

**Genetic Resources
Progress Report 29**

Kharif Sorghum Germplasm Collection in Karnataka and Adjoining Areas

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KHARIF SORGHUM GERMPLASM COLLECTION IN KARNATAKA AND ADJOINING AREAS

K. E. Prssada Rao and V. Copal Reddy*

SUMMARY

1. Present world collection is seriously lacking in photoinensitive rainy (kharif) season sorghum landraces. There are very few pockets in South India where early kharif sorghums are cultivated among which Northern Karnataka and its adjascent areas are very important. Collection of sorghum landraces in this area became immediate concern in view of the importance of the material and also the serious threat they are facing on account of the spread of hybrids and improved varieties.
2. 'Bhogapura' (durra) is a popular landrace earliest of all with a duration of 90 days. The other early duration landraces are 'Surya haula', 'Ekranal', 'Muraganika jola', 'Kadubuni jola' and 'Jari jola'.
3. Majority of the samples collected in this mission belong to the race 'durra' with a wide range of variability and remarkably early in duration. Interestingly, 50 different local landraces and cultivars belonging to this race could be collected.
4. Limited number of pure guineas and bicolors were collected. Kafirs and caudatus are totally absent. *S. purpureosericeum* is the only wild sorghum noticed.
5. Landraces collected in this mission should be of use in sorghum improvement programs because of their agronomic superiority and earliness in a long day (kharif) season.
6. Samples collected in the severe drought areas of Anantapur, Bellary, Raichur, Gulbarga and Bidar districts may provide source material for drought resistance.
7. Dharwar and Belgaum districts are hot spots for sugary disease. Disease free samples collected from this area may provide useful material for sugary disease resistance.
8. Pop and sweet-stalk sorghums collected in this mission could be of special interest.

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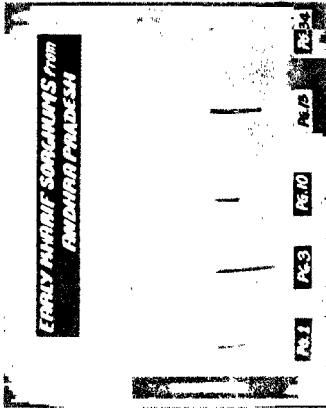


Fig. 1



Fig. 2

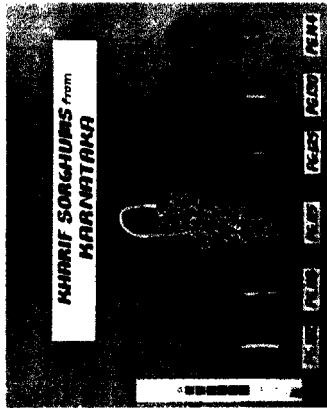


Fig. 3

Fig. 1. PG. 1 Vanakal am jonna
 PG. 3 Yerra jonna
 PG. 10 Tella jonna
 PG. 13 Patcha jonna
 PG. 34 Neeru jonna

Fig. 2. PG. 42 Sakkara guletka
 PG. 49 Kesari Jola
 PG. 53 Suryahaula
 PG. 55 Gida dimma jola
 PG. 61 Madyal jola
 PG. 88 Bhogapura

Fig. 3. PG. 102 Basavanna pada
 PG. 113 Kantivi jola
 PG. 115 Alluna jola
 PG. 125 Kharif Maidandi
 PG. 130 Jowari jola
 PG. 144 Murganikki jola

Dukka
 Dukka
 Dukka
 Dukka
 Dukka

Dukka-bafit
 Dukka
 Dukka
 Dukka
 Dukka
 Dukka

Dukka
 Dukka
 Ganche-dukka
 Dukka
 Dukka
 Dukka



Fig. 4

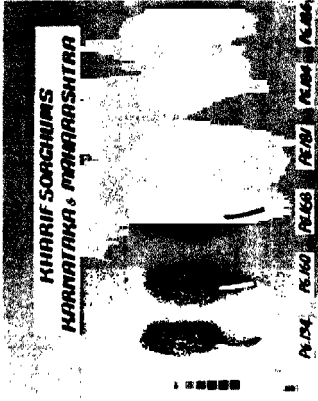


Fig. 5



Fig. 6

- Fig. 4.
- Pg. 63 Handibevar Jola
 - Pg. 69 Raichur Jola
 - Pg. 94 Mattur Jola
 - Pg. 98 Sadagar Mandya
 - Pg. 106 Gidda Kempu Jola
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- Fig. 5.
- Pg. 134 Sholapur local
 - Pg. 160 Jawari Jola
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 - Pg. 181 Tella kidiki
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- Fig. 6.
- Pg. 152 Ginigeri Jola
 - Pg. 154 Karsuni
 - Pg. 157 Gangawati
 - Pg. 166 Mangari Jola
 - Pg. 170 Gundu tenai
 - Pg. 178 Varadi Jola
- Duvva
Duvva
Duvva
Duvva-bicoLot
Duvva
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Fig. 7



