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The study of identification, collection, and authentication of fruits of *Piper cubeba*

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Abstract
Although there is hope for *Piper cubeba*'s pharmacological properties, further research into its toxicity profile must proceed with caution. To determine the safety levels of *Piper cubeba* extracts, cytotoxicity tests are required. These studies evaluate the effects on cell cultures. Understanding how different concentrations affect cells may help establish safe dosage limits.

Keywords: *Piper cubeba*, Java, botanical

Introductions

In conclusion, *Piper cubeba* is an interesting plant with many potential medical and pharmacological uses. In addition to its analgesic and respiratory health benefits, this plant also contains antibacterial and anti-inflammatory properties, which have piqued the attention of researchers and practitioners of traditional medicine. The safety of *Piper cubeba* must be ensured, however, by conducting a thorough assessment of its toxicity. A well-rounded and informed approach to using the benefits of *Piper cubeba* while minimizing any potential downsides is crucial, especially in light of the continuing developments in this field of research. To successfully incorporate it into natural medicine, this is crucial. *Piper cubeba* is difficult to understand because of the complex interplay between its pharmacological and toxicological properties. As researchers delve further into the complicated biochemical mechanisms that underlie its effects, a myriad of potential therapeutic benefits and associated risks begin to emerge.

Preliminary studies on *Piper cubeba*'s antimicrobial properties have shown that it may be useful as a natural remedy for infections caused by bacteria and fungus. New avenues for research have opened up with the identification of specific compounds, including cubebin and cubebic acid that confer its antibacterial effects. The complex mechanisms by which these compounds interact with the structures and activities of microbes provide the groundwork for the development of new antimicrobials.

We now know more about *Piper cubeba*'s potential to modulate inflammatory pathways thanks to studies on its anti-inflammatory qualities. New anti-inflammatory medicines may be possible because to the intricate web of relationships between plant bioactive compounds and cellular signalling cascades. When considering natural treatments with little adverse effects for chronic inflammatory illnesses, this quality becomes very important. Further expanding its potential medical uses are the antioxidant characteristics of *Piper cubeba*, which are associated with its anti-inflammatory effects. By isolating the plant's antioxidant compounds, we can learn more about its biological role and broaden our study of natural antioxidants for use in preventative medicine.

Literature Review

Ngbolua, Koto-Te-Nyiwa (2023) [1]. The majority of the approximately 2000 species in the Piper genus are found on the African and Asian continents. There are over 40 species mentioned in books and articles, but very few of them have really been studied. This study endeavours to elucidate the chemical make-up, physiological impacts, and traditional use of many species of Piper. Many databases were consulted throughout the search process, including PubMed, PubMed Central, Science Direct, DOAJ, and others. A literature search was conducted using terms like "Piper," scientific names of several species of Piper, and ideas related to these names, such as biological activity, phytochemistry, and uses. The result the economic worth of species in the Piper genus is high because of their adaptability to many uses, including in food production, traditional medicine, the treatment of certain infectious diseases, agricultural pest management, and pharmaceuticals. Some plant species are known to have an abundance of essential oils. The majority of the 400+ chemical compounds derived by Piper species are alkaloids, a kind of secondary metabolites. The well-documented active alkaloid among them is piperine. In addition, studies have shown that these species have biochemical properties that make them useful in fighting inflammation, infections, tumours, larvicidal infections, amoebicides, viruses, and more. Members of the Piper genus are as useful as they are aromatic as they are therapeutic, treating a wide range of conditions. To confirm the usefulness of the less researched species of Piper, nevertheless, further study is required. In addition to exploring possible synergies between alkaloids and other chemical groups, this study should aim to provide information on the pharmacokinetics and action mechanisms of the beneficial molecules. The toxicity and digestibility of these species' extracts should also be evaluated.

