Indian J. Plant Genet. Resour. 35(3): 151–153 (2022)
DOI 10.5958/0976-1926.2022.00059.6

Plant Genetic Resources for Crop Improvement: The North-Western Himalayan Perspective

SK Sharma[1*], Nikhil Malhotra[2] and Mohar Singh[2]
[1]*CSIR-Institute of Himalayan Bioresource Technology, Palampur-176061, Himachal Pradesh, India*
[2]*ICAR-National Bureau of Plant Genetic Resources Regional Station, Shimla-171004, Himachal Pradesh, India*

Himalayas is one of the unique eco-systems, rich in robust indigenous culture and traditional wisdom. Due to its varied climatic conditions, it is gifted with a wide diversity of plant genetic resources (PGRs) of several crop species and their wild relatives. These crops and their wild taxa have contributed significantly to environment and food security of the native people. Recent past has seen some breakthroughs in successful utilization of Himalayan PGRs in cultivar development that could serve as model for future crop improvement programs vis-à-vis climate change and nutritional security.

Introduction

Himalayas is one of the 36 hot spots of diversity identified globally. Plant Genetic Resources (PGRs) in the Himalayas comprise land races and primitive cultivars, obsolete farmers' and old varieties, recently released cultivars, parental line of the released hybrids, genetic stocks, wild and their weedy relatives etc. The farmers of the region grew these land races for their livelihood security since ages. Notwithstanding yield potential, these are invariably characterized by drought tolerance, pest resistance, wider adaptability with desirable quality traits etc. These land races were improved by both selection and hybridization, and a large number of high yielding varieties were developed for the benefit of farmers. In the traditional agro-ecosystem of North-Western Himalayas, these varieties have replaced the traditional cultivars and land races leading to the loss of diversity. There has to be a national action plan for further strengthening their collection, evaluation, conservation and sustainable utilization.

Status of PGRs

Himalayas, including NW Himalayan region is endowed with an array of genetic resources of crop plants, their wild relatives and a plethora of edible wild plants supporting ~85% of the region's population on agriculture for their food and daily needs. The region is very rich in species diversity of cereals, millets, pseudo cereals, pulses, oilseeds, vegetables, fruits, spices and condiments, fibers etc. It represents the richness of PGRs by having around 272 cultivated crop species and 898 wild relatives and related types (Table 1; Sharma and Rana, 2005).

Table 1. Status of PGRs and their wild relatives in NW Himalayas

Crop group	Cultivated species	Wild species	Total
Cereals	5	36	41
Millets	10	44	54
Pseudo cereals	7	20	27
Pulses	19	34	53
Oilseeds	13	11	24
Vegetables	68	58	126
Fruits and nuts	49	65	114
Fibers	9	44	53
Spices and condiments	37	55	92
Forages	8	219	227
Ornamentals	18	130	148
Medicinal and aromatic plants	29	182	211
Grand total	272	898	1170

PGR Utilization

Despite the enormous variability of crop species including wild relatives occurring in the Himalayas, their exploitation in crop improvement programs is still naive. Nevertheless, there are some notable examples demonstrating successful utilization of PGRs for the development of high yielding varieties through either selection or hybridization in NW Himalayan States/UTs. Among cereals, the use of genes from an accession of *Oryza nivara* from NW Himalayas to produce long-lasting resistance to grassy stunt virus is one of the

*Author for Correspondence: Email-skspbg@yahoo.co.in

pioneer examples of using wild germplasm in rice resistance breeding (Khush, 1997). The annual species of wild rice (*Oryza rufipogon*), which grows in the several parts of the NW Himalayas have a high degree of blast resistance (Rathour et al., 2005). Selection from available germplasm has also led to the development of several rice varieties in the region. SKUAST, Jammu, developed Ranbir Basmati and Saanwal Basmati through selection from Basmati 370 and released these for cultivation during 2005 and 2007, respectively. Later, high yielding Basmati 564 was also developed from Basmati 370 through selection during 2014. Recently, it developed Jammu Basmati 118, 123 and 138 from Basmati 370 having high yield potential. Notably, State Variety Release Committee (SVRC) released these varieties for cultivation during 2020. Similarly, pure line selection led to the genetic improvement and uniformity of three most popular rice varieties viz. Mushk Budji, Kamad and Red Rice of Kashmir valley. Of late, red rice grown in the region has also gained considerable attention nationwide due to their unique red pericarp colour and high nutritional values. In Himachal Pradesh, Bhrigu Dhan, the first high yielding red rice variety developed from a cross Chucheng/Deval®//Matali was released by the SVRC during 2005. Further, ICAR-VPKAS, Almora developed maize variety VL Baby Corn 1 during 2005 by using a local land race Murali Makkai, a Sikkim primitive maize exhibiting prolificacy and excellent popping capacity.

