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Comprehensive review on *Passiflora incarnata* Linn

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Abstract
Passilora Incarnata commonly known as passiflower, belongs to family *Passiflora*. The fruit of *Passiflora* has several seeds which contain drinkable juice. Its medicinal use has been reported in the traditional system of medicine such as Ayurveda, Siddha and Unani. *Passiflora incarnate* contains phytochemicals such as alkaloids, flavonoids which are effective sedative that is not addictive. Phenols and flavonoids present in *Passiflora* have high antioxidant properties that show significant scavenger activity of free radicals. The genus *Passiflora incarnate* has long been used in traditional herbal medicine for treatment of insomnia and anxiety. It has been used as sedative tea and also been used to cure subjects affected by opiate dependence in India.
This review aims to provide up to date information about habitat, ecology, pharmacognostic evaluation, phytochemical studies, pharmacology, toxicology and herbal preparatioin which used to reduce anxiety particularly before surgery, also for variety of problems including pain, ADHD, stress, sleeplessness.

Keywords: *Passiflora Incarnata*, stress, ADHD, sedative, anxiety, scavenger

Introduction
Passiflora comes from Latin word “passio” that was first time discovered by Spanish discoverers in 1529 and was described as symbol of “Christ” [1]. It also Known as maypop, purple passionflower, wild apricot, and wild passion Vine. The maypop, a species of passionflower belonging to the family *Passiflora*, features enormous, elaborate blooms with pronounced styles and stamens. The climbing vine known as the passion flower has white and purple Blossoms. The constituents of passion flower are releasing. South and Central America, as well as the Southeast United States, are the original homes of the passion flower. This is a fine climber suitable for covering arbours, verandahs and arches. It can be propagated by seed or layering. The fruit is edible when ripe [2]. Its medicinal usage has been reported in the traditional systems of medicine such as Ayurveda, Siddha and Unani. It has long been used to promote sleep [3]. From a phytochemical point of view, the plant contains several compounds including alkaloids, phenols, glycosyl flavonoids and cyanogenic compounds. Which are an effective sedative that is not addictive and does not cause drowsiness.
The plant contains flavonoids and alkaloids, with the leaves containing the greatest concentration of flavonoids. Other flavonoids present in *P. incarnata* include chrysin, apigenin, luteolin, quercetin, kaempferol, and isovitexin. Polyphenols belonging mainly to the C-glucoside class of flavones are present in *P. incarnata* and these phenols and flavonoids have high potential antioxidant properties that show a significant scavenger activity of free radicals. Passion flower is used by people to treat anxiety, particularly anxiety before surgery. For a variety of problems, including pain, ADHD, sleeplessness, and stress, some people also use passion flower. However, there isn't any reliable scientific data to back up these uses. Passion flower is used as a flavoring in several dishes and drinks [4].

Literature Review
M. Miroddi, G. Calapai *et al*. (2013). *Passiflora incarnata*, with 520 species having different pharmacological action like insomnia and anxiety in Europe and analgesic, anti-spasmotic in Brazil in different parts of world was found. This was due to the inadequate methodologies at different places [10].
Evans WC. Etal. (1996). The study prioritized to determine the phytochemical analysis of total phenolic, flavonoids, alkaloids, and tannins contents as well as the antioxidant

properties through 1,1-diphenyl-2-picrylhydrazyl (DPPH) quenching assay, superoxide and hydrogen peroxide radical scavenging assays of ethanol extract of *P. incarnata* leaves [11].

Rubashiny veeramohanand noorma wati haron (2015). Taxonomic studies of four *Passiflora* species- *Passiflora edulis* (Passion fruit), *Passiflora coccinea*, *Passiflora foetida*, and *Passiflora incarnata* (Fragrant passion flower) focus to distinguish their macromorphological features like leaves, flowers, and fruits which revealed variations in color, texture, and shape by using a binocular microscope [12].

Rehwald A., Meier B. *et al*. (1994). A qualitative and quantitative reversed- phase high-performance liquid chromatographic (HPLC) method has been developed for *Passiflora incarnata* flavonoid analysis like whichseprate out the major C-glycosylflavones like isovitexin, isoorientin, schaftoside [18].

Lyca R. da Fonseca *et al*. (2020). This article explores *Passiflora* species with anxiolytic properties,dealing with their secondary metabolites, pharmacological studies, and registered products. Clinical trials are limited. Yet numerous other *Passiflora* species remain underexplored for their potential in medicinal and nutraceutical applications [32].

