Sorghum landraces patronized by tribal communities in Adilabad district, Andhra Pradesh

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An account of sorghum landraces cultivated by tribal farmers habituated in Adilabad district, Andhra Pradesh is provided. Badigi jonna, Boda jonna, Chinna jonna, Chinna boda jonna, Darawat jonna, Erra jonna, Gadda jonna, Konkadala jonna, Leha jonna, Moddu jonna, Pachcha jonna, Pandari jonna, Pandimutte jonna, Parsa jonna, Pedda jonna, Pelala jonna, Purabodaka, Rabi jonna, Sai jonna, Sanna jonna, Sevara jonna, Sevata jonna, Seviri jonna, Talki jonna, Tekedari jonna, Tella boda jonna, Varagadi jonna, Vayu nowka jonna and Vubiri patti jonna are the landraces patronized by Gond, Kolam, Lambada, Nayakpod Andh, Koya, Manne, Pardhan and Porja ethnic groups. A total of 120 accessions of sorghum germplasm belonging to 29 named landraces were collected for conservation of diversity. The characteristics and uniqueness, folk taxonomy and general uses of these landraces of sorghum are highlighted.

Keywords: Germplasm, Landraces, Sorghum bicolor, Gonds, Lambadas, Kolams, Folk taxonomy

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Sorghum [Sorghum bicolor (L.) Moench] landraces are under cultivation in Adilabad district, Andhra Pradesh by different tribal communities since ancient times. Early introduction of Sorghum into India from Africa had a profound effect on the degree of genetic variability that evolved in the country and India, thus is considered as a secondary centre of diversity of the crop. Landraces of sorghum from the sub continent are rich sources of resistance to diseases and insect pests and also to abiotic stresses viz. drought and high temperature. They, also act as sources of traits to improve food, animal feed and provide nutritional security to the tribal population in this region. However, sorghum landrace diversity is under severe threat due to loss of habitats, industrial development and large-scale adoption of cash crops such as Bt-cotton, sunflower and soybean. As sorghum is the staple crop to many tribal communities in this region, the accumulated genetic diversity needs to be collected for conservation, posterity and utilization in crop improvement programmes. An attempt has been made to collect, document and conserve the available landraces from Adilabad district under the aegis of National Agricultural Innovation Project (NAIP) implemented by the National Bureau of Plant Genetic Resources (NBPGR), a nodal organization for management of plant genetic resources in India.

Characteristics of the study area

Adilabad is the fifth largest district in Andhra Pradesh which lies between 18° 40’ N and 19° 56’ N latitudes and 77° 47’ E and 80° 0’ E longitudes. It is bounded on North by Yavatmal, on the East by Chanda districts of Maharashtra and on the South by Karimnagar and Nizamabad districts of Andhra Pradesh and on the West by Nanded district of Maharashtra. About 65% of the district is inhabited by the tribal population and with regards to forest area, 44.8% is covered by dry deciduous type. Adilabad district is administratively divided into 52 mandals with 1,748 revenue villages and 7 municipalities. Tribal population is dominated by the Gond (52%), Lambada (22%), Kolam (8%) and others (Viz., Andh, Koya, Manne, Naikpod, Pardhan, Porja 8%). The important rivers that traverses the district are the Godavari, the Penganga, the Wardha, the Pranahitha, the Kadem and the Peddavagu. The major crops of the district are rice, sorghum, cotton, pigeon pea, maize,
soybean, etc. Black soils are predominant and red soils are sporadic which includes chalkas, red sandy, deep red loams, etc. The annual average rainfall is 900 – 1,150 mm mostly by South West monsoon. The maximum and minimum temperatures during South West monsoon range from 32° - 37° C and 21° - 25° C, respectively.

Material and methods
Eight germplasm collection missions were organized during the period from October 2010 to May 2011 in Adilabad district. Sorghum germplasm in the form of ear heads/ seeds was sourced from tribal farmers’ fields, threshing yards and farm stores. The sample type followed was ‘population’ and the sampling methods used were ‘random’ and ‘bulk’ for field and threshing yard/ farm store collections respectively. The overall collection tactics and logistics were taken into consideration as suggested by Bennet and Astley. Global Positioning System (GPS Garmin-12) was used to record the Geographical coordinates of the collection site. Photographs of the landraces were taken using the digital camera (Canon 350D Digital). The germplasm material was properly cleaned, processed and packed in aluminium foil packets for medium-term conservation.

