https://doi.org/10.33472/AFJBS.6.13.2024.2281-2293

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

Therapeutic Potential and Pharmacological Activities of *Pyrus Pashia*: A Comprehensive Review

Kaustavmoni Baruah[1], Dhrubajyoti Borah[2*], Suraj Bora[3], Ipsita Bhuyan[4], Parag Barman[5], Md Tanjimul Akhter[6], Priyakshi Chutia[7], Madhuchandra Lahan[8], Dr Rajesh Jesudasan[9]

[1,2,3,4,5,6,7,8,,9]School of Pharmacy, the Assam Kaziranga University, Jorhat -785006, Assam, India.

Email ID: [1]kaustavmonibaruah12@gmail.com, [2]dhruborah45@gmail.com, [3]borasuraj860@gmail.com, [4]ipsitabhuyan27@gmail.com, [5]prgbrmn9197@gmail.com, [6]akhtertanjimul44@gmail.com, [7]priyakshichutia7@gmail.com, [8]madhuchandralahan@gmail.com, [9]prof.rajeshjesudasan@gmail.com

Article Info

Volume 6, Issue 13, July 2024

Received: 28 May 2024

Accepted: 30 June 2024

Published: 26 July 2024

doi: 10.33472/AFJBS.6.13.2024.2281-2293

ABSTRACT:

The use of medicinal plants is quite important in today's society. Millions of people have long relied on a variety of neglected plant species in the Himalayan region for food and medicinal purposes. *Pyrus pashia* is one of these. It is a moderately sized fruit tree in the Rosaceae family.and is also called Kainth, another name for *P. pashia* is the Indian wild pear. In conventional medicine,this herb is used to cure a variety of illnesses, such as sore throats, eyes infections, diarrhea stomach issues, and other infections ailments. This review's primary goal is to give a thorough summary of the phytochemical components found in *Pyrus pashia* as well as any possible applications in medicine. Organic acids, flavonoids, triterpenoids, and other phenolic compounds are among the phytoconstituents found in *Pyrus pashia* plants. The variouspharmacological characteristics that Pyrus species display, including their anti-inflammatory, antifungal, antioxidant, antibacterial, hepatoprotective, and antidepressant effects, are attributed to these phytochemicals with a positive effect on human health and well-being.

Keyword*: Pyrus pashia*, diarrhea, eye infections, sore throats, phytoconstituents, pharmacological characteristics, anti-inflammatory, antifungal, antioxidant, antibacterial, hepatoprotective, and antidepressant.

1. INTRODUCTION

The use of medicinal plants is quite important in today's society. In addition to providing food, plants often yield industrial items that are not food. Large-scale cultivation of these crops is usually done to produce specialist products or fine chemicals. One such group of plants is medicinal plants, which are a veritable gold mine of chemical compounds with a wide range of uses in human medicine. Any plant that has components that are used to create effective medications, also used directly for therapeutic purposes, or that can affect human health is considered a medicinal plant according to the WHO. This definition includes plants that are whole or that contain certain parts of their bodies. Such plants are used to prevent or treat diseases in their entirety or components such as their roots, stems, leaves, stem barks, fruits, or seeds. These chemical components or therapeutically active non-nutrient molecules are called phytochemicals, bioactive chemicals, or active principles that are received from these plants [1]. The Indian subcontinent has a vast range of topological, natural, and atmospheric characteristics, which contribute to its various ecosystems India boasts over 15,000 different species of flowering plants and a mega-biodiversity. Approximately 3,000 plants with reliable records have remarkable medicinal potential. In addition to the farmed food crops, the flora of the forests provides an invaluable source of important species. The bulk of provincial residents in the Indian subcontinent rely on wild, edible organic products to meet their additional nutritional needs[2]. The utilization of medicinal plants to treat a wide range of illnesses has long piqued human curiosity, as seen by the countless historical reports from almost every civilization. Approximately 80% of the population in underdeveloped nations still primarily obtains their medical requirements from medicinal plants. Due to the rapid expansion of pharmaceutical businesses and the growing public awareness of plant-based treatments, there has been an upsurge in demand for medicinal plants in recent years. This is further corroborated by the fact that about 80% of purported traditional medicine uses plant extracts, indicating that medicinal plants may still carry out an important role in the development of novel therapeutic agents and therefore they continue to hold a significant place in contemporary medicine. Medicinal plants can include complicated structures that yield several medicinally useful chemicals that are employed as modern medications. Therefore, it is occasionally not possible to synthesize these bioactive molecules, ideally with few chemical steps and at a low cost. Consequently, it may be argued that using plant-based extracts—either whole or semi-purified—for the treatment of illnesses in accordance with conventional medical methods is a sensible and workable way to resolve the problem[3].

