Suitability Evaluation of Phytochemical Screening and Anti-nutritional, Phytochemistry and Antibacterial Activity of *Prunus armeniaca* fruits L.

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Abstract- *Prunus armeniaca* commonly known as Apricot Wild Himalayan Cherry is a medium sized deciduous tree, belonging to the family Rosaceae, Subfamily: Amygdaloideae. It is one of multipurpose species which is used as a medicinal plant in Himalayan region. The plant is acclaimed for significant medicinal importance in the traditional system of medicines and used in several Ayurvedic formulations. Its efficacy has been also recognized by the modern system of medicine. The plant has been extensively investigated for its phytochemical constituents and a considerable number of chemical constituents of diverse classes including steroids, terpenoids, flavonoids, polyphenolics, glycosides, etc. have been reported from different parts of the plant. Phytochemistry studies have revealed antibacterial, diuretic, BPH protective, antioxidant activities of the plant. However, despite wide-ranging chemical composition, and traditional medicinal investigation of the plant is limited. This review is an attempt to present a comprehensive summary of traditional uses, ethnomedicinal value, phytochemical, pharmacological, and toxicological aspects of the plant.

Keywords: *Prunus armeniaca, Traditional uses, antibacterial, diuretic value, Phytochemistry and Pharmacology.*

Introduction

Free radicals are known to cause damage to lipids, proteins, enzymes and nucleic acids leading to cell or tissue injury implicated in the process of ageing and several degenerative diseases[1]. Oxidative stress result in wide range of pathophysiological disorders like arthritis inflammation, atherosclerosis, diabetes, liver injury, coronary heart problems, Alzheimer & Parkinson diseases and cancer[2]. Antioxidants act as free radical scavengers by preventing and repairing damages caused by ROS and therefore enhance the immune defense and reduce the risk of degenerative diseases[3]. Polyphenols are responsible for much of the antioxidant activity of fruits and vegetables[4].

Prunus armeniaca is the most commonly cultivated apricot species. The apricot is native to China and Japan but is also cultivated in the warmer temperate regions of the world. The apricot (*Prunus armeniaca L.*), a member of Rosaceae family is a rich source of carbohydrates, fibre, vitamins and minerals. Apricot trees are not ubiquitous since they can only grow in certain regions where environmental conditions are favorable. It is one of the important temperate fruits grown in India with production of 16,739 tonnes from an area of 4,886 ha[5]. In India, it is commercially cultivated in Himachal Pradesh, Jammu & Kashmir and Uttaranchal. In Himachal Pradesh, it is grown in the districts of Shimla, Mandi, Kullu,

Chamba, Sirmour, Kinnaur and Lahaul-Spiti and occupies about 423 hectares of area with an annual production of 1450 metric tons[6]. Apricot kernels contain a substantial amount of dietary protein, along with significant amounts of oil and fiber[7]. Apricot kernels, depending on the variety, contain the toxic cyanogenic glycoside amygdalin, which is responsible for the bitterness of apricot kernels[8]. The diglucoside amygdalin was the first member to be isolated of a class of natural products now known as cyanogenic glucosides. Cyanogenic glucosides are present in more than 2,500 different plant species, including many important crop plants[9].

Prunus armeniaca fruit is common in temperate and is the 3rd most economically traded fruit globally after plum and peach. The *Prunus armeniaca* fruit or apricot originated from the "golden fruit" from its nutritional properties and medicinal values. It belongs to family Rosaceae. *Prunus armeniaca* consists high levels of phytochemicals namely flavonoids, carotenoids, antioxidants and phenolics. It has a spectacular yellow to orange colours with reddish random overlay, a heavy fragrance and a marked flavour. *Prunus armeniaca* fruit can be consumed fresh, dried, or processed into jam or juice[10].

Common Name- Apricot, Khubani, Jaradaalu, Sakkare Badami, Chuli, Urumana, Maghz badam Shirin, Malhei[11].

Synonym- Amygdalus armeniaca, Armeniaca ansu, Armeniaca vulgaris, Prunus ansu, Armeniaca holosericea, Armeniaca armeniaca, Prunus tiliifolia, Prunus xanthocarpos[11].

