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Collection of Germplasm Resources in North-Eastern Rajasthan

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The arid/desertic region of Rajasthan is endowed with rich genetic diversity in cultivated and wild plant species. The land race variability is of considerable interest, as it is atuned to dry conditions and adapted under agro-ecological niches with acute water stresses. In order to capture this unique genetic diversity, an exploration trip to north-eastern Rajasthan was undertaken in March-April 1986. The area surveyed comprised several districts of Rajasthan and also adjacent Haryana state. In all 290 population samples in different crops were collected. The details of which are discussed here in this paper.

Considerable genetic diversity was collected in wheat, barley, Brassicae, *chickpea and pigeonpea from diverse agro-ecological niches. In chickpea, variations occurred for plant type and seed; being dwarf, bushy to tall, erect types; pod size and colour also varied. Occasionally double pods/peduncle types also occurred in some landraces. Pigeonpea exhibited variation for dwarf types with small, light yellow, brown, black and mottled grain types. The frequency of occurrence of tall types was more in case of pigeonpea cultivars. In wheat, predominant local varieties grown included deshi gehun, deshi kanak, dhauli kanak, safed kanak, pili kanak and kharchia. The latter type being well known for its adaptability to salanity. In oilseed crops,* Brassica juncea *and* B. campestris var. yellow sarson *and var. brown* sarson *were prevalent. Taramira* (Eruca sativa) *exhibited rich genetic variation in plant type, branching pattern, pigmentation, fruiting habit, pod size, shape, grain size and colour. The response to drought and hardiness showed high tolerance. Variation exhibited in case of brinjal germplasm was interesting particularly, both spiny and non spiny forms with oblong or round, small to large size fruits occurred. Rich variability was observed in musk melon and* Cucurbita moschata. *Among wild types,* Balanites aegyptiaca *and wild bitter ground* (Momordica balsamina) *were important.*

The germplasm diversity in crop plants adapted to arid/desertic climatic conditions of Rajasthan and adjoining Haryana state is of immense significance in crop breeding programme as it provides opportunity for identifying drought hardy/tolerant genotypes in different crop plant species. With the sole aim of collecting landrace variability, an exploration trip was planned and carefully executed. The details are discussed briefly in this paper.

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MATERIALS AND METHODS

The diverse agro-ecological habitats and microniches were extensively surveyed covering in all about 125 collection sites spread in 12 districts of Rajasthan as well as in two adjoining districts of Haryana state. Districts of Bikaner, Churu, Sikar, Jhunjhunu, Nagour, Jodhpur, parts of Jaipur, Sri Ganganagar, northern Ajmer, and western Pali were extensively explored. The variability collected was of significant importance in *T. durum*, *T. aestivum*, barley, chickpea, pigeonpea, *Eruca sativa* and several vegetable crops. At each collection site, random samples were drawn to obtain reasonable estimates of natural population. The collection route is given in Fig. 1 and details of collection are summarized in Table 1.

Fig. 1. Exploration and germplasm collection from N. E. Rajasthan and Haryana, (March-April, 1986)

RESULTS AND DISCUSSION

The major collection sites were marked by distinct ecology, habitats, rainfall pattern and precipitation regime. It was observed that rainfall gradually decreased from east to north west and vegetation pattern also varied accordingly. Based on the nature of soil and vegetation, Rajasthan could be divided in three major regions; (i) fertile eastern Rajasthan, (ii) arid western Rajasthan, and (iii) semi-arid middle Rajasthan. From above regions comprising several districts, 290 samples of germplasm in pulses (120) and other crops (170) were collected. The major collection comprised of *Hordeum vulgare* (47), *Triticum aestivum/T. durum* (37), *Cicer arietinum*

TABLE 1. GERMPLASM DIVERSITY COLLECTED

State/District	Crop group	Crops	Number of accession
(I) *Rajasthan*			
Pali (2)	Cereals	Barley (47), Maize (1), *Triticum aestivum* (37), *T. durum* (1)	86
Jodhpur (6) Nagour (1)	Pulses	Chickpea (104), Cowpea (2), Lentil (4), Mungbean (1), Pigeonpea (9)	120
Bikaner (11)	Oilseeds	Castor (2), Rapeseed mustard (23), *Eruca sativa* (16)	41
Sri Ganganagar (27) Churu (5)	Vegetables	Chilli (1), Eggplant (6), Fenugreek (14) Garlic (2) Onion (3), Radish (4), Tomato (2)	32
Jhunjhunu (14)		Bittergourd (1), *Solanum xanthocarpum* (1), *Vicia sativa* (1), *Balanites* sp. (1)	4
Sikar (16)	Miscellaneous	Cotton (1), Cumin (2), *Lepidium sativum* (1), Muskmelon (2), *Plantago ovata* (1)	7
Jaipur (23) Alwar (16)			
II *Haryana*			
Mahendragarh (2) Gurgaon (2)			
Total collections			290

(104), *Cajanus cajan* (9), *Brassica* sp. (23), *Eruca sativa* (16), *Trigonella foenum graecum* (14), *Solanum melongena* (6), *Allium cepa* (5), *Raphanus sativus* (4), *Lycopersicon esculentum* (2) and *Cucumis melo* (2). Wild *Momordica balsamina* was also collected from natural/disturbed habitats.

