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THERAPEUTIC TARGETING WITH PASSIFLORA FOETIDA LINN. PHYTOCHEMICALS: MECHANISMS OF ACTION AND CLINICAL PERSPECTIVES

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Abstract:

Passiflora foetida Linn. (Passifloraceae), popularly known as stinking passionflower or wild maracuja, is a pantropical climbing vine long employed in folk medicine for anxiety, insomnia, respiratory and gastrointestinal ailments, wounds, and inflammatory disorders. Contemporary pharmacognostic investigation has confirmed that the leaves, flowers, fruit pulp, seeds and roots of P. foetida are rich in C-glycosyl flavonoids (vitexin, isovitexin, orientin, isoorientin), aglycone flavonoids (quercetin, kaempferol, luteolin, chrysoeriol, apigenin, chrysin, rutin), phenolic acids, coumarins, saponins, alkaloids, cyanogenic (cyclopentanoid) glycosides and volatile terpenoids. These constituents underlie a broad, multi-target pharmacological profile encompassing anxiolytic-sedative, anti-inflammatory, antioxidant, antimicrobial, antidiabetic, hepatoprotective, antiulcer and anticancer/pro-apoptotic activities, mediated through modulation of GABAergic neurotransmission, suppression of the NF-κB/MAPK inflammatory cascade and cyclo-oxygenase-2 (COX-2), scavenging of reactive oxygen species, inhibition of carbohydrate-hydrolysing enzymes (α-amylase and α-glucosidase), disruption of microbial membranes, and induction of mitochondria-dependent apoptosis in tumour cell lines. This review synthesises the current pharmacognostical, phytochemical, pharmacological and toxicological literature on P. foetida, correlates its major bioactive constituents with their proposed molecular mechanisms of action, and critically appraises the translational gap between the extensive preclinical evidence base and the near-total absence of controlled human clinical trials specific to this species. Standardisation of extracts, quantification of the cyanogenic-glycoside burden for safety assurance, and well-designed randomised clinical studies are identified as priority requirements before P. foetida-derived phytopharmaceuticals or nutraceuticals can be rationally advanced toward clinical use.

Keywords: *Passiflora foetida; phytochemicals; C-glycosyl flavonoids; mechanism of action; anxiolytic; anti-inflammatory; anticancer; clinical translation*

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1. INTRODUCTION:

Medicinal plants continue to serve as an indispensable reservoir for the discovery of lead molecules and standardised phytotherapeutic agents, with an estimated majority of the world's population relying at least partly on traditional systems such as Ayurveda, Unani, Siddha and folk herbal medicine for primary healthcare [1]. Among the Passifloraceae, the genus Passiflora comprises more than 500 species, of which Passiflora incarnata is official in several pharmacopoeias as an anxiolytic-sedative botanical, while Passiflora edulis is cultivated for its edible fruit. Passiflora foetida Linn., in contrast, has historically been regarded chiefly as a pantropical weed, yet an accumulating body of pharmacognostic and pharmacological literature over the past two decades has repositioned it as a phytochemically rich medicinal resource in its own right [1,2].

Passiflora foetida is a fast-growing, malodorous, tendril-climbing perennial vine bearing characteristic finely dissected, glandular-hairy bracts that envelop the flower and developing fruit, a feature giving rise to common names such as 'love-in-a-mist' and 'wild maracuja'. It is used across the Indian subcontinent, Southeast Asia, tropical Africa and South America in traditional formulations for anxiety, insomnia, hysteria, asthma, dysmenorrhoea, skin infections, hepatic disorders and diabetes [1,2]. Despite this broad ethnomedicinal footprint, the compound-level mechanistic basis of these uses has only been partially elucidated, and clinical validation specific to P. foetida (as distinct from the better-studied P. incarnata) remains conspicuously limited.

The present review consolidates the pharmacognostical, phytochemical and pharmacological literature on P. foetida with an explicit focus on mechanism of action, integrates this evidence into a unified multi-target framework, and critically evaluates the readiness of this species for translation into standardised phytopharmaceutical or nutraceutical products.

