Cultivated Grasses and their Wild Relatives in Andhra Pradesh and Their Conservation Concerns

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The study was carried out during 2007-2009. The information on the crops was collected from primary sources with the help of a planned and structured interview schedule in three regions of Andhra Pradesh. There are 65 wild relative grass species belonging to 18 genera of 24 cultivated grasses in Andhra Pradesh. Commercial grasses are represented maximum with 11 grasses and 23 wild relative species, which is followed by small millets with 7 species and 22 wild relatives, millets with 2 crop species and 12 wild relative species, cereals with four cultivated crops species and 8 wild relatives. Out of all *Panicum* having maximum of 10 wild relatives followed by bamboo (9) and *Cymbopogon* (9), *Pennisetum* (7), *Oryza* (6), *Sorghum* (5) and *Setaria* (5), *Zea* (2) and 4 crops showed minimum with one wild relative each. The wild relatives of Andhra Pradesh, particularly those occurring in the Eastern Ghats zone have narrowed distributional. Systematic efforts must be taken to conserve these wild relatives through *in-situ* means.

Key Words: Conservation concerns, Grasses, Wild relatives

Introduction

The Indian gene centre harbors about 166 species of native cultivated plants. The crops with primary, secondary and regional centers of diversity represent a part of native and introduced species which account for over 480 species (Nayar *et al.*, 2003). Wild relatives are an important genetic resource on which the sovereign rights exist for a country in the post-Convention on Biological Diversity (CBD) regime. The crop wild relatives are an important genetic resource gaining significance in crop species (Arora, 1996). The cultivated grass species are derived from centre of diversity from areas of cultivation. They are developed through different breeding methods *viz.*, pure line selections, mutants, polyploids and inter-generic/inter-specific hybrids. They are also directly selected as good performance for specific and/multiple traits (may not be yield superior). The wild relatives of crop plants constitute a part of the crop genepool, and posses a big reservoir of untapped genes that have potential to be utilized in crop improvement programmes. The wild relatives and distantly related taxa occurring in developing countries have contributed significantly towards improvement of major crop species (Witt, 1982). Identification and utilization of a single gene of importance has played a major role in crop improvement. In India, 80% of cultivated area is under food crops, of which rice covers about 30%, millets 28% and wheat 15%. Minor millets account for less than one per cent of the food grains produced in the world today (FAO, 1999). Cereals and millets were popular in the Andhra Pradesh region for hundreds of years and remained a staple food for a long time. Thus they are not important in terms of India food production, but they are essential as food crops in their respective agro-ecosystems. They are mostly grown in marginal areas or under adverse agricultural conditions where major cereals fail to give sustainable yields.

Andhra Pradesh is the fifth largest state in India with an area of 275,068 km^2. The state has 23 districts which are grouped into three zones *i.e.*, Circar or Coastal Andhra comprising the districts of Srikakulam, Vijayanagaram, Visakhapatnam, East Godavari, West Godavari, Krishna, Guntur, Prakasam and Nellore, Rayalaseema region consists of Kurnool, Kadapa, Anantapur and Chittoor districts and Telangana region includes Adilabad, Hyderabad, Karimnagar, Khammam, Mahbubnagar, Medak, Nalgonda, Nizamabad, Rangareddy and Warangal districts.

Andhra Pradesh state constitutes a total of 2,601 species belong to 1,035 genera and 173 families of angiosperms, 4 species of gymnosperms, 72 species of pteridophytes (Pullaiah and Karuppusamy, 2007). Of the 2,601 angiosperms species, 531 are tree taxa species

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(representing 245 shrubs, and 290 climbers), 1,972 dicotyledons species and 674 monocots species. The ratio of monocot to dicot families is 1:4 (34:139 families). The genetic resources of wild relatives of 73 major cultivated crops belonging to crop-groups of cereals, small millets, pulses, oilseeds, vegetables, tubers, fruit crops and spices in Andhra Pradesh are represented by 71 genera and 203 species of 36 plant families. In which, Poaceae is represented maximum with 13 genera and 34 species (Pandravada *et al*., 2008).

