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Short Communication

FORAGE GENETIC RESOURCES IN ORISSA AND THEIR CONSERVATION

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This paper deals with distribution of forages viz., 224 species of legumes and 268 species of grasses in Orissa. The distribution of tropical/subtropical/temperate species has been discussed. The causes of genetic erosion, notes on rare/threatened/endemic species have also been dealt with in detail. Conservation aspect of rare species and important forage species for improvement of grasslands/rangelands has been highlighted. *In-situ* conservation of *Cajanus cajanifolia, Rhynchosia hainesiana, Rhynchosia suaveolens, Dimeria orissae, Themeda mooneyi, Mucuna minima* has been suggested. Conservation and domestication of *Stylosanthes fruticosa* which is the only species available in India for pasture development have been highlighted.

Key words : Forage legumes, grasses, rare/threatened/endemic species, distribution, conservation

Orissa, one of the coastal state lies between 81° 27' and 87° 29' east longitudes, and 17° 49'-22°34' N latitude. It is situated in the eastern peninsula with a coast line of 482 kms and is bounded by West Bengal on the north-east, Bihar in the north, Madhya Pradesh in the West, Andhra Pradesh in the South and Bay of Bengal in the east. It covers an areas of 155,707, Sq kms. having forest cover of 68,150 sq. kms. approximately.

Geologically, it is a part of Gondwanaland landmass and gifted with big rivers like Mahanadi, Brahmani, Rushikulya, Budhabalanga and Baitarani etc. Besides these, hills and mountains like Similipal-Meghasam (1162 m), Malayagiri (1188 m), Mankadanacha (1110 m), Mahendragiri (1525 m), Devagiri (1363 m) etc are also met with in this state. So due to peculiar climatic condition coupled with various edaphic factors, Orissa is very rich and diverse in genetic resources in general and forage resources in particular.

Once upon a time, the forest cover was *ca* 40 per cent of the state cover but due to operation of biotic factors and human interference, it is reduced to 13 per cent only. As a result of which, many species have been vanished andsome are on the verge of extinction. Due to these activities, there is serious degradation of grassland/range lands, which are the main sources of forages. Now this is high time to conserve our genetic resources in general and forage resources viz., legumes and grasses in particular for future generation to use. Because livestock population is really the backbone of the rural population which not only increase the socio-economic condition of the country in general but also the people in particular. Again India is about 2 per cent of the total geographical area of the world sustains as much as 15 per cent of the world's livestock population. So the fodder and feed resources is

very less than demand. This widening gap is increasing day by day as there is severe pressure on grassland/range lands due to habitat destruction. So proper management of grassland/rangelands through improved technique is the need of hours. This can only be achieved through introduction and domestication of indigenous legumes/grasses in the grasslands and augmentation of native diversity through exploration, collection, conservation and domestication of indigenous legumes and grasses. Realising the importance of fodder resources this paper highlighted the diversity of legumes and grasses in Orissa their distribution pattern, sociability etc. and notes on rare/endemic/ threatened species, have been discussed in detail. Conservation strategies and future research have also been given.

EXTENT OF DIVERSITY

(a) **Legumes** : In India, the family Leguminosae is represented by about 400 species-60 genera only, 21 genera are useful as forages. (Mehra and Magoon, 1974). But Hussain and Kapoor (1990) reported 1150 species of legumes from India, Kaines (1921-25), the pioneer plant explorer, reported 200 species of which 62 species are reported from Orissa. Subsequently Mooney (1950) added 47 species to the previous list while Saxena and Brahaman (1996) reported 224 number of species under 64 genera from Orissa. Besides many sporadic reports have also been made by various workers (Saxena *et al.*, 1980; Choudhury and Patnaik, 1985). Bairiganjan *et al* (1985) reported 147 species and 7 varieties from Orissa during his cytotaxonomic studies of Fabaceae, of these 12 species are new records for Orissa. From the previous reports, it is evident that Orissa is very rich in legume genetic resources. Most of the legumes are used as fodder, green manure and pasutre development. The ecology and diversity of legumes having forage value have been discussed here. In Orissa, 29 genera are represented by single species. These species are *Abrus precatorius, Dolichos biflorus, Dumasia villosa, Eriosema himalaicum, Gliricidia sepium, Medicago sativa, Ormocarpum cochinchinense, Pachyrrhizus erosus, Paracalyx scariosa, Pongamia pinnata, Pseudarthria viscida, Psophocarpus tetragonoloba, Pueraria tuberosa, Rothia indica, Shuteria densiflora, Stylosanthes fruticosa, Taveniania cuneifolia* etc. The number of species in other genera are given in Table 1. The dominant genera are *Crotalaria* (31), *Desmodium* (19), *Indigofera* (17), *Vigna* (16) etc. The species of Leguminosae are found in different diverse ecological habitats. The species of

