

Pharmacognosy, Phytochemical and *In-Vitro* Thrombolytic Activity of leaves of *Artabotrys hexapetalus*

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ABSTRACT

Background: Medicinal plants remain an important source of bioactive molecules for managing thrombotic disorders, which continue to rank among the leading causes of death worldwide. *Artabotrys hexapetalus* (Annonaceae), a fragrant ornamental shrub with a long history of use in Ayurvedic, Siddha and folk medicine, has been reported to contain a range of pharmacologically active phytoconstituents, yet its thrombolytic potential has received little dedicated investigation. **Objective:** This study characterises the pharmacognostical and phytochemical profile of *A. hexapetalus* leaves and evaluates their *in vitro* clot-lysing activity. **Methods:** Authenticated fresh leaves were subjected to macroscopic, microscopic and quantitative microscopic examination, followed by determination of physicochemical constants. A hydroalcoholic extract (HAEAH) was prepared, screened for major phytoconstituents, and tested for thrombolytic activity using a clot lysis assay, with streptokinase and 0.9% saline serving as positive and negative controls, respectively. **Results:** The leaves displayed reproducible diagnostic macro- and microscopic features, and the hydroalcoholic extract (12.03% w/w yield) tested positive for alkaloids, flavonoids, tannins, saponins, terpenoids and phenolic compounds. HAEAH produced a concentration-dependent rise in clot lysis, from $63.74 \pm 0.73\%$ at 5 mg/mL to $74.78 \pm 0.38\%$ at 10 mg/mL, a level comparable to that of streptokinase ($69.43 \pm 0.33\%$). **Conclusion:** *A. hexapetalus* leaves possess a distinctive pharmacognostical profile and demonstrate promising *in vitro* thrombolytic activity, supporting their further investigation as a candidate source of plant-derived thrombolytic agents.

Introduction

Plants have supplied humankind with therapeutic remedies since antiquity, and the World Health Organization estimates that nearly 80% of the global population still depends on traditional herbal medicine for primary healthcare needs [1]. Much of this therapeutic value derives from secondary metabolites such as flavonoids, phenolics, alkaloids, tannins, terpenoids and saponins, which display antioxidant, anti-inflammatory, antimicrobial, cardioprotective and thrombolytic activities [1,2]. Several mainstay modern drugs, including aspirin, quinine, digoxin and morphine, originated from plant sources, illustrating the continuing relevance of phytochemical research to drug discovery [3]. Herbal medicines are also generally regarded as more affordable, accessible and culturally acceptable than synthetic alternatives, particularly in developing countries [3], and are increasingly incorporated into phytopharmaceuticals, nutraceuticals and functional foods aimed at disease prevention [5].

Thrombotic disorders, which include myocardial infarction, ischemic stroke, deep vein thrombosis and pulmonary embolism, are estimated to contribute to

roughly one in four deaths worldwide [10], and the adverse-effect profile and high cost of existing thrombolytic drugs have intensified interest in safer, plant-derived alternatives [15,21]. Against this background, the present study investigates *Artabotrys hexapetalus* (L.f.) Bhandari, a member of the Annonaceae long used in traditional medicine, as a candidate source of thrombolytic phytoconstituents, and establishes its pharmacognostical and phytochemical profile as a foundation for such use.

Botanical background of *Artabotrys hexapetalus*

Artabotrys hexapetalus belongs to Annonaceae, the custard-apple family, one of the largest families of flowering plants within the order Magnoliales, comprising roughly 130 genera and more than 2,300 species distributed mainly across the tropics and subtropics [4]. Members of the family are typically trees, shrubs or woody climbers bearing aromatic tissues, simple alternate leaves, fragrant actinomorphic flowers with numerous spirally arranged stamens, and berry-type fruits, and they are collectively rich in alkaloids, flavonoids, terpenoids, essential oils, tannins and phenolics that underlie their traditional use against fever, inflammation, microbial infection and cardiovascular complaints [4,5,6]. Economically notable

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relatives include *Annona squamosa*, *Annona muricata* and *Cananga odorata* [9].