Materials and Methods

The present study was carried out during 2007-2009 as part of research work on "Quantitative Assessment and Mapping of Plant Resources of Eastern Ghats". The information on the crops was collected from primary sources with the help of a planned and structured interview schedule. Farmers were randomly selected from Coastal Andhra, Telangana and Rayalaseema regions of Andhra Pradesh. In each selected village, 10 per cent households were randomly selected for interview. The farmers and respondents were interviewed thoroughly and their statements were recorded in the interview schedule. A quadrate of 5×5m was layout for enumerate shrubs and herbs were recorded from 1×1m quadrates. All the taxa were identified upto species level by using available state, regional and local floras (Gamble and Fischer, 1915-1935; Ellis, 1987; Pullaiah, 1997; Pullaiah and Alimoulali, 1997; Pullaiah and Chennaiah, 1997). The wild relatives of crop plants were recorded and specimens were made into herbarium following standard methodology and finally validated through reference material at the herbarium of Botanical Survey of India (BSI), Coimbatore.

Results and Discussion

In Andhra Pradesh, 24 grass species are cultivated which belong to the different crop groups of cereals, millets, small millets and commercial grasses. There are 65 wild wild relative grass species belongs to 18 genera of 24 cultivated grasses exists in the state (Table.1). Among the group, commercial grasses are represented maximum with 11 grasses and 23 wild relative species, which is followed by small millets with 7 species and 22 wild relatives. The millets with minimum 2 crop species and 12 wild relative species. The cereals showed 4 cultivated crops species and minimum with 8 wild relatives. *Panicum* has maximum 10 wild relatives followed by *bamboos* (9) and *Cymbopogon* (9), *Pennisetum* (7), *Oryza* (6), *Sorghum* (5) and *Setaria* (5), *Zea* (2) and four crops showed minimum with one wild relative (Table 2).

Table 1. Status of diversity in wild relatives of cultivated grasses in Andhra Pradesh

Crop group	No. of cultivated grasses	Diversity in wild relatives	
		No. of genera	No. of species
Cereals	4	5	8
Millets	2	2	12
Small millets	7	5	22
Commercial grasses	11	6	23
Total	24	18	65

Table 2. Diversity of cultivated grasses (bold) and their wild relatives, chromosome number/genome, common and local names

Species	Chromosome number/genome	Common name	Local name
Oryza sativa L.	2n=24 AA	Rice	Vari, Vadlu
Hygroryza aristata (Retz.) Nees ex Wight & Arn.	2n=24		
Leersia hexandra Swartz.	2n=48, 2n=4x=60	Southern cut grass	
*Porteresia coarctata (*Roxb.) Tateoka	2n=48		
O. officinalis Wall. ex Watl. ssp. malampuzhaensis (Krish. et Chandr.) Tateoka.	2n=24, 2n=4x=48 GG		
O. meyeriana (Zollin. & Mor.) Baill. ssp. *granulata* Tateoka.	2n=24 GG		
O. rufipogon Griff.	2n=24, AA		
Triticum aestivum L.	2n=6x=42, AABBDD	Wheat	Godhumalu
Triticum dicoccum L.	2n=4x=28, AABB	Wheat	Godhumalu
Zea mays L.	2n=20	Maize, Corn	Mokkajonna
Tripsacum laxum Nash.	2n=72		
Chionachne koenigii (Spr.) Thw.	2n=20		
Pennisetum glaucum (L.) R.Br.	2n=14	Pearl millet	Sajjalu, saddalu
Pennisetum americanum (L.) Schum.	2n=14		
P. clandestinum Hochst. ex Chiov.	2n=36		
P. hohenackeri Hochst. ex Steud.	2n=18		

Table 2. Contd.

