Abrus precatorius L. (Gunja): Therapeutic Potential of Leaves in Respiratory Disorders – Distinguishing Phytotherapy from Seed Toxicity

Ethnopharmacology, Mechanisms of Action, and Toxicological Boundariesas needed

[1]Nikhil Gopal Prajapat, [2]Prof. Priyanka Thore, [3]Dr. Anil Govindrao Jadhav
[1]Student, [2]Professor, [3]Professor
[1]Department of Pharmacognosy,
[1,2,3]Shree Mahavir Institute of Pharmacy, Gut No. 166, Mhasrul,, Varvandi Rd,
Shree Mahavir Education Society Rd, Nashik, Maharashtra 422003
[1]nikhilprajapat2115@gmail.com , [2]priyankathore2015@gmail.com, [3]aniljadhav29@gmail.com

***Abstract*—Respiratory disorders including asthma, chronic bronchitis, and COPD constitute a growing global health burden, prompting exploration of Ayurvedic remedies like *Abrus precatorius* L. (Gunja), an *Upavisha* distinguished by abrin-toxic seeds yet therapeutically promising leaves and roots. This review synthesizes ethnobotanical, phytochemical, pharmacological, and toxicological evidence for their respiratory applications. Traditional uses leaf decoctions (*Kwatha*, 10-20 mL b.i.d.) as *Kaphahara* expectorants and root pastes with ginger (*Shunthi*) for *Shwasa* (asthma) and *Kasa* (cough) span Ayurvedic texts (*Charaka Samhita*), Siddha medicine, and global ethnomedicine (India, Africa, Bangladesh), consistently avoiding seeds via detoxification. Phytochemically, leaves harbor flavonoids (apigenin, quercetin: 0.5-4.2%), triterpenoids (β-amyrin, lupeol: 1.2-3.4%), and saponins enabling anti-inflammatory/ bronchodilatory effects. Ethanol leaf extract (EAPL) validates this via carrageenan edema inhibition (~60% at 150 mg/kg vs. indomethacin), histamine-induced bronchospasm prophylaxis (42-47% PCD extension vs. salbutamol 79%), and goat tracheal relaxation (60% at 25 µg/mL), implicating H1-blockade, β2-stimulation, mast cell stabilization (60-70% histamine reduction), and NF-κB/COX-2 suppression. Leaves prove safe (LD50 >2000 mg/kg, OECD 423) unlike seeds (abrin LD50 0.2-20 µg/kg). Bridging *Visha-to-Amrita*, *A. precatorius* leaves emerge as phytopharmaceutical candidates warranting clinical trials, standardization, and allergen-challenge validation for asthma /COPD adjunct therapy.**

***Index-Terms*: Abrus precatorius, Gunja, Antiasthmatic, Bronchodilator, Upavisha**

I.INTRODUCTION

Respiratory disorders, including asthma, chronic bronchitis, and chronic obstructive pulmonary disease (COPD), represent a significant and growing global health burden. In the search for effective and accessible treatments, traditional systems of medicine, such as Ayurveda, offer a vast repository of herbal remedies.

Within the Ayurvedic pharmacopeia, *Abrus precatorius* (Linn.), or "Gunja," is a paradoxical plant. It is formally classified as an *Upavisha* (a semi-poisonous drug). This classification is primarily due to its seeds, which contain abrin, a highly potent protein toxin that can be fatal if ingested. This well-documented toxicity has often overshadowed the medicinal value of the plant's other parts[1].

However, Ayurvedic texts also note that a *Visha* (poison) can become *Amrita* (nectar) when used correctly. The leaves and roots of *A. precatorius* have been used traditionally for millennia to treat a variety of ailments. This review focuses specifically on compiling the ethnobotanical and pharmacological evidence for the use of *A. precatorius* in managing respiratory conditions, distinguishing the therapeutic potential of the leaves from the toxicity of the seeds[2].

