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PRELIMINARY CHARACTERIZATION AND EVALUATION OF *ON-FARM* CONSERVED OKRA GERMPLASM FROM TRIBAL POCKETS OF TELANGANA

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ABSTRACT

The phenotypic variability and potential of 22 local landraces of okra (Abelmoschus esculentus L. Moench) conserved on-farm by the ethnic groups in the tribal pockets of Telangana was assessed to identify elite accessions for utilization in breeding programs. These landraces were characterized and evaluated at National Bureau of Plant Genetic Resources, Regional Station, Rajendranagar during kharif, 2011 and 2012. Preliminary characterization for 20 qualitative traits revealed distinct variability especially in leaf tip, petiole colour, stem colour, leaf shape overall variability and flowering habit. Statistical analysis revealed significant variability among the landraces and quantitative traits fresh fruit weight (g), ridges/ fruit (no) and fruit length (cm) were found to be more diverse based on which promising accessions also could be identified. Okra landraces PSRJ-12952 with unique dwarf phenotype and NSJ-232 and PSRJ-12952 with desirable plant/ fruit characters could be exploited in breeding programs.

Keywords: Landraces, characterization, descriptors, evaluation, variability, quantitative traits

INTRODUCTION

Okra/ lady's finger/ *bhendi* (*Abelmoschus esculentus* L. Moench) belonging to family Malvaceae is one of the important warm season vegetables extensively cultivated throughout India. Okra is a good source of vitamins A, B and C, proteins, carbohydrates, fats and minerals iron and iodine (Diaz and Ortegon, 1997). India with 4.9 lakh hectares and 57.8 lakh tonnes accounted for 47.2% of the world acreage and 73.9% production of okra during 2011 (FAO Stat database, 2011). The genus *Abelmoschus* is of Asiatic origin and the Indian origin of *A. esculentus* was advocated by Zeven and Zhukovsky (1975) and Zeven and de Wet (1982). Out of a total of 10 species of *Abelmoschus* occurring in India, only *A. esculentus* is known to be in cultivation with maximum phenotypic variability. Significant indigenous diversity occurs in okra for plant height, branching, pigmentation, hairiness, fruit characters and their reaction to biotic/ abiotic stresses (Dhankhar *et al.*, 2005). Very tall, robust, purple pigmented, tolerant to cold and late maturing types occur in the high altitude tribal areas in the Peninsular plateau (Pandravada *et al.*, 2004). In okra, most of the local landraces are being replaced by the improved cultivars at an alarming rate and there is a tremendous urgency and scope for collection and conservation of accumulated indigenous variability. The national priority for exploration and collection of okra germplasm was categorized as medium (Mehra and Arora, 1982) given the significant amount of accumulated genetic variability in the crop. In peninsular India, Adilabad district of Telangana forms primarily a tribal dominated rich abode and a treasure trove for sustenance of ethnic diversity in different agri-horticultural crops. This district is divided into 52 Mandals (district sub-units) with 44.8% of area covered by forests and demographically 65% inhabited by the tribal groups dominated by the *Gond*, *Lambada*, *Kolam* and others (Anonymous, 2005). Generally, the okra landraces are grown in the small land holdings by the tribal farmers who are the largest growers and consumers of the local markets in Adilabad. The present paper strives to focus on the efforts to characterize and evaluate the traditional local landraces of okra collected from Adilabad for assessment of inherent variability and potential for utilization in okra improvement programs.

MATERIALS AND METHODS

Special agri-biodiversity surveys were undertaken by the National Bureau of Plant Genetic Resources, Regional Station, Hyderabad during 2009-11 to collect, salvage and conserve the current spectrum of landrace diversity in different agri-horticultural crops including okra from Adilabad district, Telangana. Following random sampling strategy, a total of 22 typical landrace populations of okra (*Abelmoschus esculentus* L. Moench) conserved *on-farm* by the ethnic tribal groups in the district were collected. These 22 local landraces were characterized and evaluated along with check varieties, *Arka Anamika*, P-8 and *Pusa* A-4 at NBPGR Regional Station, Rajendranagar during *kharif*, 2011 and 2012. Each accession was raised in a three row plot of 3.0 m length and 0.6 m width. A

