Review Article

Passiflora foetida Linn: A Phytochemically Active Weed

ABSTRACT

Passiflora foetida, commonly known as 'Stinking passion flower' is a medicinal plant, a member of Passifloraceae family. From ancient times, it is a great source of medicine worldwide. It is native to the southwestern United States, central and southern America. It has been used in traditional medicine for centuries. Leaves and roots decoction has proved to cure many ailments. Its phytochemically activeness has proved a promising future to provide beneficial treatments to the mankind. The fruits of this plant can also serve as a best source of vitamins and minerals as it grows invasive, benefiting local people as a food source. It has shown many pharmacological activities such as analgesic, anti-diarrheal, anti-tussive, antioxidant, anti-microbial, anti-diabetic, antidepressant, etc. It has also shown cytotoxic properties that can be used in cancer treatment. The biological characteristics of *Passiflora foetida* are taken in this review.

Keywords: *Passiflorafoetida*, passifloraceae, stinking passion flower,Krishna kamal,wild passion fruit.

1.INTRODUCTION

Passiflora hails from the family passifloraceae. It is commonly known as 'Stinking passion flower'. The specific apellation 'foetida' is a Latin word meaning 'Stinking', tells about the strong aroma emitted when the foliage is damaged (Ya Song et al., 2018). It is a creeping vine, same as the other members of passifloraceae family. It is native to Mexico, south-western United States (Arizona and southern Texas), the Caribbean and Central America (Asadujjaman et al., 2014). It is considered an important fruit crop for its medicinal and ornamental purposes. It grows at the edge of the forests, moist lands, roadsides, abandoned plantations, etc (Shubashini et al., 2023). It was introduced in tropical areas other than its native regions due to its medicinal, ground covering and ornamental purposes (Witt et al., 2017). The decoction of leaves and fruits has been consideredto cure asthma and biliousness, while root and leaf decoction is used to treat emmenagogue and hysteria. The leaf paste is also used to cure headaches, treat skin inflammation and erysipelas in Brazil (Annalisa et al., 2020, Asadujjaman et al., 2014).The Passiflora species are rich in principle chemicals like polyphenolic compounds, including flavonoids (quercetin, rutin, apigenin, luteolin, chrysin, and C-glycosylflavones like vitexin, isovitexin, orientin, isoorientin) which are

known for their anti-inflammatory and antioxidant properties (Marcin et al., 2021). Leaf discs of *P. foetida* are used to produce Silver nano fabrication (Lade et al., 2017). Despite its positive constituents it also has a counterpart, it is considered to be invasive (due to its drought-tolerant characteristic) which lowers the growth of native vegetation and thus pose a threat on regional habitat (Jucker et al., 2020). It has been considered invasive in India, Australia and South-east Asia. It is also considered as toxic plant due to presence of Cyanogenic glycosides like Tetraphyllin B and Linamarin. Despite this the toxic compounds has shown no symptoms of toxicity in albino rats at a dose of 500 mg/kg (Songpol et al. 2011) but the goats which were experimentally poisoned *by P. foetida*at a dose of 10 g/kgcaused severe symptoms when they were given the leaves of plants undergoing through drought which indicated that during adverse conditions plant has high concentrations of toxic compounds (Fabrício et al., 2011). The extractsshows less toxicity by oral route but showed estrogenic activity in Wistar albino rats (Bleu et al., 2012).

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2. PLANT DESCRIPTION

It is an annual or perennial vine having a woody stem, 1.5 to 6 m long, cylindrical and has dense hairs which has secretory glands which secrete digestive enzymes thus it also considered as proto-carnivorous plant which directly or indirectly benefits the plant. It consists of persistent bracts covered with sticky hairs that trap insects and degrade their bodies by providing protection to flower and fruit by remaining throughout its fruiting period (Yi Zou et al., 2023). The plant has ovate to obovate leaves, often sinuate and ciliate, with heart shaped base and pointed base. Leaves produce unpleasant pungent odour similar to asafoetida when crushed (A.S. Patil et al., 2013). Tendrils are unbranched,originating from the axillary bud which provides support for the plant (J.J.Shah et al., 1970). Each flower bud is covered by three highly reticulate and lacy green bracts. Flowers are white to lilac, bisexual and about 5-6 cm in diameter. It flowers all year round. Fruits are globose and edible, about 2-3 cm in diameter, yellowish-orange to red when ripe. It has bluish-white pulp in which numerous seeds are embedded in it. Seeds are black with serrated edges. It has a deep perennial rootstock from which sprouts arise (A.S. Patil et al., 2013).

