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Polypodium vulgare Linn. (*Bisfaij*): A critical review on its ethnopharmacological, phytopharmacological and therapeutic properties

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Abstract

Medicinal herbs are a gift to humanity to attain a healthy lifestyle as they have tremendous therapeutic potential. *Polypodium vulgare* Linn. is one of those plants that has been used for centuries in almost all older medicinal systems worldwide. In Unani classical literature, it is been given that *Bisfaij* is effective in treating various health ailments such as *Malikholia*, epilepsy, leprosy, rheumatoid arthritis, and cardiac disorders, etc., however, being an essential medicinal rhizome, it has been scientifically validated and reported to have a number of pharmacological activities including, antipyretic, antiviral, antiepileptic, analgesic, hypotensive and neuro-psychopharmacological activity. These activities are often attributed to its diverse chemical constituents, which include polyphenols, flavonoids, terpenoids, and alkaloids. The integration of traditional knowledge with scientific evidence underscores the plant's potential as a valuable resource for pharmaceutical and healthcare. This review critically evaluates the scientific evidence supporting the traditional uses and pharmacological activities of *P. vulgare*, shedding light on its therapeutic potential and encouraging further research to harness its medicinal properties for the benefit of humanity.

Keywords: *Polypodium vulgare* Linn., phyto pharmacology, *Bisfaij*, rhizome

Introduction

Polypodium vulgare Linn, is a dried rhizome of Polypodiaceae family, also known as "Bisfaij" in the Unani system of medicine. It has captivated the attention of traditional healers and scientists alike due to its remarkable medicinal properties. Rooted in centuries of traditional knowledge, this fern species has been an integral part of indigenous pharmacopeias across the globe. The term Polypodium originates from the Greek phrase poly, which indicates "many," and podion, which indicates "little foot"; it describes the plant's characteristic rhizomes, which radiate out like foot. In Persian, it is also named Bistpaya which refers to Bist- twenty and Paya- foot, which indicates various branches of rhizome like an arthropod with numerous legs known as the Arba arbain millipede ^[1-3]. In ancient times, there was a superstition that the plant sprouted from the milk of the goddess Freya, and more recently, the virgin Marry was attributed with its genesis. Because of the delicacy of the rhizome, it is known as "reglisse" or "liquorice" in various parts of France ^[4]. The rich ethnopharmacological heritage associated with *Polypodium vulgare* serves as a testament to its efficacy in traditional healing practices. Throughout history, numerous cultures have recognized and harnessed its healing potential. It has been utilized in the Unani system of medicine for hundreds of years, going back to the time of early Unani physicians like Dioscorides, Jalinoos (131-210 A.D.), Rhazes (850-925 A.D.), Ibn Sina (980-1037 A.D.), and Ishaq bin Imran, among others ^[5]. According to Dioscorides, polypody is used to expel abnormal bile and phlegm. Ibn Sina stated that Bisfaij fiercely evacuates black bile from brain, heart and entire body ^[4].

In recent years, the plant has garnered significant interest from researchers, leading to extensive exploration aimed at unraveling its therapeutic potential. In parallel with its traditional uses, it has become the focus of intense phytopharmacological investigations. Researchers have delved into its chemical composition, unveiling a plethora of bioactive compounds that underpin its medicinal properties. Phenolic compounds, flavonoids, terpenoids, and alkaloids are among the diverse array of chemical constituents found in *Polypodium vulgare*, each contributing to its pharmacological activities ^[10, 11].

Table 1: Taxonomical classification [1-4, 8-11]

Kingdom	Plantae
Division	Pteridophyta
Class	Pteridopsida
Order	Polypodiales
Family	Polypodiaceae
Genus	Polypodium
Species	<i>vulgare</i>
Botanical name	<i>Polypodium vulgare</i> Linn.

