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Research Article

DIVERSITY AND UTILITIES OF SORGHUM IN TRIBAL AREAS OF KHANDESH REGION (MAHARASHTRA), INDIA

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ABSTRACT

The present authors surveyed tribal area of Khandesh region since May-2008 with particular emphasis on agro-biodiversity and home-stead gardens. Sorghum [*Sorghum bicolor* (L) Moench] one of the staple food of the tribal. During the course of investigation various features were recorded. The characteristics such as height, no. of nodes, internode length, shape size of ears, grain colour and other tribal perceptions have been noted with due care. Agricultural practices and some special utilities of the total 25 sorghum varieties are also recorded. All these features are comparatively discussed with a view to bring out better qualities of the local sorghum varieties.

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INTRODUCTION

Sorghum [*Sorghum bicolor* (L) Moench] landraces are cultivated in tribal region of khandesh [M.S] by different communities since ancient times. Local cultivars of Sorghum are rich sources of resistance to diseases, pathogens and also to drought, high temperature, less fertile soil etc. They also act as source of traits to improve food, animal feed and provide nutritional security to the tribal population in this region. However sorghum landraces (Local cultivars) diversity is under severe threat due to loss of habitat, adoption of cash crops, like cotton and soya bean. As sorghum is staple crop to many tribal communities in this region, the accumulated genetic diversity needs to be collected for conservation and utilization in crop improvement programmes, an attempt has been made to collect and document the available local cultivars from tribal region of Khandesh. The present authors therefore extended their observations in tribal areas of Khandesh, the result of which being communicated in this paper.

Characteristics of Study Area

Khandesh is located in north-western part of Maharashtra. It comprises present Dhule, Nandurbar and Jalgaon districts of Maharashtra state. Dhule was know as the West Khandesh whereas Jalgaon was know as East Khandesh until. 1906. Later

on Dhule district was bifurcated into Dhule and Nandurbar districts separately on 1st July, 1998. The Khandesh region lies between 21^o 04' N latitudes and 74^o 49' E longitude [Dhule 20^o 58' N latitude and 74^o 47' E longitude, Jalgaon 21^o 05' N latitude and 75^o 40' E longitude while Nandurbar 21^o 23' N latitude and 74^o 19' E longitude] Khandesh is bounded on North by, Madhya Pradesh from North, Buldhana district from East, Nasik, Aurangabad and Jalna districts from South and Gujarat state from West. There are eleven tribal tehsils Raver, Yawal and Chopda are the tribal tehsils of Jalgaon district, Sakri and Shirpur are the tribal tehsils of Dhule district. While in Nandurbar [it is tribal district] Nandurbar, Taloda, Shahada, Nawapur, Akkalkuwa and Dhadgaon are the tribal tehsils. Tribal population is dominated by Pawara kokni, Bhil, Tadvi, Barella and few others.

METHODOLOGY

The agricultural surveys are carried out in Khandesh since 2008 as an exclusive topic of research. The data is accrued after frequent visits and discussions with the tribal farmers. Data of local /folk sorghum varieties is obtained with reference to local name, botanical characteristics, local uses of crop and special features such as crop yield, soil and irrigation needed, need of fertilizers and pesticides, market value etc. The plant

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specimens or their parts/ grains are collected. Personal field observations were made. The methodologies to tap indigenous knowledge as suggested by Jain (1989) have been followed to tap the information from tribal farmers. Various utilities and agricultural characteristics of folk varieties are provided under results and observations. Table I provides plant features of each variety.

