



A Review on Phytochemical Investigation of Himalayan Wild Berries and their Activities

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Abstract Wild edible fruits and berries are nutritious food sources that have been used for a very long time as a possible supply of vitamins and minerals. It is well recognised that many of the edible wild fruits and berries provide a significant source of antioxidants. Several non-conventional fruits with untapped commercial potential and nutritional value may be found in the Himalayan region. The Himalayan region's enormous range of wild edibles not only offers nutrient-dense food, but also a means of subsistence for the tribal and destitute people who live adjacent to woods and rural regions. In this review, we are going to study five Himalayan wild berries (*Euterpe oleracea*, *Vaccinium myrtillus*, *Phyllanthus embilica*, *Rubus ellipticus* *Rubus niveus*) and their activities.

Keywords Phytochemicals, *Euterpe oleracea*, *Vaccinium myrtillus*, *Phyllanthus embilica*, *Rubus ellipticus* *Rubus niveus*

Introduction

Among various mountain ecosystems in the world, the Himalayas holds a special significance for being the youngest, dynamic, complex, and diverse ecosystem. Himalaya, with its diverse biological elements and forest habitats, is among the most biodiversity-rich mountainous region. Variable climate, wide altitudinal range, and different habitat conditions govern the biodiversity of the region which helps towards sustaining life in the region. Himalayas provides habitat to many rare medicinal and wild edible plants. The Himalayas has a unique and representative floral diversity, with more than 35,000 plant species [1-2].

Throughout history, berries have been an important and valued part of the human diet. Berries contain many components, but anthocyanins, the phenolic compounds that give berries their red, blue, and purple colors, have been found to have a wide range of health-related properties, including antioxidant, antitumorigenic, anti-inflammatory, hypoglycemic, and antimicrobial effects. Wild edible fruits and berries are healthy food resources and are consumed as a potential source of nutrients and minerals for a very long time. Their vital role in health care systems across the globe is evident from the increasing attention towards their conservation and sustainable utilization. Many of the wild edible fruits and berries are known to be an important source of antioxidants that reduces the risk of various diseases by boosting immunity. They are used as a source of food in many developing countries and thus ensure nutritional security [3-5].

Among other regions of the world, the Himalayan region holds a significant place for biological diversity, especially wild edible fruits and berries. The Himalayan region is home to many nontraditional fruits with unexplored trade potential and nutritional value. The rich diversity of wild edibles in the Himalayan region not only provides nutritious food but also provides livelihood to the tribal and poor people living close to forests and rural areas. Few



studies are there from the Himalayan region has documented the diversity of wild edible fruits/wild edible plants. However, the diversity of the complete Himalayan region has not been documented so far [6-8].

Foods rich in plant-based products, including fruits and berries, are well known for their health benefits and evidence shows that their high intake reduces the risk of metabolic diseases, cardiovascular problems, and cancers. Many fruits and berries are gaining popularity as new sources of nutraceuticals and functional foods. Nutritional supplements provide adequate amounts of nutrients essential for the proper functioning of human bodies. Nutritional supplements include various products such as vitamins, proteins, herbs, meal supplements, sports nutrition, etc [9-10]. They are consumed to maintain health and provide support to the immune system that reduces the risk of illness. Various epidemiological studies have highlighted that the fruit-rich diets decreased the incidence of non-communicable diseases, such as arthritis, cancer, cardiovascular diseases, diabetes, and neurodegenerative disorders, through improvement in LDL oxidation, lipid peroxidation, total plasma antioxidant capacity, dyslipidemia, and glucose metabolism among others [11-12].

Wild fruits are gaining global interest due to their high nutritional value being rich in vitamins, beneficial phytochemicals, and antioxidants. These valuable secondary metabolites of fruits and berries have ability to protect health through preventing or delaying the oxidation of lipid, DNA, or other macromolecules by inhibiting oxidative chain reactions. Wild fruits are being consumed in the Himalayan region for their nutritional values and health benefits. Studies in many developing countries have suggested that wild fruits can play an essential role in food and nutritional security. There is an increasing interest in wild fruit and berries-derived nutraceuticals, functional foods, and food supplements as potential agents in the maintenance of good health and the prevention and treatment of diseases [13-14].

Both wild and cultivated fruits and berries are an important part of daily life for people living in the Himalayan region for their nutritional and food values. In most cases, fruits and berries are collected from the wild during their ripening stage and consumed fresh. Some ethnic groups also dry them for future uses or process them into various food products such as pickles, fermented alcoholic beverages, etc. Many of these fruits are also an integral part of traditional medicines systems especially Ayurveda and Tibetan traditional medicine. Fruits of plants such as *Terminalia bellerica*, *T. chebula*, *Phyllanthus embellica*, *Aegle marmelos*, *Myrica esculenta*, *Berberis* spp., *Rubus* spp., etc. have been used in many Ayurvedic and Tibetan traditional medicine systems from hundreds of years.

