

AN OVERVIEW ON INDIAN MEDICINAL PLANTS AND ITS THERAPEUTIC IMPORTANCE WITH SPECIAL REFERENCE TO *PASSIFLORA INCARNATA LINN.* AND *WITHANIA COAGULANS*

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**ABSTRACT**

Plants have been used for thousands of years in almost all types of ethnic medicinal practices despite the secular variations. It remained an easily accessible source in the primary health care system. The predominant usage of herbal medicine was described in almost all Vedas and the Bible. Medicinal plants have a wide range of bioactivities that are exploited to prevent and treat various ailing conditions. The knowledge of the therapeutic properties is pervasive among all human racial groups by way of oral transmission from generation to generation. Documentation of the potency is necessary for their sustainable usage and also to protect them from extinction. The main objective of this review is to summarize the properties of two plants of therapeutic importance *Passiflora incarnata Linn* and *Withania coagulans*.

**KEYWORDS:** Medicinal Properties, *Passiflora incarnata Linn*, *Withania coagulans*, Phytochemical constituents, Pharmacology.

**INTRODUCTION**

Plants are the “backbone of traditional medicine” and 3.3 billion people in underdeveloped countries still use them regularly.<sup>[1]</sup> WHO estimates that 80% of the population in developing countries use conventional plant-based components in their day-to-day activity as spices, condiments, beverages, food, medicine, and inhalation which are so integrated into their life mostly concealed as spiritual belief systems, furthermore it is affordable and safe for use.<sup>[2,3]</sup> Many medicinal plants proved their role in coping with lethal diseases like cancer, AIDS, HIV, diabetes, etc. The USA presented approximately 100 new drugs from 1950 to 1970 that are plant-derived.<sup>[4]</sup> Ayurvedic system of medication, stemming from India, has been powerful in treating and preventing various health conditions.<sup>[5]</sup> About 50% of modern drugs have bioactive compounds from medicinal plants whose molecular and biochemical interactions in the human body have been well established.<sup>[6]</sup> Henceforth World Health Organization introduced herbal medicine to national health care programs that are easily accessible, time tested, and considered to be safer than synthetic drugs.<sup>[7]</sup>

The current review aims to examine Indian medicinal plants and their medicinal importance with a focus on two plants: *Passiflora incarnata Linn.* and *Withania coagulans*.

***Passiflora incarnata Linn.***

*Passiflora Incarnata Linn.* (Passifloraceae), commonly known as the Purple passion flower, Apricot vine May apple is widely distributed in warm temperate and tropical regions. *Passiflora* comes from the Latin word "Passio" which was first time discovered by Spanish discoverers in 1529 and was described as a symbol for the "Passion of Christ".<sup>[8]</sup> *Passiflora Incarnata Linn.* are distributed in the warm temperate and tropical regions of the world. The species is native to Central or South America and some species occur in North America, Southeast Asia, and Australia. The North American passionflower *Passiflora incarnata L.* is an important herbal drug widely used in contemporary Western phytotherapy. This species, commonly known as maypop, is native to the southeastern United States but is also cultivated in Europe, Asia, and Australia, both as an ornamental and as a medicinal plant.<sup>[9]</sup>

### Morphological characteristics



*Passiflora incarnata* is an evergreen climber, rapidly growing up to 6 m (19 ft 8 in). This plant is in leaf from December to January, in flower from June to July, and its seeds ripen from September to November. This plant possesses hermaphrodite flowers (possessing both male and female organs) which are pollinated by insects such as bees. *Passiflora incarnata* can grow in light (sandy), medium (loamy), or heavy (clay) soils, with a preference for well-drained soil, and it cannot grow in the shade due to the soil moisture in shady areas.<sup>[10]</sup>

#### Description of the different parts of the plant

1. Stems: Stems can trail along the ground or climb on other vegetation. Stems are usually only slightly hairy and may reach 61 feet in length.
2. Leaves: Arranged alternately along the stem, usually only slightly hairy. Individual leaves are divided into three lobes that arise from a common point (palmately lobed). Leaves are approximately 15cm inches long and 13cm 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.
3. Flowers: Solitary flowers arise from the area between stem and leaf petioles. Flowers range from 6 to 7 in diameter and are very attractive and light purple to lavender in colour. The flower has 5 petals and 5 sepals, which are purplish to whitish, similar, and alternating. The flower has 3 styles, typically 3 stamens, and 5 greenish-white sepals with terminal appendages.
4. Fruit: A relatively large (11 inches long) berry that is green or yellowish-green in colour. Berries contain many dark brown 'dimpled' seeds (reticulate seeds).
5. Habitat: Thickets, waste ground, disturbed sites, roadsides, railroads. The plant is also cultivated.<sup>[10]</sup>

