

## **Pharmacological Aspects of Quisqualis Indica Linn and its Medicinal Properties**

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### **ABSTRACT**

Treatment of chronic diseases like Rheumatoid Arthritis, Diabetes, stroke, heart disease etc. when treated with herbal bioactives considered as promising and more suitable due to its minimum or no side effect and therapeutically effective treatment. These herbal bioactives as herbal medicine obtained from plant source and vegetable source so called as natural sources. From the past two decades, herbalists are using phytogetic agents for the treatment of several chronic as well as acute diseases. In this review article, we had explained briefly about Quisqualis Indica Linn plant as medicinal plant. This plant has been approved as medicinal plant but still used rarely as medicines so this view contrast on medicinal properties of Quisqualis Indica Linn. so as one can utilize in medicinal purpose. Other important application of this plant as for decoration, ornamental purpose. It is evergreen plant and does not depend upon seasons to grow, and available easily. Quisqualis Indica Linn contains phytochemicals such as L-Plorin ( $\alpha$ -amino acid), Quisqualic acid (against AMPA receptor), Trigonelline (Alkaloid), L-Asparagine ( $\alpha$ -amino acid), Rutin (flavonoid) two forms of cysteine synthase are as Isenzyme A and Isoenzyme B. These phytoconstituents responsible for the various pharmacological activities such as anti-inflammatory activity, antipyretic activity, antibacterial activity, antiseptic activity, immunomodulatory activity, antianthelmintic activity.

**Keywords:** Quisqualis Indica Linn, phytogetic agent, herbal bioactives, pharmacological activity, alkaloid, flavonoid.

### **INTRODUCTION**

The products which are obtained from the natural source such as plants, microorganisms, animals or minerals is the basic needs of making drugs used for the treatment of disease which are synthesized now a days for the making of a novel drugs. In the ancient time the herbal medicines is the only source which are used for the treatment of most of the disease and today also in many places it have been using for healthcare purpose so we can say that the herbal medicines remedy is an traditional system of medicine which are used in medical practices since from antiquity. During the past two decades, there has been an increasing interest in the

industrialized nations to use medicinal plants. Sources of details are pharmacopoeias, indigenous knowledge, scientific literature, and other documented sources [1]. The practices continue today because of its biomedical benefits as well as place in cultural beliefs in many parts of world and have made a great contribution towards maintaining human health. The demand of herbal medicines is currently increasing day by day because of the side effects of the allopathy drug. India is a vast repository of medicinal plants that are used in traditional medical treatments. About 80% of people in developing countries still relays on traditional medicines which are based largely on plants and animals for their primary health care. Herbal products are defined as the materials that are administered to patients and are mixtures of herbal substances and other constituents which are made by using herbals. Herbal medicine has become more popular in recent era in the purpose of healthcare. Herbal medicines are generally regarded as safe based on their long-standing use in various cultures 1 .Total global herbal market is of size 62.0 billion dollars. European Union is the biggest market with the share 45% of total herbal market and the India's contribution is only one billion dollars. But there are positive signals also for us in the global market. India has 16 Agro climatic zones, 10 Vegetative zones, 15 Biotic provinces, 426 Biomes, 45000 different plant species and 15000 medicinal plants that include 7000 Ayurveda, 700 in Unani medicine, 600 in Siddha medicine and 30 in modern medicine. This makes India one among 12 mega biodiverse countries of the world, which despite having only 2.5 % total land area, accounting for over 8 % of the recorded species of the world 2. It is estimated that at least 25% of all modern medicines are derived, either directly or indirectly, from medicinal plants, primarily through the application of modern technology to traditional knowledge. In the case of certain classes of pharmaceuticals, such as antitumor and antimicrobial medicines, this percentage may be as high as 60% 3, 4 .The scientific evaluation of safety and efficacy of herbal products and medicinal preparation is thus of vital importance from both medicinal and economic perspectives 5. Now a day's our world is facing a crisis in economic conditions so the use of herbal products is much more reliable than allopathic products because of its expensiveness. *Quisqualis indica* Linn comprises of family Combretaceae. The word *Quisqualis* meaning "Which? What?" in Latin term which was given to this plant by a Dutch botanist called Rumphius to express his astonishment at the odd behaviour of the species. A new plant grows for the first six months as an erect shrub, and then it ends out a runner from the roots which soon becomes stouter and stronger than the original stem. It is a charming plant, a native of Burma and Malaysian Archipelago, and thrives well in most parts of India, being frequently cultivated in gardens. A fresh green leaf set off the clusters of pendent pink and white blossoms and the attractive appearance is enhanced by the delicious perfume 6. Apart from its attractiveness it contains many phytoconstituent such as trigonelline (Alkaloid), L-proline ( $\alpha$ -amino acid), L-asparagine ( $\alpha$ -amino acid), quisqualic acid, rutin (Flavonoid) and two forms of the cysteine synthase, isoenzyme A and isoenzyme B (Enzyme) which is responsible for several pharmacological activities mentioned in different literatures. This plant is commonly called Rangoon Creeper which has been traditionally used over a long period of time due to its activity against common diseases such as boils, fever, diarrhoea etc. One of the reason of using this plant