Millions of people have long relied on various neglected plant species which is found in the Himalayan region for food and medicinal purposes. *Pyrus pashia* is also one. Another name for P. pashia is the Indian wild pear[2]. India, Afghanistan, Bhutan, Nepal, Thailand, Vietnam, Myanmar, Pakistan, Laos, and China are among the places where *Pyrus pashia* Buch. & Ham. is found. It is used as a sedative, laxative, and febrifuge. The fruits of *Pyrus pashia* Buch. & Ham. are tender and delicious. For the condition of dehydration, the *Pyrus pashia* fruits are most useful. For pears, *Pyrus pashia* Buch. & Ham. is a suitable rootstock. P. pashia wild plants can be top-worked with pears. The fruits are useful for stomach disorders. These are additionally effective in treating calves that have an eye infection called pterygium disease. Conjunctivitis is treated using its cell sap. *Pyrus pashia* is used medicinally in several ways. It is used to treat gastrointestinal issues, fever, headaches, diaphoretic sweats, hysteria, and epilepsy. This plant produces laxative, febrifuge, and sedative fruits[4].

Table 1: Botanical classification[5].

SCIENTIFIC NAME	*Pyrus pashia*
Genus	*Pyrus*
Species	*P.Pashia*
Family	Rosaceae
Subfamily	Maloideae
Order	Rosales
Class	Magnoliopside
Division	Magnoliophyta
Kingdom	Planate

Habitat and morphological characteristics of *Pyrus pashia*:

Pyrus pashia grows wild from 700 to 2000 meters high throughout the Himalayas. Bailey (1953) claimed that the Himalayan region was its birthplace. In this region, both solitary and group plants can be found[6]. India, Bhutan, Nepal, Myanmar, Pakistan, China, Laos, Vietnam, Thailand are among the countries where this species is found[7].

This deciduous tree grows in waste regions outside of villages, by roadsides with lots of sunlight, and in forests. The medium-sized *Pyrus pashia* tree has deciduous climacteric fruits[5]. The *Pyruas pashia* plants can reach a height of 15 meters. The trunk has rough, scaly, dark brown bark; the branches are slender and erect, and have a sparse number of elevated round or oval lenticels. Fruits from *Pyrus pashia* are edible, albeit they are of extremely poor quality. Fruits typically reach their ripeness in the second week of October, measuring 2 cm in length and 2.2 cm in width. When fully grown, fruits are symmetrical, rounded, and hang nicely. There are five to ten tiny, plump, light, brown seeds per fruit; the flesh is rich in grit cells; the skin is thin, dull, and russet with many raised white spots. It serves as a pear rootstock. Young leaves of *Pyrus pashia* are pinkish and woolly on the dorsal side, while mature leaves become dark green and glabrous. Phyllotaxy alternates, venation reticulate pinnate with hairy midrib on both sides. After a year, the lateral axillary shoots transform into thorns. Simple, trilobed, ovate to apex acuminate, elliptic, base obtuse, margins serrulate; stipules deciduous. The flowering of the *Pyrus pashia* plant starts in the first week of March with white blooms with five petals carried in short, woolly corymbs on spurs[6].