Drissi, Badreddine *et al*. (2022) [2] The traditional herbal remedy *Piper cubeba* L.f. (Piperaceae), more often known as cubeb, is useful for a variety of ailments, particularly those involving the digestive and respiratory systems. The abundance of essential oil in the plant, particularly in its fruits, makes it economically valuable. The antioxidant, antibacterial, anti-inflammatory, and anticancer characteristics of the plant and its constituents have been validated by scientific research, lending credence to its traditional uses. Phytochemicals, which include phenolic compounds, alkaloids, essential oil, and lignans, are thought to be responsible for the plant's biological activity. This study aims to update our understanding of the plant's historical use, chemical composition, and medicinal potential. Greater understandings of its nutritional and health benefits, as well as potential avenues for its use, are also covered.

Biswas, Protha& Ghorai, Mimosa & Mishra, Tulika (2022) [3] "Pippali" and "long-pepper" are common names for the perennial shrub or herbaceous vine *Piper longum*, which belongs to the family Piperaceae. This species has spread from its original Indo-Malayan habitat to every tropical and subtropical area on Earth, including the Americas, the Middle East, Sri Lanka, the Indian subcontinent, and Sri Lanka. The majority of the fruits' culinary use are as condiments or preservers. Traditional medicine relies heavily on its powerful medicinal properties to treat a broad variety of illnesses, such as bronchitis, cough, cold, snakebite, and scorpion sting. As a form of contraception, they are also used. Among the bioactive phytochemicals discovered in the plant extracts were steroids, esters, alkaloids, and flavonoids. Some of the many positive health effects of the plant's essential oils include: protecting the liver from damage, lowering cholesterol, reducing inflammation and pain, decreasing blood sugar levels, improving immune function, easing asthma attacks, protecting the heart from snake venom, and many more. These effects are due to the plant's roots and fruits, not its seeds or pods. The chemical was believed to have pharmacological properties such as antioxidant and anti-inflammatory actions and the capacity to alter various signalling pathways and enzymes. This study takes a close look of *P. longum*'s pharmacology, ethnobotany, phytochemistry, and habit. The objective is to back the long-standing belief in its therapeutic usefulness and health benefits with actual data from thorough scientific research. Included as well are clinical trials using the plant, investigations into its toxicity and safety, and research pertaining to green synthesis and nano-technology. Additionally, some unanswered questions and possible applications for the future are highlighted.

Dwita, Lusi & Iwo, M. &Mauludin, R. (2022) [4] *Piper cubeba* has a large diversity of lignans. These chemicals have antioxidant properties that could be useful in medicine, especially in the brain where they prevent neuronal damage. Research in rats examined the antioxidant effects of a *P. cubeba* fraction (LF) high in lignan. Vitamin C (200 mg/kg), LF (200 and 400 mg/kg), and a carrier were administered to the rats for a week. A control group was also included. We measured nitric oxide (NO) level, superoxide dismutase (SOD) and catalase (CAT) activity, and lipid peroxide inhibition in the rats' brains the next day as part of our antioxidant experiments. Gas chromatography-mass spectrometry (GC-MS), thin-layer chromatography (TLC), and ultra-high performance liquid chromatography-tandem mass spectrometry (UPLC-MS) were used for the analysis of the phytochemical components. Findings show that 200 and 400 mg/kg dosages considerably enhance brain antioxidant activity by reducing lipid peroxidation. In addition to decreasing superoxide dismutase activity, LF may raise catalase levels. Despite decreased NO levels in the LF-200 group, the LF-400 group was not as impressive as the control group. Ultimately, LF showed promising antioxidant properties in the brain, suggesting the chemical could have medicinal potential in treating neurological disorders.