For example, more than 35 species of wild edible fruits species of Lesser Himalayas-Pakistan have traditional medicinal value, 47 species of wild edible species are reported to be used in traditional medicines in Swat valley, 49 species of wild edibles are used ethnomedicinally in Sikkim and 86 species of wild edibles are used ethnomedicinally in West Bengal Hills. In addition, the leaves and fruits of *Hippophae rhamnoides* were given as a feed to horses for weight gain and their improving power in higher Himalayas and Tibet. However, its vitamin-rich berries are traditionally consumed for gastrointestinal disorders, coughs, and colds, as well as for menstrual disorders, besides high nutritional value. Berries of various *Rubus* species of Central Himalaya are used to cure mild coronary problems, hypertension, digestion problem, and anemia. *Myrica esculenta* found throughout the mid-Himalayas has delicious fruit with beneficial effects on dysentery and indigestion and stem bark to cure chronic cough, asthma, and ulcers. Fruits of *Pyracantha crenulata* are used as cardio-tonic, coronary vasodilator, and to treat hypertension, and leaves are used in the preparation of herbal tea, sunburn creams, and many facial creams. Similarly, *Ribes nigrum* fruits are used for treating rheumatoid arthritis and night and fatigue-related visual impairment. Fruits of *Carissa spinarum* are used in rheumatism and the preparation of some purgative formulations. Fruits and flowers of many plant species that is, *Hippophae salicifolia*, *Rhododendron arboreum*, *Aegle marmelos*, *Myrica esculenta*, *Parkia javanica* have been directly sold in the market as well as in processed form as juice, jam, jelly, pickles, and spices with improved commercial value in markets (Negi et al., 2011).

There have been various studies on the preliminary phytochemical screening and biological activities of fruits and berries from the Himalayan region. Phenolic compounds including flavonoids and phenolic acids are reported as the main constituents. The diverse ethnic communities living in the Himalayan region are rich in their culture and tradition along with unique use in medicine and food. These communities have vast knowledge; however, the knowledge is declining nowadays due to a lack of proper documentation and the changes in livelihood along with



generations. most of the fruits and berries collected in rural areas are eaten/consumed fresh and only a few of them are processed for future use. In developed countries, the fruits and berries are processed into various forms such as dried fruits, jellies, jam, juice, liquor forms, and many others [15-16].

In This Review, we are going to study five Himalayan wild berries and their activities.



1. *Euterpe oleracea*
2. *Vaccinium myrtillo*
3. *Phyllanthus embilica*
4. *Rubus ellipticus*
5. *Rubus niveus*

Euterpe oleracea

1. Plant profile

A tall, slim, multi-stemmed palm to 30m high, with an attractive crown of drooping leaves. The fruit is a round berry, purple/black at maturity, and is born in bunches of 3 to 8. It flowers throughout the year but the fruit harvesting season is usually from July to December.

The common name comes from the Portuguese adaptation of the Tupian word *ĩwasa'i*, meaning "[fruit that] cries or expels water" The *Euterpe Oleracea*, is a species of palm tree (Arecaceae) cultivated for its fruit (berries), hearts of palm (a vegetable), leaves, and trunk wood. The fruit is highly valued by the people of Brazil and the Guianas for use as a juice and in wine, and it is an important and popular dietary complement. The palm heart is also used extensively. The juice is extracted from the small round fruit by soaking the seeds in water to soften the thin outer shell and then squeezing and straining them to produce a very tasty, dense purple liquid. This liquid is served ice cold with (or sometimes without) sugar and tapioca flour. It is a nourishing and refreshing drink that is also used to produce ice cream, liquor, mousses and sweets in general.

	
<p>https://www.quintadosouriques.com/wp-content/uploads/2023/03/euterpe-oleracea-19400.jpg</p>	<p>https://images.app.goo.gl/k84eMRwnNRi9oA3RA</p>
<p><i>Tree</i></p>	<p><i>Fruits</i></p>

2. Geographical distribution

The species is native to eastern Amazonia, especially in Brazil, mainly in swamps and floodplains. It is widely distributed throughout northern South America, but it is most commonly found along river edges and seasonally flooded habitats in Brazil and is cultivated in the States of Par", Amazonas, Maranh"o and Amap", especially in the Amazon River estuary. It is now very widely grown because of its use as a food item.

3. Common names

Acai Palm
Assai Palm
Cabbage Palm

4. Scientific classification

Kingdom: Plantae
Clade: Tracheophytes
Clade: Angiosperms
Clade: Monocots
Clade: Commelinids
Order: Arecales
Family: Arecaceae
Genus: Euterpe
Species: E. Oleracea

5. Morphology

Plant: Stems clustering, to 20-25 m tall 10-20 cm in diameter. Pinnate Leaves 3-4 m long, 8 to 10 in the crown; crownshaft bluish green; petiole green, glabrous; pinnae to 100 on each side, regularly inserted, narrow, strongly pendulous, the central ones 60-110 cm long and 3-5 cm wide. Inflorescence erect, with axis 40-100 cm long; branches to 150, usually inserted on all sides of the rachis, to 70 cm long, 3-4 mm in diameter, densely covered with short, whitish brown hairs.

Fruit: The fruit is small, round, and black-purple in color. The fruit, commonly known as açai berry or açai, is a small, round, black-purple drupe about 25 mm (1 in) in circumference, similar in appearance to a grape, but smaller and with less pulp and produced in branched panicles of 500 to 900 fruits. The exocarp of the ripe fruits is a deep purple color, or green, depending on the kind of açai and its maturity. The mesocarp is pulpy and thin, with a consistent thickness of 1 mm (0.04 in) or less. It surrounds the voluminous and hard endocarp, which contains a single large seed about 7–10 mm (0.3–0.4 in) in diameter.

Seed: The seed makes up about 60-80% of the fruit. The palm bears fruit year round but the berry cannot be harvested during the rainy season.

6. Phytochemistry

A powdered preparation of freeze-dried açai fruit pulp and skin was reported to contain (per 100 g of dry powder) 534 calories, 52 g carbohydrates, 8 g protein, and 33 g total fat. The carbohydrate portion included 44 g of dietary fiber with low sugar levels, and the fat portion consisted of oleic acid (56% of total fats), palmitic acid (24%), and linoleic acid (13%). The powder was also shown to contain (per 100 g) negligible vitamin C, 260 mg calcium, 4 mg iron, and 1002 IU vitamin A.

