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COLLECTION OF CHICKPEA GERmplasm IN MADHYA PRADESH, INDIA AND THEIR AGRONOMIC EVALUATION

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Three-hundred-and-fifty-one seed samples of local chickpeas (Cicer arietinum L.) were collected in Madhya Pradesh, India, during 1986 and 1987 for the world germplasm collection maintained at ICRISAT Centre. These missions were joint efforts of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Jawaharlal Nehru Krishi Vishwa Vidyalaya (JNKVV), Jabalpur, and the National Bureau of Plant Genetic Resources (NBPGR), New Delhi. Vast variability was noticed for several morphoagronomic traits of chickpea during these missions. The collected samples were sorted out into relatively homogenous samples and later grouped into five homogenous sets for easy evaluation. These sets were evaluated for eight agronomic traits at ICRISAT Centre (18°N) and Gwalior (26°N). The performance of accessions for seeds per pod and 100-seed mass were almost similar at both locations whereas other agronomic characters varied with locations. The accessions with superior performance in five sets and two locations were identified.

Chickpea, *Cicer arietinum* L., is the most important pulse crop in Madhya Pradesh (M.P.) state of India occupying about 10 per cent of the total cultivated land (India, 1989). During 1988, 2.24 million ha of chickpea was grown in M.P., representing about 26 per cent of world hectareage under the crop (India, 1989; FAO, 1988). However, in the world chickpea collection maintained at the ICRISAT gene bank, there was inadequate representation from M.P., and further, most of the accessions were lacking precise data on their origin. The state is large, has varied agroecological conditions, and many diverse types of chickpeas are known to exist. A mission was therefore organized to collect germplasm samples, and information on cultivation practices, diversity of chickpea, and problems and prospects of this crop in the region. These collections were evaluated

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for morphoagronomic traits to enhance their documentation and utilization. The collected samples were conserved in the ICRISAT gene bank for present and future use.

MATERIAL AND METHODS

The germplasm collection work has accomplished in two missions, 5-20 March 1986 and 6-21 March 1987. The missions were jointly conducted by ICRISAT, Jawaharlal Nehru Krishi Vishwa Vidyalaya (JNKVV), Jabalpur, and the National Bureau of Plant Genetic Resources (NBPGR), New Delhi (Pundir *et al.*, 1989). The route followed is shown in Figure 1. At the majority of the collection sites, seed samples were obtained from crops in the fields. From each site samples were hand-picked from each of about 100 random plants (Pundir and Mengesha-in press). The random samples of the collections were enriched with the addition of selected samples of rare phenotypic variants, as suggested by Bennet (1970).

The two missions resulted in the collection of 351 seed samples which were heterogeneous populations. To facilitate their effective utilization and for easy evaluation, they were sub-divided into relatively homogenous samples and the entire material was grouped into five sets: 1. twin-podded accessions; 2. Kabuli and large-seeded desi; 3. tuberculated seed types; 4. short-duration typical desi, and 5. medium-duration typical desi. Sets 1 to 4 were evaluated and ICRISAT Centre as Trials 1-4 and sets 2 and 5 as trials 5 and 6 at ICRISAT Cooperative Research Station at Gwalior.

ICRISAT Centre, Patancheru (18°N) represents a characteristic short-season site for the chickpea crop. Experiments were conducted during the 1988-89 and 1989-90 seasons, in Vertisol fields. Sowings were done in first week of November, in augmented randomized block design with three replications. Each plot had 4 rows of 4 m length, with 30 cm spacing between rows and 10 cm between the plants. A basal application of 20 kg N and 60 kg P were applied and protective irrigation and insecticide sprays were also given.

Gwalior (26°N) represents a medium-season site for the chickpea crop. The sowing time and other particulars of the experiments were similar to those carried out at ICRISAT Centre.

Observations were recorded on seven characters, namely days to flowering, duration, plant height, number of pods, number of seeds, seed mass, and yield (Table 1). These are some of the important agronomic traits of chickpeas and have often shown significant correlations with seed yield (Pundir *et al.*, 1988; Raju *et al.*, 1978). From each plot, 10 representative plants were harvested and agronomic records obtained. Plot yield was recorded from all the four rows. The plot observations were statistically analysed if the crop growth was normal with acceptable plant stand (number of plants greater than 60% of the optimal number).

