

# Review on Phytochemical and Pharmacological Investigation of *Piper chaba* Hunter.

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**Abstract-** *Piper chaba* is commonly known as “choi” in Bangladesh and belongs to Piperaceae family. The review is conducted in the species considering all essential aspects namely, phytochemical and pharmacological activities. Isoflavanons and alkaloids are the main phytochemical constituents and anti-oxidant, anti-microbial, anti-inflammatory, cytotoxic activity and hypolipidemic effects are the main pharmacological activities of *Piper chaba* Hunter.

**Index Terms—** *Piper chaba* Hunter, Isoflavanons, Alkaloids, Antioxidant activity, Anti-microbial activity and Cytotoxic activity, Anti-inflammatory activity.

## 1 INTRODUCTION

**P**iper *chaba* Hunter is a hairless, smooth, scrambling shrub available in India (Tripura, West Bengal), Bangladesh (Khulna-Jessore), Malay Islands and other warmer regions of Asia including Malaysia, Indonesia, Singapore and Sri Lanka [1]. This plant is known as Java long pepper or choi [2], it is used as spices in meat, fish and mutton curry and other famous dishes. The spicy pungent flavor of Choi Jhal is a year-round additive spice. The plant has many more medicinal values in a wide variety of diseases including asthma, bronchitis, piles, colic pain, dyspepsia and gastralgia [3, 4]. The arial part of this plant has also exhibited anti-diarrhoeal, antibacterial, anti-hypertensive, carminative, diuretic, stimulant, expectorant, analgesic and smooth muscle relaxant properties [5, 6, 7, 8]. Stem bark of the plant gave a significant anti-inflammatory effect in rat model [9]. Previous phytochemical review of stem bark of *Piper chaba* had unveiled the presence of Lignan [10] and alkaloids such as piperamine-2, 4-decadienoic acid piperidide, kusunokinin and pellitorine [11].  $\beta$ -Caryophyllene, caryophyllene oxide and few monoterpene hydrocarbons, a moderate content of sesquiterpenes and high quantity of aliphatic hydrocarbons have been obtained in the fruit oil of the plant [12]. A unique piperine dimer Chabamide has also been separated from stem bark of the plant [13]. It has the major alkaloid which has shown to have antimycobacterial activity [14] and several pharmacological activities such as antihyperlipidemic [15], antiandrogenic [16], immunoregulatory [17], antidepressant [18]. The fruits of *Piper chaba* are applied as a gastro-protective, anti-flatulent, appetizing property, as an expectorant, anti-fungal agent, anti-tussive and also possesses cholesterol lowering properties [19]. Ethanolic fruit juice of *Piper chaba* has also been shown to possess erythropoietic effects [20], Central nervous system depressant and anxiolytic effects [21]. Stem is used to reduce post-delivery pain in mothers and also fruitful in rheumatic pains and diarrhea [22]. Piperine has also been shown to have certain serious toxicities such as antifertility [23], respiratory paralysis, hemorrhagic necrosis and edema in gastrointestinal tract, urinary bladder and adrenal glands [24] and

immunotoxicological effects [25]. The urging for more drug candidates from this kind of natural sources are continuously increasing day by day. Therefore, it is necessary for a regular analysis of these plants for using in the herbal medicine in different illness.