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Species	Chromosome number/genome	Common name	Local name
P. pecidellatum Trin.,	2n=14		
P. polystachyon (L.) Schult.	2n=36		
P. purpureum Schum.	2n=14		
P. setosum (Sw.) Rich.			
Sorghum bicolor (L.) Moench	2n=20	Great millet	Jonna
S. deccanense			Gaddijanu, gaddi jonna
S. halepense (L.) Pers.	2n=40		
S. nitidum (Vahl) Pers.	2n=40		
S. subglabrescens (Steud.) Schweinf. & Asch. var. *rubidium* (Burkill ex Benson)			
Echinochloa colonum (Linn.) Link	2n=36	Shama millet	Ooda gaddi, Bontha gaddi
Echinochloa frumentacea Link			Bonta Shama, Sawa, Hamalu
E. crus-galli (Linn.) P. Beauv.	2n=4x=54		Pedda windu
E. oryzoides (Ard.) Fritsch.			
E. picta (Koenig) P.W.Michael.			
E. stagnina (Retz.) P. Beauv.			
Eleusine coracana (L.) Gaertn.	2n=4x=36 AABB	Finger millet	Ragi, ragulu, chodulu, thaidalu
E.indica (Linn.) Gaertn.	2n=18 AA		
Panicum milaceum L.	2n=4x=36	Proso millet, Common millet	Warigalu, barigalu
Panicum sumatrense Roth. ex Roem et Schult.	2n=40		Gangasamalu, samalu,Chamalu
P. brevifolium L.	2n=18		
P. fischiri Bor.			
P. maximum Jacq.	2n=32		
P. milare L.	2n=40		
P. notatum Retz.	2n=36		
P. paludosum Roxb.	2n=54		
P. psilopodium Trin (related to *P. milare*)			
P. repens L.	2n=18,4x=36		Ladda gaddi, hasi gaddi
P. trypheron Schult.	2n=42		
P. walense Mez.	2n=36		
Paspalum scrobiculatum L.	2n=40	Kodo millet	Arikelu, aarkalu, nitari gaddi
P. canarae (Steud.) Veldk.			
P. paspaloides (Michx.) Scribner.	2n=20		
Setaria italica (L.) P. Beauv	2n=18	Foxtail millet, Italian millet, German millet, Hay millet	Korralu
Setaria intermedia Roem. & Schult.	2n=36		Arranki gaddi
S. palmifolia (Koen.) Stapf.			
S. paniculifera (Seud.) Fourn. ex Hems.	2n=34		
S. pumila (Poir.) Roem. & Schult.	2n=18,4x=36	Kavetta grass	Nakkathoka gaddi, chinna korralu
S. verticellata (L.) P. Beauv.	2n=18	Bristyl fox tail	Chiklenta gaddi
Bambusa arundinacea (Retz). Roxb.	2n=72	Thorney bamboo	Mulla veduru, mulla bongu
B. bambos			
B. tulda Roxb.	2n=70		
Dendrocalamus strictus (Roxb).Nees.	2n=72	Hard bamboo, solid bamboo	Veduru, sanna veduru, pillanagrovi veduru
D. membranous			
D. hamiltonii			
D. giganteous			
D. longispathus			
D. hookeri			
Desmostachya bipinnata (L.) Stapf.			Sadanapu veduru
Coix lacryma-jobi L.	2n=30	Job tears	Golugulu, gulbay gaddi
Coix aquatica Roxb.	2n=10		
C. gigantea Koenig ex Roxb.	2n=40		
Cymbopogon flexuosus Stapf.	2n=20	Lemon grass	Nimmagaddi
Cymbopogon citratus Stapf.	2n=60	Lemon grass	Nimmagaddi, vasana gaddi
Cymbopogon martini (Roxb.) Wats	2n=20	Palm rose	Nimma gaddi
Cymbopogon nardus (L.) Rendle.			
C. caesius (Hook. f.) Stapf.			Kasi gaddi
C. coloratus (Hook. f.) Stapf.			Boda gaddi

Table 2. Contd.

