**A Study on the Phytochemistry and Thrombolytic Effect of *Thaumatophyllum bipinnatifidum* Methanolic and Acetonic Extracts**

## ABSTRACT

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| **Introduction:** Medicinal plants have long served as a valuable source of therapeutic agents due to their diverse phytochemical constituents and associated pharmacological effects. Among these, thrombolytic agents derived from natural sources have gained scientific interest as potential alternatives to synthetic drugs. *Thaumatophyllum* *bipinnatifidum*, a plant traditionally used for its medicinal value, contains various bioactive compounds that may contribute to cardiovascular health through thrombolytic activity.  **Aims:** The objective of this study was to investigate the presence of major phytochemicals and evaluate the thrombolytic potential of methanolic and acetonic extracts of *Thaumatophyllum bipinnatifidum* leaves, stems, and roots.  **Methodology:** Phytochemical screening was performed on the methanolic and acetonic extracts of *Thaumatophyllum bipinnatifidum* to identify major secondary metabolites. The thrombolytic activity of these extracts was assessed using an in vitro clot lysis method, with streptokinase serving as the positive control and distilled water as the negative control.  **Conclusion:** Phytochemical analysis revealed the presence of alkaloids, saponins, and tannins in the extracts. Both methanolic and acetonic extracts of *Thaumatophyllum bipinnatifidum* demonstrated significant thrombolytic activity, suggesting their potential use in developing natural thrombolytic agents. Further research is warranted to isolate the active compounds and evaluate their mechanisms of action. |

*Keywords: Phytochemical screening; thrombolytic activity; methanolic extract; Thaumatophyllum bipinnatifidum, Pheretima posthuma.*

**1. INTRODUCTION**

Medicinal plants have played a vital role in the healthcare systems of many civilizations and continue to serve as important therapeutic agents. Across diverse natural environments, communities have used infusions, poultices, and extracts from local flora for centuries—often dating back to prehistoric times (Manisha M, 2025) . In ancient Iraq, plants like hollyhock were used for healing, and such traditional practices remain widespread in many parts of the world today (Nedhal A. Al-Douri, 2010). Over time, the role of medicinal plants has evolved, transitioning from folklore-based remedies to more scientifically validated therapeutic uses. Inflammation and infections are among the health conditions traditionally treated with plant-based preparations (Barve, 2024). Today, plants account for a significant portion of pharmaceutical ingredients in the United States, especially in antimicrobial and anti-inflammatory drug development (Anand U, 2019). Herbs and medicinal plants continue to be essential sources of natural compounds that offer therapeutic benefits, including antimicrobial, anti-inflammatory, antioxidant, and thrombolytic effects (Parham S, 2020). With the decline in new synthetic antibiotics since the 1950s and the rise of drug resistance, phytochemicals are once again gaining attention as potential alternatives. Clinical microbiologists are particularly interested in plant-based antimicrobials due to their structural diversity and reduced risk of resistance development (Salam MA, 2023). Although the development of antibiotics from microorganisms has slowed in recent decades, interest is growing again, with global investments in new anti-infective agents—including vaccines and plant-derived compounds—expected to rise (Muteeb G, 2023).

**2. MEDICINAL PLANTS EXHIBITING THROMBOLYTIC ACTIVITY**

A growing body of research has identified several medicinal plants with notable thrombolytic or fibrinolytic properties, providing alternatives to synthetic thrombolytic agents such as Streptokinase and Urokinase, which may have adverse side effects. For instance, *Clerodendrum viscosum* (Sabikunnahar J, 2016)*, Allium sativum* (garlic) (Rama Narsimha Reddy A, 2017), *Azadirachta indica* (neem)(Islam, 2019), and *Ocimum sanctum* (holy basil) have demonstrated clot-dissolving activity in various in vitro studies (Khan IN, 2011). Similarly, *Andrographis paniculata* is reported to inhibit platelet aggregation and modulate coagulation factors, while *Curcuma longa* (turmeric) exhibits thrombolytic potential largely due to its active component curcumin, which exerts antioxidant and anti-inflammatory effects (Kocaadam B, 2017).