Ruggy GH, Smith CS. (1940). The dried aerial parts of *Passiflora incarnate* L., was carried out in this article which give detail study of pharmacological effects span analgesic, antipyretic, anti-inflammatory, antimicrobial, cardiovascular, CNS depressant, and uterine stimulant[41].

Dhawan K, Kumar S, Sharma A. (2003). This article focuses on threatment of dysmenorrhea, neuralgia, and nervous tachycardia, while also serving as a mild sedative for anxiety and sleeplessness.In addition to this it have certain clinical pharmacology which includes its impact on nausea, menopause, dysmenorrhea, diabetes [51].

Habitat

The purple passionflower thrives in average, medium, well-drained soil with full sun to partial shade. The flower typically grows in southeastern U.S., particularly in Florida and Texas, but can grow in central and eastern U.S. as far north as Delaware. The plant is also known to be found in Bermuda as well. It thrives in soil with clay, loam, or sand texture with high organic matter. It can be found roadsides, prairies, plains, meadows, pastures, savannas, woodlands, and riverbanks [7].

Taxonomical Classification [8]

Kingdom: Plantae
Division: Magnoliophyta
Class: Magnoliopsida
Family: *Passiflora*ceae
Genus: *Passiflora* L.
Species: *P. incarnata* L.

Common Names [9]

English: Passion flower, Apricot, Maypop.
Hindi: Krishna kamal.
Marathi: Krishna kamad

Pharmacognstic Evaluation

Morphology [10]

Stems: The stem is herbaceous or woody, generally climbing, very rarely tree-like Vine, glabrous to slightly pubescent, tendrils present.

Leaves: Leaves alternate, sometimes simple, entire, rarely tendril axillary, arising from sterile pedicels. 3-lobed, serrate, petiolate. Petioles contains two glands near the base of the leaf blade.

Flowers: Flowers can be bisexual or unisexual, regular. The corolla consisting of a corolla and stamens. The diameter of the flower is usually 6-7 cm. The flower has 5 petals and 5 sepals, which are purplish to whitish, similar and alternate. The flower has 3 types, typically 3 stamens, 5 green-white sepals with terminal appendages.

Fruit: fleshy, initially green, yellow-red when ripe.

Table 1: (Morphology of *Passiflora Incarnata*.) [11]

Appearance	Coarse powder
Colour	Green
Odour	No Characteristic odour
Taste	Slightly bitter
Percent loss on drying	7.12
Crude fibers	9.4

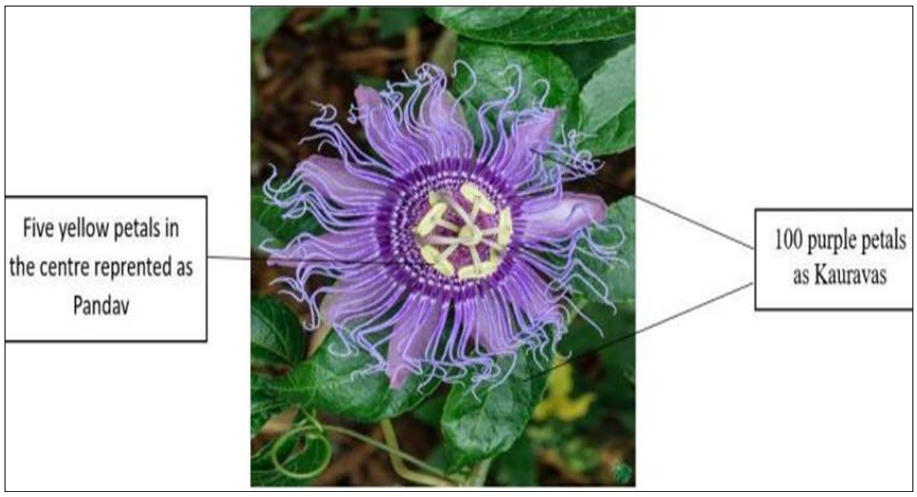


Fig 1: (*Passiflora* Flower)

Fig 2: (Passion Flower with fruit)

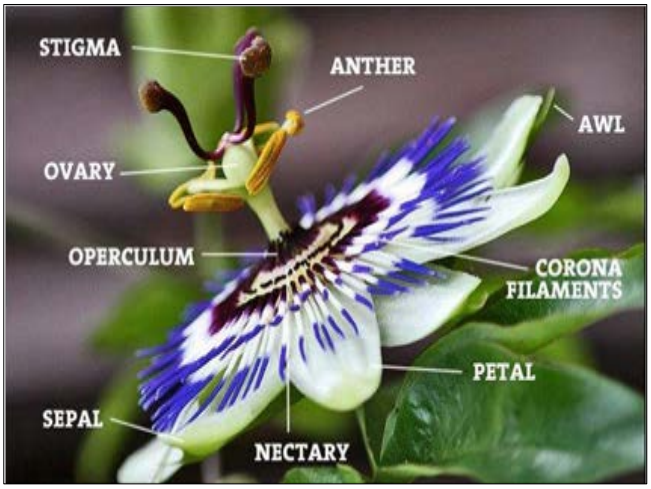


Fig 3: (Floral parts of the Purple Passionflower (*Passiflora Incarnata*)

Stigma
The stigma is located at the center of the flower and serves as the landing site for pollen.