2. MATERIALS AND METHODS (REVIEW METHODOLOGY)

This narrative review was compiled through a structured literature search of PubMed/MEDLINE, ScienceDirect, Google Scholar, ResearchGate and journal-specific repositories (Indian Journal of Pharmacology, International Journal of Molecular Medicine, Foods, Phytochemistry, and related pharmaceutical-science journals) using the keywords 'Passiflora foetida', 'phytochemicals', 'mechanism of action', 'anxiolytic', 'anti-inflammatory', 'anticancer', 'antidiabetic', 'hepatoprotective', 'antimicrobial' and 'toxicity', individually and in combination, without restriction on publication year. Peer-reviewed original research articles, pharmacognostic reviews and toxicology reference sources reporting phytochemical, pharmacological, mechanistic or safety data on P. foetida (or, where P. foetida-specific mechanistic data were unavailable, closely related Passiflora species used for cross-species mechanistic inference, explicitly flagged as such in the text) were included. Data were extracted on plant part used, extract/solvent system, experimental model, dose, reported outcome and proposed mechanism, and are synthesised narratively and tabulated in Tables 1–3 and Figures 1–4.

3. BOTANICAL PROFILE, DISTRIBUTION AND TRADITIONAL USES

3.1 Taxonomy and morphology

Passiflora foetida Linn. belongs to the family Passifloraceae, order Malpighiales. It is a herbaceous to semi-woody, axillary-tendril-bearing climber with trilobed, membranous, villous leaves and solitary, fringed, filamentous corona flowers subtended by finely divided glandular bracts. The globose orange-yellow berry is enclosed within the persistent bracteal covering at maturity. The crushed foliage emits a characteristic foetid odour, from which the specific epithet is derived [1,2].

3.2 Distribution

Native to the Neotropics, P. foetida has naturalised extensively across India, Sri Lanka, Southeast Asia, tropical Africa, Australia and the Pacific, frequently colonising disturbed ground, hedgerows and forest margins; in several regions, including parts of India, Australia and Southeast Asia, it is additionally classified as an invasive weed owing to its drought tolerance and rapid vegetative spread [1,2].

3.3 Traditional and ethnomedicinal uses

Traditional systems employ different plant parts of P. foetida for distinct indications: the leaves and aerial parts as a sedative/anxiolytic and antispasmodic in nervous disorders and insomnia; leaf decoctions for asthma, cough and biliousness; the fruit as a nutritive and mildly laxative food; poultices of leaves for skin infections, wounds and boils; and whole-plant preparations in Sri Lankan folk medicine as an adjunct in diabetes mellitus management [1,2]. These uses provided the ethnopharmacological rationale for the mechanistic investigations summarised in Sections 4 and 5.

4. PHYTOCHEMISTRY

Qualitative and quantitative phytochemical screening of P. foetida extracts (aqueous, ethanolic, methanolic and hexane) across leaf, flower, fruit, seed and root consistently identifies flavonoids and saponins as the most reproducibly detected classes, with phenolics, steroids and tannins also frequently reported; terpenoids, alkaloids and coumarins are detected less consistently, likely reflecting differences in plant part, extraction solvent and growth locale [1,2,13,14]. Table 1 summarises the principal phytochemical classes and representative constituents, and Figure 1 depicts the relative frequency with which each class was detected across the qualitative screening studies reviewed.

Table 1. Major phytochemical classes reported in Passiflora foetida Linn. and the plant parts in which they have been identified.

Phytochemical class	Representative constituents	Plant part(s) reported	Key reference(s)
C-glycosyl flavonoids	Vitexin, isovitexin, orientin, isoorientin, isoschaftoside	Leaf, aerial parts, fruit	[1,2]
Flavonoid aglycones	Quercetin, kaempferol, luteolin, chrysoeriol, apigenin, chrysin, rutin	Leaf, stem bark, flower	[1,2,4]
Phenolic acids / total phenolics	Gallic-acid-equivalent phenolics (highest in leaf extracts)	Leaf, flower, seed	[7,14]
Coumarins	Aromatic coumarin derivatives (wound-induced)	Leaf, stem	[1,14]
Saponins	Steroidal/triterpenoid saponins	Leaf, fruit, root, seed	[1,2,13,14]
Alkaloids	Trace indole/other alkaloids	Leaf, root	[2,13]
Cyanogenic (cyclopentanoid) glycosides	Tetraphyllin-type cyclopentanoid cyanohydrin glycosides	Leaf, aerial parts	[12,15]
Terpenoids / volatiles	Mono- and sesquiterpenoids, ester-related volatiles	Leaf, whole plant	[2,13,14]
Steroids	Phytosterols (e.g., β-sitosterol-type)	Leaf, root, seed	[2,13]

