

## INSIGHT ON PASSIFLORA SPECIES WITH AN OVERVIEW ON PLANT PASSIFLORA VITIFOLIA, ITS USES, PHYTOCHEMICAL SCREENING & *IN-VITRO* ANTI-INFLAMMATORY ACTIVITY

**Prof. (Dr.) G. Gnanarajan<sup>1</sup>, Jyoti Pandey<sup>\*2</sup>**

<sup>1</sup>Prof. (Dr.)., Department of Pharmaceutics, School of Pharmaceutical Sciences, Shri Guru Ram Rai University, Dehradun, Uttarakhand-248001

<sup>\*2</sup>Research Scholar, Department of Pharmaceutics, School of Pharmaceutical Sciences, Shri Guru Ram Rai University, Dehradun, Uttarakhand-248001

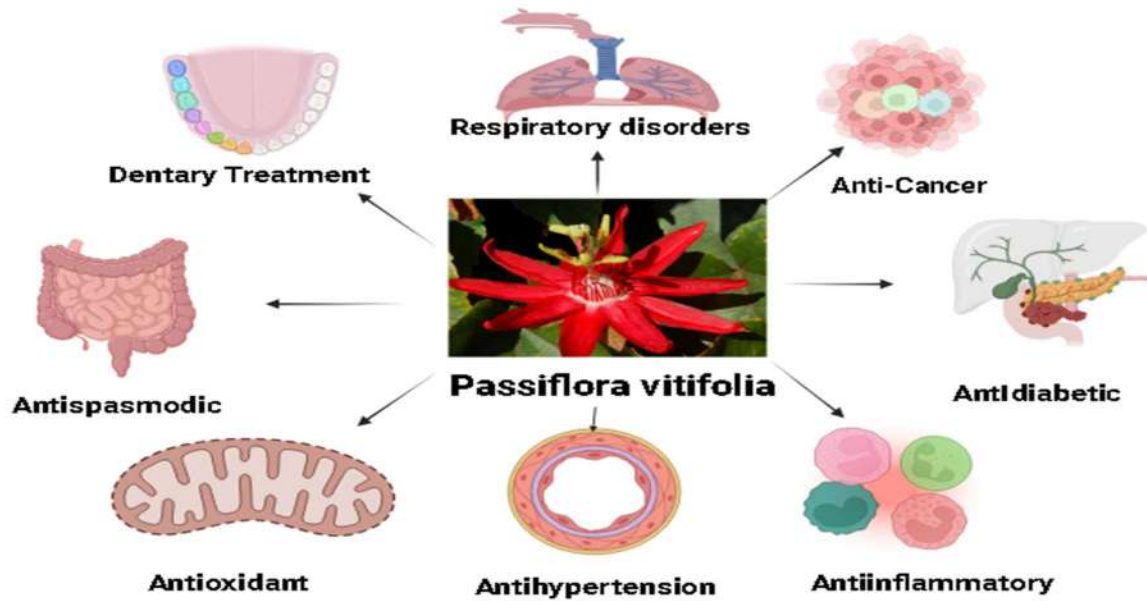
### Abstract

In India, there are plenty of herbs which are used for their medicinal properties to cure the variety of diseases. In the same lieu the category of Passifloral species are very efficacious and potential herbs. As a medicinal herb Passiflora vitifolia is a specified plant which is helpful to cure variety of health-related Issues. It is tropical climber plant and widely grown in China's subtropical areas. From the ancient time various herbs used for their medicinal benefits. Passiflora vitifolia is one of the species which is used for their variety of medicinal actions like antioxidant, anti-inflammatory, antihypertensive, antianginal and used to treat insomnia, asthma and migraine. Such pharmaceutical activity shown by the Passiflora species because of presence of variant chemical constituents like Alkaloids, glycosides, phenols, flavonoids, volatile oil, terpenoids etc. The objective of present study to establish the medical benefits of Passiflora vitifolia plant, phytochemical screening of chemical constituents presents in it, their utilization and invitro analysis for anti-inflammatory activity. In this investigation we also studied about the current progress in the formulation, characterization and enhancement of poor water solubility and bioavailability of phyto-phospholipid complexes.

**Keywords:** Passiflora vitifolia, Anti-inflammatory, Antihypertensive, Antianginal and Bioavailability.

**Graphical Abstract:** Diagrammatic representation of different medicinal uses of Passiflora vitifolia Plant





## Introduction

Many of Herbs and Herbal products are used from ancient time for the cure of various diseases because herbal formulations are safer and more efficient(1,2). In India around 25,000 plants-based formulation are available which are used by the rural communities for disease treatment. Such medicinal plants are the finest sources of bioactive compounds(3,4) The genus *Passiflora* having a 550 count of flowering species, which is also known as passionflower(5). *Passiflora* species generally grown in tropical and semi tropical United states, Mexico, Brazil, India etc. It is a kind of perennial climbing vine consisting of colourful flower and delightful fruit which is available in all over the world and preferentially in tropical and subtropical regions(6–8). This species used to treat variety of diseases like, inflammation, anxiety, insomnia, angina etc., due to presence of variety of phytochemical constituents like; flavonoids, alkaloids, glycosides, phenols, tannins, saponins, anthraquinones, terpenoids, amino acids etc(9,10). The most versatile chemical constituent in *Passiflora* to shows the anti-inflammatory effect is Flavonoid and Phenolic compounds.

The aim of the present work is to study about various passiflora species consist of their uses and to judge the various pharmacognostic character and pharmaceutical constituents present in the plant *Passiflora vitifolia* by using different extracts(11).

## Description of various species of *Passiflora*:

The Plant *Passiflora* usually available in various species belongs to the family *Passifloraceae* like; Table 1.1

Table 1.1: Tabulation subjected to detail of various species of *Passiflora* (2,3)

S.No.	Plant Species	Part Used	Uses
1.	<i>Passiflora alata</i>	Leaves and Seeds	Antioxidant and Antiinflammatory
2.	<i>Passiflora arizonica</i>	Aerial Parts	Antioxidant and Antifungal

3.	<i>Passiflora antioquiensis</i>	Leaves, Seeds and flower	Antioxidant, antianginal, In treatment of Insomnia, In Pain and as flavouring agent
4.	<i>Passiflora actinia</i>	Leaves	Antioxidant, antianginal and to treat anxiety
5.	<i>Passiflora acuminata</i>	Leaves and Seeds	Antioxidant, antianginal, In Insomnia, In Pain and as flavouring agent
6.	<i>Passiflora adenophylla</i>	Leaves, Fruit and Seeds	Antidiabetic, antianginal, In Insomnia, In Pain and as flavouring agent
7.	<i>Passiflora adenopoda</i>	Fruit, Seed and fruit	Antioxidant, antianginal and Antifungal
8.	<i>Passiflora adulterine</i>	Leaves	Antioxidant, antianginal, In Insomnia, In Pain and as flavouring agent
9.	<i>Passiflora affinis</i>	Leaves and Aerial Parts	In treatment of Hypoglycaemia, Insomnia and angina
10.	<i>Passiflora amicorum</i>	Leaves	In treatment of Insomnia, anxiety and Pain
11.	<i>Passiflora amethystine</i>	Leaves and Fruit peel	In treatment of Insomnia and angina
12.	<i>Passiflora amoena</i>	Leaves and Fruit Peel	As antianginal, In Insomnia, In Pain and as flavouring agent
13.	<i>Passiflora anadenia</i>	Leaves, Flower, Seeds and Fruit peel	Antioxidant, antianginal, In Insomnia, In Pain and as flavouring agent
14.	<i>Passiflora bahamensis</i>	Aerial Parts	In treatment of anxiety, ADH regulation, Pain relief
15.	<i>Passiflora baueri</i>	Seeds and Flower	Antioxidant, antianginal, In Insomnia, In Pain and as flavouring agent
16.	<i>Passiflora brevifila</i>	Aerial Parts	In treatment of anxiety, Insomnia and Pain
17.	<i>Passiflora caerulea</i>	Leaves, Fruit peel and seeds	Antioxidant, antianginal, antifungal, In condition of Insomnia and Pain
18.	<i>Passiflora cerasina</i>	Leaves, Seeds and flower	Antioxidant, antianginal, In Insomnia, In Pain and as flavouring agent
19.	<i>Passiflora cubensis</i>	Aerial Parts	As antianginal, In Insomnia, In Pain
20.	<i>Passiflora dasyadenia</i>	Leaves and Fruit peel	As antianginal, In Insomnia, In Pain and as flavouring agent
21.	<i>Passiflora deltoifolia</i>	Aerial Parts	In treatment of anxiety, ADH regulation, Pain relief
22.	<i>Passiflora dolichocarpa</i>	Seeds, Leaves and Aerial Parts	Antioxidant, antianginal, antifungal, In condition of Insomnia, In Pain and as