Table 1. Distribution of legumes/grasses species in Orissa and India

Name of Genus	Orissa	India	Name of Genus	Orissa	India
Aeschynomene	3	3	*Aristida*	4	15
Alysicarpus	8	12	*Arthraxon*	5	20
Atylosia	4	20	*Arundinella*	4	16
Butea	3	3	*Bothriochloa*	2	16
Canavalia	3	4	*Chrysopogon*	6	15
Clitorea	2	2	*Coix*	3	4
Crotalaria	31	82	*Dicanthium*	2	8
Desmodium	19	44	*Digitaria*	6	22
Flemingia	12	15	*Dimeria*	10	18
Glycine	2	3	*Echinochloa*	4	46
Indigofera	17	44	*Eleusine*	2	5
Lathyrus	2	9	*Eragrostris*	23	28
Macrotyloma	2	6	*Eulalia*	3	13
Melilotus	2	3	*Heteropogon*	2	7
Milletia	2	12	Isachne	3	20
Mucuna	6	15	*Iseilema*	4	4
Rhynchosia	8	23	*Oplismenus*	2	4
Sesbania	7	8	*Oryza*	5	6
Smithia	2	13	*Panicum*	16	24
Teramnus	2	3	*Paspalum*	4	14
Vigna	16	15	*Pennisetum*	6	16
Zornia	2	2	*Setaria*	6	11
			Sporobolus	8	14
			Themeda	9	17

Aeschynomene, Sesbania, Smithia, Neptunia are usually found in aquatic, semiquatic and marshy habitats of eastern Orissa. Similarly *Rothia indica, Indigofera glabra, I. asphalthoides Canavalia maritima, Dicerma biarticulatum, Tephrosia purpurea* var. *maritima, Macrotyloma ciliatum, Mucuna gigantea* are found in sandy sea shore and tidal forests of Orissa. The species viz., *Canavalia gladiata, Phaseolus lunatus, Psophocarpus tetragonolobus, Vigna aconitifolia* are cultivated in various tribal pockets of western Orissa. The species such as *Lablab purpureus, Vigna radiata, Vigna mungo, Vigna unguiculata, Phaseolus vulgaris, Macrotyloma uniflorum, Glycine max, Arachis hypogaa, Cajanus cajan* etc. are cultivated in western and eastern Orissa with striking variabilities. Hence these species require special attention for exploration and germplasm conservation. The temperate species viz., *Centrosema pubescens, Desmodium tortuosum, Macroptilium lathyroides* var., *semierecta* and *Tephrosia noctiflora* are exotic in nature and now naturalised in Orissa.

Cajanus cajanifolia (syn. *Atylosia cajanifolia*) is the wild relative of pigeonpea. Till now it exists in its type locality which was reported by Haines (1921-25). This species needs immediate conservation *in-situ* and *ex-situ. Stylosanthes* is one of the important genus used in fodder researches and pasture improvement. All the species of Stylo are temperature in nature. Only *Stylosanthes fruticosa* is indigenous to India and found in wild state in Orissa and adjoining Andhra Pradesh.