Taxonomy

Kingdom: Plantae
Phylum : Tracheophyta
Class : Magnoliopsida
Order : Rosales
Family : Rosaceae
Genus : Prunus
Species : *armeniaca*[12].

Figure - 1 *Prunus armeniaca*

Description

The apricot tree is a tiny one, growing to a height of 8 to 12 meters. It has a trunk that may reach a diameter of 40 cm and a dense, spreading canopy. The oval-shaped leaves have a pointed tip, rounded base, and finely serrated edge. They are 5–9 cm in length and 4–8 cm in width. The 5-petaled, 2- 4.5 cm-diameter blooms are produced singly or in pairs in the early spring, prior to the leaves. The fruit is a drupe that resembles a little peach, with a diameter of 1.5–2.5 cm (bigger in some contemporary varieties), with colors ranging from yellow to orange. The side that receives the greatest sun exposure frequently has a red tint. It typically has a pubescent surface. The one seed is encased in a tough, rocky shell that is sometimes referred to as a "stone." The shell is smooth and grainy except for three ridges that run along one side[13].

Distribution

Currently, the primary growing zones for apricots are a strip that runs from Turkey through Iran, the Hindu Kush, the Himalayas, China, and Japan. Nonetheless, the Mediterranean region provides the majority of the world's apricot crop. Turkey and Iran are the world's biggest producers, contributing 21.6% and 14.7% of global apricot output. These countries are followed by Pakistan, Uzbekistan, Italy, Algeria, Japan, Morocco, Egypt, and Spain. The fruit, which is high in nutrients and health benefits, is also grown in mountainous regions of northeastern Ladakh, Uttar Pradesh and Himachal Pradesh in India[14, 15].

Traditional uses

Uses Beta carotene is abundant in apricots, which supply 30% of the daily required amount. They are also a good source of fiber, potassium, and vitamin C. As an example, apricot peel, fruit, and kernel all provide a variety of health benefits, such as lowering cholesterol and promoting regular bowel movements. Additionally, apricot kernels and kernel oil have shown benefits in other situations as well, such as Tinnitus and obits media[16, 17].

Materials and Methods

Plant materials

Fruits of *Prunus armeniaca* free from diseases were collected from the authentic source i.e. the Botanical Garden of Forest Research Institute (FRI), Dehradun. Uttarakhand, India and were identified and authenticated by Systematic Botany Section of Department of Botany, FRI. A voucher specimen of the collected material is preserved in the Chemistry Division for future reference. The collected Fruits of *Prunus armeniaca* were cleaned properly under running tap water to make them free from dust. Fruits of *Prunus armeniaca* seeds were separated from the preserve fruits by pressing and berries pulp portion was dried at room temperature and used for further extraction.

Preparation of extracts Exhaustive

Fruits of *Prunus armeniaca* were dried berries pulp and powdered of (100g). It was successively extraction of fruits with n-hexane, chloroform, ethyl acetate, acetone and methanol. Fruits of *Prunus armeniaca* keeping it for 24 hrs with intermittent shaking. All extractive values were determined on dry extract weight and ground berry pulp taken weight. The exhaustive extraction was done at ambient temperature by shaking the contents at a regular interval of time till discolored solvents were obtained indicating completion of extraction. The extracts so obtained were distilled and then dried on water bath. The percentage yield of dried extracts was calculated with reference to the dried plant material initially taken[18].

The result showed crude extracts were transfer into airtight sample bottles and kept at 4^0C.

Phytochemical screening

The extracts of *Prunus armeniaca* fruits obtained by exhaustive extraction with different solvents were subjected to qualitative phytochemical screening to detect the presence and/or absence of different group of chemical constituents such as alkaloids, flavonoids, phenolics, tannins, steroids, saponins, carbohydrates, glycosides, proteins and free amino acids (FAA), etc. The extracts were tested qualitatively by standard methods using special reagents that produce characteristic colour changes with different categories of chemical constituents[19-21]. Fruits of *Prunus armeniaca* were prepared and subjected to phytochemical screening to detect the presence and or absence of various phytochemicals constituent.

