

# *Piper longum*: A concise review on Botany, Phytochemistry and Pharmacology

D.K. Pandey\*

Department of Biotechnology, Lovely Faculty of Technology and Sciences, Lovely Professional University, Phagwara-144411, Punjab, India.

## Abstract

Long pepper or Pippali (*Piper longum* Linn.L; family Piperaceae) is a very important medicinal plant. It is indigenous to South-India and Western Ghats of India, and is cultivated in hotter parts of India mainly Orissa, Kerala and Central to North Eastern Himalayas. It is being used from thousands of years in various traditional medicinal practices such as Ayurveda, Unani etc. *Piper longum* also shows various pharmacological activities such as antifungal, insecticidal, antimicrobial, antiamoebic, antidiabetic, antioxidant, anti-cancerous and effect on respiratory system. Current review deals with the Botany, phytochemistry and pharmacology of *P. longum*.

## Introduction

In traditional medicinal practices i.e Chinese traditional medicine, Ayurvedic medicine, Unani medicine wide number of plants are used for more than 3000 years. Almost all the medicinal plants bear therapeutic effects. Plant products have been used throughout history as parts of food, botanical potions, powders etc which gives varying success in curing and preventing diseases. Herbal medicines constitute a multi- billion-dollar business and continue to a major market in U.S pharmaceuticals. 1500 botanicals are approximately used as dietary supplements across the world.

Pippali is a powerful stimulant for both respiratory and digestive systems and showed a reviving effect on lungs. In Ayurveda, Pippali vardhmaan rasayana is very effective medicine in treatment of rheumatoid arthritis, chronic fever, malarial fever. Fruit and root plant parts are used to treat various diseases and infections. Pippali is used widely as expectorant, Asthma, nausea, diarrhea, possess hypoglycemic, medullary stimulant and cough suppressant effects. In fruits of *P.longum* scientific studies have identified the properties like anti-inflammatory, anti-fertility and anti-allergic. In roots only anti-fertility potential is reported (1)

Various chemical constituents are present in the *P.longum*. Among all the phytochemicals Piperine is the chief alkaloid (3-5%) on the dry weight basis. Fruit of long pepper consist large number of alkaloids and amides which is methyl piperine, along with iperonaline, piperettine, asarinine, piperlongumine, piperlonguminine, refractomide A. Lignans present are sesamin, fergasin and others. *P.longum* fruit contains esters such as tridecyl-dihydro-p-coumarate, eicosanyl-(E)-p-coumarate. Volatile oil of pepper is a complex mixture of caryophyllene, pentadecane and bisabolone. Essential oil shows insecticidal and insect repellent activities. (2).

**Botanical description of *Piper longum*:**

*Piper longum* plant is a dioecious slender, aromatic climber with perennial woody roots occurring in the hotter parts of India. Leaves are numerous wide ovate, cordate. The inflorescence is a cylindrical bearing pedunculate spike, male flowers are larger and slender as compared to female flowers, female flowers are up to 2.5 cm long and 4-5 mm wide. Fruits are long, shiny blackish green corn or spike like bodies. Male spikes are greenish- yellow in colour, fleshy, cylindrical, with minute flowers. Female spikes are erect and yellow, mature female spikes are known as long pepper and are shorter and thicker as compared to male spikes. Fruit spikes when ripe give aromatic odour and pungent taste(3).

**Distribution of *Piper longum*:**

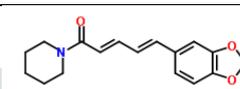
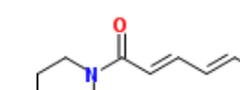
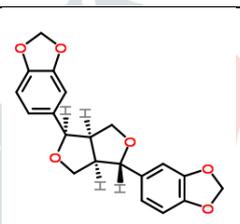
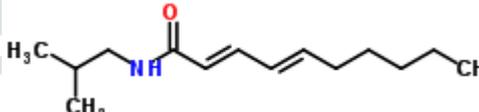
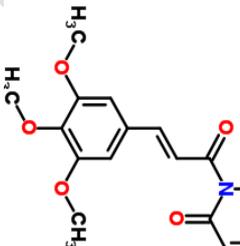
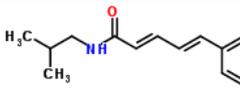
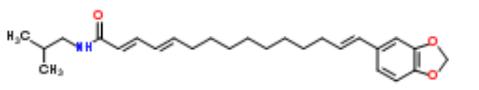
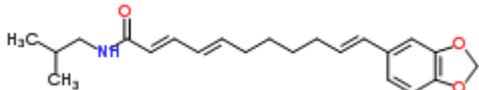
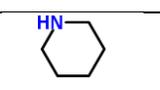
Many herbal based medicines are originated from India and they are known to cure different types of illness (Ravindran et.al.2016). It is an important medicinal plant used in traditional medicines in Asia and Pacific islands.(3). About 30 species of the genus have been reported in India and 700 species in the world (4). The herb grows wild in Malaysia, Singapore, Bhutan, and Myanmar regions. The plant is considered native to South-India and widespread in tropical regions (Zaveri et.al.2010). Plant is found throughout the hotter parts of India from Central to the North-Eastern Himalayas. In Odisha it is found in Koraput, Ganjam, Phulbani, Kalahandi, Khurda, Keonjhar, Mayurbhanj, Puri, Angul (5). *P.longum* is distributed throughout tropical and subtropical regions of the world. It is cultivated commercially in Assam, Karnataka, Maharashtra and Kerala. In North-eastern regions it is found from Khasi, Assam to Mikir hills of West Bengal and evergreen forests of Western Ghats of Kokan to Travancore (6). It is cultivated in Assam, Tamilnadu and Andhra Pradesh. *Piper longum* is cultivated in high rainfall areas with relative high humidity and in limestone soil on a large scale (7). *Piper longum* is successfully cultivated in mountain regions of Kerala (8).