A. hexapetalus itself is a scandent shrub or liana reaching 8-10 m, distributed across India (notably Tamil Nadu, Kerala, Karnataka, Andhra Pradesh and West Bengal), Sri Lanka, Bangladesh, Myanmar, Thailand and neighbouring Southeast Asian countries, and is cultivated widely for its intensely fragrant flowers [6,7]. Its leaves, flowers, roots and bark all feature in Ayurvedic, Siddha and folk medicine: the leaves for fever, inflammation and skin complaints, the roots as a digestive and rheumatism tonic, and the flowers in perfumery and for headache and stress relief [6,7,8]. Ethnomedicinal and early scientific reports additionally credit the plant with antimicrobial, antioxidant, anti-inflammatory, analgesic, antipyretic and hepatoprotective properties, attributed to its flavonoid, phenolic and alkaloidal constituents [13].

Thrombosis: pathophysiology, classification and global burden

Thrombosis, the pathological formation of a clot within a blood vessel, disrupts normal blood flow and underlies major cardiovascular events such as myocardial infarction, stroke, deep vein thrombosis and pulmonary embolism [10]. Its pathogenesis is classically explained by Virchow's triad - endothelial injury, abnormal blood flow or stasis, and hypercoagulability - which together trigger platelet adhesion, activation and aggregation, culminating in fibrin formation and clot stabilisation [11,12]. Depending on the vessel and site involved, thrombosis is classified as arterial, venous, deep-vein, pulmonary-embolic, coronary or cerebral, each carrying distinct clinical consequences and management approaches [10,14,16,17,18].

The disease burden is substantial: thrombotic disorders are estimated to account for close to 25% of all deaths globally [10], venous thromboembolism alone affects roughly 10 million people each year [19], and ischemic heart disease and stroke together caused an estimated 15.7 million deaths worldwide in recent WHO data [20]. These figures underline the continued need for effective, accessible thrombolytic therapies [15,21].

Medicinal plants, phytochemicals and the limitations of current thrombolytics

Several thrombolytic drugs, including streptokinase, urokinase, alteplase, reteplase and tenecteplase, are in routine clinical use; all act by converting plasminogen to plasmin to degrade fibrin. However, they are associated with bleeding risk (ranging from minor haemorrhage to intracranial bleeding), hypersensitivity, hypotension, vessel re-occlusion, short half-lives necessitating repeated dosing, and, for the newer agents, high cost that limits access in low-resource settings [38,39]. These limitations

have driven interest in medicinal plants as complementary or alternative thrombolytic sources [18].

Plant-derived flavonoids, phenolics, saponins and alkaloids can promote clot dissolution by enhancing fibrinolysis and inhibiting platelet aggregation [2,15]. Species such as *Ocimum basilicum*, *Punica granatum* and *Zingiber officinale* have demonstrated notable thrombolytic and cardioprotective activity in laboratory studies [32], reinforcing the rationale for screening additional traditionally used species, including *A. hexapetalus*, for similar potential [15,22].

Prior phytochemical and pharmacological studies on *Artabotrys hexapetalus*

A body of work has examined the phytochemistry and bioactivity of *A. hexapetalus* and related congeners. Comparative phytochemical and antioxidant profiling has been reported for its leaf extracts alongside other ornamental species [26], and antioxidant and antibacterial activities of leaf and flower extracts have been documented separately [42,52]. Chemical investigations have isolated aporphine alkaloids with antifungal activity [28], bisabolene-derived sesquiterpenoids [29], and flavonoid and megastigmane glycosides [55] from the plant, while essential oils of related species have shown antifungal and mosquito-repellent properties [27,41]. Pharmacological reports further describe anti-fertility activity of the leaves [30], metabolic profiling of leaf constituents [31], hepatoprotective effects of the alcoholic extract [44], antileishmanial activity linked to specific secondary metabolites [43,54], and, most recently, anti-amnesic potential attributed to its phytochemical composition [53]. Several narrative reviews have consolidated the botanical, phytochemical and pharmacological literature on the genus [39,40,49,50].

