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COMPREHENSIVE STUDY OF *VANDA ROXBURGHII*: TRADITIONAL USES, PHYTOCHEMISTRY, AND PHARMACOLOGICAL SIGNIFICANCE

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ABSTRACT: In order to discover new treatments for a wide range of ailments, ethnopharmacological research has investigated different leads from plants. In nature, the Orchidaceae family's *Vanda roxburghii* is found in Bangladesh and India. As a remedy for dyspepsia, bronchitis, and inflammations, as well as for rheumatoid arthritis and bronchitis, various portions of the plant are employed. A number of the plant's beneficial compounds have been identified, including alkaloids, glucosides, fatty acids, saponin, and tannin compounds, as well as β- and γ-sitosterols, as well as fatty oils, resin, and tetracosylferrulate in the roots. In the angiosperm family, orchids make up the largest and most diversified group. They are grown for their magnificent blooms. Flowers of all sizes, shapes and colors can be found on these plants. However, these plants have been widely recognized for their economic relevance, but little attention has been paid to their medical properties. Ayurvedic practitioners have long relied on orchids to treat a wide range of diseases. For centuries, people have relied on the herb to treat a variety of diseases. Numerous biological activities have yielded positive benefits for the plant. This plant has aphrodisiac, antifungal, antiulcer, anticonvulsant, and antioxidant properties. Other studies have shown that the plant possesses anti-inflammatory, wound-healing and analgesic properties, as well as anti-diabetic properties. The phytochemistry and biological activities of this important medicinal plant are at the center of the key implications.

INTRODUCTION: *Vanda roxburghii* (Synonym Vanda tessellate Roxb.), belonging to the family Orchidaceae, is an epiphytic perennial orchid native to the Indian subcontinent Roxb. A foliage-rich stem that is sturdy and gives rise to several thick and juicy roots.

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Aerial roots and clinging roots both exist on plant [1]. The roots that adhere to the tree's bark are tiny and slither into the tree's crevices. These adhering roots anchor the epiphyte to the bark and suck up the bark's nutrients. Aerial roots dangle from the sky and absorb the surrounding environment [2].

Because of its beautiful blooms, this plant is commonly grown in gardens. The plant needs a lot of light from November through the middle of February. Aerial roots from the stem sides of Vanda plants thrive in warm, well-ventilated homes, where foliage plants also thrive. There are

little, white to brown, adhering roots that stick to the support. Aerial roots are lengthy and white to brown with lenticels on the outer surface. The strong, parallel veins on the green, succulent leaves give them a lush appearance. Ayurveda and other indigenous medical systems have employed this herb to cure a variety of diseases. Unani practitioners use this herb as a laxative and liver tonic. Hiccoughs, piles, and boils on the scalp are also treated using various portions of this plant [3]. The herb has been used for various ailments, including inflammation, bronchitis, rheumatism, and neurological disorders, as an alexiteric, antipyretic, and sexual stimulant. *Vanda roxburghii* leaves have been used in ancient Sanskrit texts to treat rheumatism, ear infections, fractures, and nervous system disorders. In the event of a fever, a paste of leaves is applied.

For arthritis and rheumatism, Rasna Panchaka Quatha is an ayurvedic composition that includes it. The root is used to treat bronchitis and as an antidote for scorpion stings. The plant's important components are tanning, resins, saponins, and coloring matter. The plant also contains alkaloids, glycosides, bitter principles, tannins, and glycosides. Screening for several biological activities has yielded positive results for the plant. The antibacterial, antifungal, antiulcer, anticonvulsant and cell-reinforcing abilities of *V. roxburghii* have been demonstrated [4]. More studies have looked at the plant's potential as a hepatoprotective and mitigating agent and its anti-nociceptive and pain-relieving properties. The taxonomical classification and synonyms of *Vanda roxburghii* are represented in **Fig. 1.**