Table 2: Vernacular names [1-4, 8-11]

Languages	Names
Arabic	<i>Akhras-ul Kalb, Azrasul Kalb, Saaquib-ul-Hajr, Kasirul Arjil, Barzia</i>
Barbary	<i>Pishnen</i>
Egyptian	<i>Ashbatoon</i>
English	Common Polypody, Wall Fern, Adder's Fern, Golden Maiden Hair, Golden Polypody
Hindi	<i>Bisfaija, Khangali, Khange, Khatkali, Kala bichwa</i>
Latin	<i>Bazbodia</i>
Persian	<i>Bist Baya, Bist Paya, Bispaik</i>
Suryani	<i>Qoloqanddon</i>
Unani	<i>Boloqoodiyun</i>
Urdu	<i>Bisfaij</i>

**Fig 1:** *Polypodium vulgare* Linn. (Bisfaij) [6]**Fig 2:** *Polypodium vulgare* Linn. [7]**Fig 3:** Dried rhizome of *Polypodium vulgare* Linn. (Bisfaij)**Fig 4:** *Polypodium vulgare* Linn. (Leaves)**Geographical distribution**

P. vulgare Linn. is indigenous to Europe, though it is also distributed in Persia, America, Turkey, Africa, and Eastern Asia. It is imported into India from other nations. It is found throughout the year. It nurtures on rocks and moist places underneath trees. It is resistant to drought and can withstand successive dry periods in its life cycle. During the months of May and June, rhizomes of fully matured plants are collected [2-4, 9-11].

Botanical description

P. vulgare Linn is herbaceous, perennial fern with a subterranean stem termed rhizome. It is believed to have arisen as a result of chromosome doubling of a sterile diploid hybrid between two species (which are not known in Europe) one among them is *P. virginanum* from Eastern America while the other is from East Asia [12]. These rhizomes are flattened, fibrous, hard, heavy, creeping, irregular, yellowish-brown colour externally and green or darkish or brownish red internally; the surface is rugous, longitudinally fissured, upper surface is adhered with

several tubercles (horn-like) or crusty projections or suckers, each about half an inch long and fissured; petioles and leaves are above ground, deeply pennatifid, and have different types of crests, dissections, and plumes. It is demarcated as sweetish, astringent, nauseous and somewhat acrid in taste; odour ferny, resembling that of opium. Microscopic analysis of the rhizome showed a delicate cellular structure with plenty of starch and green granular particles [4, 9, 10, 11].

Morphological features in Unani (Mahiyat)

Bisfaij, which flourishes in rocky, moist areas, is about 9 inches long and has only one branch with minute leaves. It is a climber by nature and thrives on the *Baloot* (*Quercus incana*) tree's branches and trunk. It does not produce fruit or flowers. The branches and leaves of *Bisfaij* are similar to those of *Hansraj* (*Adiantum capillus*). The root which is used as drug is hard, entangled, fibrous in character and has grassy green to dark brown colour, studded with cavernous suckers similar to those found on polypus arms, rugous and longitudinally fissured. It is called "*Kasirul Arjil*" because it has numerous hairs on its upper surface that seem like tubercles or scaly projections, which give the appearance of an arthropode 'centipede'. The best quality of this root is the one which is fresh, heavy, thick like a little finger, taste resembles to clove i.e., acrid, sweetish with some astringency, externally reddish or yellowish in colour and internally green like pistachio, hence called *Bisfaij fastaqi*. As it becomes older, it becomes reddish brown in colour from the inside. It was famous as *Tashtiwan* and *Baspaik* in Persians. In Arabic, *Bisfaij* is known by the names 'Azras-ul-Kalb' which means 'dog's tooth', alluding to the toothed appearance of the leaves, '*Kasirul Arjil*' and *Saaquib-ul-Hajr* means 'many footed' and 'penetrating stones' respectively [1, 2, 3, 8, 13]. It is well-known among Muslim physicians as an expeller of all kinds of peccant humours from the body. Both Theophrastus and Dioscorides have mentioned its purgative virtues. Dioscorides stated that it is used to remove the excess bile and phlegm from the body [4].

