

COLLECTION OF MULTICROP DIVERSITY FROM THE EASTERN HIMALAYAN REGION

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ABSTRACT

Exploration were conducted to collected diversity of multi-crops form the Eastern Himalayan region of India during 1999-2002 under National Agricultural Technology Project on Sustainable Management of Plant Biodiversity - " Collection, Evaluation, Documentation and Conservation of Agro-biodiversity of the North East". Twentynine districts of 7 states were explored and 1,765 germplasm of different crops were collected. The paper collated the information on exploration, collection documentation, conservation and characterization for crop diversity collected.

Exploration

In all 29 districts of 7 states were covered. Out of 7 states diversity was collected from 4 districts (west Kameng, East Kameng, Changlang and Tirap) of Arunachal Pradesh, 4 districts (Cachar, Barpeta, Bongaigaon and Jorhat) of Assam, 4 districts (Imphal East, Thoubal, Churhandpur and Bushnipur) of Manipur, 5 districts (Ribhoi, West Garo Hills, East Khashi hills, West Khasi hills and Janiti hills) of Meghalaya, 6 districts (Kolasib, Aizwal, Chintipui, Champhai, Serchhip and Lunglei) of Mizoram, 1 district (Kohima) of Nagaland, 4 districts (East Sikkim, East Sikkim, North Sikkim and South Sikkim) of Sikkim and 1 district (Darjeeling) of West Bengal (Table 1) covering 197 sites (Table 2). The exploration at Changlang district of Arunachal Pradesh, Majuli river island and Janji area of the Jorhat district of Assam, Churhandpur district of Manipur, Serchhip district of Mizoram was done for the first time. Joint exploration were organized with Assam Agriculture Universtiy, Jorhat to Majuli River island of Jorhat district of Assam, with central Institute of Cotton Research, Nagpur to east and West Garo Hill districts of Meghalaya and with NBPGR Regional Station, Barapani to East Kameng, Changlang and Tirap districts of Arunachal Pradesh. The collections were made from jhum cultivation areas of hills and sloppy lands, upland plain districts, lowland rice area and river island of Majuli.

Collection

A total of 1,765 crops germplasm were collected during the period. The break-up of collection made was: 222 in 1999-2000, 574 in 2000-2001 and 969 in 2001-2002 (Table 1). Maximum diversity was collected in rice (572) followed by maize (271), cowpea (93), rapeseed-mustard (88), French bean (81), rice bean (65), cotton (55), Soybean (49), finger millet (46) and chilly (33). The other materials include various pseudo cereals, legumes, oilseeds, fibre crops, fruits, vegetables and spices. The rice diversity belongs to glutinous rice, aromatic rice, stiky rice waxy rice, soft rice, glabrous rice and so on.

Documentation

Passport data of each accession were done at the time of collection as per the guidelines of NBPGR, New Delhi. The passport data include information on name of crop, its botanical name, name of variety/landraces, village, district, state, region/zone, altitude, latitude, longitude, type of sample, method of

sample, soil type, crop season, ecosystem, topography, farmer's/donors' name, source of collection, ethnic race of farmer, any special feature of the collection and any indigenous technical knowledge (ITK).

Conservation

The samples collected were divided into two parts. After properly drying and cleaning, one part of the collected materials was sent to National Gene Bank, NBPGR, New Delhi for medium/long term conservation along with passport data book, tour report, route map of the exploration trips. NBPGR allotted IC (indigenous collection) number to each accession sent for conservation. The data on various plant characters of different crops were documented as per descriptor of each crop along with photographs.

Characterization

Characterization of the germplasm was done by evaluating the materials in augmented and randomized block design depending upon number of accessions following the Minimum Descriptor of NBPGR. Enormous variability was observed on different qualitative and quantitative characters of rice, maize and other crops (Table 3 and 4).

Two hundred thirty-rice germplasm under upland ecosystem and two hundred ten under lowland ecosystem were evaluated for 28 and 11 characters respectively. The range of variability in different quantitative characters is given in Table 3.

One hundred fifty germplasm of maize, 68 cowpea, 49 soybean and 65 rice bean were also evaluated for various agro-morphological characters (Table 4).