Anther
Anthers are the male reproductive parts of the flower. Anthers contain pollen, which contains the male genetic material necessary for fertilization.

Ovary
The ovary is the base of the female reproductive system within the flower. It contains ovules, which are the future seeds. After successful fertilization, the ovary develops into the fruit of the plant.

Petal
Petals are the colorful, surrounded the reproductive organs. The petals are typically purple, lavender, or pink, and they serve to attract pollinators with their vibrant colors and unique patterns.

Sepal
Sepals are the protective, leaf-like structures that encase the flower bud before it opens. They are typically green and serve to shield the developing flower.

Microscopy [12]

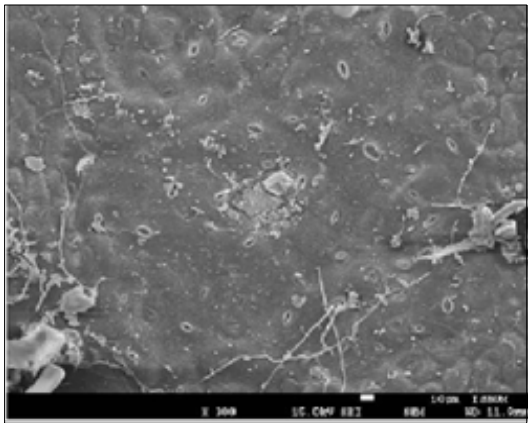


Fig 4: (Abaxial surface of *P. incarnata* leaf)

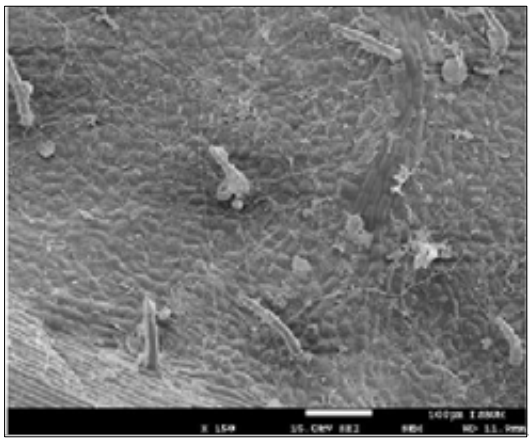


Fig 5: (Trichomes of *P. incarnata*)

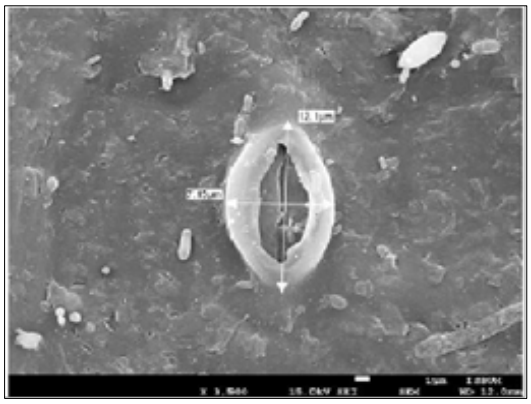


Fig 6: (Amphipericytic stoma *of P. incarnate*)

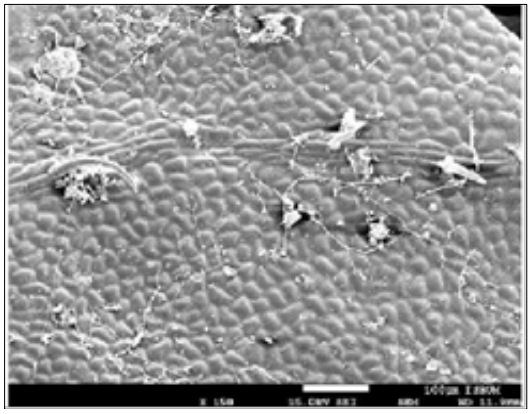


Fig 7: (Adaxial surface of *P. incarnate* leaf)

Passiflora incarnata L. leaves are alternate and palmately tri-lobed. Leaf apex is cuspidate while the leaf base is cordate with serrate margin. The adaxial surface of the leaves is dark green whereas the abaxial surface is dull green. The scanning electron microscopy view of a *P. incarnata* leaf shows papillose epidermal surface with amphipericytic stomata distributed on the abaxial surface (Fig. 1). Trichomes are simple, unicellular and sparsely distributed throughout the abaxial and adaxial surfaces of the leaf (Figs. 2 and 4). Both stomata and trichomes distribution are more dense on the abaxial surface compared to the adaxial surface.