in making many herbal products is its availability almost in every season and also it grows faster. The main motto of mine behind this article is to aware more number of researchers about number of benefits of this plant because of its easy availability so that it will be helpful for human beneficiary in healthcare and economical purpose as much as possible.

### PLANT PROFILE

Botanical Name: *Quisqualis indica* Linn.

Local Names: English (Rangoon Creeper), Hindi (Madhumalti), Bengali (Modhumalati), Telgu (Radha Manoharam), Filipino (Niyog-niyogan), Spanish (Quiscual), China (Shih-chun-tzu), Manipuri (Parijat), Marathi (Vilayaticambeli).

Kingdom- Plantae

Division- Magnoliophyta

Class- Magnoliopsida

Order- Myrtales

Family- Combretaceae

Genus- *Quisqualis*

Species- *Q.indica* 7, 8



Fig.1. Leaves and Flowers of *Quisqualis Indica* Linn.

### Habitat and Distribution

It is vining and evergreen plant which is having vigorous growth needing sturdy support and can get quite out-of-hand on its favourable growing site, it doesn't require deep and anchoring roots. It is widely distributed all over the world especially on China, Philippines, Bangladesh, Myanmar and Malaysia and now also broadly grown in India as ornamental plant in most of the garden. Distributed over 1) Thickets and secondary forests area throughout the Philippines. 2) Ornamentally planted for its flowers. 3) Also occurs in India to Malaya. 4) Introduced in most tropical countries 9. Cultivation and Collection It generally requires an area with full sunlight, regular watering to keep the soil moist and need a support stand for the vine to grow on. For the proper growth of any plant it should be provided with basic requirements having well maintained conditioning i.e. sunlight, water, fertilizer etc. Generally these plants require: Light - Prefers full to part sun and blooms best with good sunlight. Moisture- Water moderately and regularly, keeping it evenly moist. Need more water during hot seasons and less in cooler climate. During establishment it can tolerate drought condition also. Soil- Fertile humus soil with a mix of sand that can retain water, yet well-drained soil. Others: Require regular pruning to keep it within control, as well as to encourage more blooms with new branches as flowers appear on new growth.

When newer shoots observe emerging from the base of the vine we can remove them also if we'd rather have one main strong stem continuing its growth at the top, otherwise leave them be

to promote bushiness near its base. Require fortnightly or monthly feed with a flowering fertilizer to boost flowering. Relatively free from pests and diseases.

For subtropical regions - A tender evergreen that goes semi dormant or die back in lower temperature, but come back when weather warms up in spring. Flowers fall during all over summer season 10.

