

International Journal of Pharmacognosy and Pharmaceutical Sciences



ISSN Print: 2706-7009
ISSN Online: 2706-7017
IJPPS 2022; 4(1): 08-11
www.pharmacognosyjournal.net
Received: 17-12-2021
Accepted: 02-01-2022

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A brief study on *Thunbergia erecta*: A review

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DOI: <https://dx.doi.org/10.33545/27067009.2022.v4.i1a.34>

Abstract

In the Ayurveda medicinal plants play an important role, it is the Indian traditional system of medicine that focuses on the medical potential of plants. *Thunbergia* is one of the genus of flowering plants belonging to the family Acanthaceae. *Thunbergia* species included up to 100 species of annuals, perennials, and shrubs. *Thunbergia erecta* (Syn- *Meyenia erecta*, Bush Clockvine) is species of thunbergia plants that have been identified to have many reported significant medicinal value. It is a vigorous, woody shrub from Tropical Africa that grows to about 6-feet-tall and wide, which consists of purple flowers that have a yellow throat. This purple colour flower contains anthocyanin compounds which able to synthesize blue, purple, violet, magenta, and yellow colour in the flower, fruit, and leaves of the plant. The Phyto constituent are present in the leaves of the *T. erecta* plant are alkaloids, flavonoids, phenolics, tannin, saponins, and triterpenoids. The aim of this review article is a brief study on *Thunbergia erecta* other species of thunbergia and summarized Scientific classification, Morphology, Geographical Distribution, and Pharmacological activity.

Keywords: *Thunbergia erecta*, *Meyenia erecta*, bush clockvine, colour flower, Acanthaceae, anthocyanin, thunbergia

Introduction

From thousands of years, our society is dependent on traditional medicine by using medicinal plants. These plants remain useful in the new drug development and help in community health care ^[1].

In the tropical regions of Australia, Madagascar, Africa, and South Asia the thunbergia genus was found, *Thunbergia* plant is a genus of flowering plant belonging to the family Acanthaceae. In 1780 in honor of Carl Peter Thunberg, was Swedish Physician and Botanist employed in the Dutch East India Company, named the genus thunbergia by Retizius. *Thunbergia* genus consists of up to 100 species of annuals, perennials, and shrubs. In the thunbergia genus are much more twinning climbers, and some shrubby types on this various genus ^[2].

These thunbergia genus with attractive climbers are the wide-ranging group with pointed oval to heart-shaped leaves, also sometimes lobed or toothed. These plants occur in several colours, but mainly in yellow, orange, and purple- blue shades. Plants of this genus required a sunny location so they can receive direct sunlight for 6-9 hours a day. Daily deep watering is required for the plants because total dry soil will cause wilting and premature flower drops. Most of the *Thunbergia* species favour full sun and well-drained soil but can be flowering in partial shade also. Many species from the thunbergia genus show ornamental value, as well as some of them, show medicinal value also ^[3].

Thunbergia erecta is one of the species of the thunbergia genus, which is a vigorous, woody shrub and native to tropical Africa. This plant grows to about 6-feet-tall and wide with has small, ovate leaves with entire margins borne opposite on thin, and stem in brown colour. The flower of the *Thunbergia erecta* in purple colour has a yellow throat and the size of the flower is 1-1/4 inches long, which looks singly or in tiny clusters. The flowering season of the plant occurs all year long, mostly in summer. *Thunbergia erecta* produces rounded seed capsules that end in a beak ^[4].

The synonym of plant *Thunbergia erecta* is *Meyenia erecta* Benth also commonly known as Bush Clockvine, Blue bell, and King's Mantle ^[5].

This plant is a dicotyledonous angiosperm and has a beautiful purple colour flower with no odour, in this flower, contains anthocyanin compounds due to its purple colour pigment. These anthocyanins compounds are naturally occurring pigments which able to synthesize blue, purple, violet, magenta, and yellow. These pigments are found in fruit and leaves of plants and it is water-soluble [6].

Most of the species of thunbergia have traditional history, that is used in the treatment of disorders such as inflammation and pyrexia, it also effective against both gram +ve and gram -ve bacteria. These species have been reported other pharmacological activities such as analgesic, antipyretic, anthelmintic, antidiabetic, cytotoxic, antioxidant, hepatoprotective, antitumor, and antinociceptive activities [7, 8, 9, 10].

The thunbergia genus consists of chemical constituents reported as alkaloids, glucosides, naphthalene, coumaroylmalic acid, and iridoid glucosides, Grandiflora acid, benzyl beta glucopyranoside, delphinidin, apigenin, and phenolic compounds like tannin, feruloylmalic, flavonoids, phenolic acids, rosmarinic acid [11, 12]. This Review article collecting brief information about plant *Thunbergia erecta* and other species of thunbergia and summarized Scientific classification, Morphology, Geographical Distribution, and Pharmacological activity.