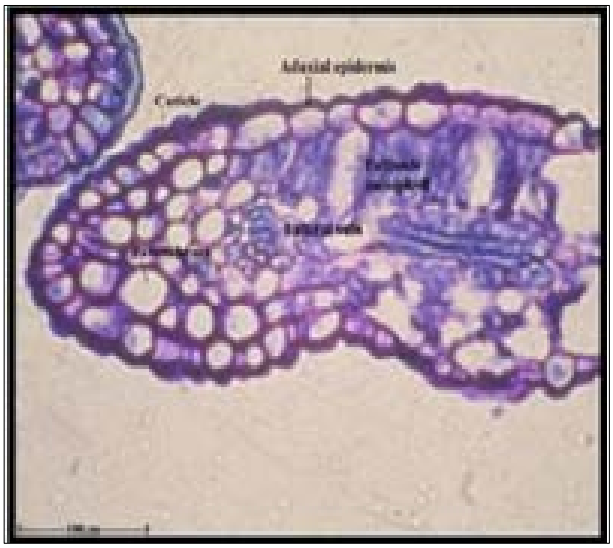


Fig 8: (T.S. of Lamila)

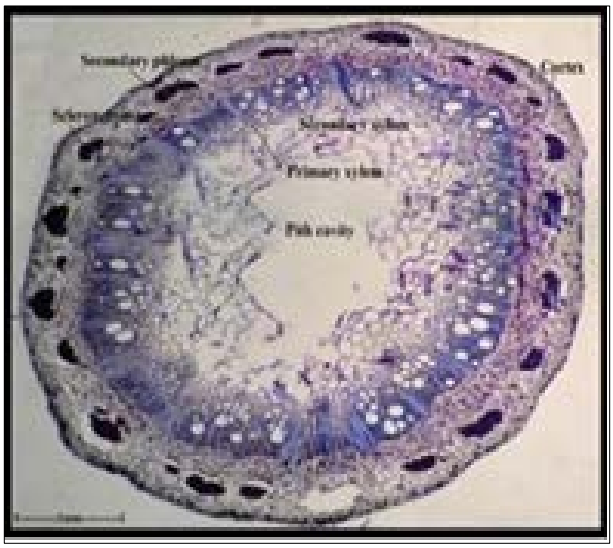


Fig 9: (T.S. of Stem)

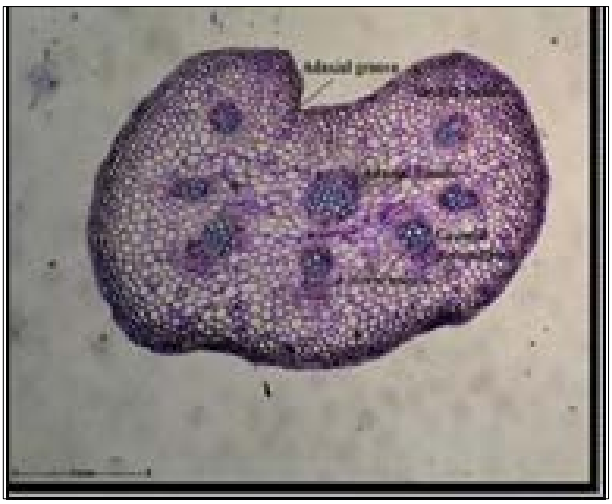


Fig 10: (T.S. of Petiole)

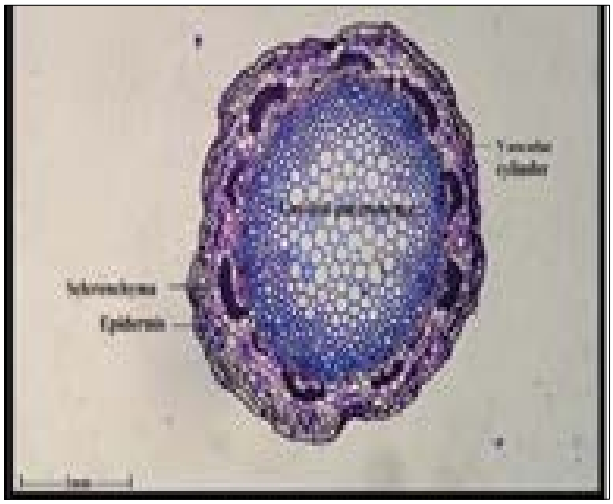


Fig 11: (T.S. Tendril)

Powder microscopy

Stomata: A baxial epidermal peelings showed the presence of epidermal cells and stomata. The epidermal cells are amoeboid in outline with wavy anticlinal walls. Stomata were densely distributed and they are anamocytic type. The guard cells are elliptical and thin walled.