Phytochemistry

Apricot contains compounds such as polyphenols, phenolic acids, coumarins, tannins, lignins, phenols, and flavonoids; vitamins, minerals, carbohydrates, fibers, and phytochemicals, such as glycosides, carotenoids, polyphenols, phenolic chemicals, aldehydes, sugars, terpene alcohols, and flavonoids; terpenoid chemicals, geraniol, and nerolidol; cyanogenic glycosides etc[22].

Anti-nutritional factors in Fruits of *Prunus armeniaca*

Iron, calcium, and phosphorus content in ragi grains are exceptionally high as compared to other cereals. However, bio availability of these minerals may be at stake, due to the presence of anti-nutritional factors like, phytic acid and tannins (polyphenols).Tannins and phytic acid bind the mineral as well as proteins and reduce their digestible contents. These anti-nutritional factors could be reduced by

conventional processing techniques like germination, fermentation and dehulling[23].

Results and Discussion

Extracts values

Prunus armeniaca fruits of the extract values in n-hexane, chloroform, ethyl acetate, acetone, and methanol are presented in the Table-1.

Table-1 Extract values of *Prunus armeniaca* fruits with different solvents

Solvents	Extract Yield (% w/w)
n-Hexane	2.31
Chloroform	3.34
Ethyl acetate	7.54
Acetone	7.62
Methanol	13.02

Qualitative Phytochemical Analysis

The results of qualitative phytochemical analysis are summarized in the Table 2. It revealed the presence of carbohydrate, protein, amino acids, steroids, terpenoids, phenolics, flavonoids, tannins, saponins, glycosides in the *Prunus armeniaca* fruits.

Table-2 Phytochemical screening of Extracts of *Prunus armeniaca* fruits

Phytochemicals	n-Hexane	Chlorofom	EtOAc	Acetone	Methanol
Steroids	+	–	+	–	+
Terpenoids	+	+	+	+	+
Phenolics	–	+	+	+	+
Flavonoids	–	+	+	+	+
Saponins	–	–	–	–	+
Tannins	–	–	–	+	+
Carbohydrates	–	–	–	–	+
Glycosides	–	–	–	–	+
Protein	–	–	–	–	+
Amino acids	–	–	–	–	+

(+) Present; (–) Absent

Phenolics and flavanoids were recorded in all extract of *Prunus armeniaca* fruits except n-Hexane. Remarkably, Phenolics and flavonoids were present all the extracts except n-hexane whereas presence of alkaloids was not detected in any of the extracts.

Phytochemical composition

Apricot contains compounds such as polyphenols, phenolic acids, coumarins, tannins, lignins, phenols, and flavonoids; vitamins, minerals, carbohydrates, fibers, and phytochemicals, such as glycosides, carotenoids, polyphenols, phenolic chemicals, aldehydes, sugars, terpene alcohols, and flavonoids; terpenoid chemicals, geraniol, and nerolidol; cyanogenic glycosides, such as amygdalin, quercetin-3-glucosides, kaempferol-3-rutinoside; neochlorogenic acid, rutin, cynidin-3-glucosides, pcoumaric acids, ferulic acid, epicatechin, epigallocatechin, and Catechin; and terpene chemicals, geraniol and nerolidol. Hexanal, ethanol, hexyl acetate, 1-hexanol, (Z)-3-hexenol, (E)-2-hexenol, and (Z)-3-hexenol-1-ol, catechin, 2-(3,4-dihydroxy phenyl)-3,5,7-trihydroxy-4H-chromen4-one, chlorogenic acid, 3,4,5-trihydroxy benzoic acid, and 3-(3,4 dihydroxy phenyl)-2-propenoic acid, fiber, lipids like sterols and fatty acids, minerals including phosphorus, selenium, magnesium, zinc, iron, potassium, and calcium[22].

