ISSN: 2347-6567

International Journal of Allied Medical Sciences and Clinical Research (IJAMSCR)

IJAMSCR |Vol.14 | Issue 2| Apr - Jun - 2026

www.ijamscr.com

DOI : https://doi.org/10.61096/ijamscr.v14.iss2.2026.908-915

Premilinary Phytochemical Screening and Invitro Anti –Cancer Activity of Stem Extract of Basella Alba L.

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Published on: 16.05.2026
Published by: Futuristic Publications
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Abstract: Cancer is a multifactorial disease characterized by uncontrolled cell proliferation, genetic alterations, and the potential for invasion and metastasis, representing a major global health burden. Despite significant advances in conventional treatment modalities such as chemotherapy, radiotherapy, surgery, and targeted therapy, their clinical application is often limited by adverse side effects, high costs, and the development of drug resistance. These limitations have intensified the search for safer, cost-effective, and more efficient therapeutic alternatives, particularly from natural sources. Medicinal plants have long been recognized as valuable reservoirs of bioactive compounds with diverse pharmacological activities, including anticancer potential. *Basella alba L.*, commonly known as Malabar spinach, is a widely distributed tropical plant traditionally used for its nutritional and medicinal properties. It is rich in essential nutrients and phytochemicals such as flavonoids, phenolic compounds, saponins, and other secondary metabolites, which are known to exhibit antioxidant, anti-inflammatory, and ant proliferative activities. In view of its therapeutic significance, the present study was designed to evaluate the phytochemical profile and in-vitro anticancer potential of *Basella alba L.* stem extracts. The plant material was collected, authenticated, and subjected to shade drying followed by size reduction into coarse powder. Successive solvent extraction was carried out using petroleum ether, methanol, and ethyl acetate through the cold maceration technique. Preliminary phytochemical screening was performed using standard qualitative methods to identify major classes of bioactive constituents. The anticancer activity of the extracts was evaluated against MCF-7 human breast cancer cell lines using the MTT assay, a widely accepted method for assessing cell viability and cytotoxicity. This study aims to provide scientific insight into the phytochemical composition and potential anticancer activity of *Basella alba L.*, thereby contributing to the development of plant-based therapeutic agents for cancer management.

Keywords: *Basella alba L.*; phytochemical analysis; anticancer activity; MTT assay; MCF-7 cell line; cytotoxicity; medicinal plants; Cold maceration.

INTRODUCTION

Cancer is a complex and multifactorial disease characterized by uncontrolled cell proliferation, genetic mutations, and the capacity of abnormal cells to invade surrounding tissues and metastasize to distant organs. It remains one of the leading causes of morbidity and mortality worldwide, with its global burden steadily increasing due to factors such as population aging, lifestyle modifications, environmental pollutants, and infectious agents. Despite significant advancements in cancer diagnosis and treatment, including chemotherapy, radiotherapy, surgery, and targeted therapies, these approaches are often limited by severe adverse effects, non-specific toxicity, high treatment costs, and the emergence of drug resistance. Therefore, the search for safer, cost-effective, and more efficient therapeutic agents continues to be a major focus in cancer research.

In recent years, natural products, particularly those derived from medicinal plants, have gained considerable attention as potential sources of novel anticancer agents. Historically, plants have played a crucial

role in drug discovery, with several well-established anticancer drugs such as vincristine, vinblastine, paclitaxel, and camptothecin derivatives originating from plant sources. These phytochemicals exhibit diverse biological activities, including antioxidant, anti-inflammatory, ant proliferative, and pro-apoptotic effects, which contribute to their therapeutic potential. The relatively low toxicity and improved biocompatibility of plant-derived compounds further enhance their suitability as alternative or complementary therapies in cancer management.