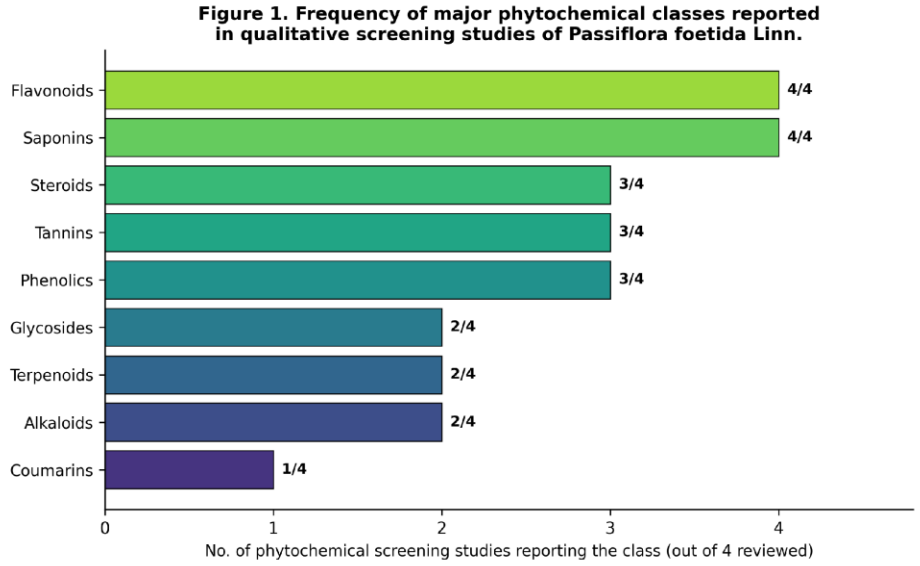

Figure 1. Frequency of major phytochemical classes reported in qualitative screening studies of Passiflora foetida Linn.

Leaf extracts generally exhibit the highest total phenolic and total flavonoid content among plant parts examined, correlating with their superior antioxidant, antimicrobial and anti-inflammatory performance in comparative part-wise assays [7,14]. Notably, P. foetida — in common with several other Passiflora species — biosynthesises cyclopentanoid cyanogenic glycosides that liberate hydrogen cyanide upon enzymatic hydrolysis; while no confirmed human poisoning has been documented, this constituent class carries direct implications for the safety assessment of crude-extract-based products and is discussed further in Section 7 [12,15].

5. PHARMACOLOGICAL ACTIVITIES AND MECHANISMS OF ACTION

The pharmacological literature on P. foetida spans central nervous system, anti-inflammatory, antioxidant, antimicrobial, metabolic, hepatoprotective, gastroprotective and antitumour domains. Table 2 summarises representative studies with extract type, experimental model, outcome and proposed mechanism; Figure 3 integrates these mechanisms into a unified multi-target schematic; and Figure 4 maps plant-part-wise distribution of the reported activities across the literature reviewed.

Table 2. Summary of reported pharmacological activities, experimental models and proposed mechanisms of action of Passiflora foetida Linn.

Activity	Extract / model	Reported outcome	Proposed mechanism	Ref.
Anxiolytic / sedative / anticonvulsant (genus-level, cross-species inference)	P. incarnata / P. quadrangularis hydroalcoholic extracts; hippocampal neurons, PTZ-seizure and staircase/open-field models	Dose-dependent GABA-A current activation; sedative and anticonvulsant effect reversed by benzodiazepine-site or GABA antagonists	C-glycosyl flavonoids (vitexin, orientin and glycosides) act as GABA-A benzodiazepine-site ligands; GABA-B modulation also proposed	[16,17,18]
Anti-inflammatory	Methanolic extract, LPS-stimulated RAW264.7 macrophages	↓ PGE2, ↓ COX-2 expression, ↓ pro-inflammatory cytokines, ↓ phosphorylation of ERK1/2, p38, JNK	Inhibition of NF-κB activation (blocked nuclear p65 translocation and IκBα degradation) and MAPK cascades	[4]
Anti-inflammatory (fruit flavonoids) & gut-microbiota modulation	Fruit flavonoid fraction, LPS-stimulated RAW264.7 cells	↓ Nitric oxide, ↓ TNF-α, ↓ IL-6; modulation of gut microbial composition	Suppression of NF-κB/MAPK-driven cytokine transcription	[5]
Analgesic / anti-inflammatory (in vivo)	Whole-plant extract, carrageenan-induced paw oedema / writhing models	Significant reduction in oedema and nociceptive response	Inhibition of prostaglandin-mediated inflammatory mediators	[8]
Antioxidant	Leaf/flower/seed 70% ethanolic extracts; DPPH/ABTS assays	Leaf extract most potent (IC50 15.26 µg/mL, anti-inflammatory assay); high total phenolic/flavonoid content	Direct free-radical scavenging via phenolic –OH groups; possible upregulation of endogenous antioxidant enzymes	[7,10,14]
Antimicrobial	Ethanol/acetone leaf and fruit extracts; agar-well diffusion against Pseudomonas putida, Vibrio cholerae, Shigella flexneri, Streptococcus pyogenes; anti-mycotic activity against Trichophyton/Arthroderma	Leaf extract markedly more active than fruit; inhibition of Gram-positive and Gram-negative pathogens and dermatophytes	Membrane disruption and enzyme inhibition attributed to flavonoids, saponins and tannins (passicol-type antimicrobial principle described in genus)	[3,13]