Fig. 9

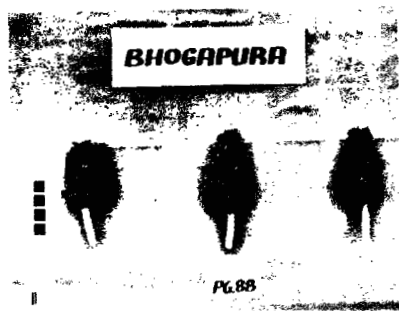


Fig. 8

- Fig. 7. PG. 138 Allina jola *Durra-bicolor*
 PG. 176 Dholijaki *Durra-bicolor*
 PG. 182 Pelala jonna *Guinea*
 PG. 183 Allu jonna *Guinea*
- Fig. 8. PG. 88
 "Bhogapura" a popular early kharif
 jowar of Karnataka.
- Fig. 9. PG. 185
S. purpureosericeum a para sorghum
 collected near Janwada village of
 Bidar district, Karnataka



Fig. 10



Fig. 11

Fig. 10. Local landraces being replaced by hybrids (CSI-5) at a faster rate

Fig. 11. PB. 111 "kareguni"
A sweet stalk sorghum with tan
plant colour

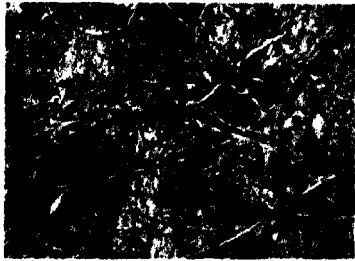
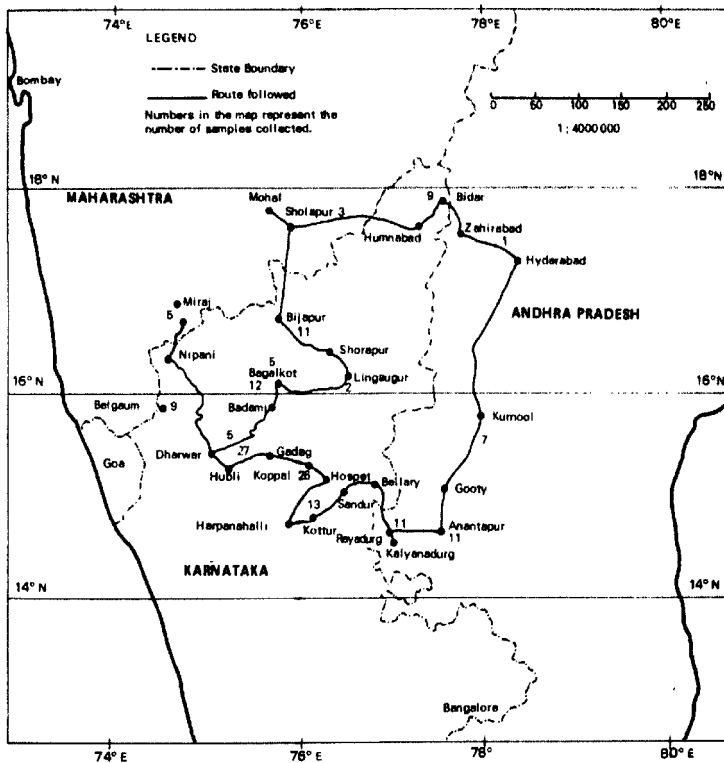


Fig. 12

Fig. 12. Sorghum grown in the rocky-red soils of Anantapur



Kharif Sorghum Germplasm Collection in Karnataka and Adjoining Areas - November 1960.

