



Research Paper

Phyto-pharmacological review of *Potentilla fulgens*: A high-altitude herb of Shivalik, Uttarakhand

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ABSTRACT

A diverse array of flora and fauna thrive in North-East India's biodiversity hotspot. Several native plants have been exploited as a traditional medicine from decades. *Potentilla fulgens* is a herbaceous flowering plant of Rosaceae family native to this region. *Potentilla fulgens* a medicinal herb as a remarkable remedial nature and is extensively used to cure numerous acute and chronic diseases either as a whole plant or its particular part. *Potentilla* has been found to have a wide range of active phytoconstituents, making it a promising medicinal source. Several tannins, polyphenol, and flavonoids have been isolated so far from the plant extracts. Different extracts of *Potentilla* exhibits different therapeutic properties such as anthelmintic, anticancerous, antitumor, antioxidants and antihyperglycemic. Thus, this review tries to explicate the therapeutic and pharmacological importance of *Potentilla fulgens* and its active phytoconstituents.

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INTRODUCTION

The biodiversity hotspot of North-East India is home to a rich range of flora and fauna. From decades, plant parts like leaves, bark, roots, shoots, and other parts of plants are used as medicine by ethnic groups in this region, despite the lack of knowledge about their mechanism of action (Maithani et al., 2019). *Potentilla fulgens*, a medicinal herb belongs to family Rosaceae, is native to the Meghalaya regions. Its taxonomical classification is provided in Table 1 (Barua and Yasmin, 2018). Some of the common names of *Potentilla fulgens* (Panigrahi and Dixit, 1980; Manandhar and Manandhar, 2002) are Cinquefoils in English, Bajradanti in Hindi, Ganeful and Dentamanjari in Nepali, Akanada and Dentamanjari in Uttarakhand, San gezil pa in Tibetan, and lyniangbru (Khasi) in Meghalaya. *Potentilla fulgens* is found to be spread in Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, and North-Eastern India, including Nepal, Bhutan, and Tibet. This plant thrives in damp environments in the temperate and upper alpine Himalayan ranges, between 1800 and 4350 metres. Since antiquity *Potentilla fulgens* has been exploited in a traditional

medicinal system and is extensively used as a curative for myriads of ailments such as cancers, parasitic infections, diabetes, to name a few (Rosangkima et al., 2010).

Morphological description of *Potentilla fulgens*

Potentilla is a genus, containing approximately 500 species of annual, biennial, and perennial herbaceous flowering plant (Figure 1). This plant is grown from 15 cm to 75 cm in height. This plant is also called five fingers and silver weeds. Many species of *Potentilla* have palmate leaves in a pinnate arrangement of either side of stem. Some species have 15 or more leaflet arrangement pinnately (Figure 1). It possesses both cauline and radical leaves. Flowers are yellow in colour and small in size (1 cm- 2 cm in diameter) (Figure 1). Flowering stem are 5 cm- 40 cm long. Inflorescence is corymbose cymose. Flower stalk is 2 cm-4 cm long with multicellular and unicellular hairs. Flowering time is in June - October. *Potentilla* roots are woody and

Table 1: Taxonomical Classification of *Potentilla fulgens*

Kingdom	Plantae
Order	Rosales
Family	Rosaceae
Genus	<i>Potentilla</i>
Species	<i>P. fulgens</i>

**Figure 1:** *Potentilla fulgens* whole plant, leaves and flower

stocky. This plant also bears nodules on its root surface. Thus, it is a non-leguminous nitrogen fixing plant (Pokhriyal et al., 1990).