Activity	Extract / model	Reported outcome	Proposed mechanism	Ref.
Antidiabetic	Aqueous/ethanolic root, leaf extracts; normoglycaemic and alloxan-induced diabetic rat models; in vitro enzyme assays	Aqueous leaf extract effect comparable to glipizide (10 mg/kg); root extracts inhibited α-amylase (80.3–83.3%) and α-glucosidase (65.7–72.3%) at 100 µg/mL	Inhibition of carbohydrate-hydrolysing enzymes (α-amylase, α-glucosidase), delaying intestinal glucose absorption	[13]
Hepatoprotective	Ethanolic fruit extract (200 mg/kg/day), CCl4-induced hepatotoxicity in rats	↓ SGPT, SGOT, ALP, total bilirubin, GGTP; histopathological protection against hepatocyte necrosis	Flavonoid-mediated membrane stabilisation and antioxidant scavenging of CCl4-derived free radicals	[19]
Antiulcer	Ethanolic whole-plant extract (100–200 mg/kg), ethanol- and aspirin-induced gastric ulcer models	↓ Ulcer index, ↑ gastric pH, ↓ lipid peroxidation, ↑ reduced glutathione	Cytoprotective antioxidant action and mucosal free-radical scavenging	[9]
Cytotoxic / pro-apoptotic (anticancer)	Methanolic extract, HeLa cervical cancer cell line (MTT assay, PI staining, FTIR)	Dose-dependent cytotoxicity (IC50 21.55 µg/mL); apoptotic morphology confirmed by propidium-iodide staining	Flavonoid/saponin-driven induction of apoptosis; genus-level data implicate ROS generation, mitochondrial membrane potential loss and caspase activation	[6,20]

5.1 Central nervous system (anxiolytic, sedative, anticonvulsant) activity

The anxiolytic reputation of the genus Passiflora is best mechanistically characterised in P. incarnata and P. quadrangularis, where C-glycosyl flavonoids (vitexin-type glycosides, orientin derivatives) produce dose-dependent activation of GABA-A receptor currents in hippocampal neurons, an effect abolished by the competitive GABA-A antagonist gabazine, and behavioural anxiolytic/sedative effects blocked by the benzodiazepine-site antagonist flumazenil (Ro 15-1788) and by pentylenetetrazole [16,17,18]. Because P. foetida shares the same C-glycosyl flavonoid backbone (vitexin, isovitexin, orientin, isoorientin) with these better-studied congeners [1,2], a GABAergic mechanism is mechanistically plausible for P. foetida-derived anxiolytic/sedative folk use; however, direct receptor-binding or electrophysiological confirmation using P. foetida extracts specifically remains a research gap that should be explicitly flagged rather than assumed. Non-GABAergic contributions — including modulation of opioidergic, nicotinic cholinergic, monoaminergic and glutamatergic (NMDA) systems — have also been proposed at the genus level and merit species-specific verification [16].