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Species	Chromosome number/genome	Common name	Local name
C. flexuosus (Nees ex Steud.) Wats. var. flexuosus.	2n=20	Malabar lemongrass, ginger grass	
C. gidarba (Ham. ex Steud).	2n=20, 4x=40		Adavi kanchi, seetha kasigaddi, thigavomigaddi
C. jwarancusa (Jones) Schult.	2n=20		
C. nardus (L.) Rendle. var. confertiflorus (Steud) Staf.			
C. nardus var. naruds	2n=40	Citronella grass	Ganjini
C. schoenanthus	2n=20		
C. winterianus	2n=20		
Saccharum officinarum L.	2n=80	Sugarcane	Cheraku
S. spontaneum Linn.	2n=64	Tatch grass, Buffello reed, crow bamboo, dog's bamboo	Rellu gaddi, billu gaddi, naga saramu
Vetiveria zizanioides (L.) Nash.	2n=20	Vetiver, Khus khus grasss	Vattivellu, vattiveru
V. lawsonii (Hook. f.) Blatt.&McCann.	2n=20		Itta gaddi

Diversity in Wild Relatives

The wild species/related genera of important cultivated grass species, their diversity and affinities among the species have been dealt with for the crop groups of cereals, millets, small millets and commercial grasses in the state of Andhra Pradesh as follows:

Cereals

In Andhra Pradesh, three cereals *viz*., paddy, wheat (fewer amounts) and maize are cultivated. Paddy and maize are grown in all the three regions of the state.

Rice *(Oryza sativa* L.*)*

Rice is commonly called *Vari, Vadlu* in Andhra Pradesh. Rice is the staple food of half of the world's population. Roschevicz (1931) proposed a polyphyletic origin for rice, and that rice might have arisen in the region of India, China and Indo-China. He proposed that majority of *sativa* varieties to have arisen from *O. spontanea* (*O. rufipogon* annual type) some of the seeded varieties from minuta and some of the West African cultivated forms grouped under *glaberrima* arising from *breviligulata*. All these wild relatives are present in Andhra Pradesh. *Hygroryza aristata* (Retz.) Nees ex Wight & Arn., *Leersia hexandra* Swartz, *Porteresia coarctata* (Roxb.) Tateoka, *O. officinalis* Wall. ex Watl. ssp. *malampuzhaensis* (Krish. et Chandr.) Tateoka, *O. meyeriana* (Zollin. & Mor.) Baill. ssp. granulata Tateoka, *O. rufipogon* Griff. Within this *O. officinalis* is resistant to insects, grassy stunt virus, and tropical strain of bacterial blight, brown plant hopper, and green leaf hopper. Others such as *O. meyeriana* ssp. granulata and *O. officinalis* ssp. *malampuzhaensis* based on taxonomic and cytological studies are reported to be distantly related to *O. sativa* (Sampath and Rao, 1951; Morishima and Oka, 1960).

Oryza rufipogon has similar distribution as that of *O. sativa* especially near ditches, ponds and in the paddy fields as off types/introgressed forms mainly in Adilabad, Warangal, Chittoor, Khammam, Medak, Nellore, Nizamabad and Srikakulam districts (Pandravada and Reddy, 1990; Pandravada and Sivaraj, 1996; Sivaraj *et al.*, 2000) and may be source of red coloured rice (Sastry and Sharma, 1974). *Lersia hexandra* occurred at higher altitudes, *Porteresia coarcata* occurred in brackish waters and *Hygroryza aristata* in moist coastal areas (Bor, 1960; Pullaiah, 1997).

Wheat *(Triticum aestivum* L. *and Triticum dicoccum* L.*)*

Wheat is commonly called as *Godhumalu* in Andhra Pradesh. There are no wild relatives found in Andhra Pradesh. This crop is cultivated in few pockets of the state.

Maize *(Zea mays* L.*)*

Maize is called as *Mokka jonna* in Andhra Pradesh. It is widely cultivated in all the three regions. Two wild relatives of maize *viz*., *Tripsacum laxum* Nash. and *Chionachne koenigii* (Spr.) Thw. are present in Andhra Pradesh.

Millets

In Andhra Pradesh, two millets are cultivated *i.e*., great millet and pearl millet. These are cultivated in the drier parts of the Telangana and Rayalseema regions. In coastal area these are cultivated for fodder purposes.