7. Uses

It has many proven pharmacological properties like: anti-proliferative, anti-inflammatory, antioxidant, and cardio protective activity.

Other Common Uses Fresh açai has been consumed as a dietary staple in the region around the Amazon river delta for centuries. The fruit is processed into pulp for supply to food product manufacturers or retailers, sold as frozen pulp, juice, or an ingredient in various products from beverages, including grain alcohol, smoothies, foods, cosmetics and supplements.

Açai oil is green in color, has a bland aroma, and is high in oleic and palmitic fatty acids. The oil is suitable for cooking or as a salad dressing, but is mainly used in cosmetics as shampoos, soaps or skin moisturizers. The oil compartments in açai fruit contain polyphenols such as procyanidin oligomers and vanillic acid, syringic acid, p-

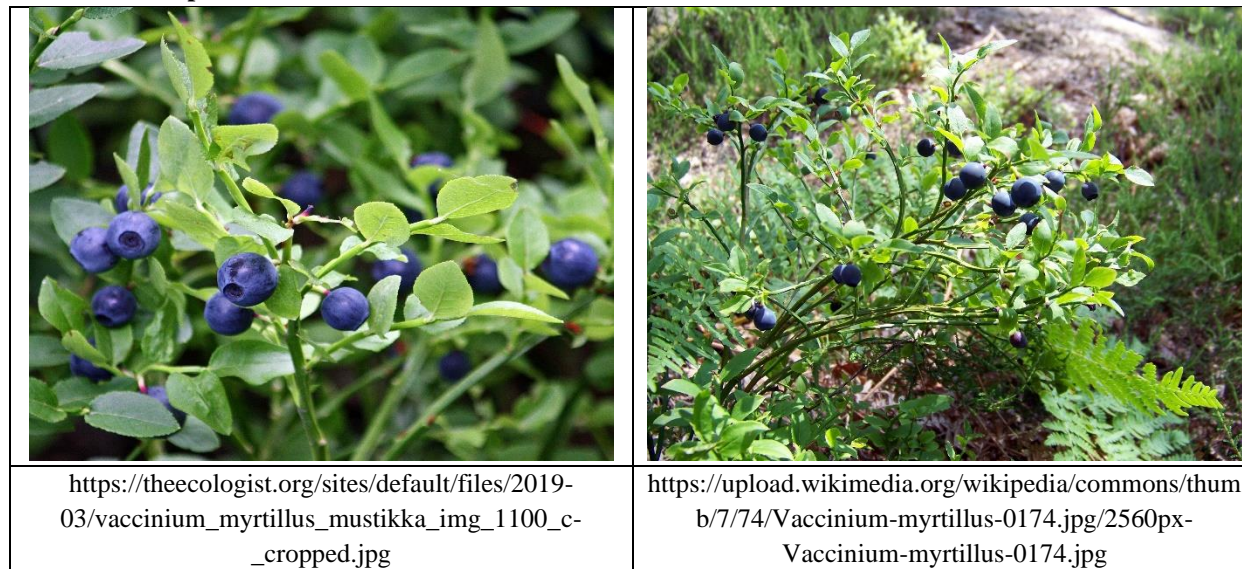


hydroxybenzoic acid, protocatechuic acid, and ferulic acid, which were shown to degrade substantially during storage or exposure to heat.

Leaves of the palm are used to make hats, mats, baskets, brooms and roof thatch for homes, and trunk wood, resistant to pests, for building construction. Tree trunks may be processed to yield dietary minerals [17-25].

Vaccinium myrtillus

1. Plant profile



Vaccinium myrtillus or European blueberry is a holarctic species of shrub with edible fruit of blue color. It is more precisely called common bilberry or blue whortleberry to distinguish it from other *Vaccinium* relatives. Bilberry (*Vaccinium myrtillus* L.) is one of the richest natural sources of anthocyanins. These polyphenolic components give bilberry its blue/black color and high antioxidant content, and they are believed to be the key bioactives responsible for the many reported health benefits of bilberry and other berry fruits.

2. Geographical distribution

The bilberry plant is a low-growing shrub native to northern Europe, but is now also found in parts of North America and Asia. Bilberry usually grows in heaths, meadows, and moist coniferous forests, and its growth is favored by moderate shade and moderately humid ground conditions. The bilberry is a small (5-9 mm in diameter) fruit, bluish black in color, with many seeds.

3. Common (Vernacular) names

Bilberry
Blueberry
Wimberry
Whortleberry

4. Scientific classification

Kingdom Plantae
Subkingdom Viridiplantae
Infrakingdom Streptophyta
Superdivision Embryophyta
Division Tracheophyta
Subdivision Spermatophytina



Class	Magnoliopsida
Superorder	Asteranae
Order	Ericales
Family	Ericaceae
Genus	Vaccinium L.
Species	Vaccinium myrtillus L.

5. Morphology

The rhizomes are generally found at 15-20 cm. from the surface and always are confined to the humus layers of a profile. Their extensive horizontal growth and sympodial branching effect a rapid spread. The rhizome bears many fine, adventitious roots.

Seedling development is slow; at the end of a 6-10 week period the plant shows the first juvenile leaves and shoot. The young leaves are reticulately veined with marginal and ventral multicellular trichomes; this latter feature is absent from adult plants. At three months the seedling shows the diagnostic leaf features of the adult plant -serrate, ovate-acute, thin textured and net-veined.

