Annals of Biology **41** (2) : 267-273, 2025 **http://agribioj.com** **Impact Score : 0.32 (Scopus)**

Ethnobotanical and Medicinal Study of the Wild Edible Plants of the Pauri Garhwal Region, Uttarakhand

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(Received: February 18, 2025; Accepted: April 7, 2025)

ABSTRACT

This assessment's purpose was to investigate the ethnobotanical and medicinal properties of various wild fruit plant species found in the villages situated in the Pauri Garhwal region of Uttarakhand State, India. Classification of the wild edible plants had described as per information by the locals which provides the information that how the wild fruits were part of their life. These wild plants should be preserved for the preservation of biodiversity in the research region and may be investigated for their nutritional and therapeutic qualities. The current study highlighted the ethnobotanical and therapeutic benefits of wild fruit plants that had been the subject of a thorough survey. A total of 28 wild edible plants species, commonly consumed by the local population, were examined and recorded belonged to the 23 families under 25 genera, along with their scientific name, local name and family. The 31 pharmacological activities were reported in these 28 plant species. As a result, the villagers in the Pauri Garhwal region currently need to protect their wild fruit plants for the future for their significance to human society and further study regarding their nutritional value, which could further help in creating awareness among common masses.

Key words: Ethnobotanical, pharmacological, wild plants, Pauri Garhwal, Uttarakhand, Himalayan

INTRODUCTION

Different plant species that exist in our environment have not been successfully domesticated and investigated; among them are wild edible plants (Singh *et al.,* 2018). Plants that not domesticated and have at least one edible part, like a leaf, root, or fruit, are referred to as wild edible plants (Asfaw *et al.,* 2023). According to Singh *et al.* (2020a) the inclusion of wild edible plants can help to achieve the sustainable development goal of ending hunger set forth by the UN. The hunger and malnutrition hinder sustainable development by reducing production, increasing susceptibility to disease and reducing opportunities to improve livelihoods. However, a number of environmental factors causing the availability of wild food plants and the associated traditional knowledge is declining at the fastest rate (Singh *et al.,* 2021). Anthropogenic activities and climate change have a major impact on wild edible plants in the study areas (Arora *et al.,* 2022, 2023, 2024). Ethnobotanical research is necessary to comprehend the uses of these plants and the effects on harvest (Singh *et al.,* 2019; Jalali *et al.,* 2024).

The Garhwal Himalaya stretches from 29°45′ N - 30°15′ N to 78°28′ E - 79°23′ E, covering an area of about 5329 km^2. Altitude ranges from 295 m above sea level to more than 3100 m. Dense coniferous woods, primarily of deodar, spruce, fir, oak and blackberry, characterise

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the highlands (1,800-2,800 m). The primary types of forests in this area are subtropical deciduous forests with tiny bushes (Kumar *et al.,* 2021a, b). The region is abundant in a wide variety of therapeutic herbs. Aside from being used medicinally, the wild plants that thrive in the forest are also tasty.

Due to its challenging geology, climate and incredible fruit taste draws people to the region as a great source of nutrition. Uttarakhand is one of the places which is favourable for wild edible fruiting plants. Wild edible fruits fulfil the needs of impoverished rural areas for protein, carbs, lipids, vitamins and minerals. It can be found both wild and in cultivation (Kumar *et al.,* 2021c, d). Farmers cultivate fruits for their financial gain, but wild fruits are found solely in their natural habitats. Wild plants become less distinctive and become fewer in number when population growth reduces the areas of forests and plantations used for human welfare. The lot of wild fruit plants which are found untouched by human activity because of their challenging topography, climate thought to be unsuitable for human survival. The well-known fact is that the Himalayan plant species can be used for food and medicinal purposes (Shah *et al.,* 2021). As per earlier studies, 1748 commercially significant plants have been identified from the Indian Himalaya where in a total of 31% native species, 13.5% endemic species and 14% threatened species, indicating the region's unique richness of significant plants (Singh *et al.,* 2020c). The health of the rural communities in the area depends greatly on wild edible plants, not only as sources of extra food, a diet that is nutritionally balanced, medications, fuel and feed, but also for their ability to generate revenue. The local people have a good ethno botanical knowledge in using plant resources and developed their own traditional system of using plants for medicinal uses (Negi *et al.,* 2020). The majority of the population in this state is reliant on their natural surroundings, which found rich in ethnobotanical plant diversity and wild edible plant history (Singh *et al.,* 2020 d). Based on these data, the current study examined therapeutic qualities of wild fruit plants in the Uttarakhand state's Pauri Garhwal region. These wild fruit plants may be explored for their therapeutic qualities in order to preserve them for the future. The study's objective was to discover and record information about edible wild plants, including indigenous knowledge that are growing naturally in the Garhwal Himalayan wilderness.