Basella Alba L., commonly known as Malabar spinach, is a perennial, succulent climbing plant widely distributed in tropical and subtropical regions. It is extensively consumed as a leafy vegetable and has been traditionally used in various systems of medicine for its nutritional and therapeutic benefits. The plant is rich in essential nutrients such as vitamins, minerals, and dietary fiber, along with a wide range of phytoconstituents, including flavonoids, phenolic compounds, saponins, and alkaloids. Previous studies have reported that *Basella Alba L*. possesses multiple pharmacological properties, such as antioxidant, antimicrobial, anti-inflammatory, hepatoprotective, and antidiabetic activities. Emerging evidence also suggests its potential role in cancer prevention and treatment, primarily through mechanisms such as inhibition of cell proliferation, induction of apoptosis, and modulation of cellular signaling pathways.

In this context, the present study aims to investigate the phytochemical composition and evaluate the in-vitro anticancer activity of *Basella Alba L*. stem extracts using established experimental models. The outcomes of this research are expected to provide scientific validation for the traditional use of this plant and contribute to the identification of potential plant-based anticancer agents for future therapeutic development.

PLANT PROFILE

Description:

- A fast-growing, perennial, herbaceous climbing plant belonging to the family Basellaceae.
- Stem is succulent, smooth, and twining, usually green in color, sometimes purplish in certain varieties.
- Leaves are simple, alternate, fleshy, and ovate to cordate (heart-shaped) with entire margins.
- Leaf surface is soft, thick, and mucilaginous, contributing to its nutritional and medicinal value.
- Flowers are small, bisexual, and white to pale pink, arranged in axillary or terminal spikes.
- Fruits are fleshy, ovoid berries that turn deep purple or black upon ripening.
- Each fruit contains a single, hard seed.

Taxonomy:

- Kingdom : Plantae
- Phylum : Magnoliophyte
- Class : Magnoliopsida
- Order : Caryophyllales
- Family : Basellaceace
- Genus : *Basella*
- Species : *Basella Alba L.*

Vernacular Names:

- **English** : Malabar spinach, Indian spinach
- **Tamil** : Pasalaikeerai
- **Hindi** : Poi saag
- **Telugu** : Bachali kura
- **Malayalam** : Vali cheera
- **Kannada** : Basale soppu

Fig.1: Stem, Flower, Leaves and Fruits of *Basella Alba L.*

MATERIALS AND METHODS

Plant Material Collection and Authentication:

Fresh plant material of *Basella Alba L.* was collected from Madurai, Tamil Nadu, and India. The collected specimen was thoroughly washed with tap water to remove adhering impurities and shade-dried at room temperature. The plant was authenticated by a qualified botanist, and a voucher specimen was preserved for future reference.

Preparation of Plant Material:

The dried stems of *Basella Alba L.* were separated and coarsely powdered using a mechanical grinder. The powdered material was stored in an airtight container and used for further extraction procedures.

Extraction Procedure (Cold Maceration Method):

The powdered plant material was subjected to successive solvent extraction using petroleum ether, methanol, and ethyl acetate by the cold maceration method. Approximately 100 g of coarse powder was soaked in 150 ml of solvent in a closed container and allowed to stand for 3–7 days with occasional stirring to ensure efficient extraction. The mixture was then filtered, and the marc was re-extracted multiple times to maximize yield. The combined extracts were concentrated using a water bath or vacuum desiccator to obtain a semi-solid residue, which was stored in airtight containers for further analysis.

PRMILINARY PHYTOCHEMICAL SCREENING

Table 1: phytochemical analysis of stem of *Basella Alba L.*

S. No	Phytochemical	Test Name	Procedure	Observation
1.	Alkaloids	Dragendroff's Test	Add 1 ml of Dragendroff's reagent to extract	Reddish-brown precipitate
2.	Flavonoids	Lead Acetate Test	Add few drops of 10% lead acetate solution	Yellow precipitate
3.	Saponins	Foam Test	Dilute 1 ml extract to 20 ml with water and shake for 15 min	1 cm foam layer
4.	Tannins	Braymer's Test	Add water and ferric chloride solution	Deep black color
5.	Phenols	Ferric Chloride Test	Add ferric chloride solution	Blue, green, or dark violet color

