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Karveer (*Nerium indicum* Mill.): A Comprehensive Review of its Botanical, Phytochemical, Pharmacological, and Toxicological Profile

Dr. Shaloni Sharma[1], Dr. Sanjay Srivastava[2], Dr. Tanishka Gupta[3], Dr. Maninder Singh Sisodiya[4]
[1]*MS Scholar, PG Department of Shalya Tantra, Post Graduate Institute of Ayurveda (PGIA), Jodhpur, Rajasthan, India*
[2]*Associate Professor, PG Department of Shalya Tantra, Post Graduate Institute of Ayurveda (PGIA), Jodhpur, Rajasthan, India*
[3]*MS Scholar, PG Department of Shalya Tantra, Post Graduate Institute of Ayurveda (PGIA), Jodhpur, Rajasthan, India*
[4]*MS Scholar, PG Department of Shalya Tantra, Post Graduate Institute of Ayurveda (PGIA), Jodhpur, Rajasthan, India*

Abstract: ***In Ayurvedic texts more than 500 medicinal plants have been mentioned with their therapeutical uses; Karvīra i.e. Nerium indicum is one of them.[1,2] It is a very useful plant with various medicinal properties such as antimicrobial, anti-pruritus, wound healer, antileprotic, cardiac tonic, etc. Since long, it is being used by physicians in various diseases especially the skin diseases. Scientific studies now also support its use in a variety of conditions such as wound infections, inflammation, cancer, diabetes and CNS depression.[3] All parts of the plant — root, bark, leaves, flowers and seeds — contain potent cardiac glycosides, primarily oleandrin, neriodorin, neriodorein, and nerifolin, which underlie both its therapeutic potential and its considerable toxicity.[4] Karveer is classified as an Upavisha (sub-toxic plant) in Ayurveda and figures prominently in classical texts including Charaka Samhita and Sushruta Samhita for the management of skin disorders, fevers, cardiac insufficiency, and various inflammatory conditions.[1] Scientific validation of its antimicrobial, anti-inflammatory, antifungal, and cardiotonic properties has grown steadily.[5,6] However, the margin between therapeutic and lethal dose remains narrow, necessitating expert supervision and proper Shodhana (detoxification) before use.[7] This review aims to serve as a reference for researchers, clinicians and students of Ayurveda and pharmacognosy.***

Keywords: Karveer, Nerium indicum, Nerium oleander, Oleandrin, Cardiac glycosides, Ayurveda, Upavisha, Phytochemistry, Toxicology

I. INTRODUCTION

India is known as the "Emporium of medicinal plants". The use of plants to treat various diseases in India dates back to the times of Ṛīgvēda, with practices even older than those recorded texts.[1] Among the wealth of medicinal flora documented in Ayurvedic literature, Karveer holds a unique position — simultaneously celebrated for its curative properties and feared for its potent toxicity. The plant is referred to variously as *Karavira, Karaveera,* or *Karveer* in Sanskrit texts and is botanically correlated with the genus *Nerium,* family Apocynaceae.[2]

Nerium indicum is an evergreen shrub or small tree in the Dogbane family Apocynaceae. It has synonyms like *Nerium oleander* and *Nerium odorum.* It is also known as oleander from its superficial resemblance to the unrelated olive *Olea*. The white- and red-flowered varieties both are equated with *Nerium indicum*. It is commonly found as an ornamental shrub in gardens throughout India and is cultivated all over the world, especially in south-west Asia. *N. indicum* is native to India, Bangladesh, Nepal, Myanmar and China.

It is about 5 metres tall, a large glabrous erect shrub with milky juice and linear-lanceolate, dark green shiny, thickened leaves. Flowers are fragrant, red, white and rose-coloured. The whole plant, especially the roots, is highly toxic; the parts most used for medicine are the roots and leaves.[3,4]

II. TAXONOMY AND BOTANICAL DESCRIPTION

A. Taxonomic Classification

Kingdom: Plantae | Order: Gentianales | Family: Apocynaceae | Genus: *Nerium* | Species: *N. indicum* Mill. (syn. *N. odorum* Soland., *N. oleander* L.)