MATERIALS AND METHODS

Ethnobotanical data were gathered by using the procedures and methodology (Lal *et al.,* 2018). In order to discuss the goal of the study and its importance to the communities, a meeting was arranged with the assistance of local administration before interviewing and

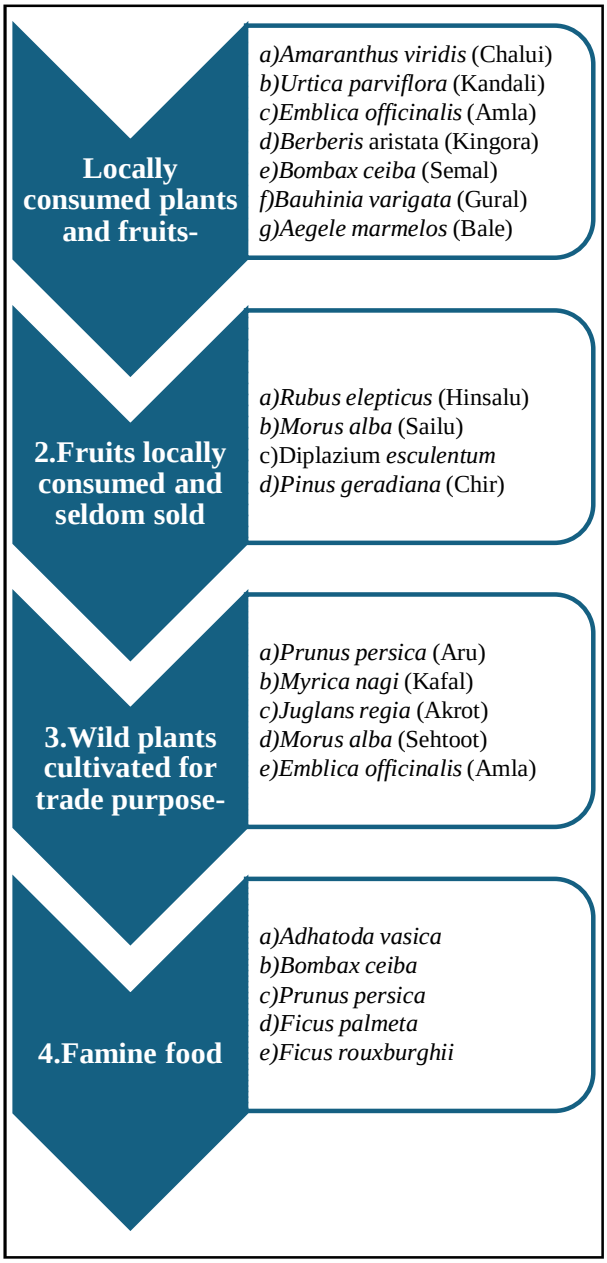

Fig. 1. Wild fruit plants observed in the study area.

gathering plant specimens. Lastly, individuals' oral consent was acquired.

RESULTS AND DISCUSSION

The current study highlights the ethnobotanical and therapeutic benefits of wild fruit plants that have been the subject of a thorough survey. The 21 edible plant occurring in the forest region were classified on the basis of the wild fruit plants observed during the study location, along with their scientific name, local name and family (Fig. 1).

The edible 28 plants in the study belonged to seven species which were locally consumed as both plants and fruits, while four species where fruits were consumed locally and seldom sold. Five species used only for trade purpose, while five species were used only as famine food (Table 1). The total 23 plant families had 25 genus and 28 species (Table 2).

