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STUDY OF ANTIMITOTIC ACTIVITY OF *FLACOURTIA JANGOMAS* LEAVES BY USING *ALLIUM* CEPA ROOT TIP ASSAY

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ABSTRACT

Objective: Cancer is still a serious worldwide health issue that calls for the investigation of new treatment options. Medicinal plants have been identified as possible sources of anticancer chemicals via phytochemical study. The Allium cepa root tip assay was used in this study to assess the antimitotic efficacy of an aqueous leaf extract of *Flacourtia jangomas*(family: *Flacourtiaceae*). The Soxhlet extraction method was used to extract dried leaves using an aqueous solvent. Methotrexate was the standard medication used to measure antimitotic activity in Allium cepa roots. When compared to the control (distilled water), the aqueous leaf extract (10 mg/ml) significantly inhibited root growth and the mitotic index in a concentration-dependent manner. The findings show significant cytotoxic and antimitotic effects, which are probably caused by the presence of phenolic chemicals, alkaloids, and flavonoids. These results imply that the leaves of *Flacourtia jangomas* contain bioactive components that may have anticancer effects and call for more research. **Conclusion:** The current study found that the leaves of *Flacourtia jangomas* contain some significant chemical components that may be extracted using water as a solvent and used in the management of cancer treatment.

KEYWORDS: Allium cepa, *flacourtia jangomas, Flacourtiaceae*, Soxhlet extraction, flavonoids, alkaloids and phenolic compounds.

1. INTRODUCTION

Flacourtia jangomas (*Lour*.) Raeusch., a member of the family *Flacourtiaceae*, is a historically significant medicinal plant that is found throughout tropical and subtropical parts of Southeast Asia and India. Indigenous medical systems have utilized the plant's various parts to treat wounds, skin- related illnesses, fever, gastrointestinal issues, and inflammatory problems. The leaves are particularly interesting among these because of their medicinal potential and ricphytochemical content. Flavonoids, phenolic compounds, tannins, and alkaloids are among the bioactive components found in *Flacourtia jangomas* leaves, according to phytochemical analyses. These chemicals are recognized to have important biological effects. These substances are characterized by cell proliferation, which is a fundamental aspect of cancer and other hyperproliferative illnesses. Agents with antimitotic and antiproliferative capabilities can effectively impede mitosis and curtail aberrant cell proliferation, rendering them significant targets in anticancer pharmacological research.

2. MATERIALS AND METHODS

2.1 Collection of *Flacourtia jangomas* leaves and processing

In November 2025, fresh leaves of *Flacourtia jangomas* were obtained from Chenappady, Kottayam district, Kerala, and verified by The plant was authenticated by the Department of Botany, St. Thomas College, Palai Kanjirappally. The leaves were cleaned with distilled water and allowed to dry at room temperature in the shade. Before bein extracted, the dried leaves were ground into a fine powder and kept in an airtight container.

2.2 Preparation of aqueous extract of leaves Soxhlet extraction was performed using ethanol as the solvent on dried and powdered leaf material. The sample was put

into a thimble within the Soxhlet extractor after around 300 mL of ethanol was added to the round-bottom flask. The assembly was heated on a heating mantle, which allowed the solvent to continuously reflux. The extraction process continued until the siphon cycles were transparent. After being collected in the flask, the ethanol extract was concentrated and kept for later examination. The Aqueous extract was subjected to preliminary phytochemical testing for the presence of different chemical classes of compounds.

Fig 1.1

2.3 Determination of mitotic index

The anti-mitotic activity of test samples was evaluated using the Allium cepa (onion) root tip assay, a widely accepted biological model for cytotoxicity and genotoxicity screening. Onion root meristem cells are ideal for such studies due to their high rate of cell division, large chromosomes, and ease of microscopic observation. Healthy onion bulbs were selected and allowed to develop roots under suitable conditions. Uniformly growing roots were chosen for experimental exposure. The roots were grouped into different treatment categories, including control, standard, and test samples (T1, T2, T3, and T4). After treatment, the root tips were processed for cytological examination using appropriate staining techniques to visualize cellular structures and mitotic stages. Prepared slides were examined under a light microscope. The number of dividing and non- dividing cells was observed, and general cellular morphology such as organization of cells, staining intensity, and presence of abnormalities were recorded. The mitotic index (MI) was used as an indicator of mitotic activity and calculated using the standard formula.

