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COLLECTION OF GERMPLASM FROM WESTERN HIMALAYAS

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A germplasm collection mission to the western Himalayas was undertaken jointly by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru and the National Bureau of Plant Genetic Resources (NBPGR), New Delhi to collect mainly wild Pennisetum, sorghum, finger millet, pulses including pigeonpea and other crops of local importance during October 1991. The hill slopes showed preponderance of primitive agriculture, followed with traditional varieties. Wild Pennisetum were found growing at 500-3100 m. Two identical species of Pennisetum viz., P. orientale L. C. Rich and P. flaccidum Griseb and some more (yet to be identified) were collected. Sorghum with long drooping panicle branches (broom corn), pigeonpea, mostly early-maturing types and finger millet were also collected. In all, a total of 133 samples consisting of Pennisetum(33), sorghum(11), pigeonpea(7), minor millet(30), amaranths(9), cowpea(5), blackgram(8), sesame(6), paddy(4), maize(4) and 16 of other crops were sampled. Good sources for cold tolerance and early maturity are expected to be available in the collected germplasm.

The objectives of the germplasm collection mission from western Himalayas were to collect mainly wild *Pennisetum*, sorghum, minor millets, legumes, amaranths and other locally available crops from their natural habitat and farmers fields; to gather information on special agricultural practices followed in this area; to assess damage by diseases and pests and other constraints for food production; and to record/study the traditional food processing methods. Initial

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planning was done at the NBPGR, New Delhi. Further, the precise areas for collection were identified with the help of Forest Research Institute(FRI), Dehra Dun. Herbarium specimens maintained at FRI were particularly useful in locating the areas of distribution of *Pennisetum*. The collection mission was laid jointly by one scientist each from ICRISAT, Patancheru and NBPGR, New Delhi.

Collection area

The area covered was situated between 29°–31° N latitudes and 79°–81° E longitudes in Uttar Pradesh, India. The altitude ranged from 500 m at Dehra Dun to 3100 m at Mana near Badrinath in Chamoli district. Soil were mostly undeveloped, mixed with sandy to clay loams. However, in the valleys where farming was practiced on terraces, the soil profiles were developed and were fertile.

Agricultural practices

Terrace cultivation on slopes was a common practice. In the valleys, a variety of crops including grain amaranth, finger millet, and various pulses like greengram, blackgram and cowpea were found growing. Pearl millet was cultivated mainly for fodder in the plains. The millet plants were very tall with very thick stems and medium sized heads. Sorghum was also grown under high population density mainly for fodder. On the slopes, tall growing, late maturing sorghums were observed which produced long, loose, drooping panicle branches. A mixture of different crops like finger millet, blackgram, amaranth were also observed which showed a wide maturity range. Finger millet was found grown mixed with upland paddy around Dehra Dun. In all these areas, fields were prepared by ploughing with a wooden plough after the first monsoon rains. Sowing was done by broadcasting or line sowing.

Sampling methods and collection strategy

The area covered and route followed were decided considering the distribution and maturity of the crops and also the distribution of related wild species. Herbarium specimens at the Forest Research Institute, Dehra Dun were examined to identify the areas of distribution for wild species. The areas covered during the present exploration and the route followed is shown in Fig.1. Course grid sampling was followed with an emphasis on collecting random samples. A farmer's field was considered as a unit for sampling and random plants were collected as populations. While collecting samples, information on traditional farming practices and other relevant passport informations were also gathered.

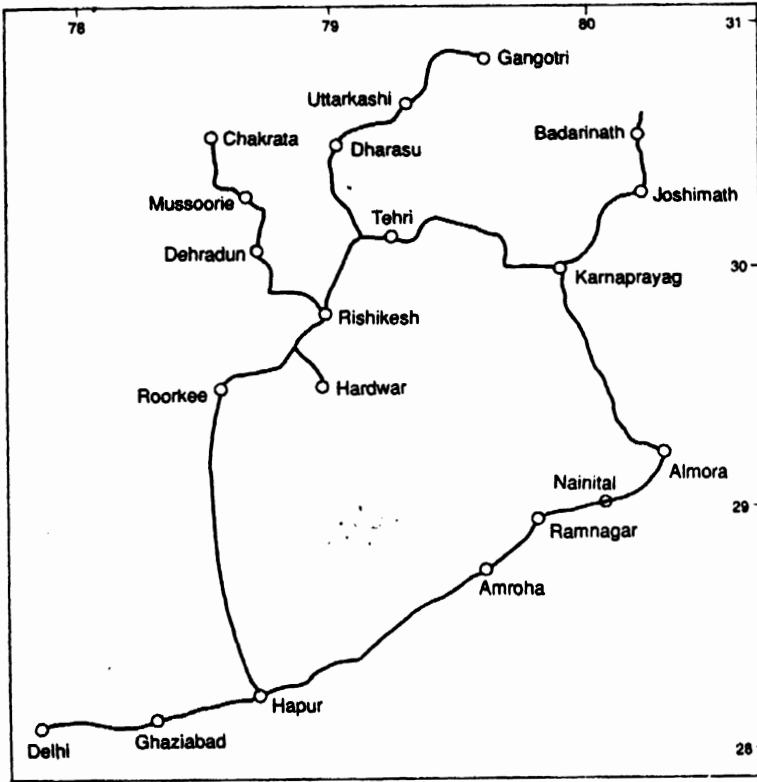


Fig. 1. : Route followed and areas explored for germplasm collected in the western Himalaya.

