wilt, and moderately resistant to cold and ascochyta blight (Singh et al. 1991). Crosses between *C. arietinum* (ILC 482) and *C. echinospermum* (ILWC 35) were successful and the F₁ plants yielded a large number of seeds (ICARDA 1990). Gaur and Slinkard (1990) studied isozymes in the F₂ progenies

of a *C. arietinum* × *C. echinospermum* (PI 489776) hybrid. Success in crosses with *C. echinospermum* may be due to its close relationship with *C. arietinum*; these two species belong to the first crossability group (Ladizinsky and Adler 1976).

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