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B. Varieties

Classical Ayurvedic texts describe multiple varieties of Karveer based on flower colour. *Bhavaprakasha* identifies two primary varieties: Shweta-Karveer (white-flowered) and Rakta Karveer (red-flowered), both botanically identified as *Nerium oleander*. *Raj Nighantu* adds two further varieties: Pita-Karveer (yellow-flowered), often correlated with *Thevetia peruviana* (Yellow Oleander), and Krishna-Karveer (dark-flowered), whose botanical identity requires further investigation.[1,2]

C. Morphology

Karveer is a highly branched, evergreen shrub growing to a height of 2–6 metres. The stem is cylindrical with smooth, grayish-white bark that exudes a milky latex when cut. Leaves are lanceolate, 10–22 cm long, leathery, with a prominent midrib, arranged in whorls of three. Flowers are showy, 5-petalled, and arranged in terminal cymes; they may be white, pink, red, or yellow depending on the variety. Fruits are elongated, paired follicles, 10–20 cm long, containing silky-haired seeds. The root system is woody with grayish bark.[3]

III. AYURVEDIC PERSPECTIVE

A. Classical Properties

Karveer possesses the following classical Ayurvedic properties:[1]

1) Rasa (Taste): Katu (pungent), Tikta (bitter)
2) Guna (Qualities): Laghu (lightness), Rooksha (dryness)
3) Veerya (Potency): Ushna (hot)
4) Vipaka (Post-digestive effect): Katu
5) Dosha effect: Balances Kapha and Vata; can aggravate Pitta in excess
6) Primary part used: Root and root bark
7) Dosage (internal, after Shodhana): 30–125 mg/day maximum

TABLE: Major Chemical Constituents of Oleander

White and Red variety (*Nerium oleander* L.)	Yellow variety (*Thevetia nerifolia*)
Neriodorin Neriodorein Karabin Neriin (identical with Digitalis) Rosaginine (strychnine-like action)	Thevetin (similar in action to Digitalis) Thevitoxin (similar in action to Digitalis) Nerifolin Peruvoside Ruvoside Cerbrin

IV. PHYTOCHEMICAL CONSTITUENTS

The entire plant — roots, bark, leaves, flowers, and seeds — contains potent toxic compounds. The principal active constituents are cardiac glycosides, but the phytochemical profile is broad.[4,8]

A. Cardiac Glycosides

Oleandrin is the most extensively studied cardiac glycoside of *Nerium indicum*. Others include neriodorin, neriodorein, neriin, nerifolin, odoroside, and karabin. In the yellow variety (*Thevetia peruviana*), thevetin A and thevetin B are the predominant glycosides. These compounds share a mechanism of action similar to digitalis, acting by inhibiting the Na^+/K^+-ATPase pump in myocardial cells.[4,9]

B. Other Bioactive Compounds

Beyond cardiac glycosides, the plant contains oleandregenin, oleanolic acid, ursolic acid (pentacyclic triterpenes), flavonoids including rutin and quercetin derivatives, tannins, sterols (beta-sitosterol), alkaloids (rosagenin), and neriine. Volatile oils are present in the flowers and contribute to the distinctive fragrance. Polysaccharides and fatty acids have also been isolated from leaf extracts.[3,8]

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V. PHARMACOLOGICAL ACTIVITIES

A. *Cardiovascular Effects*

Cardiac glycosides from *Nerium indicum* exert a digitalis-like positive inotropic effect, increasing the force of myocardial contraction while slowing heart rate at therapeutic doses. Neriodorin shares the primary mechanism of digitalis. At supratherapeutic doses, these glycosides cause fatal cardiac dysrhythmias. Their use in traditional medicine for cardiac debility, oedema secondary to poor circulation, and dyspnoea aligns with this pharmacological profile.[4,9]

