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Fragaria nubicola (Rosaceae): A review of medicinal uses, phytochemistry and pharmacology

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Abstract
Fragaria nubicola (Hoof.f) Linn. (Rosaceae) is a medicinally important plant commonly called Wild strawberry. Traditionally it has been used to treat different diseases. The study was carried out to compile all the previous data in review form on the basis of its distribution, traditional medicinal uses, pharmacology and phytochemistry.

Keywords: *Fragaria nubicola*, medicinal plant, herbal medicine, phytochemistry, pharmacology

Introduction
Fragaria nubicola (Hoof. f) Linn. belongs to family Rosaceae and is commonly called Wild strawberry [1]. It grows in wooded valleys, forest margins and meadows on mountain slopes of 1500-3600 m height and distributed in Afghanistan, Bhutan, China, Myanmar, Nepal, Pakistan and Sikkim. Plants are stoloniferous, 4–25 cm tall. Its flowering season is May to August. Although *Fragaria nubicola* is closely related to *Fragaria vesca*, it is generally recognized to be a distinct species characterised by appressed persistent sepals in fruit (this may be difficult to see in herbarium material) [2]. *Fragaria nubicola* is diploid specie having 14 number of chromosomes while all other have 7 chromosomes. Fruits are very aromatic having good aroma [3].

Fig 1: *Fragaria nubicola* (Hoof.f) Linn.

Table 1: Names of *Fragaria nubicola* in different languages/ Regions

Languages / regions	Names
Bhutan	Bri-rta-sa-zin [4]
Chinese	Xi zang cao mei [1]
English	Wild strawberry [1].
India	Jungli-istaber [5], Bhawila, bhula, Gand-kaphal [1], Aakhe [4].
Nepalese	Juphal [6]
Urdu	Budemewa [3]
Pakistan	Zamaki-toot [7], Budi meva [8]
Kashmir Himalaya	Budmew [9]

Table 2: Taxonomy [1, 2]

Kingdom	Plantae	**Sub tribe**	Fragariinae
Family	Rosaceae	Genus	Fragaria
Subfamily	Rosoideae	Species	*nubicola*
Tribe	Potentilleae	Synonyms	*Potentilla nubicola* (Hoof. f) Mabb. *Fragaria vesca* var. *nubicola* Hoof, f

Habitat	Grows in wooded valleys, forest margins and meadows on mountains slopes, 1500-3600m
Plant	Stoloniferous, 4-25cm tall
Leaves	Leaves 3-foliolate, lateral leaflets often distinctly petiolulate, elliptic or obovate, Abaxially appressed white sericeous (sometimes sparsely so between veins) appearing silvery, adaxially appressed pilose, base broadly cuneate or rounded, margin sharply incised serrate, apex obtuse.
Stem	Stems and petioles appressed to spreading. Inflorescence 1- to several flowered. Pedicels appressed white sericeous
Flowers	Flowers large, sometimes more than 2.5cm diam. Epicalyx segments lanceolate, abaxially sparsely villous, margin entire to dentate, apex acuminate. Sepals ovate- lanceolate or ovate-oblong, apex acuminate. Petals white, obovate-elliptic. Stamens numerous. Carpels numerous. Glandetum ovoid, fleshy, red, with persistent sepals appressed. Achenes ovoid, smooth to ruggose
Flowering period	May –August
Fruit	Strawberries are deep red fruit of coral like shape.

Economic importance

Whole plant is grazed by cattle. Fruit is edible but tasteless and looks beautiful [8]. *Fragaria nubicola* is medicinal, edible fruit [10]. Fruits are gathered and sold by local children [2]. Shoots are used as fodder [11].

Medicinal importance

Whole herb, fruits, leaves and roots are used traditionally to treat different ailments.

Whole plant

Plant is emetic [1]. Fresh fruits of *Fragaria nubicola*, dried leaves of *Potentilla peduncularis* and dried roots of *Geumelatum elatum* are crushed together to prepare a paste and paste is taken orally to treat cold, cough, and fever [12]. Tibetan doctors used *Fragaria nubicola* for neuropsychiatric effects and for the inflammation in the nerves [13].

Aerial parts

Decoction of aerial parts of plant is consumed twice a day for 5–6 days in the morning and evening to cure fever [14]. For treatment of hypertension by the local people of district Dir lower, Pakistan, paste and powder of aerial parts of *F. nubicola* is used for 20 - 25 days [7].