Table 2. Phytochemical constituent of *Pyrus pashia* :

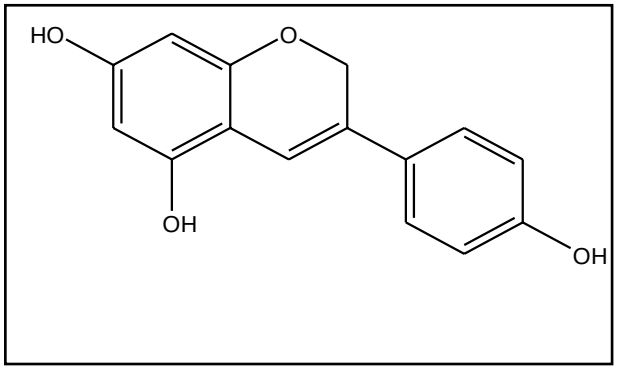
PLANTPART	EXTRACT	PHYTOCHEMICAL CONSTITUENT	REFERENCE

Flower	Ethanolextract	• 4-methoxy benzoic acid,3,4-Dihydroxy benzaldehyde • . • 3,3',4-Trihydroxy-diphenyl methane • p-hydroxy acetophenone • 4,4'-methylene-diphenol, • Cynanoneside A. • 3,4-Dihydroxy cinnamic acid, • 4-ethoxymethyl-phenol, • 4-Methoxymethyl-phenol. • methyl ester, • 5-O-p-trans- coumaroylquinic acidapigenin 7-O-β-D-glucopyranoside and Apigenin, • 4'-O-β-D-glucopyranoside • 3,5,7,4'-Tetrahydroxy-8- me thoxyflavone-3-O-β-D-gluc opyranoside, kaempferol3-rutinoside. Apigenin • 8-C-p-hydroxy benzylapigenin, • E-1-(4-hydroxyphenyl)-buten-1-en-3-one,	2

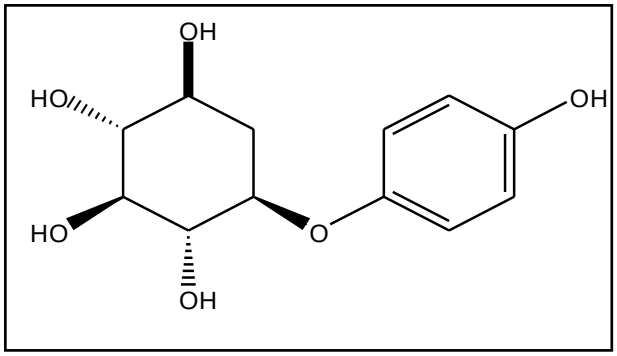
		• 4-hydroxy benzaldehyde, 4-O-Z-coumaroylarbutin • 5-O-p-cis-coumaroyl quinic acid methyl ester, Arbutin, 6-O-acetyl arbutin 2-O-acetyl arbutin, Hydroquinone	
Leaves	Methanolicextract	• Fatty acid: Dodecanoic acid, pentadecanoic acid tetradecanoic acid, octadecanoic acid, hepatodecanoic acid. • D-Allose, • pentadecanoic acid, • cis-Vaccenic acid, • 1-Heptacosanol, • 2-Hexadecen-1- Ol, • 7,8,9-Trimethoxy-4,5-dihydro 1Hbenzo[G]Indazole, • Stigmast-5-En-3-Ol etc • 9,12-Octadecadienoic Acid,	8

Fruit	Methanolextract Hexaneextract	• D Mannitol, • 1,4-anhydro, • HexitoL, • Squalene, • Octadecanoic acid, • Lup-20(29)-en-3-on, • 9,12-Octadecadienoic acid, • STIGMAST-5-EN-3-OL • Lupeol • Pentadecanoic Acid • Hexatriacontyl pentafluoropropionate • B-sitosterol-β-D glucoside • lupeol β sitosterol. • B sitosterol	8 9
Bark	Aqueous extract Ethanolextract	• Tannins • Flavonoids • Hentriacontane • hentriacontanol • β-sitosterol	2