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row-to-row distance of 60 cm and a plant-to-plant distance of 30 cm were followed. A plant population of 30 plants/ accession was maintained. The agronomic operations were taken up and experimental plots were prepared based on the recommended package of practices (Anonymous, 1996). All the accessions were characterized and evaluated for morpho-agronomic traits which include 20 important qualitative and seven quantitative descriptors (Mahajan *et al.*, 2000). Observations were recorded on five random plants excluding border plants in each accession for plant height (cm), days to 50% flowering, fruit length (cm), fruit thickness (cm), fruit weight (g), ridges/ fruit (no) and 100 seed weight (g). The pooled mean for two seasons was computed for each accession and analyzed for variance to establish significant level among the genotypes as described by Singh and Chaudhary (1985) and Steel and Torrie (1980).

RESULTS AND DISCUSSION

Characterization and evaluation play a significant role in identification of genetic diversity, promising accessions, elite material and sources of resistance for utilization in crop improvement programs (Chapman, 1989).

Table 1: Variability for descriptor and descriptor states recorded in okra germplasm

Descriptor	Variability for descriptor states
Leaf shape	Orbiculate
Leaf segment shape	Elliptical/ Lanceolate
Leaf margin	Dentate/ Sinuate
Leaf tip	Cuspidate/ Acuminate/ Acute/ Aristate
Leaf base	Hastate
Leaf shape overall variability	Less/ Intermediate/ More
Leaf colour	Dark green/ Light green
Leaf vein colour	Red to green/ Green Purple
Petiole colour	Light/ dark green with splashes of pink/ red/ purple
Petiole length	Short/ intermediate
Stem colour	Light/dark green with splashes of pink/red/purple
Stem hairiness	Pubescent (short soft hairs)
Flowering habit	None/ Few (only on few branches)/ Sparse (distributed throughout the plant)
Flower colour	Sulphur/ yellow with purple eye
Sepal colour	Green
Stigma colour and form	Purple & Cluster
Filament colour	White
Pigmentation on fruit	Absent/ Present
Fruit colour	Green/ Dark green
Fruit tip shape	Blunt

A number of landraces/ primitive cultivars were utilized either directly as a pure line selection for release as a variety and/or as a parent in okra improvement after proper characterization and evaluation (Gupta and Rai, 1994). Okra improved cultivars (CO-1, *Gujarat Bhindi*-1 and *Pusa Makhmali*) were developed directly from indigenous landraces and varieties (*Arka Anamika*, P-7, *Parbhani Kranti*, *Punjab Padmini*, *Pusa Sawani* and Selection-2) through breeding and selection by incorporating useful genes from indigenous germplasm from primary and secondary gene pools. In this respect, several workers studied the potential of genetic resources for their utilization in the improvement of okra (Ariyo, 1990; Hamon *et al.*, 1991; Reddy *et al.*, 2010). For a successful breeding programme in okra, characterization and evaluation of germplasm for horticultural traits to unravel the genetic variability is crucial for selecting elite genotypes. To make okra as a perfect crop in sustainable agriculture, it should be attractive to both producers and consumers in terms of yield and quality. The traits include, medium to tall plant height, short inter-nodes, lower position of first flowering and fruiting node, high number of fruiting nodes and early maturity for enhancing the productivity (Reddy *et al.*, 2012).

Table 2: Descriptive statistical analysis for quantitative traits in okra germplasm

Quantitative trait	Germplasm									Check varieties		
	Range		Mean	SE	SD	Variance	Kurtosis	Skewness	CV %	Arka Anamika	P-8	Pusa A-4
	Min.	Max.								Mean	Mean	Mean
Plant height (cm)	29.5	88.8	60.6	3.3	13.4	178.3	1.8	-0.1	22.0	126.8	120.5	120.4
Days to flowering	40.0	46.0	41.9	0.5	2.0	3.8	-0.5	-0.5	4.7	41.2	40.2	40.8
Fruit length (cm)	7.9	27.1	15.9	1.1	4.3	18.7	2.5	0.6	27.3	14.4	13.2	12.5
Fruit thickness (mm)	6.0	10.2	8.3	0.3	1.1	1.3	-0.1	-0.2	13.6	17.0	18.0	18.0
Fresh fruit weight (g)	12.3	59.2	34.6	2.9	11.6	135.2	0.3	0.4	33.5	17.3	18.1	16.0
Ridges/ fruit (no)	5.0	10.0	6.6	0.5	2.0	3.9	-1.2	0.7	29.9	5.0	5.0	5.0
100 Seed weight (g)	3.9	6.9	5.7	0.2	0.9	0.8	-0.3	-0.8	15.7	6.0	6.0	6.1