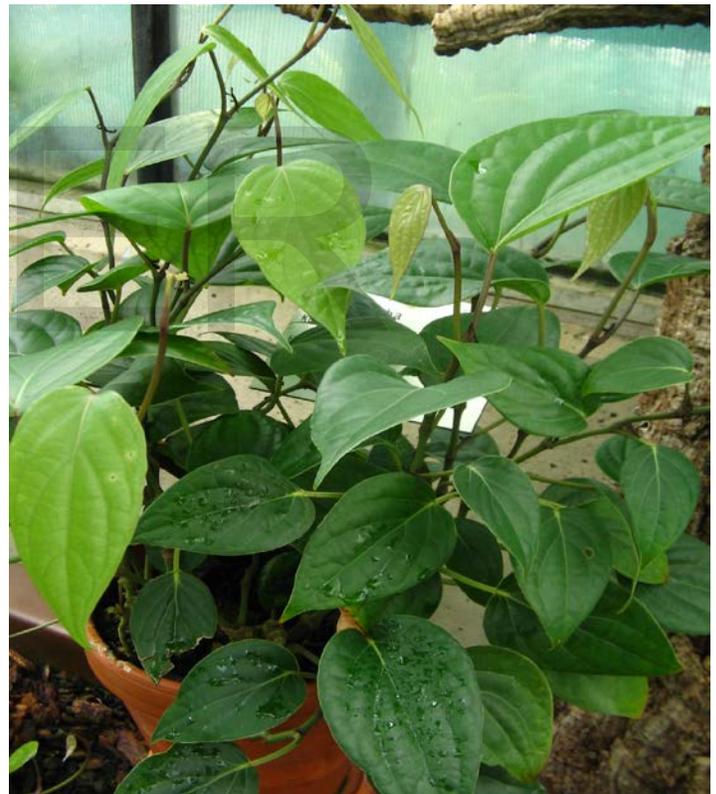


Figure 1: The Plant of *Piper chaba* Hunter.

### 1.1 Description of the plant

*Piper chaba* Hunter is a creeper plant that spreads on the ground. It may also grow around large trees. The leaves are oval-shaped and about 2 to 3 inches long. The flowers are monoecious and blossom during the monsoon. The fruit looks similar to other varieties of long pepper, with an elongated shape that can grow up to 3 inches long. The fruit is red when ripe, which turns dark brown or black when dry.

### 1.2 Vernacular names

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This plant has the different names in the different countries like in Bengoli: Choi Jhal or Chui Jhal (Khulna-Jessore region of Bangladesh, Tripura-West Bengal region of India), English: Java long pepper, Hindi: Chaba and Thai: Dee Plee.

### 1.3 Tribal Name

The name of this plant is also differing tribe to tribe. For example, Soononbom, Kasopai (Marma), Su Sang Sak (Tanchamgya), Ranga chuma (Chakma), Se-ankanlingpo (Khumi) (Figure 1).

### 1.4 Taxonomical Classification

Kingdom : Plantae  
Phylum : Magnoliophyta  
Class : Eudicots  
Order : Piperales  
Family : Piperaceae  
Genus : *Piper*  
Species : *Piper chaba* Hunter.

## 2 PHYTOCHEMICAL CONSTITUENTS

A review of the literature reveals that the presence of a variety of chemical constituents in the different parts of the *Piper chaba* are isoflavanons such as 5, 8-dihydroxy-6, 7-dimethyl isoflavan-4-one and 5, 6-dihydroxy-7, 8-dimethyl isoflavan-4-one have been isolated from the stem of *Piper chaba* Hunter [26]. Kusunokinin and pellitorine have been isolated from the stem bark of the plant [11].  $\beta$ -Caryophyllene and caryophyllene oxide have been obtained in the fruit oil of the plant [12]. Piperine, pipernonaline, guineensine, and the isobutylamide of 11-(3, 4-methylenedioxyphenyl) undeca-2, 4, 10-trienoic acid have been obtained from the extract of the flowering plant *Piper chaba* Hunter [27, 28]. Two new dimeric alkaloids, chabamide F and chabamide G, containing pyrrolidine rings, were isolated from the roots of *piper chaba* Hunter (Figure 2) [29].