The growth habits of the documented wild edible plants included four herbs, six shrubs and 18 trees. The dominant growth habit of the trees contributed 64.28% of all identified wild edible plant species, followed by the shrub habit (53.57%) and the herb growth habit contributing the least (17.85%). The fruits of 11 species were consumed by the local people. The vast majority of fruits were eaten when they were ripe or uncooked. In some of these wild documented plants that had two edible portions, such as stem and leaves or leaf and fruit. For instance in *Amarthanus viridis* both stem as well as leaves are eaten as fresh.

The leaves (64%) in 18 reported species were found as the most commonly used plant part, followed by fruits (15 species, 53%), flowers and other parts such as root, bark (nine species, each 32%), and wood and seed (five species, each 17%). The fern (one species, 4%) found least to used plant parts. The Moraceae family in wild edible plants included quite popular three species. However Rubiaceae, Rosaceae and Caesalpiniaceae each had two species. Remaining families were represented by single species. As such, multiple species comprised about 39.13% of the families.

The wild edible plants were used for different purposes by local people. The highest percentage was used for medicinal use (68%), followed by food (44%), fodder (30%), miscellaneous including fuel (21%), religion (10%) and dyes (7%).

About 31 pharmacological activities were reported in the 28 plant species. Maximum six species were used to cure digestive disorders followed by four as intoxicating agents (Table 3).

Since research has been done on the traditional knowledge of using native plants as medicines, ethnological knowledge of the populace and a list of plants native to a given area are valuable resources that may aid in comprehending the relationships between humans and their surroundings, but the farmers in the village are unaware of the therapeutic benefits of these kinds of untamed fruit plants (Singh *et al.,* 2020b, e, f). The aim of current analysis was to survey the ethnobotanical exploration, identification, issues and future potentialities of the edible wild plants in the Garhwal region. A total of 28 plant species from various families were recorded. According to Kebede *et al.* (2017), the majority of wild edible plants exhibit heterogeneity in accessible species and community cultures on food preferences and preparation. Fruit is a matured ovary which can be classified as cultivated or wild, fleshy or nut-like. Wild edible fruits are consumed by direct eating. Historically, wild, edible fruits have been utilized for food, medicine and to make wine and pickles (Benamar *et al.,* 2022). On the basis of their use, the wild the edible plant can be classified such as locally consumed plants and fruits, fruits and food locally consumed and seldom sold, famine food and plants used for trade. The locals believed that deforestation, encroachment and low rainfall reduced the variety of wild edible fruit plant species. Kebede *et al.* (2017) also reported similar factors. The significantly preferred species by the locals, found valuable importance as being utilized for edible and medicinal purposes, had high demand in the local markets (Khakurel *et al.,* 2021). The locals cultivated wild edible fruits primarily for their personal consumption as direct edible use as well as to better their standard of living and generate cash. The local people had a good ethnobotanical knowledge in using plant resources and to develop their own traditional system of using plants for medicinal uses.

CONCLUSION

Investigation of the study area concluded significance of 28 wild edible fruit plant