Pharmacological actions (Af'aa)

Muqawwi-e-Dimagh (Brain Tonic), *Muqawwi-e-Qalb* (Cardiotonic), *Mufarreh qalb-wa- dimagh* (Exhilarant), *Mushil-e-balgham* (Purgative of phlegm), *Mushil-e-safra* (Purgative of yellow bile), *Mushil-e-sauda* (Purgative of black bile), *Kasir-e-riyah* (Carminative), *Muhallil-e-Nafakh* (Antiflatulent), *Muhallil-e-ratoobat* (Resolvent) [1, 2, 3, 8, 10, 11, 13, 14, 15], *Mullayin* (Aperient), *Mufatteh* (Deobstruent), Alternative [4, 9].

Therapeutic uses (Mahl-e-istema'al)

It is good purgative of black bile, yellow bile and phlegm and hence can be efficiently used in *amraaz-e-balghami-wa-safrawi-wa-saudawi* (Phlegmatic, yellow and black bile ailments) like *Malikholia*, (Melancholia), *Juzam* (Leprosy), *Sara* (Epilepsy), *Waja-ul-mafasil* (Arthritis). It is beneficial in *Qolanj* (Colic), *Nafkh-e-shikam* (Flatulence), *Iltewa-e-asab*, *Bawasir* (Haemorrhoids), *Warm-e-Tihal* (Splenomegaly) [1, 2, 3, 8, 9, 10, 11, 13, 15]. Nasal polyp, Acne (Khory and Katrak, 1985), Cataract [4]. It expels the *balgham ghaliz* (thick phlegm) from the body. *Ibn Sina* claimed that it purges the body's excess black bile from the heart, brain, and entire body. It is beneficial for all diseases caused by excessive black bile [13]. Consumption of *Bisfaij*

along with *Maghaz Faloos Khyarshambar* for seven days, helpful in treatment of *Juzam* and *Malikholia* [1].

Parts used (Hisas-e-mustamla) Rhizome and bark [1, 2, 3, 8, 9, 10]. **Temperament (Mizaj)**

Hot 2° and Dry 3° [2, 13].

Hot 2° and Dry 1° [2, 8, 10, 11] Hot and Dry (2°) [3].

Hot 3° and Dry 2° [1].

Toxicity (Mazarrat)

It is harmful to the chest, kidneys and causes nausea [2, 8].

Corrective (Musleh)

Parsiyaoshan/ Hansraj (*Adiantum capillus*), *Ma-ush-shaeer*, *Chuqander* (*Beta vulgaris*) for chest while *Halela zard* (*Terminalia chebula*, Retz), *Gul-e-surkh* (*Rosa damascena*, Mill) are correctives for other side effects [2, 8, 10].

Substitute (Badal)

Aftimoon (half quantity of *Bisfaij*) + *Namak Hindi* (one-fourth quantity of *Bisfaij*) for purgative effect for bile [1, 2, 8].

Aftimoon (equal quantity of *Bisfaij*) + *Namak Hindi* (half quantity of *Bisfaij*) [2, 13].

Sana (*Cassia augustifolia*), *Qurtum* (*Carthamus tinctorius* L.) [10].

Therapeutic dose (Miqdar-e-khurak)

10-15g [10, 11]

4.5-10.5 g (In Powder Form), 10.5-14 g [2, 3]

Up to 14g (In the form of decoction with other drugs) [1]

7-17.5 g (In decoction form) [1].

Compound formulations (Murakkabat)

Arq-e-Juzam, *Arq-Musaffi-e-khoon ba nuskha-e-khas*, *Itrifal Aftimoon*, *Itrifal Aftimoon Mushil*, *Itrifal Deedan*, *Itrifal Ghudadi*, *Itrifal Hamaan*, *Itrifal Kishniz*, *Itrifal Mushil*, *Itrifal Sanai*, *Itrifal Ustokhuddus*, *Jawarish Shahreyaran*, *Jawarish Qurtum*, *Majoon chobchini*, *Majoon Seer Alvi Khan*, *Safoof-e-Chobchini*, *Safoof-e-Lajward*, *Sharbat Ahmad Shahi* [3, 11, 16].

