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Role of *Jasminum sambac* Extracts in Neurodegenerative Disorders

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Abstract: *Jasminum sambac*, commonly known as Arabian jasmine, is renowned for its fragrant flowers and medicinal properties. Recent research has highlighted the potential of *Jasminum sambac* and its extracts as therapeutic agents against neurodegenerative diseases. Conditions such as Alzheimer's and Parkinson's disease involve progressive deterioration of neuronal structure and function, leading to cognitive deficits and motor impairments. *Jasminum sambac* contains diverse bioactive compounds, including flavonoids, alkaloids, saponins, and essential oils, which exhibit significant antioxidant, anti-inflammatory, and neuroprotective activities. These compounds have been shown to reduce oxidative stress, suppress neuroinflammation, and inhibit apoptotic pathways, thereby protecting neurons from injury. Experimental studies suggest that *Jasminum sambac* can enhance cognitive performance and memory, modulate key signaling pathways related to neuronal survival, synaptic plasticity, and neurotransmitter regulation. Additionally, its ability to chelate metal ions, inhibit amyloid-β aggregation, and preserve cholinergic function underscores its therapeutic potential in neurodegenerative disorders. While preclinical findings are promising, comprehensive clinical trials are needed to validate the efficacy and safety of *Jasminum sambac* in humans. These observations emphasize the need for further research to explore its neuroprotective mechanisms and potential as a natural therapeutic agent in neurodegenerative diseases.

Keywords: *Jasminum sambac*, Neurodegeneration, Antioxidant, Anti-inflammatory, Neurotrophic effects.

1. Introduction

Arabian jasmine, or Sampaguita, is a highly valued plant with diverse significance across societies and countries due to its wide-ranging applications. *Jasminum sambac* Linn. (Family Oleaceae), commonly referred to as *J. sambac*, is an erect or scrambling shrub growing up to 1–1.5 meters, predominantly found in tropical and subtropical regions [1], as shown in **Figure 1**. The chemical composition of *J. sambac* flower extracts varies depending on the geographical origin of the plants—China, Pakistan, India, or Indonesia—resulting in differences in fragrance and physiological properties such as antioxidant, antimicrobial, anti-tyrosinase, antitumor, and analgesic effects. Native to the Indian subcontinent and Southeast Asia, the plant is noted for its small, snow-white, fragrant flowers that bloom throughout the year. Culturally and religiously, *J. sambac* holds profound significance, particularly in India, where the flowers are used in offerings to deities and during special ceremonies like weddings, symbolizing purity and divine blessings, often incorporated into crowns worn by gods. In the Philippines, the plant, known as Sampaguita, is the national flower, representing simplicity, purity, and humility [2]. In Chinese tradition, the flowers are utilized to infuse jasmine tea with its distinct aroma, a practice cherished for generations [3]. Medicinally, *J. sambac* has been incorporated into Ayurvedic and traditional therapies for its purported antipyretic, anti-inflammatory, and stress-relieving properties [4].

The aromatic oil extracted from its flowers is a cornerstone of aromatherapy due to its stimulating effects. Beyond medicinal and cultural significance, the plant holds substantial economic value, contributing to perfume production, decorative floriculture, and commercial plantations. Its ability to thrive in various conditions and bloom year-round enhances its global horticultural and commercial appeal [5-6]. Pharmacological studies have demonstrated that *J. sambac* extracts exhibit a broad spectrum of activities, including antimicrobial, insecticidal, analgesic, antipyretic, anti-inflammatory, antioxidant, antidiabetic, dermatological, anticancer, CNS and PNS effects, cardiovascular benefits, inhibition of lipid peroxidation, anti-obesity, and gastroprotective activity. This study aims to summarize the chemical constituents, pharmacological activities, and therapeutic potential of *Jasminum sambac* [7].

Figure 1: Leaves and flowers of *Jasminum sambac*.