Parenchyma cells: Parenchyma cells are abundant and scattered in the powder. They vary in shape and size. They may be narrow and rectangular or wide and elongated.

Some of the parenchyma cells are squarish and thin walled. The parenchyma cells are up to 140 mm long and 20 mm thick.

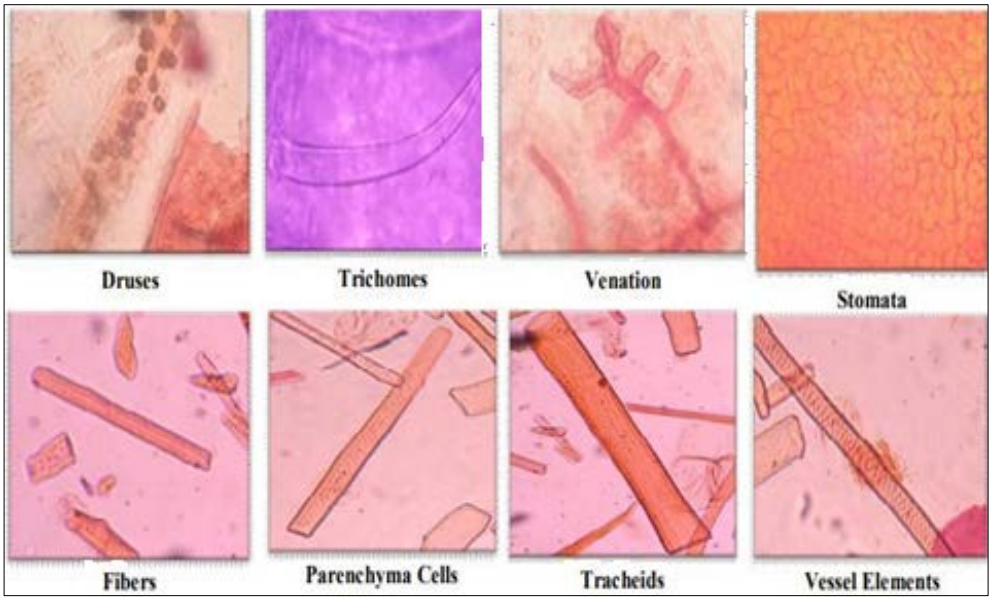


Fig 12: (T.S. of Podwer)

Botanical Voucher Specimen

Analytical Parameter [9]

Table 2: (Analytical Parameter)

Parameters	Value in w/w
Total ash	9.23
Acid- insoluble ash	10.3
Water- insoluble ash	6.50
Sulfated ash	18.20

Phytochemical Studies

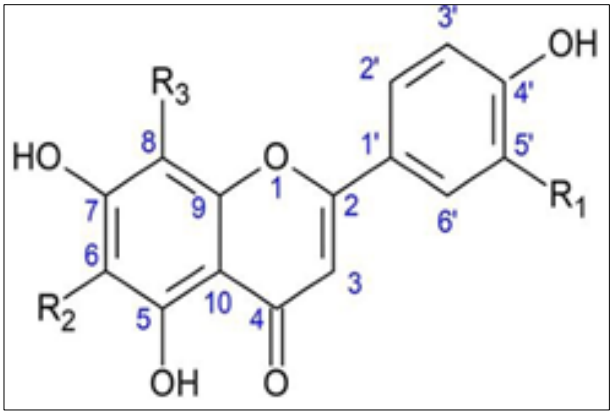
Table 3: (Phytochemical Parameter)

Sr. no.	Part of plant	phytoconstituents	Examples
1.	Leaves	Flavonoid	C- glycosylflavones, Isovitexin, vitexin, orientin, isoorientin, saponarin.
2.	Leaves	Alkaloid	Harman, harmol, harmine.
3.	Leaves and roots	carbohydrates	raffinose, sucrose, D- glucose and Dfructose

In phytochemical studies, orientin and vitexin are found in small amounts in the leaves of *P. incarnata*, *P. alata*, and *P. edulis* [10, 11]. Furthermore, iso-orientin is one of the major flavonoids in *P. incarnata* and *P. edulis* var. flavicarpa, but it is only detected in small concentrations in *P. alata.* [10, 12] A comparative metabolite profiling and fingerprinting of the genus *Passiflora* leaves were reported using a multiplex approach of UPLC-MS and NMR analyzed by chemometric tools [14]. Thin layer chromatography can also be used in order to differentiate species [24].