Other notable examples include *Zingiber officinale* (ginger), *Terminalia arjuna*, *Ginkgo biloba*, and *Moringa oleifera*, all of which have shown ability to reduce thrombosis through various biochemical pathways, such as inhibition of thromboxane synthesis, increased prostacyclin levels, and activation of endogenous fibrinolysis (Modi M, 2024) (Divya Kapoor, 2014) (Hong-wei YANG, 2024). These plants often contain secondary metabolites like flavonoids, tannins, saponins, and alkaloids, which play crucial roles in modulating vascular health, reducing oxidative stress, and improving blood flow.

**3. PHYTOCHEMICALS INVOLVED IN THROMBOLYSIS**

Phytochemicals are naturally occurring bioactive compounds found in plants that contribute to their therapeutic effects, including thrombolysis—the process of dissolving blood clots. Several classes of phytochemicals have been identified as key contributors to the thrombolytic properties observed in various medicinal plants. These compounds not only aid in breaking down fibrin clots but also modulate pathways related to platelet aggregation, blood viscosity, and vascular health.

**3.1. Flavonoids:**

Flavonoids are polyphenolic compounds widely found in fruits, vegetables, and medicinal herbs. They have been extensively studied for their antioxidant, anti-inflammatory, and antithrombotic activities (Ullah A, 2020). Flavonoids inhibit platelet aggregation by blocking thromboxane A2 synthesis, reducing oxidative stress, and improving endothelial function. Their ability to stabilize capillary walls and enhance nitric oxide production contributes to improved blood flow and clot prevention (Panche AN, 2016).

**3.2. Saponins:**

Saponins are glycosides with surface-active properties, commonly found in roots, leaves, and seeds of many plants. They possess anticoagulant effects and are believed to interfere with the coagulation cascade (Timilsena YP, 2023). Saponins also reduce blood viscosity and enhance the body's natural fibrinolytic system by stimulating plasminogen activation, which breaks down fibrin clots (Linh T NGUYEN, 2020).

**3.3. Alkaloids:**

Alkaloids are nitrogen-containing compounds that show diverse pharmacological actions, including anticoagulant and vasodilatory effects. Some alkaloids inhibit platelet aggregation, while others can influence blood pressure and circulation (Ain QU, 2016). For example, berberine and quinine have demonstrated antithrombotic effects in various studies. Their mechanism often involves inhibition of calcium influx in platelets or suppression of thromboxane biosynthesis (Bribi, 2018).

**3.4. Tannins:**

Tannins are polyphenolic compounds that bind to proteins and possess astringent properties. They contribute to vascular protection by strengthening blood vessel walls and reducing inflammation. Tannins may inhibit platelet aggregation and modulate coagulation factors, supporting their role in preventing thrombus formation (Marcińczyk N, 2022).

**3.5. Glycosides:**

Some glycosides, particularly cardiac glycosides, affect the cardiovascular system by enhancing heart function and circulation. Certain glycosides may also possess mild antiplatelet or fibrinolytic activity, which can indirectly support thrombolytic effects, especially when combined with other phytochemicals (Škubník J, 2021).

The presence of these phytochemicals in Thaumatophyllum bipinnatifidum, as revealed through phytochemical screening, supports the thrombolytic activity observed in the methanol and acetone extracts of its leaves, stems, and roots. This correlation underscores the importance of phytochemical profiling in understanding the pharmacological potential of medicinal plants and identifying candidates for further therapeutic development.

**4. RATIONALE FOR THE STUDY**

*Thaumatophyllum bipinnatifidum*, formerly classified under the genus Philodendron, is a tropical plant native to South America, particularly Brazil, Bolivia, Argentina, and Paraguay. Commonly known as split-leaf philodendron or lacy tree philodendron, it is widely cultivated as an ornamental plant due to its large, deeply lobed leaves and aesthetic appeal (Thaumatophyllum bipinnatifidum, 2025). In traditional medicine, various parts of this plant have been used for their purported anti-inflammatory and wound-healing properties (Scapinello J, 2019). Although primarily valued for decorative purposes, the plant contains a range of bioactive compounds that have recently gained attention for their potential pharmacological effects. However, scientific investigation into its therapeutic applications, especially in cardiovascular or thrombolytic contexts, remains limited—highlighting the significance of studies like the present one in uncovering novel medicinal uses of *Thaumatophyllum bipinnatifidum*.

## 5. PREPARATION OF PLANT EXTRACT

The plant was collected from Keshabpur, Jashore, Bangladesh. The procured plant parts (Leaves Stems & Roots) are cleaned and sun dried for one week after cutting small pieces. The powder was stored in a staunch and kept in a dry place whilst analysis.

