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MAIZE GERMPLASM COLLECTIONS FROM NORTH-EASTERN HIMALAYAN REGION

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Presence of striking variability for maize has been reported from the north eastern region of India which is earmarked as one of the centre of diversity for this crop. Maize germplasm has been collected from the Himalayan region periodically and such collections continue to fetch some of the types which were primitive and resembled closely to the postulated ancestors of maize. Unconscious selections made by different ethnic groups has helped in preservation of maize diversity. In three exploration trips, 799 landraces were collected from Arunachal Pradesh (252), Assam (24), Manipur (47), Meghalaya (184), Mizoram (99), Nagaland (62), Sikkim (122) and others (9). A wide range of variability for plant, ear and kernel characters was observed. Nature and extent of variability has been described.

Key words : Maize, germplasm, exploration/collection

Maize germplasm has been collected from the Himalayan region periodically ever since Anderson (1945) and Stoner and Anderson (1949) reported the presence of striking variability for this crop in the north eastern Himalayas. Such collections continue to fetch some of the types which were primitive and resembled closely to the postulated ancestors of maize as pointed out by Dhawan (1964) and Thapa (1966). A systematic indexing of 1571 accessions from various parts of India, particularly the eastern and western Himalayan regions, into 15 "races" and 3 "sub-races" ranging from primitiveness to advancement, in terms of crop evolution, was done by Singh (1977). Due to preponderance of traditional cropping systems of mixture crops under shifting cultivation pattern in the north east, some of these races e.g., 'Khasi Riewadem' are retained in its equilibrium form even to date.

The north-eastern Himalayan region is earmarked as one of the centres of diversity in maize. In the process of evolution, unconscious selections made unknowingly by different ethnic groups helped preserve and contribute to the diversity of maize crop which was supplemented by other factors like open-pollinated nature of maize, the cryptic changes in the genetic make-up of the crop due to sudden release of energy following tremors in the north-eastern

Himalayan zone etc. The local corn germplasm may be of importance due to several primitice features including popping types, marked striation of the kernels, small sized ears and more number of ears per plant etc. and also the possibility of getting transgressive segregants in crosses with the maize landraces from the new-world. The present paper highlights the attempts made to collect maize germplasm particularly from north-eastern Himalayas during the years 1991 and 1992. Collection and conservation of these diverse types in maize would be useful for posterity.

COLLECTION AREAS AND STRATEGY

Three exploration trips were undertaken for the collection of maize landraces under NBPGR-IPGRI collaborative maize collection project. In total, 799 collection were made from various parts of the north-eastern states viz., Arunachal Pradesh (East Siang, West Siang and West Kemeng); Assam (Kamrup, Karbi Anglong, Kemi and Dhekiajuli); Nagaland (Kohima, Jaluki, Ngwalwa and Punglawa); Manipur (Tabenlang, Chandel, Senapeti and More); Mizoram (Aizawl, Kolashib south, Kolashib, Kawanpuri and Taitow); Tripura; Meghalaya (Garo Hills, Khasi Hills, Jaintia Hills and Khilling Hills) and Sikkim (East