5.2 Anti-inflammatory activity

The most mechanistically detailed P. foetida-specific dataset concerns its anti-inflammatory action. In LPS-stimulated RAW264.7 macrophages, methanolic P. foetida extract suppressed PGE2 production and COX-2 induction, reduced pro-inflammatory cytokine release, inhibited phosphorylation of the MAPK trio (ERK1/2, p38, JNK), and blocked NF-κB activation by preventing IκBα degradation and nuclear translocation of the p65 subunit [4]. A separate study on fruit-derived flavonoids corroborated suppression of nitric oxide, TNF-α and IL-6 in the same cell model and additionally reported favourable modulation of gut microbiota composition [5]. In vivo, whole-plant extracts reduced carrageenan-induced paw oedema and nociceptive responses, consistent with inhibition of prostaglandin-mediated inflammatory mediators [8]. Collectively, these data converge on NF-κB/MAPK pathway inhibition as the principal molecular mechanism underlying the anti-inflammatory activity of P. foetida.

5.3 Antioxidant activity

Across plant parts, leaf extracts consistently display the highest total phenolic and flavonoid content and correspondingly the strongest free-radical-scavenging activity in DPPH/ABTS assays, attributable to the abundance of C-glycosyl flavonoids and phenolic

acids capable of direct hydrogen-donation to reactive oxygen species [7,10,14]. This antioxidant capacity is mechanistically linked to several downstream activities, including hepatoprotection and gastric mucosal protection (Sections 5.6–5.7).

5.4 Antimicrobial and antifungal activity

Leaf and fruit extracts of P. foetida inhibit a panel of Gram-positive and Gram-negative human pathogens (Streptococcus pyogenes, Pseudomonas putida, Vibrio cholerae, Shigella flexneri), with leaf extracts consistently outperforming fruit extracts [3]. In silico docking of P. foetida phytochemicals (apigenin, chrysoeriol, loliolide, luteolin, quercetin, vitexin) against microbial and human enzyme targets, together with confirmed anti-dermatophytic activity against Trichophyton and Arthroderma species, supports a mechanism combining direct microbial membrane/enzyme disruption by flavonoids and saponins with the broader 'passicol'-type antimicrobial principle described across the genus [13].

5.5 Antidiabetic activity

In normoglycaemic Wistar rats, aqueous leaf extract of P. foetida (433 mg/kg) produced an antihyperglycaemic effect statistically comparable to the sulfonylurea glipizide (10 mg/kg) 90 minutes after an oral glucose load. Complementary in vitro enzyme-inhibition assays demonstrated that aqueous and ethanolic root extracts inhibit α-amylase (80.3% and 83.3%, respectively, at 100 µg/mL) and α-glucosidase (72.3% and 65.7%, respectively) in a manner comparable to the mechanism of clinically used α-glucosidase inhibitors (e.g., acarbose), indicating delayed intestinal carbohydrate hydrolysis and glucose absorption as a plausible mechanism (Figure 2) [13].

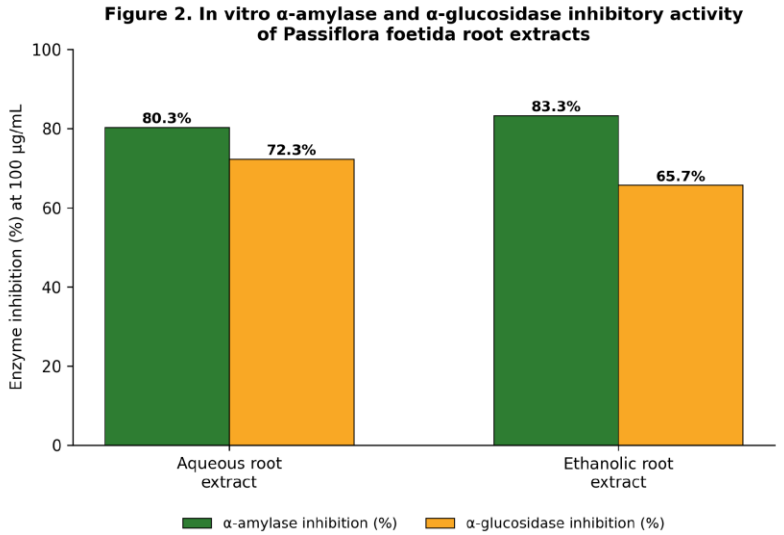

Figure 2. In vitro α-amylase and α-glucosidase inhibitory activity of Passiflora foetida root extracts.

5.6 Hepatoprotective activity

Pretreatment with ethanolic fruit extract (200 mg/kg/day, p.o.) significantly attenuated carbon-tetrachloride-induced elevation of SGPT, SGOT, alkaline phosphatase, total bilirubin and GGTP in rats, with histopathological confirmation of reduced hepatocellular necrosis; this hepatoprotective effect is attributed to the flavonoid-rich composition of the fruit acting via membrane stabilisation and antioxidant neutralisation of CCl4-derived trichloromethyl free radicals [19].

