

# Diversity, Distribution, Nativity and Indigenous Uses of Crop Wild Relative of District Mandi Himachal Pradesh and Their Potential in Crop Improvement Programme

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**Abstract-**63 crop wild relatives (CWRs) 34 herbs, 12 Shrub and 17 trees, belonging to 25 Families and 42 genera has been documented from Mandi district (31°42' 29.4" N latitudes and 76° 55' 52.92" E longitudes) of Himachal Pradesh, North West Himalaya covering approximately 3,950 km<sup>2</sup> area, comprising 469 panchayats and 3374 villages with 2, 19, 145 households. The total human populations of study area is 9, 99,777 and livestock population is 67355. Altitudinal range of study area varies from 500-4034 m. In this study family Rosaceae has been found dominant represented by 13 spp. followed by Fabaceae (5 spp.) among genera *Rosa* is found dominant represented by 5 spp. These plant resources are utilized as a source of food, fodder, fuel, oil, medicine, material and root stock for improvement of cultivated plants by local people, but their use and tradition knowledge of utilizing is on sharp decline. Due to population explosion and shrinking of agriculture land due to urbanisation, industrialization and modernization major challenge before researcher at present is to feed day by day growing population and ensure food security for coming generation. Further adverse environmental conditions followed by emergence of new pathogens and pest future crops have to thrive in a drier, warmer and more variable climatic conditions. All this necessity the production of novel crop varieties which are resistant to various biotic and abiotic stresses and also maintain natural biodiversity. CWRs are important source of the genes for breeding program because these have been evolving for thousands of years in adverse environmental conditions and possess a much higher degree of adaptability. They can provide germplasm for hybridisation and rootstock for grafting of commercial crops. To ensure food security CWRs need to be utilized efficiently in crop improvement and breeding programme for better outcome.

**Keywords-**Crop wild relatives (CWRs), Breeding program, Crop improvement, Food security.

## I. INTRODUCTION

Wild food plant especially the Crop Wild Relatives (CWR) are important source of diverse genes, better yield, nutritional quality, adaptation and resistance to various biotic and abiotic stresses [1]. These are genetically related to domesticated crops and continue to evolve in the wild by developing traits suitable for changing environmental conditions, such as drought tolerance or resistance against insect, pest and diseases. Farmers and breeders can exploit these valuable genes to improve domesticated crops to produce new better performing varieties. CWR have been used to improve the yields and nutritional quality of crops since the beginnings of agriculture. The first signs of domesticating wild plant species date back 10,500 years in Western Asia. since then domestication has been practiced in different parts of the world by different groups of people [2]. The duration and intensity of this domestication process have been very variable and vary from crop to crop [3]. The percentage number of CWR species account for about 21% of the world's flora [4][5], assuming that any species belonging to the same genus as a given crop is a CWR. On that basis, it has been estimated

that there are 50,000 to 60,000 CWR and wild food plant species worldwide [4]. CWR are commonly found growing in surroundings of cultivated crops, so are very helpful to promote natural crossing of beneficial traits and provide cultivars with valuable genes of resistance against pests, diseases and tolerance to abiotic stresses. With changed climatic condition and weather pattern future crops will need to thrive in far drier, warmer and more variable climatic conditions. Therefore, the strategy should be formulated for simultaneous improvement of yield and quality. To overcome malnutrition which has emerged as a serious health concern in the developing and under-developed countries, CWR seem to be a viable option for nutritional enrichment and disease resistance in different crops [6]. Realizing the importance of CWR in crop improvement programme, it became imperative to document the information regarding their diversity, distribution, nativity, indigenous uses and potential in crop improvement programme.

## II. RELATED WORK

Earlier studies mainly focused on defining CWR, their documentation, harnessing, conservation and prioritization to underpin global food security [1][7] [8][9].CWR are underutilized genetic resource for Improving agricultural productivity and food security [10]. For harnessing and effective use of CWR for Crop Improvement , extensive survey, conservation and sustainable use of CWR is need of hour along with establishment of a Global Network for In Situ Conservation of CWR [4] [5][6] [11]. Such type of studies regarding CWR has not been carried out in Mandi District of Himachal Pradesh , so present study will document diversity of CWR their indigenous uses, status, nativity and potential in crop improvement programme of Distt. Mandi Himachal Pradesh with following objectives.

### Objectives.

1. To know the diversity, distribution & nativity of CWR of District Mandi Himachal Pradesh
2. To know indigenous uses of CWR of District Mandi Himachal Pradesh
3. To know present status of CWR of District Mandi Himachal Pradesh
4. To assess potential of CWR in crop improvement.
5. Future recommendation

## III. METHODOLOGY

### Study area:

Mandi district (31°42' 29.4" N latitudes and 76° 55' 52.92" E longitudes) of Himachal Pradesh, North West Himalaya (Fig.1) covers approximately 3,950 km<sup>2</sup> area comprising 469 panchayats and 3374 villages with 2, 19, 145 households. The total human populations of study area is 9, 99,777 and livestock population is 67355. Altitudinal

range of study area varies from 500-4034 m. It supports diverse habitats, species, communities and Ecosystems. The vegetation mainly is of sub-tropical and temperate types and mostly dominated by broad leaved deciduous and evergreen and coniferous types. (District Economic and Statistical Department, Mandi, H.P)



Fig. 1. Google map of Mandi HP.

### Method:

Survey and sampling of CWR was done (Rapid) between amsl 500-4034 m in the study area. Information on altitudinal range, habit, habitat (s) and utilization pattern of CWR was gathered by interviewing knowledgeable persons and Government officials of agriculture, horticulture and forest department through questionnaire (Table.1).

