



FILFIL SIYAH (*PIPER NIGRUM* L.): AN INTEGRATIVE REVIEW OF UNANI AND CONTEMPORARY PHARMACOLOGICAL PERSPECTIVES

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Abstract

Piper nigrum Linn., commonly known as black pepper and referred to as Filfil Siyah in the Unani system of medicine. *It belongs to the family Piperaceae and is among the most widely used spices worldwide, earning the epithet "King of Spices" due to its exceptional culinary, and medicinal significance.* It is indigenous to India, and it has a long history of use in traditional medicine for the management of digestive, neurological, respiratory, and metabolic disorders. The present review aims to compile classical Unani literature, botanical description, phytochemistry and scientific evidence to highlight the therapeutic potential of Piper nigrum. The fruits are rich in bioactive compounds, particularly piperine, along with essential oils, alkaloids, phenolics, and terpenoids, which contribute to their wide range of pharmacological activities. In Unani medicine, Filfil Siyah is described as *Muqawwī-i-Jigar* (liver tonic), *Muqawwī-i-A'sāb* (nervine tonic), *Kāsir wa Muḥallil-i-Riyāḥ* (carminative), *Mudirr-e-Baul* (diuretic), *Mudirr-e- Haiz* (ammenagogue), *Mushtahī* (appetizer) and is effective in treating various diseases such as *Buṭlān al-Haḍm* (indigestion), *Amrāz-e-Dimāghiya Bārida*, *Amrāz-e-A'sāb* (neurological disorders), *Amrād-e-Jigar wa Tihāl* (liver and splenic diseases), *Waja' al-Khāshira wa Amrād-i-Mafāsil* (lumbago) and arthritic diseases. Scientific studies have demonstrated its antidepressant, neuroprotective, analgesic, anticonvulsant, antimicrobial, antioxidant, digestive stimulant, and bioavailability-enhancing properties. This review highlights the therapeutic potential of Piper nigrum as a valuable medicinal plant supported with scientific evidence.

Keywords: *Piper nigrum, Filfil Siyah, Piperine, Unani medicine, Bioavailability enhancer.*

Botanical name: Piper nigrum Linn.

Family: Piperaceae

Taxonomical classification ⁽¹⁾

Kingdom	Plantae
Phylum	Streptophyta
Class	Equisetopsida
Subclass	Magnoliidae
Order	Piperales
Family	Piperaceae
Genus	Piper
Species	Piper nigrum Linn

Vernacular Names ^(2,3)

Urdu	Filfil Siyah, Kalimirch
Arabic	Filfil Aswad
Persian	Filfil Siyah
Hindi	Kalamirch, Golmirch
Punjabi	Galmirich, Kalimirch

INTRODUCTION

Filfil Siyah (*Piper nigrum* L.) is commonly known as Black pepper. It is one of the most popular spices used worldwide, native to southern India. ⁽⁴⁾ It has various other names across different languages and is often referred to as the "King of Spices." ⁽⁵⁾ The name "pepper" originated from the Sanskrit word "Pipali". The other Indian vernacular names are Milagu (Tamil), Kari Menasu (Kannada), Kuru Mulagu (Malayalam), Miriyam (Telugu), and Kali Mirch (Hindi)⁽⁴⁾. Most of the production of black pepper occurs in India, Malaysia, Indonesia, China, Thailand, Sri Lanka, Vietnam, Brazil and Madagascar. ⁽⁴⁾ It is a flowering woody perennial climbing vine. It thrives in the shade with supporting trees or poles, reaching a height of up to 10 metres. The drug *Filfil Siyah* consists of fully mature dried fruit of *Piper nigrum*.^(2,6)

The pepper vines are propagated either by seeds or through vegetative propagation. The vegetative propagation is usually carried out during the months of July and August. ⁽³⁾ It has various pharmacological effects, such as antihypertensive, antioxidant, anti-inflammatory, antitumor, antibacterial, and antifungal properties. It also enhances drug bioavailability, improves digestion, and boosts cognitive function. ⁽⁶⁾