Phytochemistry of *Potentilla fulgens*

Phytochemicals are the bioactive compounds present in fruits, vegetables, grains etc. that may provide desirable health benefits beyond basic nutritive to reduce the risk of many chronic and non-chronic diseases (Maithani et al., 2012). Some well-known phytochemicals are flavonoids, isoflavones, phenolic acids, carotenoids, terpenes, triterpenes, etc. Different plant groups contain different phytoconstituents used to prevent several diseases. *Potentilla* species contain several phytochemicals such as

high amounts of tannins, and a lesser extent of triterpenoids, polyphenol and flavonoids (Kumar, 2021). It contains rich amounts of polyphenols in leaves, roots and stem. Available literature (Tomczyk and Latte, 2009) suggests that the various parts of *Potentilla fulgens* and their different extract have an active variety of phytochemicals triterpenoids triterpenes, *Potentene A*, *Potentene B*, novel *biflavonoid potifulgene*, polyphenols. These compounds are considered to exhibit antihelminthic, anticancerous, antitumor, antioxidants, antihyperglycemic, and molluscicides effects through diverse mode of actions (Tomczyk and Latte, 2009). Furthermore, Jaitak et al. reported the presence of novel bio flavonoid Potifulgene (Epiatzelchin-6-o-8"epiazfelchin)(1) in the root extract of *Potentilla fulgens* along with antioxidant polyphenolic compound epicatechin. While the aerial part is reported to

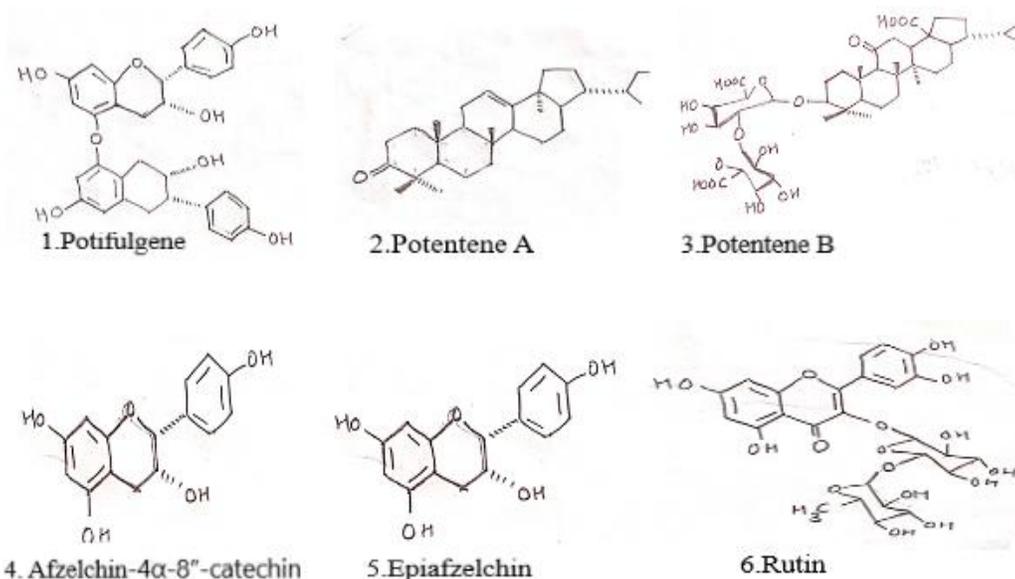


Figure 2: Structures of phyto-constituents present in *Potentilla fulgens*

have two new triterpenes is a study conducted by Kaul et al., in 2010.

These compounds are characterized as Potentene A(30-methyl-17 α -hypan-12ene-3-one)(2), Potentene B(3-0- β -D-gluconopyranosyl-(1,2)- β -D-glucuronopyranosylhopan-12-eno-11-oxo- 28oic acid)(3) (Jaitak et al., 2010). Similar extract was also reported to contain three other known compounds viz; Afzelchin-4 α -8''-catechin(4), Epiafzelchin (5)(both flavan-3-ols)and Rutin(6) a (falvan-4-one) (Jaitak et al., 2010) and their structures(1-6)are shown in Figure 2. Chandan and Nilofar in 2018 (Chandan and Yasin, 2018) isolated fourteen chemical compounds in the crude methanolic extract of roots of *Potentilla fulgens* which showed anticarcinogenic effect. The name of these polyphenolic compounds are:Catechin(7),Catechin (4 α →8)epicatechin(8), Afzelechin (4 α →8)catechin(9), Afzelechin (4 β →8) epicatechin(10), Epicatechin(11), Afzelechin (4 α →8)epiafzelechin(12), Afzelechin(13), Epiafzelechin(14), Epiafzelechin(4 β →8) epicatechin(15), Euscaphic acid(16), Fulgic acid A(17), Fulgic acid B(18), Ursolic acid(19), Corosolic acid(20) and their structure(7-14) are shown in Figure 3.