Table 1. List of informants

Sr. No.	Name	Age	Gender	Address	Profession
1	Kusum	36	F	Village Bhanwad, P.O.- Maloh, Tehsil-Sundenagar	Panchayat Secretary
2	Lal Singh	55	M	Village Bhanwad, P.O.- Maloh, Tehsil-Sundenagar	Agriculture
3	Bhop Singh	70	M	Village Baga P.O. Bagachanogi Tehsil-Thunag	Agriculture
4	Devi Singh	60	M	Village Laag, P.O.- Maloh, Tehsil-Sundenagar	
5	Kanshi Ram	58	M	Village Chohat P.O. Bagachanogi Tehsil-Sundenagar	Agriculture
6	Hema Devi	60	F	Village Keran, P.O.- Sundernagar, Tehsil-Sundenagar	Agriculture,
7	Sunita	50	F	Village Keran, P.O.- Sundernagar, Tehsil-Sundenagar	Agriculture, Stitching
8	Jethu Ram	58	M	Village Baga P.O. Bagachanogi Tehsil-Thunag	Agriculture
9	Kanshi Ram	58	M	Village Chohat P.O. Bagachanogi Tehsil-Sundenagar	Agriculture
10	Mr. NaagRam	65	M	Village chubhani, P.O. Bahyla, Tehsil-Thunag	Hakim, Agriculture
11	Parvati devi	65	F	Village Baragaon P.O. Drang Tehsil-Padhar	Agriculture
12	Champa devi	24	F	Village Jadron, P.O.- Bayla, Tehsil-Sundenagar	Traditional processing
13	Sheela Devi	48	F	Village – Shikari, P.O – Kalahod, Tehsil – Sundar nagar,	Vegetable
14	Jaithi Devi	72	F	VII.- Ghat, PO- Ghat, Teh.-Balichowki, Distt.-Mandi.	Farming
13	Anup chand	34	M	Village Baga P.O. bagachanogi Tehsil – Sundar nagar,	Agriculture
15	Begi Devi	40	F	Village Kataula, P.O. Nerchowk. Tehsil Sadar Mandi.	Lingad selling &farming
16	Sumitra en	60	F	Village & P.O.Talyahar Tehsil Sadar Mandi.	Pickle selling
17	Kripal singh	35	M	Village chohat p.o. Bagachanogi	Agriculture
18	Lata devi	43	F	Village-Kamand, P.O. Kamand, Tehsil Sadar Mandi.	Agriculture
19	Jagdish Thakur	52	M	Village Chanala. P.O. Kamand Tehsil Sadar Mandi.	Farming
20	Kamla Sharma	48	F	Village Chanala. P.O. Kamand Tehsil Sadar Mandi.	Agriculture
21	Barjee Devi	50	F	Village Sakrayar P.O. Kamand, Tehsil Sadar Mandi.	Agriculture
22	Anupriya	18	F	Village kotli, P.O.Samraham, Tehsil Kotli.	Farming and broom making

23	Meena Devi	26	F	Village Dari, P.O. Chail chowk. Tehsil chachyot,	Agriculture
24	Khem chand		M	Forest guard, Sundernagar Block	
25	Ritu Sharma		F	Horticulture Development Officer Sundernagar Block	
26	Sanjay Kumar		M	Agriculture Extension Officer, Sundernagar Block	
27	Naag Raj		M	Soil Conservation Officer, Block Sundernagar	
28	Sumitra Thakur		F	Forest Guard. Wild Life Wing, Sundernagar	

Identification of samples was done with the help of local and regional floras [11,12,13,14,15]. The nativity of the species has been identified following [16,17,18,19,20,21,22]. The species indicating its first record/origin from the Himalayan Region have been considered as natives.

Plants were analysed for their diversity, nativity, occurrence and their role in crop improvement program. CWR were chosen on the basis of their availability in natural habitat, growing wild without any human intervention and care, similarities of phenotype/genotype, source of germplasm and root stock for hybridization and grafting of commercial crops.

#### IV. RESULT AND DISCUSSION

##### Diversity, Distribution, Habit, Nativity and Occurrence.

63 CWR (34 herbs, 12 Shrub and 17 trees) has been documented during this study belonging to 26 Families and 42 genera. Family Rosaceae is dominant represented by 13 spp. followed by family Fabaceae (5 spp.) (Fig.2) among genus *Rosa* is found dominant represented by 5 spp. followed by *Prunus* 4 spp. and *Amaranthus* and *Citrus* 3 spp. each. 16 species are native to Himalayas (Fig.3) {the species indicating its first record/origin from the Himalayan Region have been considered as natives}. Out of 63 CWR 45 are abundantly present in study area while 18 are rare (Fog.4), a few of which are usually abundant in past but rare at present due to habitat fragmentation, pollution and changed climatic condition (Table.2, Fig.5). Presently only very few CWR *Citrus* spp., *Prunus*, spp., *Pyrus* spp., and *Mangifera indica* are used in crop improvement program as a rootstock for grafting while rest are still need to be exploited as a source of germplasm and their role in crop improvement program.

