Wild Edible Plants of Purmandal block of District Samba, J&K (UT), India

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Research

Abstract

Background: Edible plants that are neither cultivated nor domesticated but can be found in their natural habitat are known as wild edible plants (WEPs). In times of food scarcity, WEPs give a valuable natural nutritional supply as food, diet, and nutrients.

Methods: An ethnobotanical field study was conducted in eleven villages of Purmandal using focused group discussions, and interviews through semi-structured questionnaires. Information was gathered from a total of 153 informants (115 females and 38 males). Informants were briefed about the objectives of the study and Prior Informed Consent (PIC) was obtained as per Convention on Biological Diversity (CBD). The various uses of WEPs were quantified as use-reports, and Cultural Importance Value (CI) and Factor informant consensus (F_{ic}) were calculated.

Results: Altogether 58 plants belonging to 51 genera and 34 families were used as WEPs. Cucurbitaceae and Rutaceae (5 species each) were the most represented families, and leaves and fruits were the most frequently used plant parts. The contribution of herbs, shrubs, and climbers were 36.2%, 37.9%, and 15.5%, respectively. The maximum CI was recorded for *Mangifera indica* L., *Phyllanthus emblica* L., and *Bauhinia variegata* (L). Benth. The values of F_{ic} varied between 0.95 (medicinal usage) and 0.99 (*chutney* preparation).

Conclusion: Locals of Purmandal have good knowledge of WEPs. Traditional products made from WEPs like *Mangifera indica*, *Phyllanthus emblica* and *Bauhinia variegata* can be commercialized to improve the economic status of the locals. Furthermore, the nutritive values of important species may be studied.

Keywords: Wild edible plants, Purmandal, Food security, Sustainable agriculture.

Background

The majority of indigenous and rural populations around the world use wild edible plants (WEPs) for nutrition, food, medicine, and other purposes (Pretty *et al.* 2009). WEPs are commonly collected by people of diverse cultures from forests, arable fields, and even anthropogenically degraded zones like roadside and wastelands (Pradhan *et al.* 2020). It has been estimated that more than 85 percent of the world's population relies on less than 20 plant genera under cultivation for their daily nutritional needs (Doni and Gajurel 2020) despite the fact, use of WEPs is still prevalent and they play a significant role in complementing the global food basket, especially in rural areas.

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According to the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES, 2022) nearly 20% of the world's population directly depends on harvesting more than 10,000 WEPs for consumption and income. In the Indian subcontinent, around 53 million tribes from 550 different communities employ 9500 wild plants to meet their needs for food, medicinal, fodder, fibre, fuel, cultural, and other purposes (Jain and Tiwari 2012; Mahapatra and Panda 2012).

Diet and nutrition security is a major problem that our world is currently facing. Around two billion individuals are affected by micronutrient deficiencies, making them more susceptible to disease and creating a considerable impediment to economic progress (FAO 2012). WEPs can play an important role in alleviating poverty, maintaining food security, diversifying agriculture, producing economic resources, and lowering malnutrition (Burlingham 2000; Cavender *et al*. 2006; Shrestha and Dhillion 2006; Pieroni *et al*. 2007; Thakur *et al*. 2017; Bhatia *et al*. 2018) as they offer outstanding nutritional value, including vitamins, fiber, minerals, and fatty acids, as well as therapeutic effects (Dansi *et al*. 2008).

Rural and tribal civilizations have obtained a unique knowledge about the use of WEPs via age-old experiences, which is passed down orally from generation to generation (Doni and Gajural 2020). The amount and regularity with which WEPs are used vary by tradition, culture, and geography, and is restricted within some populations (Smith *et al*. 2019). However, knowledge of the applications of WEPs is disappearing as a result of large-scale population relocation to urban areas, rapid depletion of natural resources, and shifting cultural traditions (Luczaj *et al*. 2013; Rao *et al*. 2015; Reyes-Garcia *et al*. 2015; Doni and Gajural 2020).

Jammu and Kashmir harbours a rich floral diversity and people of Union Territory (J&K) have rich ethnic knowledge and use the local flora very efficiently. Study on WEPs have been conducted by a number of researchers across the erstwhile Jammu and Kashmir state: Srivastava (1988) and Singh *et al.* (2021) from Paddar; Ahmad *et al.* (2022); Haq *et al*. (2021) from Ladakh; Bhatia *et al*. 2018; Sarver and Nigam (2020) from Udhampur; Rashid *et al*. (2008) and Dangwal *et al*. (2014) from Rajouri; Singh and Bedi (2018) from Kashmir; Showkat and Akhter (2018) from Baramulla; Mir and Sehgal (2021) from Jammu. However, no study has been conducted on WEPs of Samba district. Documenting the information would aid in its survival and assist future studies on the effectiveness of WEPs to authenticate traditional use (Bunalema *et al*. 2014), as well as prevent harmful changes in the knowledge of these plants during generational transfer. Moreover, this information can also be used to domesticate novel crops, providing plant breeders with a varied pool of potentially valuable genetic resources for yield development (Hajjar and Hodgkin 2007). This genetic pool could contain genes that improve productivity and provide distinctive quality attribute (Konsam *et al.* 2016). The primary aim of this research was to document the traditional knowledge of WEPs from the villages of the Purmandal block of District Samba. The data were also be analyzed to find the most important species, consensus of the various use-categories of WEPs, and relationship between age and education of informants with knowledge of WEPs.

Material and Methods

Study area

Purmandal, a block of Samba district, is located between 32° 43′ 0″ N and 75° 03′ 30″ E in the Jammu division of Union Territory of Jammu and Kashmir, India (Fig., 1). Purmandal is also known as "*Choti Kashi*", a sacred place for Hindu devotees. People, especially Hindus, take holy bath in Devika River, immerse the ashes of departed souls in it and perform several other death related rituals in Purmandal. Devika is considered as holy Ganges by the people of Jammu region.

Ethnically, residents of Purmandal block are Dogras. They mainly (86%) follow Hindu religion. As per the 2011 census, Purmandal block's population is 43655; out of this, 22731 are males while the females count is 20924. Literacy rate in Purmandal block is 71%. In males, the literacy rate is 76% and female literacy rate is 65%. Agriculture is the main occupation of the inhabitants of study area along with the rearing of goats and sheep. Majority of the farmers have small land holdings and most of the agricultural land is rain fed.

The region lies in the foothills of Shiwaliks. Forests of the region are open with tree canopy density between 10 and 40%. The thorn forests of Purmandal are mainly comprised of *Acacia catechu* (L.f.) Willd., *Acacia nilotica* (L.) Willd. ex Delile, *Acacia modesta* Wall., *Zizyphus mauritiana* Lam., *Dalbergia sissoo* Roxb., *Mallotus philippensis* (Lam.) Müll. Arg., and *Butea monosperma* (Lam.) Taub. The dominant shrubs of these forests are *Carissa spinarum* L., *Justicia adhatoda* L., *Lantana camara* L., and *Woodfordia fruticosa* Kurz. The region has low annual rainfall of 30 mm, and the average yearly temperature is 27.05 °C.

