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Research Article

Narrow genetic base of private sector tomato varieties revealed by RAPD profiles

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Abstract
Genetic diversity of 17 tomato varieties under cultivation in India that have been developed by private sector was analysed by RAPD markers generated by 8 random primers. The overall high levels of pair wise similarity (mean=0.838) implied the existence of limited genetic variation among the varieties. The trend was similar to the one observed among tomato varieties bred by public sector institutions. The study was carried out with the sole purpose of demonstrating the narrow genetic base among Indian tomato cultivars irrespective of the source of breeding. Although, reduction in the genetic diversity among the modern Indian tomato cultivars may be attributed to the trend towards breeding for similar ideotypes in achieving higher productivity, this drift is ominous for the breeders from the perspectives of maintenance of genetic diversity and acquiring breeders' rights over novel varieties.

Key words: Tomato**,** Narrow genetic base, RAPD

Introduction

Genetic studies have revealed that Tomato (*Lycopersicon esculentum* Mill.) has undergone considerable reduction in genetic diversity during the course of its domestication and breeding for improved types (Rick, 1958; Rick and Fobes, 1975; Miller and Tanksley, 1990; Villand *et al*., 1998. There is also evidence of reduction in the genetic base of Indian tomato varieties (Archak *et al* ., 2002). Indian tomato seed market comprises of varieties developed both by public sector research institutions (for instance IARI, New Delhi; IIHR, Bangalore and Punjab Agricultural University, Ludhiana) and private seed companies. At present, Indian tomato seed market has a contribution of 90 % by the private seed companies. Several of these seed companies have collaborations of some sort with MNCs that cater to the needs of many countries and in the process possess germplasm of diverse origin. Some of the varieties released by private seed companies in India are popular with the farmers and consumers for the additional features they possess such as resistance to diseases, large firm fruits and high yield. These varieties are often the products of breeding programs involving exotic germplasm and therefore are expected to possess a wider genetic base.

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In a previous study Indian public sector germplasm was shown to have a narrowing genetic base by Archak *et al.,* 2002. Continuing the investigation, here we present the results of RAPD analysis of a set of private sector seeds of varieties presently in cultivation.

Materials and methods

Seeds of seventeen cultivated tomato varieties developed by private companies and two public sector varieties whose seeds are produced by private firms were procured from the open market (Table 1). These seed firms are located in the North Karnataka region often referred to as the hotbed of seed production. Ten public sector varieties were also used to facilitate the comparison between the present analysis and the earlier study; the seeds of which were available at NRC on DNA Fingerprinting. The seedlings were grown in the pots in a greenhouse at the National Research Centre for DNA Fingerprinting, New Delhi. DNA isolation, RAPD profiling and data analysis were carried out as detailed previously (Archak *et al.,* 2002).

Results and discussion

Eight decamer primers (Operon), chosen based on the earlier results (Archak *et al., 2002*) generated 56 reproducible amplification products 43 (76%) of which were found to be polymorphic. The size of the amplicons ranged from 340 to 2600 bp. The average

number of amplicons per primer was 7 while number of polymorphic bands per primer was 5.37. The pair-wise Jaccard's similarity values ranged between 0.442 and 1.00 with a mean value of 0.838±0.109. Mean pair-wise Jaccard's similarity coefficient was 0.873±0.129 among 17 private sector produced varieties with the same range. These values were compared with the similarity values obtained with the earlier study using public bred varieties from different centres (Archak *et al.,* 2002) (Figure 1). Seventeen private sector varieties apparently exhibited greater differences compared to the varieties developed at either IARI, New Delhi or at IIHR, Bangalore. The only exception was Punjab varieties, which had a mean of 0.832, the least observed in all RAPD studies so far. However, the differences were not statistically significant. These results point to the fact that the private sector varieties possess relatively narrow genetic base as identified by the RAPD markers, reflecting a common trend observed across the globe.