RESULTS AND OBSERVATIONS

1. **Cultivar: Satpani:** a) The grains are nutritious used for preparing bread and papad. b) cultivated in Kharif season c) grains are grounded into flour and used to prepare bread d) most popular variety of Chopda, Shirpur tehsils e) cultivated in black soil, heavy rainfall / irrigation is needed f) good market value g) crop yield - 10 - 12 quintals / acre h) market value Rs - 1000 - 1200 / quintal i) fodder yield is also better, cherished by animal. j) seed colour - yellowish
2. **Cultivar: Mani Jawar:** a) Cultivated in Kharif season b) drought resistant variety preferred in drought region, requires less rainfall c) variety grown well in all types of soil d) used to prepare bread e) housewives mix grains and prepare kalan [i.e. flour prepared by using mixed grains and pulses] f) persons suffering from piles prefers this variety as safe diet g) straw [green and dried] very nutritious for cattle, increases milk yields / hence some farmer cultivate especially for fodder h) crop is cultivated throughout the tribal region of Khandesh along with rural area. i) seed colour - dull white
3. **Cultivar: Burda:** a) Cultivated in Karif and rabbi season b) mostly cultivated in Yawal and Raver tehsils, on very small scale c) grown in black soil, requires heavy rainfall or heavy irrigation d) immature ears roasted and grains are consumed e) grains are not used for bread making f) the grains are not sold in market stored for sowing g) good fodder value h) seed colour - white
4. **Cultivar: Lal – Chikani:** a) Cultivated in Karif season b) mostly cultivated in tribal tehsils c) grown in all types of soil d) grow in drought condition, proper irrigation gives good yield e) disease resistant variety, chemical fertilizers, pesticides or insecticides are not needed/used f) the variety is cultivate especially for the purpose of papad preparation g) cultivated for green fodder only. Dry straw (fodder) not cherished by cattle being hard h) straw used for domestic fuel & aslo used for making compartments for fodder storage i) seed colour - reddish.
5. **Cultivar: Gavran mothijuwar:** a) Cultivated in Shahada, Akkalkuwa tehsil kharif season crop c) grow in black and fertile soil requires heavy rainfall d) variety used for bread making (as staple food) throughout the year e) good fodder value f) seed colour - whitish
6. **Cultivar: Dhani:** a) Mostly cultivated in kharif season b) it is largely cultivated in Chopada & Raver tahesils c) the variety is cultivated in rich fertile black soil, it requires regular irrigation d) the variety is cultivated for popcorns (lahya) preparation. Popcorns produce is sold in same hamlets (Pada). Popcorn is also offered locally to Goddess e) the variety is not used for fodder. f) the grains are not sold in market i) seed colour - whitish.
7. **Cultivar: Dudh Mogara:** a) The variety is cultivated in Kharif and Rabbi season b) it is largely cultivated in Shahada, Navapur and Taloda tahesil c) high yield and disease resistant variety d) variety requires Black, fertile soil e) it requires heavy and regular irrigation also this variety needs chemical fertilizers f) immature ears are roasted and grains are consumed g) variety is highly nutritious h) variety is used multi - purposely that is for stapple food, popcorn , papad preparation etc. i) variety having higher economic value (Market value) j) grains are heavy in weight compared to other varieties and hence cultivated largely for higher yield k) variety is also having good fodder value. The “Straw bundles” sold in rural markets l) seed colour - white.
8. **Cultivar: Mothali / Mothi Jwari:** a) It is cultivated in Dhadagaon tehsil b) the variety is suitable to cultivate in hilly areas, grown in poor soil, preferred in draught region, requires less rainfall c) chemical fertilizers are not required d) it is cultivated in kharif season e) grains are consumed as staple food by tribal community f) the grains are not soled in market g) variety having good fodder value, cherished by animals h) seed colour - whitish.
9. **Cultivar: Mothi Chikani:** a) The variety is cultivated in kharif season b) it is cultivated in Shirpur, Chopada, Dhadagaon Tahsil c) the variety grows in poor soil d) the variety is drought resistant, requires less rainfall e) the variety is used for bread making, in preperation of papad, sweet balls (ladu) & Khichadi f) variety is having less fodder value g) straw is affected by red-rot disease h) the variety is also used as / cultivated as inter crop with tur (*Cajanus cajan*) i) seed colour - whitish red.
10. **Cultivar: Phekari:** a) The variety is cultivated in Kharif as well as in Rabbi season b) mostly cultivated in Sakri & Navapur tribal belt c) grown in poor soil d) The ear is largely spreading (sparse) so called ‘phekari’ e) less food and fodder value f) straw is used for compartments which used for storing fodder also used for making earthen partition wall of huts g) generally planted around hut as hedge h) variety has less market value i) seed colour – yellowish.
11. **Cultivar: Motichur:** a) It is cultivated in kharif season b) the variety is cultivated in Sakri and Nandurbar tehsil c) it is cultivated in black fertile soil d) planted on the field margins e) late coming variety f) used for bread making g) straw cherished by cattle h) variety has good market value i) requires regular irrigation. j) seed colour - yellowish.
12. **Cultivar: Dhavi-chikani:** a) Cultivated in kharif season b) the variety is cultivated in Dhadgaon Shirpur Shahada tehsils c) cultivated in all types soil d) variety grows in heavy or scanty rainfall e) the grains used to prepare bread & papad. f) fodder with