Scientific classification [3, 13, 14]

- **Scientific name:** *Thunbergia erecta*
- **Family Name:** Acanthaceae
- **Kingdom:** Plantae
- **Phylum:** Spermatophyta
- **Subphylum:** Angiosperma
- **Division:** Tracheophyta
- **Class:** Equisetopsida
- **Subclass:** Magnoliidae
- **Order:** Lamiales
- **Family:** Acanthaceae
- **Genus:** *Thunbergia*
- **Species:** *Thunbergia erecta*

Vernacular names [13, 15]

- **Scientific name:** *Thunbergia erecta* (Benth.)
- **Synonym:** *Meyenia erecta* Benth
- **Common name:** Bush Clockvine, Upright Thunbergia, Blue bell
- **International Common name:** King's mantle, Purple Bush Clockvine
- **Hindi:** Nilkantha plant
- **Marathi:** Chota Mynea, Mynia
- **Bangladesh:** Nilghonta

Morphology

Thunbergia erecta is an evergreen shrub plant growing to 4-6 feet tall and spread 5-8 feet with the round, spreading plant habit. The density of the plant is moderate and the growth rate is fast [16]. The leaves are elliptic (oval) shape

with the opposite arrangement, pubescent surface. It consists of the entire leaf margin and bowed-pinnate leaf venation. The colour of the leaves is green, the length of the leaf blade is less than 2 inches [3, 4].

The flower of the *Thunbergia erecta* is in purple with yellow-throated tubular having 5 petals and blooming season is year-round mostly in summer. Fruits are like loculicidal capsules, Bark/ Branches are thin and reddish with typically clumping stems. *T. erecta* plant grows in full sun to shade, moist but well-drained loamy soil is required for cultivation, and moderate to deep watering is needed [3, 4].

Geographical distribution

Thunbergia erecta is native to tropical Australia, Africa, West Africa, South Asia, and Madagascar. This plant nowadays available in many areas within its hardiness range also it is found in many Asia regions such as Bangladesh, India, Pakistan, and other countries. *T. erecta* blooming all around the year with moist soil and deep watering required [17, 18].

Potentially active chemical constituents and phyto constituents

In a recent study Researchers investigating its medicinal properties discovered that it contained a group of carbohydrates, alkaloids, flavonoids, phenolics, tannin, saponins, and triterpenoids [19]. The *Thunbergia erecta* Plants can synthesize a broad variety of chemical compounds that are utilized to carry out important biological functions, also it is used to preventive against attack from parasite like insects, fungi. *Thunbergia erecta* mainly possesses alkaloids, carbohydrates, phenol, and flavonoids. Flavonoid and alkaloid are the most active and potentially chemical constituent of *T. erecta*. Flavonoid such as Anthocyanins (Anthocyanins) pigment is present in flower and able to produce blue, purple, violet, magenta, and yellow. These Anthocyanins with high antioxidant properties and showed fast scavenging activity due to the structure of flavanium ion, anthocyanin like Capensidine, Malvidin, contain a higher number of methoxy group. The total phenolic content (TPC) and total flavonoid content (TFC) were found in good proportions. Many glucosides are effective against Diabetes mellitus some of them are Paeoniflorin, 8-debenzoylpaeoniflorin, and Delphinidin present in leaves and flower of *Thunbergia erecta* [6, 19, 20, 21]. From the aerial parts of the *T. erecta* plant researcher investigated and isolated ten compounds and their structures were identified as β -sitosterol-3-O- β -D-glucoside; Apigenin; Apigenin-7-O- β -D-glucoside; 3-methoxy-4-hydroxy benzoic acid (vanillic acid); Trans-ferulic acid; 3,4,5-trimethoxy phenol-1-O- β -D-glucoside; Acacetin-7-O- β -D-glucoside; Acacetin-7-O-(α -D-apio-furanosyl) (1 \rightarrow 6)- β -D-glucoside; Benzyl-7-O- β -xylopyranosyl (1'' \rightarrow 2')- β -D-glucoside and Rosmarinic acid [22].