INTRODUCTION

An assessment of the present world collection of sorghum maintained at ICRISAT reveals that the majority of the germplasm constitutes either experimental accessions which are generally photo-insensitive or authentic indigenous races from tropical countries which are photosensitive. Most of the landraces assembled from tropical countries including India behave photoperiod sensitive when grown in a long day (rainy) season at Patancheru (17°27'N latitude) indicating the lacking of early insensitive types especially from India. Almost all the landraces collected from India are either late kharif or rabi types.

There are very few pockets in South India where early kharif types are cultivated among which Northern Karnataka and its adjoining areas are very important. These areas were not adequately collected in earlier missions and their valuable germplasm are facing severe threat from hybrids and improved sorghum varieties.

More landraces from this region may provide valuable source material for sorghum improvement programs particularly for earliness, probable resistance to drought (several areas are drought prone). They may also possess weathering resistance because of their maturity during rainy season.

PLANNING AND ORGANIZATION OF THE MISSION

In view of the importance of the material available in this area, a collection mission was organized to collect the traditional kharif landraces which are getting replaced by the new high yielding, uniform varieties and hybrids as research and extension activities are intensified. Planning and organization of the mission was made in consultation with Drs. R. Parameshwarappa, B.T.S. Shankar Gowda, Sorghum Breeders of University of Agricultural Sciences, Dharwar. The collection trip was planned for 14 days (20/11/1980 to 2/12,1980). The areas covered were Anantapur district of Andhra Pradesh; Bellary, Raichur, Dharwar, Belgaum, Bijapur, Gulbarga and Bidar districts of Karnataka and parts of Sholapur district of Maharashtra.

The collection team consisted of the following members of Genetic Resource Unit.

1. Mr. K.E. Praseeda Rao, Botanist
2. Mr. V. Gopal Reddy, Technical Assistant
3. Mr. Mahboob Ali, Driver-cum-General Assistant

The route followed, areas collected and number of samples collected are shown on the map. The mission was successful because of timely launching which enabled the gathering of useful information from the standing crop besides the collection of head samples.

AGRO-CLIMATIC CONDITIONS

The areas in this mission lie between 14°N and 18°N latitude. Soils are mainly red-sandy, red-loamy, occasionally medium black in Anantapur, Bellary, Bijapur, Gulbarga, Bidar and Raichur districts, pure black in Dharwar and Belgaum districts. Where soils are black with high moisture retention capacity, farmers take up a late kharif or rabi sorghum crop. In the red-sandy, red-loamy or medium black soils, farmers usually grow an early kharif sorghum crop which matures with the south-west monsoon rain. Average annual rainfall ranges between 518.1 mm (Bellary) to 1549.8 mm (Belgaum). The average monthly rainfall in various regions is shown in table 1.

Table 1: Average monthly rainfall record for the various areas of collection*

| Month | Bellary | Ananta- pur | Bijapur | Gadag | Raichur | Shola- pur | Gul- barga | Bidar | Belgaum |
|-------|---------|----------------|---------|-------|---------|---------------|---------------|-------|---------|
| Jan | 1.5 | 0.3 | 3.3 | 2.4 | 0.8 | 3.6 | 1.3 | 2.0 | 0.9 |
| Feb | 2.4 | 2.5 | 1.2 | 1.6 | 6.0 | 2.0 | 5.2 | 7.2 | 1.6 |
| Mar | 4.4 | 3.9 | 9.4 | 6.6 | 4.1 | 7.2 | 11.2 | 16.7 | 11.6 |
| Apr | 23.5 | 18.7 | 25.8 | 34.7 | 12.7 | 15.8 | 16.8 | 27.3 | 57.6 |
| May | 61.0 | 60.3 | 39.4 | 82.4 | 28.4 | 26.4 | 39.9 | 29.2 | 93.4 |
| June | 43.1 | 55.6 | 67.7 | 73.2 | 102.9 | 108.7 | 110.2 | 146.6 | 222.5 |
| July | 47.7 | 47.8 | 78.9 | 70.3 | 138.6 | 127.7 | 150.8 | 243.3 | 519.3 |
| Aug | 79.8 | 93.0 | 84.8 | 83.4 | 135.0 | 139.9 | 142.9 | 186.3 | 302.8 |
| Sept | 110.0 | 124.1 | 135.4 | 133.2 | 167.5 | 183.8 | 178.3 | 211.5 | 120.7 |
| Oct | 108.5 | 110.2 | 97.4 | 130.1 | 93.9 | 92.3 | 71.0 | 73.6 | 175.4 |
| Nov | 30.8 | 38.5 | 25.9 | 36.6 | 24.8 | 28.0 | 23.8 | 29.9 | 36.9 |
| Dec | 5.4 | 7.2 | 4.7 | 9.2 | 2.6 | 6.6 | 1.9 | 3.4 | 7.1 |
| | 518.1 | 562.1 | 573.9 | 663.7 | 717.3 | 742.0 | 753.3 | 977.0 | 1549.8 |

*Data obtained from climatological table of observatories in India (1931-1960)
India Meteorological Department, New Delhi - 1967.