Exploration, conservation and utilisation of this species is the need of hour, which will help in development of improved variety of Stylo. There are many species which occur abundantly and few species are of rare occurrence in specific habitats. The species viz., *Abrus precatorius, Alysicarpus vaginalis, Alysicarpus monilifer, Aeschynomene aspera, Atylosia scarabioeides, Desmodium gangeticum, Desmodium heterocarpon, D. pulchellum, Indigofera cordifolia, Sesbania bispinosa, Albizia lebbek* etc. are very common throughout Orissa. In addition, *Zornia gibbosa, Desmodium triflorum* are also very common in sandy and swampy localities which help in pasture development. Orissa is the meeting ground of South and North Indian flora. So the vegetation is mostly tropical, subtropical and rarely temperate in nature. The tropical species viz., *Alysicarpus racemosus, A. scarious, Canavalia maritima, Desmodium alysicarpoides, D. biarticulatum, Flemingia wightiana, Flemingia nilgherensis, Indigofera trifoliata, Macrotyloma ciliatum, Pseudarthria viscida, Rhynchosia rufescens, Rothia indica, Sesbania speciosa, Stylosanthes fruticosa, Vigna dalzelliana, Albizia amara* are similar to the flora of South India. Very few species are similar to North India. These are *Albizia procera, Dichostachya cineraria, Mimosa himalayana, Desmanthus virgatus, Pithecelobium dulce, Vicia hirsuta, Rhynchosia bracteata, Mucuna nigricans, Melilotus alba, Lathyrus aphaca, Indigofera prostrata* etc.

Grasses : Poaceae, one of the dominant family comprised 10,000 species under 1620 genera, distributed in different agro-ecological zones of world. (Hubard, 1954). This family is represented by about 245 genera and 1250 species of which 21 genera and 139 species are endemic (Mehra and Magoon, 1971). Agrostological analysis reveals that species belonging to the tribe *Andropogoneae, Paniceae, Eragrosteae, Festuceae, and Agrostideae*, being 30, 15, 9, 7 & 5 per cent respectively of the total number of grasses. Bor (1960) reported that 1/3 of grasses of India are considered of forage value. The centre of concentration of tropical grass species is the humid belt of South west India.

In Orrisa, Haines (1921-25) reported 214 number of species from different regions. Thereafter Mooney (1950) explored the hilly western Orissa and most of the species are endemic. Recently Saxena and Brahman (1996) reported

268 number of species. Which are mostly tropical and subtropical in nature. Rich diversity occur in western Orissa, Eastern Ghats and Similipal regions. The species have got similarity with Western ghats and Himalayan regions. The dominant genera are *Eragrostis* (23), *Panicum* (16), *Dimeria* (10), *Themeda* (9), *Brachiaria* (9) etc. forty seven genera are represented by single species which includes *Zoysia matrella, Vetiveria zizanoides, Thysanolaena maxima, Phragamites karka, Myriostachya, wightiana, Hackeolochloa granularis, Leersia hexandra, Apluda mutica, Dendrocalamus strictus, Dactyloctenium aegyptium* etc. The common species occurring throughout Orissa are *Brachiaria kurzii, B. ramosa, Coix lacryma jobi, Allopteropsis, cimicina, Apluda mutica, A. uaginata, Bothriochloa pertusa, Leersia hexandra, Cynodon dactylon, Dactyloctenium aegyptium*, etc. Most of the species are tropical and similar to the flora of the South India. These species are *Brachiaria mutica, B. reptans, Chloris virgata, Coix gigantea, Chrysopogon aciculatus, Arundinella benghalensis, Iseilema laxum, Myriostachya wightiana, Panicum antidotale, Paspalum cancarae, Pennisetum hohenackeri, Setaria palmifolia, Setaria pumila, Dimeria ornithopoda, Eriochloa procera, Themeda tremula, Zoysia matrella* etc. The temperate species having similarity in the Himalayan flora are not available in Orissa grasses. The grasses are mostly tropical and sub-tropical in nature. The important forage grasses are *Dichanthium, Chrysopogon, Brachiaria, Panicum, Pennisetum, Setaria, Chloris* etc. The diversity of these genus is very much in Orissa and availale in different eco-climatic regions with maximum variability.