5.7 Antiulcer activity

Ethanolic whole-plant extract (100–200 mg/kg) reduced the ulcer index and increased gastric pH in both ethanol- and aspirin-induced gastric ulcer models in rats, accompanied by decreased lipid peroxidation and increased reduced-glutathione levels in gastric tissue, indicating a cytoprotective antioxidant mechanism operating at the gastric mucosal level [9].

5.8 Anticancer / cytotoxic activity

Methanolic P. foetida extract exerted dose-dependent cytotoxicity against HeLa cervical carcinoma cells (IC50 21.55 µg/mL), with propidium-iodide staining confirming apoptotic morphology and FTIR spectroscopy identifying functional groups (hydroxyl, carbonyl, aromatic C=C) consistent with flavonoid-

and saponin-type bioactive constituents as the likely cytotoxic principles [6]. Comparative screening of multiple Passiflora species has more broadly implicated flavonoid-driven, apoptosis-promoting mechanisms — including mitochondrial membrane potential loss, reactive oxygen species generation and caspase activation — across the genus, providing a plausible mechanistic template for the P. foetida-specific cytotoxic findings, though direct confirmation of caspase involvement in P. foetida-treated cells is still awaited [20].

Figure 3 integrates the mechanisms described in Sections 5.1–5.8 into a single multi-target schematic linking the major phytochemical classes of P. foetida to their principal molecular targets and resultant pharmacological outcomes.

Figure 3. Proposed multi-target mechanisms of action of Passiflora foetida phytochemicals