- sweet taste nutritious for cattle g) fodder is demanded for milking cattle h) also cultivated as intercrop. i) seed colour - whitish.
13. **Cultivar: Menki Jawar:** a) It is a kharif crop b) the variety is cultivated in Sakri Navapur & Akkalkuwa tahesils c) variety requires well drained soil and poor rainfall d) The grains are specially used to prepare ghata (salted slurry) also used as a staple food e) variety has good fodder value f) crop yields 4-5 quintals / Acre g) market value Rs 800-900/- quintal h) Inflorescence axis bends at maturity due to weight of ear hence the name 'Menki' i) seed colour - yellowish white.
 14. **Cultivar: Mishra Jawari:** a) The variety is cultivated in kharif season b) it is commonly found in the Taloda tehsil c) the variety is sown as mixed crop hence the name d) variety requires black fertile soil e) single plant sprouts 12-16 lateral branches which bear apical spikes f) less food value rarely used to prepare bread g) good fodder value h) seed colour - yellowish.
 15. **Cultivar: Dhawal Juwar:** a) It is cultivated in Chopda & Raver tehsils b) it is cultivated in Kharif season c) it requires black, well drained soil d) used as staple food e) good fodder value f) the grains kept in water are feed to cattle as 'Dan' g) it is also cultivated as intercrop in 'Tur' immature ears are roasted and cherished by tribals h) late coming variety i) good market value j) seed colour - whitish.
 16. **Cultivar: Fatfati:** a) Cultivated in rabbi & kharif season b) the grains are used in papad and popcorn preparation c) cultivated in poor soil d) the grains are rarely used for bread making e) in rabbi season it is cultivated for green fodder f) it is cultivated as intercrop with tur and other pulse crops g) the variety is not cultivated in large scale h) seed colour - whitish.
 17. **Cultivar : Fiskari:** a) It is cultivated in kharif season b) it cultivated in Sakri, Nandurbar tehsils c) cultivated in poor soil d) the disease resistant & drought resistant variety e) it is cultivated for fodder productions f) The grains are poor in quality not used as staple food but grains are stored /preserved for next season. g) suitable for any type of soil h) it is also planted on field as borders for protection of the crops i) the straw useful for making compartments. j) seed colour - yellowish.
 18. **Cultivar : Gundya / Gundo Jawar:** a) The variety is cultivated in Chopda and Yawal tehsil b) it is cultivated in kharif season c) the variety requires black well drained, fertile soil d) variety requires heavy rain fall e) the grains are nutritious the yield is used domestically not sold in market. Grains are used as staple food f) good fodder value being sweet g) fodder largely demanded from rural area h) seed colour - dull white.
 19. **Cultivar: Adchi :** a) The variety is cultivated in Kharif season b) it is mostly cultivated in the hilly region of Sakri tehsil c) the variety is drought resistant, suitable for less fertile soil d) variety does not require chemical fertilizers e) variety is having good taste so demanded variety of the region f) it is used for staple food and also for papad and popcorn preparation g) variety is having good fodder value h) seed colour - yellowish.
 20. **Cultivar: Dadar:** a) The variety is cultivated in Shirpur, Chopda, Yawal, Sakri, Shahada, Nandurbar, Taloda, and Navapur tehsils. It is drought resistance variety b) it is a cultivated in rabbi season c) the variety requires black fertile soil d) crop grows in scanty rainfall e) variety used multi-purposely i.e. for staple food, popcorn and papad preparation f) the grains are nutritious, the variety having higher economic value, having demands from rural and urban area g) persons suffering from dysentery and piles, are advised to consume bread prepared from this variety h) variety having good fodder value, cherished by animals. The straw bundles sold in rural markets i) seed colour-yellowish.
 21. **Cultivar: Badijuwari:** a) Cultivated in kharif season b) The variety is cultivated in Akkalkawa and Taloda tehsils c) the variety requires well drained, fertile soil d) it is drought resistant variety e) grains are consumed as staple food f) the grains are crushed and offered to cattle g) variety is having good fodder value, some farmers cultivated it for fodder use h) it is late coming variety i) seed colour- white.
 22. **Cultivar: Bhali /Bhalori:** a) The variety is cultivated in Kharif season b) duration of crop is -3-3.5 month c) variety is cultivated in Navapur and Sakri tehsils d) variety requires good and black, fertile soil e) heavy rainfall/irrigation is needed d) the/grains are used to prepare bread, good nutritional value also used to prepare papad e) variety is having good fodder value f) seed colour -yellowish.
 23. **Cultivar: Dohri juwar:** a) the variety cultivated in Kharif season b) it is cultivated in Akkalkawa and Toloda tehsils c) the variety is requires well black and fertile soil d) needs heavy irrigation e) grains are used to prepare bread and papad f) variety is having good fodder value g) the variety is cultivated for fodder by some farmers, no marketing of the yield h) seed colour -whitish
 24. **Cultivar: Contoli:** a) The variety is cultivated in kharif season b) the variety is cultivated in Raver and Yawal tehsils c) it is cultivated in poor fertile soil, requires less irrigation it is drought resistant variety d) it is used to prepare bread and papad. e) the variety is having good fodder value, cherished by cattle f) the variety is also cultivated as a intercrop with soybean and *Cajanus cajan*. g) in rabbi season the variety is cultivated for fodder use h) no marketing of crop /yield i) seed colour -dull white.
 25. **Cultivar: Gari:** a) Cultivated in kharif season b) cultivated in black soil, heavy rainfall /irrigation is needed c) cultivated in Shirpur and Chopda tehsils. d) the grains are nutritious largely cultivated for staple food to prepare bread e) good fodder value cherished by cattle f) late coming variety g) seed colour - whitish.