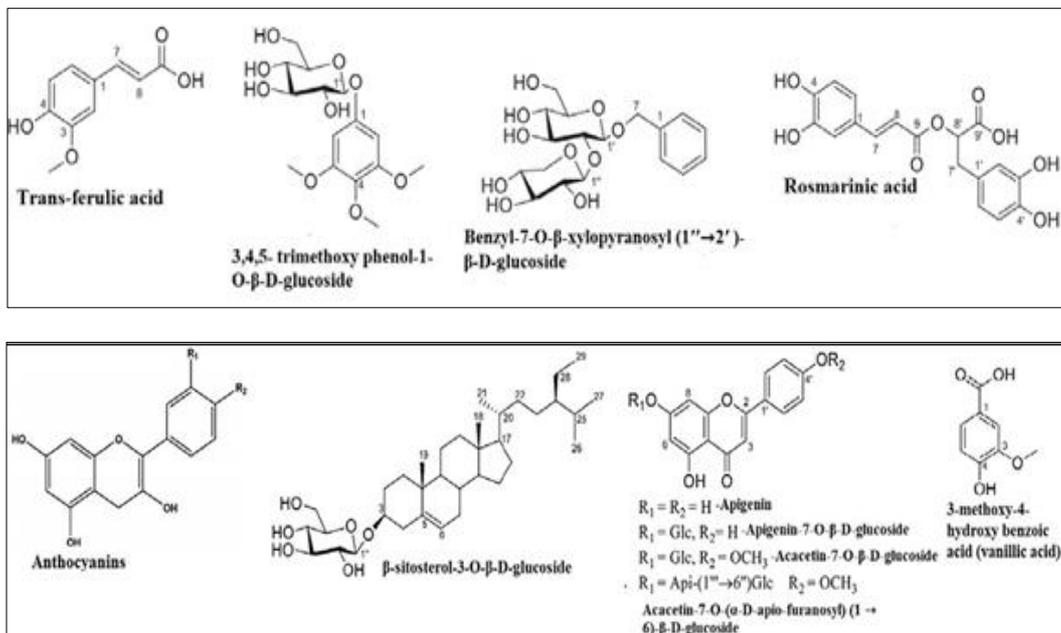


Fig 1: Structure of Chemical Compound

Medicinal Application and Pharmacological Activities of *Thunbergia erecta*

Anti-microbial activity

Secondary metabolites from a crude extract of *T. erecta* plant were tested for anti-microbial activity and showed significantly higher efficacy. The anti-microbial activity of crude flower extract was checked against both gram-positive and gram-negative microorganisms (*Bacillus subtilis* and *Pantoea agglomerans*, *Xanthomonas oryzae*). By the Isolation, purification, and identification of the pigments from the crude extract will determine which factor is responsible for this activity and add to the arsenal of molecules to fight antimicrobial resistance [23].

Anti-oxidant Activity

The anti-oxidant activity is seen in *T. erecta* due to the presence of anthocyanins in brightly coloured purple flowers, these anthocyanins consist of Capensidine, Malvidin, which contain a higher number of methoxy group with high antioxidant properties [20].

Anti-diabetic activity

The leaves extract of *T. erecta* plant was showed an anti-diabetic effect, Glucosides, such as paeoniflorin and 8-debenzoylpaeoniflorin have also able to reduce blood sugar levels in mice. The chemical compound Delphinidin is also capable to increase insulin secretion in INS-1 832/13 cell lines. *Thunbergia erecta* may be effective in diabetes treatment [21].

Antiuro lithiatic Activity

Urolithiasis is a disorder that refers to the formation of calculi anywhere in the urinary tract, which affects the Kidneys, Ureters, Bladder, or Urethra. The methanolic extract of leaves of *Thunbergia erecta* will restrict the nucleation of CaOx crystallization *in vitro* and shows Antiuro lithiatic activity. Using the different percentages of leaves extract the size of the crystal was decrease and percentage inhibition of the formation of calcium oxalate monohydrate crystal also reduced [19].

Sedative and Anxiolytic Activities

Methanolic extract of *Thunbergia erecta* leaves promising pharmacological evaluation of sedative and anxiolytic activities, this extract exerts as GABA- benzodiazepine receptor interaction in the brain. By performing open field, hole cross, and thiopental sodium-induce sleeping test as the sedative activity, And considered elevated-plus maze, light-dark box, hole-board and marble burying test as anxiolytic effects on the mice and confirm the sedative and anxiolytic activities [18].

Use as Potential Anticholinesterase and Anti-Ageing g Agents

From the aerial parts of the *T. erecta* plant researcher isolated compound apigenin, vanillic acid, and acacetin-7-O-β-D-glucoside exhibited potent inhibition of Acetylcholinesterase (AChE). Acacetin-7-O-β-D-glucoside triggered an increase in telomerase activity and promising used as n anti-ageing agent. Apigenin is used as a possible treatment of Alzheimer's disease and as a lead compound for the drug development process through applying semisynthetic modifications [22].

Other Application

- Green Synthesis of ZnO nanoparticle with extract of the plant parts such as leaf, stem, root and flowers of *Thunbergia erecta* with the simple method and less usage of toxic chemicals. This is advantageous in the pharma industry to develop effective drugs with ZnO nanoparticle and *T. erecta* plant [5].
 - Thunbergia erecta* flower is used as another acid-base natural indicator, fower extract become showed λ_{max} absorption bands at 269 and 315 that confirmed that indicator showed pH range from 10 to 11, so flower extract may be an opportunity acid-base natural indicators [6].
 - Using the petal of the flower of *Thunbergia erecta* plant to make a natural dye which was used as photosensitizers in TiO₂ multilayer film based DSSCs [24].
- Thunbergia erecta* is garden ornamental, the gardener will be used shrub along with porches or foundations [13].

Future Prospects

Purification, identification, and characterization of unexplored chemical and bioactive compounds showing different pharmacological activities of this plant and can be developed the effective drugs in future work.

Conclusion

This review article reports brief information about plant *Thunbergia erecta*, it included scientific classification, morphology, geographical distribution, active constituent and phytoconstituent, and last medicinal application and pharmacological activities. According to this review article *Thunbergia erecta* having medicinal properties like anti-microbial activity, anti-oxidant activity, anti-diabetic activity, antiuro lithiatic activity, sedative, and anxiolytic activities, will be considered as potential alternative herbal medicine to treat different types of diseases

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