Figure1: Drying of *Thaumatophullum Bipinnatifid*

**5.1 Cold extraction (Methanol extraction)**

About 500 gm of root, 400 of Stem and 300gm of Leaf powdered sample taken. soaked about 900 mL of 100% of methanol. The container was sealed and kept for a period of 10 days. Whole mixture underwent a coarse filtration apiece of clean cotton material. Then filtered through Whitman filter paper.

**5.2 Cold extraction (Acetone extraction)**

About 500 gm of root, 400 gm of Stem and 300gm Leaf powder. Performed drench in 900 mL of 100% Acetone. Container article was stave off 10 days episodic. The whole composition then underwent a coarse filtration across. Then filtered care of Whitman filter paper.

**5.3 Evaporation of solvent**

The bestowed open space to evaporate solvent thus crude extract attain.

Fine powder of *Thaumatophyllum bipinnatifidum*

(Root, Stem, Root)

Dissolved in 90% Methanol

Evaporation of corrosive

Abusive extract

## 6. METHODOLOGY

**6.1 Phytochemical test**

**6.1.1Test for Glycosides**

3mL resolution of the quiddity was taken into a test tube. 1mL mixture of Fehling solution A and B then added among the test tube. The tube was installed in a water-bath at 60° C. If a brick red ppt. form that exhibition the presence of glycosides.

**6.1.2 Test for Alkaloids**

Among testing Alkaloids, toward 0.5g of each extract will be stirred 5mL of I per cent aqueous hydrochloric acid on water bath. Few drop of mayer's reagent and 1mL medicated the similiar was Dragendorff's reagent. Orange-brown ppt. reveal presence alkaloid.

**6.1.3 Test for Flavonoids**

Inconsiderable extent of test dissolved in 5 mL of ethanol. Treated with less drops of concentrated HCL and 0.5g magnesium metal. Pink, crimson or magenta color is flourished within a minute or two. Flavonoids are present.

**6.1.4 Test for Tannins**

Touching 5g plant extract will formed with 10mL distilled water. Ferric chloride reagent will be taken to filtrate. A blue-black, green precipitate taken as instance for the presence of tannins. Blue-black color is formed indicates the subsistence of tannin.

**6.2 Worms gathering and Authentication**

Earthworms *Pheretima posthuma* (Annelida) gathered from moist soil at Khagan village, Asulia, Savar, District: Dhaka. They were decontamination with normal saline to steal soil and fecal matter. Earthworms were identified Zoology Department, Jahangirnagar University. The earthworms of 4-6 cm length and 0.2-0.3 cm width were used all experimental protocol.

**6.3 Preparation of Test sample**

Sample for experiment were raised dissolving extracts obtain a stock solution. From this tribe solution, different working dilutions were furnished get concentration range 100, 50 and 25 mg/ml extract solution.

**6.4 Preparation of standard solution**

Albendazole powder was liquefy in saline water to obtain a stock solution of 40 mg/ml (1gm of albendazole powder was dissolved in 100 ml of normal saline). From this lineage were decorated get concentration range of 10 mg/ml solution.

**6.5 Anthelmintic assay**

The anthelmintic activity appreciates adult earthworms *Pheretima posthuma* (Annelida) due to its anatomical among the intestinal roundworm parasites of human being. The test was accomplished in glass Petri dishes (35 x 10 mm). The groups of same sized earthworms five earthworms each group were released in 5 ml sample with concentration 100, 50 and 25 mg/ ml. Community of earthworms in saline solution was used as control group and group of earthworms in albendazole powder (10 mg/ml) applied.

## 7. RESULTS

**7.1 Phytochemical analysis**

The phytochemical study of the extract indicates the presence of alkaloids, glycosides, flavonoids and tanins in methanol & Acetone extract of *Thaumatophyllum Bipinnatifidum* root, stem & leaf.

**7.2 Thrombolytic activity**

Collation 100 μl SK, positive control (30,000 IU), to squeeze incubation for 90 minutes with 37 °C, 88.49% lysis squeeze. Other hand distilled water medicated in negative control. Negligible percentage of lysis clot 10.44%. The mean variety of in percentage of clot lysis between positive and negative control was found. *Thaumatophyllum Bipinnatifidum* blooming different thrombolytic activity.