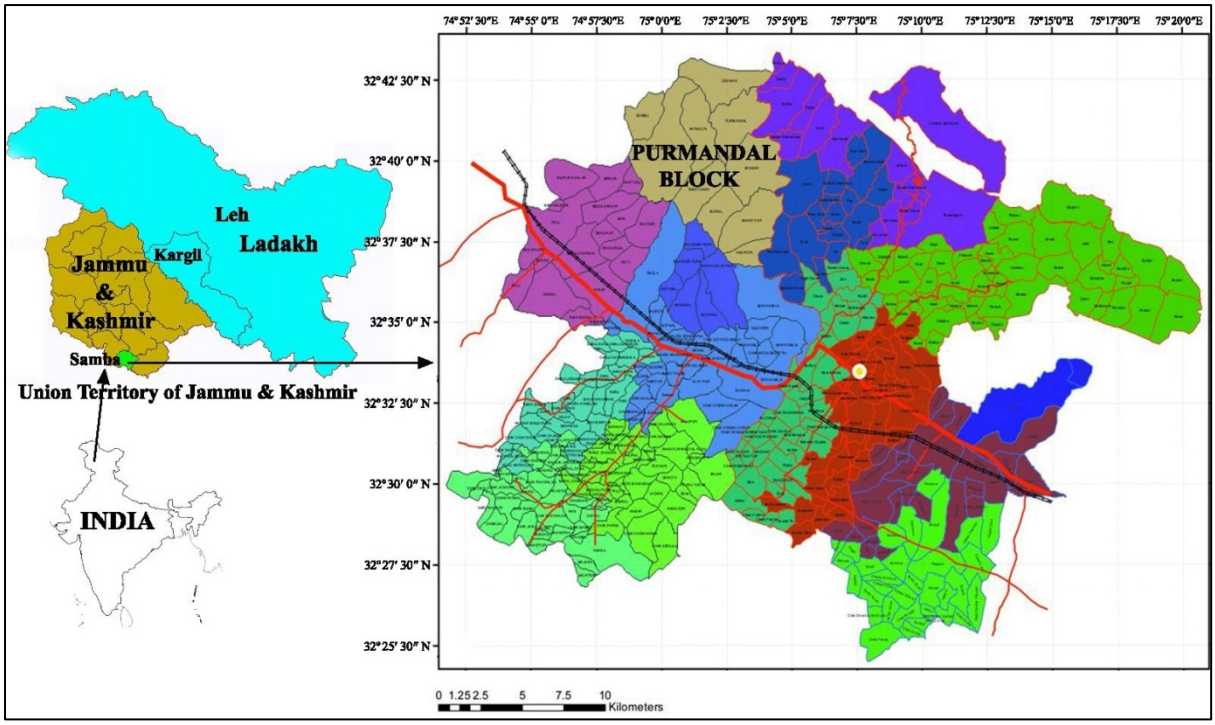

Figure 1. Location map of the study site.

Data collection

Purmandal block has total 36 villages. The present study was carried out during the years 2020-2022, in 11 of these villages (Purmandal, Karnal, Jaswal, Baabli, Lovely, Phadali, Gurgani, Padal, Sangar, Sandhi and Deon) using focused group discussions, and interviews through semi-structured questionnaires. A total of 153 informants (75.2% females and 24.8% males) were interviewed. All the interviews were conducted in *Dogri* language. The majority of informants were farmers and housewives, and small number of herders (4), who rely on agriculture and animal rearing for their livelihood, respectively. Informants were briefed about the objectives of the study and Prior Informed Consent (PIC) was taken as per Convention on Biological Diversity (CBD).

Identification of Wild Edible Plants

Plant species were tentatively identified in the field, but in some cases where this was not feasible, specimens were taken into the research lab and identified using local, and other relevant floras, such as Flora of Jammu (Sharma and Kachroo 1983) and Flora of Udhampur (Swami and Gupta 1998). The plants were grouped into families using the APG IV classification system. The specimens were dried, pressed, conserved, and mounted on herbarium sheets using normal herbarium techniques before being deposited in the University of Jammu's Herbarium.

Data analysis

The use-reports for ethnobotanical uses of plants were assessed quantitatively using cultural importance index (CI). These uses were grouped into twelve use-categories viz. cooked, raw, juice, religious, preserved, medicine, *raita*, fodder, *chutney*, snacks, toothbrush, and miscellaneous uses.

The cultural importance index (CI) is defined by the following formula:

$$CI_s = \sum_{u=u_1}^{u_{NC}} \sum_{i=i_1}^{i_N} UR_{ui}/N$$

Where, UR and N stand for use-reports and the number of informants, respectively. This additive index takes into account not just the distribution of each species' usage (number of informants), but also its flexibility, or range of uses. The theoretical maximum value of the index (NC) is attained if all informants report the use of the species in all of the use categories evaluated in the survey, which in our study is twelve. In the event of species with only one use, this index would be equal to RFC (Bhatia *et al.* 2018).

The Informant Consensus Factor (Fic) given by Trotter and Logan (1986) was used to examine the homogeneity of the acquired knowledge about a plant used to treat a certain condition. The formula, Fic = Nur – Nt/Nur – 1, was

used to calculate the index where, Nur is the number of UR for each illness group and Nt is the number of plant species utilized for that ailment category.

Statistical analysis

The Spearman correlation test was performed to see if there was a significant (*P-value < 0.05*) relationship between the number of WEPs used and the age of the informants, as well as the number of WEPs used and the informant's education.

Results

A total of 153 informants (115 women and 38 men) were interviewed in *Dogri* language. Around 46.1 percent of female informants and 23.7 percent of male informants did not attend formal schooling (Table 1). The age of informants ranged from 22 to 88 yrs, and majority (28.8%) of the informants were between the ages of 51 and 60 yrs.

Table 1. Demographic Profile of Informants.

Attributes	**Female**	**Male**
Informants	115	38
Age Class		
21-30	12	3
31-40	18	5
41-50	22	7
51-60	28	16
61-70	17	3
71-80	11	3
81-90	7	1
Education Level	**Female**	**Male**
Never attended a school	53 (41.6%)	9 (23.7%)
Attended school for 1-5 classes	31 (27.0%)	6 (15.8%)
Attended school for 6-10 classes	18 (15.7%)	10 (26.3%)
Intermediate	8 (7.0%)	7 (18.4%)
Graduation	3 (2.6%)	5 (13.2%)
Post-Graduation	2 (1.7%)	1 (2.6%)

A total of 58 WEPs from 34 families and 51 genera were found in the study site (Table 2). Figure 2(a-l) shows some of the WEPs and their preparations. Cucurbitaceae and Rutaceae, with five species each, were the most represented families (Fig 3). Other major contributors were Fabaceae, Lamiaceae, and Moraceae (4 species each). Twenty-three families had only one species.

Tree (37.9%) and herbs (36.2%) were the main life-forms used as WEPs (Fig 4). Leaves (27.7%), fruits (16.9%), seeds (15.4%), and whole-plant (10.8%) were the most important parts of plants used for the medicinal purposes (Fig 5). In case of WEPs, with other than medicinal usage, fruits (36.2%), leaves (33.3%) and stem (10.1%) were the most frequently used plant parts (Fig 6).