2. Plant Profile: *Jasminum sambac*

The global significance of herbal remedies in managing a wide range of diseases is well recognized [8]. Due to their relatively low toxicity compared to synthetic drugs, herbal remedies are widely employed as essential therapeutic agents in both traditional and modern medicine [9]. Commonly known as jasmine, *Jasminum sambac* (Family Oleaceae) has been the focus of phytochemical investigations, which confirmed the presence of various bioactive compounds, including amino acids, glycosides, coumarins, flavonoids, phenols, saponins, steroids, terpenoids, vitamin C, essential oils, and salicylic acid [10]. The taxonomy profile of *Jasminum sambac* is summarized in **Table 1**.

Table 1: Taxonomy Profile of *Jasminum sambac.*

Kingdom	**Plantae**
Order	Lamiales
Family	Oleaceae
Genus	Jasminum
Species	*Sambac*

3. Chemical Constituents

The dried leaf extract of *Jasminum sambac* is a rich source of bioactive compounds, including β-sitosterol, 2,3-dihydro-benzofuran, α-amyrin, 2,6,10-trimethyl-bicyclo[2.2.1]heptane-2,5-diol, 14-ethylene-14-pentadecene, 1-nonadecene, alpha-tocopherol-β-D-mannoside, and 1-heptacosanol, along with kaempferol-3-rhamnoglycosides. Additionally, novel plant-based cysteine-rich peptides known as jasmintides (jS1 and jS2) were identified from *J. sambac*, together with compounds such as 1-octadecyne, hexadecanoic acid, n-hexadecenoic acid, hexadecenoic acid, R-limonene, 9-octadecenoic acid, and squalene [7]. Pharmacological investigations have revealed that *Jasminum sambac* exhibits diverse activities, including lipid-lowering, anti-obesity, antibacterial, analgesic, antipyretic, antioxidant, antidiabetic, and insecticidal effects [11]. A detailed list of various phytoconstituents of *Jasminum sambac* is provided in **Table 2**.

Table 2: Phytoconstituents of *Jasminum sambac.*

Sr. No	Plant part	Phytoconstituents	References
1.	Leaves	Contain major phytoconstituents such as alkaloids, glycosides, saponins, flavonoids and terpenoids. Mainly, the Iridoid glycosides are present. These include sambacin, Jasminin, Sambacoside A (I), and Sambacolingoside. Flavonoids include quercetin (II), isoquercetin (III), rutin (IV), kempferol (V) and luteolin (VI),7,15 Secoiridoid glucoside- sambacolignoside, along with oleoside 11-methyl ester.16,17Oligomeric irridoids like molihuasides A are a dimeric irridoid glycoside, and Molihuasides C-E are trimeric irridoid glycosides18	[12]
2.	Roots	Oleanolic acid, and hesperidin (VII), iridane triol, iridane tetraol, β-daucosterol, benzyl-o-β-D-(1-6)-β-Dxylopyranoxyl, molihuaoside D, sambacoside A, sambacoside E, rutin, kaempferol-3-o-(2,6 di-o-α-Lrhamnopyranosyl)-β-D-galactopyranoside and quercetin-3-o-(2,6-di-o-α-Lrhamnopyranosyl)-β-D-galactopyranoside.	[13]
3.	Stem	Jasminol (VIII) is characterised as lup-20-en-28beta-ol; C20-C30 hydrocarbons, palmitic (IX), stearic (X), linolenic, linoleic, malvalic acid, betulinic, ursolic (XI) and oleanolic acid, D- mannitol, inositol (XII), xylitol and sorbitol, friedelin (XIII), lupeol (XIV), betulin (XV), alpha-amyrin (XVI), triterpenoids, flavonoids, six oligomeric irridoid glycosides.	[14]
4.	Flower	contains 3-hexenol, 2-vinylpyridine (XVII), indole (XVIII), myrcene (XIX), linalool (XX), geranyl linalool (XXI), alpha terpenol (XXII), beta terpenol, linalyl acetate (XXIII), nerolidol (XXIV), phytol (XXV), isophytol (XXVI), farnesol (XXVII), eugenol (XXVIII), benzyl alcohol (XXIX), methyl benzoate (XXIX), benzyl cyanide (XXX), benzyl acetate (XXXI), methyl dihydrojasmonate, methyl anilate, cisjasmone, methyl N-methylanthranilate, vanillin (XXXII), cis-3-hexenylbenzoate benzoate, methylpalmitate and methyl linoleate (XXXIII), 8,9-dihydrojasminin, 9-deoxyjasminigenin (XXXIV)16, 22, 23 Glycosidic aroma precursor like benzyl 6-O-β-D xylopyranosyl-β-D-glucopyranoside (β-primeveroside), 3(2-phenylethyl 6-O-α-Lrhamnopyranosiyl-β-D-glucopyranoside (β-rutinoside).	[15]
5.	Jasmine oil	Methyl jasmonate, Jasminoside (XXXV), Jasminol (XXXVI), Jasminolactone (XXXVII) Multiforin (XXXVIII), Olueropin (XXXIX), benzyl benzoate, linalool, linalyl acetate, benzyl alcohol, indole, jasmone, methyl anthranilate, P-cresol (XL), geraniol (XLI), racemic(5-pent-2-enyl)-5,1-pentanolide, benzyl benzoate, nerol, 1-á-terpineol, d and dl-linalool,α-jasmolactone, farnesol, nerolidol and eugenol.	[16]