Pearl Millet *(Pennisetum glaucum* (L.) R.Br.*)*

Pearl millet is known as *sajjalu, saddalu*. It is third important cereal after rice, sorghum in Andhra Pradesh. It is a source of protein, calcium, phosphorous, iron, thiamine,

riboflavin and niacin. In India these species are present, *Pennisetum americanum* (L.) Schum., *P. clandestinum Hochst.* ex Chiov., *P. hohenackeri* Hochst. ex Steud., *P. pecidellatum* Trin., *P. polystachyon* (L.) Schult., *P. purpureum* Schum., *P. setosum* (Sw.) Rich. These are resistant to floral diseases. *P. hohenackeri* generally occurs in the sandy soils near the ponds, ditches and streams mostly in the Telangana especially in the Medak districts (Pandravada, 1992a).

Grate Millet (*Sorghum bicolor* (L.) Moench)

It is locally known as *Jonna*. In India there are five basic races present *i.e., bicolor, caudatum, durra, guinea,*and *kafir* (Harlan and de Wet, 1972). It is further divided into these sub-races *durra caudatum, durra guinea, durra kafir, durra bicolor, caudatum guinea, caudatum kafir, caudatum bicolor, guinea kafir, guinea bicolor, and karir bicolor*. The main species in Andhra Pradesh are Sorghum deccanense, *S. halepense* (L.) Pers., *S. nitidum* (Vahl) Pers., and *S. subglabrescens* (Steud.) Schweinf. & Asch. var. rubidium (Burkill ex Benson) Snowden. *S. subglabrescens* var. rubidium is reported form Krishna district (Lakshminarayana *et al.*, 1997) and S. nitidum from Araku valley of Vishakhapatnam district.

Small Millets

Shama Millet (*Echinochloa colonum*) and Barnyard Millet *(Echinochloa frumentacea)*

These are commonly known as *Shamalu, Bontha samalu*. It is divided into sub species colona and frumentacea and races are stolonifera, intermedia, robusta and laxa. In Andhra Pradesh four wild relatives are present *i.e., Echinochloa crus-galli* (Linn.) P. Beauv., *E. oryzoides* (Ard.) Fritsch., E. picta (Koenig) P.W.Michael., E. stagnina (Retz.) *P. Beauv*. But E. crus-galli is widely distributed and variants of this species occur in the rice fields and in water logged habitats (Arora and Nayar, 1984). *E. oryzoides* and *E. picta* is reported from Karimnagar district only (Naqui and Raju, 1998).

Finger Millet (*Eleusine Coracana* (L.) Gaertn.)

Finger millet is commonly known as *Ragi, Chodulu* and *Chollu*. It is a staple food for many people. There are two sub species - *E. africana* and *E. coracana*. Each sub-species is derived into races and sub-races. Elongata, plana, compacta and vulgaris are main races available in Andhra Pradesh. *Eleusine* having only one wild relative in Andhra Pradesh *Eleusine indica* (L.) Gaertn. *E. indica* is the only wild species widely occurring which is morphologically and cytologically similar to *E. coracana* (Krishnaswamy, 1951). *E. indica* is of Indian origin and may be the immediate ancestor of finger millet (Mehra, 1963).

Prosomillet (*Panicum milaceum* L.) and Little Millet (*Panicum Sumatrense* Roth. ex Roem et Schult.)

Prosomillet is commonly called *Warigelu, Barigelu*. It is supposed to be one of the oldest grain crops and is grown extensively in India. It is a quick growing drought resistance crop. It has two sub-species psilopodium and sumatrense. It is classified as race- nana and robusta, sub races-laxa, erecta and compacta. In Andhra Pradesh, *Panicum brevifolium* L., *P. fischiri* Bor., *P. maximum* Jacq., *P. milare* L., *P. notatum* Retz., *P. paludosum* Roxb., *P. psilopodium* Trin (related to P. milare), *P. repens* L., *P. trypheron* Schult., and *P. walense* Mez. are present. Out of these species, *P. psilopodium* which is similar to the wild forms of *P. sumatrense* from which the later species might have originated (Anonymous, 1966).

