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Research Article

Evaluation of Anthelmintic Activity of Carica papaya Latex in Indian Earthworm

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Abstract

Helminthiasis is a widespread parasitic infection among humans and animals caused by helminths. The disease is highly prevalent particularly in developing countries due to inadequate sanitary conditions and poor management practices. *Carica papaya* Linn. belonging to the family of Caricaceae is a well-known fruit and medicinal plant that has been widely used for a long time to cure various types of infectious disease especially in South Asian countries. The papaya juice mainly contains, nbutyric, n-hexanoic and n-octanoic acid, benzyl-isothiocynate, 19- carotenoids. The fruits and seed are reported to contain papain, benzythiocarbamide, pseudocarpine. Antibacterial activity of Carica papaya latex has already been studied was expressed in terms of the radius of zone inhibition. The crude latex of *Carica papaya* was evaluated for anthelmintic activity using adult earthworms (*Pheretima posthuma* and Tubifex tubifex). The dried latex exhibited a dose-dependent inhibition of spontaneous motility (paralysis) and evoked responses to pin-prick. With higher doses (80mg/ml of dry latex) the effects was comparable with the standard drug piperazine. However, there was no final recovery in the case of worms treated with latex in contrast to Albendazole with which the paralysis was reversible and the worms recovered completely within six hours. The time of paralysis and time of death were studied and the activity was compared with as reference standard and distilled water was used as control. The latex at doses 40 mg/ml and 80 mg/ml exhibited significant anthelmintic activity as evidenced by decreased paralyzing time and death time.

Keywords: Anthelmintic; Albendazole; *Carica papaya; Pheretima posthuma; Tubifex tubifex*

Introduction

Carica Papaya plant is commonly called “papaya tree”, belongs to family Caricaceae. It is a rich source of phytonutrients, minerals, vitamins, and other compounds such as alkaloids, flavonoids, tannins, and Saponins, which have antioxidant activity and potential as an antihyperglycemic agent [1]. The different parts of the *Carica papaya* plant proved to have medicinal value including leaves, seeds, latex and fruit. C. Papaya has a wide variety of medicinal properties including anticancer, antimicrobial, anti-diabetic, antiviral, anti- inflammatory, antihypertensive, wound healing activity, free radical scavenging activity and increase in thrombolytic count or treatments for dengue fever, etc. [2]. The papaya fruit, as well as all other parts of the plant, contain a milky juice in which an active principle known as papain is present. Aside from its value as a remedy in dyspepsia and kindred ailments, it has been utilized for the clarification of beer [3]. The seed is used for intestinal worms when chewed. The root is chewed and the juice swallowed for cough, bronchitis, and other respiratory diseases. The unripe fruit is used as a remedy for ulcer and impotence, Fresh, green pawpaw leaf is an antiseptic, whilst the brown, dried pawpaw leaf is the best as a tonic and blood purifier [3]. Chewing the seeds of ripe pawpaw fruit also helps to clear nasal congestion. The green unripe pawpaw has a therapeutic value due to its antiseptic quality. It cleans the intestines from bacteria, more so that (only a healthy intestine is able to absorb vitamin and minerals, especially vitamin B12) [3]. The papa-

ya juice mainly contains, nbutyric, n-hexanoic and n-octanoic acid, benzyl-isothiocynate, 19- carotenoids. It has been reported to possess antibacterial, digestive and diuretic activities in indigenous system of medicine [4]. Latex, a sticky emulsion produced by specialized cells called laticifers, is a crucial part of a plant's defence system against herbivore and pathogens. It consists of a broad spectrum of active compounds, which are beneficial not only for plants, but for human health. Latex is a suspension of various particles (organic and inorganic) dispersed in a liquid with different refractive index. Depending on prevalent content and plant species studied, it can be milky white or yellowish, orange to brown or even colorless. However, it is more than a liquid. It is identified as a laticifer's protoplast with mitochondria, plastids, endoplasmic reticulum, Golgi bodies, polyribosomes, and vacuoles [5].

Helminthiasis causes a significant health problem with increased morbidity and, to some extent, mortality in an underdeveloped and developing country, although it may also occur in developed countries [6]. Helminths are generally restricted to tropical regions and cause enormous hazard to health and contribute to the prevalence of undernourishment, pneumonia, eosinophilia and anemia, eosinophilia and pneumonia. Worldwide prevalence lies between 500 million to one billion annually approximately. Antihelmentic drugs target the helminth parasitic worms and expel them from the body, either by stunning or by killing them. Ideally an antihelmenthic agent should have a broad spectrum of action, high percentage of cure, free from toxicity to the host and should be cost effective, but one of the synthetic drugs available in the market meets these requirements. Moreover as helminthes are increasingly becoming resistant to classical drugs, there is an urgent need for search and development of new antihelminthes agent, preferably with novel mode of action. Even the most common drugs like piperazine salt have been shown to have side effects like nausea, intestinal disturbance and giddiness and the high cost of modern antihelminthics has limited the effective control of the parasites. This leads to renewed interest in screening of medicinal plants for their antihelminthic activity. The traditional medicines hold a great promise as source of easily available effective antihelminthic agents to the people, particularly in tropical developing countries [7]. The purpose of the present study was to evaluate the latex of *Carica papaya* for anthelmintic activity in different models.