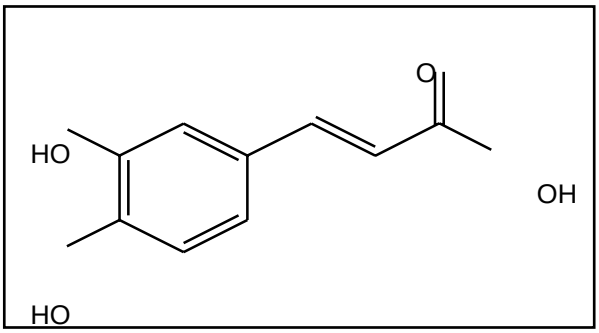
Chemical structure of common compounds of *Pyrus pashia.*



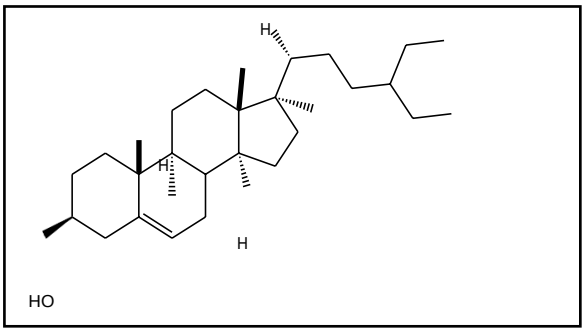
Genistein



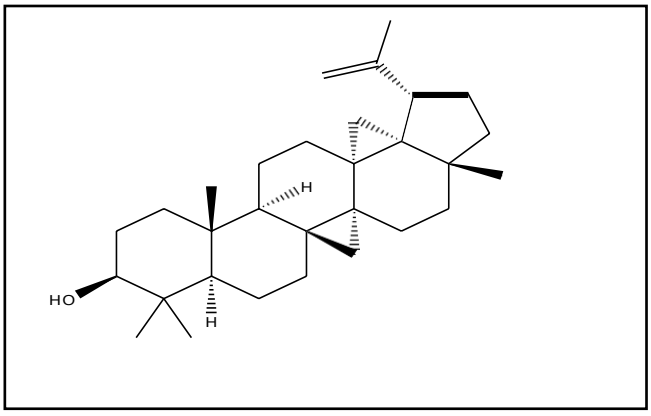
Arbutin



Caffeic

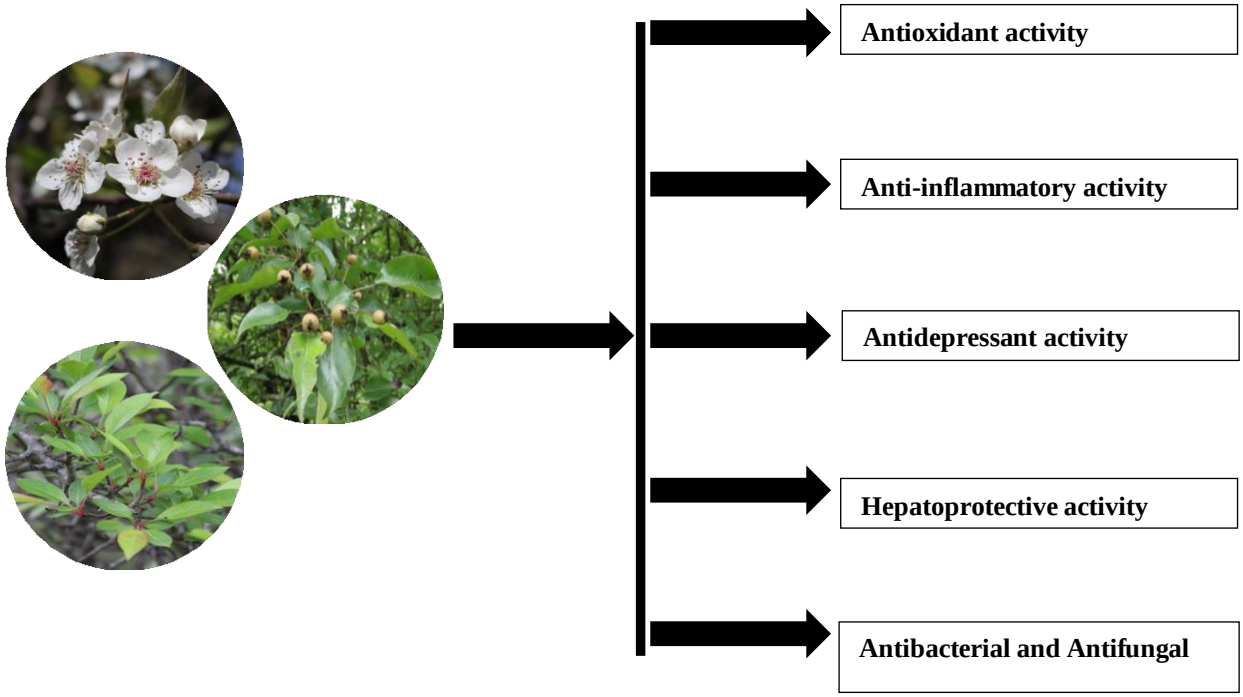


β- sitosterols



Leupol

Different pharmacological activity of *Pyrus pashia:*



Antioxidant activity:

Siddique at al. look into the methanol extract of several *Pyrus Pashia* sections' antioxidant qualities. Methanolic extracts of fruits, bark and leaves were dissolved in distilled water, and the mixture extract of fruit, bark and leaves were dissolved in distilled water, and the mixture was then separated in increasing polarity order using four organic solvents: ethyl acetate, chloroform, hexane, and n-butanol. Phytochemical screening revealed that the soluble fractions of ethyl acetate, chloroform, and n-butanol have notable amounts of flavonoids, phenolics, alkaloids and cardiac glycosides. Several techniques were employed to determine the antioxidant activity of the crude methanolic extracts. The remaining aqueous fraction were further evaluated in order to determine the total phenolics. This was done using the FRAP assay, the 1,1-diphenyl-2- picrylhydrazyl(DPPH) free radical scavenging activity and the total antioxidant activity by phosphomolybdenum complex method[4]. The fruit's chloroform-soluble fraction showed the highest value of percent inhibition of DPPH, based on data on antioxidant activity. In comparison to butylated hydroxytoluene, the fraction of antioxidants activity, The bark's ethyl acetate soluble fraction showed the highest FRAP value of the three components. By using the phosphomolybdenum complex technique, this fraction likewise displayed the greatest value of total antioxidant activity. Furthermore, out of all the fruit and leaf fractions that were studied, this fraction had the highest phenolic concentration[4].