Mitotic Index (MI) = (Number of dividing cells / Total number of cells) × 100

A reduction in mitotic index or disruption in cellular organization compared to the control was interpreted as evidence of anti-mitotic or cytotoxic activity.

3. RESULTS

Microscopic examination revealed clear differences between the control, standard, and test samples. The control group exhibited normal cellular architecture with well-organized cells and clearly distinguishable nuclei, indicating healthy mitotic activity. This group served as the baseline for comparison. The standard-treated group showed marked alteration in cellular appearance. Cells appeared densely stained, disorganized, and showed loss of normal structure, confirming strong inhibition of mitosis and validating the effectiveness of the assay system. Among the test samples, varying degrees of anti-mitotic activity were observed.

- T1 samples showed minimal deviation from the control. Cellular arrangement remained largely normal, suggesting very low or negligible anti-mitotic effect
- T2 samples exhibited mild structural changes, with many cells still appearing similar to the control, indicating weak anti- mitotic activity.
- T3 showed noticeable disruption of cellular organization, with irregular cell appearance and darker staining compared to the control. This suggests a moderate level of mitotic inhibition.
- T4 showed the most prominent changes among all test samples. Cells appeared densely stained, highly disorganized, and markedly different from the control, closely resembling the effect seen in the standard group. This indicates that T4 possesses the strongest anti-mitotic activity.

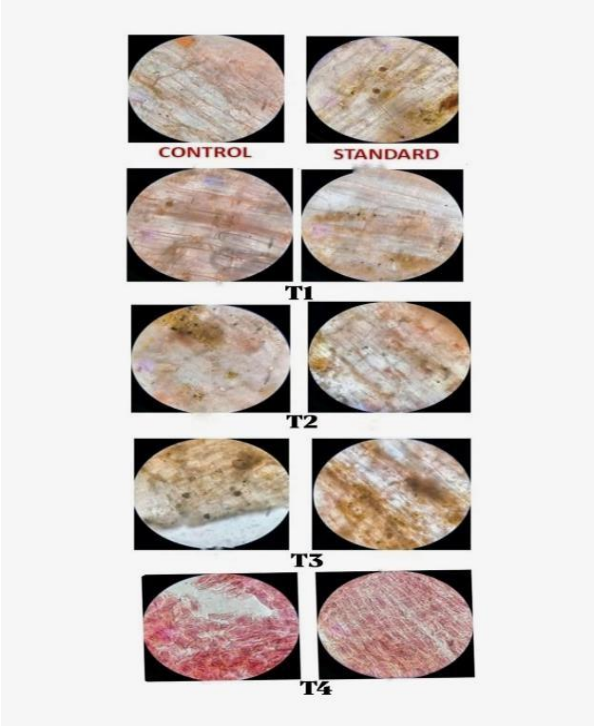
Based on qualitative microscopic observations, the relative order of activity was: Standard > T4> T3 > T2 > T1 ≈ Control.

The table 1: shows the Qualitative Assessment of Mitotic Index.

Treatment	Total no:of cell	No:of undividing cell	No:of diving cell				Mitotic Index
			Prophase	Metaphase	Anaphase	Telophase	
control	100	18	40 ±0.33	25 ±0.57	9 ±0.33	7 ±0.33	82
T4(20mg/ml)	100	78	16 ±0.57	4 ±0.33	1 ±0.57	1 ±0.57	22
T3(10mg/ml)	100	60	21 ±0.57	10 ±0.57	7 ±0..33	7 ±0.57	40
T2(5mg/ml)	100	38	28 ±0.57	18 ±0.33	12 ±0.33	4 ±0.57	62
T1(2.5mg/ml)	100	20	32 ±0.33	24 ±0.570	18 ±0.57	6 ±0.33	80
Standard(1mg/ml)	100	87	8 ±0.57	4 ±0.57	1 ±0.57	0 ±0.33	13