The aqueous extract is phytochemically characterized by a set of C-glycoside flavonoids such as vitexin (1), isovitexin (2), schaftoside (3), isoschaftoside (4), orientin (5), iso-orientin (6), and swertisin (7). [26, 27] Moreover, the free

flavonoids apigenin (8), luteolin (9), quercetin (10), kaempferol (11), and chrysin (12) are also found [15].



Flavonoids

Flavonoids are reported to be the major phyto-constituents of *P. incarnata*. C- glycosylated flavonoids found in *P. incarnata* consist mainly of a glucose group directly linked to the aromatic nucleus only in positions 6 and 8 of the flavonoid core [18]. The aqueous extract is phytochemically characterized by a set of C-glycoside flavonoids [8].

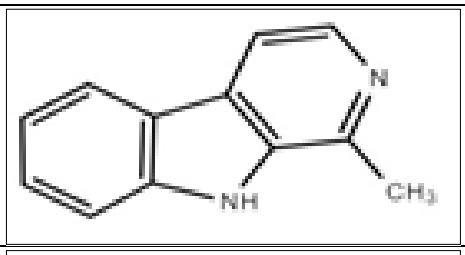
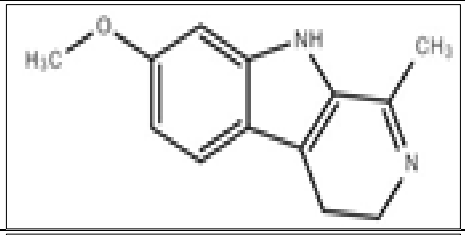
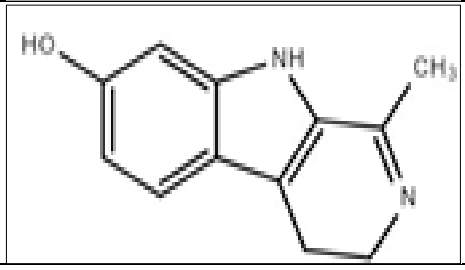
Table 4: (Flavonoid present in *Passiflora* Incarnata) [32]

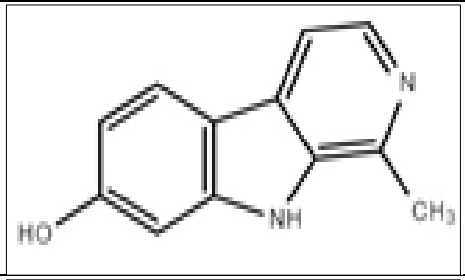
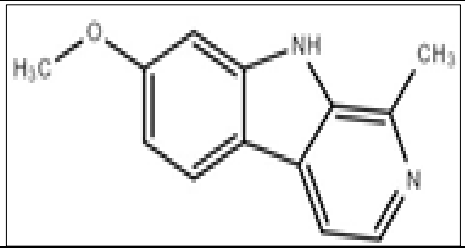
Flavonoids	R1	R2	R3	R4	R5	R6
(1) Vitexin	OH	H	H	H	OH	Glucose
(2) Isovitexin	OH	H	H	Glucose	OH	H
(3) Schaftoside	OH	H	H	Glucose	OH	Arabinose
(4) Orientin	OH	H	H	Arabinose	OH	Glucose
(5) Isoorientin	OH	OH	OH	H	OH	Glucose
(6) Isoorientin	OH	OH	OH	Glucose	OH	H
(7) Swertisin	OH	H	H	Glucose	OCH3	H
(8) Apigenin	OH	H	H	H	OH	H
(9) Luteolin	OH	OH	OH	H	OH	H
(10) Quercetin	OH	OH	OH	H	OH	H
(11) Kaempferol	H	OH	OH	H	OH	H
(12) Chrysin	H	H	H	H	OH	H

Alkaloids

The alkaloids present in *Passiflora* are of the indole type (*β*-carbolines), which are the second major known group of alkaloids (54). Some of them have value in medicine as tranquilizers and for the treatment of hypertension (55). *P. incarnata* is the most widely studied species containing alkaloids (24). In studies carried out in the 1960s, harmine (13), harmol (14), harmaline (15), harmalol (16), and Harman (17) were detected (Figure 2). Although the presence of traces of these alkaloids was confirmed. they were undetectable in most commercial materials [6].

