Pippalimoola (Root of Piper longum. Linn)–An Overview of Classical Ayurvedic References and Advanced Pharmacological researches

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ABSTRACT
Pippalimoola - Piper longum Linn. (Root), is having enormous therapeutic properties and one of the essential ingredients in many formulations of Ayurvedic systems of medicines. The significance of the drug in Ayurveda can be revealed by the fact that Acharya Charak has included it in agryaushadhi (a list of 152 most important drugs) in chapter 25 of Charak samhita. As per Ayurveda the drug possesses Katu rasa (pungent taste), Laghu (light)-Ruksha (ununctous) guna, Ushna (hot) virya and Katu vipaka. Classically it is indicated in Krimirog (Worms), Shwas (breathing problem, or Asthma), Kshaya (Pulmonary tuberculosis), Pliharoga (Splenomegaly), Vishamjvara (Intermittent fever), Arsha (Piles), Urustambha (stiffness of thigh),vatavyadhi, Anindra (Insomnia) etc. Its main chemical constituents are piperine, pipilartine, triacontane, dihydro-stigmasterol, sesamin; methyl 3,4,5, trimethoxycinnamate, two alkaloids piperlongumine and piperlonguminine etc. Its anticancer, antioxidant, hepatoprotective, anti-microbial, anti-platelet, analgesic, anti-amoebic, anti-fertility, anti-diabetic, Melanin inhibiting activity are proven pharmacologically

KEYWORDS
Pippalimoola, Piper longum, Ayurveda
INTRODUCTION

*Pippalimoola* consists of dried root of *Piper longum* L. (Piperaceae) which is a slender, aromatic, climber with perennial woody roots occurring in hotter parts of India from Central Himalayas in Assam, Khasi and Mikir hills, Lower hills of Bengal and ever green forest of Western Ghats, from Konkan to Travancore, it has been recorded from Car Nicobar Islands.\(^1\)

In Ayurveda, *Pippalimoola* (root of *Piper longum* Linn; Piperaceae) is attributed *Dipaniya*(Appetizer) – *Pachaniya* (digestive) action and considered as main drug to relieve *Anaha*(Flatulence)\(^2\). The drug possesses *Katu rasa* (pungent taste); *Laghu* (Light), *Ruksha* (rough) and *Ushna* (hot) *guna* (properties); *Katu vipaka* (Specific digestion) and used in various disease conditions i.e. *Krimi* (Worm), *shwasa* (Breathing disorders like Asthma), *Kshaya* (Pulmonary tuberculosis), *Pliharoga* (Splenomegaly), *Vishamajvara* (Intermittent fever), *Arsha* (Piles), *Urastambha* (stiffness of thigh), *Vatavyadhi* (Nervous diseases), *Nidranasha* (Insomnia), etc.\(^3\)

The aim of this article is to highlight classical references and recent advances in pharmacology of *P. longum* root.

MATERIALS AND METHODS

The literature regarding *Pippalimoola* from Ayurvedic classics, texts of modern Pharmacology, Pharmacognosy, other relevant books, journals was reviewed; data was collected, analyzed and presented here systematically.

RESULTS AND DISCUSSION

**Plant Description**

*Piper longum* Linn. is a slender aromatic climber with perennial woody roots, stems creeping, jointed, young shoots downy, leaves 5-9 long,3-5cm wide, ovate, cordate with broad rounded lobes at base ,sub acute, entire, glabrous. Spikes cylindrical pedunculate, male larger and slender, female 1.3-2.5cm long and 4-5mm in diameter ,fruits ovoid, yellowish orange sunk in fleshy spike.\(^4\)

**Taxonomical classification.**

According to Benthem& Hooker (1862-1883)

*Kingdom : Plantae*

*Division : Spermatophyta*

*Subdivision : Angiospermae*

*Class : Dicotyledonae*

*Subclass : Apetalae*

*Series : Microembryae*

*Order : Piperales*

*Family : Piperaceae*
Genus: Piper
Species: Piper longum L.

**Ayurvedic classification**
In Ayurveda texts it is described as under
Charakasamhita: Dipaniya mahakashay, Shulprashaman mahakashay
Sushruta samhita: Pippalyadi varga,
Ashtang Hridaya: Vatsakadi gana,
Dhanvantari Nighantu: Shatpushpadi varga
Bhavprakash Nighantu: Haritakyadi varga
Shaligram Nighantu: Mishrak varga
Kaiyadev Nighantu: Aushadhi varga
Madanpal Nighantu: Shunthayadi varga
Raj Nighantu: Mishrakadi varga
Sodhal Nighantu: Shatpushpadi varga
Priya Nighantu: Pippalyadi varga

**Vernacular names**
Sanskrit: Pippalimula, Granthik, Kanamul, Usana, Chavikashira, Katugranthi, Sarvagranthik, etc.
English: Piper root.
Hindi: Pippalamula, Pipramul,
Gujarati: Ganthoda
Marathi: Pimplimula
Bengali: Pipulmul
Sindhi: Tippali
Malyali: Pippalimulam, Modikaddi.
Punjabi: Pipalamul
Telugu: Mode, Pippaliveru
Tamil: Thippaliveru.

