

Evaluation and Utilization of Genetic Resources of Minor Millets

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The National Bureau of Plant Genetic Resources, during the past 7-8 years, has been engaged actively in the exploration (collection), evaluation, conservation and utilization/exploitation of genetic resources of various species, namely, Setaria italica, Eleusine coracana, Panicum miliaceum, Panicum sumatrense, Echinochloa frumentacea, Echinochloa crus-galli and Paspalum scrobiculatum under minor millet group of crops. A total of 3,123 diverse genetic resources (905 collections in Setaria, 601 in Panicum, 983 in Eleusine sp., 386 in Echinochloa sp. and 248 in Paspalum scrobiculatum) assembled from diverse agro-climatic zones from within India and abroad, were evaluated thoroughly from 1980 to 1984 at Akola and Shimla locations for various agro-botanical and economic characters. The variability occurring in above crops for most of the agronomic attributes (including fodder characters), is of immense significance to the breeder. Crop catalogues for Foxtail and Kodo millet were published and on other species are under preparation. Donor types were identified for their use as direct introductions or as parents for evolving better varieties in these crops for both in the hills and plains. An account of the variability and promising germplasm identified in each crop is presented in this paper.

In India, seven species of lesser millets are cultivated from time immemorial and used as grain and fodder in different parts of the country. Paradoxically, these crops have been always grown on marginal lands with poor soil nutrients. Since, these crops have constituted the main diets of the poor tribal and ethnic population, rich genetic diversity has evolved and perpetuated until recently. However, this genetic diversity is now under constant threats. Thus, their collection and conservation is of vital importance. The efforts made in this direction are presented here.

MATERIALS AND METHODS

Germplasm collection comprising landraces in finger millet (*Eleusine coracana*), Italian or foxtail millet (*Setaria italica*), common or proso millet (*Panicum miliaceum*), little millet (*P. sumatrense*), kodo millet (*Paspalum scrobiculatum*), barnyard millet (*Echinochloa crus-galli*) and Japanese barnyard millet (*E. frumentacea*) were built up through exploration surveys using random collection strategies. Out of total germplasm diversity comprising 3,123 accessions assembled

from different agro-climatic regions of India and introduced from abroad; 2,739 accessions (737 diverse germplasm in *Setaria italica*, 404 in *Panicum miliaceum*, 197 in *P. sumatrense*, 767 in *Eleusine coracana*, 386 in *Echinochloa* spp and 248 in *Paspalum scrobiculatum*) were evaluated (1980-1984) at NBPGR Regional stations, Akola and Shimla for various agro-botanical and economic characters and crop catalogues developed. Useful genotypes were identified for their use as direct introduction or as parents for evolving better varieties for marginal land in both hills and plains.

RESULTS AND DISCUSSION

(a) Foxtail millet

A total of 737 collections in Foxtail millet (*Setaria italica*) were studied for 45 qualitative and quantitative characters at Shimla and a wide range of variability observed in plant height (44.8-203.5 cm), internode length (6.3-24.2 cm), number of internodes (4-16), tillering capacity (2-16), leaf length (28.2-74.4 cm), leaf width (1.1-3.5 cm), spike length (7.3-40.2 cm), green fodder yield (0.2-1.8 kg) per plot (1.0 m × 0.5 m), days to flowering (53-96), days to maturity (93-147), seed yield per plant (0.9-52.0 g) and 1000 grain weight (2.0-5.92 g). Promising genotypes identified are :

High yielding grain types	: ISe-720, IC-11241, Manikaran-2 Shai Local-1, Kasol-3-92, IC-41900
Bold seeded types	: ISe-897, ISe-952, ISe-62
Longr panicle types	: ISe-720, Manikaran-2, ISe-82, IC-17336
Early maturing types	: EC 24091 (93 days), EC 24086 (95 days) and Kasol-3-92 (96 days)

The promising varieties were tested at 3 locations at Shimla, Palampur and Sangla valley and it was found that ISe-720, IC 11241 and ISe-83 are the best yielders at these locations. A Catalogue on Foxtail millet has been published (Umesh Chandra *et al.*, 1987a).

(b) Finger millet

A total number of 767 collections in finger millet (*Eleusine coracana*) were studied at Shimla for 44 characters and the germplasm varied in plant height (48.2-161.2 cm), number of internodes (5-14), culm length (5.5-18.4 cm), tillering (2-9), leaf length (19.4-67.5 cm), leaf width (0.6-2.1 cm), number of fingers per spike (4-10), finger length (4.1-10.4 cm), green fodder yield (0.1-4.8 kg) per 1 m × 0.5 m plot, days to heading (57-116), days to maturity (93-191), seed yield per plant (0.6-50.0 g) and 1000 grain weight (2.2-6.98 g). Promising genotypes identified include :

High yielding types	: IC 41819, IE-168, IC 41822, IC 18007 and IE-240.
High green fodder yielding types	: IE-240, IE-16, IE-168 and EC 130989.
Bold seeded types	: Kandaghat local, EC 130889 and EC 13007
Early maturing types	: IE-8 (93 days) and IE-11 (95 days)
High tillering types	: IE-512, IE-510 and EC 131041
Long panicle types	: E-KEP-540, EC 131056 E-KEP-545.