Kumar, Pradeep (2021) [5] there has always been an emphasis on plants in studies looking for novel medicinal uses. Traditional medicine has made extensive use of medicinal herbs since ancient times. Phytochemicals, which are bioactive components found in medicinal plants, are the backbone of traditional herbal therapy. These medications are highly esteemed in modern medicine because of their all-natural composition, which renders them safer and more successful in treating a wide range of disorders with little side effects. Medicinal applications for secondary metabolites include tannins, saponins, alkaloids, flavonoids, and phenolics. As a result, several plants with medicinal properties for various diseases were found. *Piper cubeba*, more often known as Kabab Chini, is a tropical medicinal plant that grows wild in several countries, including Indonesia. The medicinal plant *Piper cubeba* includes a wide variety of compounds. There is evidence that it can fight against leishmania, inflammation, cancer, hepatotoxicity, and kidney damage. The purpose of this literature review is to highlight the many biological activities shown by the phytochemicals and pharmacological properties of *Piper cubeba*.

Medicinal plant *piper cubeba* L.

Cubeb pepper, Java pepper, and Kabbab Chini are all names for the same flowering plant, *Piper cubeba* L. It belongs to the Piperaceae family and the genus Piper. The plant is primarily grown for its fruit and volatile oil. The two biggest genera, Piper and Peperomia, each include more than a thousand species. In the Asia and Pacific area, around 30 species of Piper have medicinal qualities. More than 700 species of the medicinal plant *Piper cubeba* grow in tropical and subtropical regions around the globe. The Javanese and Sumatran provinces are the most common places to see this species under cultivation, and it is quite variable. Some people in India have tried growing it, although not for profit, in a region of Karnataka called Mysore. The distinctive feature of the vine-like *Piper cubeba* plant is its cylindrical, smooth, and zigzag stem. The transverse stripes and somewhat bigger nodes give the stem its distinctive appearance. Whether you're looking for shrubs, climbing herbs, or trees, you'll find tropical plants all over the globe, from Asia to the Pacific islands to South and Central America. *Piper cubeba* may be found on a variety of islands in the Indian Ocean, including the Moluccas, Java, Sumatra, and southern Borneo. Java and Sumatra are the primary locations for growing this pepper, which is why it is often referred to as "Java pepper." Nonetheless, this kind of pepper is also exported by a number of African countries.

Some West Indian islands are known to cultivate it. Native to Indonesia, the *Piper cubeba* is a beautiful plant. There have been informal, non-commercial efforts to cultivate it in India, mostly in the Mysore region. Cubes may be cultivated easily on coffee farms by putting them beneath shade trees. While still green, the product is picked when fully ripe, and then sun-dried until it looks black and shrivelled. The tiny, wrinkled, spherical fruits of the *Piper cubeba* tree are around 7 to 10 millimetres in diameter. Seated on a 7 mm stem, they exhibit a spectrum of brown tones. As a result of its fusion with the testis, the fruit's pericarp-its outer layer-is a shade of reddish-brown. The fruits have a rough, rocky feel, are white in colour, and are hard. They have a pungent, bitter flavour and are famous for their aromatic appearance. Pradeep Kumar use piper for a wide range of purposes, such as seasoning, culinary uses, pesticides, fish attractants, hallucinogens, essential oils, aromas, jewellery, and medicinal purposes. Western medicine may have initially made use of *Piper cubeba* in the middle Ages. *Piper cubeba* is a popular remedy among Indonesian traditional healers for a variety of gastrointestinal problems, such as dysentery, gonorrhoea, syphilis, diarrhoea, asthma, enteritis, and stomach pain.

Morphological and geographical description

One of the families that include *P. cubeba* is Piperaceae. Despite its global distribution, this plant is particularly common in North Africa, mediaeval Europe, India, and Indonesia. Cubeb is a lignified material that looks like a perennial plant with ashy-grey stems and climbing branches. Five to fifteen metres is the height range. The base of the oval leaves is either cordate or rounded. They have a pointy end, are sleek, and uncomplicated. On the underside of each leaf, you'll find a number of little glands. The long-lived, fully-margined leaves may grow up to 15 cm in length and 6 cm in width. The tiny, compact flowers are attached to the peduncles; they are arranged in scaly spikes that are 4 cm long and have 2-3 stamens. There are about fifty female flowers in total, and each one contains an ovary with four joined carpels and four sessile stigmas. The winter is a time of continuous flowering. These spherical fruits have a diameter ranging from 6 to 8 mm. The top portion of the fruit, with a diameter ranging from 3 to 6 mm, is covered by the pericarp, which is greyish brown in colour. A straight stem forms at the base of this pericarp. Despite their sweet and robust scent, their taste is harsh and acidic. The one seed within the fruit is sub-globose in shape and has a dark brown colour. About three to four millimetres in width is the round seed. Depending on where it grows, the plant is known by several vernacular names.

