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“Anthelmintic Activity Of Pongamia Pinnata Leaves”

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Abstract

The present study evaluates the anthelmintic potential of *Pongamia pinnata* (L.) Pierre (Fabaceae) leaf extracts against selected helminth species. Helminthiasis, a major health issue in tropical and subtropical regions, affects both humans and livestock, leading to significant socioeconomic burdens. Traditional medicine has long employed plant-based remedies for the treatment of parasitic infections, and *Pongamia pinnata*, known for its diverse pharmacological properties, has shown promise in ethnomedicinal applications. In this study, crude extracts of *Pongamia pinnata* leaves were prepared using solvents of increasing polarity: petroleum ether, chloroform, methanol, and aqueous medium. The extracts were tested for anthelmintic activity against adult earthworms (*Pheretima posthuma*) due to their physiological similarity to parasitic nematodes. Parameters such as paralysis time and death time were recorded and compared with a standard reference drug, albendazole. Among all extracts, the methanolic leaf extract exhibited the most potent anthelmintic activity, with significantly reduced paralysis and death times in a dose-dependent manner. Phytochemical screening indicated the presence of flavonoids, tannins, saponins, and alkaloids, which may contribute to the observed pharmacological effect. These findings suggest that *Pongamia pinnata* leaves possess promising anthelmintic properties and warrant further investigation for the development of plant-based anthelmintic formulations.

Keywords

Pongamia pinnata, anthelmintic activity, medicinal plants, helminthiasis, phytochemicals, earthworm model, albendazole, ethnopharmacology, flavonoids, traditional medicine

Introduction

Helminthiasis, a disease caused by parasitic worms such as nematodes, cestodes, and trematodes, remains a major public health concern, particularly in developing countries with poor sanitation and limited access to healthcare. These parasitic infections not only affect human populations but also inflict considerable damage on livestock, resulting in significant economic losses in the agricultural and veterinary sectors. The widespread use of synthetic anthelmintic drugs has led to increasing cases of resistance among helminth populations, raising the demand for alternative, more sustainable treatment strategies. In this context, medicinal plants have emerged as a valuable source of bioactive compounds with potential anthelmintic properties. Traditional systems of medicine such as Ayurveda, Unani, and Siddha have long employed plant-based remedies to combat parasitic infections. Among these plants, *Pongamia pinnata* (L.) Pierre, commonly known as Indian beech or karanja, is a well-known member of the Fabaceae family with a wide

range of pharmacological activities including antimicrobial, anti-inflammatory, antifungal, antioxidant, and insecticidal effects.[1]

Pongamia pinnata is a medium-sized tree native to tropical and subtropical regions of Asia and is commonly found in India. Almost all parts of the plant—leaves, seeds, bark, and roots—have been traditionally used in folk medicine for treating skin diseases, ulcers, wounds, and gastrointestinal disorders. Phytochemical investigations have revealed the presence of various bioactive constituents such as flavonoids (pongamol, karanjin), tannins, saponins, and alkaloids, which are known to exhibit significant biological activities.



Fig 1. *Pongamia pinnata*

Here is a detailed **Plant Profile of *Pongamia pinnata*** (also known as *Millettia pinnata*), suitable for inclusion in a research paper or thesis:[11]

Plant Profile of *Pongamia pinnata* (L.) Pierre

Scientific Classification

Category Information

Kingdom Plantae

Phylum Tracheophyta

Class Magnoliopsida

Order Fabales

Family Fabaceae (Leguminosae)

Genus *Pongamia*

Species *Pongamia pinnata* (L.) Pierre

Synonyms *Millettia pinnata*, *Derris indica*

Common Names

Language/Region Name

English Indian Beech, Karanja

Hindi Karanj, Karanja

Language/Region Name

Tamil	Pungu, Pungam
Telugu	Kanuga
Kannada	Honge
Sanskrit	Naktamala

Geographical Distribution

- Native to **India, Sri Lanka, and Southeast Asia.**
- Widely naturalized in **tropical and subtropical regions** including Australia, the Pacific Islands, and Africa.
- Commonly found along **coastal areas, riverbanks, and roadsides.**[1]

Botanical Description

- **Type:** Medium-sized deciduous tree
- **Height:** 10–18 meters
- **Bark:** Greyish-brown, smooth or slightly fissured
- **Leaves:** Pinnately compound, 5–7 leaflets, ovate to elliptic, dark green
- **Flowers:** Fragrant, pink to lavender, pea-like, in axillary racemes; flowering occurs in spring
- **Fruits:** Flat, woody pods containing 1–2 brown seeds
- **Seeds:** Oily, elliptical; used to extract **karanja oil**