As reported in Table 3, the highest values of use-reports and cultural value index (CI) were recorded for *Mangifera indica* L. (UR, 462; CI, 3.02). The major contributing usages were the preserved fruit in the form of pickle and *murabba* (CI, 1.05), and eaten raw (CI, 0.82). In the villages, *Aam Paparh* preparation was also very common (CI, 0.29). Other main contributors were *Phyllanthus emblica* L. (CI, 1.67), *Bauhinia variegata* (L.) Benth. (CI, 1.44), *Cordia myxa* L. (CI, 0.93), and *Psidium guajava* L. (CI, 0.90).

All the usages of WEPs were classified into twelve categories (Table 4). The values of factor informant consensus (F_{ic}) of these use-categories ranged between 0.95 (medicinal usage) and 0.99 (*chutney*). Cultural importance index values were the maximum for consumption of fruits as raw (CI, 4.9) closely followed by medicinal usage (CI, 4.7) and cooked as vegetable (CI, 4.2).

The knowledge of WEPs increased significantly (*P<0.05*) with the age and decreased with increasing education level (Table 5). The knowledge of WEPs did not vary significantly (ANOVA; *F=2.4*; *P=0.12*) between the genders as the number of WEPs known to males and females was 23.1 and 24.6, respectively.

Table 2. Traditionally used WEPs, and their uses and use reports

Botanical name of the plants	Family	Voucher No.	Vernacular name	Habit	Plant Part used	Traditional Uses	UR
Aegle marmelos (L.) Correa	Rutaceae	GCKU1561	**bil**	T	lf, fr, rt	diarrhea, anemia, jaundice, diabetes, fruit juice	40
Aloe vera (L.) Burm	Asphodelaceae	GCKU1613	**kuar kandal**	H	Lf	jaundice, skin problems, leaf juice	51
*Amaranthus viridis*L.	Amaranthaceae	GCKU1569	**chaleri**	H	lf, st	cooked as vegetable, animal fodder	45
Artocarpus lacucha Roxb. ex Buch.-Ham.	Moraceae	GCKU1618	**teau**	T	lf, fr	pickle, animal fodder, firewood	52
Azadiracta indica Juss.	Meliaceae	GCKU1574	**neem**	T	lf, tw, st	skin problems, boost immunity, reduces dandruff, purifies blood, prevent mosquitoes, leaf juice, stem as toothbrush	65
Bauhinia variegata (L). Benth.	Fabaceae	GCKU1599	**karal**	T	lf, fl	paste of leaves mixed with oil is tied on head to take pus out from boils, animal fodder, in making traditional plates (*pattals)* and bowls (*dunas*), flowers cooked as vegetable, preserved as pickle, and *raita* is also prepared.	220
Bombax ceiba L.	Malvaceae	GCKU1578	**simbal**	T	wp, fl	dysentery, skin eruptions, wounds, cooked as vegetable	22
Cannabis sativa L.	Cannabaceae	GCKU1586	**bhaang**	H	Lf	skin ulcers, toothache, eaten fried as snacks (*pakodas*) on the occasion of *Shivratri* (holy celebrations)	72
Carissa spinarum L.	Apocynaceae	GCKU1588	**garna**	S	rt, lf, fr	jaundice, asthma, fruits are eaten raw	45
Chenopodium album L.	Amaranthaceae	GCKU1590	**bathu**	H	Lf	cooked as vegetable, feed for poultry	25
Chenopodium murale L.	Amaranthaceae	GCKU1592	**bathu**	H	Lf	cooked as vegetable	11
Citrus aurantiifolia (Christm.) Swingle	Rutaceae	GCKU1596	**jhamiri**	T	Fr	eaten raw	34
Citrus medica L.	Rutaceae	GCKU1600	**kimb**	T	Fr	eaten raw	43
Citrus pseudolimon Tanaka	Rutaceae	GCKU1604	**gargal**	T	Fr	preserved as pickle	61
Coccinia grandis Wight. & Arn.	Cucurbitaceae	GCKU1595	**kandoori**	Cl	lf, fr	diabetes, cooked as vegetable	72
Cordia myxa L.	Boraginaceae	GCKU1610	**lasooda**	T	fr, tw	skin diseases, fever, cough, asthma, diarrhea and intestinal worms, cooked as vegetable, preserved as pickle	142
Cucumis sativus L.	Cucurbitaceae	GCKU1617	**kheera**	Cl	Fr	burning micturition, heavy bleeding during periods and nasal bleeding, eaten raw as salad	38
Dioscorea belophylla (Prain)Voigt ex Haines	Dioscoreaceae	GCKU1562	**tarad**	Cl	Tu	headache, dysentery, cooked as vegetable	48
Dioscorea pentaphyla L.	Dioscoreaceae	GCKU1564	**saadu**	Cl	Tu	treatment of boils, cooked as vegetable	38
Diospyros montana Roxb.	Ebenaceae	GCKU1566	**riyaan**	T	lf, tw, fr, se	treatment of skin boils, as toothbrush, eaten raw	29
Ficus palmata Forssk.	Moraceae	GCKU1568	**fakwara**	S	la, lf, fr	leucoderma, skin eruption, eaten raw	70

