

Passiflora incarnata Linn: A phytopharmacological review

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Medicinal plants are the nature's gift to human being to have disease-free healthy life. It plays a vital role to preserve our health. India is one of the most medico-culturally diverse countries in the world where the medicinal plant sector is part of a time-honoured tradition that is respected even today. Medicinal plants are believed to be much safer and proved elixir in the treatment of various ailments. In our country, more than 2000 medicinal plants have been recognized. *Passiflora incarnata* (Passifloraceae; passion flower Family) is an important medicinal plant of tropical and subtropical India. Its medicinal usage has been reported in the traditional systems of medicine such as Ayurveda, Siddha and Unani. *P. incarnata* has been described as a passion flower and has been used extensively for treatment of some diseases like as anxiety, insomnia, convulsion, sexual dysfunction, cough and cancer. The present article including the detailed exploration of phyto-pharmacological properties of *P. incarnata* is an attempt to provide a direction for further research.

Key words: Anti-cancer, anxiety, aphrodisiac, *Passiflora incarnata*

INTRODUCTION

The genus *Passiflora* consists of 500 species that are mostly found in warm and tropical regions. *Passiflora* comes from Latin word "Passio" that was first time discovered by Spanish discoverers in 1529 and was described as a symbol for "Passion of Christ".^[1,2] This plant was used widely in traditional medicine in West India, Mexico, The Netherland, South America, Italia and Argentina. One of species of this genus named as *Passiflora incarnata* is more popular than its other species. *Passiflora* contains several compounds including alkaloids, phenols, glycosyl flavonoids and cyanogenic compounds.^[2] In some experiments, it has potential effects for treatment of some diseases like anxiety, opiates withdrawal, insomnia, attention-deficit hyperactivity disorder and cancer.^[3-9]

Classification

Botanical source : *Passiflora incarnata* L.

Family : Passifloraceae

Genus : *Passiflora* L.

Species : *Passiflora incarnata* L.

Morphological Characteristics

An herbaceous perennial vine with distinctive three-lobed leaves and attractive flowers that may reach 6 1/2 feet or more in length. Passion flower is primarily found along the edges of woods and fields, but is becoming more noticeable in many of Virginia's agronomic crops, especially where

conservation tillage is practiced.

Seedlings

Cotyledons are oval, thick and have a waxy appearance. The first true leaf is heart-shaped and also glossy. Subsequent leaves have lobes (usually three) arising from a common point (palmately lobed leaves). Seedlings can occur but sprouts from the perennial rootstocks are much more common.

Roots

Roots initially develop as a taproot but eventually develop a very deep perennial rootstock from which sprouts can emerge.

Leaves

Arranged alternately along the stem, usually only slightly hairy. Individual leaves are divided into three (only sometimes five) lobes that arise from a common point (palmately lobed). Leaves are approximately 2 1/2-5 1/2 inches long and wide and occur on petioles. A pair of nectar-filled glands occurs at the base of the leaf blade and the junction of the petiole.

Stems

Stems can trail along the ground or climb on other vegetation. Stems are usually only slightly hairy and may reach 6 1/2 feet in length.

Flowers

Solitary flowers arise from the area between stem and leaf petioles. Flowers range from 2 to 4 inches in length and are very attractive and light purple to lavender in colour.

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Fruit

A relatively large (1 1/2-3 inches long) berry that is green or yellowish-green in colour. Berries contain many dark brown 'dimpled' seed (reticulate seed).

Identifying Characteristics

The stems wiry; three-lobed leaves, serrate; pale pink flowers 5-7 cm across; fruits ovoids or globose, 3-5 cm long [Figures 1-3].^[10]

Phyto-constituents

The main chemical constituents of the Passion flower are the flavonoids (0.25%) such as vitexin, isovitexin, orientin, isoorientin, apigenin, kaempferol and quercetin. The indole alkaloids (0.1%) based on the beta-carboline ring system such as harman, harmin, harmalin, harmol and harmalol. Some other isolated plant constituents have been identified such as glycosides, carbohydrates, amino acids, benzopyrones, cyanogenic glycosides such as gyanocardin, pyrone derivatives such as maltol and ethyl maltol. Two important constituents like chrysin and tri-substituted benzoflavone moiety (BZF) have been isolated.^[11,12]

The enantiomeric compositions of the acetates, butanoates, hexanoates and octanoates of the secondary alcohols 2-pentanol, 2-heptanol and 2-nonanol were determined in yellow purple (*Passiflora*) passion fruits.^[13] The compounds were isolated by means of simultaneous distillation extraction.