			flavouring agent
23.	<i>Passiflora discophora</i>	Aerial Parts	In treatment of anxiety, ADH regulation, Pain relief, as antixyloctic action
24.	<i>Passiflora eberhardtii</i>	Leaves and Seeds	Antioxidant, antianginal, In Insomnia, In Pain and as flavouring agent
25.	<i>Passiflora elliptica</i>	Aerial Parts	In treatment of anxiety, Insomnia and Pain
26.	<i>Passiflora edulis</i>	Seeds and Leaves	Antioxidant, antibacterial, In condition of Insomnia, In Pain and as flavouring agent
27.	<i>Passiflora fanchonae</i>	Aerial parts	In treatment of Insomnia and angina
28.	<i>Passiflora foetida</i>	Fruit peel and Flower	As antianginal, In Insomnia, In Pain and as flavouring agent
29.	<i>Passiflora faroana</i>	Seeds and Leaves	Antioxidant, antianginal, In Insomnia, In Pain and as flavouring agent
30.	<i>Passiflora filamentosa</i>	Leaves and Seeds	Antioxidant, antianginal, antifungal, In condition of Insomnia, In Pain and as flavouring agent
31.	<i>Passiflora fruticose</i>	Aerial Parts	In treatment of anxiety, ADH regulation, Pain relief and hypoglycaemic agent
32.	<i>Passiflora galbana</i>	Leaves, Fruit peel and flower	As antianginal, In Insomnia, In Pain and as flavouring agent
33.	<i>Passiflora gardneri</i>	Fruit peel and Flower	As antianginal, In Insomnia, In Pain and as flavouring agent
34.	<i>Passiflora goniosperma</i>	Aerial part	As antianginal, ADH In Insomnia, In Pain and as flavouring agent
35.	<i>Passiflora guatemalensis</i>	Leaves and Seeds	As antianginal, Antibacterial and antioxidant
36.	<i>Passiflora haematostigma</i>	Aerial parts	In treatment of anxiety, ADH regulation, Pain relief
37.	<i>Passiflora hirtiflora</i>	Leaves and Seeds	Antioxidant, antianginal, antifungal, In condition of Insomnia, In Pain and as flavouring agent
38.	<i>Passiflora hollrungii</i>	Fruit peel and seeds	In treatment of anxiety, ADH regulation, Pain relief
39.	<i>Passiflora incarnata</i>	Seeds and leaves	Antioxidant, antianginal, In Insomnia, In Pain and as flavouring agent

40.	<i>Passiflora indecora</i>	Aerial Parts	In treatment of anxiety, Insomnia and Pain
41.	<i>Passiflora insignis</i>	Leaves and Seeds	Antioxidant, antianginal, antifungal, In condition of Insomnia and Pain
42.	<i>Passiflora jamesonii</i>	Aerial Parts	In treatment of Insomnia and angina
43.	<i>Passiflora jorullensis</i>	Leaves, Fruit peel and Seeds	Antioxidant, antianginal, antifungal, In condition of Insomnia, In Pain and as flavouring agent
44.	<i>Passiflora Juliana</i>	Aerial parts	In treatment of anxiety, ADH regulation, Pain relief
45.	<i>Passiflora kermesina</i>	Leaves, Seeds and Fruit peel	Antioxidant, antianginal, antixylotic action, In Insomnia, In Pain and as flavouring agent
46.	<i>Passiflora kuranda</i>	Aerial parts	In treatment of anxiety, Insomnia and Pain
47.	<i>Passiflora lanata</i>	Seeds and Leaves	Antioxidant, antianginal, antifungal, In condition of Insomnia, In Pain and as flavouring agent
48.	<i>Passiflora laurifolia</i>	Leaves and stem bark	Antioxidant, antianginal, In Insomnia, In Pain and as flavouring agent
49.	<i>Passiflora lorenziana</i>	Aerial part	In treatment of anxiety, Insomnia and Pain
50.	<i>Passiflora lutea</i>	Leaves	Antioxidant, antianginal, antifungal, In condition of Insomnia, In Pain and as flavouring agent
51.	<i>Passiflora miniata</i>	Aerial Parts	In treatment of anxiety, ADH regulation, Pain relief, hypoglycaemic action
52.	<i>Passiflora manicata</i>	Leaves and fruit peel	Antioxidant, antianginal, antifungal, In condition of Insomnia, In Pain and as flavouring agent
53.	<i>Passiflora membranacea</i>	Leaves and fruit peel	In treatment of anxiety, ADH regulation, Pain relief
54.	<i>Passiflora microstipula</i>	Seeds and Leaves	Antioxidant, antianginal, antibacterial, In Insomnia, In Pain and as flavouring agent
55.	<i>Passiflora morifolia</i>	Aerial Parts	In treatment of anxiety, Insomnia and Pain
56.	<i>Passiflora</i>	Aerial Parts	In treatment of anxiety, Insomnia and

	napalensis		Pain
57.	Passiflora nitida	Fruit peel, Seeds and Leaves	Antioxidant, antianginal, antifungal, In condition of Insomnia, In Pain and as flavouring agent
58.	Passiflora obtusifolia	Aerial Parts	In treatment of anxiety, ADH regulation, Pain relief
59.	Passiflora odontophylla	Leaves, Fruit seed and flower	Antioxidant, antianginal, antifungal, In condition of Insomnia, In Pain and as flavouring agent
60.	Passiflora ovalis	Leaves and Seeds	In treatment of Fungal infection, anxiety, Insomnia and Pain
61.	Passiflora organensis	Leaves and Seeds	Antioxidant, antianginal, antifungal, In condition of Insomnia, In Pain and as flavouring agent
62.	Passiflora ovalis	Bark and Fruit peel	In treatment of anxiety, ADH regulation, Pain relief
63.	Passiflora palenquensis	Leaves, flower and Seeds	Antioxidant, antianginal, antifungal, In condition of Insomnia, In Pain and as flavouring agent
64.	Passiflora pallens	Aerial part	In treatment of anxiety, ADH regulation, Pain relief
65.	Passiflora pallida	Leaves and Seeds	Antioxidant, antianginal and antibacterial action
66.	Passiflora penduliflora	Leaves and Seeds	Antioxidant, antianginal, In Insomnia, In Pain and as flavouring agent
67.	Passiflora picturata	Leaves	Antiinflammatory and antibacterial action
68.	Passiflora pohlii	Leaves	Anti-inflammatory, antianginal and antifungal
69.	Passiflora purii	Leaves and bark	Antioxidant, antianginal, In Insomnia, In Pain and as flavouring agent
70.	Passiflora quadrangularis	Aerial part	In treatment of Insomnia and angina
71.	Passiflora quetzal	Leaves and fruit peel	Anti-inflammatory, In Insomnia, In Pain and as flavouring agent
72.	Passiflora racemosa	Aerial Parts	In treatment of anxiety, Insomnia and Pain
73.	Passiflora reflexiflora	Leaves	Anti-inflammatory, antioxidant, antianginal, antifungal,
74.	Passiflora	Aerial Parts	In treatment of anxiety, ADH

	retipetala		regulation, Pain relief
75.	Passiflora rubra	Leaves	Antioxidant, antianginal, antifungal, In condition of Insomnia, In Pain and as flavouring agent
76.	Passiflora rupestris	Aerial Parts	In treatment of anxiety, ADH regulation, Pain relief
77.	Passiflora sanctae	Leaves	Antioxidant, antianginal, antifungal, In condition of Insomnia, In Pain and as flavouring agent
78.	Passiflora sexocellata	Leaves	Antiinflammatory, Antianginal and Hypoglycaemic action
79.	Passiflora speciosa	Seeds and Leaves	Antioxidant, antianginal, In Insomnia, In Pain and as flavouring agent
80.	Passiflora subpurpure	Aerial Parts	In treatment of anxiety, Insomnia and Pain
81.	Passiflora sumatrana	Leaves	Antioxidant, antianginal, antifungal and anti-inflammatory action
82.	Passiflora tarminiana	Leaves	Antioxidant, antianginal, antifungal, In condition of Insomnia, In Pain and as flavouring agent
83.	Passiflora trinifolia	Fruit peel	In treatment of anxiety, ADH regulation, Pain relief
84.	Passiflora tripartita	Leaves	Antioxidant, antianginal and analgesic
85.	Passiflora trisecta	Fruit peel	In treatment of anxiety, ADH regulation, Pain relief
86.	Passiflora tulae	Leaf and fruit	Antioxidant, anti-bacterial, antianginal, In Insomnia, In Pain and as flavouring agent
87.	Passiflora ulmeri	Aerial Parts	In treatment of anxiety, Insomnia and Pain
88.	Passiflora umbilicate	Leaves and Fruit peel	Antioxidant, antianginal, antifungal, In condition of Insomnia, In Pain and as flavouring agent
89.	Passiflora urbaniana	Aerial Parts	In treatment of Anxyolytic activity, anxiety, ADH regulation, Pain relief
90.	Passiflora vellozii	Fruit peel and seeds	Antioxidant, antianginal, In Insomnia, In Pain and as flavouring agent
91.	Passiflora vitifolia	Leaves, Fruit peel and seeds	In treatment of inflammation, oxidation, anxiety, Insomnia, CVS effects and Pain



