

Development of composite collection and genotyping of pearl millet [Pennisetum glaucum (L.) R. Br.]



Project PI: HD Upadhyaya, ICRISAT

Project Team: ICRISAT – CT Hash, S. Senthilvel, RK Varshney, DA Hoisington, KN Rai, KN Reddy, RP Thakur and S Chandra

About pearl millet

- Staple food for millions of people in the arid and semi-arid regions of Africa and Asia; forms an important source of feed and forage in the Americas
- Cultivated over an estimated area of about 26 million ha (FAO, 2005)
- Hardiest crop; thrives even on poor soils of dry regions in hot climates.

Origin and domestication

- Originated in a diffuse belt stretching from Senegal to western Sudan
- Domesticated 4000 years ago at its place of origin
- Reached eastern
 Africa and India about
 3000 years ago
- Spread to southern
 Africa about 2000
 years ago (Fig. 1).

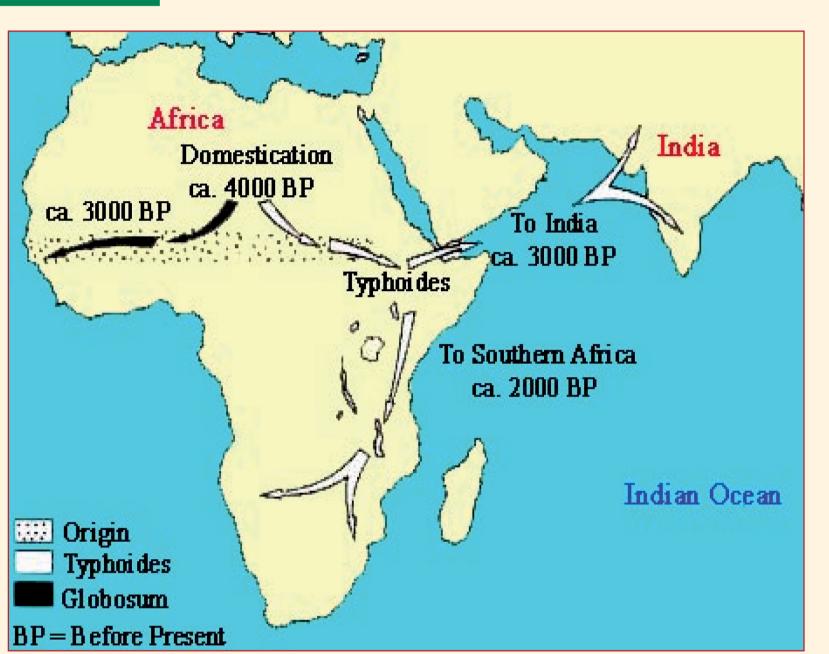


Fig 1. Origin and domestication of pearl millet.

Selection of SSR markers

all continents except Oceania.

Pennisetum species (60).

 About 100 SSR markers derived from genomic DNA, BAC and EST-libraries are available at ICRISAT.

(15) and multiple diseases (8); high seed iron and zinc content (4),

(12), forage type (8), trait specific selections (197), genepools (4),

Accessions in composite collection represent 30 countries across

breeding lines/released cultivars (246), and wild species (60).

Biologically, landraces dominated with 694 accessions followed by

released cultivars (5), elite breeding lines (47) and other

protein content (20); yellow endosperm (2), high stalk sugar content

- Markers will be used to initially screen a set of eight diverse genotypes (included in the composite collection), one each from Botswana, Burkina Faso, India, and five from ICRISAT, to select highly polymorphic markers representing all the seven linkage groups.
- Pearl millet being a cross-pollinated species with large intraaccession variation, the selected set of markers will also be used to screen the artificial pools comprising different proportions of genomic DNA of two genotypes, which are polymorphic for a given marker.
- The selected SSR markers will be screened on DNA extracted from the pooled tissues of 15 plants from each of 1000 accessions of the composite collection.

Major centers holding pearl millet germplasm

- At ICRISAT, Patancheru, the RS Paroda Genebank holds the largest collection of 21 594 pearl millet germplasm accessions including 750 accessions of wild relatives, from 50 countries.
- The other centers holding pearl millet germplasm include:
 - ➤ National Bureau of Plant Genetic Resources (NBPGR), New Delhi, India (6610 accessions)
 - Institut de Recherché pour le Développement (formerly ORSTOM), France (3607 accessions)
 - Ministry of Agriculture, Malawi (291 accessions)
 - United States Department of Agriculture (USDA), USA (5228 accessions).

Present status of research

• The composite collection was planted during the last week of August 2006, and leaf samples from 15-day old seedlings will be collected from 15 representative plants for DNA extraction.