Observations on ecology and habitats

The extreme arid climate of Rajasthan desert is characterized by high solar radiation, seasonally and diurnally fluctuating temperatures and precarius, erratic low annual rainfall which varies from year to year without following any trend. The low atmospheric humidity, powerful hot and cold winds, sand storms, dust storms, dew, mist, fog, frost, evaporation far exceeding precipitation accompanied with high isolation, all tend to modify the ecosystem (Mulay and Joshi, 1964). Based upon the physiology, the nature of the soil substratum varied from place to place in the desertic region of Rajasthan. The desert soil partly being derived from material formed by physical disintegration of the local rocks and partly from blown sand. The desert is characterized by wind blown sand dunes of various types, besides the occurence of saline and sporadic aquatic habitats. The salt content of the desert soils is not so high as to be toxic to plant growth; being

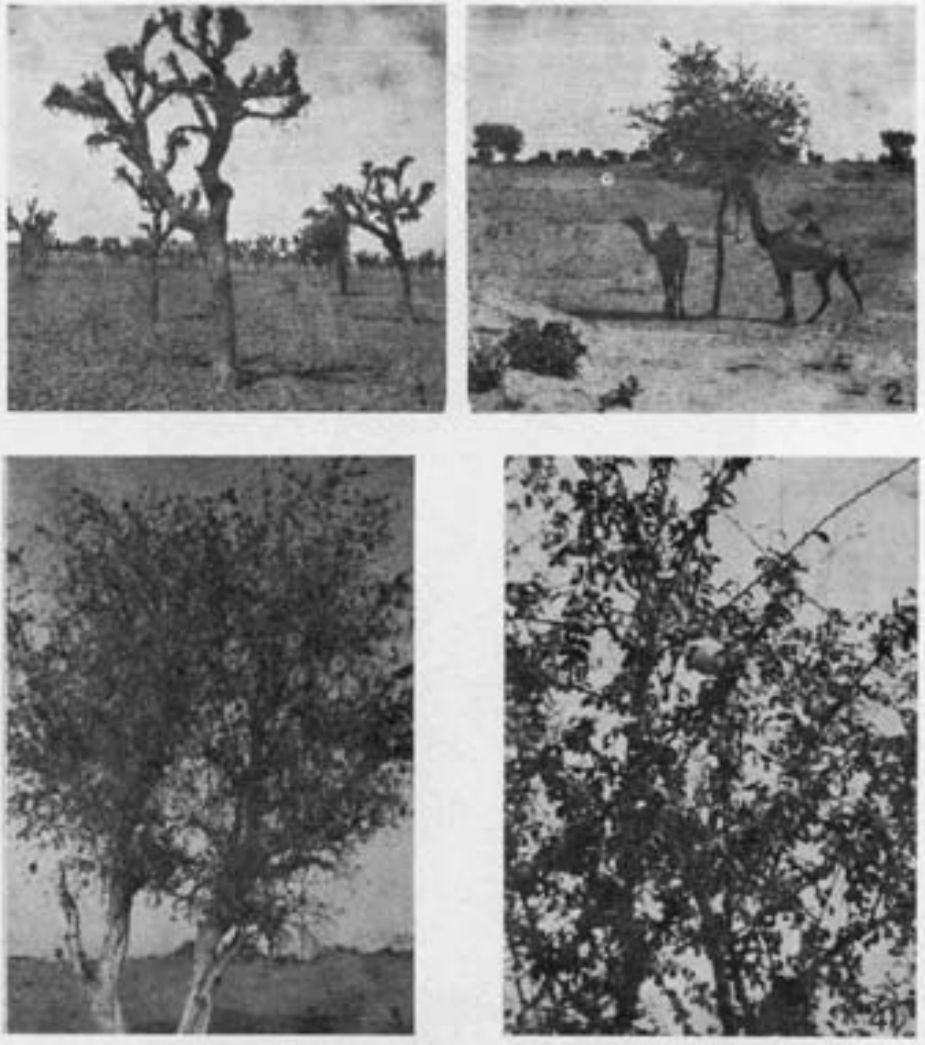

Plate I Fig. 1. Desert ecology; excessive lopping of *Prosopis cineraria* (A life saving fodder tree)

Fig. 2. *Acacia arabica*—Excess camel pressure ruins vegetation

Fig. 3. *Tecomela undulata* (Rohiro)—threatened desert tree

Fig. 4. *Balanites aegyptiaca* (Hingota)—Valuable tree species; fruits contain diosgenin.

present in that moderation to impact a certain amount of impermeability to the soil to keep the moisture in the region of the plant roots for a longer time. The subsoil is present in variable depths in different parts of the region explored.