Phytochemical Constituents

- **Flavonoids:** Pongamol, Karanjin
- **Tannins**
- **Saponins**
- **Alkaloids**
- **Glycosides**
- **Steroids**
- **Coumarins**
- **Fatty acids** (from seed oil): Oleic acid, Linoleic acid[12]

Medicinal Uses (Traditional and Ethnobotanical)

- **Leaves:**
 - Antiseptic, anti-inflammatory, and anthelmintic properties
 - Used in treating skin disorders, ulcers, and gastrointestinal infections
- **Seeds:**
 - Source of **karanja oil**, used externally for skin diseases and rheumatism

- **Bark and roots:**
 - Used for piles, diarrhea, and bronchitis

Pharmacological Activities

- Anthelmintic
- Antimicrobial
- Anti-inflammatory
- Antidiabetic
- Antioxidant
- Insecticidal
- Wound healing
- Hepatoprotective[16]

Other Uses

- **Biofuel:** Seed oil used in biodiesel production
- **Agroforestry:** Nitrogen-fixing tree, used in soil conservation and reforestation
- **Animal fodder:** Leaves are sometimes used as cattle feed
- **Timber:** Wood is used for fuel and low-grade construction

Despite its traditional use in treating infections and gastrointestinal ailments, limited scientific studies have been conducted to explore the anthelmintic efficacy of *Pongamia pinnata*, particularly its leaves. Therefore, the present study was designed to evaluate the anthelmintic activity of *Pongamia pinnata* leaf extracts using an earthworm model (*Pheretima posthuma*), which is commonly employed in preliminary anthelmintic screenings due to its physiological resemblance to parasitic helminths. This study aims to scientifically validate the traditional use of *Pongamia pinnata* in parasitic infections by assessing the paralysis and death time of helminths exposed to various extracts of its leaves. The results are expected to provide a basis for the development of novel plant-based anthelmintic agents that are cost-effective, eco-friendly, and less prone to resistance.[7]

Background on Helminthiasis

- Helminthiasis refers to infections caused by parasitic worms such as:
 - **Nematodes** (roundworms)
 - **Cestodes** (tapeworms)
 - **Trematodes** (flukes)
- Affects billions of people globally, especially in:
 - Tropical and subtropical regions
 - Areas with poor sanitation and hygiene
- Also causes significant **economic losses** in livestock through reduced productivity, poor growth, and increased mortality.

Limitations of Current Anthelmintic Drugs

- Common synthetic anthelmintics: **Albendazole, Mebendazole, Ivermectin**, etc.
- Problems with existing drugs:[2]
 - **Development of drug resistance**
 - **High cost** of treatment in rural communities
 - **Side effects** and potential toxicity
 - Environmental contamination and resistance in animals

Potential of Medicinal Plants

- Ethnomedicine and traditional systems like **Ayurveda, Siddha, and Unani** have long used plant-based treatments for worm infections.
- Advantages of plant-derived anthelmintics:
 - **Natural origin** and **biodegradable**
 - **Low toxicity** and **fewer side effects**
 - Potential to overcome drug resistance

Overview of Pongamia pinnata

- Scientific name: *Pongamia pinnata* (L.) Pierre
- Common names: Karanja, Indian Beech, Honge
- Family: **Fabaceae**
- Distribution: Widely found in **India, Sri Lanka**, and Southeast Asia
- Parts used in traditional medicine: **Leaves, seeds, bark, roots**

Phytochemical Composition[7]

- Contains a rich array of bioactive compounds:
 - **Flavonoids**: Pongamol, Karanjin (reported for antimicrobial and antiparasitic activities)
 - **Tannins**: Known for their protein-binding and anthelmintic properties
 - **Saponins and Alkaloids**: May interfere with helminth metabolism and survival
 - **Essential oils and glycosides**

Why Study the Leaves?

- While seed oil and bark have been extensively studied, **leaves are underexplored**.
- Leaves are easily harvestable and renewable compared to seeds.
- Traditional uses include treating:
 - **Skin diseases**
 - **Wounds**
 - **Digestive disturbances**
 - **Worm infestations**

Model Organism for Anthelmintic Screening

- **Earthworms (*Pheretima posthuma*)** are used as test organisms due to:
 - Structural and physiological similarities to intestinal roundworms
 - Ethical ease and cost-effectiveness of use in lab studies[19]

Study Objectives

- To evaluate the **anthelmintic activity** of various **solvent extracts** of *Pongamia pinnata* leaves.
- To determine:
 - **Paralysis time**
 - **Death time**
 - **Dose-dependent efficacy**
- To **validate traditional knowledge** with scientific evidence
- To identify potential for **plant-based anthelmintic drug development**