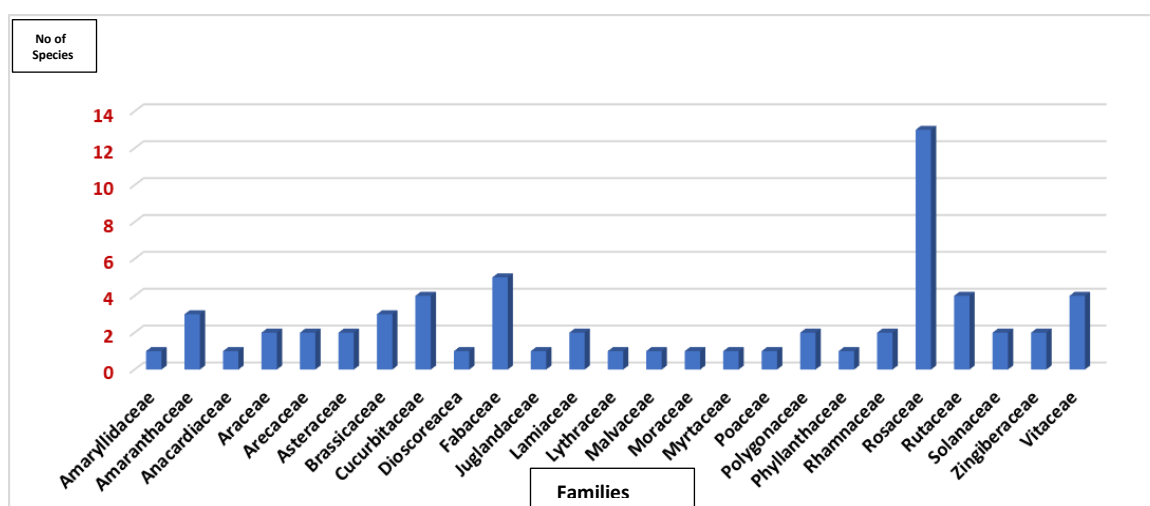


Fig. 2. Dominant & diverse families of CWR

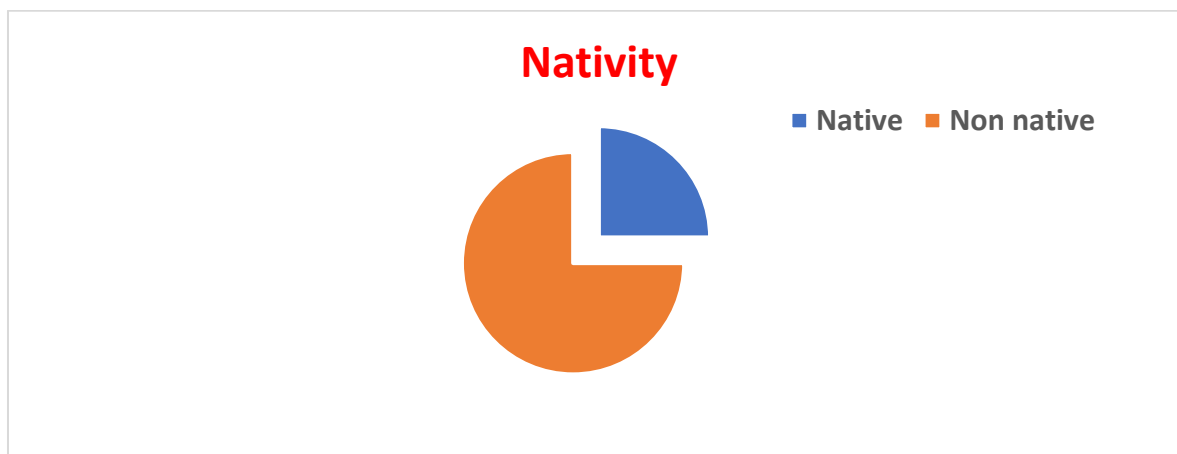


Fig. 3. Nativity of CWR

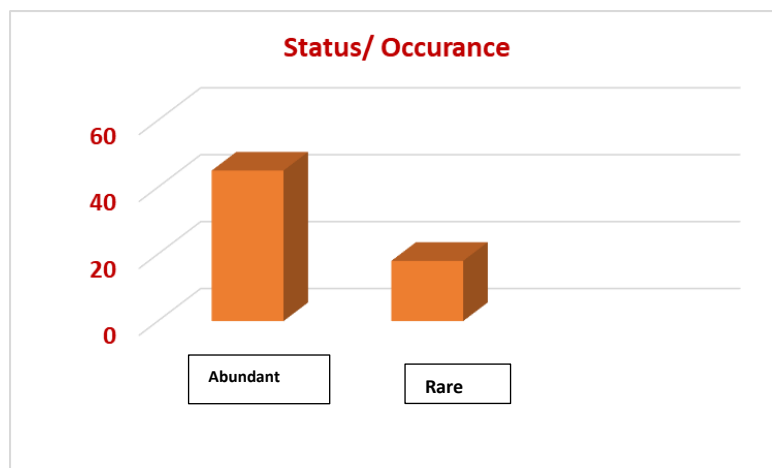


Fig. 4. Status of rare and abundant CWR

Table.2. Diversity, Distribution, Habit, Nativity, Occurrence and Utilization Pattern of CWR

Family/Taxa	LN	AR (m)	Associated crops	LF	Nativity	Status Abundant/Rare	Part Used	Indigenous Uses
<b>Amaryllidaceae</b>								
<i>Allium ampeloprasum</i> L.	Luhan	1500-3000	<i>Allium sativum</i> L.	H	Medit Central Asia	R	Lf, Bu	Md(Improve immunity, regulate menstrual flow, help to manage cholesterol and cure cancer), Ed.
<b>Amaranthaceae</b>								
<i>Amaranthus viridis</i> L.	Jangali Chauli	1200	<i>A. cruentus</i> L.	H	Reg Trop	A	Wp	Md(Bronchitis, cough, consumption, vomiting, pain in joints); Ed
<i>A. spinosus</i> L.	Kateli-Chauli	1400	<i>A. cruentus</i> L.	H	Reg Trop	A	Wp	Md(Abortifacient, antiemetic, blood purifier, cold, cough, colic, eczema, laxative, vomiting, heat in body, snake bite, scorpion sting, piles); Ed; Fd
<i>A. tricolor</i> L.	Chaulai	2000	<i>A. cruentus</i> L.	H	Reg Trop	A	Wp	Md(Bronchitis, cough, consumption, vomiting pain in joints); Ed.
<b>Anacardiaceae</b>								
<i>Mangifera indica</i> L. Wild	Aam	1200	<i>Mangifera indica</i> L. Cultivated	T	Ind Or Malaya	A	Lf, fr, Sd	Md(Abortifacient, anasarca, antifertility, cancer, cholera, vomiting, digestion, dropsy, dysentery, eye complaints, fever, jaundice, laxative, rheumatism, scabies, stomachache, tonic, toothache, ulcerated tongue.); Ed; Fule; RI(Sculptures on temples, pillars, with maidens of Jain, Hindu called (Vrikshikas), Abode of God, decoration on festivals and newly build houses
<b>Araceae</b>								
<i>Colocasia affinis</i> Schott	Jangli aalu	3000	Cultivated <i>C. esculenta</i> Schott.	C. H	Reg Himal	R	Lf, Tuber	Ed