Future plan of work

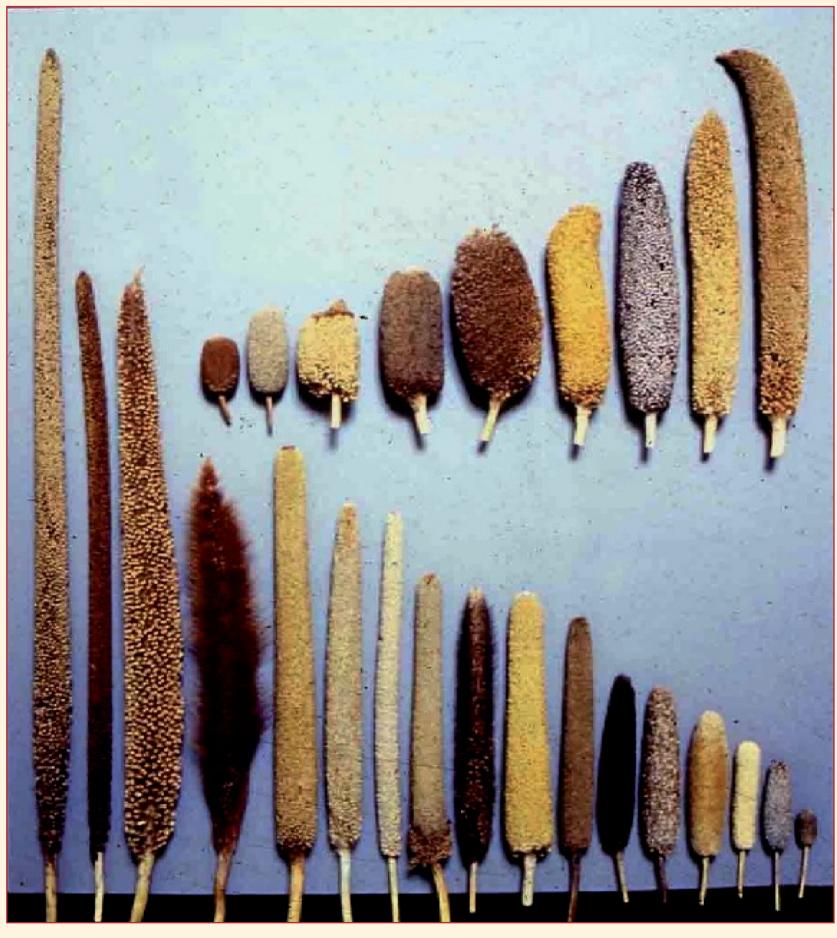
- DNA extraction from 15 plants per accession following highthroughput procedure
- DNA quantification and optimization of PCR conditions
- Screening of SSR markers on 8 diverse genotypes
- Screening artificial pools with polymorphic markers
- Identification of 20 suitable SSR markers capable of detecting

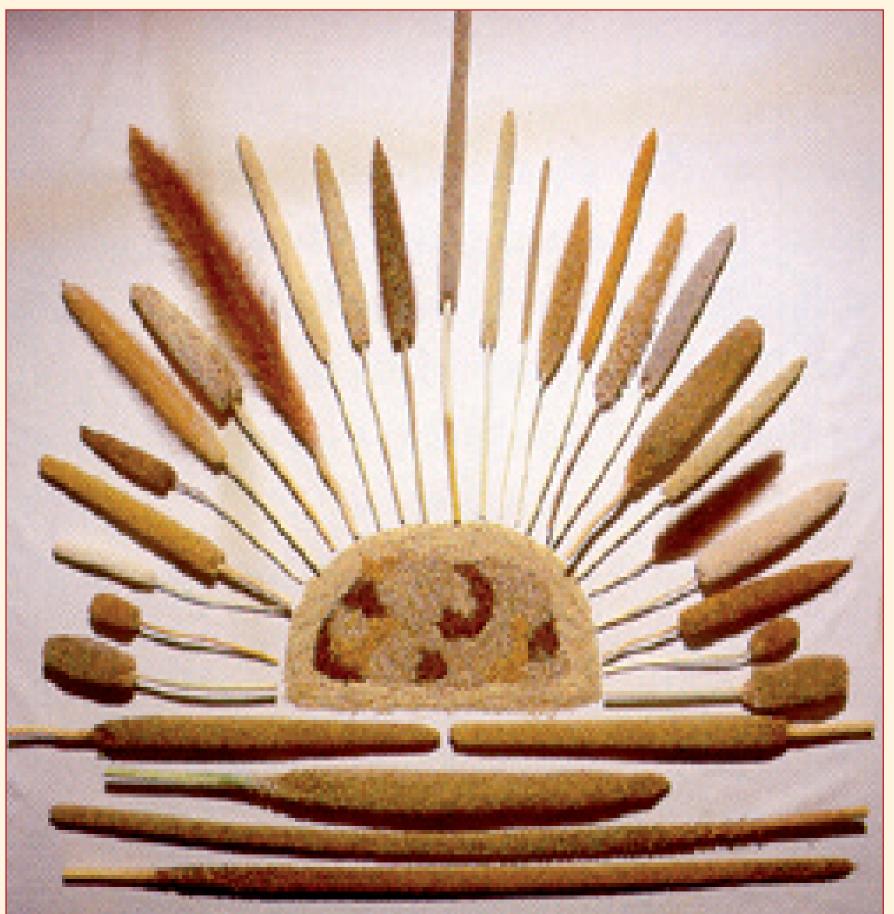
heterogeneity

- Fingerprinting the composite collection with 20 markers
- Data analysis to determine population structure and genetic diversity
- Identification of a reference collection of 300 diverse accessions.

Development of composite collection

- Composite
 collection of pearl
 millet developed
 using available data
 on phenotypic
 characterization,
 agronomic
 evaluation,
 geographic origin
 and taxonomy.
- Composite collection includes accessions of core collection at ICRISAT (504); tolerant to drought (6), heat (3) and salinity (20); resistant to downy mildew (42), ergot (20), rust (23), smut





Diversity in panicle size, shape and color in the world collection of pearl millet.

References

FAOSTAT 2005. http://apps.fao.org/