The germplasm consisting of 22 accs. was characterized for 20 qualitative and seven quantitative traits to unravel the inherent variability and potential of the material. Among the qualitative traits studied, greater variability was observed in leaf tip (acuminate/ acute/ aristae/ cuspidate), petiole colour (light/ dark green with splashes of pink/ red/ purple), stem colour (light/dark green with splashes of pink/ red/ purple), leaf shape overall variability (less/ intermediate/ more) and flowering habit (none/ few/ sparse) (Table 1). The analysis of variance revealed significant differences among the 22 landraces studied for seven quantitative characters. The traits, fresh fruit weight (g), ridges/ fruit (no) and fruit length (cm) were found to be more variable in the germplasm (Table 2). Fruit length and weight are considered to be associated directly with total yield/ plant for which high mean value is desirable. Reddy *et al.* (2012) also observed considerable phenotypic variability in the fruit characteristics of indigenous collections of okra. The present findings are in consonance with those of earlier workers in okra (Dhankar *et al.*, 2005; Reddy *et al.*, 2012). The potential of the germplasm unravelled through characterization for utilization in crop improvement programmes and the phenotypic traits of the promising accessions are given in Table 3 and 4 respectively.

Table 3: Salient phenotypic traits and values based on which promising accessions identified in okra germplasm

Character	Desirable value	Accession numbers
Plant height (cm)	< 80	PSRJ-12952,
Days to flowering	= 40	PSRJ-12952, PSRJ-13071, RJR-110, RJR-211
Fruit length (cm)	12-15	PSRJ-12952, PSRJ-12963, PSRJ-13040, RJR-45, RJR-124
Fruit thickness (mm)	6.0	RJR-265
Fresh fruit weight (g)	15-18	RJR-265
Ridges/ fruit (no)	5	NSJ-320, PSRJ-12963, PSRJ-13040, PSRJ-13071, PSRJ-13092, PSRJ-13093, RJR-110, RJR-265
100 Seed weight (g)	> 6	NSJ-320, PSRJ-13040

The landrace PSRJ-12952 with 29.5 cm plant height, early at 40 days to flowering and having a desirable fruit length of 14.5 cm was a dwarf genotype with densely branched base (DBB) growth habit along with good fruit quality. This dwarf landrace could be utilized in ideotype breeding for the development of semi-dwarf varieties of okra and could be registered as a novel genotype (dwarfness) with ICAR as well. Two other accessions were also found to be promising for multiple traits which include NSJ-320 for tall habit, ridges/ fruit and seed weight and RJR-265 for fruit thickness and fresh weight. Days to first flowering are the indicator of earliness in okra and early flowering not only gives early pickings and better returns but also widens fruiting period of the cultivar. On the basis of mean performance for growth, earliness and acceptable pod quality traits, germplasm lines namely NSJ-320, PSRJ-12952 and RJR-265 were found to be horticulturally superior, which can be utilized for the development of open pollinated varieties or hybrids.

Table 4: Characters of promising accessions identified from the okra germplasm

Accession number	Plant height (cm)	Days to 50% flowering	Fruit Length (cm)	Fruit thickness (mm)	Fruit weight (g)	Ridges/ fruit (no)	100 Seed Weight (g)
NSJ-320	88.8	44.0	27.1	10.2	59.2	5.0	6.3
PSRJ-12952	29.5	40.0	14.5	7.3	27.5	7.0	4.0
RJR-265	70.9	43.0	7.9	6.0	12.3	5.0	4.6

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