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(a)

(b)

(c)

(d)

Fig.1. (a) Stem and Leaves of *Passiflora foetida* (b) Flower of *Passiflora foetida* (c) Unripe fruit of *Passiflora foetida*(d)Riped fruit of *passiflora foetida*

Comment [WU3]: Ripe fruit

3. TAXONOMY (A.S. Patil et al., 2023) AND VERNACULAR NAMES (Shruthi et al., 2022)

Table 1. Taxonomic Description and Vernacular names of *Passiflora foetida*

Taxonomic Description	
Domain	Eukaryota
Kingdom	Plantae
Phylum	Spermatophyta
Subphylum	Angiospermae
Class	Dicotyledonae
Order	Violales
Family	Passifloraceae
Genus	Passiflora
Species	Passiflora foetida
VernacularNames	
English	Stinking passion flower, Love-in-a-mist
Sanskrit	Mukkopeera
Marathi	Vel-ghani
Hindi	Krishna kamal, Raaki phool
Kannada	Kukkiballi
Malayalam	Poochapalam
Tamil	Sirupunnaikalli
Telugu	Thelajumuki
Irula	Varingodi

Comment [WU4]: Italics

Manipuri	Lam radhikanachom
Assamese	Koth-bel, Jumka lata, Lota bel

4. PHYTOCHEMICAL CONSTITUENTS

Passiflora is reported to be rich in phytochemicals like phenolic compounds, amino acids, alkaloids, cyanogenic glycosides and organic acids. These bioactive compounds are found in leaves, stems, flowers, fruits and roots of the plants.

Comment [WU5]: Reference

4.1. Leaves

Passiflora leaves extract has phenolic compounds, flavonoids (pachypodol and ermanin), saponins, proteins, phytosterols, steroids, gums, alkaloids (Harman alkaloids), cardiac glycosides, tannins, anthraquinones, carbohydrates and sugars (Mathew et al., 2017, Yohanes et al., 2020).

4.2. Fruits

Passiflora fruit extract had phytochemical compounds such as alkaloid, phenolic compounds, flavonoids, and cardiac glycosides (Harborne, 1973). Fruit extract also contains amino acids, reducing sugars, soluble protein, ascorbic acid, carbohydrates, calcium, magnesium and phosphorous (Revathy et al., 2019). Polysaccharide like PFP1 [C16], PFP2 [C17], PFP3 [C18] and PFP4 [C19] were isolated from the extract by ethanol precipitation and column chromatography (Shubashini et al., 2023).

4.3. Seeds

Seeds of passion flower contained cyanohydrins glycosides like tetraphyllin A [C29], tetraphyllin B sulphate [C30], deidaclin [C31], volkenin [C32], tetraphyllin B[C33] and valine derived glycoside linamarin [C34] (Khaled, 2021).

4.4. Stem

Flavonoids were extracted from the stem of the *Passiflora foetida* like apigenin [C8], luteolin [C9], luteolin-7-O-glucoside [C10], orientin [C11], chrysoeriol [C12], tricin [C13], tamarixetin [C14], and vitexin-2”-O-xyloside [C15] (Thi Yeng et al., 2015).

5. GROWTH AND PROPAGATION

Seeds, cuttings, grafting technique and layering techniques are commonly used methods to propagate *Passiflora foetida*. It is cultivated using staking systems. It requires humus rich and well-drain soil to flourish. It is a drought tolerant plant so well suited for grafting as its rootstock provides strong establishment for crop. It also doesn’t likely get infested by pests due to presence of digestive enzymes secreting glands on plant (Danilo et al., 2019, Gleyse et al., 2023).

6. TRADITIONAL USES

Traditionally, *Passiflora foetida* is used to treat many ailments and hence proved many beneficial activities to mankind. The leaves and fruits of the plant are great in nutritional value and can be used to make herbal tea, tablet and nutritional powders. In regions of Surinam and Java, the young leaves are cooked and eaten as a vegetable. In India, unripe fruit of *passiflora foetida* is used as an emetic. The decoction of dried powder of leaves is used for its diuretic effect. Paste of leaves is used as pain reliever for treating headache and giddiness due to its analgesic effects. Decoction of leaves and roots is used to treat hysteria (A.S. Patil et al., 2013). It is used to treat travel vomiting, eczema and chronic ulcer

(Revathy et al., 2019). The sap or decoction of leaves and unripe fruits is used to treat snake bite in India and Papua New Guinea (Dietrich et al., 2000, Mahipal et al., 2015).