<i>C. esculenta</i> (L.) Schott.	Jangli Kachalu	2800	Cultivated <i>C. esculenta</i> Schott.	C. (L.) H	As Trop	A	Corm, Lf, St	Md (Atrophy, bronchitis, cough, cuts, cold, wounds healing); Ed, RI.
<b>Arecaceae</b>								
<i>Phoenix humilis</i> Royle ex Becc. & Hk.	Khajoor	2200	<i>Phoenix dactylifera</i> L.	T	Ind Or Burma	R	Rh, Fr	Md(Bronchitis, cough, fever, lactation, stomach disorder after child birth); Ed; Household; Broom; Fi
<i>P. sylvestris</i> Roxb.	Khajara	2000	<i>Phoenix dactylifera</i> L.	T	Ind Or	A	Rt, Lf, Ft.	Md (Souring of teeth) Household (For making mats, broom, basket & for thatching). Fr, Ed
<b>Asteraceae</b>								
<i>Tagetes minuta</i> L	Jangaligenda	3000	<i>Tagetes erecta</i> L or other cultivated <i>Tagetes</i>	L H	Amer Trop	A	Ap	Md (Astringent), oil, perfume. Ed.
<i>T. patula</i> L.	Genda	1500	<i>Tagetes erecta</i> L or other cultivated <i>Ta</i>	L H	Mexic		Ap	Md (Astringent), oil, perfume. Ed.
<b>Brassicaceae</b>								
<i>Brassica juncea</i> (L.) Czern.	Raie	3000	<i>Brassica campestris</i> L.	H	Orb VetA Cosmop Cult		Wp	Md (Boils, skin disease, cough, migraine, muscle pain, bronchitis, cough, leprosy, pneumonia, scabies); Ed; RI.
<i>Eruca vesicaria</i> (L.) Cav.	Tara mira	2700	<i>Raphanus sativus</i> L. cultivated radish	H	Mediterranean	A		A source of salad leaves, medicines, essential and fixed oils, the plant has become fairly well known as a richly flavoured addition to salads.
<i>Raphanus raphanistrum</i> L.	Wild raddish	3000	<i>Raphanus sativus</i> L. cultivated radish	H	Mediterranean	A	Wp	Md(Antirheumatic).Ed.
<b>Cucurbitaceae</b>								
<i>Melothria heterophylla</i> (Lour.) Cogn.	Ban kakri	1800	<i>Cucumis sativus</i> L.	H	As Trop	A	Rt, Lf, Fr	Md (Antifertility, cuts, diabetes, fever, stomach-ache); Ed.
<i>Momordica balamina</i> L.	Van Karela	1500	<i>Momordica charantia</i> L.	H	Trop Afri, Himal	R	Fr, Lf, tu	Fr, Md(leaves & tubers are used to cure diabetes).Ed.
<i>M. dioica</i> Roxb. ex Willd.	Jangli Karela	1200		H	Ind Or	R	Fr	Md(Help to cure burns, haemorrhoids & diabetes): Ed
<i>Trichosanthes cucumerina</i> subsp. <i>cucumerina</i>	Jangli padavala	1800	CWR of Snake Guard (Trichosanthes cucumerina hybrid)	H	As, Ind Or	A	Fr	Md(Burns, diarrhoea snake bite, veterinary hoops & mouth disease of cattle); Ed.
<b>Dioscoreaceae</b>								
<i>Dioscorea bulbifera</i> L.	Daregal	1400	<i>D.belophylla</i> (Prain) Voigt.ex Haines	H	As Trop	A	Tu	Md(Abdominal pain, bone fracture, jaundice); Ed; RI (Shivratri)
<b>Fabaceae</b>								
<i>Avena fatua</i> L	Jangli jai	3000	<i>Avena sativa</i>	H	Eur, Afri, Ind	A	Sd	Md (helpful in controlling blood pressure & diabetes):.Ed.
<i>Cajanus scarabaeoides</i>	Bankullhi	1800	<i>Cajanus cajan</i> (L.) Millsp.	H	As Ind Or	A		Md(improving digestion, swelling and pain in the leg during pregnancy; night fevers; renal stones; eye diseases; dropsy; anaemia; hemiplegia; burns and wound, small-pox; syphilis; gonorrhoea; spermatorrhoea; gravel; cholera; dysentery; snake-bite).

								Ed.
<i>Lathyrus aphaca</i> L.	<i>Mater phalli</i>	2200	<i>L. sativus</i> L.	H	Reg Himal	A	Sd	Fd: Ed.
<i>L. sativus</i> L.	<i>Chapta Matar</i>	1200	<i>Pisum sativum</i> L.	H	Oriens	A	Sd	Fd: Ed.
<i>Trifolium repens</i> L.	<i>Jangali Beerseem</i>	3500	<i>Trifolium alexandrinum</i> L.	H	As et Afr Trop	A	Wp	Md (Astringent); FdL Ed
<b>Juglandaceae</b>								
<i>Juglans regia</i> L.	<i>Akhrot</i>	3500	<i>Juglans regia</i> Cultivated	T	Reg Himal As Occ	R	Br, Fr	Md (Frost bite, rheumatism, sores of toes, toothache); Ed; RI; Insecticidal
<b>Lamiaceae</b>								
<i>Mentha longifolia</i> (L.)Huds.	<i>Jangli-Pudina</i>	3000	<i>Mentha</i> sp. (Mint)	H	Himal, Afri, Eur	A	Wp	Md(Headache, stomach-ache, wounds): Ed
<i>Origanum vulgare</i> L.	<i>Ban Tulsi</i>	3000	<i>Origanum vulgare</i> L.	H	Europ As et Afr Trop	R	Wp	Md (Bronchitis, colic & diarrhoea, fever, hysteria, tonic): Ed; RI.
<b>Lythraceae</b>								
<i>Punica granatum</i> L.	<i>Daadu</i>	2500		Sh	Europe Austr Maurit	A	Wp	Md (Antihelminthic, checks bleeding of child birth, & miscarriage, cholera, cooling, dysentery, eyeproblem, pimples, stomachache); Ed, RI.
<b>Malvaceae</b>								
<i>Abelmoschus crinitus</i> Wall,	<i>Jangli Bhindi</i>	1500	<i>Abelmoschus esculentus</i> cultivated	H	Asia( China, India, Nepal, Vietnam, Thailand)	A		Ed (Unripe pods, new levees and young shoots are eaten as vegetable)
<b>Moraceae</b>								
<i>Ficus palmata</i> Forsk.	<i>Phaegda</i>	1550	<i>Ficus carica</i> L.	T	Reg Himal Burma	A	Fr, Lf	Md (fruit act as demulcent and laxative) Ed; Fd.
<b>Musaceae</b>								
<i>Musa paradisiaca</i> L. Wild	<i>Pahadi Kela</i>	1800	<i>Musa paradisiaca</i> L. cultivated	H	As Trop	R	Fl, Lf, Rt, St	Md (Antifertility, asthma and whooping cough, mucus in urine, pain, small pox); Ed; RI; Fd.
<b>Myrtaceae</b>								
<i>Psidium guajava</i> L. Wild	<i>Amrood</i>	1500	<i>Psidium guajava</i> L. Cultivated	T	Amer Trop	A	Lf, Br	Md (Blister in mouth, fever, headache, jaundice, stomach-ache, tonic); Ed.
<b>Poaceae</b>								
<i>Saccharum spontaneum</i> L. & others	<i>Puyal</i>	1800	<i>Saccharum officinarum</i> L	H	Geront Trop	A	St, Fl, Lf	Md(Asthma, burns, cholera, cough, urine problem); Ed; RI..
<b>Polygonaceae</b>								
<i>Fagopyrum dibotrys</i> (D) Don) Hara	<i>Kathu</i>	1600-3500	<i>Fagopyrum dibotrys</i> (D Don) Hara Cultivated	H	Reg Himal China	R	Lf	Md (Insect bite); Ed.
<i>F. esculentum</i> (L.) Moench	<i>Phapara</i>	2000-3000	<i>F. esculentum</i> (L.) Moench Cultivated	H	Europ As Bor	R	Rt	Md (Lungs infection, rheumatism, urine problem); Ed.
<b>Phyllanthaceae</b>								
<i>Phyllanthus emblica</i>	<i>Ambala</i>	1500	Cultivated <i>Phyllanthus</i>	T	As Trop	A	Wp	Md (Constipation, skin problem, hair tonic); Ed; RI.

