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COMPARATIVE STUDIES OF ETHYL ACETATE EXTRACT OF MUSA PARADISIACA (*MUSA SAPIENTUM*) (MUSACEAE) FOR ANTHELMINTIC ACTIVITY

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ABSTRACT

The present study was carried out to evaluate the anthelmintic activity of *Musa paradisiaca* stem extract. The stem of *Musa paradisiaca* was dried, powdered, and extracted using the Sox hlet extraction method with ethyl acetate as the solvent. The obtained extract was subjected to preliminary phytochemical screening, which revealed the presence of bioactive compounds such as tannins, flavonoids, phenolic compounds, alkaloids, steroids, and glycosides. These phytoconstituents are known to possess potential antiparasitic properties. The anthelmintic activity of the ethyl acetate extract was evaluated using earthworms as the experimental model and compared with the standard drug mebendazole. Different concentrations of the extract were tested, and the time required for paralysis and death of the worms was recorded. The results demonstrated that the extract exhibited dose-dependent anthelmintic activity. At higher concentrations (10 mg/ml), the extract showed significant activity, producing paralysis and death of worms in a shorter time, comparable to the standard drug. The observed activity may be attributed to the presence of tannins and phenolic compounds, which can interfere with the metabolism and neuromuscular coordination of helminths. The study suggests that Musa paradisiaca stem extract possesses promising anthelmintic potential and may serve as a natural alternative for the development of herbal anthelmintic agents.

KEYWORDS: Anthelmintic activity, *Musa paradisiaca*, Mebendazole, Ethyl acetate.

INTRODUCTION

Herbal medicine refers to plant-based substances that possess nutritive, preventive, and curative properties. It is an interdisciplinary field that combines knowledge from various areas such as botany, pharmacognosy, phytochemistry, Ayurveda, Unani medicine, biotechnology, agriculture, and biochemistry. Herbal drug technology involves converting

plant materials into medicines while ensuring proper standardization and quality control using modern scientific techniques along with traditional knowledge. Herbal medicines include herbs, herbal materials, herbal preparations, and finished herbal products. Herbs are crude plant parts such as leaves, flowers, seeds, roots, bark, and stems, while herbal materials also include plant-derived substances like juices, gums, oils, resins, and powders. Herbal preparations are produced through processes such as extraction, infusion, decoction, maceration, distillation, purification, and fermentation. These preparations are then used to make finished herbal products, which may contain one or more herbs.

Herbal medicine, also known as herbalism or phytomedicine, focuses on the medicinal use of plants and is widely practiced in traditional medical systems such as Chinese medicine, Ayurveda, Unani, Naturopathy, Osteopathy, and Homeopathy. Herbal products are commonly available in forms such as tablets, capsules, powders, extracts, and teas.

Livestock production is important for a country's economy, but parasitic worm infections (helminthiasis) significantly affect animal health and productivity worldwide. These parasites are mainly classified into roundworms (Nematoda) and flatworms (Platyhelminthes), with gastrointestinal parasites posing a major threat to livestock. Although synthetic anthelmintic drugs have been widely used to control these parasites, their continuous use has led to increasing drug resistance. As a result, the effectiveness of many anthelmintics has decreased, causing higher mortality and morbidity in animals. Medicinal plants are now being considered as eco-friendly and sustainable alternatives for parasite control.

Helminth infections also affect humans globally, especially in tropical regions, causing health problems such as anemia, eosinophilia, pneumonia, and organ complications. These infections spread when helminth eggs released in feces contaminate the soil in areas with poor sanitation.

Gastrointestinal helminths are increasingly developing resistance to available anthelmintic drugs, making treatment difficult. *Musa paradisiaca* (banana) is a well-known tropical fruit believed to have spread from the southwestern Pacific to India around 600 BC and later throughout the tropical world, becoming one of the oldest cultivated crops.

The plant is a tree-like perennial herb that grows about 5–9 meters tall with a tuberous rhizome and long pseudostem. It has large inflorescences with reddish-brown bracts that are eaten as vegetables, and its ripe fruits are sweet, juicy, and have thicker peels compared to other bananas.