DISTRIBUTION AND CULTIVATION

Filfil Siyah (*Piper nigrum*) is native to India and grows in hot, humid climates. It is widely cultivated in other countries like Brazil, Indonesia, Malaysia, Thailand, and Sri Lanka. In India, it is widely distributed from the Central Himalayas to Assam, the lower hills of West Bengal, Uttar Pradesh, Andhra Pradesh, and the Western Ghats, extending south to Trivandrum. About 25 percent of production comes from India, which is the largest producer in the world. In India, Kerala is the major production centre. ^(5,7-9)

ETHNOBOTANICAL DESCRIPTION

Filfil Siyah (*Piper nigrum* L.) belongs to the family Piperaceae. It is a glabrous woody climber growing up to 10 m or more in height. It also develops 10–20 primary adventitious roots arising from the base of the mature stem. The vines are grown in a dimorphic branching (monopodial, orthotropic branches and sympodial, plagiotropic fruiting branches) pattern. The orthotropic shoot has indeterminate growth, and leaf axils produce lateral fruiting branches. Also, each node of the orthotropic shoot has clinging roots that help the plant climb over the supporting trees. Leaves are simple, alternate, with 2 to 5 cm long grooved petioles, variable leaf length and breadth, 8–20 cm and 4–12 cm respectively.

In India, flowering in black pepper plants occurs 2 to 3 years after planting, coinciding with the south-east monsoon season (May–July). The fruiting spikes are varied in length (3–15 cm). The inflorescence

is glabrous; a pendulous spike arises opposite to leaves on plagiotropic branches. Flowers are mostly dioecious in the wild variety and monoecious in the cultivated type. Self-pollination is predominant, and protogyny is also encountered in black pepper. ⁽⁴⁾ The fruit is a berry-like drupe having a single seed, about 50 to a catkin. The mature fruits are spherical in shape (~ 5 mm diameter). The harvested fruits are sun-dried for further use. ^(3,4)

DESCRIPTION IN THE UNANI SYSTEM OF MEDICINE

Filfil siyah refers to the fruit of a climbing plant, which is borne in compact clusters. The fruits are harvested at the unripe to semi-ripe stage, when they change in colour from green to reddish, and are subsequently dried. In the fresh state, the fruits are green; upon drying, they become black, hard, and characteristically wrinkled. This is referred to as *Filfil Siyah* (black pepper). When the fruits are allowed to ripen fully, the black outer pericarp separates on rubbing, exposing a whitish inner portion, which is referred to as *Filfil Safed*, although black pepper is more commonly used. The fruits possess a pungent, bitter taste with a strong aroma. The leaves resemble those of *Piper betle* (betel leaf) but are comparatively smaller in size. The plant is predominantly cultivated and found in the hot and humid regions of India. ^(10,11)

CHEMICAL CONSTITUENTS

Phytochemical investigations of *Piper nigrum* have demonstrated the presence of a wide array of bioactive organic compounds, which contribute to its diverse pharmacological properties. The plant contains several classes of secondary metabolites, including alkaloids, amides, flavonoids, phenolics, tannins, steroids, lignans, neolignans, terpenes, chalcones, saponins, polysaccharides/glycosides, and reducing sugars. ^(3,6)

The fruits possess several alkaloids, including piperine, piperetine, chavicine, and piperidine. Among these, piperine is the principal and most extensively studied alkaloid and was the first pharmacologically active compound isolated from members of the family Piperaceae. Piperine exists in four isomeric forms: piperine, isopiperine, chavicine, and isochavicine, and is largely responsible for the therapeutic activities of black pepper. ⁽⁶⁾