4. Historical Uses

Arabian jasmine, also known as Sampaguita, has a long history of cultural and medicinal use across various regions, including Asia and India. *Jasminum sambac* holds significant religious and ceremonial value [17]. In Hinduism, it is commonly used in rituals and offered to deities in temples. The flowers are also woven into garlands for gods and play an important role in wedding ceremonies, symbolizing purity and sanctity. Additionally, Sampaguita is regarded as the national flower of the Philippines, representing simplicity, purity, and humility. **Table 3** provides a summary of the historical uses of *Jasminum sambac* in neurodegenerative diseases, including additional neuro-related insights.

Table 3: Historical Uses of *Jasminum sambac.*

Category	Details	Reference
Traditional Medicinal Use	Used in Ayurveda and Traditional Chinese Medicine for treating fever, stress, and inflammation.	[18]
Neuroprotective Effects	Contains bioactive compounds that may have protective effects on neurons.	[19]
Antioxidant Properties	Reduces neuroinflammation, which plays a significant role in diseases like Alzheimer's and Parkinson's.	[20]
Jasmine Tea Consumption	Scented tea has been linked to relaxation and improved mental clarity.	[21]

5. Traditional Uses

Arabian jasmine, or Sampaguita, scientifically known as *Jasminum sambac*, holds significant cultural, medicinal, and traditional value across many civilizations, particularly in Asia. The flower is one of the most valued floral decorations in India and carries deep religious connotations [22]. It is commonly incorporated into Hindu practices and customs, where bouquets of *J. sambac* flowers are offered to deities as symbols of purity and reverence [23]. In Indian weddings, flowers are used in the bridal and groom attire, representing loyalty and love. Sampaguita is also the national flower of the Philippines, valued for its simplicity and symbolic purity [24]. Additionally, garlands and leis made from the flowers are used in welcoming rituals, signifying respect and honor. In traditional Chinese medicine, *Jasminum sambac* has long been esteemed for its therapeutic applications. The flowers are prepared as teas to relax muscles, aid digestion, and reduce inflammation [25]. Its essential oils are widely used in aromatherapy to alleviate anxiety and promote relaxation. Jasmine oil is incorporated into body products, such as massage oils and skin lotions, due to its joint-relieving and moisturizing properties. In Southeast Asia, the flowers are used in baths and beauty treatments to soften and rejuvenate the skin [26]. Folklore and traditional tales across various cultures further highlight the jasmine flower as a symbol of beauty, purity, and spirituality. These practices underscore the enduring cultural and medicinal importance of *Jasminum sambac*, reflecting the continuity of traditional knowledge over centuries [27]. The historical and traditional medicinal uses of *Jasminum sambac* related to neurodegenerative diseases are summarized in **Table 4**.