6. Phytochemistry

Bilberry contains a variety of phenolic compounds, including flavonols (quercetin, catechins), tannins, ellagitannins, and phenolic acids, but anthocyanins make by far the largest contribution to its phytochemical mix. These naturally occurring phenolic compounds are redox-active antioxidants as well as iron chelators. and are found in red-, blue-, and purple-colored flowers, fruits, and vegetables. The usual daily dietary intake of anthocyanins is approximately 200 mg. Bilberry has higher anthocyanin content compared to other types of berries, such as strawberry, cranberry, elderberry, sour cherry, and raspberry. The total anthocyanin content of bilberry is generally in the range of 300-700 mg/100 g fresh fruit, although this range varies with cultivar, growing conditions, and degree of ripeness of the berry. Along with anthocyanins, 100 g of fresh bilberry contains small quantities of vitamin C (3 mg), quercetin (3 mg), and catechin (20 mg).

7. Uses

Bilberry can be safely consumed when used appropriately. No mutagenic activity has been reported, and there are no cited contraindications to its use. Bilberry is sold as fresh, frozen, and dried whole berries, as well as in the form of preserves, jams, and juices, and, increasingly, liquid or powdered concentrates are sold as food supplements. Although most attention has been focused on the antioxidant properties of anthocyanins in relation to health benefits of bilberry, the effects are likely to extend beyond simple antioxidant action to involve cell-signaling pathways, gene expression, DNA repair, and cell adhesion, as well as antineoplastic and antimicrobial effects. Commercial bilberry products are often standardized to a 25% anthocyanidin content (equivalent to 36% anthocyanins); but this content can vary greatly. Recommended daily dosages also vary greatly, for example, 20-60 g of dried berries and 160-480 mg of powdered extract. Besides its use as a delicacy, bilberry is widely used to improve night vision and to decrease vascular permeability and capillary fragility; moreover, the berry has various other reputed health benefits, although most interest has been focused on anthocyanin-related antioxidant effects. Although there are many studies that have investigated the antioxidant and other health-related effects of anthocyanins and anthocyanin-rich berries and extracts or juices, only a few have used bilberry itself, and data from controlled human trials are scarce. Although bilberry is promoted most commonly for improving vision, it has been reported to lower blood glucose, to have anti-inflammatory and lipid-lowering effects, and to promote antioxidant defense and lower oxidative stress. Therefore, bilberry is of potential value in the treatment or prevention of conditions associated with inflammation, dyslipidemia, hyperglycemia or increased oxidative stress, cardiovascular disease (CVD), cancer, diabetes, and dementia and other age-related diseases. There are also reports that bilberry has antimicrobial activity [26-35].



Phyllanthus emblica**1. Plant profile**

Phyllanthus emblica is an important deciduous tree. The tree is small to medium in size and grows up to 5.5 m. The barks are greenish-gray in color and peel off in scales. The fruits are the most commonly used plant part and are of both dietary and medicinal use. The raw fruits are green while; the ripe fruits are yellowish-green in color. The fruits are of culinary use and are widely used to make murabbah, juice, pickle, chutneys, and as a vegetable in various dishes.

**2. Geographical distribution**

This plant belongs to the Euphorbiaceae family and was originally native to India but is today found growing in Pakistan, Uzbekistan, Srilanka, Southeast Asia China, and Malaysia.

3. Common (Vernacular) names

Assamese	Amla, Amlokhi, Amloki, Amlaki
Bengali	Amlaki
English	Indian Gooseberry
Gujarati	Amalak
Hindi	Amla, Aonla, Anwla, Bahu-muli, Brahma Vriksh
Kannada	Kaadu nelli, Aamalaka, Dodda Nelli, Betta Nelli
Kashmiri	Amalaki, Omala
Konkani	Avalo
Malayalam	Amalakam, Nelli, Nelli, Nellikka
Manipuri	Heikru, Amla
Marathi	Avala, Aanvala
Oriya	Aula
Sanskrit	Akara, Amalah, Amalakah, Tamaka, Tishya, Dhatrika, Brahmavriksh, Manda, Radha, Vajram, Vilomi, Shiva, Shambhupriya, Shriphali, Sudha
Tamil	Nelli, Attakoram, Amirta-palam, Amalaki, Intuli, Kantattiri, Kattu-nelli, Konkam, Korankam, Cirottam, Civai, Tattiri, Tecomantiram, Totti, Toppu-nelli, Nelli
Telugu	Amalakamu, Usiri, Dhatri, Nelli
Urdu	Anwla, bodo, Amlai



4. Scientific classification

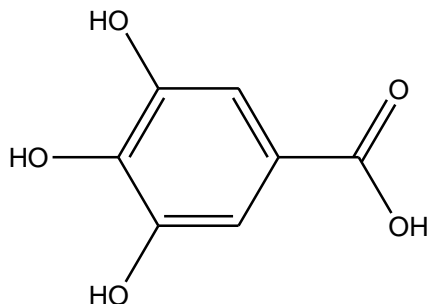
Kingdom	Plantae
Phylum	Tracheophyta
Class	Equisetopsida C. Agardh
Order	Malpighiales Juss. ex Bercht. & J. Presl
Family	Phyllanthaceae
Genus	Phyllanthus
Species	Phyllanthus emblica L.