Fig 1: Representative photos of *P. cubeba* (A) leaves, (B) flowers, and (C) berries.

Phytochemical composition

Piper species are defined by a wide variety of phytochemical substances, including benzoic acids, amides, hydrocarbons, terpenes, alkaloids, lignans, and phenylpropanoids. The berry components cubebin and hinokinin, as well as the alkaloid piperine, are the key components.

Lignans

To identify the components of *P. cubeba* (leaves, berries, stalks), a total of 28 lignans were isolated and characterised using analytical methods such as gas chromatography (GC), gas chromatography-mass spectrometry (GC-MS), high-performance liquid chromatography (HPLC), and nuclear magnetic resonance (NMR). There were four distinct kinds of lignans detected in the plant's stalks, berries, and leaves. In addition, nine lignans were isolated from berries and leaves, two lignans were extracted from leaves, and thirteen lignans were isolated from berries.

Cubebininolide, hinokinin, yatein, and isoyatein are among the furanofuranic compounds found in Piper species. The berries, leaves, and stems of this plant contain these compounds. Among the several compounds found in the berries and leaves were ashantin, clusin, cubebin, and cubebinone. However, hemiarensin was found only in the leaves. The fruit had more yatein lignan than cubebin. Hinokinin lignan was found in greater quantities in Indonesian stems and leaves. The phytochemical makeup of plants was mostly studied in Indonesia, with a focus on lignan extraction and identification.

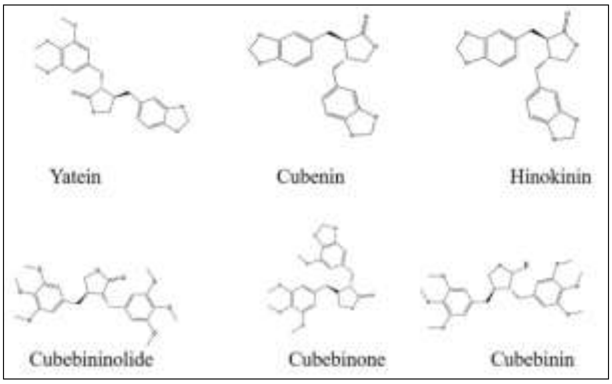

Fig 2: Chemical structure of the primary *P. cubeba* compounds.

Volatile compounds

Essential oil, oleoresin, ethanol, and dichloromethane were among the 91 volatile components identified in *P. cubeba* extracts. With eugenol making up 33.95% of the essential oil, beta-cubebene 18.3%, methyl eugenol 41.31%, and alpha-cubebene 4.1% were the primary components. Cubebol and betacubebene were the two primary components of the oleoresin, accounting for 26.1% and 12.3% of the total, respectively. Copaene and napthalene were the two most prevalent components, with ethanol extract accounting for 13.47 and 10.36 percent of the total, respectively. There were noticeable variations between the extracts. Remember that the essential oil contained 4.1% α-cubebene, the oleoresin 3.5%, and the ethanolic extract 2.07%. However, its presence remained undetectable in the dichloromethane extract. An further instance, copaene, comprising 13.47% of the total, was only present in the ethanol extract. Propylene glycol was found in 23.82 percent of the dichloromethane, which is different from the other extracts. Different extraction methods, genetic chemotypes, geographical distribution, and detection strategies might all play a role in these variations. There has to be more study to identify and characterise the extracts' non-volatile components, especially the ethanol extracts.