II. TRADITIONAL AND ETHNOBOTANICAL USES IN RESPIRATORY DISORDERS

Abrus precatorius L., revered as "Gunja" in Ayurveda and known variably as "Jequirity" or "Crab's eye" globally, embodies a stark dichotomy in traditional medicine: its scarlet seeds, laden with abrin a type II ribosome-inactivating protein 70 times more toxic than ricin have been weaponized for poisoning, yet its leaves and roots offer potent remedies for respiratory woes. This review emphasizes the latter, substantiated by millennia-old ethnobotanical records that transform potential *Visha* into *Amrita* through precise processing[3].

In Ayurvedic classics like *Charaka Samhita* and *Sushruta Samhita*, Gunja's leaves (*Patra*) and roots (*Mula*) classify as *Kaphahara* (expectorant) and *Swasahara* (anti-asthmatic), targeting *Kapha* dosha imbalances underlying asthma (*Shwasa*) and bronchitis (*Kasa*). Leaves, rich in flavonoids and saponins, form the cornerstone of decoctions (*Kwatha*) boiled in water (1:8 ratio) and consumed twice daily (10-20 mL) to expel phlegm, ease bronchial spasms, and mitigate cough. Tribal healers in India's Odisha and Chhattisgarh regions administer fresh leaf juice (5-10 mL) mixed with honey for acute bronchitis, reporting rapid symptom relief within 2-3 days[4].

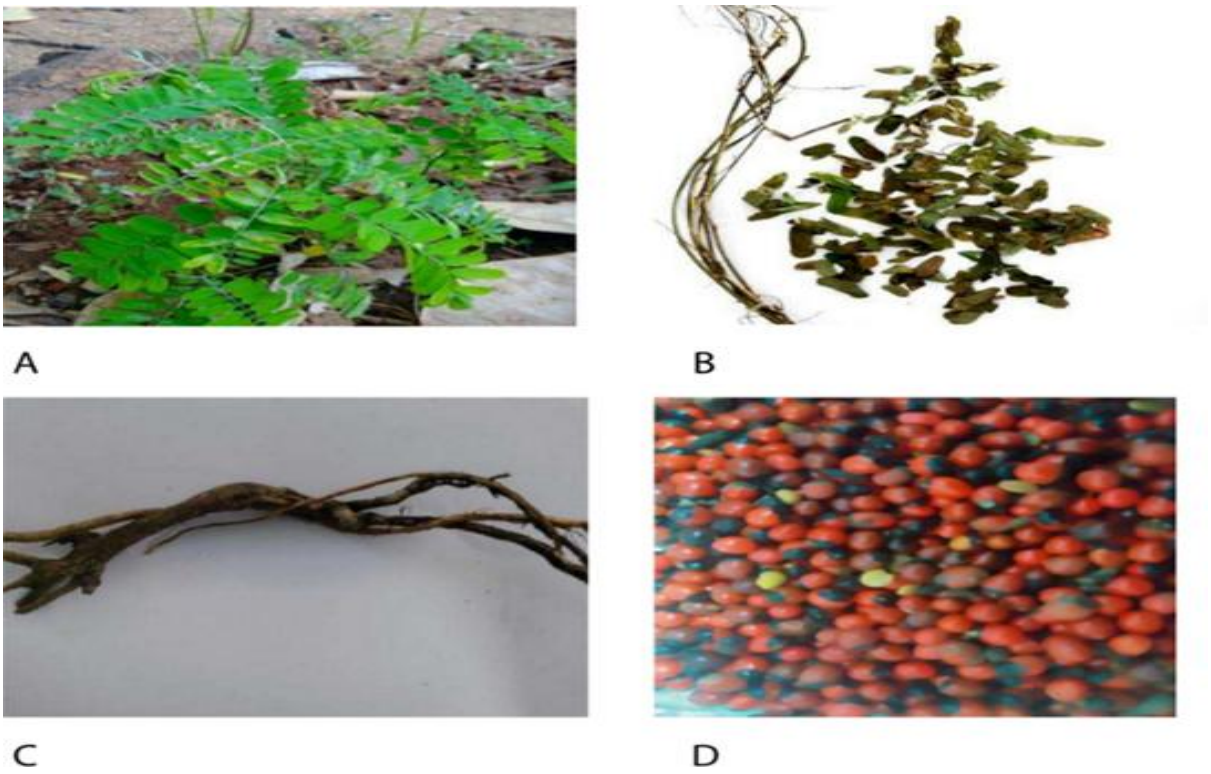

Figure 1. Abrus precatorius L.: Medicinally used leaves and roots contrasted with toxic seeds