Kodo Millet (*Paspalum scrobiculatum* L.)

Koda millet is locally called Arikelu. It has three races *viz*., regularis, irregularis and variables. In Andhra Pradesh wild related species, *Paspalum canarae* (Steud.) Veldk., *P. paspaloides* (Michx.) Scribner. are present.

Foxtail Millet (*Setaria italica* (L.) *P. beauv*)

Foxtail millet is considered to be sweet, acrid and aphrodisiac and is used as a sedative to the gravid uterus. The grain is said to posses heating properties and when taken alone sometimes causes diarrhoea. The grain is astringent, diuretic and laxative and is useful externally in rheumatism. It is a popular remedy for alleviating the pains of parturition (Kirtikar and Basu, 1935). Foxtail millet is locally called as Korralu. It is also known as Italian, German, Hungarian or Siberian millet. Cultivation of foxtail millet dated back to the third millennium BC. *S. italica* is not known in the wild state except as a weed which escapes from cultivation. *S. italica* is divided into sub species viridis and italica. *S. italica* is further classified into three races moharia, maxima and indica, and further classified into nine subraces-aristata, fusiformis, glabra, compacta, spongiosa, assamese, erecta, nana and profusa. *S. viridis* is the ancestral form of *S. italica* on the basis of chromosome number.

In the state, *Setaria* has these wild and weedy relatives *i.e., Setaria intermedia* Roem. & Schult., *S. palmifolia*

(Koen.) Stapf., *S. paniculifera* (Seud.) Fourn. ex Hems., *S. pumila* (Poir.) Roem. & Schult., *S. verticellata* (L.) *P. beauv.*

Commercial Grasses

Bamboos: Bamboos are commonly called *Veduru, Veduru* and *Bongulu*. They are perennial, woody plants of the family Poaceae. They combine the best of both worlds - it grows speedily like a grass and in much the same way and at the same time, it produces a considerable amount of strength and easily to process for woody material with similar properties. Bamboos are important ecologically because of the vast area over which they are distributed, the total quantum of the resources, on the diversity of the species and ecological habitats they occupy.

Common Bamboo (*Bambusa arundinacea* (Retz). Roxb.) and *Sadhanapu veduru* (*Dendrocalamus strictus* (Roxb). Nees.)

In Andhra Pradesh, bamboos have following wild relatives, *Bambusa arundinacea*, *B. bambos*, *B. tulda* Roxb., *Dendrocalamus membranous*, *D. hamiltonii*, D. giganteous, *D. longispathus*, *D. hookeri* and *Desmostachya bipinnata* (L.) Stapf.

Job's Tears (*Coix lacryma-jobi* L.)

It is cultivated throughout the world tropics. The panicles bear attractive, shiny white grains resembling tears and often used ornamentally as beads. In Andhra Pradesh, *Coix* have two wild relatives *viz*., *Coix aquatica* Roxb. and *C. gigantea* Koenig ex Roxb.

Lemon Grass (*Cymbopogon flexuosus* Stapf. and *Cymbopogon citratus* Stapf.)

The cultivated lemon grass in India mostly belongs to the above two species. These are distinguished in commerce, the distinction being based on properties of oil.

Palm Rose (*Cymbopogon martini* (Roxb.) Wats.)

Palm rose is a source of palmarosa. It yields grass oil and contains large amount of geraniol which can be used to adulterate otto of roses.

Citronella Grass (*Cymbopogon nardus* (L.) Rendle.)

Citronella is known as *Nimmagadd*, *Vasanagaddi* in Andhra Pradesh. This is also called 'oil of citronella'. It is pale yellow oil much used for inexpensive soaps and perfumes as insect repellent also containing 80-90% of geraniol which makes the oil an important substitute for otto of roses. In Andhra Pradesh, *Cymbopogon* wild relatives, *C. caesius* (Hook. Arn.) Stapf., *C. coloratus* (Hook. f.) Stapf., *C. flexuosus* (Nees ex Steud.) Wats. var. *flexuosus*., *C. gidarba* (Ham. ex Steud)., *C. jwarancusa* (Jones) Schult., *C. nardus* (L.) Rendle. var. *confertiflorus* (Steud) Staf., *C. nardus* var. nardus, *C. schoenanthus* and *C. winterianus* are present.