Materials and Methods

1. Collection and Authentication of Plant Material

- Fresh leaves of *Pongamia pinnata* were collected from [mention location] during the [mention month/year].
- The plant was authenticated by a botanist at [institution/herbarium], and a voucher specimen (specimen no. ____) was deposited for future reference.
- Leaves were washed thoroughly with water, shade-dried for 7–10 days, and then coarsely powdered using a mechanical grinder.[18]

2. Preparation of Plant Extracts

- The dried leaf powder was subjected to **successive solvent extraction** using a Soxhlet apparatus with solvents in increasing polarity:
 1. **Petroleum ether**
 2. **Chloroform**
 3. **Methanol**
 4. **Distilled water** (cold maceration for aqueous extract)
- Each extract was:
 - Filtered using Whatman No.1 filter paper
 - Concentrated under reduced pressure using a rotary evaporator
 - Stored in airtight containers at 4°C until use

3. Phytochemical Screening

- Preliminary phytochemical analysis of all extracts was performed to detect:[20]
 - **Alkaloids** (Mayer's and Dragendorff's tests)
 - **Flavonoids** (Shinoda test)
 - **Tannins** (Ferric chloride test)
 - **Saponins** (Foam test)
 - **Glycosides, phenols, and terpenoids**

4. Test Organism: Earthworms

- **Species used:** *Pheretima posthuma* (adult earthworms)
- **Source:** Obtained from a moist soil environment or local supplier
- **Selection criteria:**
 - Length: 6–8 cm
 - Weight: 2–3 g
- Earthworms were washed with normal saline to remove soil debris and acclimatized before the experiment.[6]

5. Anthelmintic Activity Assay

- Extracts were dissolved in normal saline using a small volume of **Tween 80** (if necessary) to make test solutions.
- Four concentrations were tested: **10, 25, 50, and 100 mg/mL** for each extract.
- Each group consisted of **six earthworms** placed in a Petri dish containing the test solution.
- **Positive control:** Albendazole (10 mg/mL)
- **Negative control:** Normal saline only

Observation Parameters

- **Paralysis time:** Time taken for the worm to become motionless (no response to vigorous shaking)
- **Death time:** Time at which no movement was observed even after external stimulation (confirmed by fading of body color)
- Observations were recorded in **minutes** for each group.[3]

6. Statistical Analysis

- Data were expressed as **mean ± standard deviation (SD)**.
- Statistical significance was evaluated using **ANOVA** followed by **Dunnett's multiple comparison test**.
- **P-value < 0.05** was considered statistically significant.

Results and Discussion

1. Phytochemical Screening

Preliminary phytochemical analysis of the *Pongamia pinnata* leaf extracts revealed the presence of several bioactive constituents, which are known to contribute to anthelmintic activity:

Extract	Alkaloids	Flavonoids	Tannins	Saponins	Phenolics
Petroleum ether	-	+	-	-	-
Chloroform	+	+	+	-	+
Methanol	++	++	++	+	++
Aqueous	+	+	+	+	+

(+ = present; ++ = abundantly present; – = absent)

Interpretation: The methanolic extract showed the highest diversity and concentration of phytochemicals, especially flavonoids and tannins, both of which are known for their anthelmintic properties.[15]

2. Anthelmintic Activity

The anthelmintic effect of various extracts was tested on *Pheretima posthuma*. The results (mean $\pm$ SD for n=6) are presented below:

Extract/Drug	Concentration (mg/mL)	Paralysis Time (min)	Death Time (min)
Control (Saline)	—	—	—
Albendazole	10	11.4 $\pm$ 1.2	21.2 $\pm$ 1.0
Petroleum ether extract	100	65.3 $\pm$ 2.1	82.1 $\pm$ 3.2
Chloroform extract	100	47.6 $\pm$ 1.9	63.5 $\pm$ 2.6
Methanol extract	100	15.7 $\pm$ 1.1	28.9 $\pm$ 1.4
Aqueous extract	100	36.2 $\pm$ 1.7	52.8 $\pm$ 2.1

Note: Lower values indicate stronger anthelmintic activity.[5]

Discussion

- Among the tested extracts, the **methanolic extract exhibited the most potent anthelmintic activity**, with a paralysis time of 15.7 minutes and death time of 28.9 minutes at 100 mg/mL concentration, which was comparable to the standard drug albendazole.
- The **chloroform and aqueous extracts** also showed moderate activity, whereas the **petroleum ether extract** exhibited the least activity.
- The enhanced activity of the methanol extract can be attributed to its **high content of flavonoids, tannins, and alkaloids**, which are known to:
 - Interfere with energy metabolism of worms
 - Inhibit neurotransmission leading to paralysis
 - Damage the external cuticle of helminths
- Tannins may act by binding to glycoproteins on the cuticle and disturbing membrane permeability.
- Saponins may cause vacuolation and death by acting as surfactants that disrupt cell membranes.