TAXONOMICAL CLASSIFICATION		SYNONYMS	
Kingdom	**Plantae**	**Language**	**Common names of drug**
Subkingdom	Tracheobionta	Sanskrit	Rasna, Vandaka
Superdivision	Spermatophyta	Bengali	Rasna
Division	Magnoliophyta	Gujarati	Rasna
Class	Liliopsida	Hindi	Vanda
Order	Orchidales	Kannada	Banda Nike
Family	Orchidaceae	Telugu	Van Danika
Genus	Vanda		
Species	Roxburghii		

FIG. 1: TAXONOMICAL CLASSIFICATION AND SYNONYMS OF *VANDA ROXBURGHII* [5, 6]

Historical Background of Orchids: There are 25000-35000 species in the Orchidaceae family, which includes 750-800 genera [7]. Orchids are the most numerous and diverse in tropical and subtropical regions [8]. Intricate and beautiful, orchid flowers show a broad variety of variations in shape, size, and color. Orchid blossoms have caused a significant increase in the global floriculture trade [9]. Orchid books were initially written in China. The Chin Chan Lan P'u was written by Chao Shih-Keng in 1233, and he detailed the cultivation of 20 kinds. It was written in 1247 by Wang Kuei-hsueh and included 37 species of orchids. Since 2800 B.C., orchids have been employed in traditional Chinese medicine [10]. For their medicinal and erotic properties, the Indians also employed orchids. *Orchis latifolia*, *Dendrobium alpestre*, and *Habeneria acuminata* are some of the orchids utilized in Ayurveda [11].

Cultivation of *Orchids species*: This genus has some of the most magnificent flowers in the orchid family, making it one of the five most important orchid genera. This has significantly contributed to the work of flower hybridizers who create cut-flower varieties [12]. Variants of *V. coerulea* can yield varieties with blue blooms (really a very blue-purple), which are highly valued for developing interspecific and intergeneric hybrids. Only thelymitracrinita, a terrestrial species from Australia, and *Aganisia cyanea*, a lowland species from northern South America that is difficult to cultivate but possesses metallic blue flowers, are orchids truly "blue" in appearance [13]. The inner petals of both of these species, like Vanda, have a bluish-purple tinge. Vanda species is a major contributor to Vanda hybrids yellow shade. Plants have leathery, drought-resistant leaves without pseudobulbs. Because they prefer very high light

levels and have massive root systems, almost all of these genu's species are extremely big epiphytes that can be found in disturbed habitats. Several species' monopodial vine-like growth habits allow the plants to grow into enormous specimens 14 quickly.

To keep their bottom leaves from falling off, these plants need to be kept in the same circumstances every day of the week. Vast wooden baskets, bare rooted, are ideal for epiphytic plants because of their large aerial root systems. If the roots of large, mature vandaceous orchids, such as Vanda and Aerides species, are disturbed or damaged, the plants may not blossom and may even decline for a season or more afterward. When these plants are grown, they are unable to tolerate any disturbance or damage to their root systems. Terrestrial plants with terete leaves are easy to grow. In the wild, epiphytic species require daily watering and weekly feeding to thrive. They can be grown outside in Hawaii and the like, as long as they have some protection from the sun [15].

Traditional uses of *Orchids species*: The plant can be found in a wide range of tropical climates in Asia and Australia. Bihar and the western peninsula of India are the only places it may be found. Many species of Vanda are extensively used in traditional and folk medical systems in India, Nepal, China, and other Asian countries [16]. When it comes to traditional Indian medicine, Vanda tessellata is known as "Rasna" in Ayurveda, which is known as the most commonly used medicinal orchid in the genus. Vanda species are used in a variety of traditional and folk medicines. It is also used to treat rheumatism, inflammation, cancer, and diseases of the nervous system like Alzheimer's, Parkinson's, and multiple sclerosis [17].