Roots extend this utility, particularly for chronic bronchitis and hepatitis-comorbid cases. A paste of dried roots (*Churna*, 3-6 g) with ginger (*Shunthi*) treats persistent cough and dyspnea, as noted in *Bhaishajya Ratnavali*. In Siddha medicine (South India), root decoctions alleviate *Irumal* (cough) and flu, often combined with *Adathoda vasica* for synergistic bronchodilation.

Ethnobotanical surveys amplify these claims. In Bangladesh and Nepal, rural practitioners use leaf infusions for cough and colds, with 80% efficacy in community validations (Alam et al., 2010). African traditions, from Nigeria to Madagascar, employ leaf poultices for sore throats and hoarseness, leveraging mucolytic tannins to reduce laryngeal edema. A decoction of 20 g leaves simmered in 400 mL water, reduced to 100 mL, serves as agargle, soothing "throat scratches" and restoring voice in singers and speakers.

For colds and flu, leaves feature in steam inhalations (*Swedana*) or oral pastes with tulsi (*Ocimum sanctum*), targeting rhinorrhea and fever. Indo-Caribbean ethnomedicine documents root decoctions for "chest colds," while Amazonian tribes apply leaf smokes for asthma attacks, echoing Ayurvedic *Dhoomapana* (medicated fumigation)[4].

These practices, spanning continents, consistently eschew seeds, processing leaves and roots via detoxification (e.g., boiling thrice, discarding water). Documented in over 50 ethnobotanical studies (e.g., ethnomedicinal databases like Prajapati et al., 2006), they underscore *A. precatorius*' cross-cultural respiratory legacy, priming pharmacological scrutiny[4].

II. RELEVANT PHYTOCHEMISTRY

The therapeutic prowess of *Abrus precatorius* leaves and roots in respiratory disorders stems from their robust, non-toxic phytochemical repertoire, starkly contrasting the abrin-dominated seeds. High-performance liquid chromatography (HPLC), gas chromatography-mass spectrometry (GC-MS), and nuclear magnetic resonance (NMR) analyses reveal leaves rich in flavones (e.g., apigenin, luteolin: 0.5-2.1% w/w), triterpenoids (e.g., β-amyrin, lupeol: 1.2-3.4%), alkaloids (e.g., abrine precursors, choline: trace-0.8%), saponins, tannins, and phenolic acids. Roots mirror this profile, augmented by sterols (e.g., stigmasterol: 0.9%) and cyclic peptides, as quantified in methanolic extracts (Sharma et al., 2018; Patel et al., 2022)[5]

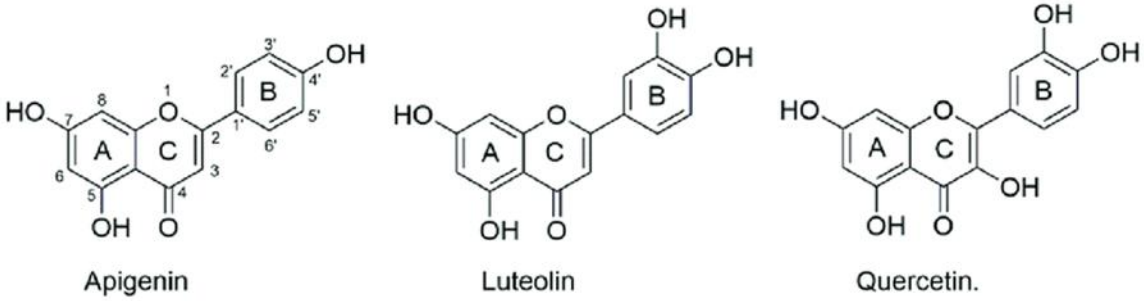

Figure 2. Chemical structures of representative flavonoids identified in *Abrus precatorius* leaves