B. *Antimicrobial Activity*

Multiple studies have demonstrated broad-spectrum antibacterial activity of *Nerium indicum* leaf and root extracts against organisms including *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumoniae*, and *Pseudomonas aeruginosa*. Antifungal activity against *Candida albicans* and dermatophytes has also been reported, supporting traditional use in skin infections, ringworm, and scabies.[5,10,11]

C. *Anti-inflammatory Activity*

Extracts of *Nerium indicum* have shown significant inhibition of pro-inflammatory mediators in experimental models. The oleanolic acid and ursolic acid content likely contributes to inhibition of inflammatory pathways. This validates the traditional use of Karveer oil in arthritis and inflammatory skin conditions.[6,12]

D. *Antipyretic Activity*

Ethanol and aqueous extracts of leaves have demonstrated fever-reducing activity in animal studies, consistent with the classical Ayurvedic indication *Jwarapaha* (fever relief), including its specific indication in *Vishama Jwara* (intermittent fevers such as malaria).[3]

E. *Antioxidant Activity*

The flavonoid fraction — particularly rutin and quercetin — contributes to significant free radical scavenging activity.[3] These antioxidant properties are considered to enhance the plant's efficacy in wound healing and chronic skin disorders.

F. *Anticancer Potential*

Recent research has explored oleandrin and related glycosides for anticancer properties. *In vitro* studies suggest cytotoxic effects against multiple cancer cell lines through apoptosis induction, though clinical evidence remains insufficient, and translational use requires considerable caution given the narrow therapeutic window.[13,14]

G. *Other Activities*

Additional pharmacological activities reported include antiparasitic effects (supporting use in malaria and scabies), diaphoretic action (promoting perspiration in skin disorders), diuretic effect (improving renal blood flow, useful in dysuria and urolithiasis), and mild digestive stimulant activity.[3]

VI. TOXICOLOGY

A. *Toxic Constituents*

All parts of Karveer are toxic, but seeds, roots, and sap are particularly dangerous. The cardiac glycosides oleandrin and neriodorin are the principal toxins. Neriodorein exerts a picrotoxin-like effect, producing muscular twitching and tetanic spasms more powerful than those of strychnine. The nectar of flowers may also produce toxic honey.[7,15]

B. *Routes of Exposure*

Oral ingestion is the most common route, either accidental or intentional. Inhalation of smoke from burning plant material may carry toxic compounds causing respiratory distress. Dermal exposure to sap may produce contact dermatitis and ocular inflammation. Oleandrin is well absorbed orally, widely distributed to tissues including liver, heart, lung, brain, spleen, and kidneys, and eliminated very slowly (1–2 weeks) from the body.[7,15]

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C. Clinical Features of Poisoning

Ingestion results in a characteristic clinical syndrome: nausea, vomiting, profuse frothy salivation, abdominal pain, and diarrhoea are early gastrointestinal manifestations. Cardiovascular effects include initial bradycardia followed by tachycardia, hypotension, and potentially fatal dysrhythmias including ventricular fibrillation. Neurological manifestations include drowsiness, tremors, seizures, and coma. Hypocalcaemia may accompany severe poisoning.[7,15,16]

D. Fatal Dose and Period

The exact fatal dose varies with the form of preparation and route. Ingestion of seeds — particularly of *Thevetia peruviana* (Pita Karveer) — is the commonest form of suicidal poisoning in rural India. Death may occur within hours to 2–3 days, typically from cardiac failure.[7,16]

E. Management of Poisoning

Management is largely supportive and follows standard poison management protocols: gastric lavage if the patient presents early, activated charcoal, cardiac monitoring, and correction of electrolyte imbalances. Atropine (1.2 mg IV) is used for bradycardia; temporary cardiac pacing may be required. For heart block with hypotension, IV glucose, atropine, adrenaline (1:1000), and noradrenaline may be administered concurrently but separately.[7,16]

F. Post-mortem Findings

At autopsy, characteristic findings include inflammation of the gastrointestinal tract, congestion of internal organs, dilated veins, and bruising of the heart. Importantly, yellow oleander is resistant to decomposition, enabling toxicological detection in exhumed or buried individuals.[16]