In addition to alkaloids, *P. nigrum* fruits are rich in amides such as piperoylin, piperoleins A and B, and N-isobutyl-cicosa-trans-2-trans-4-dienamide. They also yield phenolic amides and essential oils rich in terpenes like α -thujone, α -pinene, camphene, sabinene, β -pinene, α -phellandrene, myrcene, limonene, caryophyllene, β -farnesene, β -bisabolene, and linalool. ⁽³⁾

Temperament (Mizaj): Hot 3° Dry 3° ^(3,12)

Taste: Strong pungent ⁽³⁾

Part used: Fruit ^(8,11)

Dosage (Miqdar-e-khuraq): 1-2 g ⁽²⁾
Upto 1 gm ⁽¹¹⁾
500mg to 1gm ⁽⁸⁾
4.5 to 9 gm. ⁽³⁾

Correctives (Musleh): Honey ^(11,12)
Nabat safed ⁽¹¹⁾
Vinegar, fruits, and ice for people with hot temperament ⁽³⁾
Honey for people with cold temperament ⁽³⁾

Substitute (Badal): Filfil daraz ⁽¹¹⁾

Nafa e khas: *Hāḍim* (Digestive), *Kāsir-i-Riyāḥ* (Carminative) ⁽¹¹⁾

PHARMACOLOGICAL ACTIONS (2,3,9,11,13)

Filfil siyah possesses a variety of therapeutic effects. It has effects both on internal and external use.

Internally

- *Muḥarrrik* (stimulant)
- *Muqawwī-i-Mi'da* (stomach tonic)
- *Muqawwī-i-Jigar* (liver tonic)
- *Muqawwī-i-A'ṣāb* (nervine tonic)
- *Kāsir wa Muḥallil-i-Riyāḥ* (carminative)
- *Mudirr-e-Bawl* (diuretic)
- *Mudirr-i-Ḥayḍ* (ammenagogue)
- *Muqawwi-i-Bāh* (aphrodisiac)
- *Mukhrīj wa Munaffīth-i-Balgham* (expectorant)
- *Māni'-i-Nawbat* (anti-periodic)
- *Dāfi'-i-Ḥumūḍat* (antacid)
- *Dāfi'-i-Ḥummā* (antipyretic)
- *Mushtahī* (appetizer)
- *Tiryāq Sammūm Bārīda* (Antidote)
- *Musqīṭ-i-Janīn* (Abortifacient)

Externally

- *Muḥammir* (rubefacient)
- *Jālī* (detergent)
- *Musakkin* (tranquilizer)
- *Mukhrish-e-jild* (roughening)

THERAPEUTIC USES

Piper nigrum is effective in treating various diseases such as *Nafkh-e-Shikam* (flatulence), *Buṭlān al-Haḍm* (indigestion), *Naubatī wa Muzmin Bukhār* (periodic and chronic fever), *Zukhām* (cold), *Shaqqīqa* (Migraine), *Duwār* (vertigo), *Waja' al-Khāṣira wa Amrād-i-Mafāṣil* (lumbago) and arthritic diseases. It provides relief in earache, toothache, muscular pain and throat pain. It helps in drying out excess body humours and reduces inflammation. It is also effective against several skin conditions like *Bars-o-Bahaq*, *Ghangharānā* (gangrene) and other general skin conditions. It is beneficial in the management of *Amrāz-e-Dimāghīya Bārīda*, *Amrād-e-A'ṣāb* (neurological disorders), like *Zof-e-A'ṣāb* (nervine debility), *Amrād-e-Balghamiya* (phlegmatic disorders), *Amrād-e-Jigar wa Tihāl* (liver and splenic diseases), and *Amrāz-e-Bawl* (urinary disorders). (2,3,11,13)

COMPOUND FORMULATION (2,11)

- Dawa-ul-Shifa,
- Jawarish Kamoni,
- Jawarish Kamooni Kabir,
- Jawarish Falafali,
- Majun Talkh,
- Habbe Papita,
- Itrifal Kabir.