5. Morphology

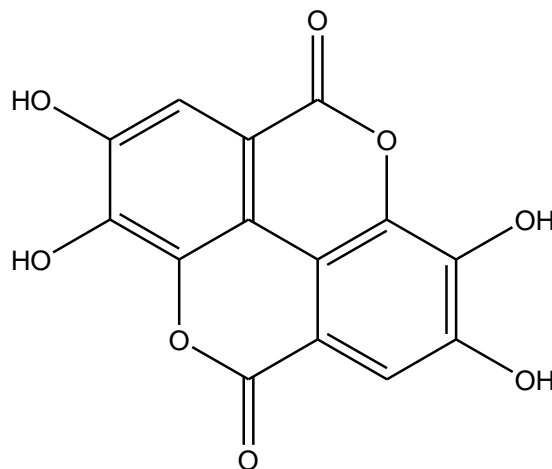
The tree is small to medium in size, reaching 1–8 m in height. The branchlets are not glabrous or finely pubescent, 10–20 cm long, usually deciduous; the leaves are simple, subsessile and closely set along branchlets, light green, resembling pinnate leaves. The flowers are greenish-yellow. The fruit is nearly spherical, light greenish-yellow, quite smooth and hard on appearance, with six vertical stripes or furrows. The fruit is up to 26 mm in diameter, and, while the fruit of wild plants weigh approximately 5.5 g, cultivated fruits average 28.4 g to 56 g. The fruits are globular in shape, fleshy and smooth striated with an obovate-obtusely triangular six-celled nut. The seeds are centrally placed and are 4–5 mm long and 2–3 mm wide.

6. Phytochemistry

Phytochemical studies have shown that amla contains tannins, alkaloids, and phenolic compounds. It is a rich source of vitamin C and the levels are more than that in the oranges, tangerins or lemon. Amla also contains gallic acid, ellagic acid, chebulinic acid, chebulagic acid, emblicanin-A, emblicanin-B, punigluconin, pedunculagin, citric acid, ellagotannin, trigallayl glucose, pectin, 1-O-galloyl-beta-D-glucose, 3,6-di-O-galloyl-Dglucose, chebulagic acid, corilagin, 1,6-di-O-galloyl beta-D-glucose, 3-ethylgallic acid (3 ethoxy-4,5-dihydroxy benzoic acid), and isostrictinin. It also contains flavonoids like quercetin, kaempferol 3 O-alpha L (6'' methyl) rhamnopyranoside, and kaempferol 3 O-alpha L (6'' ethyl) rhamnopyranoside.

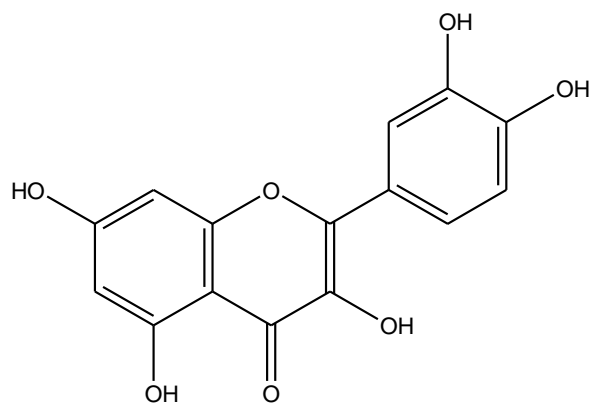


Gallic acid

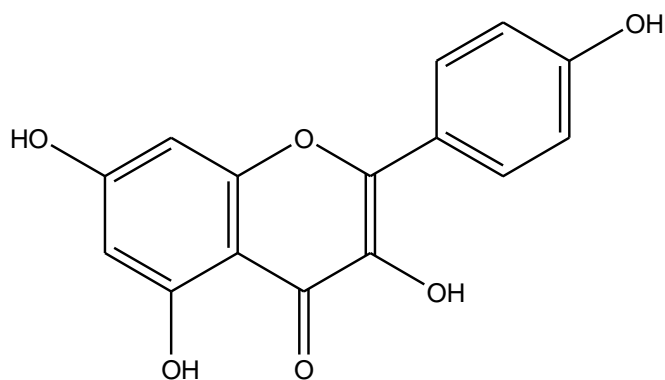


Ellagic acid





Quercetin



Kaempferol

7. Uses

Amla is a very important medicinal plant and has been widely used by Ayurvedic practitioners for more than 3000 years. In Ayurveda, amla is regarded as a very powerful rejuvenating herb and its regular consumption is also considered to be useful in stalling degenerative and senescence process, to promote longevity, enhance digestion, to treat constipation, reduce fever, purify the blood, reduce cough, alleviate asthma, strengthen the heart, benefit the eyes, stimulate hair growth, enliven the body, and to enhance intellect. The fruit is also used for making hair oils and its regular application is supposed to prevent graying of hair, increase the hair growth, and impart luster and gloss to the mane. Amla is useful in the treatment of diabetes, cough, asthma, bronchitis, cephalalgia, ophthalmopathy, dyspepsia, colic, flatulence, hyperacidity, peptic ulcer, erysipelas, skin disease, leprosy, hematemesis, inflammations, anemia, emaciation, hepatopathy, jaundice, strangury, diarrhea, dysentery, hemorrhages, leucorrhoea, menorrhagia, cardiac disorders, and intermittent fevers. Amla is also of use in Siddha, Unani, Tibetan, Srilankan, and Chinese systems of medicine. In the various folk systems of medicine, this fruit is used as an astringent, expectorant, antiasthmatic, laxative, diuretic, spasmolytic, antacid, antipyretic, anti-inflammatory, antidiarrheal, antidiabetic, and reduces premature graying of hair. It is commonly used to treat a variety of ailments such as hemorrhoids, nerve debility, anemia, jaundice, liver complaints, menorrhagia, leucorrhoea, hematuria, osteoporosis, weak vision, and inflammation of the eyes [36-45].