7. PHARMACOLOGICAL ACTIVITY

*Passiflora foetida*hasshown many pharmacological activities such as analgesic, anti-diarrheal, anti-tussive, antioxidant, antimicrobial, anti-diabetic, antidepressant etc.

7.1. Analgesic

The ethanol extracts of *Passiflora foetida* with drug at the dose of 200 mg/kg has exhibited highest significant analgesic activity by using hot plate method in mice (V. Sasikala et al., 2011).

7.2. Anti-inflammatory

Vitexin extracted from the plant is reported to show anti-inflammatory effect (Anita et al., 2015).The ethanol extract of leaf at the dose of 100 mg/kg produced a highly anti-inflammatory effect in rats (V. Sasikala et al., 2011). Extract extracted from *P. foetida* fruits effectively inhibits the biosynthesis and production of the inflammatory mediator (Nitric oxide) and pro-inflammatory cytokines (TNF-α and IL-6) (Xiangpeng et al., 2023). The methanolic extraction of *Passiflorafoetida* has shown significant decrement in production of prostaglandin E2 (PGE2) and inhibited the expression of Cyclo-oxygenase-2 (Ji-Won et al., 2018).

7.3. Antimicrobial

Extract derived from leaves and fruits shown positive antibacterial effect against various human pathogenic bacteria (Khaled et al., 2021). Passicol an antibacterial and antifungal agent was derived from the extract from seeds and showed significant activity (Joan et al., 1973). The ethanol extract and acetone extract of leaves of *Passiflora foetida* has shown significant activity on pathogenic bacteria like *Pseudomonas putida, Vibrio cholera, Shigella flexneri* and *Streptococcus pyogenes* in agar culture medium (C. Mohanasundari et al., 2007, Krastena et al., 2024).

7.4. Anti-diabetic

The extract of leaves has shown a significant reduction in the blood glucose levels in diabetic rats. The rate of glucose clearance (CL_G) was high in the rats treated with the extract (Sijuade et al., 2016).

7.5. Anti-ulcer

The ethanolic extract of *Passiflora foetida*at the dose of 100 and 200 mg/kg has shown significant anti-ulcer effects on gastric ulcers induced by aspirin in mice (R. Sathish et al., 2011).

7.6. Antioxidant

The crude ethanolic extract from leaf showed a remarkable antioxidant activity in hepatotoxicity induced by CCl_4 in mice. The antioxidant enzymes like superoxide peroxidase(SOD), catalase (CAT) and glutathione (GSH) reduced the serum aspartate aminotransferase (AST), alanine aminotransferase (ALT),

hepatic thiobarbituric acid reacting substances (TBARS) induced by CCl_4 in rats (Rasool et al., 2011). The ethanolic and methanolic extracts of *Passiflorafoetida* has shown significant scavenging potential (Loh et al., 2023).

7.7. Antidepressant

Ethanolic extracts derived from leaves showed sedative and antidepressant activity due to presence of cycloartane triterpenoid saponins, likely cyclopacifloside XII and cyclopaciflosideXIII (Krastena et al., 2024). The extract of *P. foetida* at a dose of 100, 200 and 300 mg/kg showed competitive antidepressant effects same as standard drugs i.e. fluoxetine (20mg/kg) and imipramine (15mg/kg) in rats (Santhosh et al., 2010).

7.8. Cytotoxic activity

The methanolic extracts of leaves and seeds was added to HeLa cell line cultures at different concentrations (25, 50, 75, 100, 125µg/ml) and the activity of extract was confirmed by 3-(4,5-dimethythiazol-2-yl)-2,5-diphenyltetrazolium bromide (MIT) assay and propidium iodide staining. It has shown significant cytotoxic and apoptotic effects (Maddi et al., 2024). Compounds derived from methanolic extract i.e. Cis-11-hexadecenal and 10-octadecenal showed potential cytotoxic and anti-proliferative activity on cancerous cell lines (Noor et al., 2017).

8. CONCLUSION

Passiflora foetia is phytochemically active weed, presence of various phytoconstituents like alkaloids, cyanohydrin glycosides, flavonoids, phenolic compounds and organic acids show various pharmacological activities like analgesic, anti-inflammatory, antimicrobial, antioxidant, etc has proved its capacity to produce highly efficient medications in future.

Comment [WU6]: Among others

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, Gemini etc) and text-to-image generators have been used during writing or editing of this manuscript.

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