Kannada:
Hippaliver, Hippaliver, Pippaliyveru
Arabian: Filfil-draj, Filfileymoya.
Magadhi: Pippalamula
Persian: Filfilidray, Pipal, Filfil-i-muyah
Sindhi: Filfilidray

**Ayurvedic properties**
*Rasa* Katu
*Guna:* Laghu, Ruksa
*Virya:* Usna
*Vipaka:* Katu

**Ayurvedic actions**
Dipana, Pacana, Krimighna, Anahprashaman, Shulprashaman, Vatanuloman, Gulmaghna, Ruchikar, Plihanut, Shwasahar, Kasahar, Kshayhar, Bhedan, Udarroghar

**Chemical constituents**

**Indications in ayurveda**
Krimiroga (Worm infestation), Shwasa (Breathing disorders like Asthma), Kshaya (Pulmonary TB), Pliharoga (Spleenomegaly), Vishamjvara (Intermittent
fever) *Anaha* (heaviness of abdomen), *Gulma* (flatulence) *Arsha* (Piles) *Anidra* (insomnia) etc.  

**Therapeutic uses:** In Ayurveda classics it is prescribed for many diseases as

In *krimi* (Worms): *Pippalimoola* Powder recommended with goat’s urine.

In *Anidra* (Insomnia): *Pippalimoola* Powder is prescribed to be taken with jaggery followed by buffalo’s milk.

In *Arsha* (Piles): Buttermilk kept in a vessel anointed internally with the paste of *Pippali*, *Pippalimoola*, *Chavya*, *Citraka*, *Vidang*, *Sunthi* and *Haritaki* is considered to be wholesome.

*Vishamajvara* (Intermittent Fever): *Pippalimoola* Powder given with ghee and honey followed by cow’s boiled milk is claimed to cure *hridroga* and *visam jvara*.

In *hridroga* (Heart Disease): It is recommended with cow’s milk.

In *Urustambha* (Stiffness of Thigh): Decoction of *Pippali*, *Pippalimoola* and *Bhallatak* is prescribed with honey.

As Galactogogue: Milk mixed with *Marich* and *Pippalimoola* Powder acts as galactogogue.

In *Arsha* (Piles): *Pippalimoola* Powder has been prescribed in gradually increasing dose with buttermilk to patient for one month with restriction of other food.

**Pharmacological action**

**Anticancer activity**

The effect of piperine on the inhibition of lung metastasis induced by B16F-10 melanoma cells was studied in C57BL/6 mice. Simultaneous administration of the compound with tumor induction produced a significant reduction (95.2%) in tumor nodule formation. Increased lung collagen hydroxyproline (22.37 microg/mg protein) in the metastasized lungs of the control animals compared to normal animals (0.95 microg/mg protein) was significantly reduced (2.59 microg/mg protein) in the piperine-treated animals. The high amount of uronic acid (355.83 microg/100 mg tissue) in the metastasized control animals was significantly reduced (65 microg/100 mg tissue) in the animals treated with piperine. The elevated levels of serum sialic acid and serum gamma glutamyltranspeptidase activity in the untreated control animals was significantly reduced in the animals treated with piperine. The elevated levels of serum sialic acid and serum gamma glutamyltranspeptidase activity in the untreated control animals was significantly reduced in the animals treated with piperine. The piperine-treated animals even survived the experiment (90 days) and results of the study demonstrated the
antimetastatic activity of piperine, an alkaloid present in plant *Piper longum*.\(^3\)

**Antioxidant activity**

In a study, Petroleum ether extract of the root and piperine from roots of *P. longum* Linn was found to decrease lipid peroxide levels and maintain glutathione content, demonstrating antioxidant activity.\(^3\)

**Hepatoprotective activity**

In an *in vitro* and *in vivo* study, piperine was found to protect against tertiary butyl hydroperoxide-induced and carbon tetrachloride-induced hepatotoxicity by reducing lipid peroxidation. Thus Piperine showed a hepatoprotective potency.\(^3\)

