

NATURAL CROSS-FERTILIZATION IN CHICKPEA (*CICER ARIETINUM* L.)

H. A. VAN RHEENEN, C. L. L. GOWDA AND M. G. JANSSEN

International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)
Patancheru, Andhra Pradesh 502 324

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ABSTRACT

Three chickpea (*Cicer arietinum* L.) varieties, each with a different recessive marker character, were grown in plots of 12 m² in a systematic, alternating planting pattern. In the following year, the progenies of all plants were inspected for off-types with regard to the marker characters. Only 0.05% of off-types was observed. As outcrossing between plants of the same genotype might have occurred but could not be detected, the percentage of off-types underestimates the actual percentage of outcrossing by a factor of 1.5. It is, therefore, estimated at 0.08%.

Key words: Chickpea, *Cicer arietinum*, cross fertilization, marker character.

Chickpea (*Cicer arietinum* L.) is known as a self-pollinating crop without natural cross-fertilization [1], but several studies show that outcrossing can occur. Niknejad and Khosh-Khui [2] detected 25 purple flowering plants in a field of 15,669 white flowering plants and concluded that 1.58% of outcrossing had occurred. Gowda [3] estimated the natural cross-fertilization at 1.92% when nine plants with compound leaf were observed among 926 plants with simple leaf.

This study was conducted to verify the extent of outcrossing because off-types were occasionally noted in high frequency.

MATERIALS AND METHODS

Three pure open-pollinated chickpea varieties, each with a different recessive marker character, were used: ICCV 5 with white flowers, PRR 1 with simple leaves and Annigeri DPM (Double Podded Mutant) with twin flowers and twin pods (Fig. 1). The corresponding dominant characters are purple flowers, pinnate leaves, and single pods. The initial experiment was sown in the postrainy (rabi) season of 1986/87 in two fields at ICRISAT



Fig. 1. ICCV 5 with white flowers (left), PRR 1 with simple leaves (center) and Annigeri DPM with twin flowers and twin-pods (right).

Center at three different sowing dates. The progenies were inspected in the 1987/88 postrainy season.

Each experimental plot consisted of 10 rows, 30 cm apart, and 4 m long, with 10 cm between the plants in the row. The matrix of sowing showed an alternating pattern for the three varieties (Fig. 2). The days from sowing to flowering were recorded for each plant, and the flowering period estimated. At maturity, the seeds from each plant were harvested separately.

During the 1987/88 postrainy season, the single-plant progenies were grown on ridges 60 cm apart and checked for off-types in the progenies with recessive marker characters.

RESULTS AND DISCUSSION

The observations on days to flowering are summarized in Table 1. The flowering period of the three chickpea varieties was similar (4–5 weeks). The number of off-types observed are shown in Table 2.

Of the 11,626 plants carefully examined, only 6 were off-types: one purple flowering plant in ICCV 5 and five single-podded plants in Annigeri DPM. As outcrossing between

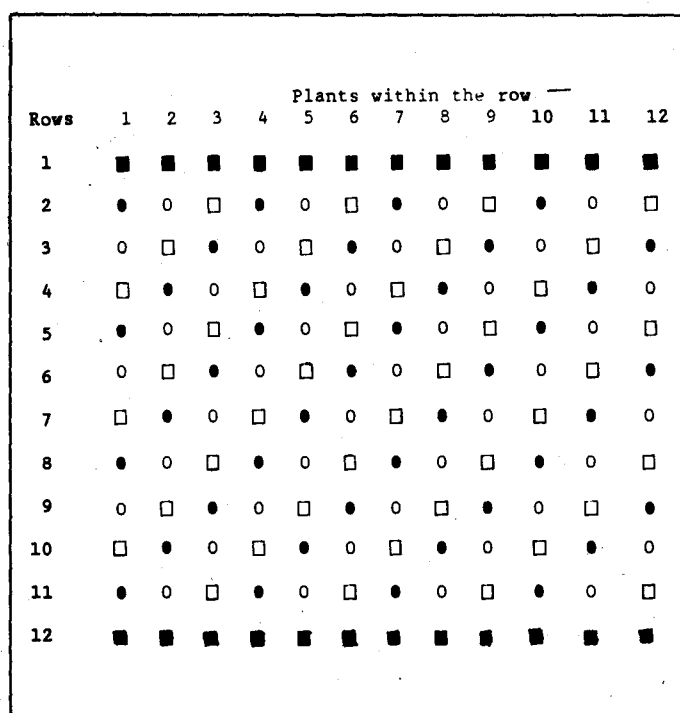


Fig. 2. Planting arrangement to determine natural outcrossing: ● ICCV 5 with white flowers, ○ PRR 1 with simple leaf, □ Annigeri DPM with twin flowers and twin pods, and ■ Annigeri border row.

plants of the same genotype might have occurred, but could not be detected the percentage of off-types underestimates the actual percentage of outcrossing by a factor of 1.5. The average percentage of natural cross-fertilization estimated from this study, therefore, is $1.5 \times 0.05\% = 0.08\%$. For one variety, it was as high as 0.20%. Such levels of outcrossing are not expected to jeopardize the open-pollinated maintenance of chickpea varieties [4]. The difference in outcrossing percentage between an earlier [3] and the present study is interesting to note but hard to explain.

Table 1. Dates of sowing and days from sowing to flowering of three chickpea varieties

Date of sowing	Variety	Days to flowering		
		range	mean	SE
Field 1:				
20 September	ICCV 5	49-73	62	4.6
	PRR 1	54-83	68	8.0
	Annigeri DPM	51-83	58	5.8
17 October	ICCV 5	39-73	48	8.1
	PRR 1	31-70	57	5.1
	Annigeri DPM	35-72	48	7.2
Field 2:				
26 October	ICCV 5	42-59	46	5.6
	PRR 1	41-57	45	2.9
	Annigeri DPM	40-54	45	3.0

Table 2. Frequency of off-types in the progenies of plants from the 1986-87 trial plots

Date of sowing	Variety	No. of progenies	Plants per progeny			No. of plants	Off-types	
			range	mean	SE		No.	%
Field 1:								
20 September	ICCV 5	81	0-52	14	1.0	1,113	0	0.00
	PRR 1	63	0-44	10	1.0	622	0	0.00
	Annigeri DPM	67	0-29	13	0.8	869	1	0.12
17 October	ICCV 5	91	0-51	16	1.0	1,445	1	0.07
	PRR 1	74	0-21	7	0.6	542	0	0.00
	Annigeri DPM	77	1-48	14	0.8	1,082	1	0.09
Field 2:								
26 October	ICCV 5	126	0-64	22	1.0	2,829	0	0.00
	PRR 1	92	0-30	10	0.7	895	0	0.00
	Annigeri DPM	111	0-55	20	1.0	2,229	3	0.14
Total		782				11,626	6	0.05

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