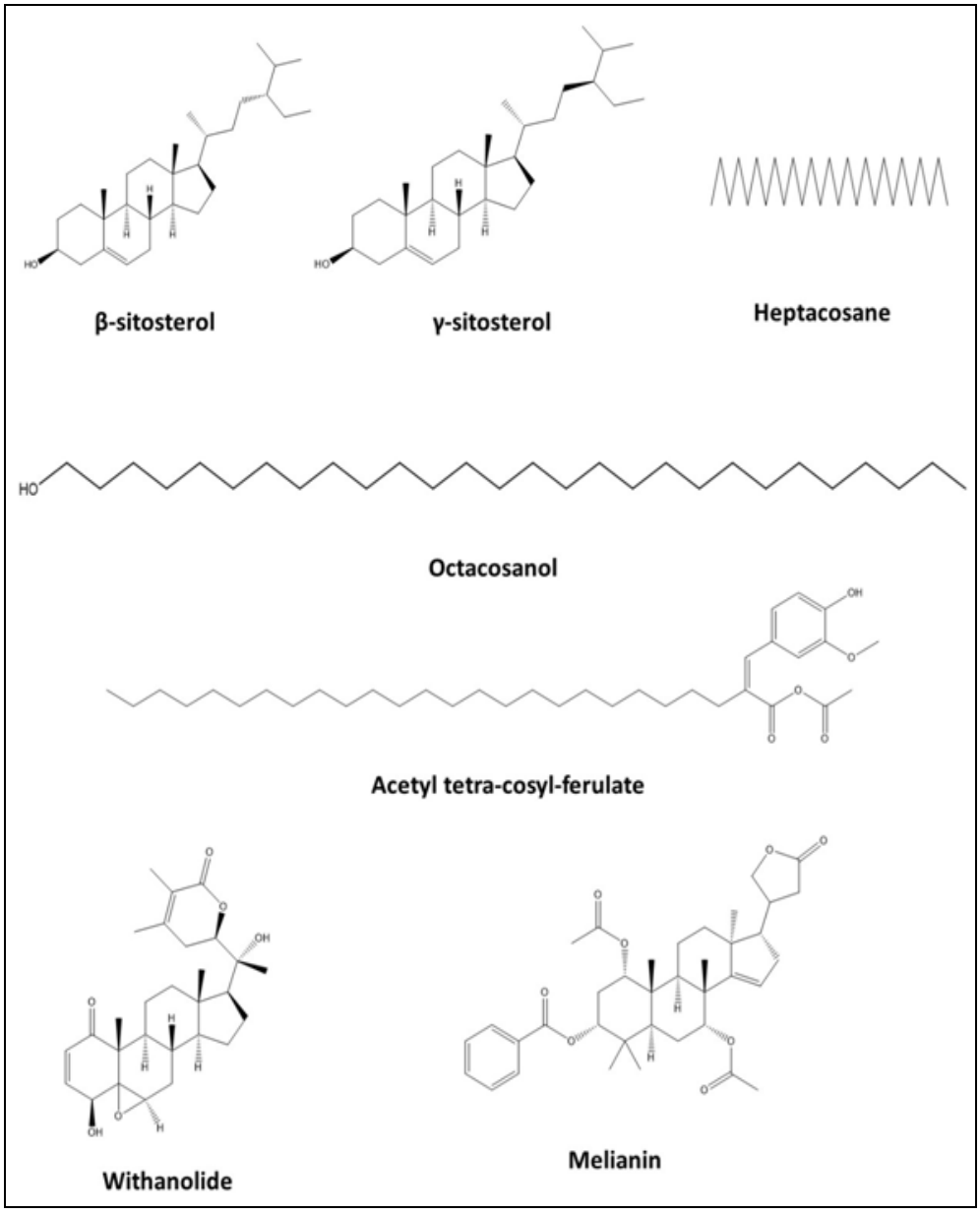
Traditional usage of *Vanda roxburghii* root in Bangladesh as a tonic for the brain and for therapy of nervous system illnesses, including Alzheimer's disease, has been documented in ethnobotanical studies. Native Americans have traditionally relied on Vanda for its anti-inflammatory properties. Malignancies such as choriocarcinoma (cancer of the germ cells), lung and stomach cancers have been shown to have antiproliferative effects by Indian Vanda. Sprains, lumbago, and back pain can all be relieved with a leaf poultice. Earaches can be alleviated with a mixture of neem oil and garlic. Bitter, laxative, and tonic to the liver and brain, the root is useful for bronchitis, piles, lumbago, toothache, and boils on the scalp, reducing inflammation and healing fractures. Plastering bone fractures with a paste made from the aerial roots and tender buds of *Phoenix loureirii* is common practice. During fevers in Chota Nagpur (India), the leaves are ground up and put into a paste; the juice is injected into the aural hole to treat otitis media, inflammation of the middle ear, and fever [18]. In cases of hemiplegia, a root compound decoction is administered since Indian physicians believed it beneficial for all forms of mental disorders, ear infections, bone fractures, fever, and rheumatism. Snake bites can be treated using this herb [19].