Ficus racemosa L.	Moraceae	GCKU1571	**rumbal**	T	fr	eaten raw	14
Flacourtia indica (Burm. f) Merrill	Salicaceae	GCKU1575	**kokoa**	T	lf, fr, se	astringent properties, antidote for snake bite, eaten raw	29
Fumaria indica Pugsley	Fumariaceae	GCKU1579	**pit-paapra**	H	wp, lf, st	jaundice, animal fodder	37
Justicia adhatoda L.	Acanthaceae	GCKU1603	**vrankad**	S	lf, fl, se, rt	fever, cough, nectar taken orally	87
Lathyrus aphaca L.	Fabaceae	GCKU1608	**mithu saag**	H	lf	cooked as vegetable	37
Luffa acutangula (L.) Roxb.	Cucurbitaceae	GCKU1611	**kali -kandoli**	Cl	fr, se	the dried, powdered seeds are effective in curing acute cough, cooked as vegetable	39
Malva pusilla Sm.	Malvaceae	GCKU1615	**sounchal**	H	wp, lf	anti-inflammatory, diuretic, cooked as vegetable	56
Mangifera indica L.	Anacardiaceae	GCKU1570	**amb**	T	lf, fr	eaten raw, preserved as pickle and local jam (*murabba*), *Aamchur, Aam Paparh* is also prepared, dried twigs used in *havanas*, leaves used in marriage ceremonies	462
Medicago sativa L.	Fabaceae	GCKU1585	**maina**	H	wp, lf	cholesterol lowering properties, taken as health supplement, cooked as vegetable	82
Mentha spicata L.	Lamiaceae	GCKU1594	**pudina**	H	lf, se	antiseptic, stomachache, fever, headache, digestive disorders, *chutney* preparation, as condiment	92
Momordica dioica Roxb. ex Willd.	Cucurbitaceae	GCKU1605	**kakore**	Cl	fr	anti-diabetic, cooked as vegetable	60
Moringa oliefera Lam.	Moringaceae	GCKU1567	**sohanjana**	T	lf, rt	cure pimples, digestive troubles, preserved as pickles	48
Morus nigra L.	Moraceae	GCKU1583	**toot**	T	lf, tw, fr	cough, nose bleeding, diabetes, eaten raw, twigs as toothbrush	52
Murraya koenigii (L.) Spreng.	Rutaceae	GCKU1601	**kari patta**	S	lf	used in curries and as condiment	41
Nelumbo nucifera Gaertn.	Nelumbonaceae	GCKU1606	**kamal doda**	H	lf, se, rz	cures vomiting, as snacks, cooked as vegetable	34
Ocimum americanum L.	Lamiaceae	GCKU1609	**ghareeda**	H	lf, se	skin diseases, burns and wounds, backache, soaked seeds taken orally as refreshing and energetic drink	25
Ocimum tenuiflorum L.	Lamiaceae	GCKU1616	**tulsi**	H	lf, se	cough, cold, fever, improve immunity, tea preparation	128
Phoenix dactylifera L.	Arecaceae	GCKU1589	**khajoor**	T	fr, rt	constipation, body pains, eaten raw	38
Phyllanthus emblica L.	Phyllanthaceae	GCKU1602	**amla**	T	lf, fr	prevents hair fall, dandruff, eaten raw, as *chutney*, preserved as pickle, local jam (*murabba*), worshiped for good health and prosperity.	255
Pinus roxburghii Sarg.	Pinaceae	GCKU1607	**chir pine**	T	se	eaten raw or roasted, cones (painted) used for decoration purposes	14
Portulaca oleraceae L.	Portulacaceae	GCKU1614	**kulfa saag**	H	lf	cooked as vegetable	36
Psidium guajava L.	Myrtaceae	GCKU1577	**amrood**	T	se, tw, fr	diarrhea, bleeding gums, eaten raw	138

Pueraria tuberosa (Roxb. ex Wild) DC.	Fabaceae	GCKU1587	**siyaali**	H	tu	jaundice, eaten raw	10
Rumex nepalensis Spreng.	Polygonaceae	GCKU1593	**jangli palak/tanaalka**	H	lf	cooked as vegetable	19
Scandix pecten-veneris L.	Apiaceae	GCKU1598	**indu saag**	H	wp, lf, st	cure toothache, stem and leaves are used as fodder for animals	14
Silene conoidea L.	Caryophyllaceae	GCKU1563	**trokla**	H	wp, lf, st	treat eye infections, cooked as vegetable	40
Solanum villosum L.	Solanaceae	GCKU1573	**kaya kothi**	H	lf, st	cooked as vegetable by the people suffering from paralysis due to stroke	14
Sonchus asper (L.) Hill	Asteraceae	GCKU1581	**duddal pattal**	H	lf	cooked as vegetable	13
Syzygium cumini (L.) Skeels	Myrtaceae	GCKU1591	**dhallan**	T	fr, se	diabetes, eaten raw	76
Telosma pallida (Roxb.) Craib	Apocynaceae	GCKU1597	**gual mande**	Cl	fls	cooked as vegetable, in the preparation of *raita*	62
Terminalia bellirica (Gaertn.) Roxb.	Combretaceae	GCKU1612	**baheda**	T	fr, se, rt	cure cough, cold and promotes hair growth, blood purifier, diabetes, digestive problems, jaundice and anemia, constipation, important ingredient of *triphala*	63
Terminalia chebula Retz.	Combretaceae	GCKU1565	**rheed/harad**	T	fr	cough, diarrhea, chronic constipation, abdominal problems, cooked as vegetable, preserved as pickle	61
Tinospora sinensis (Lour) Merr.	Menispermaceae	GCKU1576	**gloe**	Cl	lf, st	anti-diabetic, liver disorders, fever, stem juice, as toothbrush	127
Trichosanthes dioica Wall.	Cucurbitaceae	GCKU1584	**pandole**	Cl	fr	cooked as vegetable	13
Verbascum thapsus L.	Scrophulariaceae	GCKU1580	**jangli tambaku**	H	lf, fl	dried form inhaled as tobacco in traditional smoking vessels (*charri*)	9
Vitex negundo L.	Lamiaceae	GCKU1572	**banah**	S	wp, tw	stomach gas, toothache, cough, ulcers, boils and wounds, loose motions, leaves hanged on doors and windows on the eve of *Diwali* in order to keep away the evil spirits	72
Ziziphus nummularia (Burm.f.)Wight & Arn.	Rhamnaceae	GCKU1582	**ber**	S	fr	leucorrhea, eaten raw, considered sacred newly-wed couples takes circumambulations around the plant after marriage	89

Abbreviation used: Cl, climber; H, herb; S, shrub; T, tree; lf, leaves; st, stem; tw, twigs; rt, roots; fl, flower; fr, fruit; se, seeds; wp, whole plant.

Figure 2. Photographs of some of WEPs and preparations from the study site: (a) *Mangifera indica* L. pickle, (b) *Mangifera indica* L. *aamchur*, (c) *Mangifera indica* L. *chutney*, (d) *Terminalia bellirica* (Gaertn.) Roxb. pickle, (e) *Cordia myxa* L. pickle, (f) *Citrus pseudolimon* Tanaka pickle, (g) *Ficus palmata* Forssk., (h) *Ficus racemosa* L. fruit, (i) *Bauhinia variegata* (L). Benth. flowers, (j) *Phyllanthus emblica* L. , (k) *Syzygium cumini* (L.) Skeels fruits, and (l) *Morus nigra* L. fruits.

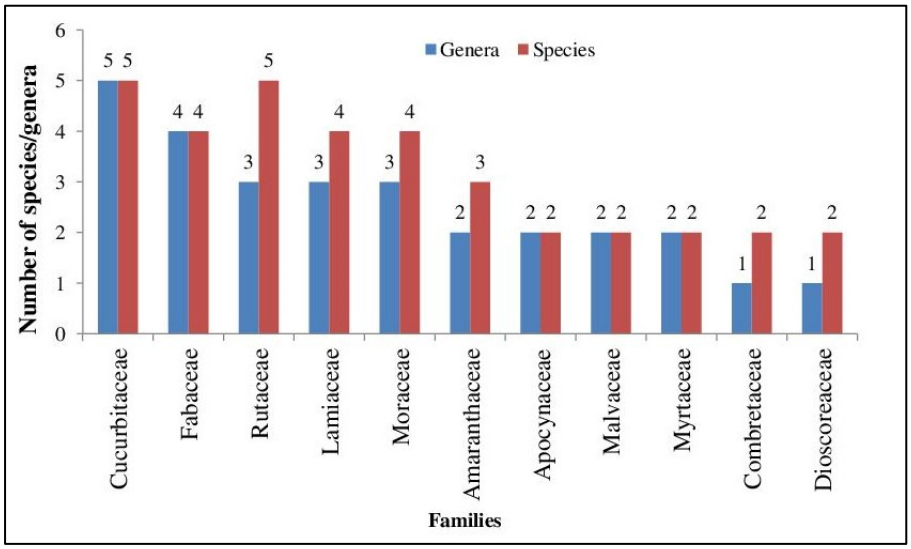

Figure 3. Most represented families with number of genera and species used as WEPs.