92.	<i>Passiflora viridescens</i>	Fruit peel and seeds	Antioxidant, antianginal, In Pain and as flavouring agent
93.	<i>Passiflora watsoniana</i>	Leaves and flower	Antioxidant and as flavouring agent
94.	<i>Passiflora weberbaueri</i>	Aerial parts	In treatment of Insomnia and angina
95.	<i>Passiflora weigendii</i>	Leaves	Anti-inflammatory and antifungal
96.	<i>Passiflora wilsonii</i>	Aerial Parts	In treatment of anxiety, Insomnia and Pain
97.	<i>Passiflora weberbaueri</i>	Fruit peel and seeds	Antioxidant, antianginal, antifungal, In condition of Insomnia, In Pain and as flavouring agent
98.	<i>Passiflora xiikzodz</i>	Aerial Parts	In treatment of anxiety, ADH regulation, Pain relief
99.	<i>Passiflora yucatanensis</i>	Leave, Fruit peel and Flower	Antiinflammatory, antioxidant, flavouring agent and In Pain
100.	<i>Passiflora zamorana</i>	Fruit peel and seeds	Antianginal, In Insomnia, In Pain and as flavouring agent

### Images of different species of Passiflora Plant:





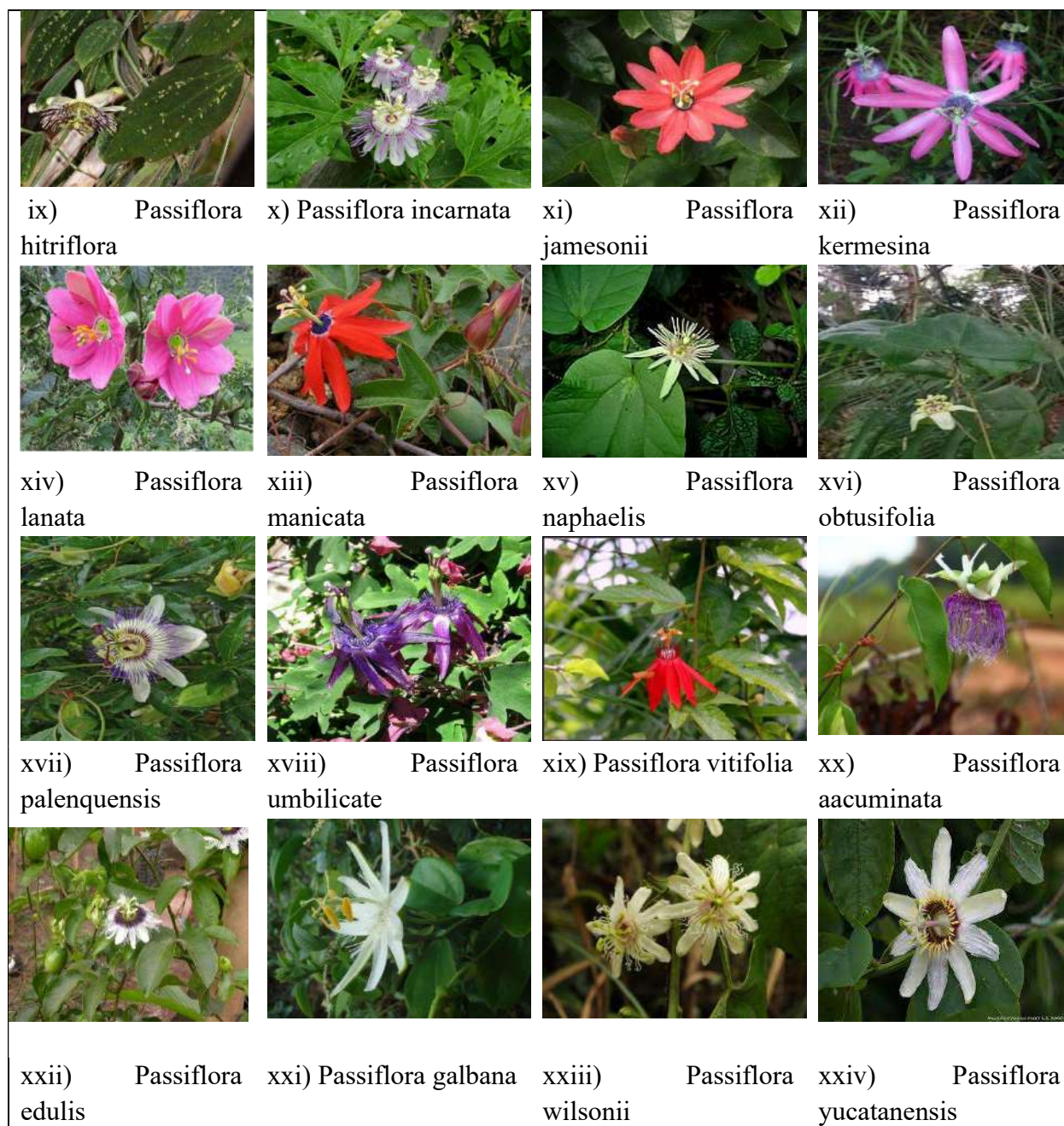


Fig1.1: Diagrammatic representation of different species of Passiflora species

**Description of Passiflora plant:****Morphological Characterization-**

**Plant:** As per morphological Analysis it is a perennial herbaceous vine with distinctive three-lobed leaves and lovely blooms that can reach lengths of up to 6 1/2 feet. In Virginia, more agronomic crops are starting to include Passion flower, especially in areas where conservation tillage is practiced(12–18). Passion flower is generally found on the edges of fields and woods(19).

**Root:** A perennial rootstock that is firmly ingrained and from which sprouts can emerge is

eventually established by roots, which at first take the shape of a taproot.

**Leaves:** Along the stem, the leaves are alternately oriented and normally have very little hair. Each leaf is palmately lobed, with three (occasionally five) lobes that branch out from the same point. The length and width of the leaves on petioles range from 2 1/2 to 5 1/2 inches. There are two nectar-filled glands at the point where the petiole meets the base of the leaf blade(20).

**Stems:** Stems can trail along the ground or clamber up other plants. Usually very slightly hairy, stems can reach a height of six-one and a half feet long.

**Flowers:** The area between the leaf petioles and the stem creates single flowers. Flowers come in various lengths and are pretty attractive, between 2 and 4 inches. They have a mild to lavender purple hue(20).

**Fruit:** A huge (1 1/2–3 cm), green or yellowish–green berry inch length). Dark brown "dimpled" seed, also known as reticulate seed is full of berries.

### Description of Passion Flower:

The Passion flowers are available in many different colours, including white, red, purple, blue, orange, and crimson etc. It often comes in lengths between 2 and 4 inches. It is a lovely, alluring flower with 6 or 8 petals and sepals. The sepal awn, a tiny, delicate spike-like structure mounted on the sepals of the flower, is what is known as Nectaries, which have a foam-like symmetry is located in the center of the flower and fully surrounded with a no. of filamentous like structure is known as coronial filament. The central part is also consisting of carpel and stamen. A carpel is made up of an ovary, a style, and a stigma. Anther and filament prevalent components of the stamen portion(21,22).

