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Mallotus philippensis: A Phytochemical, Pharmacological, and Pharmacognostic Assessment

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Abstract:
The plant family *Euphorbiaceae*, *Mallotus Philippinensis*, was the subject of the current study, which sought to evaluate its pharmacognostic, phytochemical, and pharmacological properties. Organoleptic, microscopical, and physicochemical evaluations, such as ash values, extractive values, moisture content, swelling index, foaming index, and foreign matter, were performed as part of the pharmacognostical inquiry. The acquired data demonstrated that 1.74% moisture content was discovered. Similar to that, a swelling index of (0.8cm) was noted. Index of foaming (less than 100). The results of a phytochemical examination that comprised serial soxhlet extraction were 4.9%, 5.45%, 9.77%, 8.75%, and 4.4%, respectively, for petroleum ether, chloroform, ethyl acetate, ethanol, and distilled water. The initial qualitative phytochemical screening identified the presence of fixed oils, lipids, alkaloids, glycosides, flavonoids, steroids, and phenolic substances. A pharmacological study examined the anthelmentic properties of an ethyl acetate plant extract from *Mallotus Philippinensis*. The 200 mg/kg dose will have favourable pharmacological effects.
Keyswords- *Mallotus Philippinensis*, Anthelmentic activity, Phytochemical investigation, Pharmacological investigation, Pharmacognostical investigation

INTRODUCTION

The plants employed for medicinal purpose are considered to include all plant material such as flower, fruit, root, foliage and seed which may be useful as such or in the form of extracts and chemical compounds isolated from them to produce drugs for human and veterinary medicine. These plants are closely related to those that produce stimulants, condiments, spices, essential oils, and such other higher forms of plants life that produce specific influence on cell metabolism.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 06, 2023

Among the kingdom of crude drugs (plants, animals and minerals), medicinal plants were first to be used by men. Medicinal plants account for 20% of all medical prescriptions in industrialized countries and for 80% in developing countries [1]. The World Health Organization (WHO) has compiled a list of over 20,000 common medicinal plants used in different parts of the globe and many of them are known for their efficacy against different human ailments. India has been endowed with a very rich flora due to the extreme variations in geographical and climatic conditions. These plants have been used since ancient times for the treatment of human diseases [2]. The traditional system of medicines (Ayurveda, Siddha and Unani-Tibb) together with folklore medicine still continues to serve, in spite of the advent of modern medicine, to large portions of the population, particularly in the rural areas. India is one of the world's twelve leading biodiversity centres with the presence of over 45,000 different plant species, of which about 15,000-20,000 plants have got medicinal values. However, only about 7,000-7,500 is used for their medicinal values by traditional communities. The medicinal potential of plant drugs is well recognized now, as for instance, the consumption of medicinal plants has doubled in last ten years in Western Europe [3]. It has been estimated that up to 50% of the prescriptions presently dispensed in USA may contain one or more natural product drugs. It seems certain that the continued scientific study of medicinal plant will afford a plethora of novel, structurally diverse bioactive compounds. The WHO has emphasized the utilization of indigenous system of medicine based on the ideally available raw materials i.e. medicinal plant [4].

Plant Description:

A bush to small or medium-sized tree, up to 25 metres tall and a trunk diameter of 40 cm. The trunk is fluted and irregular at the base [10]. Leaves are opposite on the stem, ovate to oblong in shape. 4 to 12 cm long and 2 to 7 cm wide with a long pointed tip. The upper surface is green without hairs, the underside pale grey in colour. Leaf stems 2 to 5 cm long, somewhat thickened at both ends. The first leaf vein on either side of the mid rib extends from the leaf base, to over half the length of the leaf [11].