Organ	Uses of <u>Phyllanthus Emblica</u>
Blood	Increases Insulin Levels therefor decreases blood Glucose levels Decreases LDL, cholesterol, TG Increases HDL
Blood Vessel	Decreases Atherogenesis Decreases Cataractogenesis
Eyes	Decreases Aging Decreases Aldol reductase
Heart	Decreases Atherogenesis Decreases Diabetic Neuropathy
Kidney	Decreases Oxidative Stress, apoptosis Decreases Inflammation Decreases Lipid peroxidation
Liver	Decreases Gluconeogenesis Increases Insulin Sensitivity Increases Glycolysis, glycogenesis



Muscles	Increases Glycolysis Increases Glycogenesis
Neuron	Decreases Neuropathy Decreases Oxidative stress Increases Insulin secretion
Pancreas	Decreases Apoptosis Preserve & Regenerate β cells
Testis	Increases Testosterone levels Increases Sperm Motility & viability

Rubus ellipticus

1. Plant profile

Rubus ellipticus Smith. commonly known as ‘Yellow Himalayan raspberry’ is an important member of Rosaceae family with high medicinal importance having antioxidant and antibacterial properties.

The golden Himalayan raspberry is a large shrub with stout stems that can grow to up to 4.5 metres (15 ft) long. Its leaves are trifoliate, elliptic, or obovate and toothed with long bristles. Its leaves can grow to up to 5 to 10 cm (2 to 4 in) long. Its flowers are short, white, and have five petals and grow in clusters, and blooms in the Himalayas between the months of February and April. Its fruit are sweet, detachable, and highly sought after by birds and elephants.

Rubus ellipticus is sweet to the taste, though it is not commonly harvested for domestic use. The fruit perishes quickly after plucking from the thorny bush.

The bark from this plant is used for medical reasons in Tibetan villages, mainly as a renal tonic and an antidiuretic. Its juices can also be used to treat coughs, fevers, colic and sore throat. The plant can also be used to make a bluish-purple dye.

Rubus ellipticus is an evergreen shrub producing a cluster of stout, heavily armed, upright, biennial stems from a woody rootstock. It usually grows 100 - 300cm tall, occasionally up to 450cm. The stems only produce leaves, and do not flower, in their first year of growth, forming flowering branches in their second year and then dying after fruiting. The plant can rapidly form tall, dense thickets. The plant is harvested from the wild for local use as a food and a medicine. The fruit is sold in local markets in the Himalayas. The plant is grown both as a fruit crop and an ornamental in a variety of places, including Florida, Jamaica, Puerto Rico and California.



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2. Geographical distribution

The golden Himalayan raspberry's origin is in the temperate Himalayas region, and is native to India, Pakistan, Nepal and China. It is found as a weed in open grasslands and rarely in forests of Himalayan states of India e.g. Himachal and Uttarakhand in their higher reaches at an attitude of 1,500 to 2,100 m (4,900 to 6,900 ft). It is often found in pine forests of the region. The golden Himalayan raspberry can be found in mesic or wet forests, and have adapted to be able to live in complete shade and in full sun exposure.

3. Common (Vernacular) names

Assamese	Borjetulipoka, Bor-jetuli-poka, Joteli-poka, Jotelupoka
English	Yellow himalayan raspberry
Gujarati	Shunu Mukram
Hindi	Hinsal, Lanchu
Kashmiri	Gouriphal, Hisara
Malayalam	Cheemullu, Mullippazham
Manipuri	Heijampet
Nepali	Ainselu
Other	Asian Wild Raspberry, Broadleafed Bramble, Ceylon Blackberry, Molucca Berry, Molucca Bramble, Molucca Raspberry, Shingu Shi, Yellow Himalayan Raspberry

4. Scientific classification

Kingdom:	Plantae
Clade:	Tracheophytes
Clade:	Angiosperms
Clade:	Eudicots
Clade:	Rosids
Order:	Rosales
Family:	Rosaceae
Genus:	Rubus
Subgenus:	R. subg. <i>Idaeobatus</i>
Species:	<i>R. ellipticus</i>

5. Morphology

R. ellipticus is a stout, weakly climbing, evergreen thorny shrub 1-3 m tall. Branchlets are pubescent and purplish brown or brownish with sparse, curved prickles and dense, purplish brown bristles or glandular hairs. Leaves are pinnate, digitate or pedate, with 3-7 dentate leaflets. Flowering occurs during March to April, and the fruiting period is from April to May, when it produces aggregate golden-yellow fruits.

6. Phytochemistry

Phenols

Four phenolic compounds have been reported from the roots and fruits of the *R. ellipticus*. These are: Gallic acid, Chlorogenic acid, Catechin, Caffeic acid.

Flavonoids

Flavonoids fulfill many functions of plants such as plant pigment for coloration, producing red, blue or yellow pigmentation. From fruits and roots, two flavonoid compounds have been identified. These are Quercetin and Rutin.

Triterpenoids

Triterpenoids are a class of chemical compounds that consists of three terpene units and have a molecular formula $C_{30}H_{48}$. Thirteen compounds have been identified from the roots of plant by using methanol as a solvent. These



include: Rubusides A, Rubusides B, Rubusides C, Rubusides D, Rubusides E, Rubusides F, Rubusides G, Rubusides H, Rubusides I, Rubusides J, Sericoside, Sericic acid, Alpinoside.

7. Uses

Whole plant reduces typhoid fevers and act as an astringent.

Roots are used for treatment of Fever, diarrhea, gastric problems, wounds healing, antipyretics, fractured bones, headache, urinary tract infection.

Fruits are used to treat Fever, dysentery, gastralgia, wound healing, diabetes, sore throats, colds, antifertility, antimicrobial, analgesic, epilepsy, ulcer, constipation.

Shoots are used to treat Stomachache, diabetes, colic pains, and hypothermia.

Bark is used in treatment of Stomachache, kidney tonic, renal tonic, cough, cold, blood disorders, and anti-diuretic, vaginal discharge, diabetes, and anti-diuretic.

Aerial Parts are used for treating Hypothermia.