### Diagram of passion fruit:

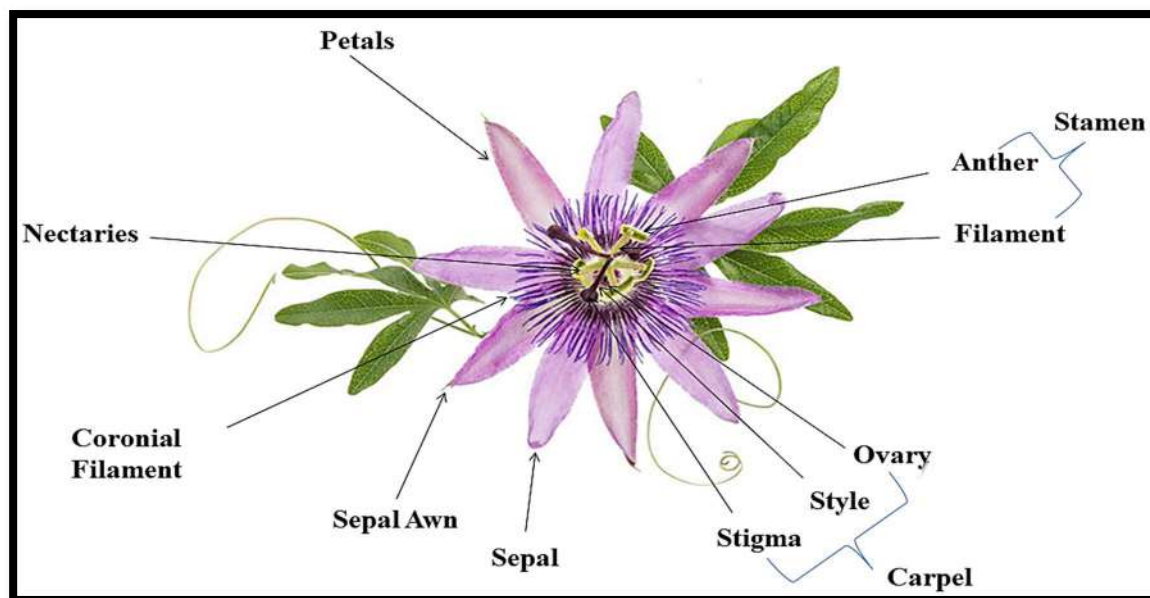


Fig 1.2: Diagrammatic representation of Passiflora flower with its Parts (Passion Flower)

### Description of Passion fruit:

Passion fruits are oval-shaped orbs approximately the size of a plum with smooth, thick, reddish-purple skin. Some species also having a green colour with white colour margins. These are most

tasty when ripe and wrinkled, looks like a custard apple from inside, the passion fruit contains a jelly-like golden liquid known as aril, surrounding hundreds of delicious black seeds(23). The central small cavity section inside the passion fruit is termed as locular cavity and the outer most layer is called as epicarp which protects the inner fleshy material of the fruit. Stems can clamber up other plants or trail along the ground. Typically exhibiting a very tiny amount of hair, stems can grow up to six feet and one & half feet in length.

#### Diagram of passion fruit:

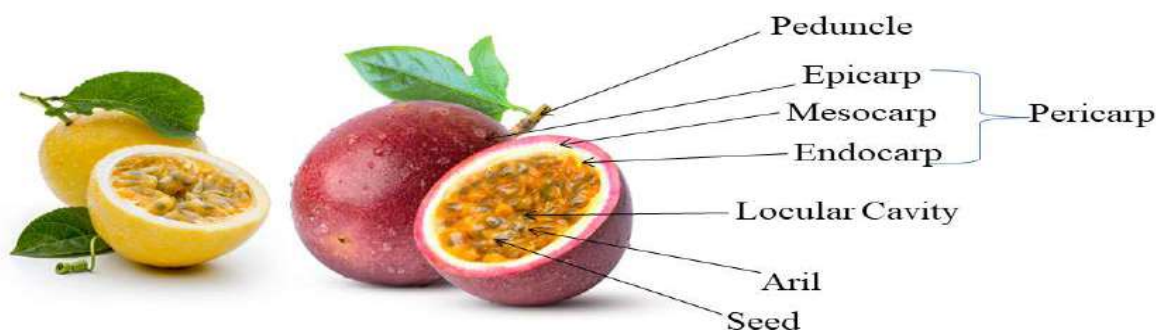


Fig 1.3: Diagrammatic representation of Passion fruit with its parts

#### Different application of Passiflora plant species:

Different species of Passiflora utilized in many pharmacological activities for the cure of various diseases in human beings. Hence, Passiflora plant species are used generally as:

- As Anti-inflammatory agent
- For Analgesic action
- As Antianginal agent
- As Antifungal agent
- As Anti-oxidant
- For Antitussive Activity
- To produce Cardiovascular effect
- To produce Sedative action
- As Anti-hypoglycaemic agent
- As Anti-Depressant
- As Anti Diabetic agent
- As Antibacterial agent
- As flavouring agent
- As Perfuming agent
- As Uterine stimulant
- In treatment of respiratory disorders
- In treatment of Anxiety
- In recovery of sexual disfunctions
- Some species also having anticancer activity.



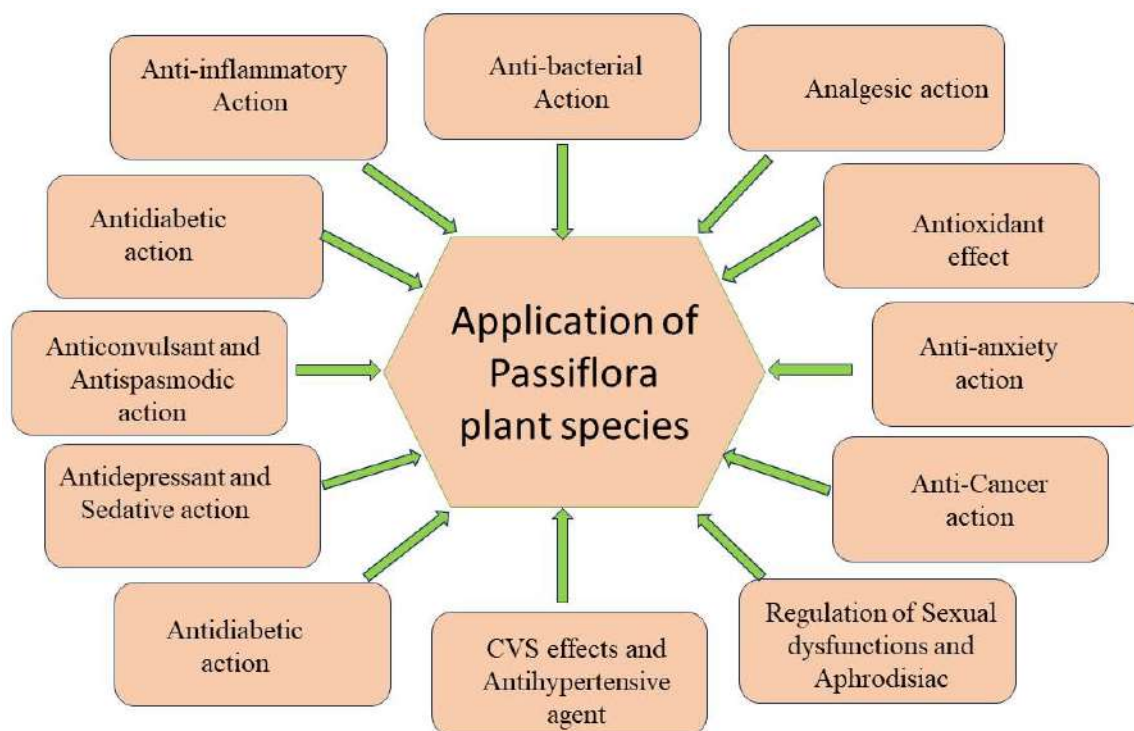


Fig 1.4: Diagrammatic representation of various applications of Passiflora species

#### Overview on Passiflora vitifolia Plant:

*Passiflora vitifolia* is one of the specified plant from the category of passifloral species comes under the family Passifloraceae. The important features of plant *P. v.* are given below:

#### Scientific classification:

Kingdom: Plantae

Subkingdom: Tracheobionta

Genus: *Passiflora*

Class: Dicotyledons

Sub class: Dilleniidae

Order: Malpighiales

Family: Passifloraceae

Species: *vitifolia*

#### Local Name:

Hindi- Rakhi Bel, Kunth

English- Grapevine leaf Passion Fruit, Perfumed Passion flower

Marathi- Vel-ghani

Telgu- Tellajumiki

#### Cultivation and Propagation of *Passiflora vitifolia*:

*Passiflora vitifolia* is a perennial climbing plant with a perennial rootstock and grape-plant like leaves. *Passiflora vitifolia* is a plant native to the damp lowlands of the tropics. *Passiflora* species

thrive in sheltered, sunny or dappled shadow conditions(24,25). Most species live in moist but well-drained soils with a lighter texture and may often blossom and fruit more profusely if soil fertility is poor(25,26). They frequently have deep roots and are relatively drought tolerant. Most *Passiflora* species prefer neutral to slightly alkaline soil and thrive in pH ranges of 6.5 to 7. *Passiflora* species are ornamental cultivar 'Scarlet Flame' features and have a strawberry-flavoured fruit. Although this common lowland species and canopy vine consist of red coloured flower which is generally grown within 1-2 meters of ground surface area(27).

