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WATTAKAKKA VOLUBILIS-AN OVERVIEW

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ABSTRACT: *Wattakakka volubilis* (L. f) Stapf, belonging to the family of Asclepiadaceae, has a history of use in traditional medicine in numerous countries. Traditionally the plant has been used for the treatment of diabetes, eye infections, snake bites, boils, skin problems, jaundice *etc.* A tribal community called Kurinjan has been using this plant to reduce blood glucose level. This plant is a tall woody climber with ash-colored older branches and green or yellowish green flowers that fall in umbellate cymes. The review demonstrates that the plant has a large number of phytochemical elements with activities such as Anti-diabetic, Antioxidant, Anti-inflammatory, Analgesic, Antipyretic, Antitumour, Antimicrobial *etc.* The phytochemicals present are Alkaloids, Flavanoids, Tannins, Glycosides, Anthocyanidins. Phytochemicals such as Drevogenin, Delphinidine, Dregein, Dregeosides have been isolated from various parts of the plant. These findings are quite encouraging and suggest that this herb be researched further to validate these findings and uncover other possible therapeutic properties. Furthermore, the active chemical constituents of *Wattakakka volubilis* with significant pharmacological values must be isolated and evaluated.

INTRODUCTION: Plants have been used as medicine from prehistoric times. According to WHO, almost 80 percent of the world population depends on herbal medicines for their primary needs¹. Reportedly 21000 plant species have the potential to be used as medicinal plants. Plants remain a source of possible innovative drugs and chemicals derived from diverse plant parts². Because of the pronounced cumulative and permanent reactions of contemporary medications, there has been a major shift towards herbal medicines in recent years. Herbal reserves are disappearing due to overpopulation, urbanization & continued exploitation³.

Many plant products are assessed in the current era of drug research and the discovery of novel therapeutic compounds based on their traditional uses⁴. *Wattakakka volubilis* one of the numerous plants being studied for its therapeutic potential. *Wattakakka volubilis* (L.f) Stapf belongs to the Asclepiadaceae family. In *Palliyar tribals* of the Sirumalai Hills, Western Ghats, Tamil Nadu, India, it's known as "Kurinjan." The Palliyar tribe uses this plant's leaf to lower blood glucose levels and enhance insulin levels⁵. The plant is known by different names throughout the country, tabulated in **Table 1**.

This plant is a big climber with drooping umbels of green flowers, smooth bark, and ash-colored leaves. Leaves are opposite, lanceolate. Seeds are yellowish brown and ovate or wide elliptic in shape. A huge, twining shrub with ash-colored branches. Boils and abscesses are treated with the leaves. Emetic and expectorant properties are attributed to the roots and sensitive stalks.

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It's also used to treat eye infections and snake bites. Roots have antimicrobial properties, and drevogenins extracted from this plant have been shown to have neuropharmacological effects ⁶. Leaf ethanolic extract was also shown to have

antidiabetic and antioxidant properties, leaf extract has a protective effect against stress-induced forgetfulness and is beneficial in addressing stress-induced CNS illness.



FIG. 1: LEAVES

TABLE 1: DIFFERENT VERNACULAR NAMES OF WATTAKAKKA VOLUBILIS

Sanskrit	Madhumalathi
Hindi	Nakchhikni
Tamil	Kodipalai
Malayalam	Vattakakkodi
Telugu	Dudhipaala
Bengali	Titakunga
Synonym	<i>Dregea volubilis</i>

Taxonomical Classification:

Kingdom: Plantae

Sub family: Apocynoideae, Asclepiadoideae

Family: Apocynaceae

Order: Gentianales

Series: Bicarpellatae

Subclass: Gamopetalae

Class: Dicotyledons

Botanical Description: It is a tall woody climber that stands 11 metres tall and has a girth of 5 meters, with thickly lenticellate and pustular branches. Younger branches are green, thin and smooth, with ash-colored older branches that are quite long and glabrous, frequently with lenticels and sometimes with black spots. Leaves are broadly ovate or sub-orbicular, acuminate glabrous or gently pubescent, reticulately veined, and have a few tiny glands immediately above the petioles. Base might be spherical or cordate ⁷. Petiole is 1.5-3cm long with long green or yellowish green