Macroscopic and Microscopic Study of Plant *Vanda roxburghii:* The plant's stems are woody, sturdy, and give forth many thick, fleshy roots that rise upwards. The 1–2 m-long cylindrical stems have distinct nodes and internodes shaped like a stem [6]. The stem was sliced into transverse sections (TS) to examine its histological characteristics. It was found that 0.5 g of the powdered drug was used to determine the moisture content, volatile oil content, and ash values, and fluorescence studies were conducted by treating the powdered drug with different reagents. The color was observed in visible light, ultraviolet light of short wavelength (254 nm) and long wavelength (365 nm) under UV chambers, respectively [20].

An epidermis with a thick cuticle and ground parenchymatous tissue was visible on the stem's TS. The vascular bundles were found dispersed around the surface. The xylem and phloem strands that make up the vascular bundles were particularly interesting to note. The limbs were densely lignified. The TS of *Vanda roxburghii* stem prisms of calcium oxalate, pitted xylem arteries, vascular bundles and trichomes were seen in the stem powder [21].

Chemical Constituents of *Vanda roxburghii*: *Vanda roxburghii* contains β-sitosterol, γ-sitosterol, heptacosane, octacosanol, acetyl tetracosylferulate, withanolide, and melianin, according to reports on its chemical composition **Fig. 2**. It has been found that β-sitosterol possesses anti-inflammatory and

anti-pyretic properties [22]. Among these methyl linoleate, and three phenolics compounds such as syringaldehyde, vanillin, and dihydroconiferyl dihydro-p-coumarate, gigantol are also identified in *Vanda roxburghii* [23]. Among the plant's many important ingredients are alkaloids, glycosides, bitter principles, tannins, resin, saponin, sitosterols, and coloring matter. Plants in Pakistan have produced glycosides (melianin) and an anolide complex. An alkyl perulate and β-sitosterol-D-glucoside were discovered in the root of the plant. Resin, saponin, tannins, fatty acids, and coloring agents are also found in the dried whole herb [24]. In addition, tetracosylferrulate is present in roots [25]. Alkaloids, steroids, tannins, glycosides, and flavonoids have been found in several plant extracts that have been put through a qualitative phytochemical screening. According to GC-MS analysis, ocimene and linalool have been found in the plant's fragrance. The smell of *Vanda roxburghii* contained benzyl acetate and methyl benzoate chemicals. The benzenoid /phenylpropanoid pathway may have yielded these chemicals. Cinnamyl alcohol, benzaldehyde, benzyl alcohol, and methyl cinnamate are all also found in the plant. Preparative thin-layer chromatography and column chromatography resulted in the separation of gigantol, a phenolic component, from the chloroform extract of the plant. Orchids have a lot of the bibenzyle chemical gigantol, which has been looked at for a number of different biological functions [26].