Fruit

The fruit is edible, laxative, digestive, purgative, astringent, diuretic used to relieve constipation [3, 6, 11, 15]. The fruit is used medicinally, juice of plant is used to treat perfuse menstruation and unripe fruit is chewed to treat blemishes [4]. In indigenous use the fruits are mixed with the leaves of *Berberis lycium* and used in cure of stomach ulcers, also used as antiseptic [16]. The berries are of great benefit for rheumatic gout. Sunburn could be relieved by rubbing a cut strawberry over a freshly washed face [17]. For diarrhea the juice of fruit is taken twice a day till recovery [5]. In Nepal, the fruit paste is used for healing wound, fruit juices cure inflammation of nerves and lungs [15]. Juice of it is considered as anti diarrheal, anti dysenteric. Also used in diabetes and sexual diseases [18]. Fruits are used for liver disorders and anemia, fruit juice is given to small children for hastening recovery from weakness after illness or high fever [1].

Leaves

In indigenous use the leaves are mixed with the leaves of *Berberis lyceum* and used in cure of stomach ulcers, also used as antiseptic [16]. The aqueous extract of leaves is used as laxative, diuretic and astringent and decoction of leaves are used to stop diarrhea and dysentery [17]. Leaves are used for boils, ulcers inside mouth and leaf juice is dropped in ear for relieving earache [1].

Rhizome

Rhizome is used to cure tonsillitis, fresh rhizome ground to a fine powder and mixed with sugar (2-5mg) for a month [9]. In Nepal, root paste is used in controlling bleeding, cough and cold [6]. Decoction of leaves and roots are used to stop diarrhea and dysentery [17]. For tonsillitis rhizome is crushed into powder and mixed with honey and taken twice for 20-25 days. For rheumatism root is dried and cut into pieces and used to make tea. One cup of tea is taken in the morning for few weeks [5]. Roots are used to treat earache [19]. Root paste is diuretic, laxative, diaphoretic, astringent and used for head ache [1].

Pharmacology

Fragaria nubicola is rich in ellagic acid and phenolic compounds. The earlier reports supports that the strawberry has potent antioxidant activity. The phytoconstituents present in *Fragaria nubicola* are ellagic acid and phenolic

compounds, which have been already proved to be potent antioxidant. The biochemical investigations reveals that *Fragaria nubicola* significantly increased the catalase and superoxide dismutase enzyme activities, which indicates that *Fragaria nubicola* may decrease the formation of free radicals. Also *Fragaria nubicola* reduced the total nitrite and malondialdehyde which is the marker of lipid peroxidation, suggesting that the antioxidant potential of *Fragaria nubicola* may have decreased the formation of oxygen radicals and further prevented the vicious chain reaction. Hence, in this study the neuroprotective effects of *Fragaria nubicola* fruit were observed. Fresh juice of *Fragaria nubicola* fruit have neuroprotective effect on ischemia reperfused brain injury and is beneficial in stroke and it accelerate the activities of various enzymes such as catalase and super oxide dismutase and decrease nitrite and malondialdehyde, indicating *Fragaia nubicola* have power to decrease the free radical formation and have antioxidant properties [20] Antimicrobial activity of dried powder of *Fragaria nubicola* acetone extract, against *E. coli*, *S. aureus*. *Aspergillu*s and *Penicillium* sp have been found [21]. Benzyl derivatives isolated from ethyl acetate fraction of Whole plant have shown dose dependent antidepressant effect [22].

Phytochemistry

Two new benzyl derivatives have been isolated from ethyl acetate fraction of wild strawberry, *Fragaria vesca* var. *nubicola* Lindl. ex Hook. f. The structures of these compounds were elucidated to be 5-(4-hydroxy-3-methoxyphenethyl)-7-methoxy-2H-chromen-3-ol and 5-(4-hydroxy-3-methoxyphenethyl)-4,7-dimethoxy-2H-chromen-3-ol [22]. Phenolic compounds have been reported from this plant [20].

Structures of compounds isolated from *Fragria nubicola* [22].

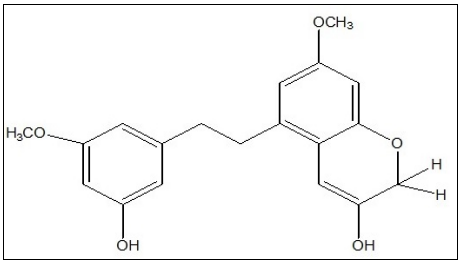

Fig 2: 5-(4-hydroxy-3-methoxyphenethyl)-7-methoxy-2H-chromen-3-ol

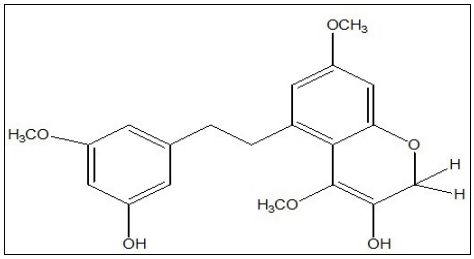

Fig 3: 5-(4-hydroxy-3-methoxyphenethyl)-4,7-dimethoxy-2H-chromen-3-ol

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