Anti-inflammatory activity:

Singh *et al.*, investigate the anti-inflammatory of *Pyrus pashia* leaves. This study reports that 70% methanol was employed in Soxhlet to extract the leaf extract at room temperature. The filtrate was separated and eventually evaporated to dryness. An oral dose of MEPPL was administered to the mice, which was suspended in water. MEPPL has shown a significant impact on acute anti-inflammatory properties at dosages of 150mg/kg, 100mg/kg, 50mg/kg. The extract showed similar initial effects to the conventional medication, Indomethacin 10

mg/kg. These findings demonstrated *Pyrus pashia* leaves' possible immediate anti-inflammatory activity[10].

Chandra *et al* examined the MEPP fruits showed potent anti-inflammatory activity.The MEPP fruits underwent a preliminary phytochemical screening that indicate the existence of tannins, phenolic compounds, terpenoids, and flavonoids, which may be the source of the anti-inflammatory action. In an in vivo investigation, Chandra et al. discovered that the paw volume was lowered by 56.61% after 4 hours when the MEPP fruits were administered orally as a suspension at 100mg/kg body weight per day. However, the same extract exhibits 61.12% inhibition at the same time when taken at 150mg/kg body weight per day. Hence, when compared to normal saline as the control and indomethacin (100 mg/kg) as the standard reference, methanolic extract provided a significant suppression of inflammation at a dose of 100mg/kg body weight[11].