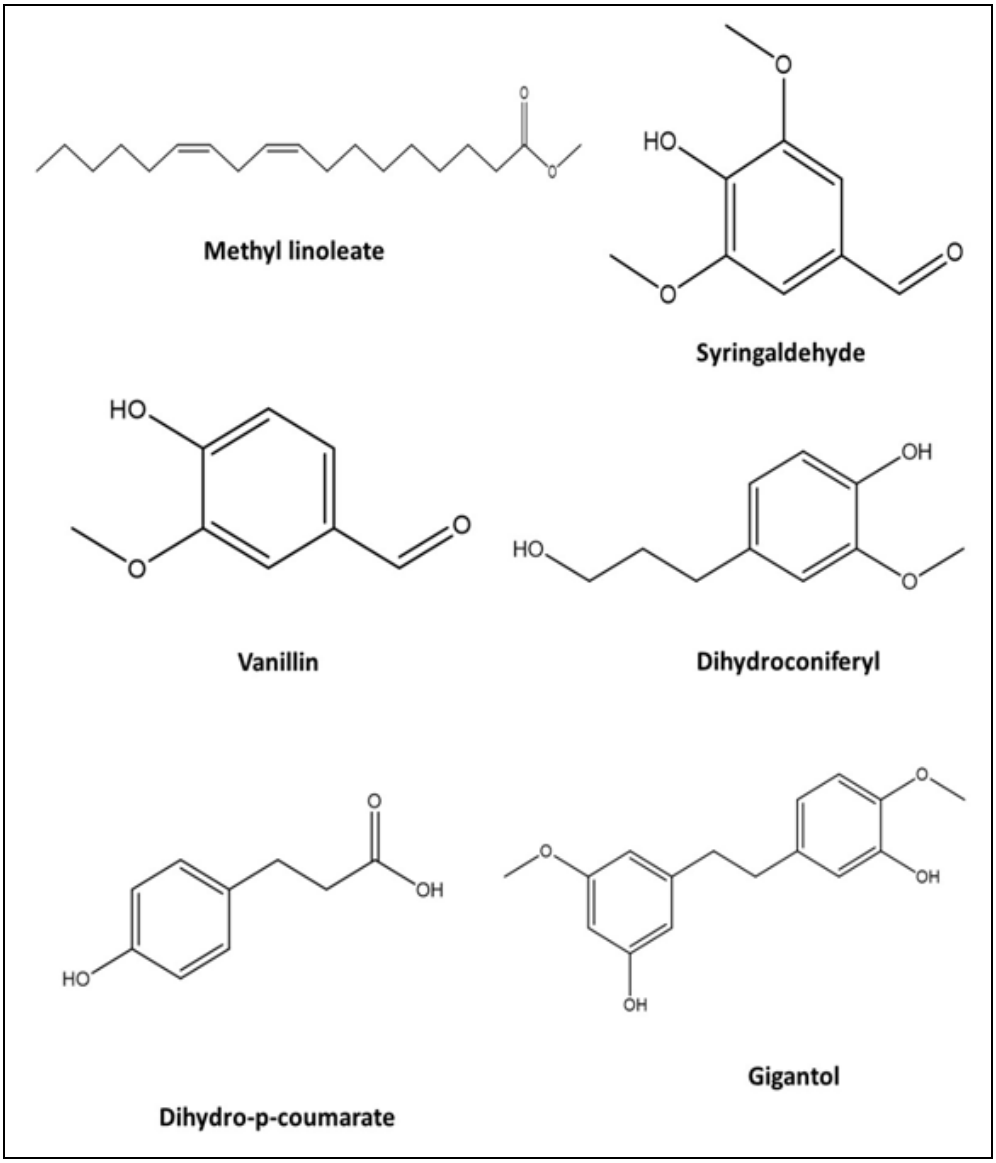


FIG. 2: SEVERAL CHEMICAL CONSTITUENTS OBTAINED FROM THE PLANT *VANDA ROXBURGHII*

Pharmacological Action of *Vanda roxburghii*

Wound Healing Activity: Nayak *et al.*, evaluated the extract of Vanda roxburghii topically for 10 days at a dose of 150mgkg-1 day-1 for wound healing studies utilizing the excision wound model in rats. Compared to the control group, rats given the extract had 60% less wound diameter (48 percent). The wet and dry granulation tissue weights, hydroxyproline, and hexosamine concentrations increased significantly.