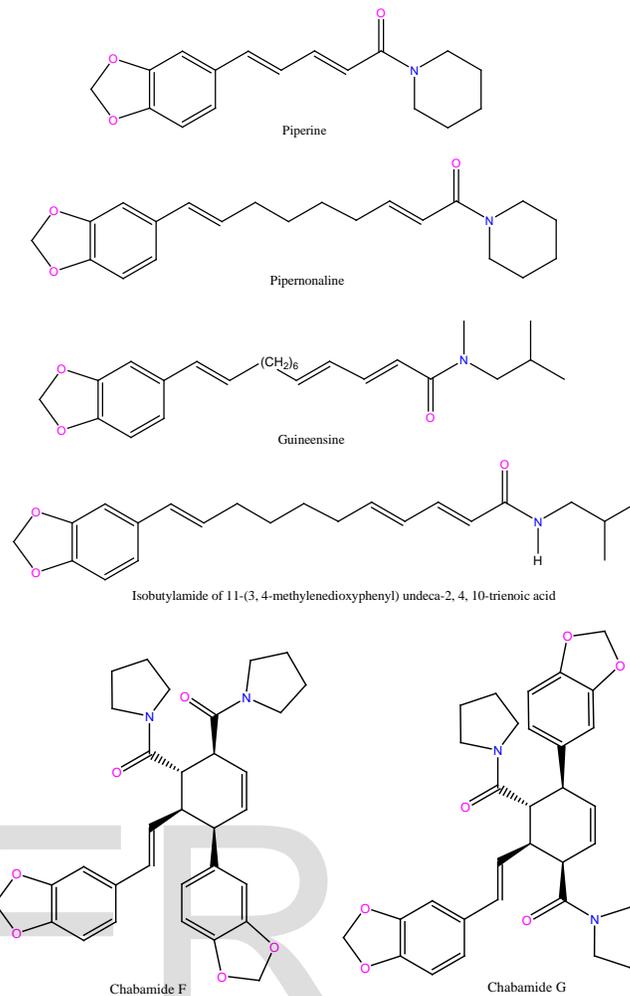
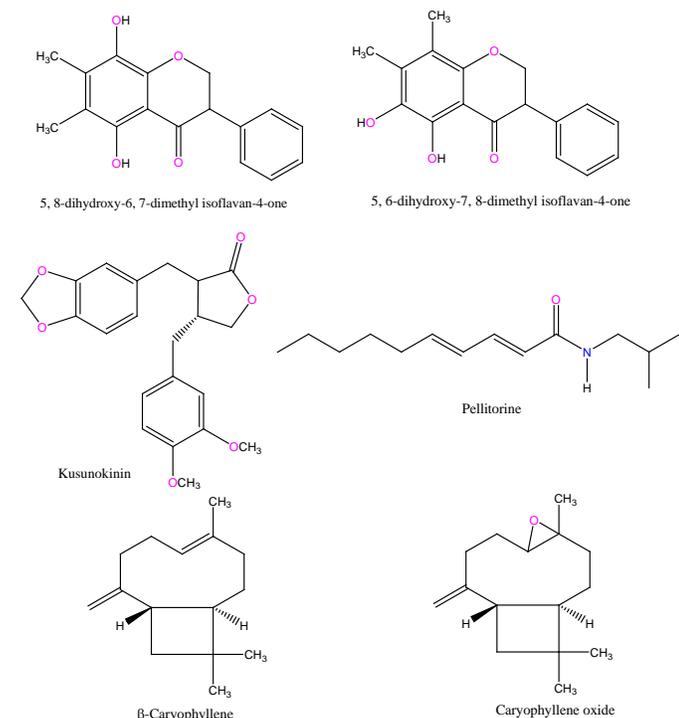


Figure 2: Phytochemical Constituents of *Piper chaba* Hunter



## 3 PHARMACOLOGICAL ACTIVITIES

### 3.1 Antioxidant activity

An antioxidant is a molecule that hinders the oxidation of other molecules. Oxidation is a chemical reaction involving the loss of electrons which can produce free radicals. In turn these radicals can start chain reactions. When the chain reaction occurs in a cell, it can cause damage or death to the cell. Antioxidants terminate these chain reactions by removing free radical intermediates and inhibit other oxidation reactions. These are widely used in dietary supplements and the prevention of diseases such as cancer, coronary heart disease, Alzheimer's disease, cataracts, Rheumatoid arthritis and even altitude sickness [30]. Industrial uses of antioxidants are as preservatives in food and cosmetics and to prevent the degradation of rubber and gasoline [31]. In this plant, isoflavanons and alkaloids are the antioxidant compounds. The  $IC_{50}$  value of DPPH free radical scavenging activity of pure piperine is 5.14  $\mu$ g/ml.

### 3.2 Antimicrobial activity

Bacteria and fungi are responsible for many infectious diseases. The increasing clinical implications of drug resistant fungal and bacterial pathogens have lent additional urgency to antimicrobial drug research. The antimicrobial screening which is

the first stage of antimicrobial drug research is performed to ascertain the susceptibility of various fungi and bacteria to any agent. This experiment measures the ability of each test sample to inhibit the *in vitro* fungal and bacterial growth. Antibacterial and antifungal properties of petroleum ether, chloroform, ethyl acetate and methanol extracts of *Piper chaba* (Choi) roots were studied by disc diffusion method and these activities were compared with primary standard drugs Kanamycin and Nystatin, respectively. The extracts were found to exhibit promising antibacterial and antifungal properties against Gram-positive, Gram-negative bacteria and fungi [32]. Here the antimicrobial activity of crude *n*-hexane, methanol and ethanol extracts of *Piper chaba* stem were done against Gram-positive, Gram-negative bacteria, fungi and standard drugs Kanamycin (Table 1).