G. Medico-legal Aspects

Suicide using *Nerium odorum* (root decoction or seed pulp) is documented in certain rural parts of India, particularly among women facing domestic or dowry pressures. Homicidal use is rare. The plant has been employed as cattle poison. Karveer is listed in Schedule E(1) of the Drugs and Cosmetics Act, India, as a poisonous plant requiring strict regulation in Ayurvedic formulations.[7,16]

VII. DISCUSSION

Use of *Nerium indicum* is known since the Vedic period — sometimes as a toxic plant and sometimes as a medicine. It is delineated in *Sam Vidhana Brahmana* and recommended for brushing the teeth. Its therapeutic uses described in various classical texts are as follows:

A. Brihattrayi

Charaka and *Sushruta* both classified *Karvira* under the group *Tikta varga* (the bitters) and *Moola visha* (poisonous roots).[1] *Charaka* frequently indicated it in *Kustha roga* (skin diseases), mentioning *Karvira* as one of the *Kusthaghna dravya* (alleviates different types of skin disorders). For the treatment of *Kustha*, he recommended its use both orally and locally; many formulations for external use are described in the *Aragvadhiya adhyaya* chapter of *Charaka Samhita*. *Sushruta* indicated *Karvira* in the treatment of *Ashmari* (stones), *Updamsha* (gonorrhoea), *Bhagandara* (fistula), and different types of skin disorders.[1]

Vagbhata also indicated it in the treatment of skin diseases including *Kikkis* (Striae gravidarum) and *Indralupta* (hair loss). Fine paste of *Dugdhika* (*Euphorbia thymifolia*) and *Karavira* made with milk is applied to the scalp to cure *Palitya* (whitening of hair).[1]

B. Nighantus

Nighantus are those Ayurvedic texts that give detailed accounts of medicinal plants and thus constitute the classical pharmacopoeia of herbal medicine. *Dhanwantri Nighantu* clearly states *Karvira* to be poisonous and recommends only external use. It is *Chakchushya* (beneficial for eyes) and useful in *Kandu, Kushta, Charmaroga* (skin disorders), etc.[1] *Kaideva Nighantu* indicated it in the treatment of eye disease, wounds, and itching, and also recommended only external application.

Bhavaprakasha Nighantu states that application of its paste alleviates venereal diseases (*Upadamsha*), that *Karvira* has *Vranashodhana* and *Vranaropana* (antiseptic) activities, acts against *Krimi* (microbes), and is very useful in the treatment of *Kushtha*. He also classified it under the *Upavishas.*[1]