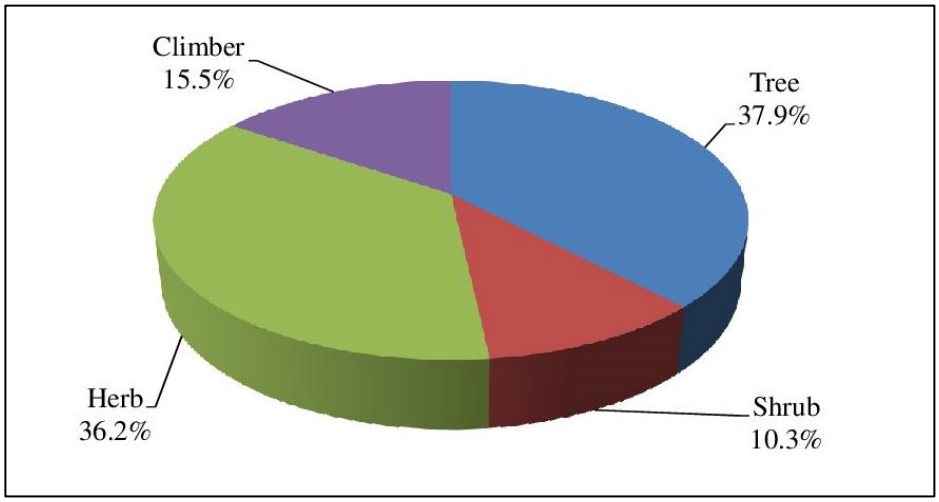

Figure 4. Percentage representation of various life-forms of WEPs.

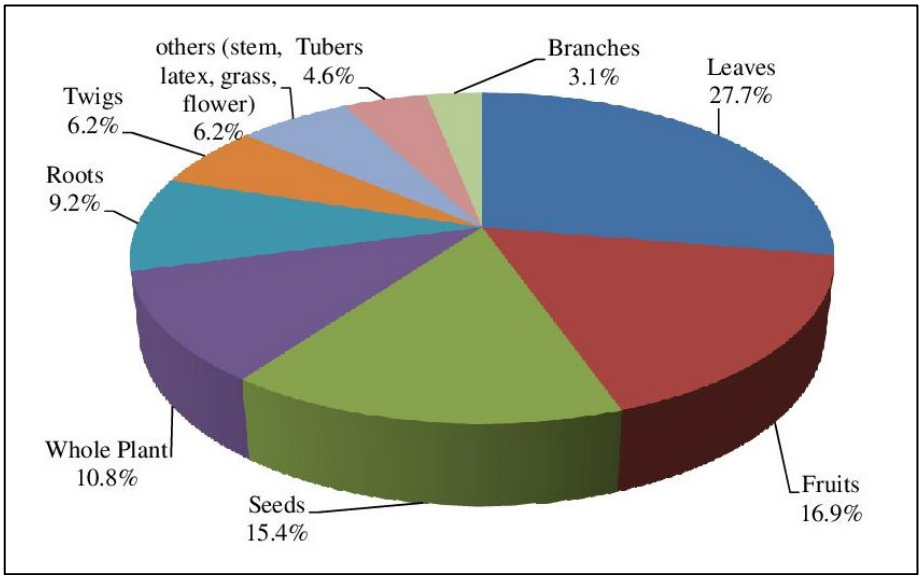

Figure 5. Percentage account of plant-parts of WEPs used as medicine in the study site.

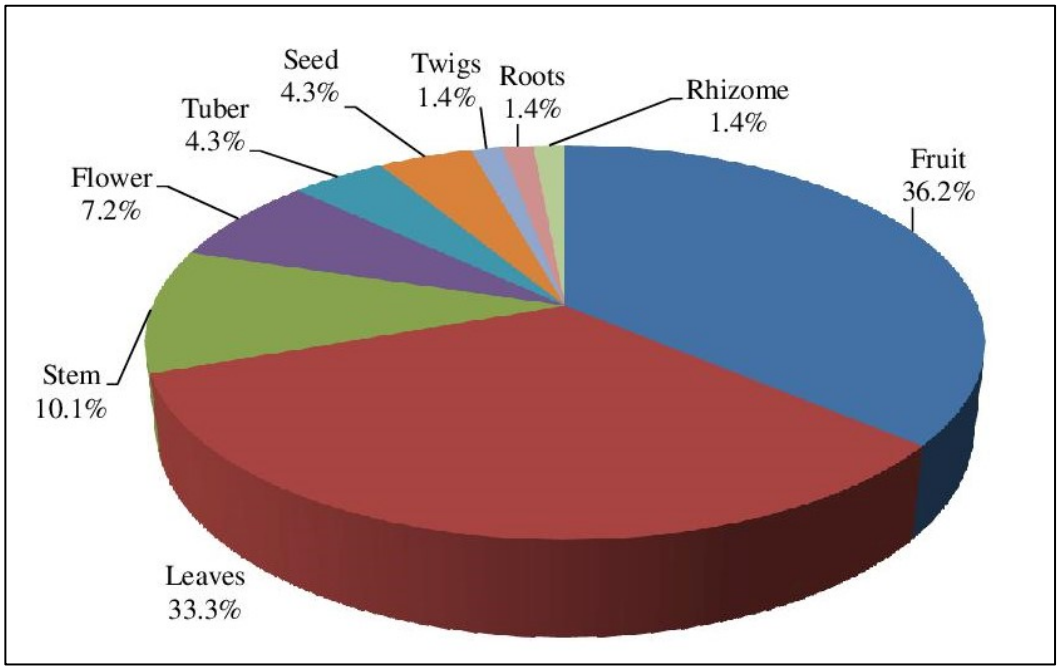

Figure 6. Percentage contribution of various plant-parts of WEPs having other than medicinal usage.