Collectively, these reports establish *A. hexapetalus* as a phytochemically rich species with a broad, if scattered, pharmacological profile. However, no dedicated study evaluating the in vitro thrombolytic activity of its leaves was identified in this body of literature, representing the specific knowledge gap that the present investigation addresses. To study the pharmacognosy, phytochemistry and in vitro thrombolytic activity of the leaves of *Artabotrys hexapetalus* (Annonaceae).

- Authentication and collection of the plant material.
- Pharmacognostical evaluation of the leaf, comprising macroscopy and microscopy (anatomical study, quantitative microscopy and powder microscopy) together with determination of physicochemical constants (loss on drying, extractive values, ash values and specific gravity).

- Preparation of a hydroalcoholic extract of the leaves and preliminary qualitative phytochemical screening of its constituents.
- Evaluation of the in vitro thrombolytic potential of the extract using a blood clot lysis assay.

Materials and Methods

Collection and authentication of plant material

Fresh leaves of *Artabotrys hexapetalus* were collected from Oothakadai in June 2026 and authenticated by Dr. D. Stephen, Department of Botany (Retd.). A voucher specimen was deposited in the herbarium of American College, Madurai-20, for future reference.

Macroscopic evaluation

The fresh leaves were examined organoleptically for colour, odour, taste, size, shape, texture, apex, margin, venation, base, surface and fracture, and the observations were photographically recorded.

Microscopic evaluation

Leaf material was fixed in FAA solution (formalin 5 mL, acetic acid 5 mL, 70% ethyl alcohol 90 mL) for 24 hours, dehydrated through a graded tertiary-butyl alcohol (TBA) series, and progressively infiltrated with paraffin wax (m.p. 58-60 °C) before embedding into paraffin blocks. Sections of 10-12 µm were cut on a rotary microtome, dewaxed, and stained with toluidine blue O, a polychromatic stain that differentially colours cellulosic walls and mucilage (pink/reddish-purple), lignified elements such as xylem and sclerenchyma (blue to blue-green), suberin (dark green) and protein bodies (violet/blue); safranin, fast green and IKI were used as alternative stains where additional contrast was needed. Paradermal sections were prepared for stomatal, venation and trichome analysis, with tissue clearing achieved using Jeffrey's fluid or 5% NaOH, and permanent mounts made in glycerin. Stained sections were examined under a compound light microscope (10× and 40×) and photomicrographs were captured for pharmacognostical documentation of the epidermis, cuticle, palisade and spongy parenchyma, vascular bundle, xylem, phloem, calcium oxalate crystals, trichomes and stomata.

Quantitative microscopy

Stomatal number, stomatal index, vein islet number, vein termination number and palisade ratio were determined on cleared epidermal peels. For stomatal number, leaf fragments (~5 × 5 mm) were cleared in boiling chloral hydrate, the epidermis peeled and mounted in glycerol-ethanol, and stomata within a 1 mm² field counted under 45× objective/10× eyepiece magnification. Stomatal index was calculated from the same peel using the standard relation:

$$\text{Stomatal Index} = S \times 100 / (E + S)$$

where S is the number of stomata and E the number of epidermal cells (including trichomes) counted in the same 1 mm² field. Vein islet number and vein termination number were determined on chloral-hydrate-cleared, safranin-stained leaf fragments (~1 cm², midrib and margin excluded) examined at 10× objective/10× eyepiece: complete vein islets, and free vein endings, within a demarcated 1 mm² field were counted (structures touching two adjacent sides were included, those touching the remaining sides excluded), and mean values calculated across several fields. Palisade ratio was recorded as the average number of palisade cells lying beneath each epidermal cell.

Powder microscopy

Shade-dried leaves were coarsely powdered and examined microscopically to identify diagnostic powder characters, including epidermal cells, stomata, phloem fibres, covering trichomes and calcium oxalate crystals.