### **Botanical Description and Identification Features**

*Quisqualis indica* Linn. of the genus *Quisqualis*, is an exceptionally impressive tropical vine, with a few varieties, distinguishable by its flower colour and leaf size. It can reach 21 m in the wild, but generally its length in cultivation ranges between 2- 9 m. A large, woody and shrubby climber over pergolas, trellises, etc and yet can be trained as a specimen shrub. Under good growing conditions, it's typically seen with lush and fresh green foliage on cascading branches with numerous axillary and terminal drooping racemose inflorescences that is simply spectacular. Leaves with distinct venation, are oblong to elliptic, 7-15cm in length with acuminate tip and rounded base. They are simple and opposite. It non-stop blooms profusely all year around in the tropics. The original Rangoon Creeper with thorny stems produces single flowers in red while the Thai hybrid has double flowers, and both exude an intoxicating fragrance at night as an added bonus. The beautifully coloured flower clusters with pendulous trumpet-shaped blooms open first white, then turn pink and end deep pink, bright red or reddish purple over a 3-day period, displaying the various colouring stages altogether on one and the same flower stalk. Its fruit is narrowly ellipsoidal, 2.5-3 cm long with 5 sharp, longitudinal angles or wings. The 12- 15mm long seeds are pentagonal (shaped like the fruit-shell) and black. The 30 to 35 mm long fruit is ellipsoidal and has five prominent wings. The fruit tastes like almonds when mature 7,8,10. Useful Parts of Plant Rangoon creeper is generally an ornamental plant but due to presence of phytoconstituent it was used as traditional medicines over a long period of time either used individually or it was given with other synergistic ingredients simultaneously. Generally the parts which are traditionally used of these plants are leaves, flower, seeds, fruits and roots. These parts contains some active ingredients which is responsible for giving particular pharmacological activity, but it will taken under some expert supervision as it giving some side effects also such as stomachaches or headaches, especially when the seeds will taken freshly or eaten frequently 9, 11.

### **PHYTOCONSTITUENTS**

Every plant contains several phytoconstituent in its different parts showing various pharmacological activities and / toxicities, likewise *Quisqualis indica* Linn. also showing many pharmacological activities due to the presence of medicinally active compounds. *Quisqualis indica* Linn contains phytoconstituent such as trigonelline (alkaloid), L-proline ( $\alpha$ -amino acid), L-asparagine ( $\alpha$ -amino acid), quisqualic acid (agonist for both AMPA receptors), rutin (flavonoid) and two forms of the cysteine synthase, isoenzyme A and isoenzyme B (enzyme). Rutin and pelargonidin-3-glucoside have also been isolated from flowers. Fruits

contain a sugary substance similar to levulose and an organic acid similar to cathartic acid. Seeds contain a fixed oil, which consists of linoleic, oleic, palmitic, stearic and arachidic acids, a sterol, an alkaloid with anthelmintic properties and a neuroexcitatory amino acid, quisqualic acid. 12

### **UTILIZATION**

**Traditional Uses** Decoctions of the root, seed or fruit can be used as antihelmintic to expel parasitic worms or for alleviating diarrhea. Fruit decoction can also be used for gargling. The fruits are also used to combat nephritis. Leaves can be used to relieve pain caused by fever. The roots are used to treat rheumatism. Flowers are used to relieve headache. The seeds of this plant and related species, *Q. fructus* and *Q. chinensis*, contain the chemical quisqualic acid, which is an agonist for the AMPA receptor, a kind of glutamate receptor in the brain. The chemical is linked to excitotoxicity (cell death). Leaves and roots extracts are anthelmintic. Juice of leaves relieve flatulence. Infusion of leaves is used externally to treat boils and ulcers. Seeds are anthelmintic given to children to expel the worms 7, 8.

### **INDUSTRIAL USES**

Medicinal plants are the richest bioresource of drugs for traditional systems of medicine, modern medicines, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates and chemical entities for synthetic drugs. The first step in the value addition of medicinal bioresources is the production of herbal drug preparations, using a variety of methods from simple traditional technologies to advanced extraction techniques. The extract is further processed to be incorporated in any dosage form such as tablets and capsules. With the increasing demand for herbal medicinal products, nutraceuticals, and natural products for health care all over the world, medicinal plant extract manufacturers and essential oil producers have started using the most appropriate extraction technologies in order to produce extracts and essential oils of defined quality with the least variations from batch to batch. Such approach has to be adopted by MAP-rich developing countries in order to meet the increasing requirement of good quality extracts and essential oils for better revenue generation within the country, as well as for capturing this market in developed countries 13.