L.			<i>emblica</i> L.					
<b>Rhamnaceae</b>								
<i>Zizyphus mauritiana</i> Lamk.	<i>Ber</i>	1800	<i>Zizyphus jujuba</i> Mill cultivated	Sh	Ind Or Malaya	A	Fr, Lf	Ed; Household; Agriculture implement; RI.
<i>Z. oxyphylla</i> Edgew	<i>Beri</i>	2000	<i>Zizyphus jujuba</i> Mill & <i>Zizyphus mauritiana</i> Lamk cultivated		Reg Himal	R	Fr, Lf	Ed
<b>Rosaceae</b>								
<i>Fragaria vesca</i> L.	<i>Jangli kaphal</i>	1000-3500	<i>Fragaria × ananassa</i> (Duchesne ex Weston) Duchesne ex Rozier	H	Ind Or (Sikkim)	R	Fr	Md(treat diarrhoea and dysentery, astringent and diuretic, The fruits contain salicylic acid and are beneficial in the treatment of liver and kidney complaints, as well as in the treatment of rheumatism and gout) Ed.
<i>Duchesnea indica</i> (Andrews.) Focke.	<i>Bhuin ankhe</i>	2400	<i>Fragaria × ananassa</i> (Duchesne ex Weston) Duchesne ex Rozier	H	As Trop	A	Fr	Md (Help in blood circulation, cure skin disease and swelling) Ed.
<i>Prunus armeniaca</i> L. Wild	<i>Khumani</i>	2000	<i>Prunus armeniaca</i> L. Cultivated	T	Reg Cauaus	R	Sd	Ed (Oil); Fuel
<i>P. cerceoides</i> D.Don	<i>Pajja</i>	3200	<i>Prunus armeniaca</i> L. Cultivated	T	Reg Himal	A	Br, Lf, Fr	Md(Bone dislocation, burns, cuts, joint pain, wounds, fever); Ed; RI; Fuel
<i>P. mira</i> Koehne	<i>Behmi, Chulli</i>	1500-4500	<i>Prunus armeniaca</i> L. Cultivated	T	Reg Himal	A	Fr	Fr edible (Oil)
<i>P. persica</i> Batsch.Wild	<i>Aru</i>	2500	<i>P. persica</i> Batsch. Cultivated	T	As Temp	A	Fr	Md(Antihelminthic, dysentery, headache, scabies); Ed.
<i>Pyrus pyrifolia</i> (Burm.f.) Nakai	<i>Naspati</i>	2000	<i>Pyrus communis</i> L.	T	As Trop S. China to Indo-China and Korea. or East Asia.	A		Md (astringent, febrifuge and sedative). Ed.
<i>P. pashia</i> Buch. - Ham.ex Don	<i>Kenth, Segal</i>	2000	<i>Pyrus communis</i> L.	T	Reg Himal	A	Lf, Fr	Md(Eye problem, diabetes); Ed; RI.
<i>Rosa. brunonii</i> Lindl.	<i>Kujja</i>	3500	<i>R. indica</i> L	Sh	Europe As Temp	A	Fl	Md (Diarrhoea, ophthalmia, wounds), Rose water & squash
<i>R. canina</i> L.	<i>Gulab</i>	2500	<i>R. indica</i> L	Sh	Europe As Temp	R	Ft, Fr	Ed, Rose water, Ornamental RI.
<i>R. hirsuta</i> ghora & panigrahu	<i>Ban gulab</i>	1900	<i>R. indica</i> L	Sh	Reg Himal	R	Fl, Fr	Ed, Rose water, Ornamental RL.
<i>R. macrophylla</i> L	<i>Jangli gulab</i>	1500=3000	<i>R. indica</i> L	Sh	Reg Himal	R	Fl, Fr	Md (cure cough and cold wound healing, apply leaf paste to treat swelling and chew petals for strengthening the gums. Fruit pulp is eaten to enhance eyesight). Ed: RI
<i>R. webbiana</i> Wall.	<i>Ban gulab</i>	3000	<i>R. indica</i> L	Sh	Reg Himal	R	Fl, Fr	Ed: RI..
<b>Rutaceae</b>								
<i>Aegle marmelos</i> (L.) Corr. Wild	<i>Bilpatri</i>	1500	<i>Aegle marmelos</i> (L.) Corr. Cultivated	T	Ind Or	A	Fr	Md(Digestive disorder); RI: Ed.
<i>Citrus aurantium</i> var. <i>khatta</i>	<i>Gambhru khatta, kharna khatta.</i>	2500	<i>Citrus reticulata</i> . Blanco	T	Reg Himal	A		Md(Cure cold and cough)Ed: RI
<i>C. jambhiri</i>	<i>Jamiridi</i>	2200	<i>Citrus reticulata</i> .	T	Reg Himal	A		Md (manage BP) Ed: RI

















			Blanco					
<i>C. pseudolimon</i> Tanaka	<i>Galgal</i> <i>Khtta</i>	2300	<i>Citrus reticulata</i> . Blanco	T	Reg Himal	A		Medicinal (Acnes, pimple on face, jaundice, kidney disease, malaria, ring worm, veterinary mucous & pus from mouth); RI
<b>Solanaceae</b>								
<i>Nicotiana plumbaginifolia</i> Viv.	<i>Jangli</i> <i>tambakuu</i>	1800	<i>N. tabacum</i> L.	H	Amer Bor et Trop	A	Lf,	Md (Skin disease, veterinary, germicide, smoked as tobacco): Ed
<i>Solanum indicum</i> L.	<i>Kantakari</i> <i>Jangli</i> <i>baingan</i>	2000	<i>S. melongena</i> L.	H	Reg Trop	A	Wp	Md (Blood purifier, cough, delirium, lungs disease, scabies, worm); Ed
<b>Zingiberaceae</b>								
<i>Curcuma aromatica</i> Salisb.	<i>Banhaldi</i>	1800	<i>C. longa</i> L.	H	Ind Or	A	Rh	Md (Fever, pain, remove dead foetus from womb); Ed.
<i>Zingiber roseum</i> (Roxb.) Roscoe	<i>Banadrak</i>	1700	CWR of <i>Zingiber officinale</i> (Zinger)	H	As Trop	A	Rt	Md (Body pain, internal haemorrhage). Ed.
<b>Vitaceae</b>								
<i>Vitis flexuosa</i> Thumb	<i>Jangali</i> <i>angoor</i>	900=1500	<i>V. vinifera</i> L. Cultivated	L. Sh	As Trop	A	Fr	Md (restorative, strengthening and tonic cancer). Ed.
<i>V. lanata</i> Roxb.		1700	<i>V. vinifera</i> Cultivated	L. Sh	Ind Or	A	Lf	Fd; Ed.
<i>V. vinifera</i> L. Wild	<i>Desi</i> <i>Angoor</i>	900=3500	<i>V. vinifera</i> L. Cultivated	L. Sh	Ind Or China	R	Lf, Fr	Md (Boils, toothache, Epilepsy); Ed.
<i>Parthenocissus semicordata</i> (Wall.) Planch.	<i>Bhambe</i> <i>grapes</i>	2000-3000	<i>V. vinifera</i> L. Cultivated	L. Sh	Reg Himal Buma Thailand W.China	R	Fr, Rt	Md (A poultice of the roots is used to help set dislocated bones). Ed.