Rare/Threatened/Endemic Species

Due to human interference and lack of proper protection, the vegetation have been ruthlessly degraded which had resulted in the extinction of many species. This is mainly due to habitat destruction and operation of many biotic factors. Due to these activities most of the species are under rare/endemic/threatened category. The details are given in Table 2 (Saxena and Brahmam, 1983 and Nayar *et al*, 1984). These species need immediate protection and conservation. Strategies should be developed for protection of these species.

Table 2. List of rare/threatened/endemic speices in Orissa

Name of Species	Family	Status
Acacia donaldii Haines	*Mimosaceae*	*Threatened*
Acacia tomentosa Willd.	*Mimosaceae*	Threatened
Albizia orissensis Sahni et Bennet	*Mimosaceae*	Threatened
Atylosia cajanifolia Haines	*Fabaceae*	*Threatened*
Desmodium ritchiei Sanjappa	*Fabaceae*	Threatened
Eleiotis sororia (L.) DC.	*Fabaceae*	Threatened
Erythrina resupinata Roxb.	Caesalpiniaceae	*Threatened*
Intsia bijuga (Colebr.) Kuntze	Caesalpiniaceae	*Threatened*
Mucuna minima Haines	Fabaceae	Endemic
Rhynchosia hainesiana Satyam. & Thoth.	Fabaceae	Endemic
Rhynchosia suaveolens (L.f) DC	Fabaceae	Threatened
Tephrosia roxburghiana Drumm.	Fabaceae	Threatened
Tephrosia purpurea (L.) Pers. Var. *maritima* Haines	Fabaceae	Endemic
Dimeria acutipes Bor	Poaceae	Threatened
Dimeria lehmanii (nees Ex Steud) Hack.	Poaceae	Threatened
Dimeria mahendragiriensis (Ravi) Saxena et Brahmam	Poaceae	Threatened
Dimeria mooney Raizada & Mooney	Poaceae	Threatened
Dimeria orissae Bor	Poaceae	Endemic
Dimeria trimenii Hook. f.	Poaceae	Threatened
Oryza Jeyporensis Govind & Krishnan	Poaceae	Endemic
Themeda mooneyi Bor	Poaceae	Endemic
Themeda saxicola Bor	Poaceae	Endemic

Conservation :

It is envisaged from the observation that many of the plant species have been vanished and some are on the verge of extinction due to interference of human civilization. This has resulted some plant to be under rare/threatened/endemic categories. Hence, it is the high time to conserve our forage genetic resources before further genetic erosion. Conservation should be *in situ* or *ex-situ* depending on the nature of species. Species viz, *Cajanus cajanifolia, Oryza jeyporenis, Rhynchosia hainesiana, Rhynchosia suaveolens, Dimeria mooney, Dimeria orissae, Themeda mooneyi, Mucuna minima, Desmodium ritchiei* etc should be conserved in *in situ* because lot of variability are also met with in these species. Conservation of genetic resources will help future plant improvement programme. Among the Legumes, the genus like *Crotalaria, Desmodium, Indigofera, and Vigna* have larger number of species with lot of variation. Similarly among the grasses *Panicum, Dimeria, Eragostris brachiaria* etc have maximum number of species. These species need maximum priority for conservation. *Stylosanthes* are the important pasture legume and forage crop also. Lot of work have been done in temperate countries where maximum species are available. In India, only *Stylosanthes fruitcosa* is found proper attention for conservation and domestication. Besides attention should be given for conservation of the threatened/endemic species. There are many important forage genus viz. *Desmodium tortuosum, Macrotyloma ciliatum, Canavalia maritima, Canavalia gladiata,* and many species of Sesbanias, should be conserved and domesticated to meet the fodder demand. Besides the threatened/ endemic species listed in the table 2 are to be conserved for posterity.

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