### **PHARMACOLOGICAL ACTIVITY**

*Quisqualis indica* Linn. showing various pharmacological activities such as anti-inflammatory activity, antipyretic activity, immunomodulatory activity, anti-staphylococcal activity, anthelmintic activity, antiseptic activity etc due to its presence of various active constituents all over the parts of plants. This plant contains some medicinally active phytochemical constituents which are responsible for various pharmacological activities. **Anti-inflammatory Activity** Inflammation is a normal, protective response to tissue injury caused by physical trauma, noxious chemicals or microbiologic agents 14. Inflammation is defined as a local response to cellular injury that is marked by capillary dilatation, leukocyte infiltration, redness, heat, pain, swelling and often loss of function and that serves as a mechanism initiating the elimination of

noxious agents and damaged tissue 15. Inflammation is of two types, acute inflammation a short term process which appears within few minutes and chronic inflammation a long term process. Anti-inflammatory action is considered to be inhibition of PG synthesis particularly it inhibits the COX at the site of injury, as the decrease in prostaglandin E2 and prostacyclin reduces vasodilation and indirectly, oedema. Accumulation of inflammatory cells is not reduced that it does not depress the production of other mediators like leukotrienes, PAF, cytokines, etc so there are many targets for anti-inflammatory actions 16,17. The hydroalcoholic extract of *Quisqualis indica* has anti-inflammatory activity in acetic acid-induced vascular permeability and cotton pellet granuloma model. The phytochemical analysis revealed the presence of polyphenols and flavonoids. The polyphenols have potent anti-inflammatory activity by inhibiting prostaglandin synthesis. So anti-inflammatory activity of hydroalcoholic extract of *Quisqualis indica* Linn can be attributed to bradykinin and PG synthesis inhibition property of polyphenols 18, 19.

### **Antipyretic Activity**

Fever or pyrexia is produced during infection through the generation of pyrogens which occurs when IL-1 releases PGs in the CNS, where they elevate the hypothalamic set point for temperature control, thus causing fever 16,17. This can be caused by PGE2 synthesis, which is stimulated when an endogenous fever-producing agent, a pyrogen, such as cytokine, is released from white cells that are activated by infection, hypersensitivity, malignancy or inflammation 20. Fever is a common medical sign characterized by an elevation of temperature above the normal range of 36.5–37.5 °C (98–100 °F) due to an increase in the body temperature regulatory set-point 21. This increase in set-point triggers increased muscle tone and shivering. As a person's temperature increases, there is, in general, a feeling of cold despite an increasing body temperature. Once the new temperature is reached, there is a feeling of warmth 22, 23. Antipyretics are the drugs that reduce the elevated temperature of the body which resets the thermostat toward normal and it rapidly lowers the body temperature of febrile patients by increasing heat dissipation as a result of peripheral vasodilation and sweating 20. The methanolic leaf extract of *Quisqualis indica* Linn plant was extensively investigated for its antipyretic activity against Brewer's yeast-induced pyrexia model in rats. The methanolic extract of the plant at a dose level of 100mg/kg and 200mg/kg exhibited competent, potent and comparable results promoting *Quisqualis indica* Linn plant as a promising antipyretic plant species 24.

### **Immunomodulatory Activity**

Immunomodulation is a process in which a substance alters the immune response by augmenting or reducing the ability of the immune system to produce antibodies or sensitized cells that recognize and react with the antigen that initiated their production. Immunomodulators include corticosteroids, cytotoxic agents, thymosin, and immunoglobulins. Some immunomodulators are naturally present in the body and certain of these are available in pharmacologic preparations 26. The term immunomodulation denotes a change, a strengthening or suppression, of the indicators of cellular and humoral immunity and nonspecific defense factors 27. Hydroalcoholic

extract of *Quisqualis indica* Linn. flower extract is a potent immunostimulant, stimulating specific and non-specific immune mechanisms. The role of phagocytosis is the removal of microorganisms and foreign bodies, dead or injured cells. The primary target of most of the immunomodulators is believed to be macrophages which play a major role by engulfing pathogens or foreign substances and initiating innate immune response. The phagocytic index of (100 mg/kg) and QI flower extract (150 mg/kg) showed significant ( $p < 0.05$ ) increased in phagocytic index when compared to control group 28.