Materials and Methods

The experiment was conducted at the IMT Pharmacy College, New Nabakalabara Road, Sai Vihar, Gopalpur, Puri, Odisha, India during September, 2024 to assess the anthelmintic activity against worms. Albendazole, Normal saline were purchased from authorized pharmaceuticals. The solvents and other chemicals used during experimental protocol were of analytical grade.

Plant materials and preparation of test substances

Latex was collected from aunthenticated papaya plant from the rural belt of Mayurbhanj, Odisha during August, 2024 at unripe stage. The fruits were subjected to shallow incisions on the 4 sides. The latex flows freely for a few seconds and soon coagulates. Exuding latex was collected into aluminium foil. After collection coagulated lumps were shredded and sun dried. The powdered latex was suspended into a sufficient quantity of distilled water and filtered to remove extraneous and undissolved matters. Aqueous solution of latex was concentrated to dryness with the help of vacuum chamber. The dried latex in a concentration of 10, 20, 40, and 80 (mg/ml each) were prepared with normal saline. Solution of standard drugs Albendazole and Test compounds in different concentrations i.e. 10 to 80 mg/ml were prepared in a normal saline solution respectively.

Worm collection and authentication

Indian earthworms *Pheretima posthuma* (Annelida) were collected from the water logged areas. They were washed with tap water for the removal of the adhering dirt. Aquarium worms *Tubifex tubifex* (Annelida) were collected from the local market.

Qualitative phytochemical analysis

Qualitative assay of the latex for the presence of phytoconstituents such as carbohydrates, alkaloids, glycosides, flavonoids, tannins etc were performed following Standard procedure [9].

- **Glycosides**: For glycosides 1 mL of freshly prepared 10% KOH was added to 1 mL of latex. The presence of glycosides was confirmed by the formation of brick red precipitates.
- **Saponins:** For saponins, frothing test was performed in which 2 ml of the latex was vigorously shaken in the test tube for 2 minutes. Presence of frothing indicated saponins.
- **Steroids:** Steroids were identified by adding 5 drops of concentrated H_2SO_4 to 1 mL of the latex in a test tube. Red coloration indicated the presence of steroids.

- **Triterpenes:** For triterpenes, 5 drops of concentrated H_2SO_4 were added to 1 mL of latex. Appearance of blue green colour indicated the presence of triterpenes.
- **Flavonoids:** Presence of flavonoids was tested by adding 1 mL of freshly prepared 5% AlCl3solution to 1 mL of latex. Yellow coloration indicated the presence of flavonoids.
- **Phenolics:** For phenolics, two drops of 5% $FeCl_3$ were added to 1 mL of the latex in a test tube. Presence of greenish precipitate indicated the presence of phenolics.
- **Alkaloids:** To detect the presence of alkaloids 0.2 gm of plant latex was warmed with 2% sulphuric acid in a test tube for 2 minutes. The mixture was filtered in a separate test tube and few drops of Dragendroff reagent were added and observed for the presence of orange red precipitates for the presence of alkaloids.

Statistical application

The experiments were carried out in triplicate. All the results are reported as mean ± standard deviation (SD).

Anthelmintic activity

The anthelmintic assay was carried out as per the method of Ajayieoba., *et al*. with minor modifications. The assay was performed in vitro using adult earthworm (*Pheretima posthuma* and Tubifex tubifex) owing to its anatomical and physiological resemblance with the intestinal roundworm parasites of human beings for preliminary evaluation anthelmintic activity [10].

The 20 ml formulations containing different concentrations of the latex (10, 20, 40 and 80 mg/ml in distilled water) were prepared and five worms (same type) were placed in it. Time for paralysis was noted when no movement of any sort could be observed except the worms were shaken vigorously. Time for death of worms were recorded after ascertaining that the worms neither moved when shaken vigorously nor when dipped in warm water at 50°C. Albendazole (25 mg/ml) was used as reference standard while distilled water as the control.