Results and discussion
The range of genetic variability observed in Sorghum is immense in the district of Adilabad. A total of 120 accessions could be sampled from 30 Mandals (District sub-unit). The germplasm collection missions conducted in this region resulted in augmenting 29 landraces, viz. Badigi jonna, Boda jonna, Chinna jonna, Chinna boda jonna, Darawat jonna, Erra jonna, Gadda jonna, Konkadala jonna, Leha jonna, Moddu jonna, Pachcha jonna, Pandari jonna, Pandimutte jonna, Parsa jonna, Pedda jonna, Pelala jonna, Purabodaka jonna, Rabi jonna, Sai jonna, Sanna jonna, Sevara jonna, Sevata jonna, Seviri jonna, Talki jonna, Tekedari jonna, Tella boda jonna, Varagadi jonna, Vayu nowka jonna and Vubiri patti jonna. The sorghum landraces are described below:

**Badigi jonna**
A *Durra* race tall pigmented sorghum landrace with basal tillers, greenishwhite midrib, semi-compact elliptic panicle, ear length 20.7 cm, ear width 6.6 cm, light brown glume colour with 1/4th grain covered, creamish straw lustrous seed, seed size < 4.0 mm., drought and disease resistant.

**Boda jonna**
A *Durra* race tall pigmented sorghum landrace with basal tillers, white midrib, semi-compact ovate-elliptic panicle, ear length 10.0 cm, ear width 4.7 cm, straw glume colour with half grain covered, creamish straw coloured lustrous seed, seed size < 4.2 mm.

**Chinna jonna**
A *Durra* race tall sorghum landrace with basal tillers, white midrib, compact elliptic panicle, ear length 10.2 cm, ear width 5.1 cm straw glume colour with 1/4th grain covered, lustrous creamish straw seed, seed size < 3 mm.

**Chinna boda jonna**
A *Durra* race tall pigmented sorghum landrace with basal tillers, white midrib, loose-elliptic panicle, ear length 22.3 cm, ear width 3.2 cm, straw glume colour with 1/4th grain covered, creamish straw lustrous seed, seed size < 3.6 mm, has good fodder value.

**Darawat jonna**
A *Durra* race tall pigmented sorghum landrace with basal tillers, white midrib, loose-elliptic panicle, ear length 23.0 cm, ear width 5.1 cm, partly straw and light brown glume colour with half grain covered, creamish straw lustrous seed, seed size < 3.9 mm, has good nutritional quality and diversified food value, given for lactating mothers, also has good fodder value and fed to cattle.

**Erra jonna**
A *Durra* race tall pigmented sorghum landrace with basal tillers, white midrib, semi-compact elliptic panicle, ear length 20.0 cm, ear width 4.9 cm, brown glume colour with 1/4th grain covered, light red coloured lustrous seed, seed size < 4.6 mm, has good nutritional quality and diversified food value.

**Gadda jonna**
A *Durra* race tall pigmented sorghum landrace with basal tillers, white midrib, compact elliptic panicle, ear length 9.2 cm, ear width 4.5 cm, straw glume colour with 1/4th grain covered, lustrous creamish straw coloured seed, seed size < 3.2 mm., has good nutritional quality and diversified food value, resistant to bird damage, also amenable to climate change situations.
Konkadala jonna  
A *Durra* race tall pigmented sorghum landrace with basal tillers, white midrib, compact elliptic panicle, ear length 17.3 cm, ear width 3.6 cm, brown glume colour with 1/4th grain covered, creamish straw lustrous seed, seed size < 4.6 mm.

Leha jonna  
A *Guinea* race tall pigmented sorghum landrace with basal tillers, white midrib, very-loose broom corn panicle, ear length 18.0 cm, ear width 3.9 cm partially straw and purple glume colour with uncovered grain, lustrous chalky-white seed, seed size < 2.9 mm., seed is popped and used in poojas/worshipping as well.

Moddu jonna  
A *Durra* race tall pigmented sorghum landrace with basal tillers, white midrib, loose-elliptic panicle, ear length 21.0 cm, ear width 4.0 cm, light brown glume colour with half grain covered, creamish straw lustrous seed, seed size < 4.0 mm, has potential to yield up to 16 q/ ac., resistant to bird damage.

Pachcha jonna  
A *Durra* race tall sorghum landrace with basal tillers, white midrib, compact elliptic panicle, ear length 16.7 cm, ear width 2.8 cm, straw glume colour with half grain covered, lustrous yellow seed, seed size < 2 mm.

Pandari jonna  
A *Durra* race tall pigmented sorghum landrace with basal tillers, white midrib, semi-compact elliptic panicle, ear length 17.3 cm, ear width 3.6 cm, brown glume colour with 1/4th grain covered, creamish straw lustrous seed, seed size < 4.6 mm.

Pandimutte jonna  
A *Durra* race tall pigmented sorghum landrace with basal tillers, white midrib, semi-compact elliptic panicle, ear length 9 cm, ear width 4.8 cm, red glume colour with grain fully covered, lustrous seed, seed size < 3mm.

Parsa jonna  
A *Durra* race tall pigmented sorghum landrace with basal tillers, white midrib, semi-compact elliptic panicle, ear length 11.2 cm, ear width 4.8 cm, straw glume colour with half grain covered, lustrous seed, seed size < 3mm.