In the year 2013 another study carried out by Chaudhary et al., (Chaudhary et al., 2017) to evaluate again anticariogenic effect of the plant *Potentilla fulgens* and isolate some chemical compounds from ethyl acetate extract. The name of these compounds are Epigallocatechin(21), Epigallocatechin gallate(22), Afzelechin, Epiafzelechin, Epicatechin, Catechin, Aafzelechin (4 β →8) epicatechin, Epifzelechin (4 β →8)epicatechin, Catechin(4 α →8)epiafzelechin, Afzelechin (4 α →8) catechin and Afzelechin(4 α →8)epiafzelechin their structure(15-22) are shown in the Figure 4. The phytoconstituent afzelechin and epiafzelechin are flavonoids while epigallocatechin,

epigallocatechin gallate and epicatechin are polyphenolic compounds. The rest of the chemical compounds were their derivatives. Few more compounds were isolated from ethyl acetate extraction of the root of *Potentilla fulgens* known to exhibit good antioxidant activity such as 2 α ,3 α ,20 β -trihydroxyurs-13-en-28-oicacid (23); 2 α ,3 α ,20 β -trihydroxyurs-13en-28-oic (24); p-hydroxy benzaldehyde, Gallic acid (25) (Chaudhary et al., 2013). Some other phenolic compounds such as quercetin (26), Ellagic acid (27), and Kaempferol (28) were also reported for the first time in n-butanol extract of root of *Potentilla fulgens* that can act as an antioxidative and cancer chemopreventive agents (Chaudhary et al., 2014). The structures of above six compounds (23-28) are shown in Figure 5.

Pharmacology of *Potentilla fulgens*

Potentilla fulgens as a whole or its specific parts exhibit extensive curative properties. Several previous studies reported their anti-diabetic and anti-oxidant nature. Moreover, the tap root of *Potentilla fulgens* is chewed along with betel nut (*Areca catechu*) and betel leaves (*piper betel*) betel leaves and betel nuts remedial for gum infections such as pyorrhoea and tooth decay. The roots of *Potentilla fulgens* are used for the treatment of tumour, colic pain, spasmodic trouble. Additionally, the aqueous root extract is used for curing intestinal parasitic infections hence also known as antiparasite. Root powder show effective anthelmintic and root juice is taken for curing of peptic ulcer and diuresis (Pala et al., 2010) and root paste is used for preventing tooth infections (Maikhuri et al., 1998). Due to this exclusive significance, it is widely used as a therapeutic in the Ayurvedic, Siddha system, and Unani in