Table 1. Wild edible plants with local and botanical names and their use

S. No.	Botanical name	Local name	Family	Life form	Plant part	Uses
1.	*Adhatoda vasica*	Basinga	Acanthaceae	S	Lf, Rt, Fl	In tuberculosis respiratory disorders, diabetes.
2.	*Amaranthus viridis*	Chauali	Amaranthaceae	H	Lf	Young shoots and leaves cooked as vegetables.
3.	*Aegle marmelos*	Bel-patri	Rutaceae	T	Fr, Lf, Fl	Fruits pulp eaten raw or made into refreshing drink, particularly useful in digestive disorders. Leaves offered to Lord Shiva. Flower useful source of bee-forage.
4.	*Berberis aristata*	Kingore	Berberidaceae	S	B, Rt, Fr	Bark of stem or root often known as 'Rasaut' dropped in ophthalmic. Infusion of root given in fever. Fruits edible; bark yields dye.
5.	*Bombax ceiba*	Sema	Bombacaceae	T	Fl, Se	Flower buds as vegetables; seed fibres used in stuffing pillows; gum used to cure digestive disorders.
6.	*Bauhinia variegata*	Kachnar	Caesalpinaceae	T	Fl, Lf	Flowers used as vegetables and leaves for fodder.
7.	*Bauhinia purpurea*	Guriyal	Caesalpinaceae	T	Fl, B	Flowers buds cooked as vegetable and foliage used as fodder; wood used for agricultural implements; bark used as medicine.
8.	*Cannabis sativa*	Bhang	Cannabaceae	H	Se, Lf	Seeds are used as condiments; seed oil; edible; its leaves and flowers used as an intoxicating agent; paste of leaf applied on wisdom tooth.
9.	*Celtis australis*	Kharik	Ulmaceae	T	Lf, Fr	Used in dysentery colic, fodder etc.
10.	*Diplazium esculentum*	Lingura	Dryopteridaceae	H	Fe	Used for vegetables. Lower part is sued for bleeding of animals.
11.	*Emblica officinalis*	Amla	Euphorbiaceae	T	Fr,Lf	Fruits used as edible, Leaves as fodder.
12.	*Rhododendron arboreum*	Burans	Ericaceae	T	FL	Wood used for fuel and Charcoal; flower eaten raw or made into sauce, jellies, jams or refreshing drinks; medicinal (flowers and bark used for digestive and respiratory disorders; fever, headache, wounds) edible; fuel; religious; wooden pots.
13.	*Quercus leucotrichophora*	Banj	Fagaceae	T	Wd, Lf, Fr	Wood used for constructions as well as fuel; leaves used as fodder; gum of the tree medicinally used for gonorrhoeal and digestive disorders: edible by wild animals; fuel; fodder and timber (agriculture tools, decomposed leaves for organic manure).
14.	*Juglansregia*	Akhrot	Juglandaceae	T	Fr, Wd, B	Fruits edible and also provide oil; wood used for furniture; bark used as dye and as tooth medicine; rind of fruits used to intoxicate fish and for dyeing.
15.	*Morus serrata*	Shatoot/Kimu	Moraceae	T	Lf, Fr	Leaves as fodder for sheep and goats; ripe fruits edible; wood used for agricultural implements and other articles.
16.	*Myrica esculenta*	Kafal	Myricaceae	T	Fr, Lf, Wd	Fuel, fodder. In traditional medicine, used to treat conditions like chronic bronchitis, ulcers, anaemia, fever, diarrhoea, and problems of the ears, nose, and throat.
17.	*Moringa oleifera*	Singara	Moringaceae	T	Fr, Lf, Fl	Use to treat liver disease, heart and cancer.

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Table 1 cond.

18.	*Ficus palmata*	Bedu	Moraceae	T	Lf, Fl, Fr	Leaves and twigs for fodder; fruits delicious in taste, often taken raw with salt or filled inside the bread; fruits are used for digestive disorders, the milky exudate used to remove thorns.
19.	*Ficus roxburghii*	Timla	Moraceae	T	Fr, Lf	Fruits edible, unripe fruits used as vegetables, wood as fuel. Leaves also provide good fodder for cattle. Plants are conserved for their religious significance and utilization.
20.	*Ociumum americanum*	Jangli- tulsi	Lamiaceae	H	Lf	Leaves used as an insecticide, also used in chutney.
21.	*Pinus roxburghii*	Chir pine	Pinaceae	T	Wd	Saw-dust with honey used in asthma, ulcer and bronchitis; making furniture, doors, flours, windows, boxes, etc); Miscellaneous (It provides strength to mud wall, also used in cattle beds). Resin also used in cuts and wounds, Seeds are edible.
22.	*Pyrus pashia*	Melu	Rosaceae	T	Lf, Fr, Fl	Fruits in digestive disorders; eye complaints.
23.	*Prunus persica*	Aru	Rosaceae	T	Fr, B, Fl	Bark used as fuel. Fruit used for bronchitis and root bark used in jaundice.
24.	*Rumex hastatus*	Almora	Polygonaceae	H	Lf	Leaf extract applied on wounds and cuts to check bleeding and also believed to relieve from suffering of nettle sting. Leaves are used in food chat.
25.	*Rubus ellipticus*	Hinsalu	Rubiaceae	S	Fr, Rt	Root extract used as local beverages as intoxicating ingredient; other uses for dysentery, malaria, stomach and worms; edible (fruits); miscellaneous; (flower useful in apiculture as bee-forage).
26.	*Rubus niveus*	Karhinsalu	Rubiaceae	S	Rt	The root relieves rheumatoid arthritis pain, detoxifies, dispels wind dampness, and treats diarrhoea.
27.	*Urtica parviflora*	Kandali	Urticaceae	H	St, Se	Stem yield strong fibre-mat weaving. Leaves are used as vegetables and fodder.
28.	*Zizyphus jujuba*	Ber	Rhamnaceae	T	Fr, Se, Lf	Leaves are used to treat obesity. Fruits are used to treat blood-borne disease.