Phytochemistry

Ecdysterone (polypodin A), 5 β-hydroxy ecdysterone (polypodin B), glucocaffeic have been extracted from the rhizome *Polypodium vulgare* Linn. [17]. Saponin glycosides based on polypodosapogenin were also produced by the rhizome, including osladin, ecdysteroids, and phloroglucin derivatives. The essential oil extracted from the roots and rhizomes of the plant possesses lauric acid, butyric acid, succinic acids, and hexoic acid, as well as methyl salicylate, isovaleric, and -methyl butyric esters. From the rhizomes, a novel cycloartane triterpenoid-cyclopodmenyl acetate is extracted and identified as 24, 24, 27-trimethyl-9, 19-cyclolanost-25-en-3β-yl acetate [18-23]. It also contains inorganic substances like potassium, calcium, magnesium, iron, sulphur, and chloride and organic substances like alkaloids, tannins, glycosides, flavonoids, protein, resins, steroids, reducing sugar [10, 11].

Pharmacological studies

Neuro-psychopharmacological activity

Mannan *et al.*, (1989) reported that the *Polypodium vulgare* Linn exhibited neuro- psychopharmacological action. Its root extract in aqueous form has a depressant effect on the

central nervous system. It decreased spontaneous motor activity, prolonged pentobarbitone- induced hypnosis, decreased body temperature, and increased response time to pain stimuli. Moreover, its treatment resulted in a mild reduction in attention and passivity ^[24].

Analgesic activity

Mannan *et al.*, (1989) reported the analgesic activity of *Polypodium vulgare*, when an aqueous extract of the same, was administered in rats, it enhanced reaction time ^[24].

Anti-epileptic activity

Mannan *et al.*, (1989) reported the anti-epileptic activity of aqueous extract of polypod root in animal models ^[24].

Hypotensive activity

Mannan *et al.*, (1989) reported that low doses of the polypody rhizome extract in anesthetized dogs induced a rapid drop in blood pressure for a shorter duration. Though, a higher dose, causes an increase in blood pressure and then it abruptly falls due to β -adrenergic receptor and vasodilation. It has been hypothesized that catechins may be responsible for the hypotensive effects of *Polypodium vulgare* ^[24].

Anti -pyretic activity

Mannan *et al.*, (1989) studied *Polypodium vulgare* extract when given to rats produced a steady lowering of rectal temperature. The same dose of the extract administered in rabbits results in significant prevention and reduction of the pyrexial response of Typhoid- Paratyphoid A and B injection ^[24].

Antioxidants activity

Souri *et al.*, (2010) evaluated the radical scavenging and antioxidant activity of the methanolic extract of *Polypodium vulgare* against linoleic acid peroxidation and 2, 2-diphenyl-1-picrylhydrazyl radical. This activity is expressed as IC50 i.e., 63.48ng/ml in *Polypodium vulgare*. *Polypodium vulgare* was found to have high antioxidant and free radical scavenging activity among all the other plant drug material which was taken for the same ^[25].

Antibacterial activity

Bahadori *et al.*, (2005) and Jizba *et al.*, (1967) screened the methanolic extract of *Polypodium vulgare* for antibacterial activity by measuring the MBC (Minimum Bacterial Concentration) and MIC (Minimum Inhibitory Concentration) values against the gram-positive and gram-negative bacteria named *Staphylococcus aureus* and *Escherichia coli* by standard assay. It has been discovered that due to the presence of secondary metabolites triterpenoids and poly- phenols in the aerial portions and rhizome of *Polypodium vulgare* have the highest antibacterial activity ^[23, 26]. Glensk *et al.*, (2019b) reported that osladin is responsible for the antimicrobial activity of the rhizome of *Polypodium vulgare* ^[27].