Table 5: (Alkaloid present in *P. incarnata*) [6]

Sr. No.	Alkaloid	Structure
1.	Harman	
2.	Harmaline	
3.	Harmalol	

4.	Harmol	
5.	Harmine	

Miscellaneous Phyto-constituents: Various other constituents which have been reported from *P. incarnata* include γ-benzo-pyrone derivative maltol (27), carbohydrates such as raffinose, sucrose, D-glucose and Dfructose (28); essential oil containing hexanol (1.4%), benzyl alcohol (4.1%), linalool (3.2%), 2-phenylethyl alcohol (1.2%), 2-hydroxy benzoic acid methyl ester (1.3%), carvone (8.1%), trans- anethol (2.6%), eugenol (1.8%), isoeugenol (1.6%), βionone (2.6%), α-bergamotol (1.7%) and phytol (1.9%) [6].

Pharmacological Activities

Table 6: (Major pharmacological activity of *Passiflora* species)

Part of plant	System	Effects	Preparation	Ref.
Flower	Chemical activities	Anxiolytic, spasmolytic, hypnotic, sedative, narcotic and anodyne	Extracts	33
	Biological and Pharmaceutical	Antimicrobial Allergic reactions, asthma, irritated sinuses, skin rashes, and skin	Products	34
		Blood vessel inflammation (Vasculitis). Congestive heart failure restlessness, anxiety, and agitation	Extract	
Leaves	Traditional uses	Smoked	Dried	35
	Biological and	Antibacterial Antioxidant	Ethanol	36
	Pharmaceutical	Anti-inflammatory	extracts	37
		Hemolytic	Extracts	
			Aqueous	
			extract	
Fruit	Biological and Pharmaceutical	Antibacterial Anti-tumor	Ethanol extracts	38
Stem	Biological and Pharmaceutical	Antioxidant	Extracts	39

Anti-Deprasant

(Ruggy G. H *et al*., 1940, Medina, *et al*., 1990 Speroni, E *et al*., 1996) initiated investigations by 25 mg/kg intra-peritoneal injection of the water extract resulted in decreased organization and locomotion, while doses of 60-250 mg/kg of 30% or 40% ethanol extracts caused a cessation of movement. The 40% ethanol extract at 60 mg/kg increased sleep duration, and at 50 mg/kg, it delayed the onset of seizures. *In vivo* studies involving rats receiving a daily dose of 5 g/kg of 30% ethanol extract for three weeks showed no significant changes in body weight, temperature, or motor organization, yet a decrease in motor activity was observed. Furthermore, chrysin, identified in Herb *Passiflora*, demonstrated a high affinity for benzodiazepine receptors, affecting animal locomotion and enhancing pentobarbital-induced hypnosis at 30 mg/kg [36, 37, 38, 39].

Anti-inflammatory activity

(Borrelli, F *et al*., *et al*. 1994, Guerin, J. C *et al*., 1985) gives tale of Herb *Passiflora* unfolded with animals taking center stage. Intriguingly, Animals receiving an intragastric injection of 75 to 500 mg/kg bw of Herb *Passiflora* ethanol extract experience a reduction in inflammation one hour later. Herb *Passiflora* has anti- inflammatory and antioxidant properties that can be used to cure and prevent numerous diseases, including intricate inflammatory processes. After a dose of 500 mg/kg bow of Herb *Passiflora* ethanol extract, it was discovered that total leukocyte passage to the animal pleural cavity had decreased by 40%. This outcome was brought about by a decline in the movement of polymorphonuclear and mononuclear leukocytes. These outcomes were equivalent to acetylsalicylic acid at 250 mg/kg [40, 41].

Anti-bacterial

Borrelli, F *et al*., in the year (1996) Research painted a vivid picture of resilience the growth of the following fungi was not inhibited by the 50% ethanol extract of Herb *Passiflora* over 500 mg/ml: Botrytis cinerea, *Aspergillus fumigatus*, *Rhizopus nigricans*, *Fusarium oxysporum*, *Penicillium digitatum*, and Candida albicans. Helicobacter pylori's

growth was inhibited by a methanol extract of Herb *Passiflora* with a minimum inhibitory concentration of 50 g/ml. Passion fruit seeds contain volatile substances that are poisonous to 1- octanol and Meloidogyne incognita. The nematicidal impact of these substances is active against Meloidogyne incognita [40].