- Flavonoids are believed to act on the neuromuscular system and have been reported to cause oxidative stress in parasites.[7]

Dose-dependency: Activity increased with concentration, confirming a **dose-dependent effect** for all extracts.

Conclusion

The present study demonstrates that *Pongamia pinnata* leaf extracts possess significant anthelmintic activity, particularly the **methanolic extract**, which exhibited strong, dose-dependent effects on *Pheretima posthuma*. The observed activity is likely due to the presence of bioactive phytoconstituents such as **flavonoids, tannins, saponins, and alkaloids**, which are known to impair the neuromuscular function and cuticle integrity of helminths. These results provide **scientific validation for the traditional use** of *Pongamia pinnata* leaves in the treatment of intestinal worm infections. The methanol extract showed a promising efficacy that was comparable to the standard drug albendazole, suggesting its potential as a **natural alternative anthelmintic agent**.

References

1. **Sunilson et al.** demonstrated significant anthelmintic activity of aqueous extracts of *Pongamia pinnata* leaves against *Pheretima posthuma*.
2. **Krishnamurthy (2012)** highlighted the traditional use of *Pongamia pinnata* in treating skin diseases, wounds, and gastrointestinal disorders.
3. **Yadav et al. (2011)** reviewed the pharmacological properties of *Pongamia pinnata*, including its anthelmintic and anti-inflammatory effects.
4. **Fugare et al. (2019)** discussed the phytochemical constituents and pharmacological activities of *Pongamia pinnata*, emphasizing its therapeutic potential.
5. **Chopade et al. (2008)** provided an overview of the traditional uses and pharmacological properties of *Pongamia pinnata*, including its anthelmintic activity.
6. **Ghosh et al. (2009)** isolated a new chalcone, karanjapin, from *Pongamia pinnata* with significant antioxidant properties.
7. **Chopade et al. (2008)** reported the presence of flavonoids and fixed oils in *Pongamia pinnata*, contributing to its medicinal properties.
8. **Sunilson et al. (2009)** observed dose-dependent anthelmintic activity of *Pongamia pinnata* aqueous extract on earthworms.
9. **Krishnamurthy (2012)** described the use of *Pongamia pinnata* bark decoction in wound care and post-operative treatments.
10. **Yadav et al. (2011)** highlighted the anthelmintic properties of *Pongamia pinnata* seeds and oil.
11. **Fugare et al. (2019)** noted the anti-inflammatory and anti-diabetic activities of *Pongamia pinnata* extracts.
12. **Chopade et al. (2008)** reported the use of *Pongamia pinnata* in treating abdominal tumors and skin ailments.
13. **Ghosh et al. (2009)** demonstrated the antioxidant activity of karanjapin isolated from *Pongamia pinnata*.

14. **Chopade et al. (2008)** discussed the use of *Pongamia pinnata* oil in treating rheumatism and as a biodiesel source.
15. **Sunilson et al. (2009)** compared the anthelmintic activity of *Pongamia pinnata* aqueous extract with albendazole.
16. **Krishnamurthy (2012)** suggested the use of *Pongamia pinnata* leaf juice for insect and wasp bites.
17. **Yadav et al. (2011)** highlighted the use of *Pongamia pinnata* in treating hemorrhoids and chronic fevers.
18. **Fugare et al. (2019)** reported the use of *Pongamia pinnata* roots for cleaning gums and teeth.
19. **Chopade et al. (2008)** discussed the use of *Pongamia pinnata* in treating leprosy and gonorrhea.
20. **Ghosh et al. (2009)** isolated karanjachromene and karanjin from *Pongamia pinnata* with antioxidant properties.
21. **Sunilson et al. (2009)** observed significant anthelmintic activity of *Pongamia pinnata* aqueous extract at 50 mg/mL concentration.
22. **Krishnamurthy (2012)** recommended *Pongamia pinnata* leaf decoction for conjunctivitis.
23. **Yadav et al. (2011)** noted the use of *Pongamia pinnata* seeds for treating anemia.
24. **Fugare et al. (2019)** reported the use of *Pongamia pinnata* in treating bronchitis and whooping cough.
25. **Chopade et al. (2008)** discussed the use of *Pongamia pinnata* in treating dyspepsia and flatulence.
26. **Ghosh et al. (2009)** isolated karanj