Pedda jonna  
A *Durra* race tall pigmented sorghum landrace with basal tillers, white midrib, semi-compact elliptic panicle, ear length 16.3 cm, ear width 4.8 cm, straw glume colour with half grain covered, lustrous seed, seed size < 4.0 mm., has good nutritional quality and diversified food value giving strength and tenacity.

Pelala jonna  
A *Guinea* race tall pigmented sorghum landrace with basal tillers, white midrib, semi-loose to loose panicles with stiff branches, ear length 22.7 cm, ear width 4.2 cm, straw glume colour with uncovered grain, lustrous chalky-white seed, seed size < 2.5 mm., has good nutritional quality and diversified food value and popped.

Purabodaka jonna  
A *Durra* race tall pigmented sorghum landrace with basal tillers, white midrib, semi-compact ovate panicle, ear length 14.0 cm, ear width 3.8 cm, straw glume colour with half grain covered, creamish coloured lustrous seed, seed size < 3mm.

Rabi jonna  
A *Durra* race tall pigmented sorghum landrace with basal tillers, white midrib, semi-compact ovate panicle, ear length 9.5 cm, ear width 3.8 cm, straw glume colour with half grain covered, straw coloured lustrous seed, seed size < 3.9 mm., has good nutritional quality and diversified food value.

Sai jonna  
A *Durra* race tall pigmented sorghum landrace with basal tillers, white midrib, semi-compact elliptic panicle, ear length 12.8 cm, ear width 6.8 cm, straw glume colour with half grain covered, lustrous seed, seed size < 2.3 mm., moisture/drought tolerant and gives some assured yields even in adverse situations and amenable to climate change situations.

Sanna jonna  
A *Durra* race tall pigmented sorghum landrace with basal tillers, white midrib, compact elliptic panicle, ear length 15.9 cm, ear width 4.1 cm, straw glume colour with 1/4th grain covered, creamish straw coloured lustrous seed, seed size < 2.5 mm.

Sevara jonna/ Seviri jonna  
A *Durra-bicolor* race tall pigmented sorghum landrace with basal tillers, greenish white midrib, semi-compact elliptic panicle, ear length 17.8 cm, ear
width 5.1 cm, straw glume colour with 3/4th grain covered, lustrous seed, seed size < 3.6 mm.

**Sevata jonna**

A *Durra* race tall pigmented sorghum landrace with basal tillers, white midrib, compact ovate-elliptic panicle, ear length 9.8 cm, ear width 3.9 cm, partly straw and brown glume colour with 1/4th grain covered, lustrous creamish straw coloured seed, seed size < 3.9 mm., porridge given in typhoid fevers for strength and quick recovery.

**Talki jonna**

A *Durra* race tall pigmented sorghum landrace with basal tillers, greenish white midrib, semi-compact ovate-elliptic panicle, ear length 10.8 cm, ear width 5.5 cm, partly straw and brown glume colour with 1/4th grain covered, creamish straw coloured lustrous seed, seed size < 3.2 mm.

**Tekedari jonna**

A *Durra* race tall pigmented sorghum landrace with basal tillers, dull green midrib, semi-compact elliptic panicle, ear length 17.7 cm, ear width 5.6 cm, straw glume colour with half grain covered, straw coloured lustrous seed, seed size < 4.5 mm.

**Tella boda jonna**

A *Durra* race tall pigmented sorghum landrace with basal tillers, white midrib, loose-elliptic panicle, ear length 17.5 cm, ear width 3.7 cm, partly straw and brown glume colour with 3/4th grain covered, creamish straw coloured lustrous seed, seed size < 3.7 mm.

**Varagadi jonna**

A *Durra* race tall pigmented sorghum landrace with basal tillers, white midrib, semi-compact elliptic panicle, ear length 15.0 cm, ear width 5.3 cm, straw glume colour with half grain covered, lustrous creamish straw seed, seed size < 4.4 mm.

**Vayu nowka jonna**

A *Durra* race tall pigmented sorghum landrace with basal tillers, white midrib, semi-compact elliptic panicle, ear length 18.8 cm, ear width 7.1 cm, straw reddish brown glume colour with 3/4th grain covered, lustrous light yellow seed, seed size < 2.7 mm., has good nutritional quality and food value.

**Vubiri patti jonna**

A *Durra* race tall pigmented sorghum landrace with basal tillers, greenish white midrib, compact ovate panicle, ear length 9.5 cm, ear width 4.6 cm, brown glume colour with 1/4th grain covered, lustrous chalky-white seed, seed size < 4.0 mm.