Naturally, self-compatibility has led to reduced variability and highly uniform genotypes in edible tomato, *L. esculentum* populations vis-à-vis greater variability observed in wild type self-incompatible species such as *L. peruvianum* (Miller and Tanksley, 1990). Human intervention in tomato breeding over the years has also contributed to the reduced genetic variation in cultivated accessions. For instance, RAPD analysis of 96 representative accessions from AVRDC collections from both old world and new world has shown diminished genetic variation in the old world accessions. Nevertheless, it was also observed, fortunately, that old world accessions were not simply redundant source of variation (Villand *et al*., 1998). However, it was frequently observed that molecular marker based analysis of genetic variation of tomato accessions puts all the new cultivars together away from vintage cultivars(Archak *et al.,* 2002; Park *et al* ., 2004). This indicates breeding for uniform types and narrow genetic background. On the contrary, Brazilian commercial cultivars were distributed among four different groups (Bernadette *et al* ., 2006) indicating that genetic variation, albeit low, exists in tomato accessions to be exploited. In India, private seed companies have access to such germplasm from the new world owing to various forms of collaborations with MNCs involved in seed production. However, RAPD based results of the present study show that despite infusion of diverse exotic germplasm, the private varieties remain as narrow as their public sector counterparts. This means that the private sector might have successfully brought in the quantitative shift in the characters by shuffling parental lines. However, this has not been accompanied by a qualitative change in terms of diverse genetic background. Clearly; this indicates a trend towards breeding for determinate and processing type tomato varieties and possibly an inadvertent choice of similar parental lines, albeit of diverse origin.

The study also compared three varieties in duplicates collected from different sources. Seeds of two IIHR varieties, Arka Vikas (pureline selection) and Arka Meghali (F1 hybrid) were collected from farmers of Belgaum region of Karnataka where seed multiplication is done for various private seed companies. They were compared with the breeder's seeds. Seeds of an IARI variety, Pusa Ruby procured from Indosem was also compared with the breeder's seeds. Arka Vikas accessions differed only at one locus whereas Arka Meghali and Pusa Ruby had nine and thirteen RAPD loci varying between duplicates respectively. These differences were reflected in the dendrograms (Figure 2). Without venturing into the possible reasons of such variation, we only wish to stress that the primers selected for the present study could throw enough polymorphism if the genetic differences existed. Other observations have been of the identical profiles of GS 124 of Golden seeds and OP526 of Sungrow seeds, and out grouping of the variety Avinash. Since we do not have the access to the information on the pedigree of the private varieties, we can neither discuss the genetic similarities among them nor detail their placement in the dendrogram.

We conducted the experiments with the sole purpose of demonstrating the narrow genetic base among Indian tomato cultivars irrespective of the parentage or institution. We presumed that all the varieties used here have been independently developed. An accurate account of the diversity needs to be brought out as an in-house exercise by the breeders from both public and private institutions using more robust molecular markers such as microsatellites. The present study along with Archak *et al*. (2002) only acts as warning bells against a trend among consumers and breeders for very narrow set of varieties to choose from. This drift is ominous for the breeders from the perspectives of both maintenance of genetic diversity and acquiring breeders' rights over novel varieties.

References:

Archak, S., Karihaloo, J.L. and Amit, J., RAPD markers reveal narrowing genetic base of Indian Tomato cultivars. *Curr. Sci,* 2002, 82: 1139-1143.

Bernadette, P.C., Lee, T.S., Gerald, F.G., Grazziotin and Sergio, E. 2006. Genetic diversity among Brazilian cultivars and landraces of tomato *Lycopersicon esculentum* Mill. Released by RAPD markers.

Genet.Res.&Crop Evolution., 53:395-400.

Miller, J.C. and Tanksley, S.D.1990.RFLP analysis of phylogentic relationships and genetic variation in the genus *Lycopersiocon*.*Theor. Appl. Genet*., 80:437-448.

Park, Y. H., Marilyn A.L., West and. St.Clair D.A .2004. Evolution of AFLPs for germplasm finger printing and assessment of genetic diversity in cultivars of tomato (*Lycopersicon esculentum*.L) *Genome*. 47:510-518

Rick C.M.1958.The role of natural hybridisation in the derivation of cultivated tomatoes of Western South America. Econ Bot., 12:346-367.

Rick C.M.and Fobes J.F.1975.Allozyme variation in the cultivated Tomatoes of western south America.Bull. *Torrey Bot. Club.*, 102:376-386.

Villand, J., Skroch, P.W., Lai, T., Hanson, P., Kuo. C.G. and Nienhuis, 1998.Genetic variation among Tomato accessions from primary and secondary centres of diversity. J., *Crop Sci.*, 38:1339-1347.