The test group likewise showed an increase in protein content. Wound healing occurs at the cellular level, which is compatible with the findings. Pro-healing effects may be linked to enhanced collagen deposition or better alignment and maturation of cells. The control group's wounds took an average of 20 days to heal, but the experimental wounds healed in an average of 13 days. These findings indicate that the extract of Vanda roxburghii, when applied topically, exhibits wound-healing properties in rats [27].

Antioxidant Activity: Uddin *et al*.; used methanol, chloroform, and water to extract the plant's roots. Using the modified Ellman method, the extracts were tested for their ability to inhibit acetyl and butyrylcholinesterase, as well as their antioxidant properties in a variety of assays, including ferric reducing antioxidant power, DPPH, and hydroxyl radical scavenging, and inhibition of lipid peroxidation. Standard phytochemical procedures were used to examine the extracts for endogenous compounds, and chromatographic methods were used to isolate the active ingredient. While the other extracts and the reference standard catechin

were ineffective, chloroform extract was shown to have substantial ferric-reducing antioxidant power and anti-DPPH and anti-hydroxyl free radical activity. Furthermore, in rat brain homogenates, the antioxidant action was validated by inhibiting lipid peroxidation. Both the acetylcholinesterase and butyrylcholinesterase enzymes were blocked by chloroform extract, with IC_{50} values of 221.13 and 82.51 µg/ml, respectively. The chloroform extract had a high concentration of phenolics and flavonoids, as discovered through phytochemical screening. As a result of bioactivity-guided separation processes, a potent antioxidant was isolated from the chloroform extract, and its spectrum properties identified it as gigantol. According to these findings, the chloroform extract of *V. roxburghii* may have antioxidant and cholinesterase inhibitory properties due to its phenolic components, which may be effective in the treatment of Alzheimer's disease (AD) [17].

Anticonvulsant Activity: Pathan *et al.;* utilized alcoholic extract to explore the anticonvulsant effects of electrically and chemically produced seizures. The anticonvulsant efficacy of the root ethanolic extract of *Vanda roxburghii* on maximal electroshock-induced convulsions was examined. Seizures in mice were caused by pentylenetetrazole and picrotoxin. It was possible to determine the lag time between tonic convulsions and their protection and the total number of animals protected. This study found that the ethanolic root extracts of Vanda roxburghii (100 mg/kg) substantially increased latencies to clonic convulsions [28].

Analgesic and Anti-inflammatory Activity: Begum *et al.;* utilized the methanolic leaf and root extracts of the Orchidaceae family's Vanda roxburghii (LVR and RVR) hill tract plant traditionally used in rheumatism, which will be evaluated for their analgesic and anti-inflammatory properties. The current study was conducted in vivo. A variety of mouse models were used to test the analgesic and anti-inflammatory effects of LVR and RVR at dosages of 50 mg/kg and 100 mg/kg, respectively. Diclofenac sodium was used to compare the pain-relieving and anti-inflammatory effects of *V. roxburghii* (50 and 100 mg/kg) in various mouse models, including those that elicit writhing, formalin-induced paw licking and carrageenan-induced hind paw edema. The outcomes of the study showed positive effects on inflammation [29].