**Abbreviations used:** LN= Local Name; AL= Altitudinal range; H=Herb; T=Tree; Sh=Shrub; St=Stem; Fr=Fruit; Rh=Rhizome; Sd=Seed; WP=Whole Plant; Ap= Aerial Part; Lf=Leaf; Fl= Flower; Rt=Root; Tu=Tuber; Wd= Wood; Fi=Fiber; and Bb= Bulb; Reg Himal= Himalayan region; As=Asia; Trop= Tropical; Ind Or=Indian Oriental; Amer= America; Trop=Tropical. Ed: Edible; Md; Medicine: RI= Religious: Fd: Fodder.







 <p><i>Fagopyrum dibotrys</i></p>	 <p><i>Fagopyrum esculentum</i></p>	 <p><i>Lathyrus sativa</i></p>	 <p><i>Magnifera indica</i></p>
 <p><i>Mentha longifolia</i></p>	 <p><i>Momordica balamina</i></p>	 <p><i>Momordica dioica</i></p>	 <p><i>Musa paradisiaca</i></p>
 <p><i>Nicotiana plumbaginifolia</i></p>	 <p><i>Origanum vulgare</i></p>	 <p><i>Parthenocissus semicordata</i></p>	 <p><i>Phoenix sylvestris</i></p>
 <p><i>Phyllanthus emblica</i></p>	 <p><i>Prunus armeniaca</i></p>	 <p><i>Prunus cerceoides</i></p>	 <p><i>Prunus mira</i></p>

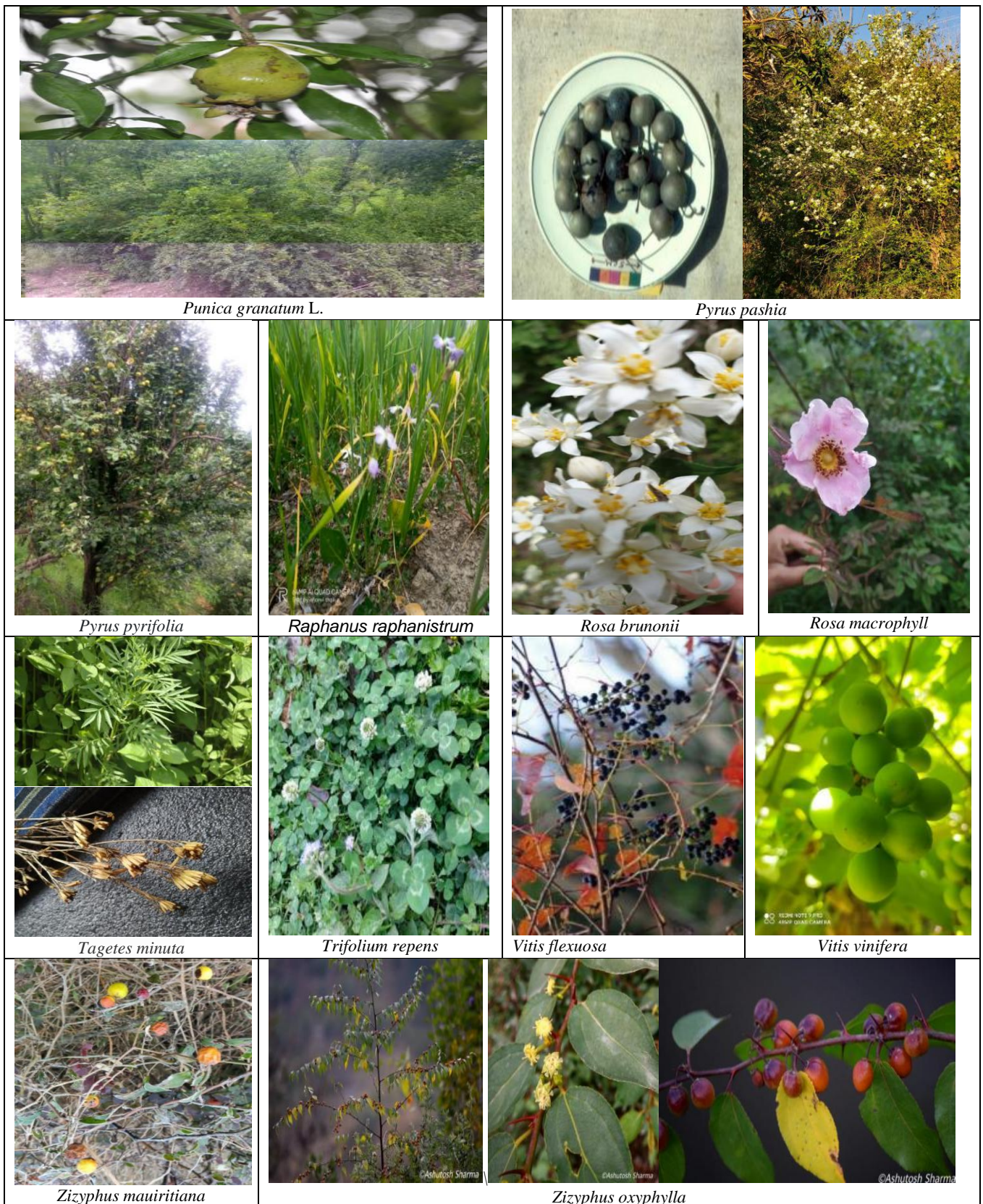


Fig. 5.

