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Short communication

Genetic variability studies in chilli germplasm under hot arid eco-system

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Chilli (*Capsicum annum* L.) a native of tropical Africa and West Indies, was introduced into India by the Portuguese in the seventeenth century. *Capsicum annum* commonly known as red pepper or chilli is mainly cultivated for fruits which are used as vegetable for culinary purposes, in medicine as a stimulant and source of oleoresin. The fruits contain an active pungent principle substance, an alkaloid known as Capsaicin ($C_{18}H_{27}O_3N$). Chilli is one of the most important vegetable-cum-spice in Indian diet valued for its aroma, taste and pungency.

Realizing the importance of chilli cultivation in drier parts of arid and semi-arid regions of north-western India, research work was started 1998 at CIAH, Bikaner. Two crop specific explorations were conducted in arid, semi-arid and sub-humid areas of Rajasthan and Gujarat resulting in 182 collections from target variability pockets and areas of commercial chilli cultivation. Besides, 18 landraces collected from 10 districts of Gujarat by GAU, Vejalpur and 10 lines of Guntur type chillies from Lam (Andhra Pradesh) were also assembled. Thus, total 210 chilli genotypes were evaluated from 1999 to 2002 under hot arid agro-climatic conditions at CIAH, Bikaner for agromorphological growth, flowering and fruiting behaviour, fruit yield and quality contributing characters, and also to screen the material against biotic and abiotic stresses.

The survey studies revealed that a large number of varieties and types of chillies are under cultivation and perhaps these have been developed by natural selection, long period of cultivation under varying climatic conditions and hybridization. As India is a secondary centre of origin, arid and semi-arid parts of Rajasthan and Gujarat also possess rich diversity of chilli (Dwivedi and Bhandari, 1). In these areas chillies are widely cultivated during July to December and red ripe fruits of chillies fill the market in November-January (Samadia *et al.*, 2). Based on fruit size and shape, seed content and pungency, some popular types and selections are well known, e.g., Mathania, Haripur-Raipur, Mehsana, Nikhari, Patodi, Tonk Local, Mahaveerji Local and some *desi* types. In the past few years, however, due to several factors such as high incidence of viral diseases and unavailability of good

quality and pure seeds of desired types, there is drastic reduction in yield potential even in some popular types like Mathania Local. One of the approaches is phenotypic selection from the available variability. The success of phenotypic selection in a breeding programme, however, depends upon the range of genetic diversity available in the population and also on its information on the heritability of plant characters and association among yield and its component characters.

The results of evaluation and categorization of the collected germplasm revealed that, in general, there are well known pockets/areas where some typical types of landraces or local cultivars of chilli are still being cultivated on large scale and maintained by the growers owing to its peculiar quality and market demand (Table 1). Due to one or more production factors, the yield potential of these landraces is low and even then its cultivation is continuing. These are Mathania type chilli in Jodhpur, Nagour and Jalore; Mahaveerji Local in Karoli and Swaimadhampur; Patodi and Nikhari in Tejara (Alwar) and Tonk Local in Tonk districts of Rajasthan. Besides, there are very peculiar types or landraces locally known as *desi* of the particular areas have distinct quality components and liked by a group of community. In tribal areas, still farmers are being maintaining the local landraces for their domestic purposes possessing unique fruit quality, small size and high in pungency. By and large, on the basis of fruit quality and market demand, the local land races/types of Mathania, Mahaveerji, Tejara (Alwar) and Tonk could be further exploited to develop uniform fruit producing genotypes with consistence yield potential.

The chilli genotypes were characterized for more than 45 traits. However, the studies on analysis of variance for nine important quantitative characters revealed that the mean squares were highly significant for all the nine characters indicating considerable variability in the genotypes. The range, mean and genetic variability components are presented in Table 2. The estimates of PCV and GCV exhibited almost similar trend of variability. The extent of coefficient of variation indicates that fruit yield per plant, number of fruits/plant, fruit weight, number of seeds/fruit, fruit length and fruit diameter had maximum PCV indicating better scope of phenotypic selection to enhance the fruit yield in chilli. Genetic advance as percentage of mean ranged from 13.47 to 185.64 per cent. Thus, there

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Table 1. Land races/local types of chillies and their main characters.

Landrace/type	Major pocket(s)	Fruit characters
Desi type	Udaipur, Ajmer, Sikar	Fruit long, broad at upper and tapered at lower end, fleshy thick, wrinkled, dark green, glossy and mild in pungency
Mathania Local	Jodhpur, Nagour, Jalore	Fruit very long, broad at upper, middle and tapered lower end, fleshy, wrinkled, dark green, glossy and mild in pungency
Haripur-Raipur type	Jodhpur, Nagour Jalore, Ajmer	Fruit very long, slender, tapered, light green, glossy, high in pungency and seed content
Mehsana type	Jodhpur, Nagour Jalore	Fruit slender, tapered, green, dull and high in pungency and seed content
Mahaveerji Local	Karoli, Sawai-Madhupur	Fruit long, broad at upper end and tapered downward, curved, fleshy, dark green, glossy and high in pungency
Tonk Local	Tonk	Fruit medium long, broad base, straight, green, glossy and high in pungency
Desi of Khandar areas	Kota, Jhalawar Bundi	Fruit long, linear, thin, slender, green, dull and high in pungency
Patodi type	Alwar (Tijara)	Fruit medium long, thin, linear, slender, straight, dark green, glossy and high in pungency
Nikhari type	Alwar (Tijara)	Fruit medium long, thin, slender, tapered, straight, dark green, glossy and pungent
Kadedda Local	Ajmer	Fruit small, medium thick, blunt end, light green, dull and high in pungency
Desi of tribal areas (Rajasthan and Gujarat)	Banswara, Udaipur, Dungarpur, Sirohi, Dahod, Panchmahal,	Fruit small, thick, slender, dark green, glossy, straight and high in pungency
Wild form	Tribal areas of Rajasthan and Gujarat	Fruit very small, conical shape, yellowish green, dull and extremely pungent

Table 2. Genetic variability components for major characters in chilli.

Character	Range		Mean	GCV (%)	PCV (%)	Heritability (Broad sense) (%)	Genetic advance	Genetic gain (%)
	Min	Max						
Days to 50 % flowering (DAT)	44.70	84.86	56.42	12.68	12.86	97.12	14.52	25.74
Days to green fruit harvest (DAT)	60.23	102.46	79.78	11.29	11.36	98.83	18.46	23.14
Days to red ripe fruit harvest (DAT)	88.53	122.60	104.09	6.65	6.76	96.73	14.02	13.47
Fruit weight (g)	2.70	27.63	12.08	52.52	52.53	99.97	13.07	108.18
Fruit length (cm)	3.23	18.73	9.72	39.47	39.48	99.96	7.90	81.31
Fruit diameter (cm)	1.50	3.36	1.62	31.81	31.94	99.24	1.06	65.29
Number of seeds/fruit	21.53	152.00	81.21	40.90	41.03	99.38	68.21	83.99
Number of fruits/plant	3.60	162.03	42.97	65.60	65.66	99.82	58.03	135.03
Green fruit yield/plant (g)	12.68	2257.15	558.24	90.18	90.25	99.85	1036.37	185.64

is a tremendous scope to isolate superior genotypes for improving yield through simple selection procedures.

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