PHARMACOLOGICAL STUDIES

1. Digestive activity

Black pepper is well recognised for its digestive stimulant properties. Piperine, the principal bioactive constituent of *Piper nigrum*, has been shown to enhance digestive efficiency by stimulating digestive secretion and significantly reducing gastrointestinal transit time. Experimental studies have shown that dietary piperine significantly enhances digestive enzyme activity. *Platel* and *Srinivasan* reported that piperine supplementation (20 mg%) increased the activity of intestinal mucosal enzymes, including lipase, sucrase, and maltase, as well as pancreatic enzymes such as amylase, lipase, trypsin, and chymotrypsin in experimental rats. In addition, dietary inclusion of piperine (0.02 g%) for six weeks significantly shortened gastrointestinal transit time in adult female Wistar rats, as assessed using ferric oxide as a non-absorbable marker. ⁽⁶⁾

2. Effect of Piperine on metabolism: A bioavailability enhancer

Piperine is widely recognised as a potent bioavailability enhancer that improves the absorption and therapeutic efficacy of several drugs and nutrients. It enhances gastrointestinal absorption by modulating membrane dynamics and increasing intestinal permeability at the site of absorption. Additionally, piperine prolongs the serum half-life of compounds such as β -carotene and coenzyme Q10 by inhibiting key drug-metabolising enzymes, including cytochrome P450 (CYP3A4), NADPH-cytochrome reductase, UDP-glucuronyl transferase, UDP-glucose dehydrogenase, and aryl hydrocarbon hydroxylase. These enzymatic inhibition leads to reduced metabolic degradation and enhanced systemic availability of various pharmacological agents and nutrients e.g. amoxicillin, ampicillin, carbamazepine, ciprofloxacin, norfloxacin, metronidazole, nimesulide, pentobarbitone, phenytoin, resveratrol, beta-carotene, curcumin, gallic acid, etc by different mechanisms. Therefore, piperine is known as a bioavailability enhancer and a potent drug metabolism inhibitor. ⁽⁶⁾

3. Analgesic activity

Tasleem et al. (2014) evaluated the analgesic activity of hexane and ethanolic extracts of *P. nigrum*, along with its major bioactive constituent piperine, using established experimental models including tail immersion, analgesy-meter, hot plate, and acetic acid-induced writhing tests. Piperine exhibited the strongest analgesic response in the tail immersion test, producing maximum effect at 120 min with a dose of 5 mg/kg. In the analgesy-meter test, the ethanolic extract showed the highest efficacy at 60 min with a dose of 10 mg/kg. Similarly, in the hot plate test, piperine significantly increased the latency to paw licking or jumping. In the acetic acid-induced writhing model, both piperine (10 mg/kg) and the ethanolic extract (15 mg/kg) completely inhibited writhing responses, indicating potent peripheral analgesic activity. ⁽¹⁴⁾

4. Antidepressant activity

The antidepressant-like activity of piperine, the principal bioactive constituent of *Piper nigrum*, has been investigated using a corticosterone-induced model of depression in mice. Depression-like behaviour was established following chronic administration of corticosterone for three weeks. This model was characterized by a significant decrease in sucrose consumption, along with increased immobility time in the forced swim test and tail suspension test. In addition to behavioral alterations, corticosterone administration resulted in a marked reduction in brain-derived neurotrophic factor (BDNF) protein and mRNA expression in the hippocampus. Treatment with piperine significantly attenuated both the behavioral deficits and the biochemical changes induced by corticosterone. These findings suggest that piperine exerts a pronounced antidepressant effect. ⁽⁶⁾

5. Neuroprotective effect

Experimental studies provide substantial evidence supporting the neuroprotective potential of *Piper nigrum*. *Hritcu et al.* (2014) demonstrated that the methanolic extract of *Piper nigrum* fruits significantly ameliorated amyloid- β (1–42)–induced spatial memory impairment in rats by attenuating oxidative stress in the hippocampus. Building on these findings, a subsequent study reported that the extract also produced pronounced anxiolytic- and antidepressant-like effects in male Wistar rats, further supporting its neuroprotective and neuromodulatory potential (*Hritcu et al.*, 2015).