Where, Fe = Fern, Fr = Fruit, Fl = Flower, Se = Seed, Rt = Root, S = Shoot, Wp = Whole plant, B = Bark, Lf = Leaf, Wd = Wood and St = Stem.

Table 2. The occurrence of recovered genus and species in different plant families

S.No.	Name of family	Genus	Species	S. No.	Name of family	Genus	Species
1.	Acanthaceae	1	1	13.	Ericaceae	1	1
2.	Amaranthaceae	1	1	14.	Fagaceae	1	1
3.	Rutaceae	1	1	15.	Juglandaceae	1	1
4.	Berberidaceae	1	1	16.	Moraceae	2	3
5.	Bombacaceae	1	1	17.	Myricaceae	1	1
6.	Caesalpinaceae	1	2	18.	Moringaceae	1	1
7.	Cannabaceae	1	1	19.	Lamiaceae	1	1
8.	Ulmaceae	1	1	20.	Pinaceae	1	1
9.	Dryopteridaceae	1	1	21.	Rosaceae	2	2
10.	Euphorbiaceae	1	1	22.	Polygonaceae	1	1
11.	Rubiaceae	1	2	23.	Urticaceae	1	1
12.	Rhamnaceae	1	1	Total	23	25	28

Table 3. Number of recovered plant species based on the pharmacological activities

S. No.	Pharmacological activities	No. of species	S. No.	Pharmacological activities	No. of species
1.	Tuberculosis	1	17.	Anaemia	1
2.	Respiratory disorders	2	18.	Diarrhoea	2
3.	Diabetes	1	19.	Ears, Nose and Throat (ENT)	1
4.	Refreshing drink	2	20.	Liver disease and	1
5.	Digestive disorders	6	21.	Heart	1
6.	Ophthalmic drop	2	22.	Cancer	1
7.	Fever	3	23	Insecticide	1
8.	Intoxicating agent	4	24	Asthma	1
9.	Tooth ache	2	25	Jaundice	1
10.	Dysentery colic	1	26	Malaria	1
11.	Bleeding	2	27	Stomach worms	1
12.	Headache	1	28	Rheumatoid arthritis	1
13.	Wounds	3	29	Dampness	1
14.	Gonorrhoeal	1	30	Obesity	1
15.	Chronic bronchitis	4	31	Blood borne disease	1
16.	Ulcers	2			

species. Although these are distributed throughout the world, wild fruit plants are quite rare. Due to their challenging geography and climate, the majority of fruiting plants in the area were often wild and unaffected by human influence. Wild edible plants were crucial to the health of the rural communities. The local farmers used these as a source of revenue in addition to providing supplemental food, a nutritionally balanced diet, medications, fuel and fodder. Numerous additional wild fruits, including *Ficus auriculata* and *Berberis asiatica* were noted to have beneficial medicinal qualities. The seminars, workshops and short-term trainings should be provided by government and non-government organizations for the local population to improve their standard of living. Further study on the detailed nutritional value is needed so that it could help in creating awareness among common masses.

ACKNOWLEDGEMENT

The authors are thankful to local people and agriculturists of the study area for sharing valuable information about seasonal wild fruit plant species.

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