### **Anti-staphylococcal Activity**

Staphylococci (staph) are gram positive spherical bacteria that occur in microscopic clusters resembling grapes. Bacteriological culture of the nose and skin of normal humans invariably yields staphylococci. *S. aureus* is a successful pathogen is a combination of bacterial immune-evasive strategies 29. *S. aureus* can cause a range of illnesses, from minor skin infections, such as pimples, impetigo, boils (furuncles), cellulitis folliculitis, carbuncles, scalded skin syndrome, and abscesses, to life-threatening diseases such as pneumonia, meningitis, osteomyelitis, endocarditis, toxic shock

syndrome (TSS), bacteremia, and sepsis. Its incidence ranges from skin, soft tissue, respiratory, bone, joint, endovascular to wound infections. It is still one of the five most common causes of infections and is often the cause of postsurgical wound infections. Each year, some 500,000 patients in American hospitals contract a staphylococcal infection 30- 32. The extract of stem bark of *Quisqualis indica* Linn which was macerated with methanol followed by sequential solvent-solvent partitioning with n-hexane, carbon tetrachloride and chloroform act as an antibiotic against staphylococcal infection 33. The effectiveness of the respective antibiotics is expressed as 'Therapeutic Index' (TI) according to the formula,  $TI = LD_{50} / MIC$

Which calculates the toxicity of antibiotics towards microorganisms in vitro (MIC = Minimal Inhibitory Concentration in ppm) and the toxicity towards animals in vivo ( $LD_{50}$  = a dose causing death of 50% of test animals in mg/kg/body weight) 34.

### **Acetylcholinesterase Inhibitors**

Acetylcholine (ACh) is a major neurohumoral transmitter at autonomic, somatic as well as central sites 35. The preganglionic fibers terminating in the adrenal medulla, the autonomic ganglia and the postganglionic fibers of the parasympathetic division use acetylcholine as a neurotransmitter. Cholinergic neurons innervate the muscles of the somatic system and play an important role in the CNS 36.

Acetylcholinesterase inhibitors are also called as anticholinesterases, the agents which inhibit Cholinesterase, protect ACh from hydrolysis produce cholinergic effects in vivo and potentiate ACh both in vivo and in vitro. It gives action by reacting with enzyme in the same way as ACh. The carbamates and phosphates respectively carbamylate and phosphorylate the ester site of the enzyme, whereas the acetylated enzyme reacts with water extremely rapidly and the ester site is

freed in a fraction of a milliseconds, the carbamylated enzyme reacts slowly and the phosphorylated enzyme reacts extremely slowly. The methanol extract of flowers gave high total polyphenol content and exhibited strong antioxidant activity. There was research works suggested that the phytochemical antioxidants might act as Acetylcholinesterase inhibitors. Currently, the effective chemicals for Alzheimer's disease therapy are Acetylcholinesterase inhibitors, which elevate the attenuated acetylcholine concentrations in the Alzheimer's disease affected brain by enhancing cholinergic function. Although the use of Acetylcholinesterase inhibitors e.g. Donepezil, Rivastigmine and Galantamine, a symptomatic treatment of Alzheimer's disease, causes the adverse effects due to cholinergic stimulation in the brain and peripheral tissues. Therefore the searching for new Acetylcholinesterase inhibitors particularly edible flowers which may cause lower side effects is very interesting for extensively investigated 38.

### **Antioxidants Activity**

An antioxidant is a molecule capable of inhibiting the oxidation of other molecules. Oxidation is a chemical reaction that transfers electrons or hydrogen from a substance to an oxidizing agent. Oxidation reactions can produce free radicals. In turn, these radicals can start chain reactions. When the chain reaction occurs in a cell, it can cause damage or death to the cell such as nucleic acids, proteins, lipids or DNA and can initiate degenerative disease. Antioxidants terminate these chain reactions by removing free radical intermediates, and inhibit other oxidation reactions. They do this by being oxidized themselves, so antioxidants are often reducing agents such as thiols, ascorbic acid, or polyphenols 39. The methanolic plant extract *Quisqualis indica* Linn show 95% antioxidant activity was due to the redox properties, which allowed them to act as reducing agents by scavenging free radicals such as peroxide, hydroperoxide or lipid peroxy and thus inhibit the oxidative mechanisms that lead to degenerative diseases. The present study showed that the partitionates of the methanolic extract of *Q. indica* (stem bark) especially the chloroform soluble fraction possesses significant antioxidant potentials 40.