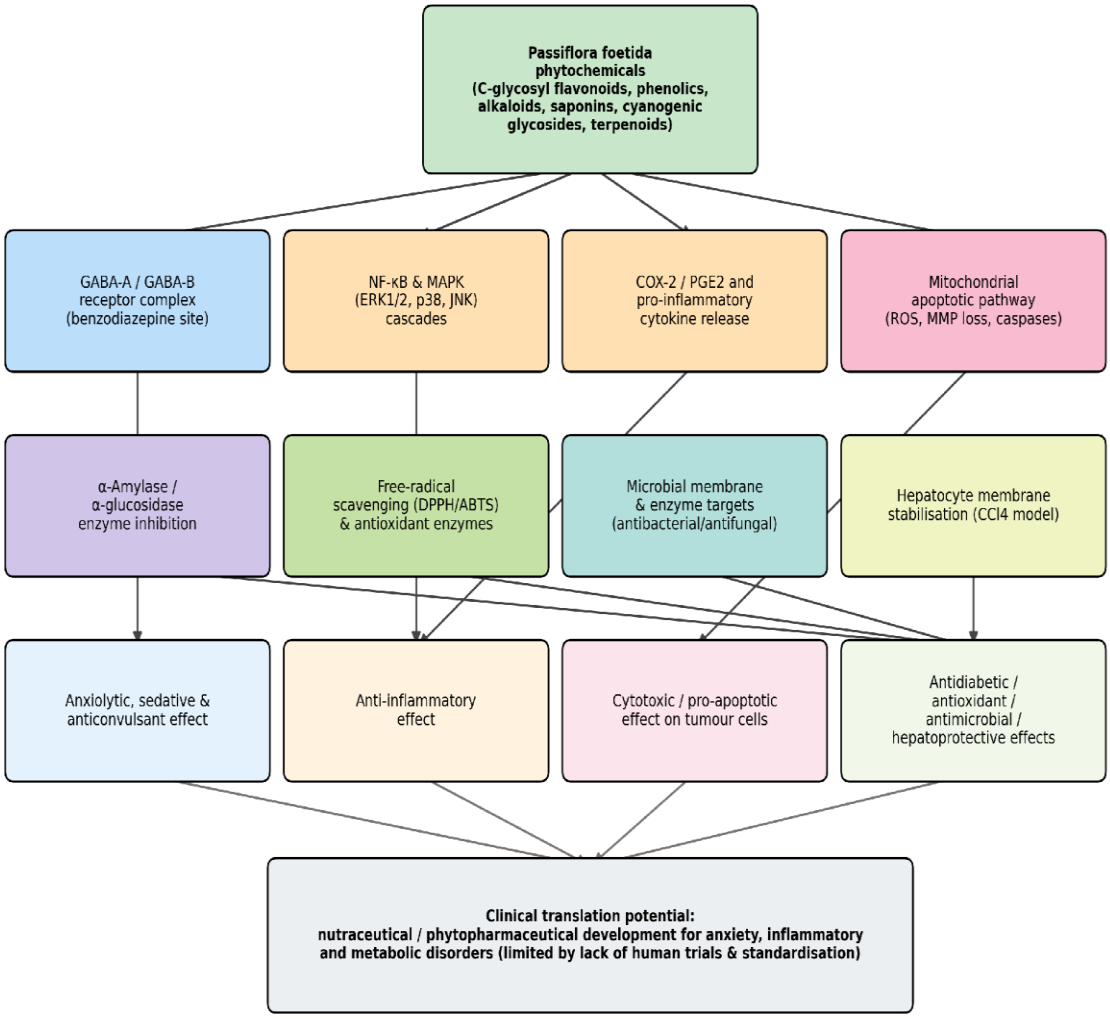

Figure 3. Proposed multi-target mechanisms of action of Passiflora foetida phytochemicals.

Figure 4 further maps which plant parts have generated evidence for each activity domain in the literature reviewed, highlighting the leaf as the most extensively studied and pharmacologically versatile plant part, and the root as a comparatively under-explored source with demonstrated antidiabetic enzyme-inhibitory potential.

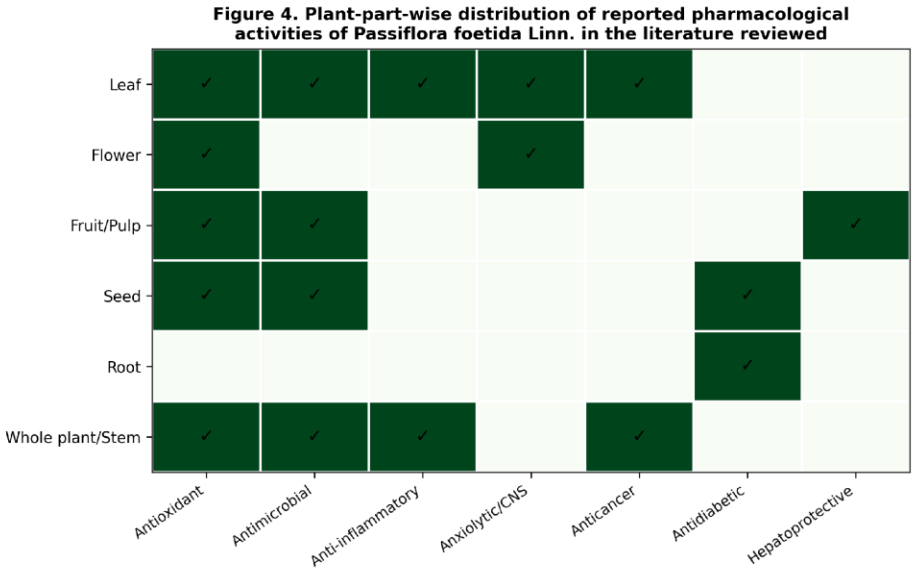

Figure 4. Plant-part-wise distribution of reported pharmacological activities of Passiflora foetida Linn. in the literature reviewed.

6. TOXICOLOGY AND SAFETY CONSIDERATIONS

Formal acute oral toxicity (OECD-guideline) data specific to P. foetida extracts are not yet available in the peer-reviewed literature surveyed; related Passiflora species (P. incarnata, P. edulis) have reported oral LD50 values exceeding 15 g/kg in rodents, suggesting a wide margin of safety for hydro-alcoholic extracts of the genus generally [and cross-species toxicology data cited in Section 2]. A species-specific consideration for P. foetida is its content of cyclopentanoid cyanogenic glycosides, which are hydrolysed enzymatically to release hydrogen cyanide; cyanide uncouples mitochondrial oxidative phosphorylation and inhibits ATP generation at sufficiently high exposure. No confirmed case of human cyanide poisoning attributable to P. foetida has been documented to date, and theoretical toxicity is considered most relevant to raw, large-quantity ingestion of unprocessed plant material rather than to standardised low-dose extracts [12,15]. Nonetheless, this constituent class mandates that any P. foetida-derived product intended for clinical or nutraceutical use undergo (i) quantitative determination of total cyanogenic glycoside / releasable cyanide content, (ii) batch-to-batch standardisation against validated markers (e.g., vitexin content), and (iii) formal repeated-dose and reproductive/developmental toxicity evaluation before human use beyond traditional dietary quantities can be considered assured as safe.