For propagating a passion flower by grafting method require to take a 10 to 15 cm long cutting of fragrant passionflower. Remove the bottom leaves, dip in rooting hormone, and place in a moist soil-filled pot. Cover with plastic and keep in the shade, warm, and moist, repotting after a root system has formed. This takes around a month on average for proper growth of *Passiflora* species(28,29).



Fig1.5: Images of Plant *Passiflora vitifolia* with its aerial parts

#### **Description of Different Parts of plant *Passiflora vitifolia*:**

The various parts of plant *Passiflora vitifolia* is used for some medicinal properties due to the existence of some important bioactive components in individual part of the plant.

The Plant composed with some important parts like; leaves, stem, flower, fruit and seed(29,30).

**Leave:** The leaves of passion plant is known as grapevine leaves. The specific appellation "vitifolia," denotation "grape leaves," is derived from the Latin term "vitis," which means grape, and refers to the lobed leaves' resemblance to grape leaves little bit looks like a leaves of grape plant, which is present as three loabed, ovate and bronze style which produce a perfect protective surrounding for the passion flower(31).

**Flower:** The flower is also known as Passion flower. It is attractive red or reddish orange in colour with 4-5 inch length and 10-12 cm width. The innermost mid-section is composed with the ring of bright red coronial filaments. The foilage consist of delicate carpel and filaments(32).

**Stem:** It consist of brownish green colour cylindric stems coated with reddish-brown hairy soft spikes(33).

**Fruit:** The fruits are flashy and generally reddish-purple, yellow, orange in colour. When non ripe it is peculiar in taste and green in colour. It takes up to a month to ripen and acquires the full

flavour of sour strawberries. Inside the fruit is filled with a jelly-like golden liquid known as aril, surrounding hundreds of delicious black seeds. It is grown throughout the Caribbean on a modest scale because of the aromatic fruit(34).

**Seed:** The seeds of Passiflora plant are black in colour and these little seeds are distributed whole inside the fruit endocarp layer and covered with the golden-brown flashy layer. The seeds are rock hard in texture. The taste is crunchy and sour.(35,36) Hence the seed of fruit taken by mixing the fruit with some sweetening agent to mask the sourness(37).

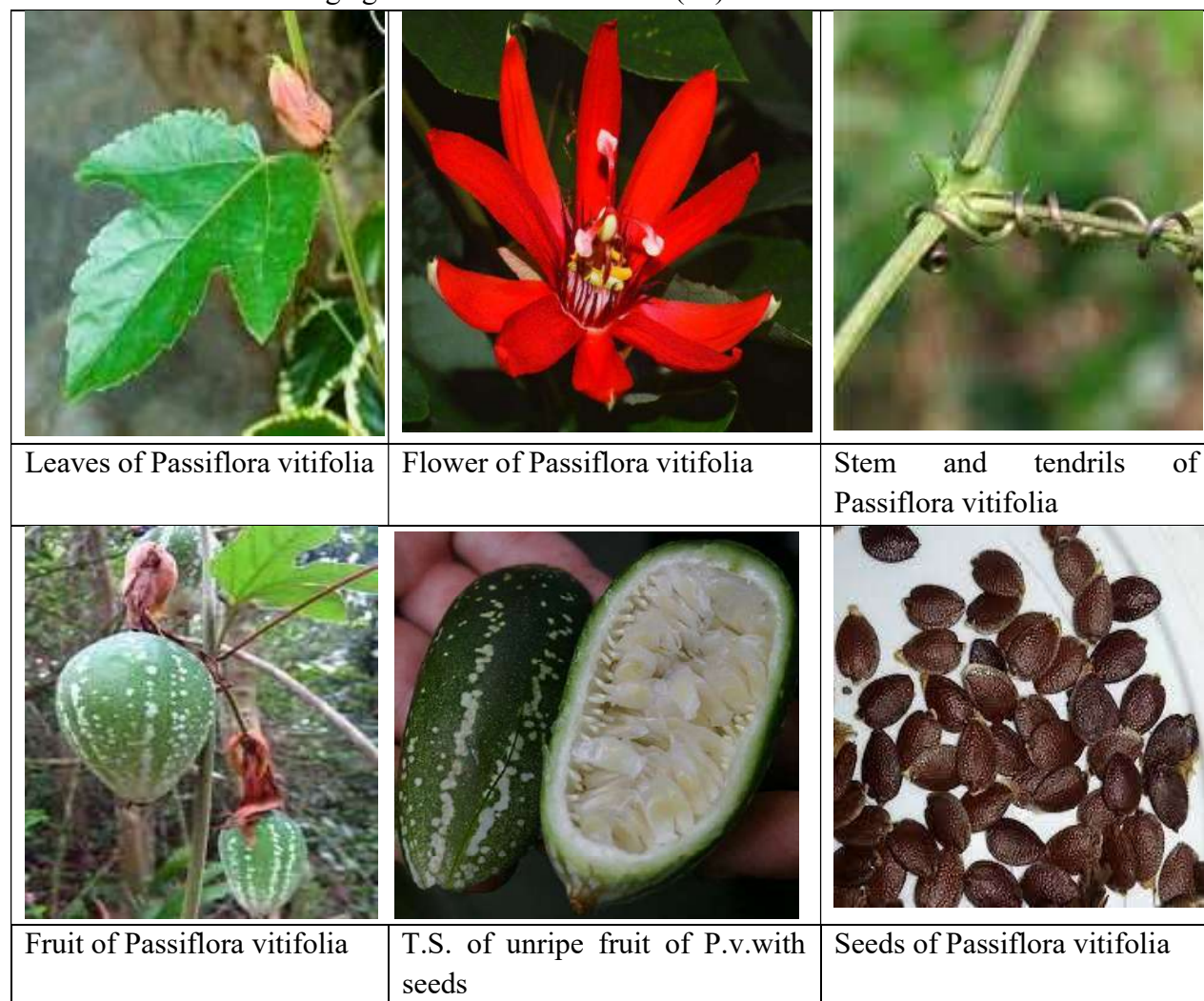


Fig1.6: Diagrammatic representation of Different parts of Passiflora vitifolia

#### Phytochemistry of Passiflora vitifolia Plant:

The P. v. plant contains various chemical constituents, more specifically the flavonoids, alkaloids, phenols, glycosides and volatile oils etc.

**Chief constituents:** The following under mention chief bioactive components are present in Passiflora vitifolia plant(37,38)

i) Flavonoid components (Represented in table no. 1.2)

Table 1.2: Tabulation subjected to detail of various flavonoid components of Plant Passiflora vitifolia



S.No.	Chemical Constituents	Part Used
1.	Luteolin-7-O-dirhamnoside-3'-O-glucoside	Leaves and Flower
2.	Luteolin-3'-O-dirhamnoside-7-Orhamnoside	Leaves and Flower
3.	Vitexin-7-O-glucoside	Leaves and Flower
4.	Vitexin	Leaves, Flower and Seeds
5.	Apigenin-7-O-diglucoside	Leaves, Flower and Seeds
6.	Isoorientin	Leaves, Flower and Seeds

ii) Glycosidal component: (Represented in Table 1.3)

Table 1.3: Tabulation subjected to detail of various Glycosidal components of Plant *Passiflora vitifolia*

S.No.	Chemical Constituent	Part Used
1.	Methylcyclohexane	Leaves
2.	Methyl butyrate	Leaves
3.	Methyl hexanoate	Leaves
4.	Limonene	Leaves
5.	Methyl 5-hexenoate	Leaves and Seeds
6.	4-Hydroxy-4-methyl-2-pentanone	Leaves, Flower and Seeds
7.	Tetradecane	Fruit peel and Seeds
8.	Methyl 3-hydroxybutyrate	Leaves and Seeds
9.	Methyl benzoate	Leaves
10.	Methyl 4-oxo-hexanoate	Leaves, Flower and Seeds
11.	Methyl 3-hydroxyhexanoate	Leaves, Flower and Seeds
12.	$\delta$ -Octalactone	Leaves
13.	P-Cresol	Leaves and Seeds
14.	4-Ethyl-5-methylthiazol	Leaves, Flower and Seeds
15.	Methyl zingerone	Flower
16.	Methyl 5-oxo-hexanoate	Leaves and Flower
17.	Methyl 5-hydroxyhexanoate	Leaves and Flower
18.	Benzoic acid	Leaves and Fruit
19.	Benzophenone	Leaves, Flower and Seeds

#### Different medicinal uses of *Passiflora vitifolia* plant:

This species consists of following various medicinal uses:

- i) It is used against the treatment of Inflammation.
- ii) It is also having a potential to act against the dentary treatment.