### **TOXICITY**

Although herbal medicines are preferential because of its less side effect and minimum toxicity in comparison of synthetic medicine but due to adulteration in herbal compound and lack of appropriate knowledge about herbal plant and plant parts lead to cause toxicity [41]. Whereas, India is a rich country of having more herbal plants along with their medicinal values. Many herbs which are not properly known by their chemical constituents or their mechanism of action, may cause adverse effects [42]. In herbal formulation, some unwanted things are happened like adulteration and improper formulation, knowledge deficiency in field of plants which lead to toxicity in body and produces adverse effects that might be life threatening or lethal [43]. Therefore, it is required to use double blind method in order to determine the safety and efficacy of every plant before



there recommendation for medicinal use [44]. Quality control depend upon three pharmacopeial points which depend upon toxicity:

Identity	<ul style="list-style-type: none"><li>• Herbs should be matched with that herb which are be using.</li></ul>
Purity	<ul style="list-style-type: none"><li>• contamination or any impurity should not be there.</li></ul>
Content or assay	<ul style="list-style-type: none"><li>• Active constituents must be explained with defined limitations.</li></ul>

As per Organization for Economic Co-operation and Development gives definition of acute toxicity, sub-acute toxicity and chronic toxicity of the herb and medicine [41]. In acute toxicity testing, a single dose of drug is given to animal and check LD50 means the dose which kills 50% of the population which have been tested. Toxicity categorized as sub chronic toxicity takes 14 to 25 weeks in testing. Herbal products were tested on animal to check whether toxicity or not. To obtain this result animal were given the dose of herbal drug through same route that is of human beings which must be simulate. Experiment was observed for any toxicity in body along with any change in body structure and weight or in consumption of food. At last stage of dose regimen, animals were euthanized in response to get tissue toxicity evaluation with proper evidence. In chronic toxicity studies involve testing of disease, how long it is? means disease state of time period. Long term toxicity testing involves carcinogenic potential of many herbal substances. In chronic toxicity testing, the time period is up to two year and test animals are observed for the same parameter as those on subchronic testing. Toxicity and carcinogenicity also performed by postmortem analysis [47].

## CONCLUSION

Many plants with medicinal values found in India and it is indowed with herbal plants having medicinal usage along with various benefits in terms of curing diseases. Here we have used the term herbal drugs which means any part of plant or whole plant converted into phytopharmaceuticals having medicinal usage and obtained by using simple or complicated process such as harvesting, drying, extraction, collection, storage. To get the product from plant, plant processing happened in which collection, drying, mechanical size reduction and extraction like organic solvent or aqueous solvent example ethanol which could affect the final quality of product. In determination of active chemical constituent present in herbal substances, an analytical technique was used to identify and confirmation. Although, from historical medicine practices, herbal medicine based upon that. How to use herbal medicine and how to formulated

these all the things comes from historical practices. Well defined procedure and documents related to herbal formulation are mentioned in pharmacopoeias and dating back about 2000 years and others monographs in some cases. Directly use of *Quisqualis Indica* linn in the form of folk remedies and as pharmaceutical form used indirectly in modern medicine. Rngoon Creeper (*Quisqualis indica* linn) is such type of plant that is easy to grow and can be grow anywhere and it is used as ornamental plant, in India, also used as decorative plant in houses. It has many different pharmaceutical usages and it can be blended with other herbal plants to get more effective as compare to single one. On the basis of its ethnomedicinal background and many research on it, can be concluded that this plant brings action as antipyretics, anti-inflammatory, immunomodulatory, Anti anthelmintic anti septic etc.

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