Antidepressant activity:

Pandey *et al* evaluated the effects of MEPPL on depression in albino rats. Rats were devided in to four groups (n = 6/group) used for this experiment. The first group was designated as the control group, using only distilled water; the second group was designated as the standard group, using imipramine hydrochloride (15 mg/kg) as the standard; and the remaining two groups were designated as the test groups (T1, T2). T1 and T2 were administered with two dosages of the MEPPL, which were 100 and 200 mg/kg, respectively. The control, standard, and test samples were given orally by gavage.The locomotor activity (LMA) results and forced swimming test (FST) showed the dose-dependent antidepressant effect. The MEPPL's basic findings significantly decreased the FST's immobility durations ($p<0.001$). Likewise, the concentration significantly amplified the effects of rearing, feces, and locomotion in comparison to the control group ($p<0.001$). We can infer from the Panday *et al* trial that MEPPL has antidepressant actionin FST and LMA[12].

1.1. Hepatoprotective activity

Athokpam *et al* examined the aqueous extract of the aerial part of *Pyrus pashia* hepatoprotective activity against carbon tetrachloride-induced hepatotoxicity in mice. Olive oil with 30% CCl4 produced hepatotoxicity (1 ml/kg i.p.).An oral dose of 500mg/kg and 250mg/kg body weight of aqueous extract *Pyrus pashia* were given to the mice. The results were compared with silymarin, a drug known to have liver-protective properties. Compared with the CCl4-treated group, the P. pashia water extract pre- and post-treatment groups significantly reduced the high levels of bilirubin, serum transaminases, alkaline phosphatase and increased the total protein levels. that *Pyrus pashia* also has hepatoprotective effects[13].

1.2. Antibacterial and Antifungal activity:

Saklani et al. assessed the antifungal and antibacterial properties of chloroform, methanol, ethanol, acetone, ethyl acetate, petroleum ether, and water extracts of the plant*Pyrus pashia* in vitro using the disc diffusion technique against ten bacterial strains (Staphylococcus epidermidis, Salmonella entericatyphim, Streptococcus pyogenes Shigella flexneri, Klebsiella pneumoniae, Bacillus cereus, Staphylococcus aureus, and Enterobacter gergoviae) and three fungal strains(Aspergillus flavus, Candida albicans, and Aspergillus parasiticus). Parts of the plant material were separated into their assignedcomponents (fruit, leaf, bark, root), air-dried, ground into a fairly fine powder, and then subjected to Soxhlet extraction using a solvent of increasing polarity (ethanolic, water, methanolic, petroleum ether, ethyl acetate, acetone, and chloroform). Low pressure was applied to each extract using a rotating evaporator. The fruit bark and root coarse powder was extracted hot and continuously using several solvents, one at

a time. The powderedmaterial was then allowed to air dry before being extracted again using the next solvent (weight of crude extract: 100gm). From Saklani *et al* we got that the ethanolic bark extracts of the plant showed noteworthy efficacy against Escherichia coli, flexneri, shigella, and Klebsiella pneumonia. The fruit of the *Pyrus pashia* plant had extractive values examined for fresh part weight, with total moisture (60.36±0.25%), ash (1.10±0.05%), crude fate (11.62±0.20%), crude fiber(5.26±0.56), carbohydrate(28.38±0.12) and tannins, glycosides, alkaloids, flavonoids, sterol saponins, and resin was found in the preliminary phytochemical analysis test. According to this study, we concluded that *P. pashia* has antibacterial and antifungal activity[14].

Table 2. Health benefits from various parts of the *Pyrus pashia* plant studied in vitro.

REGION	HEALTH BENIFIT	PLANT PARTS	REFERENCE
Monpa Community(Tawang District of Arunachal Pradesh)	Health Beverage	leaves	15
China	Anti-Diarrhoea	Branches and Leaves	16
China	Lowering blood lipids level	Flower	17
Himalayan Region(India)	Gastro-intestinal, Respiratory and Vascular complication	All Parts of the plant.	18
India	Constipation	Ripe Fruits	19
India	Astringents and Diuretics	Fruits	20
India	Eye condition, Digestion disorder, Headache, Epilepsy, Sour-throats, anaemia.	Fruits	20
India	Cure emesis, Diarrhoea	flower	20