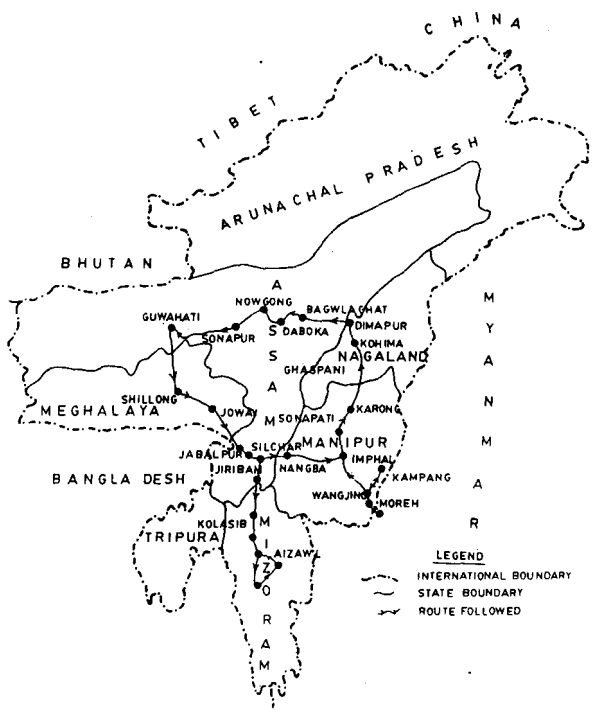

Fig. 1. Route map for maize germplasm collection from parts of N.E.H. Region (Sept - Oct 1991)

Sikkim, North Sikkim and South Sikkim). The route maps followed during these explorations are given in Fig. 1 to 4. The majority of the collection in this study were made directly from the farmers' field during the harvest season. An effort was made to obtain 10-15 ears from each field and to include in this number as much variation as possible in respect of ear and plant types. Detailed passport data on each accession were collected and studies were made on population sample. The collections were dried, catalogued and photographed.

Standard descriptors were used for taking the notes on ear and kernel characters. The frequency of accessions for each characters were calculated on the basis of scores given such as ear length (cm) (1 = 5-10, 2= 11-15 and 3 = >15); kernel row number (1 = 8-10, 2= 12-16, 3 = >16); kernel number per row (1 = < 15, 2 = 15-30, 3 - >30); kernel type (1 = flint, 2 = semiflint/semident, 3 = pop and 4 = others); kernel colour (1 = yellow, 2 = wite, 3 = others) and ear number (1= 1, 2 = 2, 3= 3 and above). After taking the data, a sample ear of each accession was selected, whereas the remaining ears were shelled and the seed was mixed.

Table 1. Maize diversity collected during 1991-1992

State	No. of collections	Altitude (m)
Mizoram	99	350-1300
Nagaland	62	310-570
Manipur	47	280-1259
Meghalaya	284	400-1800
Arunachal Pradesh	252	200-2300
Sikkim	122	330-1900
Assam	24	250-1350
Others	9	-
Total	799	

GERMPLASM VARIABILITY

In recent explorations, extensive variability for various ear and kernel characters was recorded in collections made from the north-eastern region of India. The variability in maize cultivars from Sikkim, Meghalaya, Arunachal Pradesh, Manipur and Assam was outstanding. The study of natural populations and data recorded at site revealed that a wide range of variability existed with respect to ear length, ear diameter, ear number per plant, kernel row arrangement, kernel rows, kernels per row, kernel type and kernel colour. Dwarf to tall landraces (1-2.2 m) continue to occupy the region differing

widely in adaptation to varying altitudes (200-2500 m) and soil conditions from mountainous, sub-mountainous ranges slopping to the plains of assam. Some of the landraces collected from Khilling area of east Khasi Hills were reported to be early maturing (75 days) and are still under cultivation.

Kernel row arrangement showed interesting feature and it varied from 'regular', 'irregular to base', 'irregular to tip', 'irregular from base to middle of the ear' and 'totally irregular'. In this collection, majority of the landraces had regular kernel row arrangement, though in some accessions, totally irregular or other kernel row arrangement also occurred suggesting primitiveness of the landraces. The frequency distribution for different ear and kernel characteristics is given in Table 2. Much variation occurred in ear length (6-22 cm).

