

## **Mirch-e-Siyah (*Piper nigrum* L.): Unani Perspectives Phytochemistry and Therapeutic Applications – A Comprehensive Review**

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Received: 21 November 2025

Revised: 09 December 2025

Accepted: 22 December 2025

### **ABSTRACT**

Mirch-e-Siyah or Black Pepper (*Piper nigrum* L.), a member of the family Piperaceae, is one of the most widely used spices and medicinal plants worldwide and is traditionally known as the “King of Spices.” In Unani medicine, it is described as having a hot and dry temperament and is commonly prescribed for digestive, respiratory, and metabolic disorders. This review summarizes the botanical, pharmacognostic, phytochemical, and pharmacological attributes of *Piper nigrum* based on classical Unani texts and modern scientific literature. Botanically, it is a perennial woody climber producing characteristic drupaceous fruits, while microscopy reveals *distinct* tissue layers with a mesocarp rich in oil, resin, and starch. Piperine is the principal bioactive constituent, along with phenolics, flavonoids, essential oils, and minerals. Traditionally, it is used in conditions such as *Fasad-e-Hazam*, *Nafkh-e-Shikam*, *Kasrat-e-Riyah*, *Bars*, and *Bahak*. Experimental studies confirm antibacterial, antioxidant, anti-inflammatory, mild analgesic, and emerging neuroprotective activities. Overall, traditional and contemporary evidence supports *Piper nigrum* as a valuable medicinal spice with broad therapeutic potential.

**Keywords :** *Mirch-e-Siyah* , Piperaceae , Piper Nigrum , *Nafkh-e-shikam* , Neuroprotective activities

### **1. INTRODUCTION**

*Piper nigrum* L., commonly known as black pepper, belongs to the family Piperaceae, one of the oldest families of flowering plants prevalent in tropical climates. This family includes 13 genera. Black pepper is globally acknowledged as the “King of Spices” due to its dominant share in international spice trade. The word “pepper” is derived from the Sanskrit word “Pippali”, meaning berry.<sup>1</sup>



**Figure 1: *Filfil Siyah* (*Piper nigrum* L.)**

### **2. Materials and Methods**

This review is based on extensive literature from Unani medicine texts , research articles , and experimental studies .

## Botanical Description

### Morphology

*Piper nigrum* is a perennial woody aromatic climber, capable of growing up to 50–60 cm in height. It is glabrous and robust with cylindrical, slightly tapered stems that root thinly but thicken at the nodes. Leaves: Oval, acuminate, leathery texture, measuring 10–18 cm x 5–12.5 cm, with 5–9 alternate nerves; petioles are 1.3–2.5 cm long. Flowers: Appear in glabrous spikes of 5–15 cm length; they may be dioecious or polygamous. Female flowers have bracts attached to the rachis beneath the ovary. Fruits: Drupes, 6 mm in diameter, green when unripe, bluish at ripening, and black when dried.<sup>2,3</sup>

### Microscopic Characteristics

Outer layer: Polygonal cells with a clear cuticle and dark brown/black content. Parenchymatous Zone: Thin-walled cells intermixed with thick-walled stone cells, 2–3 layers thick. Mesocarp: Broad zone comprising 7–8 layers of parenchyma containing starch, chlorophyll, oil and resin sacs. Endocarp: Made of stone cells providing structural support.<sup>4</sup>

**Differences in Black and White Pepper:** Black Pepper: Made by drying unripe berries with the outer pulp intact, resulting in a wrinkled texture. White Pepper: Obtained by removing the outer pulp from ripe berries and then drying the seeds.<sup>4</sup>

**Habitat and Distribution:** Native Regions: Southern India Major Cultivation Areas: Tamil Nadu, Kerala (Western Ghats) Other Regions: Sri Lanka, Thailand, South America, France.<sup>4</sup>

### VERNACULAR NAMES<sup>5</sup>

Language	Name
English	Black Pepper
Urdu	Filfil Siyah, Kalimirch
Arabic	Filfil Aswad
Hindi	Kalamirch
Persian	Filfil Siyah
Gujarati	Kalimor
Bengali	Golmorich, Kalaorich
Tamil	Milagu
Marathi	Kalamiri
Punjabi	Galmirich, Kalimirch
Telugu	Miriyalu, Marichamu
Kannada	Menaru, Karimonaru

### SCIENTIFIC CLASSIFICATION<sup>5</sup>

Rank	Name
Kingdom	Plantae
Class	Equisetopsida
Subclass	Magnoliidae
Super Order	Magnolianae
Order	Piperales
Family	Piperaceae
Genus	Piper
Species	<i>P. nigrum</i>
Binomial Name	Piper nigrum L. <sup>69</sup>