### *Withania coagulans*

*Withania coagulans* Dunal (family Solanaceae), is reported in Ayurveda for its biological potential. It is commonly known as "Paneer ke phool" in Hindi and "Indian cheese maker" or "Vegetable rennet" in English, distributed in drier parts of India.<sup>[11]</sup> It is reported that the withanolides are responsible for its antihyperglycemic activity. In India, two species of the genus *Withania*, *Withania somnifera*, and *Withania coagulans* are found.<sup>[12]</sup> *Withania coagulans* (Paneer phool) are one such source in which every part of the plant possesses therapeutic properties. It has many bioactive compounds that are responsible for its biological and pharmacological activities. Besides phenols, flavonoids, tannins, saponins, and alkaloids the withanolides present in it are the major bioactive components.<sup>[13]</sup> This shrub is common in Iran, Afghanistan, Pakistan, East India and Nepal. In India, the plant is found in drier parts of Rajasthan, Punjab, Gujrat, Simla, Kumaun, and Garhwal. *Withania coagulans* are also distributed in the east of the Mediterranean region extending to South Asia.<sup>[14]</sup>

### Morphological characteristics



*Withania* is a small or medium undershrub, 30-150cm in height, erect, grayish, branching perennial, with a strong disagreeable odour like a horse's urine.

- 1) Leaves: The leaves are simple, entire, and clothed with a persistent grayish tomentum on each side. 2.5 to 5.7 by 1 to 2.2 cm, long however usually shadowy. Yellow in axillary determinate clusters, berries orbicular, red or chromatic, smooth, basined in coriaceous ringlet. Leaves contain four internal secretion lactones referred to as Withanolides.
- 2) Fruits: The berries are 7 to 12 millimeters in diameter, red, smooth, closely girt by the enlarged membranous ringlet that is scurfy-pubescent outside. Seeds 2.5 to 3 mm. Fruits are carminative, depurative, used for upset stomach, flatulence, and strange. Berries contain milk-coagulating enzymes, esterase, free amino acids, fatty oil, volatile oil, and

alkaloids. The volatile oil was active against the genus *Micrococcus pyogenes* power unit. aureus and conjointly shows anthelmintic activity. The fruits of berries area unit is used as a blood setup. Liquid extract of fruit *W. Coagulans* exhibited medication and inhibitor activity.

3) Flowers: 7 to 12 millimeters across, yellowish, dioecious and polygamous in nature. The flowers seem a very bright yellow or green and they carry little berries that are unit orange-red in color. Flowering amount - Jan to Gregorian calendar month.<sup>[15]</sup>

**Table 1: Taxonomical Classification of Medicinal Plants.**<sup>[16,17]</sup>

Classification	<i>Passiflora incarnata</i> L.	<i>Withania coagulans</i>
Kingdom	Plantae	Plantae
Division	Magnoliophyta (Flowering plants)	Angiosperma
Class	Magnoliopsida (Dicotyledons)	Magnoliopsida (Dicotyledons)
Botanical source	<i>Passiflora incarnata</i> L.	<i>Withania coagulans</i>
Family	Passifloraceae	Solanaceae
Genus	<i>Passiflora</i> L.	<i>Withania</i>
Species	<i>Passiflora incarnata</i> L.	<i>W. Coagulans</i>

### Phytochemical Constituents Present in the Plants

#### *Passiflora incarnata* Linn.

##### 1. Flavonoids

Flavonoids are reported to be the major phyto-constituents of *Passiflora incarnata* (L.). These include apigenin, luteolin, quercetin, kaempferol, C-glycosyl flavonoids vitexin, isovitexin, orientin, isoorientin, schaftoside, isoschaftoside, isovitexin2-O-glucopyranoside, isoorientin-2-O-glucopyranoside, 2-glucosylapigenin, isoscoparin-2-O-glucoside, 2-Oglucosyl-6-C-glucosylapigenin. The greatest accumulation of flavonoids has been reported to be in leaves and the highest concentration of isovitexin was found to be between the pre-flowering and flowering stages. During various quantitative studies, it was observed that the ethanol-free liquid extract of *Passiflora incarnata* (L.) contains higher contents of flavonoids as compared to commercial preparations. Amongst various other species of the genus, *Passiflora incarnata* (L.) contains the highest content of isovitexin.<sup>[18]</sup>