Plant Description:

- **Bark:** Slender branch bark is pale, and the younger branch is covered in rust-red matted hairs.
- **Leaves**: Alternate, ovate-lanceolate, 8-22 x 3-8 cm, 3-nerved at base, glabrous above, pubescent and with numerous red glands beneath.
- **Flowers**: Small; dioecious, males in erect terminal spikes forming elongated paniculate racemes; females solitary in short spikes, ovary covered with red glands. Flowers are covered by rust red matted hairs.
- **Fruits:** Globose, 3-lobed, 8-10 mm in diameter,covered with bright red powder.
- **Seeds:** Subglobose, black, 3-4 mm across.
- **Plant type / Growth Habit:** Tree
- **Duration:** Perennial
- **Distribution:** Found throughout India, occasionally ascending to 1500 m in the outer Himalayas; also found in Sri Lanka, Southern China, Myanmar, Thailand, and throughout Malaysia to Australia.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 06, 2023

- **Habitat:** Subtropical and tropical areas.
- **Vernacular names / Synonyms**:
  Ayurvedic: Kampillaka, Kampilla, Kapila, Karkasha, Raktanga, Rechi, Kampilla.
  Bengali: Kamala, Kamalagundi
  English: Kamala tree, Monkey Face Tree, Dyers rottlera, Kamala dye tree, Monkey face tree, Orange kamala, red kamala, scarlet croton
  Gujrat: Kabilo
  Hindi: Kamala, Sindur, Rohini, Kambhal
  Kannada: Kampillaka, Kunkumadamara
  Punjabi: Kumila, Kamal, Kambal, Kamela
  Siddha: Kamela
  Unani: Kamila

METHODOLOGY

1. Aims and Objectives

It comprised of consecutive three steps:

Part A: Pharmacognostical Studies

Part B: Phytochemical Studies

Part C: Pharmacological Studies

Part A: Pharmacognostical Investigation

It included collection, identification and authentication of plant material, drying and size reduction, organoleptic evaluation, microscopic evalution (transerverse section of leaf, stem and root), powder microscopy and determination of leaf constant [9].

Physico-chemical investigation included determination of foreign organic matter, ash value (total ash, acid insoluble ash and water soluble ash), extractive value, moisture content (loss on drying), swelling index and foaming index. [5]

Part B: Phytochemical investigations

It included extraction (successive soxhlet extraction with increasing polarity of various solvents-petroleum ether, chloroform, ethyl acetate, ethanol and water), phytochemical screening (chemical tests of various extracts) and fluorescence analysis [6].

Part C: Pharmacological Study

Evaluation of *in vitro* Anthelmentic activity:

All the experiments were carried out in Indian adult earthworms (*Mallotus philippenesis*) due to its anatomical resemblance with the intestinal roundworm parasites of human beings. They were collected from moist soil and washed with water to remove all fecal matters. [7]

Experimental Design:

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 06, 2023

The Anthelmentic activity was performed according to the Ghosh *et al.,* method [8]. On adult Indian earth worm *Mallotus philippenesis* as it has anatomical and physiological resemblance with the intestinal round worm parasites of human beings. *Mallotus philippenesis* was placed in petridish containing four different concentrations (25, 50, 100 and 200mg) of methanolic & aqueous extract of *Mallotus philippenesis***.** Each petridish was placed with 4 worms and observed for paralysis or death. Mean time for paralysis was noted when no movement of any sort could be observed, except when the worm was shaken vigorously; the time death of worm (min) was recorded after ascertaining that worms neither moved when shaken nor when given external stimuli. The test results were compared with reference compound albendazole (15 mg/ml) treated samples.