Phyto-pharmacology

Cannabinoids reversal

The newly reported benzoflavone (BZF) moiety from the plant *P. incarnata* (Linn) has been evaluated in light of traditional reports on the use of this plant in breaking down cannabis addiction. In the modern or allopathic system of therapeutics, there has been no suitable remedy to combat the severe withdrawal effects of various cannabis products, including marihuana, marijuana, bhang, hashish, ganja, etc., the world-wide consumption of which has attained alarming proportions especially among the younger generation. It has been reported that the BZF of *P. incarnata*, when administered concurrently with cannabinoids, prevented the development of tolerance and dependence of cannabinoids in mice. Even an acute administration of the BZF significantly blocked the expression of withdrawal effects in cannabinoid dependence. So these studies suggested that the BZF may have beneficial role in cannabinoids reversal.^[12]

Nicotine reversal

Some of the pharmacological studies on the BZF moiety also confirmed that the BZF moiety isolated from *P. incarnata* was very effective in countering the menace of addiction-prone

substance nicotine in laboratory animals. In light of various reports mentioning the usefulness of *P. incarnata* in tobacco addiction, studies have been performed by using the bioactive BZF moiety isolated from the aerial parts of *P. incarnata*. So these studies, although preliminary, suggested that the BZF may have value in treating nicotine addiction.^[14]



Figure 1: Passion flower



Figure 2: Whole plant



Figure 3: Fruits

Alcohol Withdrawal

A BZF moiety has been reported recently to be responsible for the multifarious CNS effects of *P. incarnata* Linn. In the light of the established usefulness of the BZF moiety in counteracting the withdrawal effects of substances like cannabinoids and nicotine by the authors, the bioactive BZF moiety has been tested in mice treated with an addictive dose of ethyl alcohol, in order to evaluate its effectiveness in countering alcohol dependence. The chronic administration of *P. incarnata* with alcohol had better preventive effects than the single acute treatment with *P. incarnata* in alcohol-dependent mice. These results suggested that the treatment of *P. incarnata* extract could be used as safe and alternative drug for alcohol withdrawal.^[15]

Anticonvulsant Activity

The current therapeutic treatment of epilepsy with modern antiepileptic drugs (AEDs) is associated with side effects, dose-related and chronic toxicity and teratogenic effects, and approximately 30% of the patients continue to have seizures with current AEDs therapy. Natural products from folk remedies have contributed significantly in the discovery of modern drugs and can be an alternative source for the discovery of AEDs with novel structures and better safety and efficacy profiles. Evidence for anticonvulsant activity of *P. incarnata* in the clonic seizure of the pentylenetetrazole model has been tested. As the protective effects of *P. incarnata* in clonic seizure, it suggests that it could be useful for treatment of absent seizure. Furthermore, the important role of benzodiazepine receptor in the effects of *P. incarnata* should be considered.^[9]

Antianxiety Activity

Herbal medicines are popularly used worldwide and could be an option for treating anxiety if shown to be effective and safe. Passion flower extract is one of these compounds.^[16] *P. incarnata* has been used to cure anxiety and insomnia since time immemorial. A fraction derived from the methanol extract of *P. incarnata* has been observed to exhibit significant anxiolytic activity in mice using elevated plus-maze (EPM) model of anxiety. The possibility of a phytoconstituent having BZF nucleus as the basic moiety being responsible for the bioactivity of *P. incarnata* is highly anticipated.^[17] The potential anxiolytic effects of chrysin, a *Passiflora* extract and the purported modulation of the benzodiazepine receptor on the GABA (A) receptor in laboratory rats have been tested. It has been hypothesized that chrysin decreases anxiety via interaction with the GABA (A) receptor in laboratory rats as measured by elevated plus-maze, corticosterone and catecholamine assays.^[18] In this study, each animal received an intraperitoneal injection of (1) vehicle (DMSO 4%), (2) chrysin, 2 mg/kg, (3) midazolam, 1.5 mg/kg, or (4) flumazenil, 3 mg/kg and (5) chrysin, 2 mg/kg. The EPM was used to evaluate the behavioural component of