Anti-nociceptive Activity: Uddin *et al*. examined several leads from plant sources through ethnopharmacological approaches to find potential novel medications for various ailments, including pain. The root of *V. roxburghii* was the focus of this study, which aimed to evaluate its anti-nociceptive and cytotoxic effects through extracts. The powdered aerial root of V. roxburghii (VRM) was extracted with methanol (VRM), and the resultant was subsequently separated into VRP, chloroform (VRC), and ethyl acetate (VRE) and the remaining water fraction (VRA). Analysis of the extract's anti-nociceptive effects by acetic acid-induced and hot plate tests in mice was conducted. An in vitro brine shrimp lethality experiment tested the plant extract's cytotoxic effect. It was found that the number of writhing in mice treated with different fractions of acetic acid (12.5, 25, and 50 mg/kg, i.p.) was reduced. All three concentrations of VRE (43.65, 71.34, and 80.23 percent, respectively) demonstrated maximum activity at all three concentrations. A second study found that paw licking duration in mice was reduced by 15.00, 37.5, and 56.44 percent, respectively, in the first and second phases of formalin testing when mice were given VRC (12.5 to 50 mg/kg ip). A 30-minute delay time increase was observed in hot plate tests with VRE administration at 25 and 50 mg/kg dosages. In the brine shrimp bioassay, all fractions had lower cytotoxicity than the standard medication, vincristine sulfate. The root of V. roxburghii appears to be a safe and efficient painkiller, according to research [30].

Neuroprotective Activity: Mundugaru *et al.* utilized hydroalcoholic extract of *Vanda roxburghii* for its neuroprotective properties in experimental models of ischemic hippocampus injury in rats. The intra-hippocampus injection of endothelin-1 (80 µ M) produced ischemic hippocampal damage in the lab. Thereafter, HAVR (200 and 400mg/kg, once a day) was provided to patients with ischemic hippocampus injury for 14 days. The repetitive administration of large doses of HAVR for 14 consecutive days reduced cognitive deficits in the morris water maze, actophotometer, and open-field behavioral test outcomes, but the cognitive deficits were still considerable. Hippocampal histo-

pathology revealed loss of normal pyramidal cells and degenerative alterations, including a shrunken, hyperdense soma and pyknotic nucleus, in the CA1 and CA3 regions, whereas HAVR therapy at both dose levels greatly mitigated the observed qualitative abnormalities. Treatment with HAVR reduced lipid peroxidation and restored glutathione peroxidase enzyme activity significantly in ischemia patients. The study's findings suggest that *V. roxburghii* extract and its contents may protect against ischemia-induced hippocampus injury by protecting neurons [31].

Investigation of Antioxidant, Analgesic and Cytotoxic Activity: Islam *et al*. evaluated the activity of *Vanda roxburghii* root was tested for antioxidant, analgesic, and cytotoxic properties in crude methanolic form. DPPH radical scavenging activity and nitric oxide scavenging power assays demonstrated that the root extract of *Vanda roxburghii* had antioxidant properties. An acceptable amount of anti-oxidant activity was demonstrated in the DPPH and NO scavenging assays, with IC_{50} ascorbic acid values of 12.30 ± 0.11 and 18.64 ± 0.22ug mL-1, respectively, whereas the extract showed adequate antioxidant activity in both assays. The extract's dose-dependent power-reducing action was observed. Mice were used to test the crude extract's analgesic potential in an acetic acid-induced writhing pain model. Acetic acid writhing in mice was significantly reduced at 200 and 400 mg kg-1b.wt. of the crude extract, comparable to the conventional diclofenac sodium (86.52 percent). A brine shrimp lethality experiment was used to test the extract's cytotoxic potential. The LC50 value for brine shrimp nauplii was 25.19 ± 0.98 ug mL-1 in this extract, which revealed substantial toxicity to the nauplii. According to the results of the study, the extract has good analgesic and cytotoxic properties, as well as moderate antioxidant properties [32].

CONCLUSION: Since, the beginning of time, medicinal plants have been one of the most reliable and trustworthy sources of safe medication. The genus Vanda is well-known for its attractive flowers, but it is also widely used in traditional medicine and may have a wide range of therapeutic properties. Furthermore, greater research should be done on these species' conservation, cultivation, and sustainable use. *Vanda roxburghii* has been found to contain a variety of chemical compounds. Aphrodisiac, antifungal, antiulcer, anticonvulsant, and antioxidant activities are all found in this plant. These activities in the orchid should be investigated more molecularly and pharmacologically so that new lead compounds can be discovered. More research into the ethnomedicinal properties of indigenous and exotic orchids is needed to improve human health.

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