Leaves are useful in Fever, dysentery, stomach pain, diabetes, wound healing, ulcer and anti-fertility.

Antimicrobial Activity: The extracts prepared by using hexane, ethyl acetate and methanol from the leaves of *R. ellipticus* showed antimicrobial activity against the strains of *Staphylococcus aureus*, *Escherichia coli*, *Candida albicans*, *Candida tropicalis*, *Penicillium marneffii*, and *Trichophyton rubrum* by using well-diffusion method. One study has reported that ethanolic fruits extract shown good activity against selected bacteria strain: *Bacillus cereus*, *E. coli*, *Enterobacter gergoviae*, *Klebsiella pneumonia*, *Salmonella enteritidis*, *Shigella flexneri*, *S. aureus*, *Staphylococcus epidermidis*, *Streptococcus pyogenes* and fungal strain i.e. *C. albicans*, *Aspergillus flavus* and *Aspergillus parasiticus* by using well-diffusion method. Ethanolic leaves extracts of *R. ellipticus* shown significant activity against selective bacterial and fungal strain, i.e. *S. aureus*, *S. epidermidis*, *Pseudomonas aeruginosa*, *E. coli*; *Candida krusei*, *Trichoderma lignorum*.

Antioxidant Activity: Methanolic leaves extracts of *R. ellipticus* shown invitro antioxidant activity by DPPH free radical scavenging while it is also reported the similar activity from its fruit. Petroleum ether, ethanol and water have been used to extract the fruits of *R. ellipticus*. All the extracts i.e. petroleum ether, ethanol and water shown the antioxidant activity but ethanol extracts shown the best scavenging and reducing power activities as compared to petroleum ether and aqueous extracts while methanol fruit extracts also given the similar in-vitro antioxidant activity. A study reported that methanolic extracts shown in-vivo antioxidant activity by effectively reduced DPPH, nitric oxide and Superoxide radical scavenging while the methanolic roots extracts also given strongest Superoxide radical scavenging.

Anti-inflammatory Activity: Flavonoids result into anti-inflammatory activity. Ethanolic extracts of roots of *R. ellipticus* gave the high anti-inflammatory activity by reducing the edema swelling of the rats.

Wound healing Activity: This activity is shown by phenolic compounds. Leaves of *R. ellipticus* when extracted with methanol solvent have shown the wound healing activity.

Anti-diabetic Activity: Phenolic compounds are also responsible for antidiabetic Activity. The dried powder of leaves of *R. ellipticus* has been extracted with methanol and it has been shown anti-diabetic activity by the inhibition of α -glucosidase.

Anticancer Activity: Triterpenoids generally cause for anticancer activity. Methanolic leaves extract of *R. ellipticus* has shown the anticancer activity. It was carried out on mice and there were reduction of ascites and solid tumor [46-53].

Rubus niveus

1. Plant profile

Rubus niveus is a deciduous shrub producing a cluster of erect to arching, often scrambling, prickly biennial stems from 100 - 300cm long. The stems only produce leaves, and do not flower, in their first year of growth, forming



flowering branches in their second year and then dying after fruiting, A very spiny plant, it often scrambles into other plants, supporting itself by means of its prickly stems.

There is at least one named variety. 'Mysore' is a form suitable for sub-tropical areas, it has mild but nice flavoured fruit with small seeds.

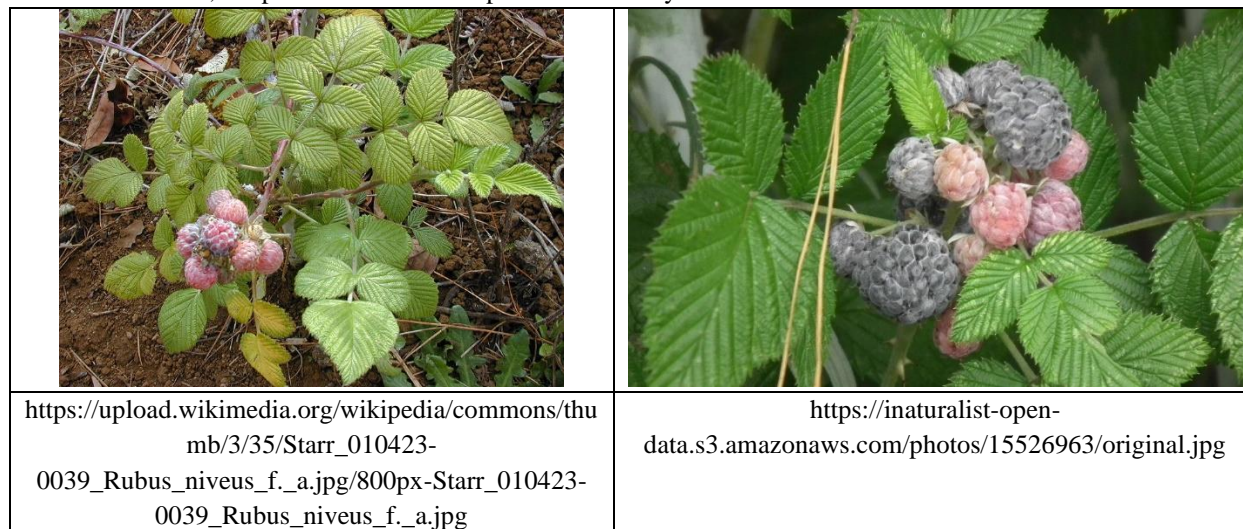
The plant is commonly harvested from the wild for local use as a food, and is also used as a medicine. It is occasionally cultivated for this fruit in Asia, and has been introduced as a fruit crop to Florida and Puerto Rico.