##### 2. Alkaloids

*Passiflora incarnata* (L.) contains simple indole alkaloids based on a carboline ring system namely harman, harmol, harmine, harmalol, and harmaline. The content of harman, and harmine, determined by direct spectrofluorimetric methods on TLC plates, has been reported to be 10–20g/100 ml in the medicinal fluid extract of *Passiflora incarnata* (L.). Recently, all types of carboline alkaloids have been analyzed quantitatively by HPLC with selective fluorometric detection. The vegetative parts of greenhouse-grown *Passiflora incarnata* (L.) contain 0.012 and 0.007% of harman, and harmine, respectively, while the content of these alkaloids in the plant grown in fields has been reported as 0.005% and nil, respectively.<sup>[19]</sup>

#### *Withania Coagulans*

The defatted meal from the seeds of *W. coagulans* Dunal contains 17.8% free sugars, consisting of d-galactose and d-arabinose in the ratio 1:1, with maltose in traces. Enzymatic studies showed the absence of a  $\beta$ -galactosides linkage in the polysaccharide. The seeds of

*W. coagulans* are reported to contain 12–14% fatty oil.<sup>[20]</sup> The various primary and secondary metabolites such as carbohydrates, proteins, amino acids, alkaloids, phenols, tannins, steroids, saponins, organic acids, etc. Various therapeutic activities of *W. coagulans* plant are due to a specific steroid derivative group, steroidal lactones known as “Withanolides”. *W. coagulans* is rich in steroidal lactones, which are known as withanolides. A variety of Withanolides such as coagulanolide, coagulin-F, coagulin-G, Withacoagulin, etc. have been isolated from the whole plant of *W. coagulans*.

**Withanolides** are C28 steroidal lactones. The basic structures of withanolide consist of six or five-membered lactone rings formed on the ergostane skeleton. The withanolide skeleton may be defined as 22-hydroxy ergostan-26oic-acid-26, 22olide. Different types of Withanolides have been identified based on their chemical composition and structure. All the plants known to produce withanolides share two features in common, one being the ability to incorporate oxygen at almost every position of the carboxylic skeleton and side chain and another characteristic feature of withanolide in the presence of a side chain of 9 C containing 6 or 5 membered lactone ring. The ring is often fused with the carboxylic part of the molecule through a C-C bond or an oxygen bridge.<sup>[21]</sup>

### Pharmacological activities of Plants

#### *Passiflora incarnata* Linn.

##### 1. Antitussive

The methanolic extract of leaves of *P. incarnata* (100 and 200 mg/kg, p.o.) exhibited significant antitussive activity on sulfur dioxide-induced cough in mice, the cough inhibition being comparable to that of codeine phosphate. These results corroborate the folklore claims on the effectiveness of the plant in managing ‘tough’ cough conditions. Moreover, *P. incarnata*, which has not been reported anywhere to possess addiction liabilities, could present advantages over available cough-suppressants (opiates, anti-histaminics) which, though acting fast, have several adverse effects including CNS depression, dryness of mouth, blurred vision, severe

gastrointestinal effects, and burning micturition. Further studies are, therefore, necessary to evaluate better the potential of *P. incarnata* as an effective cough suppressant.<sup>[22]</sup>

## 2. Antianxiety

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. *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. 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 has 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.<sup>[23]</sup> In this study, each group of animal received an intraperitoneal injection of vehicle (DMSO 4%), chrysin, 2 mg/kg, midazolam, 1.5 mg/kg, or flumazenil, 3 mg/kg and chrysin, 2 mg/kg. The EPM was used to evaluate the behavioral 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.<sup>[24]</sup>

## 3. Anti-asthmatic

The methanol extract of the leaves of *P. incarnata* was evaluated for its anti-asthmatic 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.<sup>[25]</sup>

## 4. Antidiabetic

The antidiabetic activity of *Passiflora Incarnata* Linn. has been evaluated in experimental animal models. The methanolic extracts of leaves of *Passiflora Incarnata* Linn. were administered orally and found to have antidiabetic activity against streptozotocin-induced diabetes in mice.<sup>[26]</sup>