Significance of Nutritional composition

Fruits of *Prunus armeniaca* are nutritionally superior to other fruits. It serves as an excellent source of carbohydrate (71%), proteins (6.6%) with essential amino acids as well as non essential amino acids like valine, methionine, and tryptophan, minerals (calcium, phosphorus, potassium, and iron) as well as vitamins (thiamine, niacin, and riboflavin), and fats for which they are extensively been researched[23].

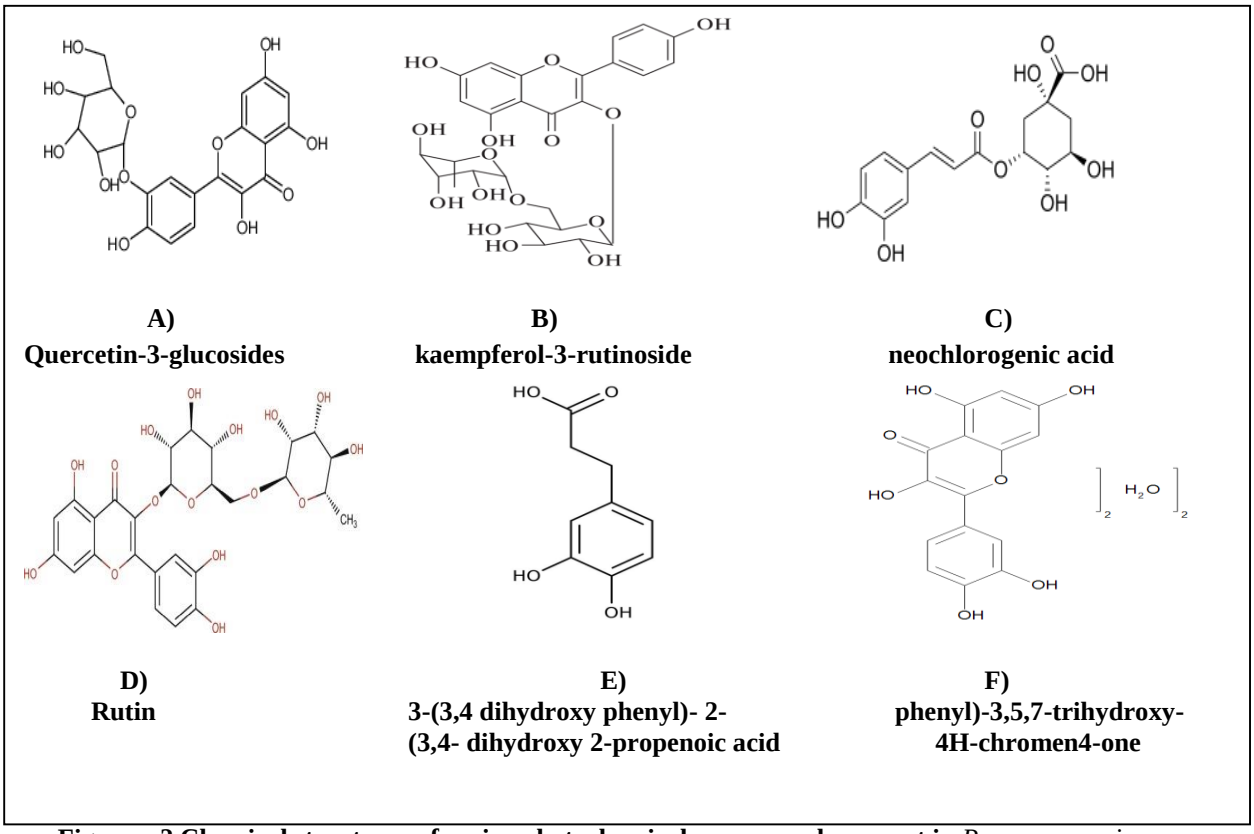

Figure – 2 Chemical structures of major phytochemicals compounds present in *Prunus armeniaca*

Table – 3 General Nutrient Composition of Fruits of *Prunus armeniaca* per 100g

Nutrient composition of Fruits of *Prunus armeniaca*	
Moisture	11.24%
Protein	6.6%
Carbohydrate	71.36%
Fibre	1.12%
Minerals	2.33%
Fat	1.12%
Energy	331.4 cal/100g