Figure 2: Thrombolytic activity of *Thaumatophyllum Bipinnatifidum* plant extract

Figure 3: Scatter plot with connecting lines showing paralysis and death times in minutes for methanolic and acetonic extracts of *Thaumatophyllum bipinnatifidum* roots, stems, and leaves at various concentrations, compared to control and standard (Albendazole).

**8. DISCUSSION**

The phytochemical analysis of the methanolic and acetonic extracts of *Thaumatophyllum bipinnatifidum* roots, stems, and leaves revealed the presence of several bioactive compounds, including alkaloids, glycosides, flavonoids, and tannins. These secondary metabolites are known for their diverse pharmacological properties, which often contribute to the therapeutic potential of medicinal plants.

The thrombolytic activity observed in this study may be linked to these phytochemicals. Flavonoids are reported to exhibit antiplatelet and fibrinolytic activities, potentially enhancing blood flow and reducing clot formation. Tannins have also been noted to exert anticoagulant effects by interacting with proteins involved in the coagulation cascade. The extracts of *Thaumatophyllum bipinnatifidum* showed dose-dependent thrombolytic activity when compared with the standard drug Albendazole, indicating a potential for the plant to act as a natural thrombolytic agent. The higher activity observed in methanolic extracts could be attributed to better solubility and extraction efficiency of polar bioactive compounds in methanol.

These findings provide scientific support for the traditional use of plant-based remedies in the management of cardiovascular conditions, particularly those involving thrombotic events. Further investigation, including in vivo studies and isolation of individual active constituents, is necessary to confirm the mechanisms of action and to validate the therapeutic potential of *Thaumatophyllum bipinnatifidum* in thrombolytic therapy.

**9. CONCLUSION**

The findings of this study provide significant insights into the pharmacological potential of Thaumatophyllum bipinnatifidum. Phytochemical screening of the methanolic and acetonic extracts of the plant's leaves, stems, and roots revealed the presence of key bioactive compounds including alkaloids, flavonoids, glycosides, and tannins—phytochemicals widely known for their antioxidant, anti-inflammatory, and cardiovascular-modulating properties. These compounds are often associated with blood-thinning and thrombolytic effects, suggesting their potential role in dissolving clots and improving vascular health. The thrombolytic activity demonstrated by both methanol and acetone extracts, as compared to standard thrombolytic agents like Streptokinase, indicates that *Thaumatophyllum bipinnatifidum* may serve as a promising natural source of clot-dissolving agents. This is especially relevant in the context of cardiovascular diseases, where there is a growing demand for alternative therapies that are both effective and free from the adverse side effects associated with conventional synthetic drugs.

Despite these promising in vitro findings, further research is essential to substantiate the therapeutic potential of *Thaumatophyllum bipinnatifidum*. Future studies should focus on isolating and characterizing the specific phytochemical constituents responsible for the thrombolytic effect. Moreover, in vivo studies and well-structured clinical trials are necessary to establish safety, efficacy, optimal dosage, and mechanisms of action in biological systems. this study not only broadens our understanding of the medicinal value of *Thaumatophyllum bipinnatifidum* but also reinforces the relevance of exploring underutilized tropical plants as viable candidates for the development of novel phytotherapeutic agents, particularly for cardiovascular and thrombotic disorders.

**DISCLAIMER (ARTIFICIAL INTELLIGENCE)**

This manuscript is solely the result of the authors' original research and efforts. No external assistance was utilized in its preparation. The authors assume full responsibility for the accuracy and integrity of the content.

**CONSENT AND ETHICAL APPROVAL**

It is not applicable.

Competing interests

Authors have declared that no competing interests exist.

**REFERENCES**

Ain QU, K. H. (2016, Sep). Plant Alkaloids as Antiplatelet Agent: Drugs of the Future in the Light of Recent Developments. *Front Pharmacol*. doi:10.3389/fphar

Anand U, J.-H. N. (2019, Nov). A Comprehensive Review on Medicinal Plants as Antimicrobial Therapeutics: Potential Avenues of Biocompatible Drug Discovery. *Metabolites, 9*(11). doi:10.3390/metabo9110258

Barve, R. S. (2024, February). Role of herbal medicines in the treatment of infectious diseases. *Vegetos*, 41-51. doi:10.1007/s42535-022-00549-2

Bribi, N. (2018). Pharmacological activity of Alkaloids: A Review. *Asian Journal of Botany*.