flowers **Fig. 1**, dropping in umbellate cymes. The calyx is divided close to the base, ovate-oblong, obtuse, ciliolate, and the corolla is deeply divided and glabrous on the exterior. The lobes are roughly oval, obtuse, and veined, overlapped to the right, huge corona lobes, fleshy. Anther tips membranous broadly ovate-oblong obtuse pollen-masses oblong attached to pollen carriers by very short caudicles, style aped domeshaped follicles 7-10 cm long slightly tapering to a very blunt point rugosely straited glabrous ⁸. The seeds are oval, curved, smooth, glossy, and sharp-edged, with very fine, white, silky hairs crowning them. Latex was a colourless, liquid substance. Its odour was distinctive and it tasted bitter.

Microscopy:

Leaves: The lower and upper epidermis of the mid rib of the leaves in **Fig. 2** consist of the thin-walled compact oval to oblong cells with the thin cuticle in the transverse section. Collenchymas cells may be found below and above the upper epidermis, with 6-7 layers of collenchymas cells in the lower epidermis and 2-4 layers in the higher epidermis. The vascular bundle was bicollateral in nature. The protoxylem was pointing in the direction of the on-top portion Parenchymatous cells filled the remaining cells in the midrib. Cluster crystals were found in the mid-rib. Beneath upper epidermis, mesophyll tissue has two kinds of cells. Palisade parenchyma cells were found in two layers, extending up to the mid-rib beneath the top epidermis. The remaining lamina is covered with spongy parenchymatous cells that are ovate to

elongated in form. Both epidermises showed uniseriate multicellular glandular trichomes. In the mesophyll region of the lamina, there were many prismatic, rosettes and cluster crystals. The upper epidermis lacked stomata, but the lower epidermis had two types of stomata: paracytic and anomocytic^{9,10}.



FIG. 2: FLOWERS

Root: A transverse section of the root revealed a cork and cortex area surrounded by an endodermic layer. Cork was composed of 5–15 rows of thick-walled rectangular cells with thick walls. It was followed by the cortex, which included thin-walled parenchymatous cells; in the inner cortical area, 5–7 layers of stone cells were found in a circular pattern. Cluster, rosette and prismatic crystals were abundant in both cork and cortex. Cluster, rosette, and prismatic crystals were abundant in both cork and cortex. Between the cortex and the stellar area, there is a single layer of endodermis. Scattered vascular bundles were identified in the stellar area. The root was devoid of pith and has uniseriate medullary rays. Section revealed simple starch granules¹¹.

Stem: The transverse section of the stem has an almost spherical shape. The outermost layer was made up of a single row of epidermal cells. Pericycles were described in the cortex's inner area by dispersed groupings of thick-walled lignified fibers arranged in a circular pattern. Intraxylary phloem was found as distinct strands near the pith's boundary. Medullary rays were either uniseriate or biseriate. Many rosette, cluster crystals, and tannins lined the cortex and pith¹².

Traditional uses: Roots and delicate stalks are used as emetic, purgative and expectorant, while plant juice is used as sternutatory¹³. Rheumatoid arthritis, cough, fever, and a bad cold are all treated with the leaves. Skin problems, diabetes, cough,

jaundice, poison stings and blood abnormalities were treated using the roots and leaves¹⁴. The roots are used to cure kidney stones, while the leaf paste is used with pepper to alleviate dyspepsia¹⁵. It is being used to treat rheumatoid arthritis, cough, fever, severe cold, boils, and abscesses. Its bark paste is combined with hot milk and used internally to treat urinary problems. When leaf powder is given orally together with cow's milk, it is known to have anti-diabetic effect¹⁶. Leaf juice is used to treat sprains¹⁷. *W. volubilis* is also used to treat scorpion and snake bites. Sneezing is relieved by inhaling leaf juice¹⁸. The plant's alcoholic extract is widely used in India as a traditional remedy for boils and abscesses. The extract also possess anticancer activity¹⁹.