Rubus niveus grows in subtropical or cool tropical climates with a well-distributed medium to high rainfall. In general this species is not very tolerant of frost, though one report says that selected provenances can succeed outdoors in the milder regions of the temperate zone. Easily grown in a good well-drained loamy soil in sun or semi-shade. Plants are intolerant of drought. Another report says that the plants are highly tolerant of dryness.

Rubus niveus is a highly invasive plant that was introduced around the world through the horticultural trade for its production of sweet tasting fruit and as an ornamental due to the striking red-purple colour of its stems. Nevertheless, cultivated crops were abandoned due to the formation of dense, spiny thickets and many plants escaped from cultivation aided by the distribution of seed by birds. Outside of cultivation, it can outcompete native vegetation, decrease biodiversity and threaten rare endemic species. *Rubus niveus* has been described as the most invasive weed species on the Galapagos Archipelago and has been declared a noxious weed in the state of Hawaii.

Seedling plants can commence bearing fruit when about 1 - 2 years old.

In warm climates, the plant can flower and produce fruit all year round.



2. Geographical distribution

Rubus niveus originates from Asia, but can now be found in several non-Asian locations around the globe. its native range is within the temperate areas of Himalayan regions from Afghanistan to China. It is frequently seen growing along roadsides, wastelands and thickets on slopes, sparse forests, montane valleys as well as streamside's between an altitude of 1000-2800 m. In other parts of Asia, *Rubus niveus* can be found at temperate altitudes in areas of south India, Sri Lanka, Taiwan and other south-east Asian countries. Beyond these regions, herbarium specimens and on-line databases indicate that *R. niveus* can be found in East and Southern Africa, Australia and New Zealand, as well as in Central and South America.

3. Common (Vernacular) names

English	Ceylon raspberry, hill raspberry, Java bramble, snowpeaks raspberry, Mysore raspberry
Spanish	frambuesamora
Chinese	hong pao ci teng
Hindi	kala hinsalu, Kalianchhi,



Kannada	Gomili
Tamil	Kolaalindu, Karunkanni, Vellaicheethi
Malayalam	Karimcheechi
Nepali	Kalo aselu

4. Scientific classification

Kingdom	Plantae
Phylum	Tracheophyta
Class	Magnoliopsida
Order	Rosales
Family	Rosaceae
Genus	Rubus
Species	Rubus niveus Thunb.

5. Morphology

Rubus niveus is a large perennial shrub growing up to 4.5 metres in height that may form dense thickets of intertwining stems. The flexible, arching **stems** may be downy when young but become glabrous and glaucous at maturity. They are covered with sharp, hooked thorns 3-7mm long. The **leaves** are pinnately compound into 5-9 serrated, elliptic-ovate leaflets that are 2.5-6cm long and 2-5cm wide. The leaves are dark green and glaucous above and white tomentose below. The petiolules are approximately 0.1cm long and are covered with small prickles, as are the leaf rachises. The inflorescences are short, axillary or terminal panicles of 24 or more **flowers**, which are pink to rose purple. The 5-petaled flowers are approximately 1.25cm broad with petals of 4-5mm in length. The **fruit** of R. niveus is a subglobose aggregate of drupelets and is 1-2cm in diameter with a purple-black colour and fine bloom at maturity. It is juicy and sweet with small seeds, and may be produced throughout the year

6. Phytochemistry

Various types of chemicals have been isolated and extracted from the R. niveus plant which includes phenol, carbohydrate, steroids, saponin, flavonoid, tannin, triterpinoids. On the basis of chemical constituents R. niveus is convenient in the treatment of various types of diseases e.g. several kinds of cancers, hepatic injuries, wound healing, inflammation etc.

7. Uses

Ripe fruits are edible both raw or cooked. They are eaten by the local people. They are cooked in pies, desserts, smoothie, puddings, pies and preserves. Fruits are also employed to extract fruit juice.

Traditional uses: Decauction of R. niveus root is helpful to treat cold & cough, headache, fever, dyspepsia, tonsillitis, vertigo/dizziness and enervate period. Fruit part is also beneficial in the treatment of headache, useful for human health and nutrition in both ancient and modern times. Root and inner bark infusion are helpful to treat jaundice. Root relieves rheumatoid pain, clear heat and detoxify, clear wind damp, treat dysentery. Freshly root tip helps to treat menorrhagia, Anti-gastropathy and also effective as an antidote of snake bite.

Pharmacological activities include Anti-inflammatory, Analgesic, and Antipyretic properties of R. niveus root acetone extract, antioxidant activity of hill raspberry etc. The R. niveus plant also shows antitumor and wound healing activities. It also shows little Antibacterial activity, Antifungal activity, Gastroprotective effects against acute gastric ulcer [54-61].

Conclusion

Himalaya, which spans numerous nations, is home to a variety of floral and animal species and is rich in biological diversity. The Himalayas have worldwide relevance and require particular consideration for biodiversity conservation and management since four out of the 36 global biodiversity hotspots are



located there. One of the most crucial floral components in the area for supplying sustenance and sources of income is wild edible plants. Hence, utilising the potential of wild food plants to support local livelihoods requires a unique attention. Several wild edible fruits and berries have information on the macronutrients, phytochemicals, and minerals composition, which suggests their potential for wider use. They have only lately been utilised as dietary supplements and as a secondary source of income thanks to the creation of several goods with value additions. Understanding how edible wild fruits and berries contribute to food security and economic opportunities in the Himalayan region is therefore important. It is now essential for mainstreaming wild bio-resources for sustainable development to have an understanding of diversity, distribution, availability, traditional use practises, nutraceutical & nutritional properties, cultivation practises, demand, supply & marketing, and conservation & management of high-value plant species.

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