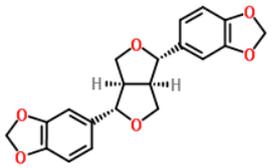
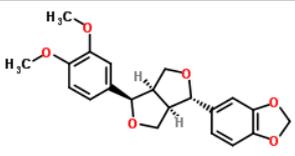
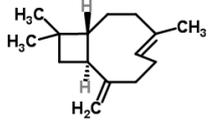
**Phytochemical constituents:**

Thorough studies and research is done on phytochemistry of plant parts such as roots, fruit of *P.longum* and immense number of bioactive compounds have been reported which are alkaloids, amides, lignans, esters and volatile oils. *P.longum* fruits contain large number of alkaloids which is Piperine along with methyl piperine, iperonaline, asarinine, pellitorine, piperlongumine, piperlonguminine, Brachystamide-A, pipericide and piperidine 9). Lignans present in *P.longum* are Sesamin, Fergesin (10).

Bio-active compounds present in *P.longum* are listed below with their respective structures:

**Table 2.** Phytochemistry of *Piper longum* (11)

Bio active compounds	Phytochemistry
Piperine	
Piperettine	
Asarinine	
Pellitorine	
Piperlongumine	
Piperlonguminine	
Brachystamide-A	
Pipericide	
Piperidine	

Lignans	
Sesamin	
Fargesin	
Caryophyllene	

## Ethnopharmacology

Rajanighantu describes four different types of *Pippali* viz. *Pippali*, *vanapippali*, *saimhali* and *gaja pippali*. Of these the first three are identified as *Piper longum* Linn., *Piper sylvaticum* Roxb., and *Piper retrofractum* Vahl. Respectively (5). *Piper longum* Linn. Is the main source of *Pippali* in Kerala. ‘*Trikatu*’ is a common herbal combination of *Piper longum* Linn., *Piper nigrum* Linn. and *Zingiber officinale* Rosc and its individual components are used widely in different Ayurvedic preparations (6).

Ayurveda maintains the principle “A sound mind in a sound body” and is a fundamental road to absolute health. Deep rooted vedic tradition of India is certainly the source of Ayurveda. Other than Ayurveda, many codified systems like sidha, Unani, Amchi etc use medicinal plants in pharmaceutical preparations. WHO evaluates that 65-85% of the world population is still choosing traditional medicines due to their high efficacy, easy availability and wide spread acceptability.

*Pippali* enhances the bioavailability of other drugs also. The biochemical basis of this enhanced drug bioavailability is through the interaction of the active ingredient piperine with enzymatic drug biotransforming reactions (Atal et al., 1981, 1984, 1985). *Vardhamana pippali* –therapeutic application of this drug in increased doss is an accepted treatment in respiratory disorders (Anus12).

Properties like Anti-inflammatory, Anti-spasmodic, Anti-fertility and hypotensive activity of different spp. Of *Piper* is reported (11).

The main chemical components of long pepper are alkaloids piperine, piperlongamine, N-isobutyldeca trans-2-trans-4 dienamide and a terpenoid substance. Piperine and piperlongamine are reported in fruits and roots.

## Pharmacology

### Antifungal activity:

Essential oil extracted from *Piper longum* showed fungicidal activity. Hexane fraction of *P.longum* used to isolate piperonaline, a piperadine alkaloid showed potent fungicidal activity at concentration of 0.25-0.5mg/ml against *Puccinia recondita*. Fruit derived material containing piperonaline was tested towards six phytopathogenic fungi (5).

### Insecticidal activity:

Essential oil derived from fruits of *Piper longum* showed insecticidal and insect-repellant activity. Piperonaline and piperocadecalinidone were figured out against five species of arthropod pests (Kokate CK et.al.1980).

### Antimicrobial activity:

Various extracts like fruit and root extracts were prepared assessed against bacterial pathogens like *Salix alba*, *Salmonella typhi*, *E.coli* and one fungus *Aspergillus niger*. In comparison with Streptomycin plant extract showed good antibacterial activity. Against all the tested bacteria n-Hexane extract and isolated constituents showed varying degree of antibacterial activity (12).

### Antiamoebic activity:

Methanol extract of *Piper longum* fruit act against *Entamoeba histolytica* infecting the caecum of mice were studied (Sawangjaroen N et.al.2004). The n-butanol soluble fraction, hexane fraction, ethanolic extract of both *P.longum* roots and fruit containing Piperine exhibit antiamoebic activity (13).