Phytochemistry: The preliminary phytochemical analysis of *Wattakakka volubilis* revealed the presence of alkaloids, carbohydrates, glycosides, saponins, phytosterols, phenols and flavonoids, tannins, Amino acids and diterpenes^{20, 21}. The research showed that phytol (29.20 percent) was the most abundant component in the leaves of *Wattakakka volubilis*. Other significant components present in leaves are Octadecatrienic acid, ethyl ester, Dodecanoic acid, Tetradecanoic acid, n-Hexadecanoic acid and squalene. The presence of oleonic acid and ursolic acid was reported in a methanol extract of the leaf of *W. volubilis*²². Phytochemical analysis of *Wattakakka volubilis* fruit aqueous extract indicated the presence of significant bioactive components that may maintain a wide range of pharmacological and medicinal properties.

These phytochemicals include Alkaloids, Terpenoids, Steroids, Coumarins, Tannins, Flavonoids, Proteins, Phenolic compounds, Carbohydrates, Glycosides, Starch, Phytosterol, Lipids, Anthocyanidins, Amino acids and Lignins. The anthocyanidins detected are Delphinidin and Peonidin. Flavanoid compounds identified are Rutin, Quercetin, Luteolin, Apigenin, Orientin, Vitexin.

Phenolic compounds detected are Caffeic acid, Protocatechuic acid, Chlorogenic acid, Iso-Chlorogenic acid, Homo-Protocatechuic acid and Gentisic acid. Lipids present in the fruit extract are Phosphatidic acid Phosphatidyl serine,

Phosphatidyl inositol, Phosphatidylcholine Phosphatidyl ethanolamine, Digalactosyl diglyceride Phosphatidyl glycerol²³. Steroids, triterpenoids, phenolic chemicals and flavonoids were detected in the root. Phytoconstituents present in root are Drevogenin A, Quinic acid, 1,2-Benzenedicarboxylic acid, diisooctyl ester. 8 compounds are isolated from the ethanolic extract of *Wattakakka volubilis* root²⁴. Polyphenols, flavonoids, alkaloids and proanthocyanidins were discovered in the stem bark following the preliminary phytochemical screening. β -sistosterol, pregnane glycosides and kaempferol were reported in the bark²⁵. Olubiloside A, B and C, three polyoxypregnane glycosides, were extracted from the flowers²⁶. In the plant, a rare triterpenoid ether, multiflor-7-en-12, 13-ether and a novel multiflor-7-en-12-ol was also discovered²⁷. Dregein is an active ingredient found in the fresh pericarp that has been separated from the seeds. Dregeosides and Drevogenins **Fig. 2**, triterpenoid glycosides, and

aglycones have also been discovered²⁸. Two pregnane glycosides, dregeosides Ap1, and A01, derived from this Thai plant, demonstrated anticancer activity in mice when tested against melanoma B-16²⁹. The secondary metabolites present in various parts of the plant are tabulated in **Table 2**.

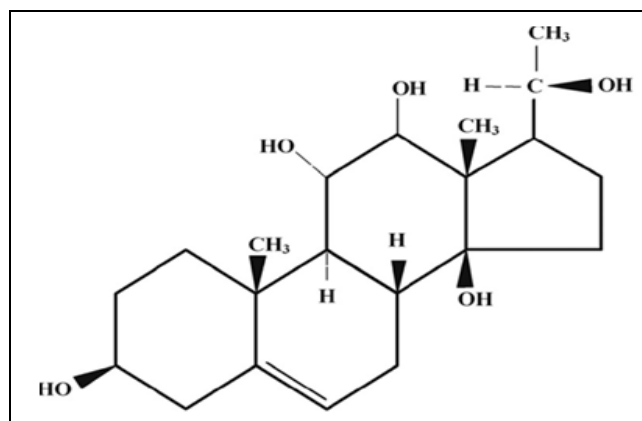


FIG. 3: DREVOGENIN D

TABLE 2: PHYTOCHEMICAL CHARACTERISTICS OF LEAVES, FRUITS & ROOTS OF WATTAKAKKA VOLUBILIS

Phytochemicals	Leaves	Fruits	Roots	Stem
Alkaloids	+	+		+
Tannins		+		
Terpenoid		+	+	
Steroids	+	+	+	
Glycosides	+	+		
Phenols	+			
Carbohydrates		+		
Proteins		+		
Lipids		+		
Anthocyanidins				+
Phenolic compounds		+	+	+
Flavanoids			+	+