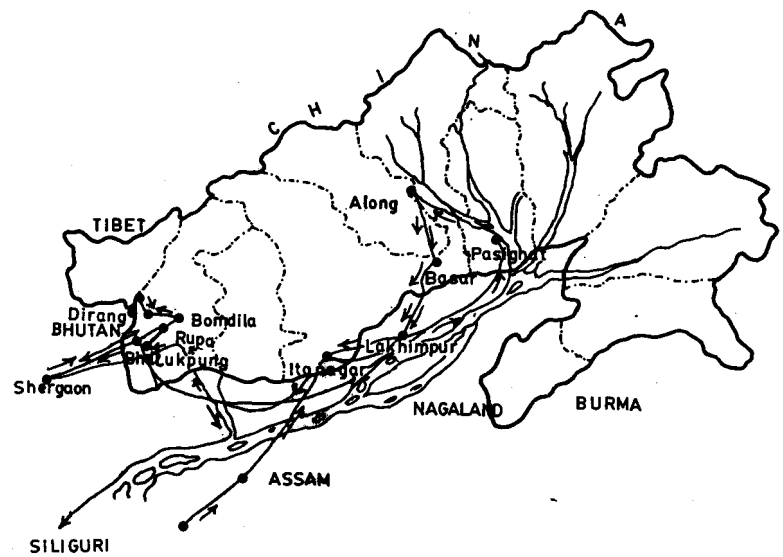

Fig. 2. Route map for maize germplasm collection from Arunachal Pradesh (Sept. 1991)

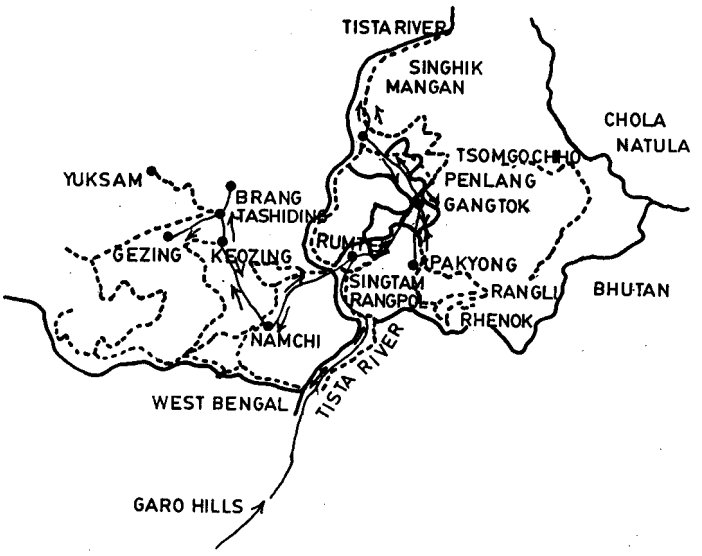

Fig. 3. Route map for maize germplasm collection from Sikkim (Nov. 1992)

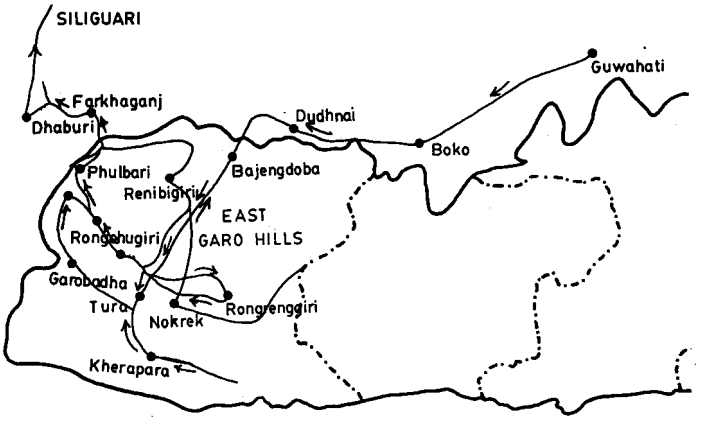

Fig. 4. Route map for maize germplasm collection from Garo Hills (Nov. 1992)

Table 2. Frequency distribution for different ear/kernel characteristics in maize germplasm (Percentage values in the parenthesis)

Character/Grade	Frequency			
	1	2	3	Total
Ear length	110 (13)	533 (67)	156 (20)	799 (100)
Kernel rows	90 (11.5)	665 (82)	44 (5.5)	799 (100)
No. of kernels per row	90 (11)	564 (70)	145 (19)	799 (100)
No. of ears per plant	532 (66)	75 (10)	192 (24)	799 (100)
Kernel type	593 (74)	50 (6)	156 (20)	799 (100)
Kernel colour	574 (72)	35 (4)	190 (24)	799 (100)