Yang et al. (2015) reported that piperine significantly reduced 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP)–induced impairments in motor coordination and cognitive performance. Collectively, these findings suggest that *P. nigrum* exert neuroprotective effects through antioxidant mechanisms and modulation of motor and cognitive functions. ⁽¹⁴⁾

6. Anticonvulsant Effects.

The anticonvulsant potential of *P. nigrum* has been well documented. *Belemkar et al.* (2013) reported that ethyl alcohol and hexane extracts of *P. nigrum* significantly delayed the onset and reduced the duration of seizures in Wistar rats subjected to pentylenetetrazol (PTZ)- and maximal electroshock (MES)-induced seizure models. Furthermore, *Bukhari et al.* (2013) demonstrated that piperine exerted dose-dependent anticonvulsant effects, with a dose of 50 mg/kg showing superior protection against PTZ-induced seizures compared to higher doses. The highest tested dose of piperine (70 mg/kg) markedly increased seizure latency in picrotoxin-induced convulsions when compared to the control group. These findings collectively support the anticonvulsant potential of *Piper nigrum* and its active constituent piperine. ⁽¹⁴⁾

7. Antimicrobial Effects

According to *Rani et al.*, piperine exhibits notable antibacterial and antifungal activity, including *Staphylococcus aureus*, *Bacillus subtilis*, *Escherichia coli* and fungi such as *Aspergillus niger*, *A. flavus*, *Alternaria alternata* and *Fusarium oxysporum*. Phenolic constituents isolated from fresh black pepper seed extracts have also been reported to inhibit bacterial growth. Furthermore, *Zhang et al.* demonstrated that black pepper essential oil exhibited effective antibacterial activity against meat-borne *E. coli* at a minimum inhibitory concentration of 1.0 μ l/ml, suggesting its potential application as a natural antibacterial agent in the meat industry. Similarly, BPEO (black pepper essential oil) also displayed substantial activity against *E. coli*, *B. subtilis* and *S. aureus* has also been reported. ⁽⁴⁾

8. Anti-Oxidant effect

Anti-oxidant effect of *P. nigrum* has been investigated in various studies. *Vijayakumar et al.* reported that piperine effectively protects against lipid peroxidation and oxidative stress in rats fed a high-fat diet. Under in vitro conditions, *Jeena et al.* observed that black pepper essential oil efficiently scavenged superoxide radicals and inhibited tissue lipid peroxidation. ⁽⁴⁾

MATERIALS AND METHODS

The present review is based on a comprehensive survey of classical Unani literature and modern scientific publications. Relevant research and review articles were identified, selected, and analysed to compile the available evidence.

CONCLUSION

Piper nigrum (Filfil Siyah) occupies a prominent position in both traditional Unani medicine and modern pharmacological research due to its extensive therapeutic potential and wide spectrum of biological activities. The plant's rich phytochemical profile, particularly the presence of piperine and essential oils, underlies its diverse pharmacological actions, including digestive stimulation, neuroprotection, antidepressant, analgesic, anticonvulsant, antimicrobial, antioxidant, and bioavailability-enhancing effects. Classical Unani literature describes Filfil Siyah as a potent stimulant, carminative, nervine tonic, and digestive agent, which is strongly supported by experimental and preclinical studies discussed in this review. However, further well-designed clinical trials on single drugs are required to further validate its safety, efficacy, and dosage standardization.

Abbreviations

BDNF – Brain-Derived Neurotrophic Factor

MES – Maximal Electroshock Seizure

PTZ – Pentylentetrazol

BPEO – Black Pepper Essential Oil

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