Pharmacological Studies:

Anti-asthmatic Activity: The anti-asthmatic activity of methanolic extract of *Wattakakka volubilis* was assessed *in-vitro* using a goat tracheal chain preparation model and *in-vivo* with a broncho-protective test technique employing aminophylline as a control.

The results of this study revealed that methanolic extracts of *Dregea volubilis* block histamine-Induced contraction in goat tracheal chain preparation. This appear due to the capacity to prevent the entry of calcium in to the smooth muscles that line the airways. *Dregea volubilis* methanolic extracts have flavonoids, which are

known to have bronchodilating properties and also stop mast cells from releasing histamine^{30, 31}.

Expectorant Activity: Phenol red secretion tests were used to assess expectorant activity of methanolic extract of *Wattakakka volubilis*.

In *in-vivo*, Methanolic extracts of *Dregea volubilis* increased phenol red secretion into the airway when combined with the standard expectorant drug ammonium chloride, indicating that the expectorant action may be related to its ability to increase tracheobronchial mucus secretion and thus decrease mucus viscosity³².

Anti-inflammatory Activity: In a carrageenan-induced model of acute inflammation, the anti-inflammatory effects of the methanolic extract of *Wattakakka volubilis*, its petroleum ether and chloroform fractions, were examined.

With the progression of time, anti-inflammatory action gradually increased. Petroleum ether and chloroform fractions of methanolic extracts had greater efficacy than methanolic extract, indicating a greater presence of phytoconstituents having anti-inflammatory activity³³.

Immunomodulatory Activity: The immunomodulatory effect of an ethanol extract from the leaves was investigated. By selectively accelerating apoptosis through a caspase-dependent route, it was shown to promote non-activated lymph node cells while inhibiting previously activated T cells. Selenite-induced oxidative stress and calpain activation were inhibited in cultured rat lens by Drevogenin-D, an aglycone isolated from its leaf³⁴.

Antioxidant Activity: Various *in vitro* experiments were used to study the antioxidant activity of a methanolic extract of *Wattakaka volubilis* leaf. The extract's radical scavenging ability was measured using 1,1-diphenyl-2-picryl-hydrazyl (DPPH), superoxide, nitric oxide, and hydroxyl radicals. Methanolic extract of *Wattakakka volubilis* has considerable antioxidant activity, as evidenced by different radical scavenging activities, according to the findings of this study. Its antioxidant potential is related to its concentration³⁵.

Fasciocidal and Larvicidal: The fasciocidal activity of a methanol extract of *D. volubilis* leaves was tested against a live parasitic trematode, *Fasciola gigantica*, which resulted in the organisms' paralysis and death. The highest fasciocidal activity was obtained at a concentration of 100 mg/ml and a time of 38.83 3.41 min. Methanol leaf extract was reported to have high larvicidal efficacy against filarial mosquito larvae, namely *Culex quinquefasciatus*^{36,37}.

Anti Tumour Activity: Methanolic extract of *Wattakakka volubilis* was evaluated for *in-vitro* cytotoxicity and *in-vivo* antitumor activity on EAC-bearing mice along with its effect on lipid peroxidation. The *in-vivo* investigation

demonstrated that methanolic extract treated rats at dosages of 50,100 and 200 mg/kg dramatically reduced tumour volume, packed cell volume and tumour cell count, as well as modifying haematological parameters to near normal levels³⁸.

Anti-amnesic: The ethanol extract from *D. volubilis* leaves was found to protect rats against stress-induced amnesia, suggesting that it might be effective in the treatment of stress-related CNS diseases³⁹.