**Antimicrobial activity**

Antimicrobial and antifungal screening were performed with petroleum ether, ethyl acetate, chloroform and methanol extracts of root of *Piper longum* against 13 pathogenic bacteria (5 gram-positive and 8 gram-negative) and 6 fungi by the standard disc diffusion method. Standard antibiotic discs of Kanamycin and Clotrimazole were used for comparison in antibacterial and antifungal tests. Ethyl acetate extract exhibited activity against gram-negative *Klebsiella species* and also showed excellent activity against gram-positive *Sarcinulatea* and gram-negative *Shigellasonnei* whereas methanol extract showed strong activity against gram-negative *Shigella* thus ethyl acetate extracts of *P. longum* root were found to exert antimicrobial effects against various microorganisms.\(^3\)

**Antiplatelet activity**

In another study the inhibitory effects of the four acid amides piperine, pipernonaline, piperoctadecalidine, and piperlongumine, isolated from the fruits and roots of *P. longum* L. were evaluated on washed rabbit platelet aggregation and all of the four tested acid amides dose-dependently inhibited washed platelet aggregation induced by collagen, arachidonic acid, and platelet-activating factor, but not that induced by thrombin.\(^3\)

**Analgesic activity**

The aqueous suspension of *P. longum* root powder (200, 400, and 800 mg/kg) was given orally to mice and rat to evaluate its analgesic effects. The delay in reaction time to thermal stimulus was assessed in rats, and the amount of writhing to chemical stimulus was assessed in mice. The effects of the 400 and 800 mg/kg doses of *P. longum* were similar to that of nonsteroidal anti-inflammatory drugs \((p < 0.001)\). Both ibuprofen (40 mg/kg) and *P. longum* (800 mg/kg)
demonstrated 50% protection against writhing. The delay in reaction time to thermal stimulus was < 6% for different doses of *P. longum* as compared with 100% for pentazocine. Thus indicated that the plant root produces a weak opioid-type but potent non steroidal anti-inflammatory drug-type of analgesia.\(^{36}\)

**Melanin-inhibiting activity**

Piperlonguminine from *P. longum* inhibited melanin production in melanoma B16 cells stimulated with snocyte-stimulating hormone, 3-isobutyl-1-methylxanthine, or protoporphyrin IX, where the compound exhibited stronger depigmenting efficacy. This effect was attributed to the inhibitory action of piperlonguminine on alpha-melanocyte stimulating hormone signaling through cAMP to the cAMP-responsive element binding protein, which in turn regulates the expression of the microphthalmia associated transcription factor, a key activator of tyrosinase expression. Thus the enzyme inhibited internally, thereby suppressing the production of melanin.\(^{37}\)

**Ant amoebic activity**

The fruits were tested for their efficacy against *Entamoeba histolytica* *in vitro* and against experimental cecal amebiasis *in vivo*. The ethanol extract and isolated piperine improved cecal amebiasis by 90% and 40%, respectively, in rats.\(^{38}\)

**Bioavailability enhancer activity**

Piperine has shown to enhance the bioavailability of structurally and therapeutically diverse drugs and also has been reported to enhance the oral bioavailability of phenytoin in humans.\(^{39-41}\)

**Antifertility activity**

*P. longum* and *E. ribes* seeds administered on days 4 to 7 and 6 to 9 of pregnancy showed 100% antifertility activity in female albino rat.\(^{42}\)

**Anti-diabetec activity**

In a study to assess the antidiabetic activity of phytoconstituents from root of *Piper longum* using model of alloxan induced diabetec mice, ethanol extract root powder was proved as a potential Ayurvedic anti-diabetic drug.\(^{43}\)

**Therapeutic Dose of Pippalimoola**

Powder-0.5-1.0 gm.\(^{44}\)

**Classical Ayurvedic Preparations**

In various Ayurvedic classics many formulations of *Pippalimoola* are quoted. Bharat Bhaishyja Ratnakar\(^ {45}\) has reported about 465 formulations which contain *Pippalimoola*. Some important formulations are Abhayamodak, Agatsyaharitaki, Chandraprabha vati, Changeri ghrita, Dashmula kwath, Kalyanaka ghrita,
Kumaryasava, Panchkol churna, Punarnava mandura, Sudarshan churna, Talishadi churna, Yograj Guggulu etc.

**CONCLUSION**

Numerous references of *Pippalimoola i.e. P. longum* Linn(root) found in Ayurvedic literature right from the time of Charak up to the latest nighantus prove its utility in therapeutics especially in gastrointestinal and respiratory system diseases. Further Pharmacological researches have proved its anticancer, antioxidant, hepatoprotective, anti-microbial, antiplatelet, analgesic, anti-amoebic, anti-fertility, anti-diabetic, Melanin inhibiting activity and bioavailability enhancer action. The drug being easily available, inexpensive, backed by years of therapeutic use by indigenous system of medicine has immense potential for therapeutics as well as further researches.
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