**Table 1:** Antimicrobial activity of crude extracts of *Piper chaba*

Test bacteria and fungi	<i>n</i> -hexane extract	metanol extract	ethanol extract	kanamycin
	300 (µg/disc)			30 (µg/disc)
<b>Gram-positive bacteria</b>				
<i>Bacillus cereus</i>	-	6.5	6.5	32
<i>Bacillus megaterium</i>	-	-	6.5	32
<i>Bacillus subtilis</i>	14	-	-	33
<i>Staphylococcus aureus</i>	13	14	13	33
<i>Sarcina lutea</i>	12	-	-	33
<b>Gram-negative bacteria</b>				
<i>Escherichia coli</i>	12	12	10	33
<i>Salmonella paratyphi</i>	10	-	-	33
<i>Salmonella typhi</i>	12	-	7	33
<i>Shigella boydii</i>	-	-	-	33
<i>Shigella dysenteriae</i>	12	-	-	33
<i>Vibrio mimicus</i>	13	-	-	32
<i>Pseudomonas aeruginosa</i>	6.5	7	7	33
<b>Fungi</b>				
<i>Candida albicans</i>	13	-	-	32
<i>Aspergillus niger</i>	10	18	11	32
<i>Sacharomyces cerevaca</i>	13	-	-	32

“-“ Indicates ‘No activity’.

### 3.3 Anti-inflammatory activity

The anti-inflammatory activity was reviewed in rats by injecting 0.1ml of 1.1 % carrageenan suspension into the planter surface, where oedema of the rat's hind paw was utilized as an index of acute inflammation. Ethanol extract of *Piper chaba* stem bark given orally 1 hour before injection at doses of 120 and 240 mg/kg body weight, produced significant anti-inflammatory effect compared to control and the percentage of inhibition of oedema formation was 32% and 34% respectively, which however was less compared to aspirin (45%) and hydrocortisone (55%). The result indicates that in case of acute inflammation, *Piper chaba* stem bark possess mild to moderate anti-inflammatory effect compared to that of aspirin and hydrocortisone [33].

### 3.4 Cytotoxic activity

Cytotoxicity is the quality of being toxic to cells. Examples of toxic agents are an immune cell or some types of venom, e.g. from the puff adder (*Bitis arietans*) or brown recluse spider. It can also be monitored using the 3-(4, 5-Dimethyl-2-thiazolyl)-2, 5-diphenyl-2H-tetrazolium bromide (MTT) or with 2,3-bis-(2-methoxy-4-nitro-5-sulfophenyl)-2H-tetrazolium-5-carboxanilide (XTT), which yields a water-soluble product. A similar redox-based assay has also been developed using the fluorescent dye, resazurin. In addition to using dyes to indicate the redox potential of cells in order to monitor their viability, researchers have developed assays that use ATP content as a marker of viability [34]. The extracts of *Piper chaba* were also reviewed for their cytotoxic activities by brine shrimp lethality bioassay, where gallic acid was used as primary standard. It was observed that the petroleum ether extract was potent cytotoxic with the LC<sub>50</sub> value of 0.97 µg/ml against *Artemia salina* (L). This result suggests the use of *Piper chaba* as anthelmintic in traditional medicine [32].

### 3.5 Hypolipidemic effects

Hypolipidemic agents, or antihyperlipidemic agents, are a diverse group of pharmaceuticals that are used in the treatment of high levels of fats (lipids), such as cholesterol, in the blood (hyperlipidemia). They are called lipid-lowering drugs. The study was conducted on albino rabbits weighing 1000 gms-1500 gms. The animals were directed ethanolic extract of *Piper chaba* 160 mg/kg which was further diluted in dimethyl sulfoxide (DMSO) and dose was adjusted in ml based on weight of animals. After 7 days dosing animal's blood was drawn and assessed for Cholesterol, HDL and LDL. The study indicated that Ethanolic extract of *Piper chaba* possess significant hypolipidemic effects and lowers cholesterol and LDL levels while shows significant effect on HDL levels [35].

## 4 CONCLUSION

*Piper chaba* Hunter has been treating different kind of diseases and it has a great number of herbal uses specially the antimicrobial and antioxidant active results of these kinds of compounds exhibited good to excellent. Unexpurgated repository references have been provided in the text in relation to the comprehensive overview on *Piper chaba* with an objective to

update researchers with proper information for its effective research for human benefit.

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