Smooth muscle relaxant activity

Naz *et al.*, (2016) used *in-vivo* and *in-vitro* experimental techniques on albino mice and rabbits to demonstrate the muscle-relaxing properties of *P. vulgare*. *P. vulgare* rhizome extract reversed high K⁺ (80 mM) and carbachol (1 M)-mediated contractions in isolated rabbit jejunum (5 and 10 mg/mL), urinary bladder (3 and 10 mg/ml) and trachea (5

and 10 mg/mL) showing higher efficacy against carbachol than high K⁺, comparable to dicyclomine. With administration of crude extract (1-3 mg/ml), cumulative response curves for carbachol were seen to move to the right, similar to dicyclomine. Mice subjected to castor oil-induced diarrhoea were protected by crude extract (300-500 mg/kg) in a dose-dependent manner. The ability of the crude extract to relax smooth muscles has a dual-blocked mechanism, which reveals the therapeutic benefits of *P. vulgare* for the respiratory, digestive systems and urinary bladder disorders ^[28].

Insecticidal activity

Ecdysone analogues may be beneficial not only as insecticides but also as miticides since Krishnakumaran and Schneiderman (1968) showed that the ecdysones contained in the rhizome (0.07%-1% dry weight) of *Polypodium vulgare* act topically on a wide range of arthropods and cause aberrant moulting and mortality ^[29].

Conclusion

In conclusion, the critical review presented here sheds light on the extensive traditional, ethnopharmacological, phytopharmacological, and therapeutic properties of *Polypodium vulgare* Linn. (*Bisfaij*). Through centuries of traditional use and contemporary scientific exploration, this remarkable fern species has emerged as a valuable resource in the realm of natural medicine and pharmacology. *Polypodium vulgare* Linn is one of those potent and efficacious herbs from the Unani system of medicine, it produced astonishing effects in treating various ailments, especially in the management of neurodegenerative and psychiatric disorders *Bisfaij* produced promising results when studied in animal models, indicating its relevance in addressing complex health challenges. These findings not only validate its traditional uses, however, also offer a scientific basis for its efficacy. It is imperative to encourage further investigations into phyto-chemistry, pharmacology, and clinical applications of *Polypodium vulgare* Linn. The validation of its therapeutic efficacy, coupled with a greater understanding of its safety profile, will be instrumental in harnessing its full potential. This critical review not only serves as a tribute to the enduring traditional wisdom surrounding *Polypodium vulgare* Linn. But also as an invitation for continued exploration and innovation in utilizing this botanical species for the betterment of human health.

Conflict of Interest

Not available

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Not available

References

1. Ibn Baitar ZB. Al Jame ul Mufradat al Advia wal Aghziya (Urdu translation). Vol I. New Delhi: CCRUM; c1986.
2. Ghani N. Khazianul Advia (Musawwar Edition). Darya Ganj, New Delhi: Idara Kitab- ul-Shifa; c2011.
3. Lubhaya HR. Goswami Bayan-ul-Advia. Delhi: Goswami Pharmacy; c1977.
4. Dymock W, Warden CJH, Hooper D. Pharmacographia India: A history of the principal drugs of vegetable