Physicochemical evaluation

Physicochemical constants were determined on the air-dried powdered leaf. Foreign organic matter was separated manually from a 100 g sample and weighed. Loss on drying was measured by drying ~10 g of powder at 105 °C to constant weight. Extractive values were obtained by macerating ~5 g of powder with 100 mL of petroleum ether, ethanol or water for 24 hours (with intermittent shaking over the first 6 hours), evaporating a 25 mL aliquot of the filtrate to dryness at 105 °C, and expressing the residue as % w/w. Total ash was determined by incinerating ~3 g of powder at ≤450 °C to a carbon-free residue; acid-insoluble ash was obtained by boiling the total ash with 2 M HCl, and water-soluble ash by boiling the total ash with water, in each case igniting and weighing the insoluble residue. Specific gravity of the extract was also recorded.

Preparation of the hydroalcoholic extract

Powdered leaves were extracted with a hydroalcoholic solvent system to prepare the hydroalcoholic extract of *A. hexapetalus* (HAEAH). The extract was dried in a vacuum desiccator, and the yield (12.03% w/w) was stored at 4 °C until further use.

Preliminary phytochemical screening

The hydroalcoholic and aqueous extracts were screened qualitatively for major phytoconstituent classes using standard chemical spot tests. Alkaloids were tested by Mayer's, Dragendorff's, Wagner's and Hager's reagents; carbohydrates and reducing sugars by Molisch's, Fehling's and Benedict's tests; saponins by the froth test; glycosides by Borntrager's and modified Borntrager's tests; flavonoids

by Shinoda's, alkali-reagent, lead-acetate and acid tests; proteins and amino acids by Millon's, Biuret and ninhydrin tests; terpenoids by the tin/thionyl chloride test; volatile and fixed oils by hydro-distillation and the grease-spot test, respectively; tannins by the ferric chloride test; sterols by Salkowski's and Liebermann-Burchard's tests; and phenolic compounds by ferric chloride and lead-acetate tests. A positive (+) or negative (-) result was recorded for each test (Table 5).

In vitro thrombolytic activity: blood clot lysis assay

Principle: The assay assesses the ability of a test substance to dissolve a pre-formed blood clot. Blood is allowed to coagulate in a pre-weighed tube, the serum removed, and the clot exposed to the test extract; thrombolytic activity is reflected in fibrin breakdown and a measurable reduction in clot weight, compared against streptokinase (positive control) and normal saline (negative control).

Instruments and reagents: Analytical balance; micropipettes (100-1000 µL) with sterile tips; sterile microcentrifuge tubes (1.5-2 mL); 37 °C incubator/water bath; vortex mixer; stopwatch; HAEAH; fresh goat blood; 0.9% isotonic saline; streptokinase; distilled water; and 70% ethanol for surface disinfection.

Procedure: Fresh blood (0.5 mL) was dispensed into pre-weighed sterile microcentrifuge tubes and incubated at 37 °C for 45 minutes to allow clotting. Serum was carefully withdrawn and each tube re-weighed to obtain clot weight. HAEAH was reconstituted in sterile isotonic saline at 5 and 10 mg/mL, and 100 µL of the appropriate concentration was added to the clot-containing tubes; 100 µL of streptokinase and 100 µL of isotonic saline were added to the positive- and negative-control tubes, respectively. All tubes were incubated at 37 °C for 90 minutes, after which the released fluid was withdrawn and the tubes re-weighed. Each treatment was performed in triplicate.

Calculation: Clot weight was obtained as the difference between the tube-with-clot and empty-tube weights, and clot dissolved as the difference between clot weight before and after treatment. Percentage clot lysis was calculated as:

Clot lysis (%) = (Weight of clot dissolved / Initial clot weight) × 100 [34]

Results are expressed as mean ± SD (n = 3).