## 5. Anticonvulsant

The current treatment of epilepsy with modern Anti-Epileptic 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 AED therapy. Natural products from folk remedies have contributed significantly to 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 the anticonvulsant activity of *Passiflora incarnata* (L.) in the clonic seizure of the pentylenetetrazole model has been tested in mice. As the protective effects of *Passiflora incarnata* (L.) in clonic seizure, it suggest that it could be useful for treatment of absence seizure. Furthermore, the important role of the benzodiazepine receptor in the effects of *Passiflora incarnata* (L.) should be considered.<sup>[27]</sup>

## *Withania coagulans*

### 1. Anti-inflammatory Activity

Inflammation in the human body is caused by several ways. Cyclooxygenase 1 (COX-1) and Cyclooxygenase 2 (COX-2) are two enzymes that make prostaglandins, thromboxane, from arachidonic acid and these prostaglandins can cause inflammation in the body. *Withania coagulans* fruit extract includes 3-hydroxy-2,3-dihydro withanolides, which has the highest anti-inflammatory activity by inhibiting COX-2 as opposed to COX-1. The anti-inflammatory activities of *W. coagulans* have been studied by several researchers.

The aqueous extract of *W. coagulans* fruits has a significant anti-inflammatory effect in subacute inflammation models such as granuloma formation and formalin-induced arthritis in rats.<sup>[28]</sup>

### 2. Antidiabetic Activity

*Withania coagulans* contains Alkaloids, steroidal lactone, and saponin along with some metal ions such as Cadmium, Mercury, Magnesium, and calcium. The higher concentration of calcium and magnesium ions shows anti-hyperglycaemic activity, as calcium is the main cofactor that increases the expression of a gene required to produce insulin through Calcium Responsive Element Binding Protein (CREB).<sup>[29]</sup>

In the studies show that the aqueous extract of *Withania coagulans* Fruit reverses the Nicotinamide and Streptozotocin-induced Diabetes in Rats by increasing the glucokinase and phosphofructokinase while significantly decreasing the glucose-6-phosphatase activity.<sup>[30]</sup>

### 3. Diuretic

The diuretic activity is calculated based on the excretion of electrolytes from the body. Withaferin A has the potential to show maximum diuretic activity by exerting action on the Proximal tubule and ascending loop of the henle as a result of a high number of Sodium and Potassium ions get excreted from the body.<sup>[31]</sup>

### 4. Wound Healing Activity

The hydroalcoholic fraction of the methanolic extract of *Withania coagulans* was administered in the form of 10% w/w ointment topically and at a dose of 500 mg/kg



body weight orally to streptozotocin-induced diabetic rats. *W. coagulans* showed significant wound-healing activity in open and incised wound models. The hydroalcoholic fraction in both the forms, i.e., topical (10% w/w ointment) and oral (500 mg/kg body weight, p.o.) showed a significant increase in the rate of wound contraction compared to diabetic controls.<sup>[32]</sup>

#### 5. Antibacterial

The extract of *Withania coagulans* fruit contains 17 $\beta$ -hydroxy withanolide k, withanolide F and volatile oil which shows a wide spectrum of Antifungal activity on Human fungus. While the root contains Withaferin A which shows significant Antibacterial activity against Gram-positive as well as Gram-negative bacteria.

The study of antibacterial activity of Withaferin A by using nutrient agar culture against *B. subtilis*, *E. coli* and *S. aureus* and concluded that after 2 days, there is inhibition of bacteria on culture with the help of the Inhibition zone method.<sup>[33]</sup>

#### CONCLUSION

This article comprehensively reviews Indian medicinal plants, focusing on *Passiflora incarnata L.* and *Withania coagulans*. It assesses the contribution of traditional Indian medicine towards healing and the potency of medicinal plants in both historical cures and present-day medications. The study analyses the chemical makeup and pharmacological benefits of these plants, encompassing anti-inflammatory, antibacterial, antidiabetic, and diuretic properties. *Passiflora incarnata* Linn. has traditionally been used to treat anxiety, cough, asthma and convulsions while *Withania coagulans* has been utilized in Ayurvedic medicine for its inflammation, bacterial infection, diuretics, and cancer properties.

The review emphasize the need for additional research into the therapeutic potential of these plants to preserve indigenous knowledge and rituals related to medicinal plants.

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