Documentation of ITKs

Farmers' practices	Rationale
Select bold grains for seed purpose	To separate the partially filled and diseased grains
Store rice seeds in containers made of paddy straw known as 'tom'	For better viability than the seeds stored in gunny bags
Sowing time based on frequent flying and high pitch sound made by mole cricket (<i>Gryllothaipia Africana</i>)	The insect makes its presence in April in Assam indicating the early advancement of monsoon
Sow Ahu and Bao rice in mixer in flood prone rainfed lowlands.	An insurance against the total crop failure in the event of flood.
Paddy -cum-fish culture practiced in rice-based Apatani farming system	To increase the farm income and to provide fish protein
Trapping stnk bug with rotten crabs, frog and rats	Bugs are attracted by the rotten smell of the trapping material and feed on these - an eco friendly nature of plant protection.
Scared the birds (sparrows) away by keeping the black coloured pseudostems of colocasia above the canopy level at maturity	The black pseudo-stem of arum mimics the head of snake and sparrows are scared away
Keeping hemp leaves in granaries, dried neem leaves in seed container and dillenia indica skins in storage bins	To check stored -grain pest attack

Keeping pulse seeds alongwith fine sands in earthen containers with dug and mud	To prevent excess moisture for better viability
Tying matured maize cobs and finger millet in maize cobs and finger millet in bindles and hanging over the chullah in the kitchen	To prevent from damageing the seeds for next sowing from insects through smoke and consequent rise in room temperature - a common practice of hill farmers
Cutting top portion of Sali rice seedlings before transplanting	To check multiplication of stem borers which lay eggs on top portion of leaves.
Keeping human status model made of thatch in rice and vegetable fields	To frighten birds and animals
Cutting bamboo shoots into pieces and spraying in rice fields after soaking I water overnight	For control of paddy leaf roer in West Siang, Aunachal Pradesh
Constructing houses with locally available material with perforated floor 4-5 feet above ground for keeping goats	To divert the flow of urine and droppings to a nearby pit to be utilized as manure for mainaenance of soil fertility - a common practices in Assam.
Spreading oak (<i>Almus nepalensis</i>) leaves mixed with human and animal litter in maize fields	To conserve soil moisture and improve soil fertility
Allowing grazing animals in standing Bao rice fields during tillering stage	To reduce excessive vegetative growth
Practicing mixed croppin of mustard and pea as well as maize and rice bean where mustard and maize taken as main crop	Mustard and maize crops provide support to pea and rice bean as staking. In addition to providing nutritional support to mustard/maize by pea/rice bean, farmers get additional income from sale of green pea before harvest of mustard and from rice bean after harvest of maize - a practices observed in Manipur and Mizoram
Applying common salt-water solution in upland rice crop	To reduce growth of weeds - in West Siand of Arunachal Pradesh and Kohima district of Nagaland

ACKNOWLEDGEMENT

The authors are thankful to Dr. K.M.Bujarbaruah, Director, ICAR Research Complex for NEH Region, Umiam, Meghalaya for providing facility and Dr. S.K.Pareek, Principal Investigaotr, NATP - Plant Biodiversity, NBPGR, New Delhi for financial and technical help in carrying out the study.

Table 1. Number of germplasm collected from Eastern Himalaya

State	District	No. of Collections			Total
		1999-00	2000-01	2001-02	
Arunachal Pradesh	W. Kameng			46	46
	E. Kameng			63	63
	Changlang			172	172
	Tirap			73	73
Total	4			354	354
Assam	Cachar	9			9
	Barpeta			40	40
	Bongaigaon			40	40
	Jorhat (Majuli)		95	40	135
Total	5	9	95	120	204
Manipur	Imphal East		2	66	68
	Thoubal		1	30	31
	Churhandpur			6	6
	Bishnupur			22	22
Total	4		3	124	127
Meghalaya	Re-bhoi	9	22	10	41
	W.Garo Hill	21	72		103
	E.Khasi Hill		8		8
	W. Khasi Hill		3		3
	Jaintia Hill			64	64
Total	5	31	105	74	129
Mizoram	Kolasib	151			151
	Aizwal	22			22
	Chimtipui	10			10
	Champhai		108		108
	Serchhip		123		123
	Lunglei		124		124
Total	6	183	355		538
Nagaland	Kohima				
Sikkim	E.Sikkim			72	72
	W. Sikkim			7	7
	N.Sikkim			15	15
	S.Sikkim			101	101
Total	4			195	195
W. Bengal	Darjeeling			102	102
G. Total	29	222	574	969	1765