RESULT:

1. **Pharmacognostical Investigation:**

A. Organoleptic Evaluation:

Aerial part	
Characters	**Observation**
Colour	Reddish brown
Texture	Coarse
Taste	Bitter
Odour	Odourless

Table no: 1 Organoleptic evaluation of the plant *Mallotus philippenesis*

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 06, 2023

(e)

Figure 1: Mallotus philippinensis. (a) Mature plant; (b) leaf; (c) initial inflorescence of seed setting; (d) mature fruits twig; (e) mature fruit with seed

B. Powder microscopy:

SI.NO	Part of the plant	Characters
1.	Dry powder of the aerial part of *Mallotus philippenesis*	Uniseriate multicellular trichomes Anisocytic stomata cruciferous Sclerenchymatu fibers Starch grains Bundle of acicular Cluster crystals

Table no: 2 Powder microscopy of the aerial part of the plant. *Mallotus philippenesis*

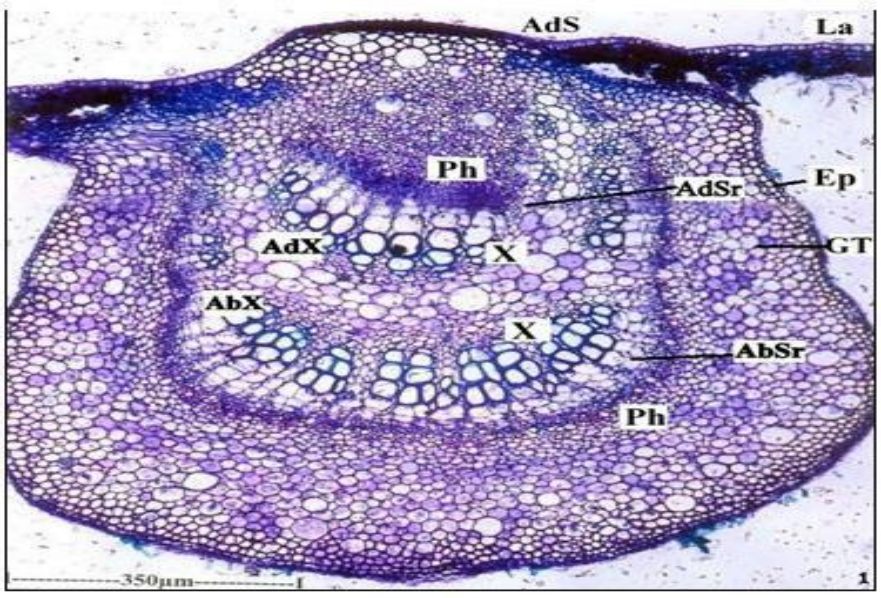
C. Stomata number:

SI NO	Parameters	Value (1mm^2)
1	Vein islet number (1 mm2 leaf surface)	22
2	Vein termination number	15
3	Stomatal index (per sq.mm)	Upper surface-0.22 Lower surface- 035
4	Stomatal number (per sq.mm)	Upper surface-15.94 Lower surface-27.09

Table no: 3 Stomatal number of the plant *Mallotus philippenesis*

D. Transverse section examination of stem and flower:

It was carried out by using the fresh *Mallotus philippinensis* plant parts for section cutting. Stems and leaf were soaked in chloral hydrate for few minutes in order to make them soft and then the cross sections were prepared by taking free hand section. The finally prepared slides were then captured through compound microscope and



ISSN: 0975-3583,0976-2833 VOL14, ISSUE 06, 2023

labeled .The labeled characters was as shown in figure.

Figure 2: Transverse Section of leaf through Midrib (10X)

(AdS – Adaxial side, AbSr – Abaxial strand, AdSr - Adaxial strand, AbX – Abaxial xylem, AdX – Adaxial xylem, Ep – Epidermis, GT – Ground Tissue, La – Lamina, Ph – Phloem, X – Xylem)