**Indigenous Uses:**

In addition to using CWR in breeding programme, people also gather species from the wild for their personal edible use and cook them as a food. Sometime people gather

these plant parts for commercial uses and can enhance their income by selling in local market. Farmers also often grow CWR alongside with domesticated crops to promote natural crossing of beneficial traits for providing cultivars

with quality genes showing resistance against pests, diseases and improved tolerance to abiotic stresses. Usually, CWR are used as source of food, food supplement, fodder, fuel, oil, medicine, root stock for grafting and material for personal and commercial use and important in uplifting socio-economic status of people directly or indirectly. 14 CWR are considered sacred and worshipped during religious ceremonies tradition knowledge of utilizing wild food is on sharp decline due to modernization (Table.2).

#### **Importance of CWR and their role in crop improvement:**

CWR surviving in extreme range of environmental condition harbour favourable genes for adaptation to new or dynamically changing environments [23]. These always have proved to be a good source of better yield augmenting genes [24]. Mostly these are used for the pest and disease resistance. The mechanism of the adaptation of plants in harsh environments can be evolved from the analysis of genetic variation in wild populations existing in contrasting environment [25]. Breeders consistently trying to exploit wild relatives for mining of the source of resistance to diseases [26] and in future also we have to rely upon the different gene pools for searching the genes that can convey resistance to major crop pests and diseases [27,28]. Crop wild relatives are in focal point for crop improvement programme as they are excellent source of useful genes, some of which are lacking in cultivated crops. These are also related to the food plants, which we eat and further are source of useful traits which can help breeders to develop crops with more resilient to climate change which is going to be a big challenge in coming years. Population explosion and day by day shrinking of agriculture land due to urbanisation, and modernisation will further challenge researcher to ensure food security for growing population. So, need of hour is to produce novel crop varieties which are resistant to biotic and abiotic stresses and also maintain natural biodiversity. In the present scenario, identification and utilization of CWR genes for crop improvement has been continuously increasing due to their potential to serve as a reservoir of not only disease and pest resistance but also of different quality traits.

CWR help the genetic improvement of domesticated or commercial crops in following multiple ways.

1. Trait improvement by providing quality genes and rootstock for hybridisation and grafting.
2. Crossing with CWR increase tolerance of cultivar to biotic and abiotic stress
3. Ensure food security by multiplying yield.
4. Ensure nutritional security by producing better nutrient quality product.
5. Climate Security.
6. Reconstruction evolutionary history of cultivars.

In present study CWR like *Citrus spp.*, *Mangifera indica*, *Phoenix*, *Ficus spp.*, *Prunus spp.*, *Pyrus spp.*, *Psidium guajava* and *Rosa spp* are utilized as useful rootstock for

crop improvement, while rest can be used as source of genes for crop improvement (Table.2).. In general Crop wild relatives (CWR) have contributed to crop domestication for millennia, but nowadays over exploitation of plants and other environmental resources they are threatened and hence they need protection to guarantee plant evolution and food supply for coming generations [29]. Utilization of CWRs has enjoyed a great success only in few crops despite having valuable genes with immense value for crops improvement and adaptation to changing environmental conditions. Many genes still lie untapped in these genetic resources, presumably due to the lack of useful genetic information and genetic bottlenecks. The plant breeders have not fully exploited the potential of CWRs as they rely on searching genes for beneficial traits associated with certain CWRs rather than searching more generally for beneficial genes. The process of domestication also has resulted in reduced diversity in modern day crops. For example, more than half of the genetic variation has been lost in cultivated soybean [30][31].

#### **V. CONCLUSION AND FUTURE SCOPE**

CWR are not only important source of valuable genes and traits for the breeders, researchers, agriculturist and horticulturist for constant improvement of cultivated crop, but these are also good source of food, fodder, medicine and material for local people. Many of these are an important source of income and help to enhance the socio-economic status of local people. Utilization of CWRs has enjoyed a great success only in few crops species despite having valuable genes with immense value for crops improvement of many other commercial and personally domesticated crops. Many genes still lie untapped in these genetic resources, presumably due to the lack of useful genetic information and genetic bottlenecks. The plant breeders have not fully exploited the potential of CWRs as they rely on searching genes for beneficial traits associated with certain CWRs rather than searching more generally for beneficial genes adapting to changing environmental conditions. The use of CWRs lags far behind its potential due to certain hindrances such as cross incompatibilities, infertility in the F1 and subsequent progeny, non-availability or poor conservation of CWRs; under-utilized and under-explored wild germplasm, lack of reliable evaluation data, and the expression of desirable traits in cultivated genetic background. Accessibility of CWR resources to researchers and breeders is another important issue for crop improvement utilizing CWRs. Present study will serve as a reference material for the researchers, educationists, students and policy makers dealing with agriculture, genetics, plant breeding etc for their effective further utilization.. Further it would be of immense value in identification, collection, conservation and sustainable utilization of wild relatives as well as setting priorities for future challenges.

## RECOMMENDATION

The process of domestication has significantly reduced diversity in food plants, as a result many plant species worldwide are facing the risk of extinction. Overgrazing and exotic weed spread cause loss of some plant populations and important genes from wild habitat, further urbanization and the intensification of agriculture have made situation worse by destroying populations of many plant species and restricting their habitat. Today threats faced by CWR are no less than other plants and are vulnerable to changes. Many are at risk of extinction. So, there is an urgent need to conserve the germplasm through natural or artificial means by.

1. Establishment of seedbanks for the conservation of large amount of germplasm.
2. Preparation of exotic genetic library,
3. Awareness among inhabitants for sustainable use of CWR plants and their conservation in natural habitat.