Table 3. Traditional uses of the *Pyrus Pashia* plant:

PARTS	TRADITIONAL USE	REFERENCE
Fruit	➢ In addition to being delicious and consumed as part of the local diet, fruits are also utilized to reduce thirst and are known to help with constipation. ➢ Juice from fruits is diuretic and astringent. ➢ Fruit is also used to treat anemia, ocular issues, digestive disorders, sore throats, irritability, and abdominal pain in addition to dysentery and leishmaniasis. ➢ The fruit is mixed with cattle feed to raise the amount of milk produced .	21.
Leaves	➢ The Monpa Community in Tawang, Arunachal Pradesh, drinks as a tea made from the leaves. ➢ It is also provided as sheep and goat feed.	22, 2
Flower	➢ As a herbal remedy to reduce cholesterol levels in the blood. ➢ P. pashia flowers are traditionally soaked in water for about 24 hours and then cooked with beef, chicken, or egg to cure cough, emesis, and diarrhea.	. 23.
Bark	➢ The barks have tonic and astringentqualities. ➢ Bark is used to treat fever, peptic ulcers, stomach ulcers, sorethroats, and typhoid fever.	24

2. CONCLUSION

In conclusion, the complex phytochemical composition and variety of pharmacological activity of Pyrus species demonstrate their medicinal potential. For human health, every component of the plant is essential. The different components of the plant that as leaves,fruits, flowers, and bark have some antioxidant, anti-inflammatory, antidepressant,hepatoprotective, antibacterial, antifungal, and many more pharmacological activities that are beneficial for human health and well-being. The presence of bioactive substances such as vitamins, triterpenoids, flavonoids, and phenolic compounds highlights their potential as functional foods and natural therapies. Researchers studying Pyrus species are finding that the traditional eating of these fruits has been validated by contemporary research, and it could lead to the development of novel drugs and dietary supplements. However, more investigation is required to understand their mechanisms of action, enhance extraction methods, and consider their potential for medical uses. All things considered, *Pyrus pashia* are highly promising as a useful resource in complementary and alternative medicine. Therefore, to utilize the plant's constituents effectively, great efforts are needed to investigate its limitless pharmacological characteristics and raise public awareness of its benefits.

3. REFERENCE

1. Aftab T, Hakeem KR, eds. Medicinal and Aromatic Plants: Healthcare and Industrial Applications. Springer International Publishing; 2021. doi:10.1007/978-3-030-58975-2
2. Prakash O, Chauhan A, Kudachikar V. Traditional uses, nutrition, phytochemistry and various pharmacological properties of Indian wild pear (Review). Int J Funct Nutr. 2021;2(4):9. doi:10.3892/ijfn.2021.19
3. Zakaria ZA, Kamisan FH, Omar MH, et al. Methanol extract of Dicranopteris linearis L. leaves impedes acetaminophen-induced liver intoxication partly by enhancing the endogenous antioxidant system. BMC Complement Altern Med. 2017;17(1):271. doi:10.1186/s12906-017-1781-5
4. Siddiqui SZ, Rubab K, Abbasi MA, Ajaib M, Rasool ZG. Pyrus pashia: A persuasive source of natural antioxidants. Pak J Pharm Sci. Published online 2015.
5. Sharma S. Value addition to underutilized wild Himalayan Pear (Pyrus Pashia): Development, Composition, and sensory characteristics of jam. Published online July 29,2022. doi:10.14293/S2199-1006.1.SOR-.PPFFBDC.v1
6. Shukla AK, Pramanick KK, Watpade S, Kumar J, Patial M. Characteristic features of Pyrus species. Int J Trop Agric. Published online 2021.
7. Zamani A, Attar F, Joharchi MR. PYRUS PASHIA (ROSACEAE), A NEW RECORD FOR THE FLORA OF IRAN. Published online 2009.
8. Bharali P, Tina M, Mahanta D, Kalita MC, Das AK. Phytoconstituent evaluation of Pyruspashia Buch.-Ham. ex D. Don – a potential ethnomedicinal plant from Arunachal Pradesh, India. Pleione. 2019;13(2):284. doi:10.26679/Pleione.13.2.2019.284-290
9. Khandelwal R, Paliwal S, Chauhan R, Siddiqui AA. Phytochemical screening of hexane soluble fraction of Pyrus pashia fruits. August 08 2008.
10. Singh DrA. IN-VIVO ANTI-INFLAMMATORY ACTIVITY OF METHANOLIC EXTRACT OF LEAVES PART OF PYRUS PASHIA. World J Pharm Res. Published online September 1, 2017:621-628. doi:10.20959/wjpr20179-9216
11. Chandra S, Saklani S, Kumar S. In-vivo Anti-inflammatory activity of Pyrus pashia Fruit. January 2016.
12. Pandey N, Singh A, Pant J. ANTIDEPRESSANT ACTIVITY OF METHANOLIC EXTRACT OF PYRUS PASHIA LEAVES IN RATS. World J Pharm Pharm Sci.