Accession IE-168 and IE-240 were observed good both for grain and fodder. They can be used as direct introductions.

(c) *Proso millet and Little millet*

In India, *Panicums* are grown in Andhra Pradesh, Maharashtra, Karnataka, Tamil Nadu and to a small extent in Bihar, Madhya Pradesh, Uttar Pradesh and Punjab. Four hundred and four accessions in proso millet (*Panicum miliaceum*) and 197 collections in little millet (*P. sumatrense*) were studied for 34 agro-botanical and economic characters at Shimla location and variability was observed in plant height (38.4-172.6 cm), internode length (4.1-16.7 cm), number of internodes (4-15), culm length (4.8-13.6 cm), tillering capacity (2-12), leaf length (21.5-61.4 cm), leaf width (1.0-2.3 cm), panicle length (15.7-46.2 cm), green fodder yield (0.2-1.2 kg) per 1.0 m × 0.5 m plot, days to heading (47-67), days to maturity (78-92), seed yield per plant (2-40 g) and 1000 grain weight (3.0-8.44 g). Promising strains identified include :

High grain yielding types	: HCC-20, HCC-112, EC 25096, EC 24114 & EC 24113
High fodder yielding types	: IC 41854, HCC-20, HCC-12 EC 24124, EC 24114, Runa local & Shai local
Long panicle types	: Shai local, EC 24114
Early maturing types	: Jaried local (78 days) and IC 13358 (80 days)

(d) *Barnyard millet*

Three hundred and eighty six collections were evaluated for 37 characters in barnyard millet (*Echinochloa* sp) at Shimla location. Much variability was observed in plant height (76.7-153.1 cm), internode length (9.6-18.2 cm), number of internodes (4-12), tillering capacity (2-17), leaf length (14.1-48.1 cm), leaf width (1.1-1.8 cm), spike length (9.4-18.3 cm), green fodder yield (0.2-3.2 kg) per 1.0 m × 0.5 m plot, days to heading (55-83), days to maturity (127-160), grain yield per plant (3-12 g) and 1000 grain weight (2.4-4.86 g). Promising donors identified include :

High grain yielding types	: IC 28431, IC 23428 and IC 41785
High fodder yielding types	: IC 41785
Early maturing types	: IC 28431 and Local Enzalu

(e) *Kodo millet*

Two hundred and forty eight collections in Kodo millet (*Paspalum scrobiculatum*) assembled from drier tracts of Madhya Pradesh and Andhra Pradesh were evaluated for 26 characters at two locations (Akola and Shimla). The collections varied in plant height (44.4-82.0 cm), days to heading (101-126), number of internodes (2-5), tillering capacity (2-7), number of spikelets per spike (2-3), spike length (4.5-7.4 cm), number of rows per spikelet (2-4), days to maturity (154-168 days), grain yield per plant (3-9.2 g) and 1000 grain weight (2.40-6.38 g). Promising donor genotypes identified are :

High grain yielding type	: IC 76268, IC 76264 and IC 76267
Bold seeded types	: IC 41865, IC 76262 and IC 76214
Early maturing types	: IC 76169, IC 76213 and IC 41856.

A catalogue on Kodo millet has been published (Umesh Chandra *et al.*, 1987b).

Other two important millets grown in emergency/stress situation are *Digitaria cruciata* and *Coix lacryma jobi*. *Digitaria cruciata* var. *esculenta* is grown by the khasi tribals in Shillong plateau. It is cold tolerant grass for food and fodder (Singh and Arora, 1972). The soft shelled form of *Coix lacryma jobi*, easy hulling types with bigger kernel and heavy fruiting occur in North-Eastern region. In Garo hills (Meghalaya), variability has been reported (Arora, 1977).

Multilocation evaluation and documentation is very important for future utilization of minor millet germplasm (Thomas *et al.* 1986). Much work in this direction is currently being carried out by the ICAR coordinated project on minor millets. Strengthening of genetic resources from untapped areas and documentation of existing evaluated material is pertinent. The NBPGR Gene Bank is currently storing about 2000 collections of diverse minor millets germplasm. Improvement in yield is the immediate need and easy access to diverse germplasm will be the first step in aiming at higher yield of lesser millet crop species.

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