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A BRIEF REVIEW OF WILD HIMALAYAN PEAR *PYRUS PASHIA*

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ABSTRACT: Within the Magnoliopsida class, *Pyrus pashia* is widely found throughout the Himalayan areas. *P. pashia* is a member of the Rosaceae family of medicinal plants. It's commonly called a wild pear. The plant has a range of nutritional and medicinal uses. In ethnomedicine, it is widely utilized as a hepatoprotective, inflammatory, antibacterial, antifungal, disinfectant, antioxidant, antimicrobial, and antidepressant to treat a wide range of illnesses. The genus *P. pashia* comprises approximately 38 species globally and contains approximately 160 phytochemical compounds, including primary and secondary metabolites such as alkaloids, glycosides, flavonoids, steroids, saponins, and tannins. Additionally, it contains useful polyphenolic therapeutic constituents like arbutin, flavan-3-ols, and chlorogenic acids. The phytochemistry, pharmacological activity, ethnomedicinal applications, and toxicological profile of *P. pashia* are all thoroughly updated in this review. This plant's scientific understanding as well as its potential for use in pharmaceutical research in the future, are critically examined.

INTRODUCTION:

Taxonomy and Origin: *P. pashia* is a medium-sized deciduous tree in the Rosaceae family that falls under the scientific category Maloideae [1]. *P. pashia* is primarily found in the Himalayas, which stretch from Pakistan to Vietnam and from the southern Chinese provinces to the northern regions of India [2, 3]. The common term for *P. pashia* is "wild pear." It is specifically utilized in the treatment of disorders pertaining to the digestive system [1]. The nutritional benefits of this plant's fruits are well known, and it is said that they are utilized to make herbal wines [4].

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India's woods are a valuable source of a wide variety of medicinal plants that have both therapeutic and preventive uses for human health. The wild fruit species may become valuable resources for pharmaceuticals and financial gains to meet the needs of good development and nourishment. One example of a wild fruit is *P. Pashia* (Kainth), a member of the Rosaceae family that is widely distributed in the Himalayan region with excellent ethnic advantages and is widely used by local communities to treat vascular, pulmonary, and gastrointestinal issues [5, 1, 6, 7].

The fruit of the Kainth plant is rich in several phytochemicals that have beneficial effects on fitness and is also high in vitamins. The authors from the Kainth fruit 2 have reported 28 significant phenolic compounds. Since, Kainth is extremely perishable when fully ripe and cannot be moved, it is classified as an underutilized fruit. Fruits should be priced to reduce waste, increase local

consumption, and enhance their value in the fight against malnutrition and other health issues [8]. Wood is a superior gas source in the crucial Himalayan region, and leaf extract is utilized as a tonic against hair loss. The leaves have a sour taste and are fed to lambs and goats [9]. The use of edible vegetation in the treatment of positive malignancies and cardiovascular illnesses is attributed to the presence of phenolic chemicals [10]. Taxonomically, *P. pashia* is one of the 38 species that belongs to the genus *Pyrus.* All species of this genus are found in tropical and subtropical regions of Asia, Europe and South Asia. Most species produce bioactive constituents, especially phenols and polyphenols are used widely in ethnomedicine [2].

Different Pyrus Species and their site of Origin [11]:

TABLE 1: SOME PRIMARY SPECIES OF *PYRUS*, GEOGRAPHICAL GROUP AND THEIR SITE OF ORIGIN

Geographic group	Species	Site of Origin
Asian pear species	*Pyrus armeniacifolia* T. T. Yu	China
	Pyrus baccata var. himalaica Maxim.	China, Bhutan, India, Nepal
	Pyrus betulifolia Bunge	China, Laos
	Pyrus calleryana Decne.	China, Korea, Taiwan, Vietnam
	Pyrus calleryana var. dimorphophylla (Makino) Koidz.	Japan
	Pyrus calleryana var. fauriei (C. K. Schneid.) Rehder	Korea
	Pyrus doumeri Bois	China, Taiwan, Laos, Vietnam
	Pyrus foliolosa Wall.	Burma, Bhutan, India, Nepal, China
	Pyrus harrowiana Balf. f.and W. W. Sm.	China, India, Nepal, Burma
	Pyrus lanata D. Don	Afghanistan, India, Nepal, Pakistan
	Pyrus sikkimensis Hook. f.	China, Bhutan, India
	Pyrus vestita Wall. ex G. Don	China, Bhutan, India, Nepal, Myanmar
Europe and Southern Africa.	*Pyrus aria* (L.) Ehrh. var. cretica Lindl.	North Africa, Middle East, Central Europe Oriental and Southern and Turkmenistan
	Pyrus boissieriana Buhse	Azerbaijan, Turkmenistan, Iran
	Pyrus caucasica Fed.	Eastern Europe and Central Greece
	P. communis var. cordata (Desv.) H.f.	UK, Portugal, Spain, France
	P. communis subsp. pyraster (L.) Ehrh.	Western Europe, Central Eastern, and Southern
	Pyrus domestica (L.) Sm.	Algeria, Cyprus, Eastern Europe Central West and Meridional
	Pyrus elaeagrifolia subsp. kotschyana	Turkey
	Pyrus praemorsa Guss	South of Italy, France
	Pyrus torminalis (L.) Ehrh.	North Africa, Middle East, South Caucasus, whole Europe
Americas	*Pyrus americana* DC	Greenland, USA, Canada
	Pyrus coronaria L.	Canada, USA
	Pyrus arbutifolia (L.) L. f.	USA
	P. coronaria var. ioensis Alph. Wood	USA
	*Pyrus diversifolia*Bong.	USA, Canada
	Pyrus fusca(Raf.) C. K. Schneid.	USA, Canada
	Pyrus floribunda Lindl.	USA, Canada
	Pyrus sanguinea Pursh	Canada, USA

Botanical Description: The leaves are petiolate, with a length of 4.5 to 11 cm and a width of 2.5 to 4.2 cm. The petiole is crenate, reticulate crenate, ovate to lanceolate, and has an acute apex to acuminate. The leaves are stipulate. One-year-old shoots have alternating patterns of leaf emergence. A single leaf with a stipule emerges laterally on each node of two years old branches. The axil is never without a thorn. The thorn also produces 2 to 30 pubescent, alternating leaves. On the fruiting spurs of older wood, there are five to seven leaves [12]. Fruit is a spherical berry. The size of the fruits varied from 1-2.5 cm in diameter. The surface of the fruit is dark greyish in colour bearing numerous densely distributed white and yellow spots. The fruit consists of fine wide radiating carpel chambers with one or two seeds attached in axile placentum [13].

Microscopic Characteristics [1]: *P. pashia* has undergone microscopic investigations to determine its morphological characteristics, which are useful in differentiating it from other species. The microscopic features of the plant are as follows:

Leaf: Simple, alternating leaves with a petiole are present. The lamina has an obovate or elliptical form, with a little hairy lower surface and a smooth top surface. There is spongy parenchyma and palisade in the mesophyll.

Stem: The bark is smooth and covers the cylindrical stem. The cortex is made up of thin-walled cells arranged in many layers. There is a coating of sclerenchyma fibres around the dispersed vascular bundles.

Root: *P. pashia* has a taproot root system, and its cortex is made up of parenchyma cells with a few strewn sclerenchyma fibres. Concentric circles comprise the arrangement of the xylem and phloem.

Flower: *P. pashia* flowers are hermaphrodite and have five petals, five sepals, and many stamens. The style is long and narrow, and the ovary is superior.

Phytochemical Screening: For a qualitative phytochemical examination to determine whether *P. pashia's* crude ethanol extract included any secondary metabolites, such as alkaloids, saponins, anthraquinones, coumarins, sterols, terpenes, flavonoids, and phenols [14]. Some of the major phytochemicals reported in *P. pashia* are listed below:

Flavonoids: Quercetin, kaempferol, luteolin, apigenin, and naringenin.

Phenolic Acids: Gallic acid, ellagic acid, chlorogenic acid, and caffeic acid.

Tannins: Condensed tannins, hydrolysable tannins, and proanthocyanidins.

Triterpenoids: Ursolic acid, oleanolic acid, betulinic acid, and maslinic acid.

Steroids: β-Sitosterol, stigmasterol and campesterol.

Chemical Constituents: In this plant secondary metabolites like Alkaloids, flavonoids, sterols, triterpenoids and phenolic compounds are present [15].

The methanolic extract of the fruits consists of d-Mannitol, 1,4-anhydro, Hexitol, Pentadecanoic Acid, 9,12-Octadecadienoic Acid (z, z), d-Mannitol, 1-o-(22-hydroxydocosyl), Octadecanoic acid, Squalene, Hexatriacontyl pentafluoro propionate, Stigmast-5-en-3-ol, (3. beta), Lup-20(29)-en-3-on, Lupeol, *etc.* [16].