Table 4: Historical and Traditional Medicinal Uses of *Jasminum sambac* Related to Neurodegenerative Diseases.

Use Category	Specific Use	Description	Region/Culture	Reference
Historical Medicinal Uses	Sedative	Used to induce relaxation and improve sleep quality.	India, Southeast Asia	[28]
	Anxiolytic	Employed to alleviate anxiety and nervousness.	India, China	[29]
	Analgesic	Applied for pain relief, including headaches and migraines.	Traditional Chinese Medicine	[30]
	Anti-inflammatory	Utilized for reducing inflammation, potentially beneficial for neurodegenerative conditions.	Ayurveda, Southeast Asia	[31]
	Aromatherapy	Inhalation of jasmine aroma is believed to enhance mood and mental clarity.	Global	[28]
Traditional Medicinal Uses	Memory Enhancement	Used in traditional remedies to improve memory and cognitive function.	Ayurvedic Medicine, India	[30]
	Neuroprotective	Believed to protect nerve cells and prevent damage.	Traditional Chinese Medicine	[28]

	Anti-stress	Employed in herbal teas and oils to reduce stress and improve mental resilience.	Southeast Asia	[32]
	Mood Stabilizer	Used to stabilize mood and manage symptoms of depression.	Ayurveda, Southeast Asia	[16]
	Herbal Formulations	Incorporated in various traditional herbal formulations aimed at treating neurodegenerative diseases.	India, China, Southeast Asia	[16]

6. Phytochemistry and Pharmacology

Arabian jasmine, or Sampaguita, possesses a rich profile of volatile compounds and flavonoids, which underlie its diverse medicinal properties, as summarized in **Table 5** [33].

Table 5: Phytochemistry and Pharmacology of *Jasminum sambac* with a focus on Neurodegenerative Diseases.

Category	**Phytochemicals**	**Pharmacological Effects**	**Relevance to Neurodegenerative Diseases**
Essential Oils	Benzyl acetate, Linalool, Methyl anthranilate [34]	Antioxidant, Antimicrobial, Anxiolytic	Helps reduce neuroinflammation and oxidative stress.
Flavonoids	Quercetin, Kaempferol [35]	Antioxidant, Anti-inflammatory	Protects neurons from oxidative damage, potentially aiding in Alzheimer's and Parkinson's.
Phenolics	Chlorogenic acid, Ferulic acid	Strong antioxidant activity	Shields against neurodegeneration by reducing oxidative stress.
Alkaloids	Jasmine alkaloids [36]	Sedative, Analgesic	May help in managing anxiety, stress, and neuro-related pain.
Neuroprotective Compounds	Various bioactive phytochemicals	Cognitive enhancement, Neuroprotection	Supports memory function and may slow cognitive decline.
Anti-inflammatory Effects	Polyphenols and flavonoids	Reduces neuroinflammation	Important for managing neurodegenerative conditions like Parkinson's and ALS.
Antioxidant Properties	Multiple antioxidants present	Fights oxidative stress	Prevents neuronal damage and supports brain health.

7. Clinical Evidence for Neuroprotective Effects

There is limited published clinical evidence on the potential of *Jasminum sambac* in combating neurodegenerative diseases, but preliminary studies have shown promising results [37]. Current research primarily focuses on investigating the plant's phytochemicals and their potential applications in treating neuropathological disorders. Experimental studies using models of neurodegeneration have demonstrated the protective effects of *J. sambac* extracts (JSE) and essential oils (JO) [38]. Oxidative stress plays a critical role in conditions such as Alzheimer's and Parkinson's disease; *J. sambac* may help mitigate neuronal degeneration