Anti-nauseating effect

(Fisher, A. A *et al*. 2000, Freson G, *et al*. 2008) unveiled a cautionary chapter in the story of *Passiflora incarnata*. In a clinical trial, a 34-year-old woman experiencing severe nausea after receiving *Passiflora incarnata* as directed. Thus, this patient experienced negative effects from *Passiflora* 14 ncarnate. Due to the carboline alkaloids (Harmaline, harmane, and tetrahydroharmine), which excite the central nervous system by slowing down the metabolism of amine neurotransmitters, *Passiflora incarnate* causes optical and auditory illusions, locomotor ataxia, nausea, vomiting, misperception, and anxiety [42]. According to a clinical investigation, passionflower is effective in strengthening resilience in individuals with nervous restlessness [43, 44, 45].

Anti-anxiety activity

Dhawan K, Kumar S, Sharma Ain the year (2001) take plant *Passiflora incarnate Linn*. Which Has been used to cure anxiety and insomnia since time immemorial. A fraction derived from the methanol extract of *P. incarnate* has been observed to exhibit significant anxiolytic activity at a dose of 10 mg/kg in mice using elevated plus-maze model of anxiety. This fraction comprises mainly two components which are visible as blue and turquoise colored fluorescent spots at 366 nm of the UV light. The possibility of a phytoconstituent having benzoflavone nucleus as the basic moiety being responsible for the bioactivity of P. incarnate is highly anticipated [46].

Antitussive activity

Dhawan K, Kumar S, Sharma A, in the year (2003-2017). Studied on mice and found that when mice were exposed to sulphur dioxide, the leaves of P. 15ncarnate showed considerable antitussive action, with cough induction comparable to that of codeine phosphate [47, 48].

Hypertension

Benson VL *et al* in the year (2008). Delved into the enduring challenge of Cardiovascular disease continues to be the leading cause of morbidity and mortality worldwide despite advances in pharmacotherapies and mechanical treatments and there is a good possibility that this burden will rise. An associated species of *P. nepalensis* called P. 15 ncarnate has been known to have antihypertensive properties.

P. incarnate has an antihypertensive effect because it contains flavonoids and water- soluble component that has been identified as a mercury salt (C10H22O8 NHgCl2). An associated species of *P. nepalensis* called P. 15ncarnate has been known to have antihypertensive properties [53].

Herbal Preparation [62]

- Hard capsule (300 mg/capsule
- Tablet (400 mg/tablet)
- Oral liquid
- Herbal tea (2g per tea sachet)

Table 7: (Herbal Preparation)

No.	Preparation	Dosage form	Posology	Indication
1.	Passion flower herb	Hard capsules (300mg/capsule)	Adults and the elderly: For relief of symptoms of mild anxiety 1-2 capsules 3 times a day. To aid sleep, take 2 capsules 30 minutes before bedtime with an earlier dose of 2 capsules earlier in the evening if necessary. Maximum daily dose: 8 single doses	Temporary relief of mild anxiety and to aid sleep.
2.	*Passiflora* 16 nc arnate L.,herba	Tablet (400 mg/tablet)	Adults and adolescents over 12 years of age: 400 mg - 2 g (1- 4 tablets per day)	Relief of mild symptoms of mental stress and to aid sleep. Also relief of mild nervous tension.
3.	*Passiflora*eherba, cut	Herbal tea (2g per tea sachet)	Adults and adolescents over 12 years: 1 cup of tea from 1 tea sachet 2-4 times daily	To improve general condition in mental stress and to aid sleep.
4.	Powder	Hard capsule (1 capsule contains 300 mg of powdered drug)	Adults: 2 hard capsules 2 times daily Adolescents over 12 years of age: 1 hard capsule 2 times daily	Symptomatic treatment of neurotonic conditions of adults and children, notably in cases of mild disorders of sleep.

Conclusion

P. incarnata, a plant widely employed in the Indian system of medicine. According to these investigations, this natural remedy is a cutting-edge option for drug development and bioprospecting for the treatment of conditions like anxiety, sleeplessness, convulsions, sexual dysfunction, cough, cancer, and postmenopausal syndrome. These plants' phytochemicals and minerals will make it possible to utilize them for therapeutic purposes. Flavonoid make up the majority of Herb *Passiflora*e's components. For treatment of dysmenorrhea, neuralgia, and nervous tachycardia, Herb *Passiflora* is used. Herb *Passiflora*e's fruit is used to make jams, jellies, and sweets. The juice is a preferred beverage flavoring. Some *Passiflora* species have not yet been thoroughly investigated for their medicinal potential. In the future, they can be examined for their medicinal potential.

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