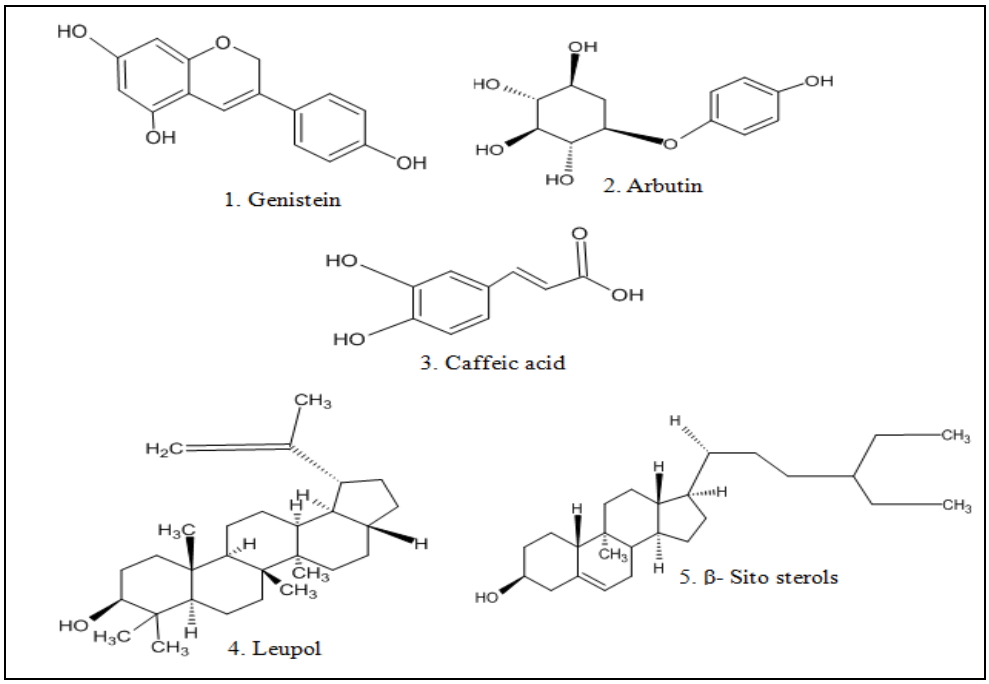

FIG. 1: CHEMICAL CONSTITUENTS OF PYRUS PLANT

TABLE 2: PHYTOCHEMICALS REPORTED FROM PYRUS PLANT

Sr. no.	Name	Part Used	Phytoconstituents	References
1.	*Pyrus pashia*	Stem	Hexacosanol, Hydroquinone, βsitosterol-β-D- glucoside, Luteolin glycoside. hen triacontanol, β-sitosterol, friedelin α-amyrin, Arborinol	17.
2	*Pyrus pashia*	Seedling leaves	Apigenin7-glucoside, Luteolin 7- glucoside, Luteolin 4 'glucoside, Chrysoenol 7-glucoside, Quercetin, Epicatechin, Catechin, Caffeoylcalleryanm, Caffeoyl arbutin, pCoumaroylarbutin, Arbutin, Acetyl arbutin	18.
3.	*Pyrus pashia*	Branches and Leaves	-3,5-Dicaffeoylquinicacid methyl 3,5-dicaffeoylquinate methyl 5-O-caffeoylquinate-4-Hydroxy-trans-cinnamomicacid 4-β-D-glucopyranosyloxybenzylester- 4-Hydroxy-cis-cinnamomic acid 4-β-D-glucopyranosyloxy benzyl ester p-Hydroxyphenyl6-O-trans-p-Coumaroyl-β-D-glucopyranosid e,p-Hydroxyphenyl 6-O-cis-p-Coumaroyl-β-D-glucopyranoside -4-Hydroxybenzoicacid - 4-(methoxymethyl) phenyl-1-O-β-D-glucopyranoside - 3,4-Dihydroxyacetophenone - 3,4-Dihytroxybenzaldehyde -Picein-Caffeic acid -trans-p-hydroxycinnamic acid - cedrusin- (+) -Isolarisiresinol - Arbutin, tannins, phloridzin, pectin, and amygdalin	19-21
4.	*Pyrus pashia*	Flowers	- 4-O-Z-coumaroylarbutin, 4-hydroxy benzaldehyde (35) -3,4-Dihydroxy benzaldehyde, 4-methoxy benzoic acid - 4-Methoxymethyl-phenol, 4-ethoxymethyl-phenol - E-1-(4'-hydroxyphenyl) -buten-1-en-3-one - 3,4-Dihydroxyl cinnamic acid; p-hydroxy acetophenone - Cynanoneside A, 4,4'-methylenediphenol - 3,3',4-Trihydroxy-diphenylmethane - Hydroquinone, arbutin, 6-O-acetylarbutin - 2-O-acetyl arbutin, 5-O-p-cis-coumaroyl quinic acid methyl ester- 5-O-p-trans-coumaroylquinic acid methyl ester - Gastrodin, 2-methoxy-4- (2- propenyl) phenyl β-D-glucopyranoside 3,5-O-caffeoylquinic acid, 3,5-O-caffeoylquinicacidmethylether - 8-C-p-hydroxy benzyl apigenin- 3, 5 ,7, 4'-Tetrahydroxy-8-methoxyflavone-3-O-β-D-glucopyranoside kaempferol 3-rutinoside, apigenin - Apigenin 4'-O-β-D-glucopyranoside; and apigenin 7-O-β-D-glucopyranoside	19.
5.	*Pyrus pashia*	Fruits	Sitosterol, lupeol, Chrysin	22.
6.	*Pyrus pashia*	Bark	Steroids and tannins	17.