Fatty acids and additional

Nineteen distinct fatty acids and esters were extracted and reported from the berries of *P. cubeba*. The composition of the mixture includes dodecanoic acid (lauric acid, 24.05%), hexadecanoic acid (palmitic acid, 11.37%), 9-octadecenoic acid (10.00%), decanoic acid (capric acid, 2.62%), 9,12-octadecadienoic acid (Z,Z) (2.50%), octadecanoic acid (2.08%), methyl decanoate (capric acid methyl ester, 1.80%), tetradecanoic acid (myristic acid, 1.66%), ethyl-(R,E)- 4-hydroxy-3-methylpent-2-enoate (1.12%), along with other compounds present in concentrations below 1% relative abundance, such as palmitic acid methyl ester (0.65%) and octanoic acid (caprylic acid) (0.18%). 2-Aminophenol and 2,4-bis(1,1-dimethylethyl)-Phenol were identified in the dichloromethane fraction of the phenolic compounds. The fruit juice of *P. cubeba* contains a number of other phenolic acids and flavonoids, such as syringic acid, gallic acid, caffeic acid, and catechin.

Mineral, phenolic, and flavonoid content

Utilising the Folin-Ciocalteu technique, we determined the total phenolic content of piper fruit. The ethanolic extract contained 123.1 and 185.65 µg of GAE per gramme of extract, respectively, compared to 1,280 µg in the methanolic extract. We tested the flavonoid content and found that the ethanolic extract had 65.83 µg QE/g. The water-based *P. cubeba* fruit extract included the elements zinc (Zn), selenium (Se), magnesium (Mg), phosphorus (P), iron (Fe), and manganese (Mn).

Common applications of *P. cubeba*

The several forms that *P. cubeba* takes include powder, decoction, and essential oil. Many different ailments may be alleviated by using the fruit, which is known for its calming, anti-asthmatic, and gastro-tonic properties. The cancer therapy toolbox now includes this Moroccan herb. There is scientific evidence to back up some of these more conventional usages. These actions include antibacterial, nematocidal, analgesic, and anticancer properties. In addition to its many culinary applications, *P. cubeba* fruits are also used in cosmetics, food colouring, and food preservation.

Pharmacological and biological effects

P. cubeba has several biological and pharmacological benefits, as shown by research. These effects include anti-inflammatory, anti-cancer, anti-depressant, antibacterial, antiparasitic, insecticidal, wound healing, and depressive properties. *P. cubeba* components, essential oils, and extracts have all shown these benefits. Some plant chemicals have the ability to attach to cellular components including proteins and nucleic acids. Therefore, toxicity studies are necessary to assess the usefulness and safety of the things being studied. Investigating *P. cubeba*'s toxicity, this section summarises the biological and pharmacological activity of the plant's extracts and components, identifies specific action pathways, and summarises key research results.

Toxicity studies

Several studies have documented their findings on the evaluation of the toxicity of *P. cubeba* extracts. In the 3-(4, 5-dimethylthiazol-2yl)-2, 5-diphenyltetrazolium bromide (MTT) test, *P. cubeba* extracts did not show any signs of toxicity towards RAW 264.7 cells, which are monocyte/macrophage-like. Normal oral fibroblasts were not subjected to any cell toxicity or structural alterations when exposed to chemicals extracted from *P. cubeba*, such as methylcubebin, dihydrocubebin, and hinokinin. The results showed that female Wister rats showed no adverse effects from *P. cubeba* fruit methanol extract at dosages up to 2,000 mg/kg body weight. Toxic symptoms, changes in behaviour, or deaths were not documented. The (−)-hinokinin, which was partly synthesised from (−)-cubebin isolated from *P. cubeba* fruits, was given to male Wistar rats orally once daily for one week in a separate investigation. This medication had no discernible effect on the experimental subjects' weight or water consumption. *P. cubeba* essential oil was given to male Wistar rats at doses ranging from 50 to 3, 000 mg/kg in other investigations. No one died or shown severe abnormalities in behaviour, such as shaking, convulsions, writhing, chewing, bigger pupils, changed feeding habits, or increased faeces output, according to the results. We tested the biosafety of *P. longum* L. fruits by assessing the mortality of mice over a period of 90 days and over a shorter period of 24 hours. Based on the statistics, it seems that the fruits did not cause any substantial mortality. The glyoxalase system in Swiss albino mice was unaffected by oral treatment of *P. betle* leaf extract at 1.5 and 10 mg/kg for 2 weeks.