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## REFERENCES

- [1]. Pandey, AnjuJa, D. C. Bhandari, K. C. Bhatt, S. K. Pareek, A. K. Tomer and B. S. Dhillon. "Wild Relatives of Crop Plants in India: Collection and Conservation". National Bureat\ of Plant Genetic Resources, New Delhi, India. P.73,2005.
- [2]. Willcox, G. "The beginnings of cereal cultivation and domestication in Southwest Asia". In *A Companion to the Archaeology of the Ancient Near East*, 1st ed.; Potts, D.T., Ed.; Blackwell Publishing Ltd.: Oxford, UK, pp. 163–180.2012.
- [3]. Purugganan, M.D. "Evolutionary Insights into the Nature of Plant Domestication. *Curr. Boil*". Vol. 29, pp.R705–R714.2019.
- [4]. 19. FAO. "Voluntary Guidelines for the Conservation and Sustainable Use of Crop Wild Relatives and Wild Food Plants; Food and Agriculture" Organization of the United Nations: Rome, Italy, p106, 2017.
- [5]. 25. Maxted, N.; Kell, S.P." Establishment of a Global Network for the In Situ Conservation of Crop Wild Relatives: Status and Needs" *Background Study Paper No. 39*; FAO Commission on Genetic Resources for Food and Agriculture: Rome, Italy, p 224, 2009
- [6]. Choudhary, Mukesh, Vishal Singh, Vignesh Muthusamy, and Shabir Hussain Wani. "Harnessing Crop Wild Relatives for Crop Improvement." *LS: International Journal of Life Sciences* 6, no. 2. pp. 73-85.2017.
- [7]. 24. Maxted, N.; Ford-Lloyd, B.V.; Jury, S.L.; Kell, S.P.; Scholten, M.A. "Towards a definition of a crop wild relative". *Biodivers. Conserv.* Vol. 15, pp. 2673–2685, 2006.
- [8]. 32. Allen, E.; Gaisberger, H.; Brehm, J.M.; Maxted, N.; Thormann, I.; Lupupa, T.; Dulloo, M.E.; Kell, S.P. "A crop wild relative inventory for Southern Africa: A first step in linking conservation and use of valuable wild populations for enhancing food security". *Plant Genet. Resour.* Vol 17, pp. 128–139, 2019.
- [9]. 29. Vincent, H.; Wiersema, J.; Dobbie, S.; Kell, S.P.; Fielder, H.; Castañeda-Álvarez, N.P.; Eastwood, R.P.; Guarino, L.; Maxted, N. "A prioritized crop wild relative inventory to help underpin global food security". *Biol. Conserv.* Vol.167, pp. 265–275, 2013.
- [10]. Fonseka, R. M., H. H. D. Fonseka, and K. M. R. D. Abhyapala. "Crop Wild Relatives: An Underutilized Genetic Resource for Improving Agricultural Productivity and Food Security." In *Agricultural Research for Sustainable Food Systems in Sri Lanka*, Springer, Singapore, pp. 11-38. 2020.
- [11]. Hajjar R and Hodgkin T. "The use of wild relatives in crop improvement: A survey of developments over the last 20 years". *Euphytica*, Vol. 156, No. 1-2, pp. 1-13.2007.
- [12]. Chowdhery HJ, Wadhwa BM. "Flora of Himachal Pradesh", *Botanical Survey of India*, Calcutta. Vol. 1-3. 1984
- [13]. Collett H. "Flora Simlensis", Bishen Singh Mahendra Pal Singh, Dehradun. 1902
- [14]. Dhaliwal DS, Sharma M. "Flora of Kullu District, Himachal Pradesh", Bishen Singh and Mahendra Pal Singh, Dehradun. 1999
- [15]. Singh PB, Singh, "Flora of the Mandi District Himachal Pradesh North West Himalaya". Bishen Singh Mahendra Pal Singh, Dehradun. 1918.
- [16]. Anonymous. "Index Kewensis Plantarum Phanerogamarum" Clarendon Press, Oxford. Vol. 1-2, 1883-1885.
- [17]. Samant SS, Dhar U. "Diversity, endemism and economic potential of wild edible plants of Indian Himalaya". *The International Journal of Sustainable Development & World Ecology*. 4(3): pp.179-191, 1997.
- [18]. Samant, S.S., Dhar, U. and Palni, L.M.S. "Medicinal plants of Indian Himalaya: Diversity Distribution Potential Values" . Gyanodaya Prakashan, Nainital 1998a.
- [19]. Samant, S.S., Dhar, U. and Rawal, R.S. "Biodiversity status of a protected area of west Himalaya.I-Askot Wildlife Sanctuary". *International Journal of Sustainable Development and World Ecology*, Vol. 5:pp.194-203.1998b.
- [20]. Samant, S.S. "Diversity, nativity and endemism of vascular plants in a part of Nanda Devi Biosphere Reserve in west Himalaya". *Himalayan Biosphere Reserves,(Biannual Bulletin)* Vol. 1(1&2):pp. 1-28.1999.
- [21]. Samant, S.S., Joshi, H.C. and Arya, S.C. . "Diversity, nativity and endemism of vascular plants in Pindari area of Nanda Devi Biosphere Reserve-II".*Himalayan Biosphere Reserves*, Vol. 2(1&2):pp. 1-29.2000a
- [22]. Samant, S.S., Dhar, U. and Rawal, R.S. "Assessment of Fuel resource diversity and utilization patterns in Askot Wildlife Sanctuary in Kumaon Himalaya, India, for conservation and management". *Environment Conservation*, Vol. 27(1):pp.5-13. 2000b
- [23]. Henry RJ, "Genomics strategies for germplasm characterization and the development of climate resilient crops". *Frontiers in Plant Science*, Vol. 5, pp. 68.2014.
- [24]. Hajjar R and Hodgkin T. "The use of wild relatives in crop improvement: A survey of developments over the last 20 years". *Euphytica*, Vol. 156, No. 1-2, pp. 1-13, 2007.
- [25]. Henry RJ and Nevo E. "Exploring natural selection to guide breeding for agriculture". *Plant Biotechnology*, Vol. 12, pp. 655-662, 2014.
- [26]. Prescott-Allen C and Prescott-Allen R, " The first resource: Wild species in the North American economy". *Brittonia*, Vol. 39, pp. 427-427.1986.
- [27]. Brar D and Khush G, "Alien introgression in rice". *Plant Molecular Biology*, Vol. 35, pp. 35-47.1997.
- [28]. Rick C and Chetelat R, "Utilization of related wild species for tomato improvement", first international symposium on

- Solanacea for fresh market. *Acta Horticulturae*, **Vol. 412**, pp. **21-38.1995**.
- [29]. Perrino, E.V., Perrino, P. "Crop wild relatives: know how past and present to improve future research, conservation and utilization strategies, especially in Italy: a review". *Genet Resour Crop Evol* **67**, **1067–1105 2020**.
- [30]. Zhou, Z.K., Jiang, Y., Wang, Z., Gou, Z.H., Lyu, J., Li, W.Y. and Tian, Z.X. "Resequencing 302 wild and cultivated accessions identifies genes related to domestication and improvement in soybean". *Nature Biotechnol.*, **33**: **4.2015**.
- [31]. Hyten, D. L., Song, Q. J., Zhu, Y.L., Choi, I.Y., Nelson, R.L., Costa, J.M. and Cregan, P.B. "Impacts of genetic bottlenecks on soybean genome diversity". *PNAS USA*, **103**: **16666–16671.2006**.

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