Pharmacological Activities:

Antimicrobial Activity: Using the disc diffusion method, the antimicrobial properties of petroleum ether, chloroform, ethyl acetate, acetone, methanol, ethanol, and water extracts of the medicinal plant *Pyrus pashia* were evaluated against ten bacterial strains and three fungal strains (different gram positive and gram negative). The ethanolic bark extracts of *Pyrus pashia*, comprising distinct fractions of bark, fruit, and leaf, demonstrated noteworthy efficacy (17±1 mm, 15±1 mm, and 14±1 mm) against *Escherichia coli*, *Klebsiella pneumonia*, and *Shigella flexneri*. The extractive values of the fruit of the medicinal plant were evaluated in fresh part weight. The ash value of the fruit was 1.10 ± 0.05%), moisture content was 60.36±0.25%, crude fat content was 1.62±0.20%, and crude fiber content was 5.26±0.05%. According to the preliminary phytochemical analysis test, there were 28.38±0.12% of carbohydrates along with glycosides, alkaloids,

flavonoids, saponins, tannins, and unsaturated triterpenoids [23].

***In-vivo* Anti-inflammatory Activity:** Methanolic leaf extract from *P. pashia* has anti-inflammatory properties in albino rats. Five sets of six rats each were used in this investigation. Group 2 was given 100 mg/kg of the standard reference medication Indomethacin, Group 3 received 50, 100, and 150 mg/kg of the methanol extract with 2 ml of 1% vanillin, and Group 5 received 1% saline as the control group. To cause paw edema, the rats were intradermally injected with 0.1 ml of a 1% solution of carrageenan into the plantar surface of their right hind limb. Plethysmographic measurements of the paw volume were made both prior to induction (0 H) and four hours later at one-hour intervals. Groups II, III, and IV's paw volumes were contrasted with the controls. Therefore, both methanolic extract dosages demonstrated an inhibitory effect on paw edema generated by carrageenan, demonstrating an anti-inflammatory activity against acute inflammation [24].

Hepatoprotective: Aqueous extract of *P. pashia* in CCl4 -induced hepatotoxicity in mice: hepatotoxicity was produced by CCl4 30% in olive oil (1 ml/kg i.p.), and mice were given oral doses of 250 and 500 mg/kg b.w.t. of the extract for a period of 14 days. Pre-treatment (once daily for 14 days prior to CCl4 intoxication) and post-treatment (2, 6, 24 and 48 hours following CCl4 intoxication) groups were both present. The observed protective effect may be explained by several phytochemicals promoting the healing of liver injury. Additionally, the histological analysis validates the hepatoprotection [25].

Gastrointestinal, Respiratory, Cardiovascular: In vitro tests were conducted on isolated rabbit jejunum, tracheal, and aorta preparations using the crude ethanol extract of *P. pashia* fruits. The study included male and female rabbits of the local strain, weighing between 1.0 and 1.8 kg, that were acquired from the local market and had an age limit of 6 to 7 months. These were kept in the animal home in a climate-controlled setting (23–25°C). Standard food and tap water were given to the animals on an as-needed basis. The animals had free access to water but were denied food for twenty-four hours before the studies began.