Effects on cell death and cancer prevention

The cytotoxic and anticancer properties of *P. cubeba* extracts on cancer cells have been investigated in several researches using various methods, the most prominent of which is the MTT test. Reason being, a lot of cancer chemotherapeutics are derived from compounds found in plants. Dichloromethane, an extract of *P. cubeba* fruit, has been shown to induce cell death in 3 types of cancer (MCF-7 and MDA-MB-231 for triple negative breast cancer, HT-29 for colon cancer, and KKU-M213 for cholangiocarcinoma), with only a moderate effect on normal fibroblast cells (L929). According to sequential extraction, one component, dichloromethane 15 (DE15), increased multi-caspases activity in the MDA-MB-231 breast cancer cell line. For this enhancement, a time-dependent manner was shown. The methanolic crude extract of *P. cubeba* fruits had more cytotoxic activity against MDA-MB-468 and MCF-7 breast cancer cell lines than the dichloromethane crude extract, according to Graidist *et al*. Of the six fractions, the one showing the most activity had an IC50 value greater than 4 µg/mL. The MCF-7, MDA-MB-468, MDA-MB-231, and L929 cancer cell lines demonstrated an apoptotic pattern in the DNA fragmentation experiment, in contrast to the normal MCF-12A cells.

There has been continuous research into the potential of (-)-cubebin and its derivatives, along with other chemicals derived from *P. cubeba*, to inhibit the progression of cancer and trigger cell death. Niwa *et al*. examined the cytotoxicity, mutagenicity, cell growth kinetics, and apoptosis induction of (-)-cubebin on HT29 human colon adenocarcinoma cells to ascertain its safety properties. A cytotoxic effect of (-)-cubebin was seen in the MTT experiment at a concentration of 280 µM, while no cytotoxicity was observed at values below 28 µM. The results of the micronucleus test also showed that (-)-cubebin did not cause mutations. It failed to cause cell death within twenty-four hours and had no effect on cell growth rate over four days. Furthermore, other types of squamous carcinoma cells were studied, including those from the larynx (Hep-2) and the mouth (SCC-25), as well as the effects of *P. cubeba* extract and its primary lignans (Cubebin, dihydrocubebin, ethylcubebin, hinokinin, and methylcubebin). Without altering their shape or damaging DNA, they were all successful in preventing cell migration and proliferation. Theoretically, this event was caused by the inflammation-related shift in gene and protein expression. The findings demonstrate that the cubebin and methylcubebin chemicals isolated from *P. cubeba* have a substantial impact on the characteristics of head and neck cancer cells, including their migration, proliferation, and genetic damage. Perhaps due to its ability to intercalate and destroy CT DNA, the ethanolic extract of P. nigrum L. was shown to be hazardous to MCF-7 cells. Several compounds derived from Korean *P. kadsura* A549 have shown cytotoxic activity against several cell lines, including SK-OV-3 (skin melanoma cells), A549 (non-small cell lung adenocarcinoma cells), and HCT-15 (colon cancer cells). A variety of different Piper plants have historically been used to treat cancer and its symptoms. The use of these herbs has shown promising results in the treatment of some malignancies. As for skin cancer, *P. aduncum* L. is used for that, breast cancer for that, and tumours or cancers of the abdomen, lungs, or stomach for that, along with *P. longum* L. for breast cancer. There are a variety of Piper-derived chemicals and extracts that have shown cytotoxic activity against cancer cells. For instance, among the chemicals with the greatest biological activity, amide alkaloids make up over 53%. Piperlongumine has been shown in both *in vitro* and *in vivo* tests to be very toxic to a number of cancer cell lines. Clinical trials evaluating the bioactive compounds found in Piper plants (e.g., *P. cubeba*) and their potential as cancer treatments are therefore needed.