by inhibiting free radicals and reducing oxidative stress. Certain clinical trials indicate that *J. sambac* exhibits cognitive benefits against age-related decline and overall brain degeneration [39]. Additionally, the essential oil of *J. sambac* has been studied for its anxiolytic and sedative properties, with clinical trials showing decreased anxiety levels and improvements in mood and performance *via* inhalation or topical application. Neuroinflammation also plays a key role in neurodegenerative diseases, and cell culture studies reveal that *J. sambac* has anti-inflammatory effects that may protect neurons from inflammation-induced damage. Ongoing clinical trials are further exploring its potential anti-inflammatory activity in neuropathological disorders, which could lead to therapeutic applications [40]. In conclusion, although further clinical studies are required to validate its neuroprotective efficacy, existing research suggests that *J. sambac* could serve as a natural agent for neurological diseases. Its bioactive compounds demonstrate antioxidant, anxiolytic, sedative, and anti-inflammatory effects, making it a promising candidate for the development of non-conventional therapies for neurodegenerative disorders [41-42].

8. Mechanism of Action in Neurodegenerative Disorder

The neuroprotective roles of *Jasminum sambac* in treating neurodegenerative diseases are diverse and involve multiple molecular targets that confer benefits to neurons. Antioxidant activity is one of its primary mechanisms, as oxidative stress can induce synaptic damage and lead to neuronal cell death. Bioactive compounds isolated from *J. sambac*, including flavonoids and phenolic compounds, have been shown to inhibit free radical formation and mitigate its harmful effects on neurons. By protecting neurons from oxidative stress, this tropical plant demonstrates potential for slowing or preventing the progression of neurodegenerative disorders [43].

8.1 Anti-inflammatory Effects

Jasminum sambac has demonstrated notable anti-inflammatory properties by inhibiting the release of pro-inflammatory cytokines and modulating microglial activation. Through these actions, *J. sambac* helps alleviate the pathophysiology associated with neuroinflammation, thereby preventing neuronal loss and providing neuroprotection in neurodegenerative diseases [27].

8.2 Modulation of Neurotransmitter Activity

Jasminum sambac essential oil contains volatile compounds that have been reported to modulate neurotransmitter function in the brain [44]. Among these, linalool is particularly significant, as it enhances the activity of gamma-aminobutyric acid (GABA) receptors, a key neurotransmitter involved in anxiety regulation. By influencing neurotransmitter release, *J. sambac* extracts exhibit anxiolytic and sedative properties, which may help manage symptoms such as anxiety and insomnia associated with neurodegenerative disorders [45].

8.3 Neurotrophic Effects

Brain-derived neurotrophic factor (BDNF) is a protein crucial for neuronal development and neuroplasticity. Enhancing neurotrophic support may promote neuronal repair, aid in the management of neuropsychiatric disorders, and improve cognitive function [46].

8.4 Modulation of Signaling Pathways

Leadership approaches shape organizational culture and influence employee outcomes. Given that drug-resistant tuberculosis (DR-TB) affects employees, their families, and communities, organizational leaders need to understand the hierarchy of prevention. For example, studies on *Jasminum sambac* extract for the treatment of skin disorders have highlighted its ability to modulate inhibitors and activators of the Akt/mTOR pathway, which plays a critical role in regulating cell survival and growth [47].

9. Conclusion

Jasminum sambac, also known as Arabian jasmine or Sampaguita, is a botanical treasure with profound cultural, medicinal, and pharmacological significance across civilizations worldwide. Its historical role in religious ceremonies, folk traditions, and ornamental uses underscores its enduring importance in societies from the Indian subcontinent to Southeast Asia and beyond. Beyond its cultural value, its rich phytochemical

profile highlights its therapeutic potential, particularly in neuroprotection. Although clinical evidence for its neuroprotective effects remains limited, preliminary studies suggest promising roles in mitigating oxidative stress, reducing inflammation, modulating neurotransmitter activity, and promoting neuronal recovery. These findings provide valuable insights into the potential of *Jasminum sambac* as a natural intervention for neurodegenerative disorders, offering hope for the development of novel strategies in non-conventional medicine. Overall, the multi-dimensional significance of *Jasminum sambac* reflects its timeless relevance and its capacity to bridge traditional knowledge with modern pharmacology. As research continues to uncover its therapeutic benefits, this remarkable plant remains a vital resource with considerable implications for health, culture, and well-being.

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