### Effect on respiratory system:

Piperine isolated from plant material was tested on laboratory animals such as Frogs, mice, rats and dogs as it showed central stimulant action. Respiratory stimulation was produced in smaller dose by petroleum ether extract of *Piper longum* but higher dose of extract cause convulsion in laboratory animals (7).

### Antidiabetic activity:

A study was conducted on rats suffering from alloxan-induced diabetes, anti-hyperglycemic and anti-lipidperoxidative effects of ethanolic fruit extract of *P.longum*. Dried fruit's oral application has shown antioxidant, anti-hyperglycemic, anti-lipidperoxidative effects (14).

### Antioxidant activity:

*Amrita bindu* is the combination of salts, spices (*Piper nigrum*, *Piper longum* and *zingiber officinale*) and herbs (*Cyperus rotundus* and *Plumbago zeylanca*) and this combination was tested for anti-oxidant activity (3).

### Anti cancer activity:

Significant anti-tubercular activity is reported to exhibited by *Piper longum*. A major alkaloid, piperine is present in *P.longum* which showed significant anti-metastasis activity (Pradee CR et.al.2002). Chemopreventive effects are also shown by piperine when it is administrated orally on the animals suffering from lung cancer. Cytotoxic activity is showed towards tumor cell lines by alkaloidal amides such as piplartine and piperine (15).

### Conclusion

Thus, Pippali is a powerful stimulant for both respiratory and digestive systems and showed a reviving effect on lungs and used in various ayurvedic and siddha formulations can be the effective drugs.

### References

- 1) Anand A, Rao CS (2000) A rapid in vitro propagation protocol for *Piper barberi* Gamble, a critically endangered plant. *In Vitro Cell Dev Biol* 36:61–64.
- 2) Balakoul I, Aruna K (1993) Evaluation of the liver protective potential of piperine an active principle of black and long peppers. *Planta Med* 59:413–419.
- 3) Ghosal S, Prasad BN, Lakshmi V (1996) Antiamoebic activity of *Piper longum* fruits against *Entamoeba histolytica* in *in vitro* and *in vivo*. *J Ethanopharmacol* 50:167–170
- 4) Gomez KA, Gomez AA (1984) Statistical procedures for agricultural research. Willey, New York .
- 5) Koul IB, Kapil A (1993) Evaluation of liver protective potential of Piperine, an active principle of black pepper and long pepper. *Planta Med* 59:413–417.
- 6) Mujumdar AM, Dhuley JN, Deshmukh VK, Raman PH, Naik SR (1990) Anti-inflammatory activity of piperine. *J Med Sci Biol* 43:95–100.
- 7) O’Brine TP, Fedder N, McCully ME (1964) Polychromatic staining of plant cell wall by toluidine blue O. *Protoplasma* 59:368–373.
- 8) Prasad AK, Kumar V, Arya P, Kumar S, Dabur R, Singh N, Chhillar AK, Ghosh B, Wengel J, Olsen CE, Parmar VS (2005) Investigations toward new lead compounds from medicinally important plants. *Pure Appl Chem* 77:25–40.
- 9) Saji KV, George J, Parthasarathy U, Parthasarathy VA (2007) Biodiversity of *Piper* in India. National Biodiversity Authority, Chennai.
- 10) Scott IM, Puniani E, Jensen H, Livesey JF, Poveda L, SanchezVindas P, Durst T, Arnason JT (2005) Analysis of Piperaceae germplasm by HPLC and LCMS: a method for isolating and identifying unsaturated amides from *Piper* spp extracts. *J Agric Food Chem* 53:1907–1913.
- 11) Mohapatra M, Basak. U. C(2015), Evaluation of Piperine Content from Roots of *Piper Longum* Linn., Originated from Different Sources with Comparison of Zonal Variation in Odisha, India. *International research of Pharma research &review*, 4(9):1-8.

- 12) Ahmed Nisar, Fazal Hina, Haider Abbasi Bilal H, Farooq Shahid, Ali Mohammed and Khan Ali Mubarak(2012), Biological role of *Piper nigrum* L. (Black pepper)- A review, Asian Pacific Journal of Tropical Biomedicine, 1945-1953.
- 13) Bao, Narisu, Ochir Sarangowa, Zhaorigetu Sun, Gereltu Borjihan, and Takashi Yamagishi(2014). Occurrence of piperidine alkaloids in Piper species collected in different areas, Journal of Natural Medicines, vol 68:1-11.
- 14) Yang, Jun, Yao Su, Ji-Feng Luo, Wei Gu, Hong-Mei Niu, Yan Li, Yue-Hu Wang, and Chun-Lin Long (2013). New amide alkaloids from Piper longum fruits", Natural Products and Bioprospecting, vol 3.6:277-281.
- 15) B. Bisht. "PHARMACOGNOSY OF 'PIPLAMUL' – THE ROOT AND STEM OF PIPER LONGUM LINN.", Planta Medica, 12/1963.