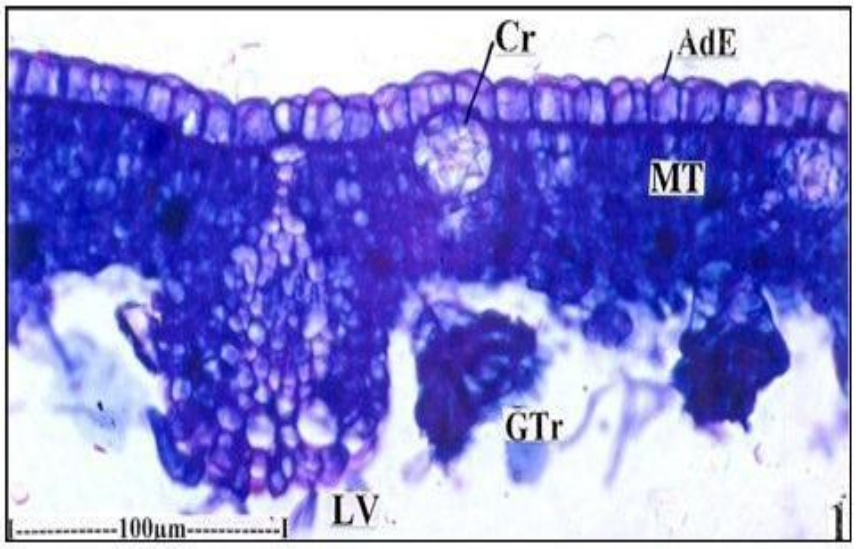


Figure 3: Transverse section of lamina showing crystals, glandular and non glandular trichomes (40X)

(AdE – Adaxial epidermis; Cr – Crystal; GTr. - glandular trichomes; LV – Lateral vein; MT – Mesophyll tissue)

2. PHYSICO-CHEMICAL INVESTIGATION

A. Foreign organic matter:

SI.NO.	Parameter	% yield (w/w)
1	Foreign Organic matte	0.18

Table no: 4 foreign organic matter of the plant *Mallotus philippenesis*

B. Ash value:

SI.NO	Parameters	% Values (w/w)
1	Total ash	27-37%
2	Acid insoluble ash	37%
3	Water soluble ash	11-16%

Table no: 5 Ash value of the plant *Mallotus philippenesis*

C. Moisture content (Loss on drying)

SI.NO.	Parameter	%Value (w/w)
1	Moisture content	1.74

Table no: 6 Moisture content of the plant *Mallotus philippenesis*

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 06, 2023

D. Swelling index

SI.NO.	Parameter	Value (cm.)
1	Swelling index	0.8

Table no: 7 swelling index of the plant *Mallotus philippenesis*

E. Foaming index

SI.NO.	Parameter	Value
1	Foaming index	Less than 100

Table no: 8 foaming index of the plant *Mallotus philippenesis*

3. PHYTOCHEMICAL INVESTIGATIONS

A. Extractive Yield of Different Extracts

Extracts	% Yield	Color
Petroleum Ether	4.9%	Reddish brown
Chloroform	5.45%	Reddish brown
Ethyl acetate	9.77%	Reddish brown
Ethanol Extract	8.75%	Reddish brown
distilled water	4.4%	Reddish brown

Table no: 9 Extractive values of the *Mallotus philippenesis*

B. The phytoconstitutent of the plant *Mallotus philippenesis*

Sl. N	Test/ reagent used	Extracts		
		Pet. ether extra	Chloroform extrac	Ethanol Extract
1	**Alkaloids**			+
	Mayer's Reagent	-	-	+
	Dragendroff's Reagent	-	-	+
	Wagner's Reagent	-	-	+
	Hager's Reagent	-	-	+
2	**Carbohydrates:-**			
	Molisch's Test	-	-	+
	Fehling's Test	-	-	+
	Benedict's Reagent	-	-	+
	Barfoid's Test	-	-	+

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 06, 2023

	Iodine Test	-	-	+
3	**Glycosides:-**			
	Keller-Killiani Test	+	_	_
	Legal Test	+	_	_
	Modified Borntrager's Test	+	_	_
	Borntrager's Test	+	_	_
4	**Proteins and Amino acids:-**			
	Ninhydrine Test	_	_	+
	Biuret Test	_	_	+
	Millon's Test	_	_	+
	Xanthoproteic Test	_	_	+
5	**Tannin:-**			
	Ferric chloride solution	_	+	+
	Gelatin solution	_	+	+
	Lead acetate solution	_	+	+
6	**Terpenoids**	+	+	-
7	**Saponin**	+	_	_
	Foam Test	+	_	_
	With $NaHCO_3$	+	_	_
8	**Flavonoids**			
	With NaOH	_	_	+
	With H_2SO_4	_	_	+
	With Mg/HCl	_	_	+
9	**Steroids:-**			
	Liebermann's Test	_	+	+
	Salkowski test	_	+	+