Table-I Botanical Characteristics of Local Cultivars of Sorghum [*Sorghum bicolor* (L.) Moench]

Sr. No.	Name of Cultivar	Crop Duration (Months)	Height of Plant (Ft.)	No. of Nodes	Length of Internode (In.)	Length of Leaf (In.)	Width of Lamina (In.)	Ear		Grain	
								Length (In.)	Shape	Compact/ Sparse	Colour
1	Satpani	3	13-Dec	13-14	7-7.5	40	4	9-Aug	Oval	Compact	Yellow white
2	Mani juwar	3	5-8.5	12-Nov	3.5-7	27-37	2.75-3	10-Jul	Elongated	Compact	Dull white
3	Burda	3-3.5	12-Oct	11-Sep	6-May	40-42	2.5-3	10-Aug	Oblong	Sparse	Yellow
4	Lal Chikani	4	7.5-8	15-Dec	5.5-8	25-42	2.5-3	10-Aug	Oblong to oval	Compact	Reddish to red
5	Gavran Mothi Juwar	3	13-Dec	15-17	7-Jun	40	4	9-Aug	Oblong	Compact	Yellow white
6	Dhani	3	10-Aug	10-Jul	7-Jun	38-40	3-Feb	14-16	Oblong	Sparse	Dull white
7	Dudhmogra	4	12-Oct	16-Dec	14-Nov	42-44	3-Feb	17-17.5	Oval	Compact	Bright white
8	Mothali/ Mothi Jawari	4	10-Jul	9-Aug	8-Jun	38-41	2.3-3	8-Jul	Oblong	Compact	White
9	Mothi Chikani	4-Mar	13-15	15-Dec	12.5-13	32-33	2.5-3	11-Oct	Oval	Compact	Golden yellow
10	Phekari	4	14-Dec	14-Oct	8-May	40-43	3	18-19	Elongated	Sparse	White
11	Motichur	4	10-Sep	10-Aug	7.5-8	36-38	2.5-3	16-17	Oval	Sparse	Yellow
12	Dhavi Chikani	3.5-4	10-Aug	10-Sep	7-Jun	35-40	4-Mar	6-May	Oval	Compact	Milky white
13	Menki Jawar	4-4.5	10-Aug	13-Nov	8-Jul	40-42	4	6.5-7	Oblong	Compact	Fairly white
14	Mishra Jawari	4-Mar	8-Jul	11-Oct	5-6.5	28-28.5	1.5-2.5	8.5-12	Oblong	Sparse	Red
15	Dhawal Juwar	4	10-Aug	9-Aug	6-May	40-42	3-Feb	9-Jul	Oblong	Sparse	White
16	Phatfati	5-Apr	10-Aug	12-Oct	7-7.5	25-31	2.5-2.7	6-May	Oval	Compact	White
17	Fiskari	5-Apr	5.5-6	11-Sep	7-8.5	34-36	2.7-3.5	6.8	Oval	Sparse	White
18	Gundya/ Gundo Jawar	4-Mar	10-Sep	11-Aug	7-May	39-41	2.5-3	11-Sep	Oblong	Sparse	Dull white
19	Adchi	4	11-Oct	11-Sep	9-Aug	28-30	1.5-2	6-May	Oblong	Compact	Whitish
20	Dadar	3-3.5	10-Aug	11-Oct	13-Oct	28-30	3.5-4	8-Jul	Oval	Compact	White
21	Badi Juwari	4	10-Sep	13-15	7-7.5	45-56	3.5-4	11-Oct	Oval	Compact	White
22	Bhali/Bhalori	3-3.5	8-Jul	10-Aug	6/5/2007	22-27	2.75-3	9-Aug	Oval	Compact	Yellow
23	Dohri Juwar	4	7-7.5	8-Jul	9-Aug	35-40	3.14-3.54	7-Jun	Oval	Compact	Dull white
24	Contoli	3	5-Apr	7-Jun	3.3.5	35-42	2.48-2.55	7-May	Oblong	Compact	Reddish White
25	Gari	3-3.5	7-Jun	9-Aug	7-Jun	28-33	3.5-4	8-Jul	Oval	Compact	Whitish