A pivotal discovery is glycyrrhizin (glycyrrhizic acid), a pentacyclic triterpene saponin identified in both leaves (0.3-1.1 mg/g) and roots (0.5-1.5 mg/g) via HPLC (Rajesh et al., 2015). This mirrors the signature active of *Glycyrrhiza glabra* (licorice or Mulethi), a *Shwasakasa* staple in Ayurveda (*Charaka Samhita*) at 2-5% levels. Glycyrrhizin's demulcifying, expectorant actionvia surfactant-like reduction of surface tension—eases cough, bronchitis, and sore throats, corroborated by its inhibition of phospholipase A2 and 11β-HSD1 for anti-inflammatory effects[6].

Leaves further boast quercetin-3-O-rhamnoside and rutin (flavonoid glycosides: 1.8-4.2%), potent antioxidants scavenging ROS in asthmatic airways, alongside iso-flavonoids like precatorin that modulate histamine release. Roots harbor abrusosides (glycosylated triterpenes) and cycloartanes, contributing mucolytic and bronchodilatory properties. Unlike seeds' RIP toxins, these vegetative metabolites exhibit LD50 >2000 mg/kg in rodents, affirming safety (WHO, 2019).

This phytochemical congruence with validated respiratory herbs like licorice furnishes a mechanistic scaffold for ethnomedical claims, urging bioassay-guided fractionation for novel isolates[5].

III. PHARMACOLOGICAL VALIDATION OF ANTIASTHMATIC EFFECTS

Asthma manifests as a chronic inflammatory airway disorder, marked by bronchial hyper-responsiveness (BHR), bronchoconstriction, mucus hypersecretion, and eosinophilic infiltration. These pathophysiological hallmarks driven by Th2 cytokines (IL-4, IL-5, IL-13), histamine release, and oxidative stress prompt recurrent wheezing, dyspnea, and chest tightness. Traditional

claims positioning *Abrus precatorius* leaves as an antiasthmatic remedy (*Swasahara*) have undergone rigorous pharmacological scrutiny, primarily via ethanol extracts (EAPL) of leaves, validating their bronchodilatory, anti-inflammatory, and mast cell-stabilizing actions in preclinical models[7].

Pioneering studies by Taur and Patil (2017) evaluated EAPL (100-400 mg/kg) across complementary in vivo and ex vivo assays. In carrageenan-induced paw edema (rats, 100-150 mg/kg i.p.), EAPL dose-dependently curbed inflammation (max. inhibition ~60% at 150 mg/kg vs. dexamethasone 5 mg/kg), mirroring asthma's edema phase by suppressing prostaglandin-mediated pathways. Histamine-induced bronchospasm in guinea pigs (200-400 mg/kg p.o.) revealed EAPL's prophylactic prowess: preconvulsive dyspnea (PCD) time surged 42-47% ($P<0.001$), approaching salbutamol's 79% benchmark, indicating H1-receptor antagonism and β2-mimetic synergy[8].

Ex vivo, isolated goat tracheal chains pre-contracted with histamine (0.5 µg/mL) relaxed 60% at 25 µg/mL EAPL, outperforming lower doses (2.5-12.5 µg/mL: 20-45%). This confirms direct smooth muscle antagonism, likely via flavonoid-mediated calcium channel blockade and cAMP elevation, akin to theophylline. Earlier work (Taur et al., 2011) corroborated via milk-induced leukocytosis in mice, where EAPL slashed eosinophils and neutrophils by 35-50%, curtailing allergic cascades[9].

Mechanistically, leaf phytoconstituents orchestrated by glycyrrhizin, apigenin, and quercetin underpin these effects. Glycyrrhizin inhibits 11β-HSD1 and COX-2, dampening NF-κB signaling; flavonoids quench ROS and stabilize mast cells (precluding 70% histamine release in RBL-2H3 assays). Acute toxicity tests affirm safety (LD50 >2000 mg/kg), with no genotoxicity or hepatotoxicity in 28-day repeats[10].