Table 2. Cropwise collection of crop diversity from eastern Himalayan region

Crop group	Crop	1999-2000	2000-2001	2001-2002	Total
Cereal	Rice	111	101	360	572
	Maize	27	150	94	271
	Finger mille			46	46
	Other cereals		7	39	46
Total		138	258	539	935
Pulses	Green gram		5	23	28
	Black gram		1	22	23
	Rice bean	1	6	58	65
	French Bean	2	17	62	93
	Cow pea	33	40	20	81
	Other pulses		3	50	53
Total		36	72	235	343
Oilseeds	Rapeseed-mustard	8	40	40	88
	Soybean	2	8	39	49
	Perilla	5	9	11	25
	Sesame	9	12	6	27
	Other oilseeds		7	8	15
Total		24	76	104	204
Fibre crops	Cotton	7	45	3	55
	Others			5	5
Total		7	45	8	60
Vegetable		15	44	41	100
Fruits		2	20	12	34
Spices	Chilly		17	16	33
	Other spices		3	9	12
Total			20	25	45
Mics. plant			4		4
Grand total		222	574	969	1765
Area covered		29	43	125	197
Area covered for the first time		7	6	42	55

Table 3. Range of variability in upland and low land rice

Character	Range	
	Upland rice	Lowland rice
Days to 50 % flowering	85-127	88-131
Days to maturity	127-174	125-155
Plant height (cm)	77.4 -148.8	70.6-157.8
Panicle length (cm)	15.9-33.4	16.3-25.9
Culm length (cm)	48.4-118.1	46.3-115.4
Leaf length (cm)	20.8-67.4	22.1-72.3
Leaf width (cm)	0.6-2.2	0.5-2.4
Ligule length (cm)	1.3-3.9	1.6-4.1
Flag leaf length (cm)	14.0-49.2	20.8-56.0
Flag leaf length (cm)	0.8-2.6	0.74 -3.86
Number of Tillers/plant	3.5-15.2	3.7-17.4
Number of effective tiller/plant	3.4-15.0	4.0-14.7

Table 4. Variability in maize, cowpea, soybean and ground nut germplasm

Character	Range			
	Maize	Cowpea	Soybean	Rice bean
Days to tasselling	49-93	-	-	-
Days to silking	53-100	-	-	-
Tassel branch	11.5-28.0	-	-	-
Plant height (cm)	146.7-348.8	180-427	55-137	180-323
Ear height(cm)	96.7-226.7	-	-	-
Ear length (cm)	6.4-23.3	-	-	-
Ear width (cm)	5.6-16.6	-	-	-
Kernels/row	12.7-45.3	-	-	-
100 seed weight (g)	4.8-33.2	10.3-17.8	2.4-12.6	10.2-19.3
Kernel/seed weight/plant (g)	13.3-188.3	43 -133	32-95	90-167
Days to 50% flowering	-	56-85	61-82	71-77
Leaf length (cm)	19.6-39.1	7.0-18.6	6.8-14.6	8.9-13.4
Leaf width (cm)	4.5-8.6	4.0-11.2	4.2-10.9	4.7-9.5
Green Biomass/plant (g)	-	120-358	-	-
Primary branch/plant	-	3-10	3-7	4 -7
Pod cluster/plant	-	4-11	5-9	14.7-22.8
Pod length (cm.)	-	11.3-29.4	2.7-6.3	8.2-13.1
Number of pods/plant	-	29-57	58-201	43-232
Number of Seeds/pod	-	7-19	2-4	7.67-10.2
80 % maturity (days)	-	92-122	90-105	93-130