Antioxidant activity

The wine made from fruits of *Prunus armeniaca* fruits contains highest flavonoids and antioxidant compounds Total antioxidant activity and polyphenol content were also found to be highest in wines made from the fruits which entail a better option for bio-utilization of this highly valuable wild fruit which are otherwise of no commercial value[24]. The antioxidant properties of the gum were evaluated by DPPH and hydroxyl scavenging activities, reducing power and total phenolic contents which showed the gum possess antioxidant property[25]. Chloroform, ethylacetate, acetone and methanol extracts of *Prunus armeniaca* fruits were evaluated for total phenol, total flavonoid and antioxidant activity. All the extracts exhibited varying

degree id antioxidant efficacy in a concentration-dependant manner, Methanol extract however recorded the highest total phenolic content 0.035 mg GAE/g of extract and free radical ± (3.660.232± scavenging (antioxidant) activity (IC50, 55.00 µg/ml). Total phenolic content had positive correlation with antioxidant capacity. The study established *Prunus armeniaca* fruits as rich sources of phenolic compounds and natural antioxidants[26].

Antibacterial activity

Prunus armeniaca fruits reported to have antibacterial activity against both gram positive and gram-negative bacteria. Antibacterial activity of ethanolic extract of *Prunus armeniaca* fruits was examined with Gram positive bacteria (Bacillus subtilis and *Staphylococcus aureus*) and Gramnegative bacteria (Escherichia coli and Salmonella typhi) and the extract recorded inhibitory action against all the bacteria[27]**.** Antimicrobial screening of aqueous extract from stem bark of the plant was carried out against various pathogenic microorganisms and results suggest that the aqueous extract could be a potential source to obtain new antimicrobials and effective herbal medicines to combat the problem of ever emerging microbial resistance[28].

Diuretic activity

The seeds of *Prunus armeniaca* fruits are traditionally known for treatment for urinary disorders, polyurea and the treatment of stone in the kidney[29]. Puddumin-A a flavonone glucoside from *Prunus armeniaca* fruits showed the increased diuretic activity. Effects of fruits extract were investigated on prostate and urinary disorders. Three different fractions of methanolic extract were evaluated of activity against prostate disorder on rat. The Fraction III treated group shows the lessened effect of testosterone on the prostate gland enlargement comparing to that of group I and group II treated group. The fruits extract of *Prunus armeniaca* fruits showed the capability to reduce the testosterone induced prostate weight of rat[30].

BPH protective activity

Protective effect of bark of *Prunus* species including *Prunus armeniaca* fruits was evaluated against benign prostatic hyperplasia (BPH) and the results indicated a meaningful inhibitory effect of testosterone induced BPH by the bark of different species of *Prunus* in the and *Prunus armeniaca* fruits[31] .

Conclusion

In the ongoing study, efficacy of berries in relation to its chemical composition is established. In this study the extreme free radicals production generally leads to oxidative stress. *Prunus armeniaca* fruits have natural anti-oxidants and anti-bacterial, Diuretic activity, BPH protective activity, nutritional activity in the ability to protect organisms from damage caused by free radical-induced oxidative stress. *Prunus armeniaca* fruits have been traditionally used in folkloric medicine and most of the medicinal properties. Also *Prunus armeniaca* fruits have been attributed to its antioxidant activities. Now considering, this study revealed that *Prunus armeniaca* fruits has higher polyphenolic content and antioxidant activity. Therefore, it can be ventured that *Prunus armeniaca* fruits can also be potentially useful as a natural source of antioxidant or in medicine. As well as phytochemical studies and in-vitro antioxidant assay of fruit *Prunus* species will notably add to the inventory of natural antioxidants.

Therefore, the plant deserves proper attention towards systematic approach for the collection, storage, processing and value addition that could be helpful in the economic development of tribal areas in the Himalayan foot hills where the species is mostly grown.

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Disclaimer Statement

Authors declare that no competing interest exists. The products used for this research are commonly used products in research. There is no conflict of interest between authors and producers of the product.

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