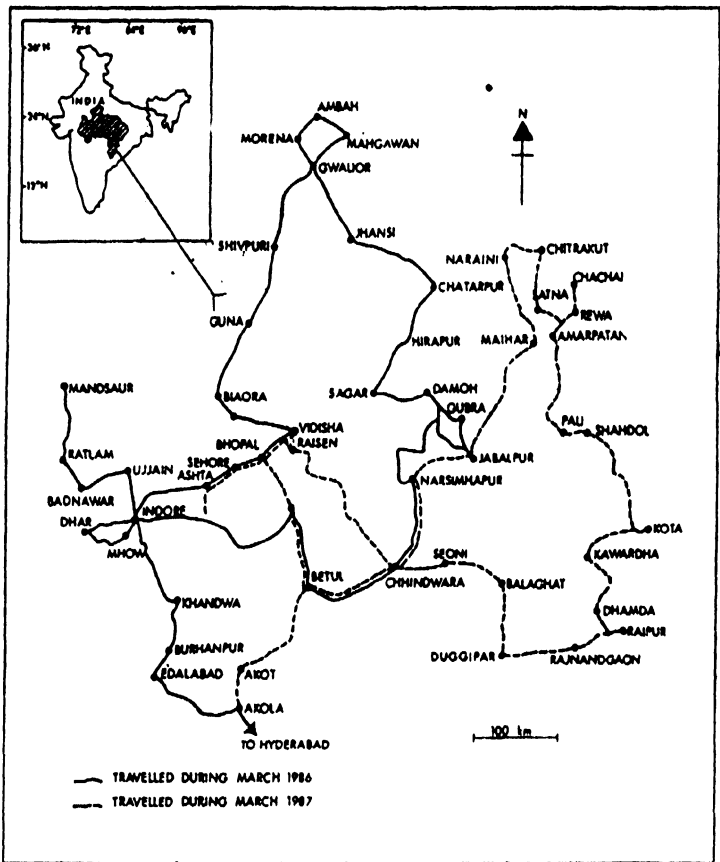


Fig. 1. Map showing route followed during the chickpea germplasm collection in Madhya Pradesh India, during 1986 and 1987

Table 1. Summary results of replicated evaluations of chickpea germplasm originating from Madhya Pradesh, India tested at ICRISAT Centre, Patancheru and Gwalior, 1988-89

	Top five accessions									
	Days to 50 % flowering	Flowering duration (days)	Plant height (cm)	Pods per plant	Seeds per pod	100-seed mass (g)	Seed yield (kg ha ⁻¹)	Accession No.	Seed yield (kg ha ⁻¹)	
AT ICRISAT CENTRE										
Trial-1										
Twin-podded accessions	Range 46-64	22-33	23.0-27.8	26-47	1.0-1.2	13.6-16.4	839-1211	ICC 14614	1211	
Entries :16	Mean 50.7	28.7	24.9	35.4	1.1	15.5	1044	JG 62	1200	
	SE ±1.18	±1.02	±0.09	±4.14	±0.08	±0.21	±92.5	ICC 14772	1145	
JG 62 (check)	49	29	25.3	34	1.2	15.7	1200	ICC 15160	1120	
								ICC 15158	1083	
Trial-2										
Kabuli and large-seeded desi accessions	Range 44-70	25-34	-	18-41	1.0-1.3	13.7-34.0	910-1360	ICC 4953	1360	
Entries:24	Mean 52.0	30.0	-	28.6	1.0	28.0	1160	ICC 14627	1330	
L 550 (check)	SE ±1.35	±1.20	-	3.57	±0.0	±0.97	±114.4	ICC 15070	1280	
	62	27	-	29	1.1	19.2	1070	ICC 14628	1280	
								ICC 14637	1260	
Trial-3										
Short duration type accessions	Range 46-71	21-31	21.6-31.7	20-42	1.0-1.6	9.9-27.8	870-1817	ICC 15129	1817	
Entries : 157	Mean 57.6	24.3	25.2	28.2	1.2	13.9	1414	ICC 14750	1796	
	SE ±0.93	±0.74	±0.87	±2.71	±0.07	±0.29	±126.3	ICC 14743	1784	
Annigeri (check)	49	29	24.2	30	1.2	17.9	1317	ICC 14670	1783	
								ICC 15128	1763	

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Table 1. Contd

		Top five accessions									
		Days to 50 % flowering	Flowering duration (days)	Plant height (cm)	Pods per plant	Seeds per pod	100-seed mass (g)	Seed yield (kg ha ⁻¹)	Accession No.	Seed yield (kg ha ⁻¹)	
Trial-4											
Tuberculated seed type accessions Entries : 112	Range Mean SE	39-53 41.8 ±0.52	32-42 37.8 ±1.20	21.0-40.8 30.8 ±1.19	22-56 33.9 ±3.31	1.0-1.5 1.1 ±0.07	1.0-27.4 16.6 ±0.26	854-2448 1966 ±159.5	ICC 14860 ICC 14780 ICC 15196 ICC 15168 ICC 14849	2448 2435 2370 2345 2338	
JG 74 (check)		44	37	29.9	30	1.0	16.6	1702			
					AT GWALIOR						
Trial-5											
Kabuli and large-seeded desi accessions Entries : 21	Range Mean SE	51-89 69.7 ±4.34	31-64 47.7 ±4.23	70.5-87.3 76.7 ±3.84	22-56 38.7 ±5.22	1.0-1.5 1.1 ±0.08	16.7-36.3 29.5 ±0.78	1991-3097 2474.0 ±246.4	ICC 15115 ICC 14639 ICC 14696 L 550 ICC 14648	3097 3084 2901 2888 2872	
L 550 (check)		76	42	70.9	43	1.2	23.4	2888			
Trial-6											
Medium and long- duration type accessions Entries : 99	Range Mean SE	74-90 83.0 ±1.33	24-38 31.6 ±2.15	48.5-68.2 57.1 ±1.68	43-85 60.8 ±6.22	1.1-1.8 1.4 ±0.11	12.4-28.3 15.1 ±0.41	2155-3411 2791.1 ±172.3	ICC 14817 ICC 14802 ICC 14791 IC 14811 ICC 14798	3411 3355 3344 3315 3224	
JG 315 (check)		74	38	57.6	63	1.1	14.7	2674			