In 1980, the Anantapur district of Andhra Pradesh, Bellary and Bidar districts of Karnataka experienced severe drought. Much of the sorghum area in these districts was not planted and, in areas where it was planted, the crop suffered from severe drought.

Sorghum is planted as a mixed crop in almost all the early kharif areas and the following are the common crop mixtures.

1. sorghum + groundnut + bajra + green gram + gingelly (sesame) + pigeonpea.
2. sorghum + groundnut + bajra + green gram + gingelly
3. sorghum + bajra + pigeonpea + gingelly + green gram + cowpea
4. sorghum + groundnut + pigeonpea
5. sorghum + groundnut + cotton
6. sorghum + bajra + cotton
7. sorghum + pigeonpea + green gram
8. sorghum + groundnut + green gram
9. sorghum + groundnut + horse gram
10. sorghum + gingelly + groundnut + pigeonpea
11. sorghum + cowpea + pigeonpea + gingelly
12. sorghum + pigeonpea
13. sorghum + groundnut
14. sorghum + cotton
15. sorghum + green gram

Sorghum + pigeonpea is the most popular mixed cropping followed.

COLLECTION OF SORGHUM GENPLAINS

The mission was just in time for collection of sorghum in several areas except it was bit late for the collection of early kharif types such as 'Bhogapura'. In areas where the crop was harvested, head samples were collected from farmer's field where the crop is staked after harvesting.

Crops and number of samples collected is listed below:

| Crop | Wild types | Head Samples | Farmers seed samples | Market samples | Total |
|--------------|------------|--------------|----------------------|----------------|-------|
| Sorghum | 2 | 148 | 3 | 4 | 157 |
| Pearl millet | - | 17 | 4 | - | 21 |
| Setaria | - | 3 | 6 | - | 9 |
| Eleusine | - | 2 | - | - | 2 |
| | | | | | 189 |

No wild sorghums were noticed in the area of collection except two accessions of *S. purpureosericeum* (para sorghum). The list and details of the collection are presented in appendix I and II.

All the accessions collected are authentic indigenous landraces except D-340 (PG-137) which is an improved variety locally called 'Gangavati' and one 'Anthur-Benth-r' a rabi variety (PG-120) developed by a progressive farmer. CSH-5 and CSH-1 are the most popular hybrids in this area which are spreading fast (Fig. 10).

Sorghum grain is generally used for the preparation of roti (unleavened bread) in this area. Most of the kharif sorghum landraces were planted in June and harvested in October. In some patches of Bellary district, the crops were planted in May and harvested in September. In Belgaum district, sorghum is grown as a late kharif crop where it is planted in July and harvested in December. In the present mission, special emphasis was given to the collection of early kharif types. The duration of these landraces ranged from 90 to 110 days.

VARIABILITY IN THE SORGHUM COLLECTION

The panicle shape and spikelet morphology of the samples were observed and recorded at the time of collection. The collected samples were classified into basic and intermediate races.

The collected samples belong to the following taxonomic races.

| Species / race | No. of samples collected |
|--|--------------------------|
| Para Sorghums (<i>S. purpureosericeum</i>) | 2 |
| Eu-Sorghums | |
| <i>Sorghum bicolor</i> (L.) Moench | |
| <i>ssp. bicolor</i> | |
| Race Durra | 135 |
| Durra-bicolor | 6 |
| Durra-kafir | 2 |
| Bicolor | 2 |
| Guinea | 2 |
| Guinea-durra | 1 |
| Not classified | 7 |
| | 157 |

Most of the landraces collected in the present mission belong to the basic race durra. Pure races of bicolor and guinea were also present to a vary limited extent. Pure races of kafir and caudatum are totally absent.