An overview of the phytochemical and pharmaceutical properties of a commonly used spice, *Piper cubeba*

Everyone agrees that the cornerstones of a healthy life are a balanced diet, regular exercise, and the development of good habits, as well as enough time for mental rest. To sustain one's physical and mental health, food is typically considered vital. Cooking is a fundamental part of food preparation, which includes using oils, sauces, spices, and salt to boost the flavour. Spices not only contribute scent and flavour to food, but they also have pharmacological and medicinal benefits. On top of that, they facilitate the secretion of digestive enzymes. Many plants' outer layers, subterranean components, reproductive units, and developed ovaries may be found in dried and processed spice forms. To get a powdered consistency, the raw spices undergo pulverisation, grinding, and sifting operations. Substantially varying concentrations of this powder are subsequently used to provide flavour, colour, or anti-aging effects. Furthermore, several of these compounds are used in traditional medicine; they aid in health maintenance and have properties that might be used to cure illnesses. Thanks to globalisation, these spices are now more accessible than ever before, which has added to their popularity.

Commonly referred to as "pepper," the spice genus Piper is distributed across the pantropics. The Piperaceae family counts about a thousand species spread throughout the two halves of the globe. Plants, shrubs, and even trees that grow in an upright or climbing manner define their growth pattern. Tropical plants of the Piperaceae family have a long list of practical applications, including seasonings, culinary items, fish poison, hallucinogens, pesticides, oils, perfumes, and therapeutic remedies for a variety of ailments. Because of its many stalks, the enormous piper plant species *Piper cubeba* is often known as tailed pepper; nevertheless, in Java, it is known as Java pepper. This crop is mostly grown in the southern Indian subcontinent and on the islands of Java, Sumatra, and Borneo in Indonesia. The fruit and essential oils of the *Piper cubeba* plant are very valuable due to its culinary, medical, and economic use on a global scale. The widespread distribution of the plant has led to its several naming conventions.

In traditional folk and Unani medicine, *Piper cubeba* has an impressive history of pharmacological effects. Benefits of *Piper cubeba* include lowering inflammation, pain, hypoglycemia, nephroprotection, hepatoprotection, gastroprotection, and asthma, according to research. *Piper cubeba* has various practical uses beyond its aesthetic and nutritional ones, such as a pesticide, food preservative, flavouring ingredient, and in a variety of manufacturing processes. The purpose of this study is to investigate and evaluate the medicinal potential of *Piper cubeba*. Common names, taxonomy, traditional usage, phytochemistry, pharmacology, toxicity, and economic considerations/impact will all be detailed.

Botanical Classification

Piper cubeba is a climbing perennial with a woody stem. The limbs and stems of this climbing plant have an ash grey hue. At its joints, the plant takes root. The height of the plant may be anything from five to fifteen metres.

Leaves The leaves of this plant are oval in shape and may be found with a cordate or rounded base. A sturdy pedicle connects them to the stem, and they are smooth with many veins. They have an uncomplicated, modern form with a pointed tip. There are several tiny glands that are set into the ventral surface. Their leathery texture and full margins make them up to 15 cm in length and 6 cm in breadth.

Fig 3: A view of the leaves (A), blossoms (B), and fruits (C) of *Piper cubeba*.

Floral arrangements the tiny, densely packed blooms are unisexual and produced by a plant without a perianth. There is a smooth and scaly pattern to the spike arrangement, with female spikes being more curled. The primary flower spikes, which are about 4 cm long, usually have two or three stamens. The female spikes consist of around fifty solitary blooms. The elongated ovary, consisting of four joined carpels and four sessile stigmas per carpel, is the most common structure in these flowers. A fruiting body of four or five centimetres in length is present. The base of an ovary develops into a stem-like, cylindrical base when it achieves full maturity. The rainy season is characterized by the blooming of flowers.