Table 3. Cultural value index (CI) of WEPs for various use-categories

Botanical Name	CI_{Med}	CI_{Jui}	CI_{Raw}	CI_{Pre}	CI_{Rai}	CI_{Cook}	CI_{Chut}	CI_{Sna}	CI_{TB}	CI_{Rel}	CI_{Fod}	Mis	Total CI
Aegle marmelos	0.14	0.12	-	-	-	-	-	-	-	-	-	-	0.26
Aloe vera	0.22	0.12	-	-	-	-	-	-	-	-	-	-	0.33
Amaranthus viridis	-	-	-	-	-	0.14	-	-	-	-	0.15	-	0.29
Artocarpus lacucha	-	-	-	0.25	-	-	-	-	-	-	0.05	0.04	0.34
Azadiracta indica	0.17	0.12	-	-	-	-	-	-	0.14	-	-	-	0.42
Bauhinia variegata	0.05	-	-	0.31	0.30	0.02	-	-	-	0.18	0.32	0.25	1.44
Bombax ceiba	0.06	-	-	-	-	0.08	-	-	-	-	-	-	0.14
Cannabis sativa	0.08	-	-	-	-	-	-	0.14	-	0.24	-	-	0.47
Carissa spinarum	0.06	-	0.24	-	-	-	-	-	-	-	-	-	0.29
Chenopodium album	-	-	-	-	-	0.12	-	-	-	-	-	0.05	0.16
Chenopodium murale	-	-	-	-	-	0.07	-	-	-	-	-	-	0.07
Citrus aurantiifolia	-	-	0.22	-	-	-	-	-	-	-	-	-	0.22
Citrus medica	-	-	0.28	-	-	-	-	-	-	-	-	-	0.28
Citrus pseudolimon	-	-	-	0.40	-	-	-	-	-	-	-	-	0.40
Coccinia grandis	0.15	-	-	-	-	0.32	-	-	-	-	-	-	0.47
Cordia myxa	0.09	-	-	0.60	-	0.24	-	-	-	-	-	-	0.93
Cucumis sativus	0.03	-	0.22	-	-	-	-	-	-	-	-	-	0.25
Dioscorea belophylla	0.06	-	-	-	-	0.25	-	-	-	-	-	-	0.31
Dioscorea pentaphyla	0.03	-	-	-	-	0.22	-	-	-	-	-	-	0.25
Diospyros montana	0.03	-	0.05	-	-	-	-	-	0.10	-	-	-	0.19
Ficus palmata	0.18	-	0.28	-	-	-	-	-	-	-	-	-	0.46
Ficus racemosa	-	-	0.09	-	-	-	-	-	-	-	-	-	0.09
Flacourtia indica	0.08	-	0.11	-	-	-	-	-	-	-	-	-	0.19
Fumaria indica	0.12	-	-	-	-	-	-	-	-	-	0.12	-	0.24
Justicia adhatoda	0.24	-	-	-	-	-	-	-	0.14	-	-	0.20	0.57
Lathyrus aphaca	-	-	-	-	-	0.24	-	-	-	-	-	-	0.24
Luffa acutangula	0.05	-	-	-	-	0.20	-	-	-	-	-	-	0.25
Malva pusilla	0.07	-	-	-	-	0.29	-	-	-	-	-	-	0.37
Mangifera indica	-	-	0.82	1.05	-	-	0.55	-	0.05	0.25	-	0.29	3.02
Medicago sativa	0.08	-	-	-	-	0.45	-	-	-	-	-	-	0.54
Mentha spicata	0.24	-	-	-	-	-	0.37	-	-	-	-	-	0.60
Momordica dioica	0.18	-	-	0.06	-	0.15	-	-	-	-	-	-	0.39
Moringa oliefera	0.12	-	-	0.06	-	0.14	-	-	-	-	-	-	0.31
Morus nigra	0.08	-	0.25	-	-	-	-	-	-	-	-	-	0.34
Murraya koenigii	-	-	-	-	-	0.14	-	-	0.13	-	-	-	0.27

Nelumbo nucifera	0.02	-	-	-	-	0.14	-	0.06	-	-	-	-	0.22
Ocimum americanum	0.05	-	-	-	-	-	-	-	-	-	-	0.12	0.16
Ocimum tenuiflorum	0.21	-	-	-	-	-	-	-	-	0.25	-	0.38	0.84
Phoenix dactylifera	0.09	-	0.16	-	-	-	-	-	-	-	-	-	0.25
Phyllanthus emblica	0.29	-	0.42	0.65	-	-	-	-	-	0.30	-	-	1.67
Pinus roxburghii	-	-	0.03	-	-	-	-	-	-	-	-	0.06	0.09
Portulaca oleraceae	-	-	-	-	-	0.24	-	-	-	-	-	-	0.24
Psidium guajava	0.16	-	0.53	-	-	-	-	-	0.21	-	-	-	0.90
Pueraria tuberose	0.02	-	0.05	-	-	-	-	-	-	-	-	-	0.07
Rumex nepalensis	-	-	-	-	-	0.12	-	-	-	-	-	-	0.12
Scandix pecten-veneris	0.03	-	-	-	-	-	-	-	-	-	0.06	-	0.09
Silene conoidea	0.05	-	-	-	-	0.22	-	-	-	-	-	-	0.26
Solanum villosum	-	-	-	-	-	0.09	-	-	-	-	-	-	0.09
Sonchus asper	-	-	-	-	-	0.08	-	-	-	-	-	-	0.08
Syzygium cumini	0.14	-	0.35	-	-	-	-	-	-	-	-	-	0.50
Telosma pallid	-	-	0.14	-	0.12	0.15	-	-	-	-	-	-	0.41
Terminalia bellirica	0.20	-	0.22	-	-	-	-	-	-	-	-	-	0.41
Terminalia chebula	0.31	-	-	0.06	-	0.03	-	-	-	-	-	-	0.40
Tinospora sinensis	0.38	0.31	-	-	-	-	-	-	0.14	-	-	-	0.83
Trichosanthes dioica	-	-	-	-	-	0.08	-	-	-	-	-	-	0.08
Verbascum thapsus	-	-	-	-	-	-	-	-	-	-	-	0.06	0.06
Vitex negundo	0.08	-	-	-	-	-	-	-	-	0.39	-	-	0.47
Zizypus nummularia	0.05	-	0.41	-	-	-	-	-	-	0.12	-	-	0.58

Abbreviations used: CI, cultural importance index; CI_{Med}, medicine; CI_{Jui}, juice; CI_{Pre}, preserved; CI_{Rai}, raita; CI_{Cook}, cooking; CI_{Chut}, chutney; CI_{Sna}, snacks; CI_{TB}, toothbrush; CI_{Rel}, religious; CI_{Fod}, fodder; Mis., miscellaneous; UR, Use reports.

Table 4. Factor of Informant Consensus (F_{ic}) and cultural importance value (CI) for various use-categories of WEPs.

Use category of WEPs	**Nur**	**Nt**	**Fic**	**CI**
Medicinal	719	39	0.95	4.7
Juice	103	4	0.97	0.7
Raw	746	19	0.98	4.9
Preserved (pickle & *murabba*)	525	9	0.98	3.4
Raita	64	2	0.98	0.4
Cooked as vegetable	649	25	0.96	4.2
Chutney	140	2	0.99	0.9
Fried snacks	31	2	0.97	0.2
Toothbrush (*datun*)	139	7	0.96	0.9
Religious	265	7	0.98	1.7
Fodder	108	5	0.96	0.7
Miscellaneous	220	9	0.96	1.4

Abbreviations used: Nur, number of use-reports; Nt, number of taxa used.

Table 5. Correlation analysis between number of WEPs and (i) age, and (ii) education level of informants

Attributes	**n**	**Interaction**	**r**	***P-value***
All informants	153	Age x no. of WEPs	0.41	< 0.001
	153	Education x no. of WEPs	-0.32	< 0.001
Female informants	115	Age x no. of WEPs	0.37	< 0.001
	115	Education x no. of WEPs	-0.22	0.0176
Male informants	38	Age x no. of WEPs	0.58	< 0.001
	38	Education x no. of WEPs	-0.51	0.0012

Abbreviations used: n, number of informants; no., number; r, correlation coefficient.