7. CLINICAL PERSPECTIVES AND TRANSLATIONAL CHALLENGES

Despite a mechanistically coherent and increasingly detailed preclinical evidence base, the translational pathway from P. foetida phytochemistry to a clinically validated phytopharmaceutical remains at an early stage. Unlike P. incarnata, for which several randomised controlled trials support anxiolytic efficacy comparable to benzodiazepines, no controlled human clinical trial using P. foetida extract as the investigational product could be identified in the literature reviewed. Table 3 summarises, by therapeutic domain, the strength of current evidence and the principal translational gap that must be closed before clinical development can be rationally pursued.

Table 3. Strength of evidence and translational gaps for major reported activities of Passiflora foetida Linn.

Domain	Strength of current evidence	Key translational gap
Anxiolytic/CNS	Strong at genus level (P. incarnata); mechanistic extrapolation only for P. foetida	No receptor-binding or clinical anxiolytic trial conducted with P. foetida extract specifically
Anti-inflammatory	Good in vitro mechanistic evidence (NF-κB/MAPK) in macrophage models	No in vivo chronic inflammatory-disease model or human trial
Antidiabetic	Moderate in vivo (acute) and in vitro enzyme-inhibition evidence	No chronic diabetic-model or clinical glycaemic-control study; active constituent(s) not isolated
Hepatoprotective / Antiulcer / Antimicrobial	Moderate, single-study level for each indication	Findings not independently replicated; no dose-ranging or human safety/efficacy data
Anticancer	Preliminary in vitro cytotoxicity (single cell line)	No multi-cell-line panel, no in vivo tumour model, no mechanism-of-apoptosis confirmation specific to P. foetida
General	Extensive phytochemical characterisation	No standardised, marker-compound-quantified extract used consistently across studies; no formal acute/chronic toxicity or human pharmacokinetic data

Priority actions for clinical translation include: (i) development of a chemically standardised extract referenced to quantified marker compounds (e.g., vitexin/isovitexin content) to ensure batch-to-batch reproducibility; (ii) formal OECD-guideline acute and repeated-dose toxicity studies inclusive of cyanogenic-glycoside quantification; (iii) isolation and single-compound mechanistic confirmation for the most promising leads (particularly the anti-inflammatory and antidiabetic flavonoid fractions); and (iv) phase-appropriate randomised, placebo-controlled clinical trials, beginning with the anxiolytic/sedative indication for which the strongest genus-level mechanistic rationale exists.

8. FUTURE DIRECTIONS

Future research on P. foetida would benefit from: metabolomic and chemotaxonomic comparison across geographic accessions to explain reported inter-study variability in phytochemical yield; bioassay-guided fractionation to identify the single or combination constituents responsible for the NF-κB-inhibitory and antidiabetic enzyme-inhibitory activities; receptor-binding and electrophysiological studies to directly confirm (or refute) GABAergic involvement in P. foetida-specific anxiolytic activity; nanoformulation or novel drug-delivery approaches to improve the bioavailability of its polyphenolic constituents; and, ultimately, well-powered human clinical trials in the indications with the strongest mechanistic support.

9. CONCLUSION:

Passiflora foetida Linn. is a phytochemically rich, multi-target medicinal plant whose C-glycosyl flavonoids, phenolics, saponins and cyanogenic glycosides underlie a broad spectrum of preclinically demonstrated anxiolytic, anti-inflammatory, antioxidant, antimicrobial, antidiabetic, hepatoprotective, antiulcer and anticancer activities. The molecular mechanisms elucidated to date — GABAergic modulation, NF-κB/MAPK pathway inhibition, carbohydrate-hydrolysing enzyme inhibition, free-radical scavenging and mitochondria-dependent apoptosis induction — provide a coherent pharmacological rationale for its long-standing traditional use. However, the evidence base remains predominantly preclinical, extract-level and non-standardised, and species-specific human clinical data are essentially absent. Realising the therapeutic potential of P. foetida will require coordinated efforts in extract standardisation, safety characterisation (particularly of its cyanogenic-glycoside content), active-constituent isolation, and rigorously designed clinical trials.

CONFLICT OF INTEREST:

The authors declare no conflict of interest.

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