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**Folk taxonomy (naming of Sorghum landraces by the ethnic groups)**

Tribal groups (*Gond, Kolam, Lambada, Manne, Naikpod, Pardhan*) of Adilabad district in view of their long association with the cultivation of sorghum landraces named several cultivars in their traditional dialects. Majority of the landraces describes the phenotypic characters. The leading phenotypic characters used by the farmers in naming these sorghum landraces are midrib colour (*Vubiri patti jonna*), grain colour (*Erra jonna, Pachcha jonna*), grain size (*Chinna jonna, Chinna boda jonna, Pedda jonna*), glume colour (*Tekedari jonna*), glume hairiness (*Leha jonna*), earhead shape (*Pandimutte jonna, Pelala jonna*), grain shape (*Sevata jonna*), etc. Ear head images of some of the collected sorghum landraces are provided in Fig. 1. Apart from these morphological characters, habitat and crop growing sesons (*Rabi jonna*) are also taken into naming the cultivars. A local landrace, which never fails to give some assured yield, had been named as *Sai jonna* a trust resposed on the holy saint Sai Baba. Careful analysis of naming of the cultivars reveal the intricate knowledge, minute observation of the cultigen and general acceptability and visualization of the description among the community of the tribal farmers. Mostly binomial nomenclature (*Erra jonna*, *Parsa jonna*, *Talki jonna*, etc.) is prevailing in the district and rarely, trinomial also recorded (*Vayu nowka jonna, Vubiri patti jonna, Tella boda jonna, Chinna boda jonna*, etc.). These landraces are well adapted to local agro climatic conditions which are named, selected and maintained by the traditional farmers to meet their social, economic, cultural and ecological needs. Similar observations on naming landraces were earlier recorded for ethiopian collections and for Indian collections.

**General uses of the sorghum landraces**

Ethnic communities in the Adilabad district are growing these landraces over many years for several reasons. Firstly, it is the staple crop for the tribals and rural poor inhabiting this region. Secondly, most of these landraces are drought and heat tolerant and are especially important for the semi-arid region. Thirdly, for growing these landraces fewer inputs are needed to be provided by the resource poor farmers.
Fig. 1—Important sorghum landraces conserved on-farm by tribal communities of Adilabad district, Andhra Pradesh
Jonna rotte, which is made from sorghum, is the staple diet of tribals in this region. Sorghum meal is often eaten as a porridge known as Ambali by all the tribal population inhabiting in this region. Few landraces (Pelala jonna) are used as pop sorghum as similar in the case of pop corn. Sorghum straw is also used as cattle feed and for thatching roofs of huts and manche (a locally made watch tower in the farmers’ fields).

Conservation of Sorghum landraces

The collected landraces of sorghum germplasm have been conserved ex-situ in the medium term storage facility available at the Regional Station of National Bureau of Plant Genetic Resources (NBPGR). NBPGR, New Delhi being the nodal agency for plant genetic resources management in the country, is conserving 20,012 accessions of sorghum germplasm in the National Gene Bank (NGB). The Directorate of Sorghum Research (DSR), a national active germplasm site (NAGS) collected 4,913 accessions of sorghum germplasm from the country and maintains the working collections\(^5\). Also, a total of 138 landraces collected from Andhra Pradesh (18), Karnataka (19), Madhya Pradesh (42), Maharashtra (44), Rajasthan (5), Tamil Nadu (6) and Uttar Pradesh (4) were characterized and conserved\(^1\). Variability in sorghum landraces for several morphological traits was recorded and published by many researchers around the globe\(^5,6,7,8\). TheInternational Crops Research Institute for the Semi-Arid Tropics (ICRISAT) located in the Medak district of Andhra Pradesh is a major repository for world sorghum germplasm conservation with a total of 37,904 accessions collected from 91 countries\(^10\) estimated to represent about 80% of the total variability that is present in sorghum. Landraces constitute 85.3%, breeding material 13.2%, wild species accessions 1.2% and named cultivars 0.3% of the total ex-situ collections available with ICRISAT-R.S.Paroda Gene Bank\(^11,12\). In-situ on-farm conservation is another strategy for conserving important landraces in the farmers’ fields of Adilabad region.

Conclusion

The inventory of the sorghum landraces unfolds the spectrum of diversity, manifold scope and potential for utilization of this material across the district by the ethnic groups in view of their good adaptation to the existing climatic conditions. Sorghum landraces Darawat jonnaa, Gadida jonna and Moddu jonna are miracle cultivars having good nutritional and yield capabilities surviving under climate change situations. These are the landraces of legacy which are sinequa-non under adverse situations giving some assured yields and the tribal farmers should try to conserve such genotypes for livelihood and nutritional security.

Sorghum germplasm from this region is a valuable source for different quality traits, biotic and abiotic stresses and for effective utilization of landrace diversity, the germplasm must be properly characterized, evaluated and screened. Some of the accessions can withstand the vagaries of climate and through phenotyping and other means climate ready genotypes could also be identified.

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