2017;6(10).
13. Athokpam R, Bawari M, Choudhury MD. HEPATOPROTECTIVE ACTIVITY OF AQUEOUS EXTRACT OF PYRUS PASHIA BUCH.- HAM. EX D. DON AGAINST CCl4 INDUCED LIVER DAMAGE. Int J Pharm Sci Res. 2017;8.
14. Saklani S, Chandra S. IN VITRO ANTIMICROBIAL ACTIVITY NUTRITIONAL PROFILE OF MEDICINAL PLANT OF GARHWAL, HIMALAYA. 2011;3.
15. Zamani A, Attar F, Joharchi MR. YRUS PASHIA (ROSACEAE), A NEW RECORD FOR THE FLORA OF IRAN. Published online 2009.
16. He J, Yin T, Chen Y, et al. Phenolic compounds and antioxidant activities of edible flowers of Pyrus pashia. J Funct Foods. 2015;17:371-379. doi:10.1016/j.jff.2015.05.045
17. Ibrahim RM, Hammoudi ZM. PHYTOCHEMISTRYAND PHARMACOLOGICALACTIVITY OF PEAR (PYRUS COMMUNIS LINN) : A REVIEW.
18. Janbaz KH, Zaeem Ahsan M, Saqib F, et al. Scientific Basis for Use of Pyrus pashia Buch.-Ham. ex D. Don. Fruit in Gastrointestinal, Respiratory and Cardiovascular Ailments. Ahmad M, ed. PLOS ONE. 2015;10(3):e0118605. doi:10.1371/journal.pone.0118605
19. H Rymbai, N A Deshmukh, H D Talang, A K Jha. Physico-chemical variation in fruits ofPyrus pashia genotypes. Published online 2019. doi:10.13140/RG.2.2.14758.88645
20. Prakash O, Chauhan A, Kudachikar V. Traditional uses, nutrition, phytochemistry and various pharmacological properties of Indian wild pear (Review). Int J Funct Nutr. 2021;2(4):9. doi:10.3892/ijfn.2021.19
21. Janbaz KH, Zaeem Ahsan M, Saqib F, et al. Scientific Basis for Use of Pyrus pashia Buch.-Ham. ex D. Don. Fruit in Gastrointestinal, Respiratory and Cardiovascular Ailments. Ahmad M, ed. PLOS ONE. 2015;10(3):e0118605. doi:10.1371/journal.pone.0118605
22. Tsering J, Gogoi BJ, Tag H. ETHNOBOTANY AND PHYTOCHEMICAL ANALYSISOF PYRUS PASHIA LEAVES. 2012;3.
23. He J, Yin T, Chen Y, et al. Phenolic compounds and antioxidant activities of edible flowers of Pyrus pashia. J Funct Foods. 2015;17:371-379. doi:10.1016/j.jff.2015.05.045
24. Krause S, Hammer K, Buerkert A. Morphological biodiversity and local use of the Himalayan pear (Pyrus pashia) in Central Bhutan. Genet Resour Crop Evol. 2007;54(6):1245-1254. doi:10.1007/s10722-006-9105-5