- origin. III. Pakistan: The Institute of Health and Tibbi Research, Hamdard National Foundation; c1893.
5. Chevallier A. The Encyclopedia of Medicinal Plants. London: Dorling Kindersley; c1996. p. 252.
 6. Tłałka D, Zawisza-Raszka A. Rodzime taksony paproci w Miejskim Ogrodzie Botanicznym w Zabrzu. Native Taxa of Ferns in the Municipal Botanical Garden in Zabrze. Wiad. Bot. 2022 Mar 28;66:662.
 7. Øllgaard B, Tind K. Scandinavian ferns: A natural history of the ferns, clubmosses, quillworts, and horsetails of Denmark, Norway and Sweden [keys]. Rhodos; c1993.
 8. Hakeem MAH. Bustanul Mufradat. New Delhi: Idara Kitabus Shifa; c1999.
 9. Khory NR, Katrak NN. Materia Medica of India and their Therapeutics. 3rd Edition., Delhi: Neeraj Publishing House; c1985.
 10. Central Council for Research in Unani Medicine. Standardisation of Single Drugs of Unani Medicine. First Edition, New Delhi; c1997, 1(3).
 11. Central Council for Research in Unani Medicine. The Unani Pharmacopoeia of India. New Delhi: Part 1st (III); c2007.
 12. Fernald ML. Contributions from the Gray Herbarium of Harvard University-new series, no. LXVI. *Polypodium virginianum* and *P. vulgare*. Rhodora. 1922 Jul 1;24(283):125-42.
 13. Ibn Sina. Al Qanoon fil Tib (Urdu translation by Kantoori G. H.). Daryaganj, New Delhi: Eijaz Publishing House; c2010.
 14. Ibn Sina. Risala Advia Qalbīa (Farsi Tarjuma). Aligarh Muslim University, Aligarh: Publication Division; c1996.
 15. Kabeeruddin HM. Makhzanul Mufradat Al Maroof Khawasul Advia. Deoband: Faisal Publication; c2000.
 16. Kabeeruddin HM. Al-Qarabadeen. New Delhi: Central Council for Research in Unani Medicine; c2006, II.
 17. Rastogi RP, Mehrotra BN, Sinha S, Pant P, Seth R. Compendium of Indian Medicinal Plants: 1985-1989. Central Drug Research Institute and Publications & Information Directorate, New Delhi; c1990.
 18. Chopra RN, Nayar SL, Chopra IC. Glossary of Indian Medicinal Plants with Supplement. Council of Scientific & Industrial Research, New Delhi 1956, 201
 19. Det Beste. Vare Medisinske Planter. Forlaget Det Beste A/S Oslo, Barcelona, 1984, 250.
 20. Duke JA, Ayensu ES. Medicinal Plants of China 4, Vol. 2. Reference Publications; Michigan; c1985. p. 517-518.
 21. Chiej R. The Macdonald encyclopedia of medicinal plants. Macdonald & Co (Publishers) Ltd; c1984.
 22. Foster S, Duke JA. A field guide to medicinal plants: eastern and central North America. The Peterson field guide series (USA); c1990.
 23. Jizba J, Herout V, Šorm F. Isolation of ecdysterone (crustecdysone) from *polypodium vulgare* L. Rhizomes. Tetrahedron letters. 1967 Jan 1;8(18):1689-91.
 24. Mannan A, Khan RA, Asif M. Pharmacodynamic studies on *Polypodium vulgare* (Linn.). Indian journal of experimental biology. 1989 Jun 1;27(6):556-60.
 25. Souri E, Amin G, Farsam H, Jalalizadeh H, Barezi S. Screening of thirteen medicinal plant extracts for antioxidant activity. Iranian Journal of Pharmaceutical Research. 2008 Apr 30;7(2):149-54.
 26. Bahadori MB, Kordi FM, Ahmadi AA, Bahadori S, Valizadeh H. Antibacterial evaluation and preliminary phytochemical screening of selected ferns from Iran. Res J pharmacogn. 2015 Apr 1;2(2):53-9.
 27. Gleńsk M, Tichaczek-Goska D, Środa-Pomianek K, Włodarczyk M, Wesolowski CA, Wojnicz D. Differing antibacterial and antibiofilm properties of *Polypodium vulgare* L. Rhizome aqueous extract and one of its purified active ingredients—osladin. Journal of Herbal Medicine. 2019 Sep 1;17: 100261.
 28. Naz SB, Chaudhry MA, Rahaman MS. Dual receptors blocked mechanism arbitrates smooth muscles relaxant effect of *Polypodium vulgare*. Bangladesh Journal of Pharmacology. 2016;11(2):414-20.
 29. Krishnakumaran A, Schneiderman HA. Chemical control of moulting in arthropods.
 30. Nature. 1968 Nov 9;220(5167):601-3.

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