Discussion

Altogether, 58 WEPs were utilized in the study area. These values are well within the range of 32-72 WEPs reported from Jammu and Kashmir (Kumar and Hamal 2009; Dangwal *et al.* 2014; Singh *et al.* 2021), other parts of Indian Himalayas (Aryal *et al.* 2018; Radha *et al.* 2018; Thakur *et al.* 2020), Nepal Himalayas (Bhattarai *et al.* 2009; Uprety *et al.* 2012; Khakurel *et al.* 2021), and the World (Alemnah 2020; Hegazy *et al.* 2020; Purba and Silalahi, 2021; Ahmad *et al.* 2022). However, some studies have reported very high number of WEPs in their studies; 335 WEPs were identified from Hunan, China (Zou *et al.* 2011), 173 WEPs from Xishuanbanna valley, China (Ghorbani *et al.* 2012), 159 WEPs from Heihe valley, China (Kang *et al.* 2012), 111 WEPs from Bandipora, Jammu and Kashmir, India (Singh *et al.* 2016), 90 WEPs from Udhampur, Jammu and Kashmir, India (Bhatia *et al.* 2018), 117 WEPs from Uzbekistan

(Khojimatov *et al.* 2020), and 130 plants from Kishtwar region of Jammu and Kashmir, India (Thakur and Dutt 2020). The number and diversity of WEPs is the representation of local resources like condition of forests, major land-use, and sustainable utilization of local flora. In the present study, the forests are predominantly open (density < 40%) with tropical thorn forests vegetation. The condition of these forests is very poor due to the invasion of *Lantana camara* L. that reduces the local diversity (Luna *et al.* 2007).

Cucurbitaceae and Rutaceae were the most utilized families as WEPs. Most of the earlier research work conducted in union territory of Jammu and Kashmir has reported Rosaceae as the most utilized family because these studies were carried out in temperate regions having numerous edible rosaceous fruits. The present study was conducted in the sub-tropical part of the union territory. Cucurbitaceae, a family distributed more in tropical regions, provide a major economic and cultural function in many societies (Yang & Walters 1992; Rafael & Caballero 2002; Purba and Silalahi 2021). It consists of diverse type of fruits and vegetables that are consumed raw as salad or dessert fruit, cooked, pickled, candied, used in confectionaries (Murthy *et al.* 2013), and have medicinal value due to the presence of cucurbitacins that possess wide-ranging oxidation properties (Rajan and Markose 2007). Rutaceae is another family distributed primarily in tropical and sub-tropical regions (Kubitzki *et al.* 2011) and having vast economic value. Members of the family are traditionally used as food, appetizer, immunity enhancer, and as medicine for treating bronchitis, rheumatism, snakebites, stomatitis, toothache, and other diseases (Aldona *et al.* 2016; Bhatia *et al.* 2018; Van *et al.* 2020).

Trees were the most used life-forms. Kumar (2019), Tugume and Nyakooja (2020) and Haseen (2021) have also reported the higher usage of trees as WEPs. However, these results are in contrast to Alemnah (2020), Thakur and Dutt (2020) and Ahmad *et al.* (2022) who have reported high usage of herbs in their studies. The higher utilization of trees may be because of their perennial and throughout the year availability, and diverse plant parts like leaves, twigs, stem, flowers, fruits, and seeds.

Leaves were the most important plant part used in case of WEPs consumed for their medicinal properties. Sharma *et al.* (2012), Bhatia *et al.* (2014), and Hussain *et al.* (2022) have also reported the higher usage of leaves due to simplicity of preparation (Gazzaneo *et al.* 2005), presence of more bioactive ingredients (Bhattarai *et al.* 2006), almost throughout the year availability (Rao *et al.* 2015), and the richest source of active principles, delicate fragrances and volatile components (Castellani 1999).

Amongst WEPs, with other than medicinal usage, fruits and leaves were the main plant parts used. These findings are in agreement with Addis *et al.* (2013), Aryal *et al.* (2018), Kumar (2019), Alemnah (2020), and Ahmad *et al.* (2022) who also reported usage of a greater number of fruits in their studies. Higher nutritional value (Mahapatra and Panda 2012; Nayak and Basak 2015), better taste, free of cost availability, and eaten raw without cooking or processing are the prime reasons for the popularity of fruits among the general masses. The results of the nutritional analysis of some wild fruits have shown that they contain appreciably higher nutrients and energy than the cultivated species (Addis *et al.* 2013).

The highest cultural value index (CI) was recorded for *Mangifera indica* L. Every part of this beautiful tree is used in the traditional system. The leaves are used in religious ceremonies especially marriages, dried branches are used in holy fire (*yagna*), ripe fruit is eaten raw as well as preserved as *murabba*, and from unripe fruits, *chutney* and pickle are prepared. *Murabba* is the local jam preparation in which near to ripe fruits are selected and cut into slices and then cooked in sugar syrup along with *Piper nigrum* L. and *Foeniculum vulgare* L. The unripe fruit is used for the making of *chutney* that is consumed in almost every household during summer months. As per informants, pickle and *chutney* are excellent appetizers, and *murabba* is good for immune system and improves digestion. The juice of *Mangifera indica* is put as a thin film in plates or other shallow utensils and dried in sunshine to get '*aam paaperh*". The villagers sell this *paaperh* in market or to locals and earn good revenue. *Aam paaperh* is not prepared by herders. Children rub the seed of *Mangifera indica* on stone and use it as whistle. Das *et al.* (2019) has also recorded the traditional products like *amchur*, *chutney*, *murabba*, *panhe* (juice or *sharabat*), and pickle from Northeastern parts of India. According to Mallick *et al.* (2020), the endosperm of mango seed is dried, grinded as flour, and used as a famine food by the tribes of Odisha, India. Mango is abundant in antioxidants (ascorbic acid) and polyphenols (carotene, as vitamin A), as well as a blend of sugar (16–18% w/v) and acids. Green mango's main carbohydrate is starch, which is converted to reducing sugars during maturation (sucrose, glucose, and fructose). Ripe mango contains modest amounts of cellulose, hemicellulose, and pectin in addition to these carbohydrates (Krishnamurthi 1962). Ethnopharmacological studies have proved that various bioactive constituents of mango

offer different benefits, such as anti-diabetic, anti-cancer, anti-hyperlipemic, anti-inflammatory, anti-microbial, anti-oxidant, and immunity enhancing activities (Ediriweera *et al*. 2017; Lebaka *et al*. 2021).