Results

Macroscopic characteristics

The fresh leaves of *A. hexapetalus* were dark green on the dorsal surface and pale green ventrally, bitter in taste, aromatic in odour, and oblong-lanceolate to elliptic in shape, with the morphometric details summarised in Table

1. These macroscopic features provide a reliable basis for field- and market-level identification of the drug.



Figure 1. Whole plant of *Artabotrys hexapetalus*.



Figure 2. Macroscopy of leaves of *Artabotrys hexapetalus*.

Table 1. Macroscopic characters of *Artabotrys hexapetalus* leaves.

S. No.	Character	Observation
1	Colour (upper surface)	Dark green
2	Colour (lower surface)	Dull/pale green
3	Taste	Bitter / slightly astringent
4	Odour	Aromatic
5	Margin	Entire, ~9 cm
6	Shape	Oblong-lanceolate to elliptic
7	Length	18.2 cm
8	Width	4.6 cm
9	Apex	19-20 cm
10	Base	1 cm

Microscopic characteristics

Transverse sections of the leaf showed an upper and lower epidermis of thin-walled polygonal cells, diacytic stomata, and glandular and covering trichomes of one to three cells; palisade cells were confined to the region beneath the upper epidermis, and the midrib exhibited collenchyma beneath both epidermal layers along with a vascular bundle and starch grains. These anatomical features serve as diagnostic markers for authenticating the crude drug.

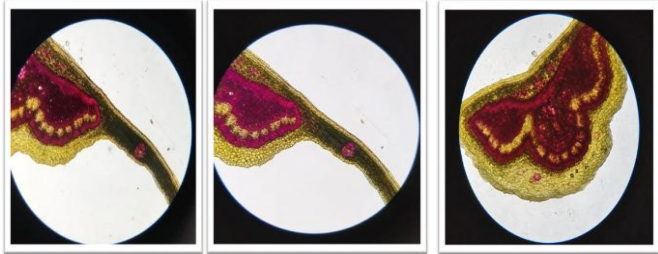


Figure 3. Microscopic structure of Artabotrys hexapetalus leaves.

Quantitative microscopy

Quantitative microscopic evaluation gave a stomatal number of 24/mm², stomatal index of 14%, vein islet number of 11/mm², vein termination number of 6/mm² and a palisade number of 5 (Table 2), providing numerical leaf constants useful for standardisation of the crude drug.

Table 2. Leaf constants of Artabotrys hexapetalus.

S. No.	Parameter	Value
1	Stomatal number	24 / mm ²
2	Stomatal index	14%
3	Vein islet number	11 / mm ²
4	Vein termination number	6 / mm ²
5	Palisade number	5

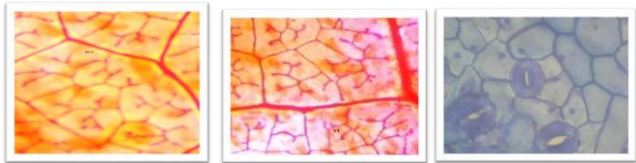


Figure 4. Quantitative microscopic analysis of Artabotrys hexapetalus leaves.

Powder microscopy

Powder microscopy at 10× revealed epidermal cells, stomata, phloem fibres, covering trichomes and calcium oxalate crystals, consistent with the anatomical features observed in transverse section and useful for identifying the drug in its powdered form.



Figure 5. Powder microscopy of Artabotrys hexapetalus leaves.

Physicochemical constants

The powdered leaf was free of foreign organic matter and gave the physicochemical values summarised in Table 3, while the physical parameters of the alcoholic extract are

given in Table 4. These constants provide reference limits for assessing the quality and purity of the crude drug.

Table 3. Physicochemical constants of *Artabotrys hexapetalus* leaves.

S. No.	Physicochemical constant	Value
1	Loss on drying	9.49% w/w
2	Petroleum ether extractive value	7.6% w/w
3	Ethanol extractive value	7.2% w/w
4	Water extractive value	8.2% w/w
5	Total ash value	5.6% w/w
6	Water-insoluble ash	10.33% w/w
7	Specific gravity	0.8949

Table 4. Physical parameters of the alcoholic extract of *Artabotrys hexapetalus* leaves.