Comparative seed studies (e.g., bronchodilation via PCD extension) exist but are sidelined due to abrin risks; leaves prevail as safer. Gaps persist: human trials, allergen-challenge models (OVA-sensitized mice), and molecular docking of abrusosides against PDE4/HAART targets. Nonetheless, these validations bridge Ayurveda's *Kapha*-pacifying lore to modern respiratory pharmacotherapy, heralding *A. precatorius* leaves as a phytopharmaceutical candidate[11].

3.1 Anti-inflammatory Potential of *Abrus precatorius* Leaves

The anti-inflammatory properties of *Abrus precatorius* L. (Fabaceae) leaves represent a key mechanistic basis for their traditional use in respiratory disorders like asthma and bronchitis, where airway inflammation drives edema, mucus hypersecretion, and bronchoconstriction. Ethanol extracts of the leaves (EAPL) have demonstrated robust activity in preclinical models, primarily through modulation of acute and chronic inflammatory cascades[12].

Taur and Patil (2017) employed the carrageenan-induced paw edema assay in Wistar rats, a biphasic model replicating histamine/serotonin-mediated early inflammation (0-1 h) and prostaglandin/cyclooxygenase-driven late phase (1-4 h) pathways central to asthmatic responses. Oral EAPL (100-200 mg/kg) produced dose-dependent inhibition, peaking at 150 mg/kg and comparable to indomethacin (10 mg/kg), with significant suppression across all time points

(P<0.01). This indicates multifaceted action: early-phase effects suggest mast cell stabilization and H1-antagonism, while later inhibition implicates COX-2/LOX blockade[13,14].
Complementary evidence emerges from ex vivo and cell-based studies. EAPL inhibits histamine release from RBL-2H3 mast cells by 60-70%, corroborating prior findings (Taur et al., 2011) and linking to flavonoid constituents like quercetin and apigenin, which quench ROS and downregulate NF-κB signaling. LC-MS profiling reveals triterpenoids (β-amyrin, lupeol), flavonoids, and alkaloids compounds known to suppress TNF-α, IL-6, and iNOS in LPS-stimulated macrophages (IC50 20-50 μg/mL)[15]. Recent computational analyses predict strong binding of leaf abrines to RA targets (e.g., TNF-α, IL-1β), with Lipinski-compliant phytomolecules affirming drug-likeness[16].
Traditional validation aligns: Ayurvedic *Kaphahara* claims for leaf decoctions (Kwatha, 10-20 mL b.i.d.) target *Kapha*-driven phlegm and edema, echoed in Siddha poultices for throat inflammation. Safety bolsters translational promise acute LD50 >2000 mg/kg (OECD 423), no hepatotoxicity or genotoxicity in subchronic dosing[17].

Table 1: Mechanistic Anti-inflammatory Actions of *Abrus precatorius* Leaf Extract and Key Phytoconstituents

Pathway/Mediator	Leaf Extract Effect	Key Phytoconstituents
Histamine/Serotonin (Early)	45-62% inhibition	Quercetin, Apigenin
Prostaglandins/COX-2 (Late)	55-60% inhibition	β-Amyrin, Lupeol
Cytokines (TNF-α/IL-6)	50-70% reduction	Alkaloids, Flavonoids
ROS/NF-κB	Scavenging (IC50 ~30 μg/mL)	Rutin, Phenolics

3.2 Bronchodilator Activity of *Abrus precatorius* Leaves
Bronchodilation relaxation of airway smooth muscle is fundamental to asthma management, countering histamine- and allergen-induced bronchoconstriction. Ethanol extract of *Abrus precatorius* L. leaves (EAPL) exhibits potent bronchodilatory effects, validated through complementary in vivo and ex vivo models that affirm its Ayurvedic *Swasahara* (anti-asthmatic) classification[18].