For use in *in-vitro* research, rabbits that had suffered a hit to the back of the head were slaughtered. Via several pathways, the aqueous ethanolic extract of *P. pashia* demonstrated vasoconstrictive, bronchodilator, and spasmolytic properties. Although α-adrenergic, muscarinic, serotonergic, and angiotensin II agonistic components may be present, blockage of Ca2+ channels are most likely the mechanism behind the bronchodilator and spasmolytic actions. The phytochemical components of *P. pashia* fruits namely, alkaloids, flavonoids, glycosides, and anthraquinones are responsible for the Ca2+ channel blocking action [10].

Anti-depressant Activity: Methanolic *P. pashia* leaf extract has antidepressant effects on albino rats. Rats were split into four groups for this study: the first was the control group, which received only distilled water orally; the second group was the standard group, which received imipramine hydrochloride (15 mg/kg) as the standard; the third group was the test group, which received T1 (100 mg/kg); and the fourth group was the test group, which received T2 (200 mg/kg) (p.o.). In both test groups, methanolic extracts of P. pashia leaves (100 and 200 mg/kg) were utilized as T1 and T2, respectively. The results showed that there was an antidepressant effect in FST and LMA that was dose dependent. Caffeic acid and genistein, two compounds found in *P. pashia* leaves, may contribute to the plant's antidepressant properties [26].

Anti-Convulsant Activity: Ethanolic extract of *P. pashia* (EPP) fruit has anti-convulsant properties in albino rats. To explore a potential treatment mechanism for EPP, the anticonvulsant effect of isolated chrysin was tested against experimental animal models.

The maximum electroshock (MES) and pentylenetetrazol (PTZ) models of experimental epilepsy were used to assess the anticonvulsant activity in terms of the duration of the onset of hind limb tonic extension and convulsion of standardized EPP, respectively. In addition, chrysin's antioxidant effectiveness against PTZ-induced convulsion in experimental mice and its anticonvulsant and electrophysiological characteristics were studied. The chrysin's neurotoxic profile was also evaluated using the

rotarod apparatus and photo actometer for running and movement duration, respectively. In experimental rats, PTZ-induced convulsions and an acute form of MES were both significantly suppressed by EPP (100, 200, and 400 mg/kg). Additionally, rats given PTZ-induced convulsions showed notable anticonvulsant effect when given chrysin at doses of 2.5, 5, and 10 mg/kg. Furthermore, chrysin did not behave in a sedative-like manner in the rodent experiments. For the treatment of epilepsy, EPP may be a viable and different therapeutic strategy [27].

Medicinal Uses [10, 22, 24, 6, 27]:
Plant part: Fruit:

- It is a common diet item among tribal groups; it helps with constipation, reduces thirst, manages dysentery,
- It is beneficial for eye issues, sedatives, and leishmaniasis. Beneficial for treating dyspepsia and dysmenorrhea, Irritability, sore throat, and digestive issues, anaemia and abdominal pain.
- Dried fruit decoction enhances stomach and spleen function. Cattle fodder was added to increase the amount of milk produced.

Plant Part: Leaves and Branches:

- Provideas grazing for sheep and goats Leaf extract is used as a non-fermented beverage.
- It improves cosmetic appearance.
- In Chinese traditional medicine, it cures diarrhoea and abdominal pain
- It is a tonic for hair loss.

Plant Part: Flower: In the Chinese region of Yunnan, it is used as a health food to lower blood cholesterol and to treat diarrhoea, emesis, and cough.

Plant Part: Bark:

- Has both tonic and astringent qualities. Helpful in treating typhoid fever
- Used to treat fever, peptic ulcers, and gastric ulcers.

CONCLUSION: *P. pashia*, or wild Himalayan pear, is a common name for this plant (Kainth). It is well known that the fruits of this plant have nutritional value and are utilized to make herbal wines. The fruit of the Kainth tree is rich in several phytochemicals that have beneficial effects on fitness and is also high in vitamins. In the vital Himalayan region, wood is a first-rate gas supplier, and leaf extract is employed as a tonic against hair loss. *P.pashia* has undergone microscopic examinations to determine its morphological characteristics, which are useful in differentiating it from other species. Bioactive components, particularly phenols and polyphenols, are produced by most species and are extensively employed in ethnomedicine. This review examines pharmacological actions that include antibacterial activity, *in-vivo* anti-inflammatory activity, hepatoprotective activity, and activity related to the digestive, respiratory, cardiovascular, antidepressant, and anti-convulsant systems. This review includes a comprehensive update on *P. pashia* phytochemistry, pharmacological activity, ethnomedicinal uses, and toxicological profile.

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