Phyllanthus emblica L. (*Amla*) is another very important tree for the locals. Like *Mangifera indica*, it is also having religious believes associated to it. As per informants, on *Amla Navami* (celebrated during Oct/Nov month as per lunar calendar), the tree is worshiped for good health and prosperity. It is also believed that Devi Lakshmi, the Goddess of Wealth, bestows her blessings to the one who worships the tree, and eating under the tree brings prosperity. The religious use of plants ensures their sustainable use and conservation for future generations. Twigs of *Phyllanthus emblica* are offered in the last rituals (cremation) of a Hindu. Fruits are eaten raw, and also preserved as pickle and *murabba*. According to informants, both of these are good appetizers, and improve digestion and immune system. The dried fruits are also applied on the hairs to keep them black and healthy. Bhatia *et al*. (2018) has also recorded the use of fruits of *Phyllanthus emblica* as pickle and *murabba* from Udhampur, Jammu and Kashmir (UT), India. *Phyllanthus emblica* has aphrodisiac, antipyretic, carminative, cooling, digestive, diuretic, dyspepsia, ophthalmic, laxative, rejuvenative properties, and in folk medicine, it is useful against anaemia, asthma, bronchitis, cardiac disorders, cephalalgia, colic, cough, diabetes, diarrhoea, dysentery, dyspepsia, emaciation, erysipelas, flatulence, haematogenesis, hemorrhages, hepatopathy, hyperacidity, inflammations, intermittent fevers, jaundice, leprosy, leucorrhoea, menorrhoea, ophthalmopathy, peptic ulcer, premature graying of hair, skin diseases, and tridosha (Krishnaveni and Mirunalini 2010; Dasaroju and Gottumukkala 2014)

Bauhinia variegata (L.) Benth. is another multi-utility tree. Leaves are used as fodder whereas flower bud are either consumed fresh as *raita* (a preparation in which the flower buds are boiled slightly, crushed, and mixed with curd) or preserved as pickle. The flowers are cooked as vegetable or fried as snacks (*pakoras*). Bhatia *et al*. (2018) has also recorded the use of flower buds in the preparation of *raita* and pickle from Udhampur, Jammu and Kashmir (UT), India. Bhatti *et al*. (2022) has reported that flower of *Bauhinia variegata* is a good source of carbohydrates, proteins, and vitamin C.

The fruits of *Cordia myxa* L. are preserved as pickle and young fruits are cooked as vegetable. Singh *et al*. (1997) has reported that *Cordia myxa* is eaten raw, as vegetable, and pickle in Jaiselmer, Rajasthan, India, and Bhatia *et al*. (2018) have reported the use of fruits in the preparation of pickle and vegetable from Udhampur, Jammu and Kashmir (UT), India. In tropical areas of Africa, ripened fruits are eaten fresh whereas the green fruits are eaten fresh as vegetable or pickled. The fruits are also used to enhance the flavour of sorghum beer and food (Elkot *et al*. 2017). Pharmacological studies demonstrated that *Cordia dichotoma* showed analgesic, anti-inflammatory, antimicrobial, antiparasitic, cardiovascular, gastrointestinal, immunomodulatory, insecticidal, and respiratory effects (Al-Snafi, 2016).

All the preparation like *chutney*, pickle, *murabba*, and cooking is done by females. These results are in accordance with Monika *et al*. (2016), as they also reported the tradition of women's role in the preparation of pickles in Himachal Pradesh, India, and Bhatia *et al*. (2018) reported that all the traditional preparation are carried out by women's in Udhampur district of Jammu and Kashmir (UT).

The maximum value of Factor Informant Consensus (F_{ic}) was recorded for *chutney*. Two species viz. *Mangifera indica* (CI, 0.55) and *Mentha spicata* L. (CI, 0.37) are used for the preparation of chutney in the study site. *Chutney,* also known as the poor man's food adjuster, is a ready-to-eat preparation (Ramachandran and Ali, 1996). *Chutney* is served with meals, especially during the summers, because it aids digestion and serves as an excellent appetiser, antigastric, and antispasmodic recipe (Bhatia *et al.* 2014; Rao *et al.* 2015; Bhatia *et al.* 2018).

Medicinal plants recorded the minimum consensus (F_{ic}, 0.95) because the main aim of the study was to collect the information regarding WEPs moreover the informants were not medical practitioners. The high consensus values for all the use categories are in accordance with other studies carried out in various parts of the state (Bhatia *et al.* 2018; Singh *et al.* 2021), which means that the informants share their traditional knowledge (Bhatia *et al.* 2014).

The knowledge of WEPs significantly increased with age and decreased with increasing education level. These results are in concordance with Bhatia *et al*. (2018) and Pascual-Mendoza *et al.* (2021) who have recorded the same results from Udhampur (India) and Oaxaca (Mexico), respectively. However, these finding are in contrast to Punchay *et al.* (2020) from Thailand, and Cheng *et al.* (2022) from China who reported no significant correlation of number of WEPs with age and education. Older informants knew more about WEPs than younger informants, which could

be due to the community's improved educational position and the younger generation's lack of desire to inherit and apply edible plant knowledge (Bhatia *et al.* 2018). Moreover, when the community's understanding is eroded significantly, it is noted that WEP's use and knowledge increases with age (Mendoza *et al.* 2021). The informants who had never attended school had more knowledge about WEPs than the literates in the current study, and there was a strong negative correlation between the number of WEPs known and educational level. This could be because those who are literate are more likely to be exposed to modernisation (Bhatia *et al.* 2018; Singh *et al.* 2021).

The knowledge of WEPs did not vary significantly on the basis of genders. These results are in corroboration with Joshi *et al.* (2015) and Khakurel *et al.* (2021) who also recorded no significant difference in knowledge of WEPs among the informants based on gender. However, according to Shirai and Rambo (2014) and Bhatia *et al.* (2018), collection of WEPs is mostly carried out by females and children. Kristensen and Balslev (2003), Kujawska and Luczaj (2011) and Kang *et al.* (2013) stated that males have higher knowledge of WEPs as they can move deep into the forests.

Novelty of the work

Some of the WEPs like *Chenopodium murale* L., *Luffa acutangula* (L.) Roxb., *Malva pusilla* Sm., *Sonchus asper* (L.) Hill, *Telosma pallida* (Roxb.) Craib are recorded for the first time from the Union Territory of Jammu and Kashmir.

Conclusion

The Purmandal block informants are well versed with the usage of local plants, and floristic surveys have allowed us to compile a taxonomic inventory of 58 WEPs. WEPs were mainly utilized as raw, medicine, and vegetable. As per informant concensus factor values, *Chutney* had the maximum acceptability among the informants. The preparations of *chutneys* with both *Mangifera indica* and *Mentha spicata* may be analyzed for nutritive, digestive, and stomachache relieving properties. Other WEPs reported in the present paper can also be explored to ascertain their nutritional value, in addition to the phytochemical and pharmacological analysis of medicinally used food plants.

Declarations

List of abbreviations: APG, Angiosperm Phylogeny Group; CBD, Convention of Biological Diversity; CI, Cultural Importance Value; F_{ic}, Factor informant consensus; PIC, Prior informed consensus; UR, Use-report; WEPs, Wild Edible Plants.

Ethics approval and consent to participate: All the informants were briefed about the objectives of the present study. All of them rendered an oral consent to share the information.

Consent for publication: The final manuscript was read and approved for publication by all authors.

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