Table 1: Tomato cultivars used in the study

Name of the variety	Source
Ronco	Bejo Sheetal,Ranebennur,Karnataka
BSS 211	Bejo Sheetal, Ranebennur,Karnataka
Champakali	Vijay seeds, Ranebennur,Karnataka
GS 124	Golden seeds, Ranebennur, Karnataka
GC 670	Golden seeds, Ranebennur,Karnataka
Rashmi	Indo American Hybrid seeds, Ranebennur,Karnataka
Utpan	Indo American Hybrid Seeds, Ranebennur,Karnataka
K 21	Kanchan seeds, Ranebennur, Karnataka
S 72	Mahyco company, Ranebennur, Karnataka
Ananga	Namdhari seeds, Ranebennur, Karnataka
S 33	Namdhari seeds, Ranebennur, Karnataka
S 816	Namdhari seeds, Ranebennur, Karnataka
NS 815	Namdhari seeds, Ranebennur, Karnataka
S 2535	Namdhari seeds, Ranebennur, Karnataka
PKM 1	Paras seeds, Ranebennur, Karnataka
Avinash 2	Sandoz seeds, Ranebennur, Karnataka
OP 526	Sungrow seeds, Ranebennur, Karnataka
SCT 101	Sarpan hybrid seeds,Dharwad, Karnataka
Punjab Chuaara	Tropica Seeds,Ranebennur, Karnataka
L15 (Megha)	University of Agricultural Sciences, Dharwad, Karnataka
Arka Vikas 1	Indian Institute of Horticultural Research, Bangalore, Karnataka
Arka Vikas 2	Collected from farmers of Belgaum region of Karnataka,(2002)
Arka Meghali 1	Indian Institute of Horticultural Research, Bangalore, Karnataka
Arka Meghali 2	Collected from farmers of Belgaum region of Karnataka,(2002)
Punjab Tropic	Punjab Agricultural University, Ludhiana,Punjab
Pusa Ruby	Indian Agricultural Research Institute, New Delhi
Pusa Ruby (Indosem)	Indosem,Ranebennur, Karnataka
Sioux	Introduction
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Figure 1. Comparison of average pair-wise similarity values among varieties developed by various sources. Only private include the 17 varieties from private sources analysed in this study. Values indicated against Pusa, Arka, Introductions and Punjab are taken from Archak *et al* (2002). For details see text.

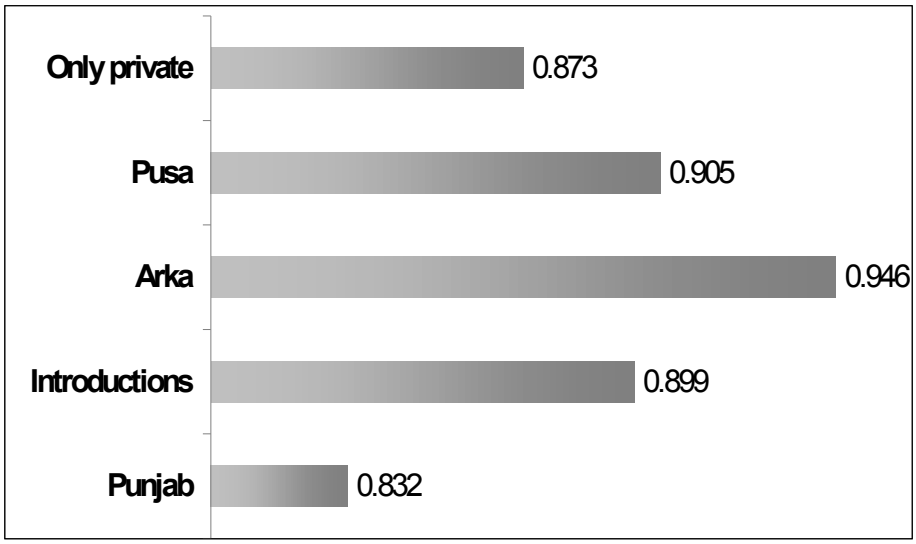

Figure 2. Dendrogram of 29 tomato cultivars resulting from UPGMA cluster analysis based on Jaccard's similarity coefficients