The variability in each race, the agronomic importance and other special features are discussed hereunder.

Durra

The durras collected in this mission showed a wide range of variability. Each landrace is easily distinguishable and carries a local name mostly based on its morphological characters and utilization. The 50 durra landraces were collected in this mission and their respective local names is listed below:

| S.No. | Local Name | No. of samples collected |
|-------|--------------------------------|--------------------------|
| 1. | Kempu jola (Red sorghum) | 13 |
| 2. | Bhogapura | 8 |
| 3. | Tella jonna (white sorghum) | 5 |
| 4. | Punasa jonna (kharif sorghum) | 5 |
| 5. | Mungari jonna (kharif sorghum) | 5 |
| 6. | Surya haula | 5 |
| 7. | Raichur jola | 5 |
| 8. | Ekranal | 5 |
| 9. | Bili jola (white sorghum) | 5 |
| 10. | Nandyal jola | 4 |
| 11. | Yerra jonna (Red jowar) | 4 |
| 12. | Mattur | 4 |
| 13. | Jowari jola | 4 |
| 14. | Gidda kempu | 4 |
| 15. | Patcha jonna (yellow sorghum) | 3 |
| 16. | Irala jonna | 3 |
| 17. | Gida dimma jola | 3 |
| 18. | Gangavati | 3 |
| 19. | Sholapur local | 3 |
| 20. | Gidda jola | 3 |

| S.No. | Local Name | No. of samples collected |
|-------|--|--------------------------|
| 21. | Pasara jonna (yellow sorghum) | 2 |
| 22. | Kesari jola | 2 |
| 23. | Allu jola | 2 |
| 24. | Sadagar Nandyal | 2 |
| 25. | Kanivi | 2 |
| 26. | Kharif | 2 |
| 27. | Chalo jola | 2 |
| 28. | Kar jola | 2 |
| 29. | Peeli jonna (yellow sorghum) | 2 |
| 30. | Vanakalam jonna (rainy season sorghum) | 1 |
| 31. | Neeru jonna | 1 |
| 32. | Lathvavani jonna | 1 |
| 33. | Kunti jonna | 1 |
| 34. | Kespu kesari | 1 |
| 35. | Nandibevur jola | 1 |
| 36. | Ayidukalasa | 1 |
| 37. | Kodimuruka | 1 |
| 38. | Mulagond | 1 |
| 39. | Bailhongal local | 1 |
| 40. | Shadbol | 1 |
| 41. | Gadda jola | 1 |
| 42. | Mura ganika | 1 |
| 43. | Kadabuni jola | 1 |
| 44. | Ginigeri | 1 |
| 45. | Karegumi | 1 |
| 46. | Gundu Tenai | 1 |
| 47. | Kamakala jola | 1 |
| 48. | Varadi jola | 1 |
| 49. | Tella kiddiki | 1 |
| 50. | Jingridukhi | 1 |
| | Local names could not be traced | 2 |

'Kempu jola' (Fig. 4, PG-161) have dark red pericarp and are without subocat. These are widely distributed throughout the tract and some of them are used in the preparation of a special kind of sweet. 'Bhogapura' (Fig. 8, PG-88) is a popular landrace earliest of all with a duration of 90 days from seed to seed. The other early duration landraces are 'Surya haula' (Fig. 2, PG-53), 'Ekranal', 'Muraganika jola' (Fig. 3, PG-144), 'Kadabuni jola' and 'Jari jola'.

'Patcha jonna' (Fig. 1, PG-13), 'Pasara jonna', 'Peeli jonna' (Fig. 5, PG-184) are those with yellow pericarp. Gada dimma jola (Fig. 2, PG-55) and Raichur jola (Fig. 4, PG-69) are highly priced for their grain quality. 'Allu jola' is a popping type. 'Nandyal' (Fig. 2, PG-61) are agronomically superior with good head size and maximum grain number per panicle. 'D-340', a named cultivar locally called as 'Gangavati' (Fig. 6, PG-157), is very popular in Bijapur and Dharwar districts.

'Kharif Maldandi' (Fig. 3, PG-125) is a photoperiodinsensitive, medium tall, converted version of rabi Maldandi which is photoperiod-sensitive and tall. This could have come by chance selection of a photoperiodinsensitive segregate from the Maldandi variety when grown in kharif (long day) season. However, this cultivar is similar to Maldandi in all other respects.