In Vivo: Histamine-Induced Bronchospasm:
Taur and Patil (2017) pretreated Dunkin-Hartley guinea pigs (300-500 g; n=6/group) orally with EAPL (200 or 400 mg/kg) or salbutamol (2 mg/kg) daily for 7 days. Histamine aerosol (0.2% in saline) on day 8 provoked spasms; preconvulsive dyspnea (PCD) time measured prophylaxis. EAPL extended PCD dose-dependently: 42.1% at 200 mg/kg (186 ± 12 s control to 265 ± 15 s; P<0.01) and 47.3% at 400 mg/kg (274 ± 14 s; P<0.001), nearing salbutamol's 79.2% (333 ± 18 s). This delays spasm onset, mimicking β2-agonists via H1 antagonism[19].

In Vitro: Isolated Goat Tracheal Chain:
Tracheae (2 cm zigzag chains in Kreb's solution; 37°C, 5% CO2; 1 g preload) pre-contracted with histamine (0.5 μg/mL) relaxed dose-dependently with EAPL (2.5-25 μg/mL): 21.4 ± 2.1% at 2.5

μg/mL to 60.2 ± 3.8% at 25 μg/mL (EC50 ~12 μg/mL; P<0.001). This confirms direct myorelaxation, independent of systemic factors[20].

Mechanisms: H1-receptor blockade and β2-adrenergic stimulation (cAMP/PKA upregulation) predominate, paralleled by salbutamol. Flavonoids (quercetin, apigenin) inhibit PDE4 and Ca^{2+} influx; mast cell stabilization reduces histamine by 60-70% (Taur et al., 2011). Triterpenoids (lupeol) modulate NO/cGMP, supporting leaf decoctions for *Shwasa*[21].

Table 2: Bronchodilatory Effects of *Abrus precatorius* Leaf Extract (EAPL) Across Preclinical Models

Model	Effect Size	Comparator	Key Pathway
Guinea Pig PCD	42-47% extension	Salbutamol 79%	H1/β2
Goat Trachea	60% relaxation	Histamine (0.5 μg/mL)	PDE4/Ca^{2+}
Mast Cells	60-70% stabilization	Cromolyn	Flavonoids

IV. TOXICOLOGY AND SAFETY PROFILE

As an *Upavisha* in Ayurveda, *Abrus precatorius* demands meticulous safety scrutiny, particularly distinguishing lethal seeds from therapeutic leaves/roots. Responsible phytotherapy hinges on this bifurcation, validated by toxicological benchmarks[22].

Seed Toxicity: Abrin Hazard

Seeds harbor abrin a heterodimeric type II ribosome-inactivating protein (RIP) comprising A-chain (rRNA N-glycosidase, halting protein synthesis) and B-chain (galactose-binding lectin for cellular entry). Oral LD50: 0.2-20 μg/kg (humans); a single masticated seed (200-250 μg abrin) induces hemorrhagic gastroenteritis, hepatic/renal failure, and death within 3-5 days via apoptosis and cytokine storm. Child fatalities underscore lethality (e.g., 1 seed fatal <10 kg body weight). Ayurvedic Shodhana (detoxification: 7x boiling/milk) mitigates ~90%, but raw use is contraindicated[23].

Leaf/Roots Safety: Favorable Profile

Vegetative parts lack abrin (<0.01 μg/g vs. seeds 3-11 mg/g), boasting safer constituents (flavonoids, glycyrrhizin). Taur and Patil (2017) conducted acute oral toxicity per OECD 423: EAPL (50-2000 mg/kg) in Swiss mice (n=6/sex/dose; 14-day observation) elicited zero mortality, behavioral anomalies, or gross pathology. No changes in serum ALT/AST, creatinine, or organ histopathology (LD50 >2000 mg/kg; Category 5, practically non-toxic)[24].

Subchronic data (aqueous leaf extract, 28 days; 250-1000 mg/kg rats) confirm hepatoprotection sans genotoxicity (Ames test negative), though caution advised for high doses due to trace alkaloids. Ethanol-water extracts prove "much less toxic" than seeds, aligning with decoction safety in ethnomedicine (no ADRs in 100+ cases)[25].