Fresh Produce The fruits are roughly spherical in shape, have a stem, and are pointed at the tip. Their diameter is 6-8 mm. With a diameter of about 3-6 mm, the top half of the cubeb fruit is spherical. A reticulated pericarp, which is a shade of greyish brown, makes up the outermost layer. A straight stalk develops from the base of the pericarp. They have a powerful, fragrant perfume in addition to their crisp, somewhat bitter flavour. When broken, the fruit releases a single subglobose seed that is smooth and has a dark brown surface. This seed, which is 3-4 mm broad, contains a tiny embryo in a top chamber. The component that is being utilized is made up of dried, unripe, fully ripe fruits.

Traditional Importance

The multi-purpose plant *Piper cubeba* is extensively described in classic Unani writings for its many uses, including but not limited to its powder, decoction, and essential oil formulations. It lowers body temperature, decreases water retention, soothes nerves, dries out the mouth, stimulates the liver, prevents diabetes, eases asthma, gastrointestinal issues, inflammation, numbs pain, heals wounds, and has a long list of other medicinal uses. therapeutic benefits. Furthermore, due to its substantial function in cancer treatment, *Piper cubeba* has been included into the traditional medical practices of China and Morocco.

Economic Importance

The worldwide spice trade relies on *Piper cubeba* for its pepper, which is a dried berry form, which adds substantial economic value to the plant. It has nutritious properties and is also used in the manufacturing of perfumes, food preservatives, alcoholic beverages, cosmetics, and colouring compounds. On top of that, it is grown for its greenery.

Phytochemistry

Among the several phytoconstituents found in *Piper cubeba* are terpenoids (The plant's essential oil), alkaloids, polyphenolic compounds (including phenolic acids, flavonoids, and lignans), and many more. The distribution of several phytoconstituents in *Piper cubeba* is summarised in the figure.

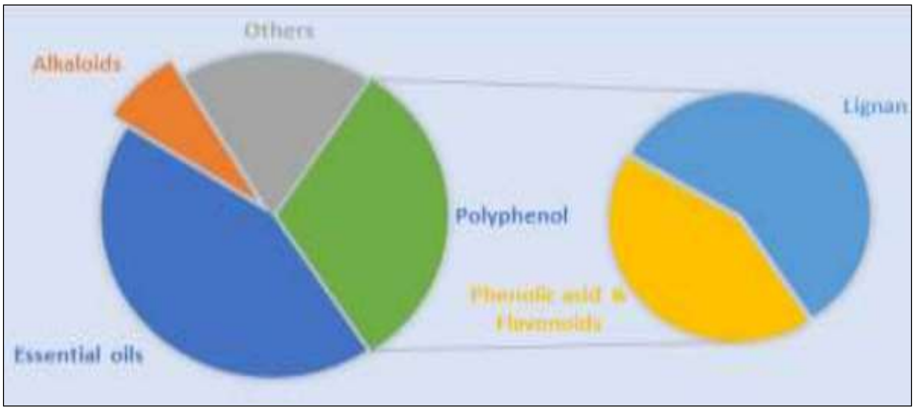

Fig 4: Comparison of *Piper cubeba* components reported by different subtypes

Conclusion

Scientists studied rats with alloxan-induced diabetes how an ethanol extract of *Piper cubeba* fruits affected several biochemical indicators. After 21 days of diabetic ketoacidosis, rats were fed different amounts of an ethanol extract from *Piper cubeba* fruits. The effects of the extract on several biochemical indicators in the serum of the rats were next examined. On both days 14 and 21, the results demonstrate that the treatment groups' serum blood glucose levels were noticeably lower than the control groups. Furthermore, the ethanolic extract of *Piper cubeba* fruits effectively reduced total cholesterol and triglyceride levels while increasing HDL cholesterol concentrations. These changes might show the liver's lipid profile and enzymes. The findings demonstrate that the ethanol extract of *Piper cubeba* reduces blood sugar levels in diabetic circumstances.

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