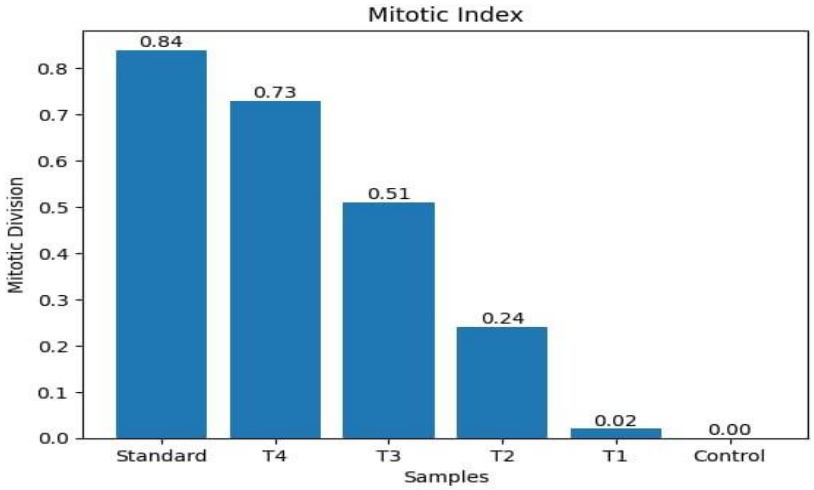
No of dividing cell expressed as Mean ± SEM

Table 1 shows the mitotic index of samples T1, T2, T3, T4, control, and standard. A high mitotic index indicates increased cell division associated with cancer, whereas a low mitotic index indicates inhibition of cell growth, suggesting anticancer activity. Among the samples, T4 (20 mg/mL) exhibited the highest anticancer property.



Comparative ranking, table no:2.

Rank	Sample	Percentage mitotic division	Activity Level
1	Control	0	None
2	T_1	2%	Very weak
3	T_2	24%	Mild
4	T_3	51%	Moderate
5	T_4	73%	Strong
6	Standard	84%	Very Strong



Graph No 1: Mitotic Index of aqueous extracts of *Flacourtia jangomas.*

4. DISCUSSION AND CONCLUSION

The Allium cepa root tip assay is widely recognized as a sensitive and reliable system for evaluating the cytotoxic and anti-mitotic effects of various chemical and biological substances. Because the root meristem contains rapidly dividing cells, any interference with mitosis is easily reflected through changes in cellular morphology and reduction in visible dividing cells.

In the present study, the control group maintained normal cellular integrity, confirming that the experimental conditions were suitable for healthy cell division. The standard treatment produced strong cellular disruption, confirming that the assay was functioning effectively and

capable of detecting anti-mitotic activity. Among the test samples, **T4 demonstrated the highest inhibitory effect on cell division,** as evidenced by severe disturbance of cellular architecture and intense staining patterns. This suggests that the bioactive components present in T3 may interfere significantly with mitotic processes such as spindle formation, chromosome movement, or nuclear division. Such activity is often associated with compounds possessing potential cytotoxic, anti-proliferative, or pharmacological properties.

T2 exhibited moderate anti-mitotic activity, indicating partial inhibition of cell division. Thi **T3 produced only mild alterations**, suggesting weak inhibitory potential, while **T4 showed minimal changes compared to the control**, indicating that its effect on mitosis is negligible under the tested conditions. Differences in activity among the test samples may be attributed to variations in their chemical composition, concentration of active constituents, solubility, or ability to penetrate cells and interact with mitotic machinery. The results indicate that not all test samples possess equal biological activity.

Overall, the findings suggest **that T4 is the most promising sample with significant anti- mitotic potential** and could be considered for further detailed investigation using quantitative analysis and advanced cytogenetic or molecular techniques.

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