MATERIALS AND METHODS

Fresh stems of *Musa paradisiaca* were collected from Puliankuzham and authenticated by a botanist from the Department of Botany at Manonmaniam Sundaranar University. The stems were washed, shade-dried for 7–10 days, and ground into a coarse powder. About 500 g of the powder was extracted using ethyl acetate in a Soxhlet apparatus for 48–72 hours. The extract was filtered and concentrated with a rotary evaporator to obtain a semi-solid mass, which was stored in airtight containers at 4 °C for further use. The ethyl acetate extract was then subjected to preliminary phytochemical screening to identify secondary metabolites. Qualitative tests were also performed for primary metabolites, including a carbohydrate test by dissolving the extract in distilled water and filtering the solution.

- **Test for proteins and amino acids:** About 100 mg of the extract is dissolved in 10 ml of distilled water, filtered using Whatman-1 filter paper, and the filtrate is used to test for the presence of proteins and amino acids.
- **Test for fixed oils and fats:** The extract is treated with a few drops of 0.5 N alcoholic potassium hydroxide and phenolphthalein, then heated in a water bath for 1–2 hours. Formation of soap indicates the presence of fatty materials.

- **Phytochemical screening for secondary metabolites:** Qualitative tests are performed on plant extracts to detect compounds such as alkaloids, glycosides, steroids, terpenoids, phenolic compounds, tannins, flavonoids, and saponins.

In-vitro Anthelmintic Activity

Indian earthworms (*Pheretima posthuma*) were used as the test organisms due to their physiological similarity to human intestinal roundworms. Healthy worms measuring about 3–5 cm in length and 0.1–0.2 cm in width were collected from moist soil and washed with normal saline to remove soil debris. The ethyl acetate extract was prepared in 1% Tween-80 solution to obtain concentrations ranging from 2 to 10 ml. Mebendazole (10 mg/ml) was used as the standard drug, while 1% Tween-80 in saline served as the negative control. For the procedure, six earthworms of equal size were placed in separate petri dishes containing different concentrations of the extract, the standard drug, and the control solution. The time required for paralysis and death of the worms was recorded. Paralysis was noted when the worms did not move even on slight shaking, and death was confirmed when the worms showed no movement after being transferred to warm water (50°C) and their body color faded. The number of dead and alive earthworms was recorded, and both positive (ethyl acetate) and negative (water) control experiments were conducted.

RESULTS AND DISCUSSION

Preliminary phytochemical screening

The observed anthelmintic activity of the ethyl acetate extract may be attributed to be presence of bioactive, phytochemicals such as tannins, flavonoids, phenolic compounds and alkaloids which have been reported to exert anthelmintic effect through multiple mechanisms. Tannins are known to bind to free proteins in the gastro intestinal tract of worms or glycoproteins on the cuticle, leading to disruption of the parasites metabolism. Flavonoids and phenolic compounds may interfere with neuromuscular coordination and inhibit energy, generation in helminthes, ultimately resulting in paralysis and death.

Table 1: Preliminary phytochemical screening for *Musa paradisiaca.*

S. No.	Test with ethyl acetate extract	Result
1	Carbohydrate	_
2	Proteins and Amino acids	_
3	Fixed oils and fats	_
4	Alkaloids	+
5	Glycosides	_
6	Steroids and Terpenoids	+ +
7	Phenolic compounds and tannins	+ +
8	Flavanoids	+ +
9	Saponin glycosides	_

Key: - ve not detected; + ve in low concentration; ++ present in moderate concentration

Pharmacological activity

Table 2 and 3 displays the anthelmintic effects of the ethyl acetate extract of *Musa paradisiaca* stem on earthworms subjected to varying concentrations.

Table 2: Anthelmintic activity of different concentration of ethyl acetate extract of *Musa paradisiaca* stem on earthworm.

GROUP	TREATMENT	CONCENTRATION	PARALYSIS (minutes)	DEATH (minutes)
1	Extract A	2ml	36	40
2	Extract B	4ml	31	36
3	Extract C	6ml	27	30
4	Extract D	8ml	20	22
5	Extract E	10ml	14	16
6	Control (water)	-	No paralysis	No death