- iii) It is also utilized to treat the CVS disorders.
- iv) It is also used for its antioxidant action.
- v) The plant extract also used to treat the bowel infections.
- vi) It also has a potential to act against the disease cancer.
- vii) It is highly active against the respiratory disorders.
- viii) It is also having an antidiabetic action.
- ix) It also used as to regulate mensural irregularity.
- x) It also acts as antihypertensive agent.
- xi) The *Passiflora* species also used as digestive stimulant.(39)

### **Miscellaneous Uses of *Passiflora vitifolia* plant:**

This species also used for some additive uses:

- i) It is available as Passionflower tea.
- ii) The passionflower also used as herbal gel for soothing action.
- iii) The passionflower is utilized as an aromatic agent in food products and beverages industry.
- iv) It is also formulated as tincture product for sleeping action.
- v) It is also utilized as ornamental plant as a climber.

### **Therapeutic approaches of *Passiflora vitifolia* Plant:**

The utilization of biocomponent of herbs is usually more potential and safer to cure variety of diseases. In condition of *Passiflora vitifolia* plant the therapeutic uses of plant has been evidenced in conventional medical systems including Ayurveda, Siddha, and Unani. As per the documented reports the plant *Passiflora vitifolia* used in treatment of various diseases and disorders in human beings. The potentially active biocomponent of respective plant shows the different activity. Such as extract of leaves shows the anti-inflammatory, antioxidant, antihypertensive and anxiolytic activity. The fruit extract shows the additive property like used as flavouring agent in preparation of jam, jellies and sweet candies. The fruit peel shows the anti-bacterial, analgesic, regulation of CVS disorders, antipyretic and antidepressant action. The Seed extract of plant shows antioxidant, dysmenorrhea regulation, attention deficit-hyperactivity disorder (ADHD) and uterine stimulant action.

**1) Anti-inflammatory activity:** Aditya et al, (2023) has reported the anti-inflammatory activity of *Passiflora vitifolia* plant by using ethanolic leaf extract(26,40).

Pal and co-workers (2021) have documented the anti-inflammatory properties of *Passiflora vitifolia* leaves in vitro through the use of leaf extracts in ethanol, ethyl acetate, chloroform, pet ether, and acetone, among other solvents (41–43). According to test results, the leaves include cardiac glycoside, flavonoids, alkaloids, and carbs (44). In order to assess the anti-inflammatory activity, four distinct concentrations (50, 100, 150, and 200 µg/ml) were created. The HRBC membrane stabilisation and protein denaturation inhibition techniques were applied to the varying concentrations.(45)

- 2) **Antihypertensive activity:** it has reported the antihypertensive activity of plant extract of plant *Passiflora vitifolia*(26). Benson VL et al, (2008) has reported the invitro antihypertensive potential of hydroalcoholic leave extract(46).
- 3) **Antioxidant activity:** Marna E. Sakalem et al: (2012) has reported that different extract of *Passiflora* shows the various activity and ethanolic extract also exhibit the antioxidant property(29,45,47).
- 4) **Anti hyperglycaemic activity:** Avila et al; has reported that the total phenolic components, protein, and lipids were determined using the ethanolic extract of the plant *P. vitifolia*'s seed and peel (48, 49). The plant extract's seed (10 671 mg GAEs<sub>seed</sub>/100 g sample) has nearly four times as much phenolic chemicals as the peel (2817 mg GAE/100 g sample), according to the data (50). Similarly, the seeds have larger crude protein and fat levels (15.5% and 25.6%, respectively) than the peel (6.60% and 5.70%, respectively). For both extracts, nine phytoconstituents were positive (51). It also mentioned the plant's seeds and fruit peel's in vitro anti-hyperglycemic properties. An in vitro investigation was conducted utilising the 3,5-dinitrosalicylic acid (DNSA) technique to examine the inhibitory action of alpha-amylase.(52).
- 5) **Antispasmodic action:** Patel et al; (2011) has reported the antispasmodic activity of aqueous extract of whole plant of *Passiflora vitifolia*, especially used in Italy(53,54)(23).
- 6) **Respiratory disorder treatment:** Patel et al; (2011) has also reported the respiratory stimulant activity of leaf and tendrils part of *Passiflora*(23).
- 7) **Anticancer activity:** Bisht T. et al; (2021) has also studied and reported that the hydroethanolic extract of the plant also exhibit the anticancer activity of *passiflora* species(19).
- 8) **Antixiolytic activity:** Marna E. Sakalem; (2012) Many authors have explained that flavonoids are responsible for the anxiolytic activity of the hydroethanolic extract of *Passiflora vitifolia*. Of the species included in this paper, flavonoids are present as main constituents in *P. sidifolia*, *P. bahiensis*, *P. coccinea*, and *P. vitifolia*; however, only in *P. sidifolia* was apigenin-6-C-rhamnosyl-8-C-arabinoside, a flavone-6,8-di-C-glycoside (29).
- 9) **Antioxidant Activity:** Pal et al; (2021), explained that the ORAC technique, DPPH (1,1-Diphenyl-2-picrylhydrazyl Assay), FRAP (Ferric Reducing Antioxidant Power), and ABTS were used to investigate the extract's antioxidant activity (55). The following is how the results showed that RSC had increased: Extract from peels against ABTS. The average free radical absorbance capacity ( $\mu\text{mol TEAC}$ , or Trolox equivalent antioxidant capacity) and ORAC (Oxygen radical absorbance capacity) 100/g values were determined to be 95.50 and 502.60  $\mu\text{mol TEAC}$ , or Trolox equivalent antioxidant capacity), respectively.(56,57).

Thus, distinct leaf extracts were made using various solvent systems, including acetone, petroleum ether, ethanol, ethyl acetate, and chloroform. According to the test results, the leaves contain cardiac glycoside, flavonoids, alkaloids, carbohydrates, and phenols. Due the presence of these chemical constituent various parts of *Passiflora vitifolia* species shows various activity which was represented in the below mention table 1.4:

Table 1.4: Tabulation subjected to detail of various pharmacological activity of Plant *Passiflora vitifolia* with different solvents(58-65)

S.No.	Plant Part Used	Solvent Used	Pharmacological activity	References
1.	Leaves	Ethanol	Antiinflammatory	(17, 19)
		Hydroethanol	Antiinflammatory, Antioxidant, Hypoglycaemic	(22)
		Hydroalcoholic	Antioxidant and Antiglycation	(33)
		Aqueous	Anti-inflammatory	(29, 30)
		Methanolic	Antiasthmatic	(32)
2.	Leaf and Fruit	Ethanol and Acetone extract	Antibacterial	(32)
3.	Fruit Peel and Seeds	Ethanol	Antioxidant, Antihyperglycaemic	(18)
4.	Aerial Parts	Mother Tincture /Methanolic extract	Anxyolytic activity	(24, 27)
5.	Aerial Part with Underground Parts	Methanolic extract	Anxyolytic activity	(24)
6.	Aerial Parts and Seed	0.5% Carboxymethyl cellulose (CMC) / Ethanol	Sedative effect	(1,2)

### Phytochemical Screening of *Passiflora vitifolia* plant:

#### Collection of Plant material:

The crude Plant material leaves of *Passiflora vitifolia* was collected from the Rajeswari Nursery, Doiwala, Dehradun. The leaves were dried properly and the herbarium of the complete plant specimen has been deposited to the Botanical Survey of India (BSI), a Botany Discipline of Forest Research Institute, Dehradun a for their taxonomic determination, where it was determined as *Passiflora vitifolia* with a voucher specimen no. BSI/NRC/Tech./Herb(Ident.)/2022-23/1191.(68)

**Macroscopic Examination:**

The determination of macroscopic characteristics of *Passiflora vitifolia* leaves was done by determining the organoleptic characteristics like: colour, odour, taste, shape and surface texture.(69,70)

**Microscopical Examination:**

The microscopy of fine powder of *Passiflora vitifolia* leaves was done by placing the uniform fine layer of powdered drug over the clean and dried glass slide and observed the glass slide under the microscope by using defined reagent and examine the different characters of sample drug.