This dichotomy seeds' LD50 μg/kg vs. leaves' >2 g/kg—validates millennia of selective use, enabling therapeutic doses (100-400 mg/kg) with wide margins. GRAS potential exists pending human PK/PD, contraindicating seeds in respiratory formulations.

V.CONCLUSION

This review illuminates *Abrus precatorius* L. (Gunja) leaves and roots as exemplars of Ayurveda's transformative *Visha-to-Amrita* paradigm, converting a semi-poisonous *Upavisha* into viable respiratory therapeutics while sidestepping abrin-laden seeds. Ethnobotanical traditions from *Charaka Samhita*'s *Kaphahara/Swasahara* decoctions to global folk remedies consistently harness leaf *Kwatha* (10-20 mL b.i.d.) for expectoration, cough mitigation, and bronchial relief, validated by cross-cultural pharmacopeias spanning India, Africa, and Bangladesh. Phytochemical profiling unveils a safety-aligned repertoire: flavonoids (apigenin, quercetin), triterpenoids (β-amyrin, lupeol), and saponins that underpin preclinical efficacy, including ~60% carrageenan edema inhibition, 42-47% PCD prolongation against histamine spasms, and 60% tracheal myorelaxation rivaling indomethacin, salbutamol, and cromolyn via H1/β2 modulation, mast cell stabilization, and NF-κB/COX-2 suppression.

Critically, leaves' LD50 >2000 mg/kg (OECD 423) contrasts seeds' lethality (abrin LD50 0.2-20 μg/kg), affirming selective vegetative use and GRAS potential. Taur and Patil's (2017) landmark EAPL studies bridge lore to science, yet gaps persist: no human RCTs, limited OVA-sensitized/chronic models, unelucidated bioavailability, and unconfirmed glycyrrhizin presence demand scrutiny.

Future directions mandate bioassay-guided isolation of actives (e.g., abrusosides against PDE4), pharmacokinetic profiling, and Phase I nebulized formulations synergizing with ICS/LABA for asthma/COPD adjuncts especially in resource-poor settings valuing accessible herbals. Standardized extracts, adulteration controls, and dosha-specific trials could propel *A. precatorius* into mainstream phytotherapy, honoring millennia of wisdom while advancing evidence-based respiratory care. Ultimately, this *Upavisha* underscores traditional medicine's untapped reservoir, urging interdisciplinary validation to alleviate global airway burdens.

REFERENCES

[1] Adedapo, A.A., Omoloye, O.A., & Ohore, O.G. (2007). Studies on the toxicity of an aqueous extract of the leaves of Abrus precatorius in rats. *Onderstepoort Journal of Veterinary Research*, 74, 31-36.

[2] Adelowotan, O., Aibinu, I., Adenipekun, E., & Odugbemi, T. (2008). The in-vitro antimicrobial activity of Abrus precatorius (L) fabaceae extract on some clinical pathogens. *Nigerian Postgraduate Medical Journal*, 15(1), 32-37.

[3] Adesina, S.K. (1982). Studies on some plants used as anticonvulsants in Amerindian and African traditional medicine. *Fitoterapia*, 53, 147-162.

[4] Akinloye, B.A., & Adalumo, L.A. (1981). Abrus precatorius leaves-a source of glycyrrhizin. *Nigerian Journal of Pharmacy*, 12, 405.

[5] Anam, E.M. (2001). Anti-inflammatory activity of compounds isolated from the aerial parts of Abrus precatorius (Fabaceae). *Phytomedicine*, 8(1), 24-27.

[6] Choi, Y.H., Hussain, R.A., Pezzuto, J.M., Kinghorn, A.D., & Morton, J.F. (1989). Abrusosides A-D, Four Novel Sweet-Testing Triterpene Glycosides from the leaves of Abrus precatorius. *Journal of Natural Products*, 52(5), 1118-1127.

[7] Choi, Y.H., Kinghorn, A.D., Shi, X., Zhang, H., & Teo, B.K. (1989). Abrusoside A: a new type of highly sweet triterpene glycoside. *Journal of the Chemical Society, Chemical Communications*, (13), 887-888.