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 06, 2023

Table no: 10 The phytoconstitutent of the plant *Mallotus philippenesis*

PHARMACOLOGICAL STUDY

Table 12- indicates the phytochemical constituents of methanolic, benzene and aqueous extract of the *Mallotus philippenesis* when subjected to qualitative analysis for carbohydrates, protein, alkaloids, flavonoids, steroids, saponin, glycosides, terpenoids, tannins and phenols. By preliminary phytochemical screening it was found that all the three extract of plant contain carbohydrates, protein, alkaloids, flavonoids, steroids, saponin, glycosides, terpenoids, phlobatannins, tannins and phenols.

Table 1 3 - **s**hows higher concentration of extract produced paralytic effect much earlier and time taken for death was shorter for worms. Aqueous and methanol extract of *Mallotus philippenesis* exhibited anthelmintic activity in dose – dependent manner showing maximum efficacy at 25, 50, 100 and 200, mg/ml concentration for worms than benzene extract of *Mallotus philippenesis*

Figure 13- shows higher concentration of extract produced paralytic effect much earlier for worms. Aqueous and methanol extract of *Mallotus philippenesis* exhibited anthelmintic activity in dose-dependent manner showing maximum efficacy at 25, 50, 100 and 200 mg/ml concentration for worms than benzene extract of *Mallotus philippenesis.*

Figure 13- shows higher concentration of extract time taken for death was shorter for worms. Aqueous and methanol extract of *Mallotus philippenesis* exhibited anthelmintic activity in dose-dependent manner showing maximum efficacy at 25, 50, 100 and 200 mg/ml concentration for worms than benzene extract of *Mallotus philippenesis.*

S.No	Phytochemical Constituents	Methanolic extract	Benzene extract	Aqueous extract
1.	Carbohydrate	+	+	+
2.	Protein and amino acids	+	+	+
3.	Alkaloids	+	+	+
4.	Flavonoids	+	+	+
5.	Steroids	+	+	+
6.	Saponin	+	+	+
7.	Tannins	+	+	+
8.	Phenols	+	+	+
9.	Glycosides	-	+	+

Table 11- Phytochemical alalysis of different solvent extracts of Mallotus philippenesis

: (+) Present, (-) Absent

Group	Treatment of extracts	Concentration (mg/ml)	Time taken for paralysis (min)	Time taken for death (min)
1.	Normal control	-	-	-
2.	Experimental control	-	-	-
3.	Albendazole	15	43 □1.61	55 □1.60
		25	58 □4.16	74 □6.35
		50	52 □4.54	63 □2.94

ISSN: 0975-3583,0976-2833 VOL14, ISSUE 06, 2023

		100	33 □2.38	42 □2.64
4.	Methanol	200	27□1.63	35□2.00
	Hydroalcololic	25	77□□□□□	97□□□□□
		50	64□□□□□	81□□□□□
		100	53□□□□□	69□□□□□
		200	38□□□□□	55□□□□□
		25	56□9.91	69□9.91
		50	50□9.72	60□9.72
6.	Aqueous	100	42□1.29	48□1.41
		200	27□1.29	32□1.41

Table-12 *In vitro* Anthelmentic activity of various extracts *Mallotus philippenesis*

All values represents mean □ SD; n=4 in each group. Comparisons made between standard / treated groups.