RESULTS AND DISCUSSION

Germplasm Collection

During both missions, the travel period appropriately coincided with the maturity of chickpea crop and majority of the samples were collected from the farmers' fields. The seeds were shared among the three collaborating institutes.

Often chickpea was sown as a sole crop, though in some cases it was mixed with linseed; "sarson" (*Brassica campestris*, *B. juncea*) or wheat. Seed was generally broadcast in the field with moderate level of land preparation. The crop was sown from September to November depending on optimal soil moisture and harvested from February to April, *i.e.*, in about 110-days in different regions. Wherever feasible, the crop was irrigated and large-seeded desi and kabuli types were grown. In general, we noticed good agronomic performance of the crop. Pod-borer damage was minimal and diseases were also not serious. However, sometimes the damage caused by collar rot, Fusarium wilt, and Alternaria blight, were seen. Occasionally, excessive vegetative growth which would lead to low seed yield, was also seen (Pundir *et al.*, 1989).

The chickpea fields that we encountered showed a wide range of variability. Variations of leaf size, plant height, and growth habit were observed. All possible seed types namely typical desi, pink seeded (desi-kabuli intermediate), tuberculated (small projections on seed coat), large-seeded desi and kabuli types were cultivated. In the collected samples, variation in 100-seed mass ranged from 7.0 to 39.1 g with a mean of 15.9 g. However, the majority of samples were between 13 and 17 g per 100 seeds. Twin-podded chickpeas in contrast to single-podded types (common type), were seen in many fields. The crop duration was relatively short (about 110 days) in the southern part of the state and medium (about 140 days) in the northern part. The extent of chickpea diversity in M.P. is comparable with that of Ethiopia (Pundir and Mengesha, 1982), whereas in other Indian states or in other countries, the diversity is much less.

Agronomic Evaluation

A summary of observations on seven agronomic characters from six trials are given in Table 1. In general, all the accessions took fewer number of days to flowering and maturity at ICRISAT Centre than at Gwalior. This comparison is particularly relevant between trial numbers 3 and 6, which consisted of the same set of accessions at both the locations. The number of days to flowering was about 20 per cent longer at Gwalior, than at ICRISAT Centre and the difference was greater for flowering duration, which is a clear indication of prolonged conducive season for chickpea at Gwalior. This resulted in increased number of pods and seed yield. The accessions which produced highest seed yields at ICRISAT Centre did not do so at Gwalior. However, the values of seeds per pod and 100-seed mass were almost similar at both the locations.

The performance of many characters varies according to the environmental conditions and therefore, selection and utilization of the accessions for these characters will be location specific. Undisputedly, however, the researchers across the locations will be interested in the increased manifestation of the three traits: pods per plant, seeds per pod and seed mass, provided that these traits are not inversely related with seed yield. For the benefit of users, we are listing accessions that performed best for these yield traits in the six trials at two locations (Table 2). Though the results are based on replicated trials in different environments, they must still be used as preliminary observations. The seeds are available for research use on request from the Genetic Resources Unit, ICRIAT.

Table 2. Chickpea accessions scoring highest for some yield traits in either of the six trials and in two locations (ICRIAT Centre, Gwalior), 1988-89

Yield trait	Accession numbers			
Number of pods per plant	ICC 14637	ICC 14696	ICC 14718	ICC 14784
	ICC 14818	ICC 14825	ICC 15103	ICC 15122
	ICC 15152	ICC 15154	ICC 15195	ICC 15468
Number of seeds per pod	ICC 4951	ICC 14680	ICC 14684	ICC 14696
	ICC 14704	ICC 14722	ICC 14778	ICC 15115
	ICC 15152	ICC 15155	ICC 15203	ICC 15233
100-seed mass (g)	ICC 4953	ICC 5003	ICC 14648	ICC 14694
	ICC 14713	ICC 14808	ICC 15115	ICC 15160
	ICC 15183	ICC 15201	ICC 15227	ICC 14362

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