DIVERSITY IN GERMPASM COLLECTED

One hundred thirty three samples were collected in pearl millet(2), wild *Pennisetum* spp.(31), sorghum(11), pigeonpea(7), minor millets(30), amaranthus(9), cowpea(5), blackgram(8), sesame(6), paddy(4), maize(4), besides 16 samples of miscellaneous crops. The extent of variability observed and collected in different crops is as under :

Sorghum : Broom corn sorghum for grain, brooms and for forages was commonly grown mixed with finger millet or amaranths. Its panicles were large and loose with drooping branches. Another form with well shaped compact, oval panicles and chalky white grain was also grown for grain.

Pearl millet : It was relatively less important crop of the area, grown mainly in the plains for fodder. Plants were seen over 4 m tall and produced medium size grain. Stems were thick, nodes many with 3-5 basal tillers. Pearl millet was not grown at high elevations.

Pigeonpea : It was grown in valleys at the margins of sugarcane fields. Most varieties were relatively early-maturing, grown upto 2 m tall and produced several branches. Considerable variation was observed in number of branches, pods per plant and seeds per pod. Variation was also observed in seed size, colour and shape. Good sources for early maturity, profuse podding and small seed size were observed in this area.

Finger millet : It was extensively grown on terraces, mixed with a variety of legumes like blackgram, greengram or cowpea. It was grown mixed even with rice around Dehradun. Considerable variation was observed in plant height, size and shape of the head and number of fingers(Fig.2). Fingers per head varied from 3-11, and fingers were top curved, incurved, open or compact. Intermediate weedy forms were found in several cultivated fields as a result of introgression between wild and cultivated types. Good sources for large compact heads, white grain and cold tolerance were observed.

Grain amaranths : At higher altitudes amaranths were extensively grown for grain (Fig. 3). They grew over 2 m tall with several branches, and very large inflorescence of different colour (green, red, and a number of intermediate forms). The grain is used as food, tender leaves as vegetables and the stalk for forage. It was usually mixed with legumes.

Legumes : Blackgram(*Vigna mungo* L.) and greengram(*Vigna radiatus* L.) are commonly grown mixed with a variety of crops. Blackgram was twining in habit and produced hairy pods with mottled seeds. Greengram produced clusters of long pods with shining green seeds. In Cowpea(*Vigna unguiculata* (L.) Walp.) long creeping types with profuse branching were commonly grown. Fresh pods were used as vegetable and mature seeds as pulse. It was also an important fodder crop. It was grown mixed with sorghum, amaranths or with other legumes.

Wild relatives : *Sorghum helepense* was found growing almost throughout the area surveyed. However, intermediate shatter canes were not observed. At least four distinct species of *Pennisetum* were collected from the Kumaon and Garhwal hills. Wild *Pennisetum*(Fig.4) were found on bunds and on wastelands upto an altitude of



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Fig. 2. : Variability in finger millet germplasm.

Fig. 3. : Variability in grain amaranths.

Fig. 4. : Collection of wild *Pennisetum* at high altitude.

3000 m, specially near Mana pass, not far from Badrinath. *Pennisetum orientale* L.C.Rich., found at medium to high altitudes, was used for forage. *P. flaccidum* Griseb. was found at medium altitudes. Two more types were collected which are yet to be identified. *Pennisetum* collected were good source for cold tolerance. *Eleusine* was found to grow wild at low to medium altitudes, specially around Dehradun and Mussoorie. It was found to hybridize with cultivated finger millet and weedy intermediate forms were found at varying proportions. This clearly indicates the occurrence of introgression in this area. The weedy forms produced heads which were intermediate between wild and cultivated forms and shattered their spikelets at maturity like the wild forms.

GENETIC EROSION

Farmers cultivated only traditional varieties of all crops except for rice, for which improved varieties are used. All the sorghum, pigeonpea and finger millet fields were sown with primitive types. Hence, as such, there appeared to be no threat of replacement of traditional types with improved varieties. However, the wild relatives were threatened because of over grazing by sheep, goats and cattle.

UTILITY OF THE GERMPLASM

The collected germplasm in general and the wild *Pennisetums*, in particular, should be good sources for cold tolerance as the material was collected at higher altitudes. The pigeonpea material was a good source for early maturity, small grain size and good grain quality; and the finger millet for large finger size and white grain colour.

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