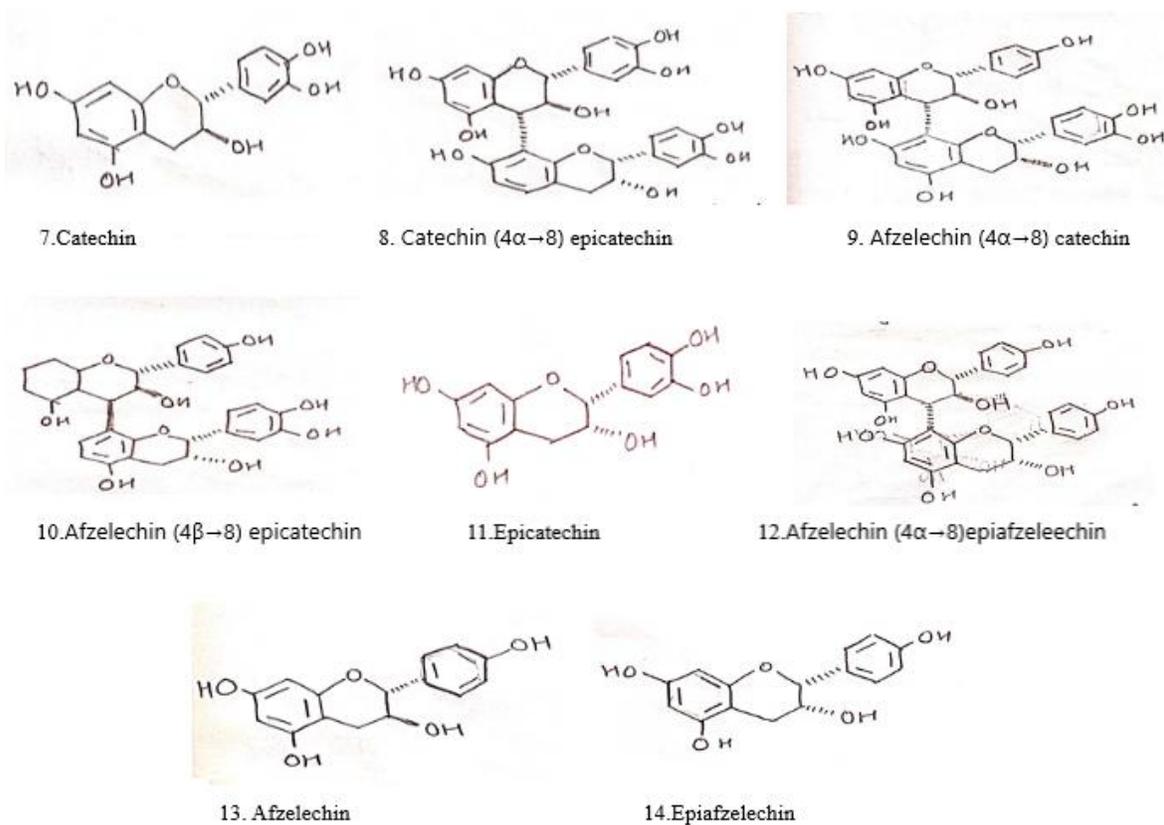


Figure 3: Structures of phyto-constituents present in *Potentilla fulgens*

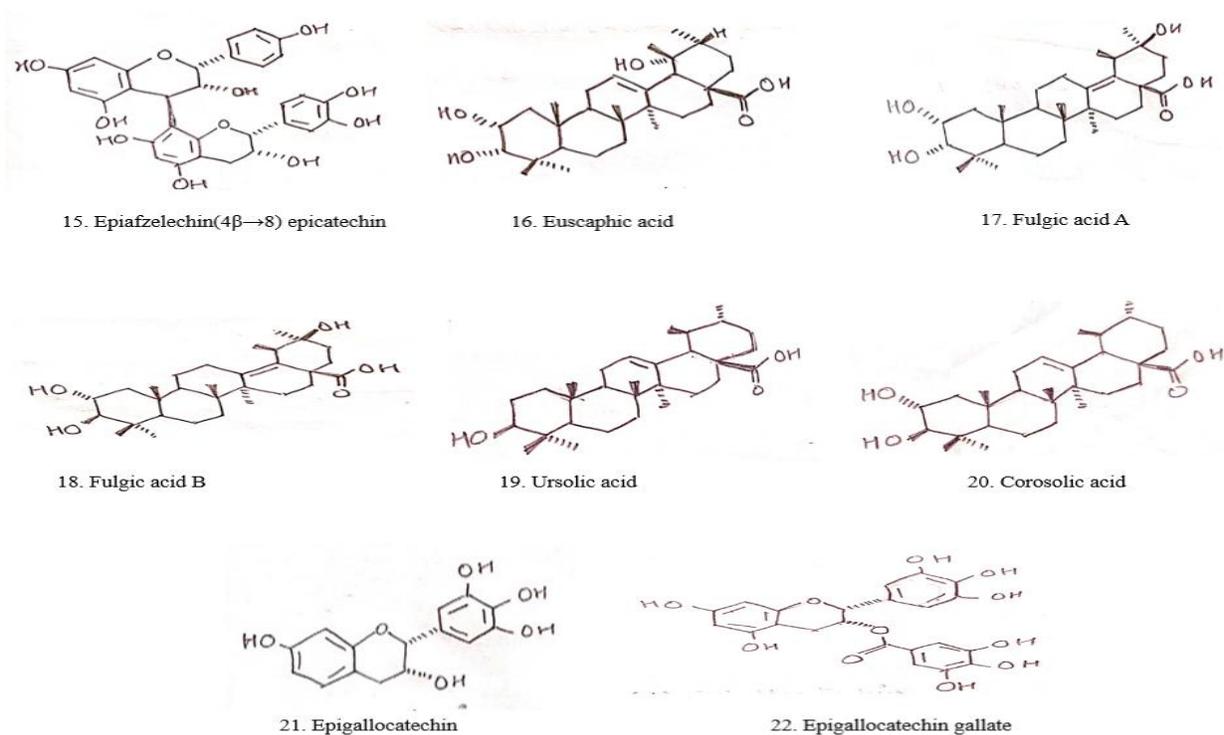


Figure 4: Structures of phyto-constituents present in *Potentilla fulgens*

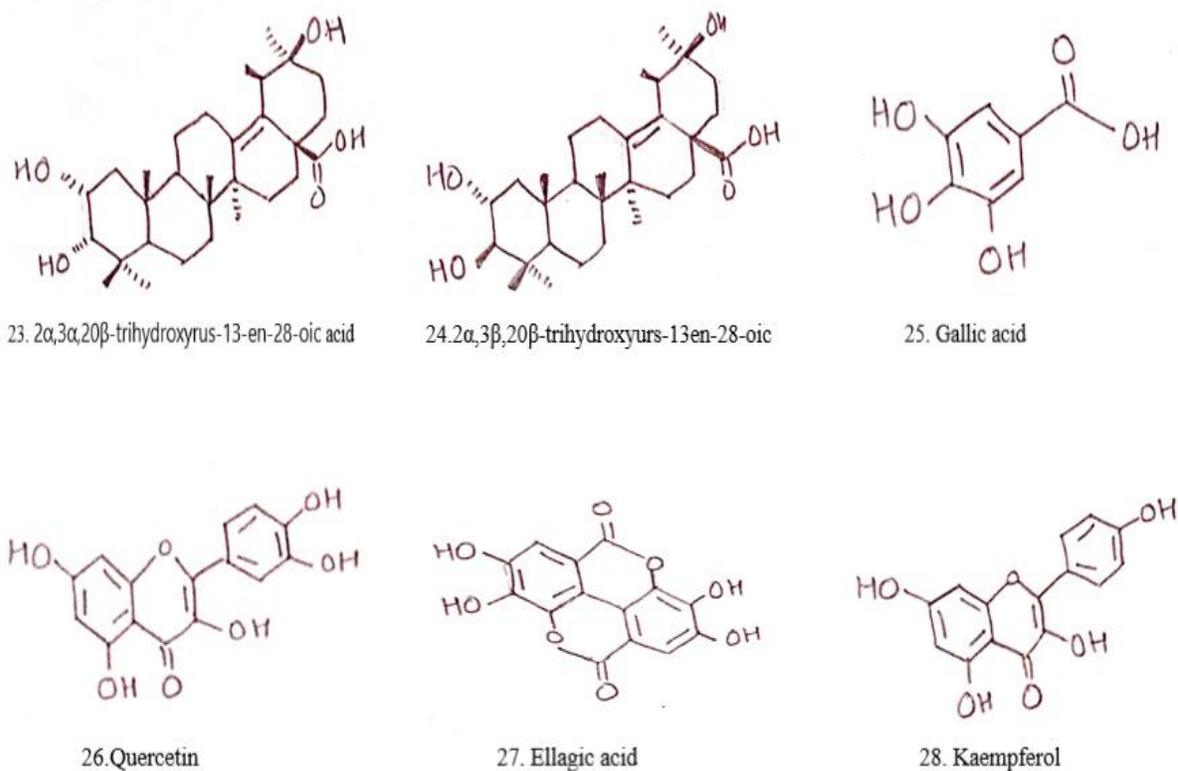


Figure 5: Structures of phyto-constituents present in *Potentilla fulgens*

India (Delgado et al., 2000; Xue et al., 2005). As per World Health Organization report almost 80% of the world's population depends on plants for their survival and primary health care. *Potentilla* extracts (water, alcoholic) were used from the decades for treating toothache, throat inflammations, mouth ulcers, jaundice, wound healing, dysentery, and as a homeostatic. The whole plant part of *Potentilla fulgens* can be used in pharmaceutical and have several pharmacological activities. The plant juice of whole plant (*Potentilla fulgens*) is used for the prevention of cold, cough, stomach problems, and respiratory problems in Bhutan and Nepal (Pala et al., 2010, Kumar, 1998, Syiem et al., 2002). The root extract of *Potentilla fulgens* used for the treatment of several bacterial diseases, cancer, diabetes, parasitic diseases (Syiem et al., 2002, Rosangkima and Prasad, 2004). Whole plant parts of *Potentilla fulgens* are used in several forms for the caring of tooth related problems (pyorrhoea), stomach problem (diarrhoea), cough, diabetes, cancer (Kaul et al., 2011; Syiem et al., 2009a; Syiem et al., 2009b).