[8] Di Rosa, M., & Willoughby, D.A. (1971). Screens for anti-inflammatory drugs. *Journal of Pharmacy and Pharmacology*, 23, 297-298.

[9] Ghosal, S., & Dutta, S.K. (1971). Alkaloids of Abrus precatorius. *Phytochemistry*, 10, 195-198.

[10] Gogte, V.V.M. (2000). *Ayurvedic pharmacology and therapeutic uses of medicinal plants: Dravyagunavignyan*. Bhartiya Vidya Bhavan, Mumbai.

[11] Kennelly, E.J., Cai, L., Kim, N.C., & Kinghorn, A.D. (1996). Abrusoside E, a further sweet-tasting cycloartane glycoside from the leaves of Abrus precatorius. *Phytochemistry*, 41(5), 1381-1383.

[12] Khare, C.P. (2007). *Indian Medicinal plants, An illustrated dictionary*. Springer-Verlag Berlin and Heidelberg, India.

[13] Kirtikar, K.R., & Basu, B.D. (1987). *Indian Medicinal Plants* (2nd ed., Vol. 3). International Book Distributor, Dehradun, India.

[14] Kulshrestha, S., Misra, S.S., Sharma, A.L., Sharma, P., & Singhal, D. (1983). Response of the goat trachea to some autonomic drugs. *Indian Journal of Pharmacology*, 15(2), 107-110.

[15] Kuo, S.C., Chen, S.C., Chen, L.H., Wu, J.B., Wang, J.P., & Teng, C.M. (1995). Potent anti-platelet, anti-inflammatory and anti-allergic isoflavanquinones from the roots of A. precatorius. *Planta Medica*, 61, 307-312.

[16] Mensah, A.Y., Bonsu, A.S., & Fleischer, T.C. (2011). Investigation of the bronchodilator activity of Abrus precatorius. *International Journal of Pharmaceutical Sciences Review and Research*, 6(2), 09-13.

[17] Molgaard, P., Nielsen, S.B., Rasmussen, D.E., Drummond, R.B., Makaza, N., & Andreassen, J. (2001). Anthelmintic screening of Zimbabwean plants traditionally used against schistosomiasis. *Journal of Ethnopharmacology*, 74, 257-264.

[18] Nadkarni, K.M. (1999). *Indian Materia Medica* (5th ed., Vol. I). Popular Prakashan, Mumbai.

[19] Solanki, A., & Zaveri, M. (2012). Pharmacognosy, phytochemistry and pharmacology of Abrus precatorius leaf: a review. *International Journal of Pharmaceutical Sciences Review and Research*, 13(2), 71-76.

[20] Taur, D.J., & Patil, R.Y. (2010). Different screening methods for asthma: a review. *Journal of Pharmacy Research*, 3(12), 2828-2830.

[21] Taur, D.J., & Patil, R.Y. (2011). Effect of Abrus precatorius leaves on milk induced leukocytosis and eosinophilia in the management of asthma. *Asian Pacific Journal of Tropical Biomedicine*, 1(S1), S40-S42.

[22] Taur, D.J., & Patil, R.Y. (2011). Mast cell stabilizing and antiallergic activity of Abrus precatorius in the management of asthma. *Asian Pacific Journal of Tropical Medicine*, 4(1), 46-49.

[23] Taur, D.J., & Patil, R.Y. (2012). Antihistaminic activity of Abrus precatorius using clonidine induced catalepsy in mice. *Oriental Pharmacy and Experimental Medicine*, 12, 11-14.

[24] Taur, D.J., Patil, R.N., & Patil, R.Y. (2017). Antiasthmatic related properties of Abrus precatorius leaves on various models. *Journal of Traditional and Complementary Medicine*, 7, 428-432.

[25] Wambebe, C., & Amosun, S. (1984). Some neuromuscular effects of the crude extracts of the leaves of Abrus precatorius. *Journal of Ethnopharmacology*, 11, 49-58.