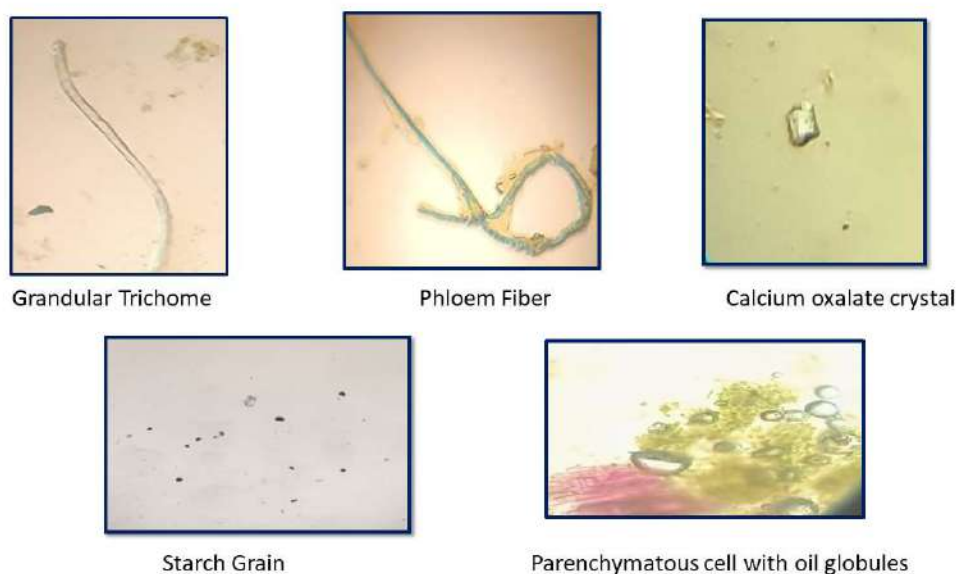


Fig 1.7: Representation of Powder Microscopy of *Passiflora vitifolia* leaves Powder

**Preparation of Plant Extract:**

In order to, remove any undesired materials, the freshly collected leaves were cleaned and given a purified water wash. For four to five days, the leaves were sun-dried under a shade cloth to achieve a completely dry state. After being dried, the leaves were ground using a mechanical grinder in order to extract more material. After the plant material was defeated with petroleum ether, it macerates in a variety of solvents, including acetone, ethanol, chloroform, and ethanol. In a Soxhlet apparatus, the dried and coarsely ground leaves of *Passiflora vitifolia* were packed separately for each solvent (pet ether and hydroalcohol). Every extract was dried out completely using low pressure and kept in storage at  $-20^{\circ}\text{C}$ . Furthermore, constant extractive values were recorded.(71-73)



Fig 1.8: Macerates of *Passiflora vitifolia* with different solvent (A1-Acetone, B1-Ethyl acetate, C1-Ethanol, D1-Chloroform, E1-n-Hexane)

#### Examination of Extractive Value:

Detection of extractive value is useful to know the nature of chemical constituents and to find out the value of specific constituent in specific solvent which is utilized for the process of extraction. In this process the different macerated extracts of P.v. were filtered out and allowed for evaporation till dryness and accumulation of traces of crude plant material at the flat bottom of china dish at 1500 °C. As a final step the weight of traces material was found out and allow for detection of extractive value of different solvent extracts.(74,75)



Fig 1.9: Representation of Examination of Extractive Value of P.v. Extracts

#### Characteristics of Extracts:

The different extract of plant *Passiflora vitifolia* with different solvent were characterized and following results were found, which is shown in table no.1.8.

Table 1.5: Representation of characterization of different solvent-based leaf extract of *Passiflora*



vitifolia(76-78)

Extract	Colour of extract	Odour	Consistency	Sense of touch	Weight of plant material (g)	Amount of extract (gm)	%Extractive Value (w/w)
Petroleum ether	Light Yellow	Characteristics	Semisolid	Sticky	15	0.50	3.34
Ethanol	Dark Green	Characteristics	Semisolid	Sticky	15	1.13	7.54
Acetone	Dark Green	Characteristics	Semisolid	Sticky	15	0.89	5.94
Ethyl Acetate	Green	Characteristics	Semisolid	Sticky	15	0.49	3.27
Chloroform	Light Green	Characteristics	Semisolid	Sticky	15	0.31	2.07
n-hexane	Light Green	Characteristics	Solid	Powder	15	0.19	1.27

#### Extractive value of leaves of *Passiflora vitifolia* by Soxhlation Process:

The extractive value of *Passiflora vitifolia* leaves by Soxhlation process with ethanol and petroleum ether were determine and result was calculated. It was shown in table 1.9.



Fig 1.10: Representation of Soxhlation of ethanolic leaves extract of *Passiflora vitifolia*

Table 1.6: Tabulation subjected to characterization of ethanolic extract of *Passiflora vitifolia*(79)

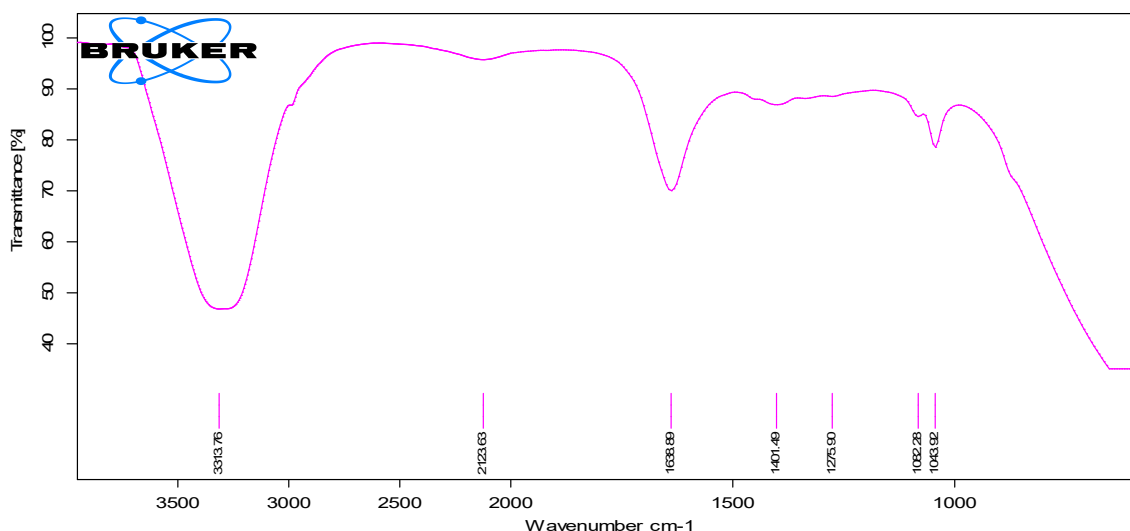
S.No .	Extract	Colour of extract	Wt. of Plant material	Amount of extract (gm)	%Extractive Value (w/w)
1.	Petroleum ether (for Defecation)	Light Yellow	25	0.89	3.56
2.	Ethanol	Dark Green	25	2.06	8.24

### Phytochemical screening of *Passiflora vitifolia*:

#### Quantitative Analysis:

#### FTIR Analysis:

The sample of *Passiflora vitifolia* leaves extract was analyzed for IR. The following functional group with the band frequency were determined as; Alcohol (OH) Stretch-3313.76, Ketone (C=O)-1605-162, Alkene (C=C)-1043.92, Aromatic (C=C)-1401.49 and Alkane (C-H)-1275.90 respectively.(80)



C:\OPUS_7.0.122\MEAS\2.PV Extract	1.PV Extract	Instrument type and / or accessory	22-Mar-23
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Page 1/1

Fig 1.11: Representation of FTIR analysis of *Passiflora vitifolia* ethanolic leaves extract

#### TLC Fingerprinting analysis of ethanolic leaves extract:

TLC fingerprinting analysis was done to detect the number of components in a mixture, to identify the compounds, and to check purity of a compound. By observing the appearance of a product or the disappearance of a reactant, it can also be used to monitor the progress of a reaction. The below mentioned solvent system in the different ratios represented in the table no. 1.9 were used to perform the TLC analysis. (81)

Table 1.7: Tabulation of Solvent system in various ration for TLC analysis

S.No	Solvent system	Ratio	Percentage
1	Chloroform/Methanol	1:9	90%
2	Chloroform/Methanol	2:8	80%
3	Chloroform/Methanol	3:7	70%
4	Chloroform/Methanol	4:6	60%

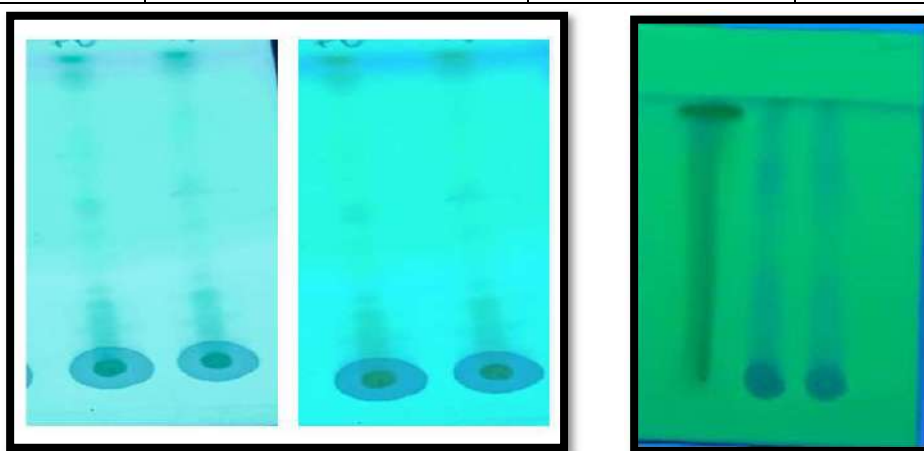


Fig 1.12: Representation of TLC analysis of plant extract with standard

#### Phytochemical Screening of *Passiflora vitifolia* leaves extract:

Phytochemical screening of ethanolic leaves extract of *Passiflora vitifolia* was done to detect the presence and absence of available phytoconstituents.