DISCUSSION AND CONCLUSIONS

Sorghum bicolor (L.) Moench Sorghum is the 5th most important cereal crop in the world. There are five basic races viz., bicolor, guinea, caudatum; durra and kafir (cf. Seetharama et al., 2007; Harlan and de Wet, 1972). Large number of landraces are found worldwide. It was domesticated in different parts of Africa. The earliest carbon-dated archaeological records is from Nabta Playa in Southern Egypt, close Sudan. Indian subcontinent is the secondary origin of sorghum. Its cultivation was discovered at Saurashtra dating back to about 4500 years, probably brought to India from eastern Africa during the first millennium B.C. (cf. Seetharama et al., loc. cit.). It is generally cultivated in dry and hot areas (38-40^o C) with an average annual rainfall of 400 -750 mm and mostly grown in Maharashtra, Madhya Pradesh, Karnataka, Andhra Pradesh, Gujarat and Tamil Nadu. Area under cultivation in India decreased but production level especially during 2003 was nearly similar to early 1970s. This is largely attributed to adoption of improved varieties and hybrids (cf. Seetharama et al., 2007). This situation warrants decrease in the local races, varieties or landraces. This is an alarming situation and threatens for plant genetic diversity.

Being one of the important crop species, sorghum have been studied extensively worldwide in view of agrobiodiversity w.r.t. diversity, conservation, distribution, classification on evolutionary dynamics, traditional utilities, germplasm collection and conservation, crop improvement, and resource management (cf. Elangovan, 2005; 2007; Elangovan et al., 2005; Grenier et al., 2004; Harlan and de Wet, 1972; Murty and Kumar, 1975; Seetharama et al., 2007; Harlan, 1975; Fuller et al., 2004; Rachie, 1975; Teshome et al., 1997; Appa Rao et al., 1999, Tunstall et al., 2001; Abdi et al., 2002; Prasada Rao et al., 1995; Gopal Raddy et al., 2002; 2006; Pandravada et al., 2013; de Wet, 1977).

However, the region of Khandesh has remained largely untapped on this line of research. The present author surveyed diversity of sorghum in Khandesh and documented as many as 25 local varieties (Table-1). Various characteristics such as height of the plant, no. of nodes, internode length, shape and size of ears, grain color, season, soil type, market value, fodder value, local utilities and perceptions of tribal farmers on various aspects. These varieties / landraces are, however, rarely observed in non-tribal areas of Khandesh. Sorghum has diverse uses. Grains are traditionally used as whole, meal flour and milled fractions. The formers is used for making roti or bhakri, and gruel, bread, idli, dosa, ponganum, papad, badi, kurdigai, etc. Sorghum grains can be popped and used for preparing beer, alcohol confection, sweet meet, etc. Some races or varieties have good demand for fodder and feed. Leaves and stalks are useful for papermaking. Stalks are useful for making plywood as it has better content of cellulose. Red pigment of grains is used in lipstick, shampoo and candy (cf. Seetharama et al., 2007). In Khandesh region, it is used for making bread (bhakri) papad, popcorn, roasted immature ears, sweet balls (ladu), khichadi, salted slurry (ghata), etc. Generally stalks of all races are used as fodder, however, few ones have better value, being sweet. One of the preparation viz., popped grains should be promoted for commercial purpose It can fetch better income for these tribals. Sorghum grains contain protein, fat, carbohydrates, calcium, phosphorus, iron and majority of amino acids, (Pomeranz, 1987). Sorghum, in general, is multipurpose and fair nutritional contents. It has deeply rooted traditional uses and has better scope for industrial applications. In non-tribal areas, hybrid sorghum is mostly favored but over-all its production is still favoured.

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