Results and Discussion

Plants and its extracts were practiced in traditional and ethnic medicine for the treatment of many diseases such as malaria, dengue fever, wound healing, viral and bacterial diseases, cancer, arthritis, diabetes, menstrual disorders and as supplementary food for normal metabolism and growth of humans [11]. According to the world health organization infectious diseases are the main cause of death and the key agents of the afflicting world wide. These infectious are usually transmitted through contaminated water/food, unwashed hands, feces or contact with contaminated objects [12]. Helminths infections are among the most wide spread infections in humans especially in poverty - stricken and developing countries with warm moist environments and poor sanitary conditions [13]. The C. papaya is a tropical fast growing tree. In India. The fruits of the tree have been used for centuries in India for purposes like pharmaceuticals, cosmetics, agriculture, medicinal cures, insect repellents etc. From India the tree and the knowledge about its many uses and benefits has spread [14]. The preliminary phytochemical analysis of latex evidenced the presence of multiple components in it. The results revealed the presence of flavonoids, tannins, steroids, saponins, terpenes, and phenolic compounds in Table 1.

Test for ↓	Remarks
Tanins	+
Saponins	+
Fats and Oils	-
Alkaloids	+
Flavonoids	+
Coumarin	-
Terpenoids	+
Steroids	+
Phenols	+
Glycosides	+

Table 1: Preliminary qualitative phytochemical analysis of the Latex *of Carica papaya.*

(+) shows the presence of constituents, (-) shows the absence of constituents.

The results of anthelmintic activity of all the plant samples are summarized in Table 2. It is evident that *C. papaya* latexexhibited anthelmintic activity in dose-dependent manner giving shortest time of paralysis and death with 40 mg/ml and 80 mg/ml concentration. The latex at 80 mg/ml caused paralysis and death for the worms *Pheretima posthuma* (Annelida) and *Tubifex tubifex* respectively. For *Pheretima posthuma* the times are 9.8 and 11.6 min as per paralysis is concerned where as the time of death is 21.9 and 20.8 min., while the latex at 40 and 80 mg/ml of the worm *Tubifex*

tubifex is 10.4 and 11.5 min as per paralyzed and as per death it is 22.3 and 19.5 min. All the doses showed different anthelmintic activity in terms of mortality rate at the same concentration during the six hours time period.

The results can be considered significant since the latex is crude sample with a number of compounds and can be a source of phytochemicals with anthelmintic activity comparable to standard drugs

Group	Treatment	Concentration (mg/ml)	Time taken for paralysis (P) and death (D) of worms in minutes	
			P	D
I	Vehicle	DW	-	-
II	Albendazole	25	11.8 ± 2.52[c]	17.1 ± 3.24[c]
Anthelmintic activity on Pheretima Posthuma				
III	CPL	10	3.2 ± 1.4	34.5 ± 4.7
IV		20	5.4 ± 1.3	28.9 ± 3.2
V		40	9.8 ± 1.8[c]	21.9 ± 3.6[c]
VI		80	11.6 ± 2.4[c]	20.8 ± 3.5[c]
		Anthelmintic activity on Tubifex worms		
VII		10	4.7 ± 2.3	36.5 ± 4.3
VIII		20	7.6 ± 2.4[c]	26.8 ± 5.4[c]
IX		40	10.4 ± 3.2[c]	22.3 ± 3.2[c]
X		80	11.5 ± 4.2[c]	19.5 ± 4.3[c]

Table 2: Effect of different doses of Latex *of Carica papaya* on anthelmintic activity on Pheretima Posthuma and Tubifex worms.

Values are expressed in MEAN ± S.E.M of six animals. One Way ANOVA followed by Dunnet's t-test. (F-value denotes statistical significance at *p < 0.05, **p < 0.01) (t-value denotes statistical significance at [a]p < 0.05, [b]p < 0.01 and [c]p < 0.001 respectively, in comparison to group-II).

used. Although the rate of death of worms after each hour was different for different doses, at the end of six hour time period the rate of death of worms was same.

A number of studies are available for anthelmintic activity of tannins, alkaloids and flavonoids [15]. The presence of these phytochemicals may be responsible for the observed anthelmintic activity of plant latex in present study. Tannins have been shown to interfere with coupled oxidative phosphorylation thus blocking ATP synthesis in these parasites. Tannins may also bind to the cuticle of the helminth's body surface making it immobile causing the parasite to become paralysed leading to its death [16].

Conclusion

Plants are one of the most important sources of medicines. The role of medicinal plants in promoting the ability of human health to cope with the unpleasant and difficult situations is well documented from ancient times till date all over the world. Medicinal plants are rich in secondary metabolites which are potential sources of drugs and of therapeutic importance. There is increasing interest in the use of plant latex as therapeutic agents. The study has shown that the latex of *Carica papaya* have significantly determined anthelmintic activity in a dose dependent manner. The results are shown the significant activity as compared to Albendazole. Further studies are in process to identify the possible Phytoconstituents responsible for anthelmintic activity.

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