Plate II Fig. 1. Landrace diversity in wheat
Fig. 2. Variability in musk melon germplasm
Fig. 3. *Cordia myxa*—A wild tree species with edible fruits

Observations on vegetation

The excessive and indiscriminate cutting, lopping, stripping and amputating the branches of the sparsely natural occurring trees of *Prosopis cineraria, Acacia* species, *Balanites aegyptiaca,* etc. have caused considerable damage to the developing vegetation (Plate 1). The impact on vegetation of the indiscriminate grazing and trampling by domestic animals like camels, large flocks of goats, sheeps, and donkeys and other burrowing animals have all resulted in the destruction of ground vegetation inhabiting wild species. Despite hazardous climate, unproductive soils and intense pressure, vegetation still covers a lot of land surface of Rajasthan. The flora comprises xerophytic shrubs, such as *Zizyphus nummularia, Capparis decidua, Calotropis procera,* etc. spread in descrete and discontinuous patches of plant communities. It consists of ephemerals, grasses, perennial herbs, under shrubs, dwarf trees and badly mutilated trees.

Observations on crop diversity

The predominant crops prevalent in *Rabi* season in the area explored comprised mainly wheat (*Triticum aestivum* and *T. durum*), barley (*Hordeum vulgare*), chickpea (*Cicer arietinum*), rapeseed mustard (*Brassica* species), and taramira (*Eruca sativa*). In some localized pockets, cultivation of pigeonpea (*Cajanus cajan*) was also observed. Similarly, cultivation of fenugreek (*Trigonella foenum graecum*) and lentil (*Lens culinaris*) in the districts of Alwar, Jaipur, Jhunjhunu and Sikar was predominant. Chickpea exhibited considerable variability largely grown in the rainfed areas of Sri Ganganagar, Hanumangarh upto Rawatsar and only scantly upto Sardar Shahar.

Observations on genetic variability

In Phagi and Chaksu areas (Distt. Jaipur) cultivation of local wheat called Safed kanak was observed followed by barley, rapeseed and mustard. Local landraces of *durum* wheat prevalent in the area were also collected particularly from Chaksu and Dhansa region. Rajasthan region holds rich genetic variability in chickpea and a wide spectrum of landraces/forms are still in the cultivation. Crop is chiefly grown under rainfed conditions and to a limited extent under canal irrigation. Two types of cultivated chickpea are recognised; deshi (small seeded, angular and variable colour forms) much prevalent in north-west region; kabuli types mainly confined to irrigated tracts being invariably round, large seeded and slightly tinged in some cases. The latter form is mainly cultivated in Sri Ganganagar district. In majority of the areas explored, it was found that local landraces were still predominant due to their better adaptations and moderately good grain yields. In some areas, improved chickpea varieties were also tried, but these could not replace the old cultivars due to poor adaptability, low grain yield, susceptibility to drought and water stress conditions. In the areas explored, chickpea cultivation was predominant in Bikaner, Churu, Sikar, Jhunjhunu, Jaipur, Alwar and Sri Ganganagar region. Variations largely occurred for plant type; both dwarf bushy to moderately tall, erect types occur under cultivation. Genetic

polymorphism for pigmentation of stem was observed in cultivars. The pod, grain size and colour were also observed to be variable; light yellow to deep purplish pigmented pods with single, occasionally double pods/peduncle occurred in the populations of some fields. Invariably pigmented type was linked with brown seed. While greenish yellow plant type possessed dull yellow to bright yellow grains of variable size. A few cultivars with white seeds were also collected. Variations were predominant for their root system and also for water requirement/uptake.

Among other crops, pigeonpea exhibited interesting variability particularly in the Chaksu/Phagi region of Jaipur and Alwar districts. Both dwarf to tall types with small, light yellow, brown and mottled grained types were found as mixed culture (crop) with pearlmillet and sorghum. *Trigonella* is grown extensively in this region particularly as cattle fodder and feed crop. Tall erect types were predominant. Important oil seed crops included *Brassica juncea*, *B. campestris* var. *yellow sarson* and taramira (*Eruca sativa*), the latter is grown extensively and exhibited significant genetic variations for plant type, branching patterns, pigmentation, fruiting habit, pod size, shape and colour as well as grain size and colour. The crop exhibited remarkable plasticity for adaptation to soil conditions, drought hardiness as well as resistance to diseases and pests.

Extensive surveys in the Jodhpur-Pali region showed predominance of *Kharchia* landrace of wheat (*T. aestivum*). This race is well adapted to the high concentration of salinity and gives fairly high grain yields even under adverse conditions. In Sikar district, interesting variability in wheat landraces (Plate II, Fig. 1) was observed. The variation was conspicuous, as these landraces were very tall with long ear, black purplish glumes and long purplish black awns. The grains were very bold, amber coloured; the crop is primarly grown under rainfed condition (Plate I).

REFERENCE

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