S. No.	Parameter	Observation
1	Colour	Dark green
2	Specific gravity	0.8949

Extraction yield

Hydroalcoholic extraction of the powdered leaves gave a yield of 12.03% w/w. The dried extract (HAEAH) was stored at 4 °C for subsequent phytochemical and pharmacological evaluation.



Figure 6. Preparation of the hydroalcoholic extract of *Artabotrys hexapetalus* leaves.

Preliminary phytochemical screening

The hydroalcoholic extract tested positive for alkaloids, carbohydrates, terpenoids, tannins, sterols and phenolic compounds, but negative for saponins, glycosides, flavonoids, proteins/amino acids, volatile oil and fixed oil. In contrast, the aqueous extract was positive for all the classes screened, including saponins, glycosides, flavonoids and proteins/amino acids that were absent from the hydroalcoholic extract (Table 5), indicating differential solubility of the plant's phytoconstituents across the two solvent systems.

Table 5. Preliminary phytochemical screening of *Artabotrys hexapetalus* leaf extracts.

S. No.	Phytoconstituent	Hydroalcoholic extract	Aqueous extract
1	Alkaloids	+	+
2	Carbohydrates / reducing sugars	+	+
3	Saponins	-	+
4	Glycosides	-	+
5	Flavonoids	-	+
6	Proteins and amino acids	-	+
7	Terpenoids	+	+
8	Volatile oil	-	+
9	Fixed oil	-	+
10	Tannins	+	+
11	Sterols	+	-
12	Phenolic compounds	+	+

(+) indicates a positive reaction; (-) indicates a negative reaction.

In vitro thrombolytic activity

HAEAH produced a clear, concentration-dependent increase in clot lysis. At the lower concentration (5 mg/mL), mean clot lysis was $63.74 \pm 0.73\%$, rising to $74.78 \pm 0.38\%$ at 10 mg/mL - a level slightly exceeding that produced by the streptokinase positive control ($69.43 \pm 0.33\%$) - while the 0.9% isotonic saline negative control produced only minimal lysis ($5.09 \pm 0.09\%$) (Tables 6 and 7, Figure 7).

Table 6. Blood clot lysis assay - raw data (triplicate determinations).

Treatment	Conc.	Clot wt. before lysis (g)	Clot wt. after lysis (g)	Clot lysis (%)
0.9% Isotonic saline	-	0.661	0.628	4.99
0.9% Isotonic saline	-	0.682	0.647	5.13
0.9% Isotonic saline	-	0.679	0.644	5.15
HAEAH	5 mg/mL	0.696	0.250	64.06
HAEAH	5 mg/mL	0.744	0.266	64.25
HAEAH	5 mg/mL	0.755	0.280	62.9
HAEAH	10 mg/mL	0.661	0.165	75.04
HAEAH	10 mg/mL	0.682	0.175	74.34
HAEAH	10 mg/mL	0.679	0.170	74.96
Streptokinase	Positive control	0.661	0.204	69.14
Streptokinase	Positive control	0.682	0.206	69.79
Streptokinase	Positive control	0.679	0.208	69.37

Table 7. Mean ± SD clot lysis (%) for each treatment (n = 3).

Treatment	Mean clot lysis ± SD (%)
0.9% Isotonic saline (negative control)	5.09 ± 0.09
Streptokinase (positive control)	69.43 ± 0.33
HAEAH 5 mg/mL	63.74 ± 0.73
HAEAH 10 mg/mL	74.78 ± 0.38

Artabotrys hexapetalus leaf extract versus streptokinase (mean ± SD, n = 3).