**MIZAJ (TEMPERAMENT):** Hot 2 Dry 2 , Hot 3 Dry 3<sup>6,4</sup>

### ISTEMAAL (USES):

*Nafkh-e-Shikam, Fasad-e-Hazam, Zof-e-Hazam, Kasrat-e-Riyah, Bars-o-bahak.*<sup>6</sup>

### AFAAL (ACTIONS)

**EXTERNALLY:** *Jali, Musakkin, Muhallil, Jazib-e-Khoon.*<sup>6,7</sup>

**INTERNALLY:** *Muquawwi-e-Jigar, Meda wa Asab, Muharrik, Kasir-e-Riyah, Mudirr-e-Baul-wa-haiz, Muqawwi-e-Bah, Munaffis-e-Balgham, Tiryaq-e-medā.*<sup>6,8</sup>

**MIQDAR-E-KHURAK (DOSAGE):** 1-2 grms , 4.5 – 9 grms <sup>6,8,9</sup>

**MUZIR :** Hot Temperamental individuals , Chest, Throat , kidneys <sup>6,8</sup>

**MUSLEH:** *Shahed khalis , cold oils .Ghee* <sup>8</sup>

**BADAL:** *Zanjabeel , Safed mirch , Dar e filfil* .<sup>6,8,9</sup>

### 3. Results and Discussion

#### 3.1 CHEMICAL CONSTITUENTS

The principal bioactive compound isolated from *Piper nigrum* is the alkaloid piperine, which is recognized as the first pharmacologically active compound from the Piperaceae family. Piperine exists in four geometric isomeric forms:

- Piperine
- Isopiperine
- Isochavicine
- Chavicine.<sup>11</sup>

The pericarp of the pepper fruit contains high concentrations of:

- Total phenols
- Total flavonoids
- Piperine

The nutritional composition of black pepper includes:

- Carbohydrates: 37.4%
- Proteins: 25.5%
- Fibers: 23.6%
- Moisture: 4.7%
- Fat: 5.3%

It also contains essential minerals:

- Potassium (K): 0.66%
- Calcium (Ca): 0.20%
- Phosphorus (P): 0.16%
- Magnesium (Mg): 0.16%

The volatile oils of *Piper nigrum* are rich in:

- Terpenes (e.g.,  $\beta$ -caryophyllene, limonene)
- Nitrogen-containing compounds

These constituents contribute to its pungency, aroma, and therapeutic properties.<sup>12</sup>

### 3.2 PHARMACOLOGICAL ACTIVITIES

#### Antibacterial Activity

Solvent extracts, purified piperine, and piperic acid from *Piper nigrum* have demonstrated antibacterial activity. Tested against both Gram-positive and Gram-negative bacterial strains, the antimicrobial efficacy was assessed by:

- Zone of inhibition measurements
- Minimum Inhibitory Concentration (MIC) values

Active strains include:

- Gram-positive: *Bacillus subtilis*, *Enterococcus faecalis*, *Staphylococcus xylosus*, *S. aureus*, *S. epidermidis*
- Gram-negative: *Escherichia coli*, *Klebsiella pneumoniae*, *Salmonella enterica*

#### Antioxidant Activity

In vitro antioxidant evaluation was conducted on:

- Solvent extracts
- Piperine
- Piperic acid

These were compared against Butylated Hydroxytoluene (BHT) as a standard control. The compounds exhibited significant free radical scavenging activity, contributing to oxidative stress modulation.<sup>13</sup>

#### Analgesic activity

Analgesic activity was determined by placing the left hind paw of the rat on a plinth under a cone-shaped pusher of the Ugo Basile analgesy-meter. Maximum analgesic effect was achieved at a dose of 15 mg/kg after 120 min as compared to control and standard drug. Statistical calculation showed that *P. nigrum* L., possesses non-significant analgesic activity by thermal stimuli.<sup>14</sup>

#### Anti-inflammatory activity

Carrageenan induced paw edema method was used to detect the anti-inflammatory effect of piperine, hexane and ethanol extracts. The results indicate that piperine possesses inhibition of prostaglandin release mediated anti-inflammatory properties.<sup>15</sup>

#### Neuroprotective Activity

Gas Chromatography-Mass Spectrometry (GC-MS) analysis identified key bioactive molecules in *Piper nigrum* extracts. Neuroprotection was demonstrated through:

- Reduction in oxidative stress
- Restoration of mitochondrial membrane potential in neuronal cells

These findings suggest a potential therapeutic role in neurodegenerative conditions.<sup>15</sup>

**4. CONCLUSION :** Further clinical validation is essential . Future studies should focus on randomized controlled trials and molecular research to confirm traditional claims and expand therapeutic applications.

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How to cite this article:

Shuaib S et al. Ijsrm.Human, 2026; Vol. 29 (1): 52-56.

Conflict of Interest Statement: All authors have nothing else to disclose.

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