Hepatoprotective Activity: The methanolic leaf extract of *Wattakakka volubilis* exhibited remarkable protection against aluminium sulphate induced hepatotoxicity. The amount of metabolising enzymes, estimate of DNA and RNA, and measurement of DNA fragmentation and gene expression were all studied. Methanolic extract of *Wattakaka volubilis* at a 200 mg/kg dose considerably improved these altered enzyme levels in drug-treated rats⁴⁰.

Antibacterial & Antifungal Activity: *Wattakaka volubilis* ethanolic extracts were tested for antibacterial activity against two pathogenic bacterial strains (*Escherichia coli*, *Staphylococcus aureus*) and antifungal activity against two fungus strains *Aspergillus niger*, *Aspergillus flavus* at various dosages (50 mg/ml, 100 mg/ml, 200 mg/ml, 500 mg/ml, 1000 mg/ml). The antibacterial and antifungal potential of ethanolic extracts was measured in bacterial growth inhibition zone⁴¹.

Antidiabetic Activity: Fruits and leaves of *Wattakakka volubilis* exhibited Antidiabetic activity. *Wattakaka volubilis* (L. f) Stapf. (Family: Asclepiadaceae) leaf ethanol extract was tested for anti-diabetic activity in Wistar Albino rats. Diabetes was induced in albino rats by the administration of alloxan monohydrate. The hypoglycemic ethanol action of *W. volubilis* leaf was shown to be stimulating insulin release from diabetic rat pancreatic cells. Flavonoids in plant extract helps to restore damaged beta cells. Phenolics have been discovered to be excellent antihyperglycemic agents. It indicates that the antidiabetic action of *W. volubilis* leaf ethanol extract may be correlated with the presence of more than one antihyperglycemic component and their synergistic effects. The fruits of *D. volubilis* have

been shown to have anti-diabetic properties in studies where administration of its petroleum ether extract to streptozotocin-induced diabetic rats resulted in a significant reduction in blood sugar levels and normalisation of serum biochemical profiles when compared to streptozotocin control rats^{42, 43}.

Analgesic & Antipyretic: Taraxerone isolated from the fruits has been shown to have analgesic efficacy in Swiss albino mice against acetic acid-induced writhing and anti-inflammatory activity in Wistar albino rats against carrageenan-induced hind paw oedema. This compound's enol derivative, D – friedoolean – 14 – en 3- ol or taraxerol, was isolated from *Wattakakka volubilis* fruits and displayed analgesic and anti-inflammatory properties in the same experimental paradigms as taraxerone⁴⁴.

TABLE 3: REPORTED ACTIVITIES IN VARIOUS PARTS OF WATTAKAKKA VOLUBILIS

Parts Used	Reported Activity
Leaf	Antioxidant, Antibacterial, Immunomodulatory, Antitumour, Antioxidant, Antidiabetic, Anti-amnesic, Antiinflammatory Antipyretic, Analgesic
Fruits	Antitumour, Antioxidant, Free radical scavenging activity, Analgesic, Antiinflammatory, Hepatoprotective
Stem	Free radical scavenging activity
Root	Chondroprotective activity

CONCLUSION: In several regions of the world, *Wattakakka volubilis* is said to be utilized as a traditional medicine for different ailments. Whole plants and plant parts have been discovered to be used for various medicinal applications including Diabetes, Rheumatoid arthritis, Jaundice, cough cold, skin diseases, and kidney stones. *Wattakakka volubilis* has been shown to have number of phytoconstituents, including steroids, triterpenoids, phenolic compounds, flavonoids & glycosides. The plant possesses various pharmacological activities like Antidiabetic, antioxidant anti-inflammatory, analgesic, antitumour, antipyretic and hepatoprotective activity. According to the current literature review, the leaf and fruits have been subjected to the most chemical and pharmacological (pre-clinical) studies, with promising results. The researchers may find the current compilation useful as a source of

fundamental and applied scientific content for research. Further comprehensive research is needed to demonstrate a relationship between traditional applications, bioactive chemicals and claimed pharmacological activity. Clinical research on the safety and efficacy of *Wattakakka volubilis* is also required to generate safe and effective dosage forms from this plant.

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CONFLICTS OF INTEREST: Nil

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