In pulses, CSK HPKV, Palampur developed three popular varieties of rajmash namely, Baspa (KRC-8) derived from collection from Kinnaur and released as variety for cultivation in Himachal Pradesh. This is very popular variety for its attractive seed colour and field resistance to bean anthracnose and is still under cultivation in many segments of the state. Triloki variety was derived from a land race of Lahaul valley, and Kailash (SRC-74) was selected from the local germplasm collected from Sangla valley and released for cultivation in the dry temperate region of Himachal Pradesh during 2003. The University also developed horsegram Baiju (HPK-4) variety from local germplasm collection. ICAR-VPKAS, Almora developed wilt and rust resistant lentil VL Masoor 514 by crossing VL Masoor 501 × VL Masoor 103 during 2011. VL Masoor 103 is a selection from local collection of Uttarakhand Himalayas. SKUAST, Jammu developed Bhaderwah Rajmash variety (BR-104) through selection from local germplasm and released by the SVRC during 2020.

In potential crops, the notable instances of the effective use of amaranth germplasm from the Himalayas is the development of the high yielding cultivar Annapurna during 1984 which was a direct selection from a local genetic line followed by Durga during 2006 developed from IC35407 by ICAR-NBPGR Regional Station, Shimla. Both these varieties were released by the CVRC. Similarly, ICAR-NBPGR Regional Station, Shimla also developed buckwheat variety Himpriya as a pure line selection from IC13374 followed by Shimla B1 from IC341671 and notified by CVRC during 1991. Further, ICAR-VPKAS, Almora developed VL UGAL 7 variety during 1991 through mass selection. Recently, ICAR-NBPGR Regional Station, Shimla developed Himphapra variety of buckwheat valued for high protein content (13.10 %) from IC341589 and was dedicated to the nation by Hon'ble Prime Minister of India on 28th September 2021.

CSK HPKV, Palampur developed a number of varieties in forages for improving temperate grasslands and pastures by involving the local land races and indigenous germplasm collected from different parts of the Himalayas. Napier-Bajra hybrid NB-37, Red clover PRC-3, Setaria grass S-92, Tall fescue grass Hima-1 and Hima-4, and White clover Palampur Composite-1 are some of the major varieties developed during 1987-2005 and released by the SVRC.

Wild species of fruits are growing abundantly in Himalayas and have been used as rootstock for cultivated temperate/sub-temperate fruit crops. These include different *Prunus* species as rootstock for cherry and plum, kainth for pear, crab apple as seedling rootstock for apple, wild apricot or chulli for apricot, hard-shelled almond and walnut for almond and walnut, respectively. SKUAST, Jammu recently developed high yielding walnut and pecan nut varieties Bhusan and SJPP-25, respectively through selection of local germplasm collected from Kishtwar region in Jammu and released by SVRC for cultivation during 2020. Likewise, popular variety of drying apricot namely Halmen cultivated in Kargil, Leh and Spiti was selected from a local land race. Likewise, Racharpo a table purpose apricot variety and the sweetest in the world was selected from a local land race in Kargil.

Future Prospects and Action Points

- Mainstreaming the use of ancient crop varieties and revisiting the diverse regions of the Himalayas harboring them could help in the conservation and long-term sustainable utilization of PGRs.
- Awareness and capacity building programs are required to enable the local people to use highly diversified crop plants inhabiting the region to increase agricultural productivity as per future needs.
- Promoting the registration of traditional land races with PPV&FRA in response to IPR issues will protect the interests of native farming communities.
- An integrated approach of conventional and advanced technologies such as high throughput genotyping and phenotyping, development of genomic resources and strengthening PGR informatics should be the contemporary trail for the effective utilization of Himalayan PGRs to develop improved cultivars with climate resilient traits along with superior agronomical and nutritional features.

References

Khush GS (1997) Origin, dispersal, cultivation and variation of rice. *Plant Mol. Biol.* **35**: 25-34.

Rathour R, V Gaur, RP Kaushik and RS Chauhan (2005) *Oryza rufipogon* – a possible source of novel resistance specificities against rice blast (*Magnaporthe grisea*). *Curr Sci.* **89(3):** 443-447.

Sharma BD and Rana JC (2005) *Plant Genetic Resources of Western Himalaya – Status and Prospects.* Bishen Singh Mahendra Pal Singh, Dehradun, India, 467 p.