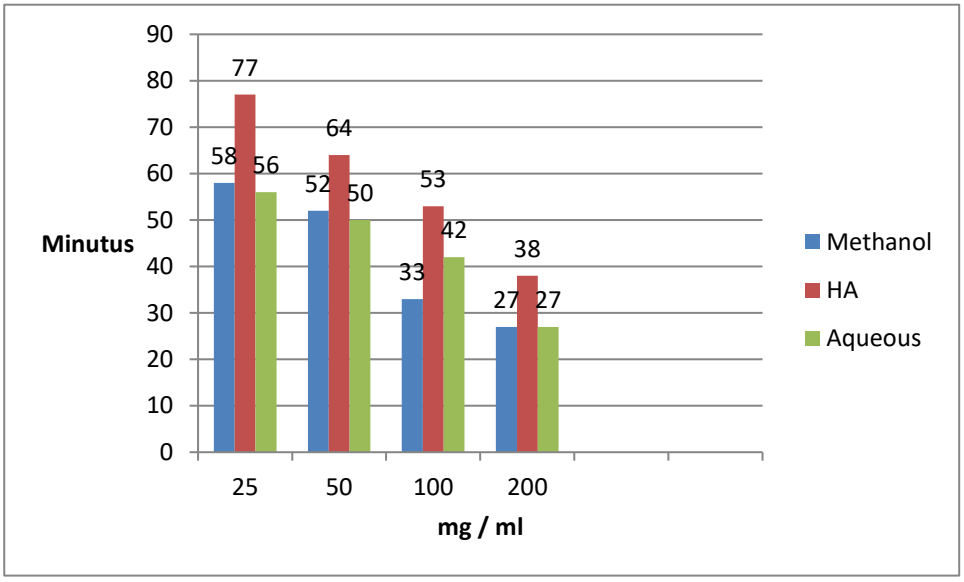


Figure no: 4 Time taken for paralysis of *Pheretima posthuma* by various solvent extracts of Mallotus philippenesis

DISCUSSION

Helminthes infections are among the most widespread infections in humans, distressing a huge population of the world. Although the majority of infections due to helminths are generally restricted to tropical regions and cause enormous hazard to health. To evaluate compounds with anthelmintic activity, a number of substances were analyzed using different species of worms, for example, earthworms, *Ascaris, Nippostrongylus and Heterakis*. From all these species, earthworms have been used extensively for the preliminary evaluation of anthelmintic compounds *invitro* because they are similar to intestinal "worms" in their reaction to anthelmintics and are easily accessible. It has been verified that all anthelmintics which are toxic to earthworms are

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creditable to study as an anthelmintic.[26] Earthworms have the ability to move by ciliary movement. The outer layer of the earthworm is a mucilaginous layer and composed of complex polysaccharides. This layer being slimy enables the earthworm to move freely. Any damage to the mucopolysaccharide membrane will expose the outer layer and this restricts its movement and can cause paralysis. This action may lead to the death of the worm by causing damage to the mucopolysaccharide layer. This causes irritation leading to paralysis. Commonly used anthelmintic drugs like piperazine citrate and albendazole by increasing chloride ion conductance of worm muscle membrane produces hyper polarization and reduced excitability that leads to muscle relaxation and flaccid paralysis.

CONCLUSION

The success of natural remedies in the pharmaceutical industry drives the creation of new drugs. Utilizing data acquired from conventional systems that have used plant products to manage sickness and injury is another method for discovering natural product drugs. from an industrial perspective regarding a sufficient supply of active ingredients from natural products. The yield is lower since there are fewer secondary metabolites present. Simpler semi-synthetic or synthetic analogues have been developed using a method that also enhances their medicinal characteristics. Using tissue culture techniques is an excellent way to address the demand for secondary metabolites.

From the experimental work, it was evident that ethanol extract contained carbohydrate, cardiac glycosides, tannins, flavonoids, and saponins while chloroform extract tested positively for carbohydrate, glycosides, and steroids. Methanolic extract also contained terpenoids and steroids. At a high dose of 200 mg/ml, the therapeutic value indicated that it has an anthelmintic effect in ethanolic extract and is considerable.

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Conflict index:

No conflict of interest

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