Divya Kapoor, R. V. (2014, Sep). Terminalia arjuna in coronary artery disease: Ethnopharmacology, pre-clinical, clinical & safety evaluation. *Journal of Ethnopharmacology, 155*(2). doi:10.1016/j.jep.2014.06.056

Hong-wei YANG, H.-l. Y.-w.-h.-p. (2024, Jun). Antithrombotic Effect of Ginkgo biloba Extract: a Study Based. *Latin American Journal of Pharmacy, 43*(11).

Islam, M. S. (2019, Jun). Antimicrobial and Thrombolytic Activities of Decoction of Azadirachta indica. *SEU Journal of Science and Engineering, 13*(1).

Khan IN, H. M. (2011, Jun). Thrombolytic potential of Ocimum sanctum L., Curcuma longa L., Azadirachta indica L. and Anacardium occidentale L. *J Basic Clin Pharm*, 125-127.

Kocaadam B, Ş. N. (2017, Sep). Curcumin, an active component of turmeric (Curcuma longa), and its effects on health. *Crit Rev Food Sci Nutri, 57*(13). doi:10.1080/10408398.2015.1077195

Linh T NGUYEN, A. C. (2020). An Overview of Saponins – A Bioactive Group. *Bulletin UASVM Food Science and Technology, 77*(1). doi:10.15835/buasvmcn-fst: 2019.0036

Manisha M, B. R. (2025, March 17). Medicinal Plants and Traditional Uses and Modern Applications. *J Neonatal Surg [Internet], 14*(3), 162-75. doi:10.52783/jns.v14.2210

Marcińczyk N, G.-P. A. (2022, Jan). Tannins as Hemostasis Modulators. *Front Pharmacol*. doi:10.3389/fphar

Modi M, M. K. (2024, Aug). *Ginger Root.* StatPearls Publishing.

Muteeb G, R. M. (2023, Nov). rigin of Antibiotics and Antibiotic Resistance, and Their Impacts on Drug Development: A Narrative Review. *Pharmaceuticals (Basel), 16*(11). doi:10.3390/ph16111615

Nedhal A. Al-Douri, L. Y.-E. (2010). A Survey of Plants Used in Iraqi Traditional Medicine. *Jordan Journal of Pharmaceutical Sciences, 3*(2), 100-108.

Panche AN, D. A. (2016, Dec). Flavonoids: an overview. *J Nutr Sci.* doi:10.1017/jns.2016.41

Parham S, K. A.-R. (2020, Dec). Antioxidant, Antimicrobial and Antiviral Properties of Herbal Materials. *Antioxidants (Basel), 9*(12). doi:10.3390/antiox9121309

Rama Narsimha Reddy A, S. L. (2017). Effect of Allium sativum (Garlic) Extract on Blood Coagulation. *Advances in Pharmacology and Clinical Trials, 2*(1).

Sabikunnahar J, J. U. (2016). Naturally Growing Medicinal Plant Clerodendrum viscosum in Bangladesh -. *International Journal of Pharmacy Teaching & Practices, 7*(1), 2678-2684.

Salam MA, A.-A. M. (2023, Jul). Antimicrobial Resistance: A Growing Serious Threat for Global Public Health. *Healthcare (Basel), 11*(13). doi:10.3390/healthcare11131946

Scapinello J, M. L. (2019, May). Antinociceptive and anti-inflammatory activities of Philodendron bipinnatifidum Schott ex Endl (Araceae). *J Ethnopharmacol*.

Škubník J, P. V. (2021, Apr). Cardiac Glycosides as Immune System Modulators. *Biomolecules, 11*(5). doi:10.3390/biom11050659

*Thaumatophyllum bipinnatifidum.* (2025, May 8). Retrieved from Fairchild Tropical Botanic Garden. (n.d.): https://fairchildgarden.org/interpretation/clt/thaumatophyllum-bipinnatifidum/

Timilsena YP, P. A. (2023, Aug). Perspectives on Saponins: Food Functionality and Applications. *Int J Mol Sci, 24*(17). doi:10.3390/ijms241713538

Ullah A, M. S. (2020, Nov). Important Flavonoids and Their Role as a Therapeutic Agent. *Molecules, 25*(11). doi:10.3390/molecules25225243