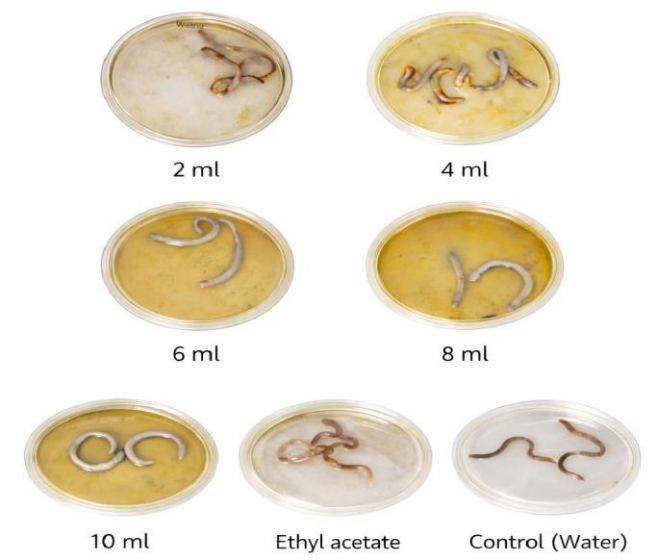
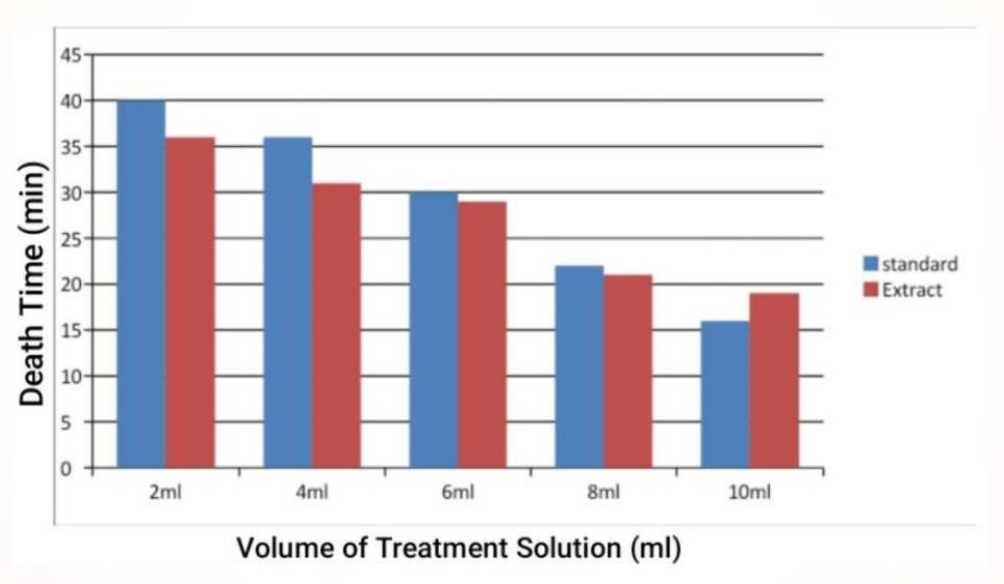


TABLE 3: The Anthelmintic activity of *Musa paradisiaca* using ethyl acetate extract was compared to standard drug of Mebendazole.

GROUP	TREATMENT	CONCENTRATION	PARALYSIS (minutes)	DEATH (minutes)
1	Standard A	2ml	30	36
2	Standard B	4ml	26	31
3	Standard C	6ml	23	29
4	Standard D	8ml	20	21
5	Standard E	10ml	18	19
6	Control(water)	-	No paralysis	No death

The highest concentration of ethyl acetate extract of demonstrated marked high anti helminth activity with paralysis and death time those observed compared with mebendazole (10mg/ml). Anthelmintic activity of musa paradisiaca stem extract and standard drug (mebendazole) in earthworm. 31 highest concentration of ethyl acetate extract of Musa paradisiaca (10mg /ml) demonstrated marked high anti helminth activity with paralysis and death time those observed compared with mebendazole (10mg/ml).

TABLE 4: Anthelmintic activity of *Musa paradisiaca* stem extract and standard drug (mebendazole) in earthworm.



CONCLUSION

The present comparative study concludes that the ethyl acetate extract of musa paradisiacal shows significant anthelmintic activity against Indian earthworm *(Pherethma posthuma*) in a concentration dependent manner. The extract effectively induced paralysis and death of the worms with higher concentration showing activity comparable to the standard anthelmintic drug. The study provides scientific support for the traditional medicinal use of *Musa paradisiaca* in the treatment of helminth infections. The observed activity may be due to the presence of various bioactive phytochemicals present in the ethyl acetate extract. Hence, *Musa paradisiaca* can be considered a promising natural anthelmintic agent. Further investigations such as isolation of active compounds, in-vivo studies and toxicity evaluation are necessary to confirm its therapeutic potential and safety.

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