Fig 1.13: Representation of Phytochemical screening of ethanolic leave extract of *Passiflora*

vitifolia

The detail description of observation of screened sample with various reagents were represented below through the table No. 1.8.

Table No. 1.8: Tabulation subjected to phytochemical screening of ethanolic leave extract of *Passiflora vitifolia* plant(82,83)

S.No.	Phytoconstituents	Method	Ethanol extract of <i>Passiflora vitifolia</i>
1.	Alkaloids	Wagner's Test	+ve
		Hager's Test	+ve
		Dragendroff's test	-ve
		Mayer's test	+ve
2.	Cardiac Glycoside	Legal Test	+ve
3.	Flavanoid	Shinoda Test	+ve
		Lead acetate Test	+ve
4.	Tannins & Phenol	Lead acetate Test	+ve
		Bromine water Test	+ve
		Acetic acid solution Test	+ve
		Dil. Potassium Permanganate Test	+ve
		Dil. Iodine solution Test	+ve
		Dil. Nitric acid Test	-ve
5.	Proteins	Biuret Test	+ve
		Xanthoprotein Test	+ve
		Test for Protein containing Sulphur	-ve
		Biuret Test	+ve

#### Pharmacological Activity: In-vitro Analysis:

In-vitro analysis was done by working on two methodologies:

- 1) Human Red Blood Cell (HRBC) membrane stabilization method
- 2) Inhibition of protein denaturation

# 1) HRBC membrane stabilization method of extract of leaves of *Passiflora vitifolia*:

## a) Preparation of suspension of blood for HRBC Method:(84)

5 ml of blood were taken from experimental wistar mice that had been under observation for the previous month and had not received any NSAIDS for two weeks before the experiment. The drawn blood sample was then treated with an equivalent volume of Alsever solution, which contains 0.45% sodium chloride, 0.8% sodium citrate, 0.5% citric acid, and 2% dextrose. After that, the three to four blood samples (Fig: 1.4) were kept for twenty-four hours at 40 degrees Celsius. Samples were centrifuged at 2500 rpm for 5 minutes after a predetermined 24-hour period, and the supernant layer was subsequently removed. A sterile saline solution (0.9% w/v NaCl) was used to wash the cell suspension. Once more, this solution was centrifuged for five minutes at 2500 rpm. Until supernant, the same process was carried out at least three times. .



Fig 1.14: Representation of Blood cell suspension to Undergo HRBC assay

## b) HRBC (Hypotonicity Induced Human Red Blood Cell):

Test samples totaling 1.0 ml from each of the concentrations (0.05, 0.1, 0.15, and 0.2) in phosphate buffer, 0.5 ml of 10% HRBC suspension, and 0.5 ml of 25% hyposaline were incubated for 30 minutes at 37°C. After that, the samples were centrifuged for 20 to 25 minutes at 3000 rpm in a mechanical centrifuge. A UV spectrophotometer set to 560 nm was used to estimate the supernatant solution. By assuming that the control group produced 100% of the hemolysis, the percentage of hemolysis was estimated. As a reference standard, diclofenac sodium was utilised, and extracts were left out to create a control . The following formula was used to determine the percentage of hemolysis and membrane stabilisation or protection: -(85)

$$\% \text{ of Haemolysis} = \text{Optical density of test sample} / \text{Optical density of control} \times 100$$

$$\% \text{ Protection} = 1 - [\text{Optical density of test sample} / \text{Optical density of control} \times 100]$$

Hence, through the different concentrations of hydroethanolic extract of leaves of *Passiflora vitifolia* plant the percentage inhibition of proteinase activity were determined. The treatment and result of different concentrations of drug and extract were given below in table no. 1.9.

Table No. 1.9: Tabulation represents the % stabilization of Haemolysis through HRBC membrane stabilization method by using different concentration (50,100,150,200 µg/ml) of ethanolic leave extract of *Passiflora vitifolia* plant (86)

S.No.	Treatment	Concentration (µg/ml)	Absorbance at 660nm	% stabilization of Haemolysis
1.	Control	-----	0.63	-----
2.	Hydroethanolic extract	50	0.43	40
		100	0.18	75
		150	0.096	88
		200	0.092	84
3.	Diclofenac Sodium	100	0.096	89

#### Effect of *Passiflora vitifolia* leaves extract on inhibition of protein denaturation:

A 0.5 ml reaction mixture was made with 0.45 ml of bovine serum albumin (5% aqueous solution) and various concentrations of *P. vitifolia* leaf extract. Phosphate buffer (pH 7.4) was used to maintain the pH. The following formula was used to determine the percentage of protection against denaturation: -

$$\% \text{ inhibition} = 100 - [\text{Optical density of test sample} - \text{Optical density of control} / \text{Optical density of control}] \times 100$$

The effect of various Ethanolic concentrations of *Passiflora vitifolia* leaves is tabulated below in table 1.10.

Table No. 1.10: Effect of *Passiflora vitifolia* leaves extract on inhibition of protein denaturation (87,88)

S.No.	Treatment	Concentration (µg/ml)	Absorbance at 660nm	Inhibition of proteinase action
1.	Control	-----	0.63	-----
2.	Ethanolic Extract	50	0.43	35
		100	0.18	84



		150	0.096	87
		200	0.092	88
3.	Diclofenac Sodium	100	0.096	86

### Future Perspectives:

The present study insight that the different species of *Passiflora* shows a variety of chemical constituents with variant therapeutic activities. Due the presence of different phytoconstituents like flavonoids, alkaloids, terpenoids, glycosides, volatile oils, phenols etc, different researcher work on the *passiflora*'s species and can be able to develop and formulate a new formulation with antidiabetic, anti-depressant, antioxidant, antianginal as well as the novel product with a future potential to treat cancer disease as well.

### Conclusion:

The above investigation concluded that *Passiflora* species having a variant ethnic value and utilized for the number of activities like Antioxidant Activity, Anti-inflammatory Activity, Wound Healing Activity, Antibacterial Activity, Cardiovascular Activity, Antifungal Activity, Antidepressant and Antidiabetic Activity. These species exhibit presence of various phytoconstituents like; Flavanoids, alkaloids, glycosides, phenols, volatile oils etc, which are responsible for different kind of pharmaceutical uses. Flavonoid make up the majority of Herb *Passiflorae*'s components utilizes for the treatment of inflammation, fungal infection, sedative, dysmenorrhea, antidiabetic purposes. Some *Passiflora* species have also been thoroughly investigated for their additive properties like certain *passiflora*'s species fruits used to prepare fruit jam, jelly and flowers used to prepare flavoured beverages. Hence, *Passiflora* species has a leading function for the development of novel highly potent drugs in future. After phytochemical screening of *passiflora* species it was found that the max. % Extractive Value (w/w) were exhibit with Ethanolic solvent i.e., 7.94. FTIR analysis shows the presence of alcoholic, phenolic, aromatic, alkane, alkene etc. functional group and phyto screening shows the presence of various chemical constituents like: alkaloid, flavonoid, protein, glycosides, phrnols and tannins. TLC fingerprinting express the best result in a solvent system (Chloroform:Methanol) with a solvent ratio of 1:9. In the same lieu, the In-vitro anti-inflammatory activity was carried out by utilizing two different methodology; HRBC method and inhibition of protein denaturation method with using variant concentrations i.e., 50,100,50,200µg/ml of ethanolic extract. Thus, obtained data shown the satisfactory results on the method used as anti-inflammatory analysis. Based on the result of this study it can be said that the plant *Passiflora vitifoli*'a has a leading capacity for the development of advanced and virtuous efficacy drugs in forthcoming time and can be potential source to cure and control many diseases. Therefore, these plants phytochemicals and minerals will make it possible to utilize them for therapeutic purposes.

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