anxiolysis, and catecholamine and corticosterone assays were examined to measure the neurohormonal effects of anxiety. No statistical difference was found among groups in catecholamine and corticosterone levels. The data suggested that chrysin may have anxiolytic properties similar to midazolam but to a lesser magnitude at the 2 mg/kg dose used in this study.^[18]

Sexual Dysfunction

The isolation of a tri-substituted BZF moiety as the main bioactive phyto-constituent of *P. incarnata* has been an encouraging breakthrough in elucidating the mode of action of this plant, which finds mention in the ancient ayurvedic medical writings as a promising cure for male-impotence, post-menopausal decline in libido in females, menstrual irregularity, morphinism, alcoholism and tobacco addiction.^[11] BZF speeds up the restoration of sexuality in rats upon cessation of the administration of substances like alcohol, nicotine and alcohol-nicotine combinations, which have severe detrimental effects upon male sexuality, fertility and vigor. BZF, the strongest inhibitor of aromatase enzyme (a member of cytochrome P-450 enzyme family, i.e., P-450 3A4) prevents the metabolic conversion of androgens (testosterone) to its metabolites, thereby, increasing the testosterone levels in the gonadal tissue, thus, increasing the free testosterone and decreasing free estrogen.^[19] The testosterone levels in the plasma have an effect upon the gonadotropins (luteinizing hormone (LH) and follicle-stimulating hormone (FSH)) which regulate spermatogenesis and maturation of sperms. BZF, when administered concurrently with substances like alcohol and nicotine restores sexual virility, libido and vigor in male rats by maintaining the blood-testosterone levels high.^[20]

Aphrodisiac Activity

The aphrodisiac properties of the methanol extract of leaves of *P. incarnata* Linn. had been evaluated in mice by observing the mounting behaviour. So this study suggested that the *P. incarnata* may cause sexual desire in human beings as well.^[21]

Antiasthmatic

The methanol extract of the leaves of *P. incarnata* was evaluated for its antiasthmatic effects against acetylcholine chloride-induced bronchospasm in guinea pigs. This may be due to defective alpha-adrenoceptor function reported after excessive or continuous administration of an alpha-receptor agonist.^[22]

Antitussive Activity

The methanol extract of the leaves of *P. incarnata* exhibited significant antitussive activity on sulfur dioxide-induced cough in mice, the cough inhibition being comparable to that of codeine phosphate.^[23]

Anticancer Activity

The phytochemical composition of passion fruit juice was hypothesized to have valuable anti-cancer activity.^[8] Chrysin, a passion flower extract, may be beneficial because of its potential to attenuate surgical suppression of natural killer (NK) cell activity, thereby minimizing metastatic spread of cancer.^[24]

Hypertension

Despite improved pharmacotherapies and mechanical treatments, cardiovascular disease remains a principal cause of morbidity and mortality worldwide, with every chance that this burden will increase.^[25] *P. incarnata* which is an allied species of *P. nepalensis* had already been reported to possess antihypertensive effects. The antihypertensive effect of *P. incarnata* is due to the presence of water soluble substance isolated as a mercury salt ($C_{10}H_{22}O_8NHgCl_2$)^[10] and flavonoids. *P. nepalensis* is used in folklore medicine for treating hypertension.

CONCLUSION

The therapeutic efficacy of *P. incarnata* extensively used in Indian system of medicine has been established through modern testing and evaluation (pre-clinical and clinical trials) in different disease conditions. These studies place this indigenous drug as a novel candidate for bioprospection and drug development for the treatment of such diseases as anxiety, insomnia, convulsion, sexual dysfunction, cough, cancer and postmenopausal syndrome. The medicinal applications of this plant and countless possibilities for investigation still remain in relatively newer areas of its function. Hence, phytochemicals and minerals of these plants will enable to exploit its therapeutic use.

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