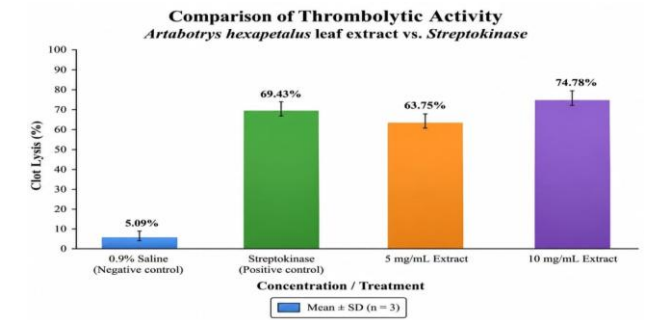


Figure 7. Comparison of thrombolytic activity of HAEAH: hydroalcoholic extract of Artabotrys hexapetalus.

Discussion

The pharmacognostical evaluation performed in this study - macroscopic, microscopic, quantitative-microscopic and powder-microscopic characterisation together with the physicochemical constants - provides a reproducible set of diagnostic parameters that can be used to authenticate *A. hexapetalus* leaves and distinguish them from adulterants or substitute drugs, in line with standard pharmacognostical practice for establishing crude-drug identity [4,5].

Phytochemical screening confirmed that the leaves are a rich source of alkaloids, tannins, terpenoids and phenolic compounds, with flavonoids, glycosides, saponins and proteins recovered specifically in the aqueous but not the hydroalcoholic extract - a pattern consistent with the differing polarities of these constituent classes and with earlier phytochemical reports on the species [26,42]. Several of these compound classes have documented roles in modulating haemostasis: flavonoids and phenolics can reduce oxidative stress and platelet reactivity, while saponins and alkaloids have been linked to fibrinolytic and cardioprotective effects [2,15,23], offering a plausible phytochemical basis for the thrombolytic activity observed here.

The clot lysis assay demonstrated a clear concentration-dependent effect, with 10 mg/mL HAEAH achieving clot lysis (74.78 ± 0.38%) numerically comparable to, and in this dataset marginally exceeding, the streptokinase positive control (69.43 ± 0.33%), while the saline control produced negligible lysis (5.09 ± 0.09%), confirming assay validity. This magnitude of activity is broadly consistent with thrombolytic potencies reported for other medicinal plants screened by the same in vitro clot-lysis method, such as ginger and various Bangladeshi medicinal plants [22,36,37], and extends the pharmacological profile of *A. hexapetalus* - previously documented mainly for antioxidant, antimicrobial, hepatoprotective and antileishmanial activities [42,44,52,54] - to include thrombolytic potential, addressing the specific gap identified in the literature review.

These findings should nonetheless be interpreted with the caveats appropriate to a preliminary in vitro study. The clot lysis assay, while a widely used and convenient screening tool, does not capture the full complexity of in vivo haemostasis, and the specific phytoconstituent(s) responsible for the observed activity were not isolated in this work. Bioassay-guided fractionation, structural characterisation of the active constituents, mechanistic studies (e.g., effects on plasminogen activation or platelet aggregation), and toxicity and in vivo evaluation are

therefore necessary before the thrombolytic potential of *A. hexapetalus* can be translated toward practical application.

Conclusion

This study establishes a detailed pharmacognostical and phytochemical profile for the leaves of *Artabotrys hexapetalus*, including diagnostic macroscopic and microscopic characters, quantitative leaf constants, and physicochemical parameters that together support the identification, authentication and quality assessment of the crude drug. Phytochemical screening confirmed the presence of flavonoids, phenolics, tannins, saponins, alkaloids, glycosides and terpenoids, several of which are plausibly linked to the observed pharmacological activity. In the clot lysis assay, the hydroalcoholic leaf extract produced a concentration-dependent thrombolytic effect that, at 10 mg/mL, approached the activity of the standard agent streptokinase, providing preliminary experimental support for the traditional and pharmacological relevance of this plant. Taken together, these findings position *A. hexapetalus* leaves as a promising natural source of thrombolytic bioactive compounds, warranting further bioassay-guided fractionation, mechanistic and in vivo studies to substantiate their therapeutic potential.

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