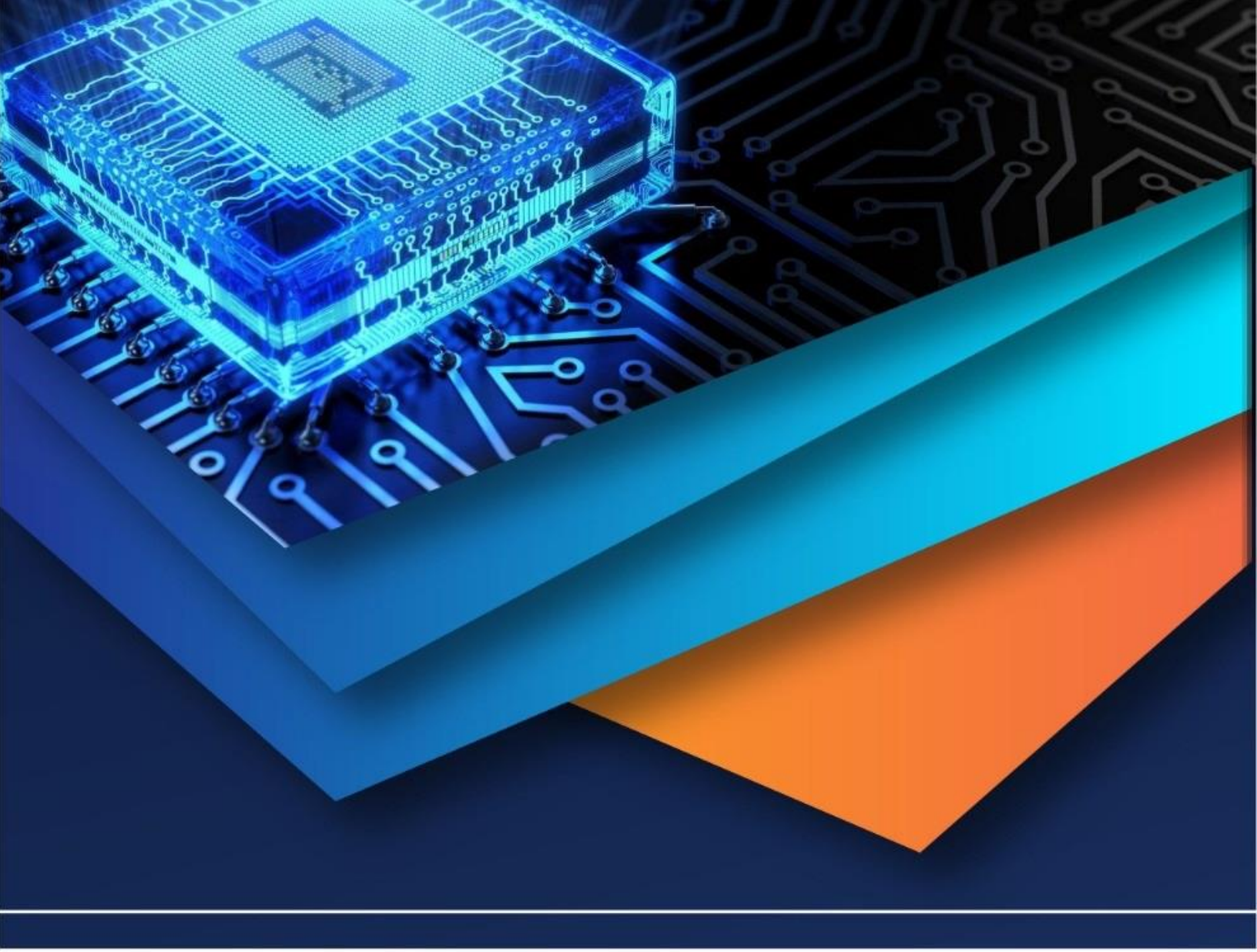
Raj Nighantu described twenty-two synonyms of *Karvira*. *Ashva-maraka* and *Haya-maraka* (so toxic that it can even kill a horse) are common synonyms that indicate its poisonous nature.[1] *Chakrapani*, the renowned physician of the 11th century, indicated application of medicated oil with *Karvira* on *Pama* (eczema). *Vrinda Madhava* described an oil preparation of root of *Karvira* and *Vatsanabha* (Aconite) with *Gomutra* (cow urine) for the treatment of different types of skin diseases including *Charmadala* (xeroderma pigmentosa), *Sidhma* (pityriasis versicolor), *Pama* (bullae), *Krimi* (microbes), *Kitibha* (psoriasis). Leaf powder has been indicated as a snuff for treating epilepsy.[1]

VIII. CONCLUSION

Karveer (*Nerium indicum* Mill.) is a botanically, pharmacologically, and toxicologically significant plant with deep roots in Indian traditional medicine. Its therapeutic use in skin disorders, fevers, cardiac conditions, and inflammatory diseases is substantiated by both classical Ayurvedic documentation and modern scientific research.[1,2,3] Simultaneously, its potent cardiac glycosides render it one of the most dangerous plants in the Indian pharmacopoeia when misused.[4,7,15] Safe and effective use demands adherence to *Shodhana* protocols, precise dosing, professional supervision, and respect for contraindications. Further standardised clinical studies are warranted to define the therapeutic window more precisely and to explore the anticancer potential of its bioactive constituents under controlled conditions.[13,14]

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