In India the whole plant of *Potentilla fulgens* is used production of ViccoVajardanti tooth powder and paste (Panigrahi and Dixit, 1980; Farooqui et al., 2001; Behl et al.). Jaitak et al. (2010) reported antioxidant activities of methanol extract, from the roots and aerial part (Syiem et al., 2002, Miliauskas et al., 2004) of *Potentilla fulgens*. The

antioxidant activity of novel *biflavonoid potifulgene* was found higher than that of epicatechin (Jaitak et al., 2010). Antioxidant plays an important role in preventing chronic diseases by reducing the oxidative damage to cellular components caused by reactive oxygen species (Ceriello 2003). Anti-neoplastic activity in methanolic root extract of *Potentilla fulgens* has also been reported by some researches in daltons lymphoma (DL) cells which was found active against particular/few tumours in a dose dependent manner (Kaul et al., 2011). Root Methanolic extraction also shows hypoglycemicor antihypoglycemic activity in normal mice and alloxan-induced mice (Kaul et al., 2011). Blood glucose level was shown to reduce by 31% in normal and 63% in alloxan-induced mice. The methanolic root extract of *Potentilla fulgens* also reduces free radical-mediated oxidative stress in diabetic mice (Saio et al., 2012). Methanolic root extract of this plant shows potent hepatoprotective effects, hence it can be used as a natural protecting agent against liver damage as reported by Tiewlasubonuriah et al. in 2019 in their study (Tiewlasubon et al., 2019). Ethanol intoxicated rats developed a significant hepatic damage which is shown by hepato specific enzyme like ALT, ASTT, ALP, and total bilirubin with decrease in total protein level. The amount of these enzymes reduced after treatment with varying doses of methanolic root extract of *Potentilla fulgens*. Significant

decrease on the level of ALT, ALP, AST, TB, and increase in total protein level. *Potentilla fulgens* can be also be considered as a source of anticariogenic agent identified by many chemicals' constituents in their root extracts as reported using HPLC/UV, NMR, ESI/MS technique (Syiem et al., 2009).

CONCLUSION

Treatment of a variety of chronic diseases remains a major problem for contemporary medicine, and the World Health Organization has acknowledged that alternative medicines must meet stringent criteria in the treatment and cure of such complicated disorders. *Potentilla fulgens* and other species of this plant are widely recognised for a number of phytopharmaceutical compounds that are employed by Ayurvedic and other traditional practitioners for their great medicinal capabilities. The present comprehensive review article examines the phytopharmacological potential of *Potentilla fulgens*, which may be useful for further study into the development of more efficient and cost-effective bio-medicines.

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