Pogonatherum paniceum (Lam.) Hack.

This grass is extensively cultivated as an ornamental in gardens due to its peculiar tillering and foliage. *Pogonatherum crinitum* (Thunb.) Kunth. is the wild relatives.

Sugarcane (*Saccharum officinarum* L.)

Sugarcane is derived from the sanskrit word shakkara. This crop from the east provides a linguistic evidence of Indian origin of sugarcane. In Andhra Pradesh, many sweet based products are prepared from sugarcane. There is only one wild relative *Saccharum spontaneum* L. is present in Andhra Pradesh.

Vetiver (*Vetiveria zizanioides* (L.) Nash.)

Vetiver is known as *Vattivellu* or *Vatti verlu* in Andhra Pradesh. It is a source of vativer oil. The oil obtained by distillation of these roots and useful as a fixer of 'violet' odours. The roots are made into mats for air cooling (Khaskhas mats). Andhra Pradesh has only one wild relative *Vetiveria lawsonii* (Hk. f.) Blatt. & Mc Cann.

Conservation of Wild Relatives

Conservation of wild relatives of crops is the most important task to match the challenges of erosion of species. The existence of these wild relatives are shrinking fast due to various bio-edaphic factors and disturbed habitats. In the present rate of threat of genetic erosion, we must collect all requisite information of the wild relatives to make use of their wider adaptability/tolerance/resistance to diseases and insect-pests, yield, quality attributes and other biotic and abiotic characters. In comparison to the cultivated landraces, these wild relatives are given less emphasis for collection/augmentation, characterization, conservation and utilization. Specific programmes on collection, conservation and utilization of wild relatives and related taxa need to be intensified in areas of species (Arora and Nayar, 1984).

Collection and conservation of wild species are generally most effective when there is a specific requirement for research or crop improvement programmes (Bothmer and Seberg, 1995). Conservation of diversity of

cultivated plants on private land using on-farm approach and their wild relatives in the landscape has been strongly recommended (Gadgil *et al.*, 1996). The modern agricultural practices strongly favour reduction of diversity by providing crop subsidies for replacement of landraces of crops by uniform stands of high yielding varieties and use of herbicides to eliminate weedy relatives of crop plants.

We can utilize these wild relatives for conventional breeding programmes. Though hard to develop resistant varieties by conventional breeding procedures to withstand the pest pressure under diverse farmer conditions.

A great number of plant species including several unique and irreplaceable taxa have faced extinction and some of these have already disappeared from the earth in nature's own process of evolutionary changes. The wild relatives of Andhra Pradesh, particularly those occurring in the Eastern Ghats zone have shown narrow distribution.

The endemic diversity in wild relatives are *O. officinalis* ssp. *Malampuzhaensis* reported from Nallamalais of Eastern Ghats only. *Bambusa arundinacea* var. *gigantea* (Gigantic bamboo, distributed in north coastal districts), *Cymbopogon coloratus*, *C. gidarba*, *Panicum fischeri* and *Vetiveria lawsonii* are endemic to peninsular India in Andhra Pradesh. These wild species need immediate attention for collection and conservation *in situ/ex situ*.

Conservation of wild relatives using in situ/on-farm can be successfully achieved by providing special incentives to farmers/local people for growing difficult or uneconomical material on private land or domestic gardens. The village communities may get the benefits through watershed management, wild life habitats and environmental stabilization. Complementary conservation strategies include the protection of wild species, plant populations and traditional crop varieties where they have evolved (*in situ*) with the collection and preservation of inter and intra-specific diversity in gene banks and botanical gardens (*ex situ*). National gene banks, research institutes should collect and conserve the wild/weedy relatives of these cultivated crops. Scientists, individuals, departments, and institutions in particular State Agricultural Board, State Biodiversity Board should come forward and work together in coordination to protect these natural resources.

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