* = see text for details

About 67 per cent accessions had ear length between 11-15 cm, whereas 20 per cent accessions had ear length more than 15 cm. A good amount of variability was observed for the prolificity of the ear and it varied from 1-5. Ear number per plant in 76 per cent accessions was either one or two, whereas in 24 per cent accessions the number was either 3 or more. Ear diameter varied from 1.8 cm to over 4.5 cm. Kernel rows varied from 8 to as high as 22. Kernel rows between 12-16 possessed in 67 per cent accessions, whereas about 6 per cent (44) accessions had kernel rows more than 16. Kernel number per row between 15-30 were found in 76 per cent accessions and only 18 per cent accessions had more than 30 kernels per row.

A wide range of variability existed in kernel colour (yellow, white, purple, dark-purple, cherry, blackish to varied ad-mixtures). About 72 per cent collections had yellow kernel colour. Whereas, only a few accessions (35) possessed white kernels. Kernel type varied from flint, semiflint, semident to pop. Of the total collections, 74 per cent collections had flint kernel type and 20 per cent had pop kernel type. The frequency of semiflint and semident was very low (5%). It was observed that yellow flint types were predominant and under cultivation throughout the north-eastern Himalayan region of India. Earlier reports (Wellhausen, 1965) suggested that Indian maize seemed to be nearly, yellow, flint with long slender ear, somewhat enlarged at the 'butt' with light yellow endosperm and shallow grains closely resembling the early yellow flints grown in North-eastern parts of United States of America.

This collection represented primitive to advance types (Fig. 5). It is worthwhile to record again that the primitive types and other landraces encountered about the 20 years ago are still prevalent in pure form to a larger extent in the Garo Hills and other pars of north-east India. Some of the strains from Sikkim had very close resemblance to the postulated ancestors of maize. Further, this diversity collected or observed, represents 10 of Indian maize

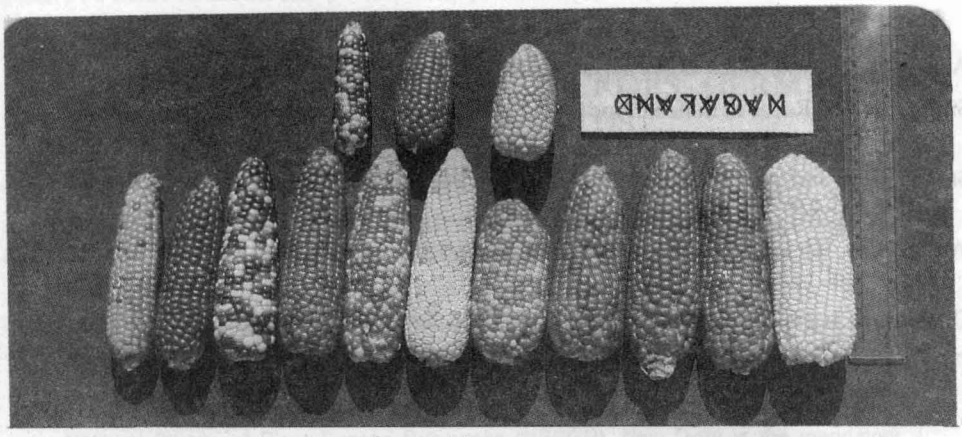

Fig. 5. Maize collections from NEH region representing primitive to advance types

Fig. 6. A primitive land race of maize stored separately from an improved cultivar

races reported from the north-eastern Himalayan Region by Singh (1977). The north-eastern region is not only having this wide spectrum of genetic variability but it is clear that this diversity falls in distinct groups, whose identity has been preserved over centuries. These races provide useful information on the types of variability available and the varietal populations that would be suitable in meeting the needs of specific breeding programmes.

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