ANTI-CANCER ACTIVITY

The anti-cancer activity of *Basella Alba* was evaluated using in-vitro methods against the human breast cancer (MCF-7) cell line. Plant extracts, particularly methanol and ethyl acetate extracts, exhibited significant cytotoxic effects on cancer cells. The activity was found to be concentration-dependent, where higher concentrations resulted in a greater reduction in cell viability. The presence of bioactive phytoconstituents such as flavonoids, phenolic compounds, and saponins is responsible for its anticancer potential. These compounds are known to induce apoptosis, inhibit cell proliferation, and interfere with cancer cell metabolism. The MTT assay results indicated that the ethyl acetate extract showed comparatively higher activity with lower IC_{50} values than the methanolic extract. The decrease in viable cells confirms the ant proliferative effect of the plant extracts. Thus, *Basella Alba* demonstrates promising in-vitro anticancer activity and may serve as a potential source for developing novel anticancer agents after further investigation.

Procedure

The in-vitro anticancer activity of *Basella Alba* was evaluated using the MCF-7 cell line by MTT assay. The cells were cultured in Dulbecco's Modified Eagle's Medium (DMEM) supplemented with 10% fetal calf serum and maintained at 37°C in a humidified atmosphere with 5% CO_2. The cells were trypsinized and resuspended in fresh medium to prepare a uniform cell suspension. About 1 mL of the cell suspension was seeded into each well of a 96-well plate.

Different concentrations of plant extracts (0, 12.5, 25, 50, 100, and 200 µg/mL) were added to respective wells and incubated for 48 hours. After incubation, MTT reagent (5 mg/mL) was added and further incubated for 2 hours. The medium was carefully removed, and 100 µL of DMSO was added to dissolve the purple formazan crystals formed by viable cells.

The absorbance was measured at 570 nm using a microplate reader. Cell viability percentage was calculated by comparing test absorbance with control. A decrease in absorbance indicates increased cytotoxic activity of the extract.

RESULTS AND DISCUSSION

Percentage yield:

Table2: Percentage yield of stem extract of *Basella Alba L.*

EXTRACTS	% YIELD (%W/W)
Ethyl acetate	4.022
Methanol	7.471

The % yield of stem extract of *Basella Alba L.*using ethyl acetate and methanol was found to be 4.022% w/w and 7.471%w/w respectively.

Phytochemical studies

The effective crude extract of *Basella Alba L*. was evaluated for phytochemical constituents. The results of premilinary phytochemical of various crude extract of stem extract of *Basella Alba L*. was shown in Table 3:

Table3: Preliminary phytochemical screening of crude extracts of stem extract of *Basella Alba L.*

PHYTOCONSTITUENTS	EXTRACT	
	ETHYL ACETATE	METHANOL
Alkaloids	-	+
Terpenoids	-	-
Flavonoids	-	+
Saponnins	+	+
Tannins	-	+
Phenolic compounds	-	+

(+) denotes the presence of constituents

(-) denotes the absence of constituents

The phytochemical screening of Ethyl acetate extract revealed the presence of saponnins.

The Methanolic extract show the presence of alkaloids, flavonoids, saponnins, tannins and phenolic compounds.

Invitro MTT Assay

The in-vitro cytotoxicity activity results of the test sample against MCF7 cells showed remarkable cytotoxicity, which was observed in the results.

It was evident that the test samples Ethyl acetate and Methanol tested at a high concentration of 200 µg/ml and showed cell viability as low as 24.59% and 28.58% against MCF7 cell line, respectively.

It was proven that the cytotoxicity effect of the test samples showed cell disintegration after 48 hours of treatment against the tested MCF7 cell lines, at higher concentrations.

The IC_{50} concentration of the tested samples Ethyl acetate and Methanol against MCF7 cell lines were 100.35 µg/ml and 107.93 µg/ml, respectively.

Table 4: Invitro cytotoxicity effect of *Basella Alba L* extract

CONCENTRATION (µg/ml)	% CELL VIABILITY	
	ETHYLACETATE	METHANOL
0	100.00	100.00
12.5	81.82	82.71
25	70.59	73.62
50	55.17	58.33
100	40.43	41.39
200	24.59	28.58

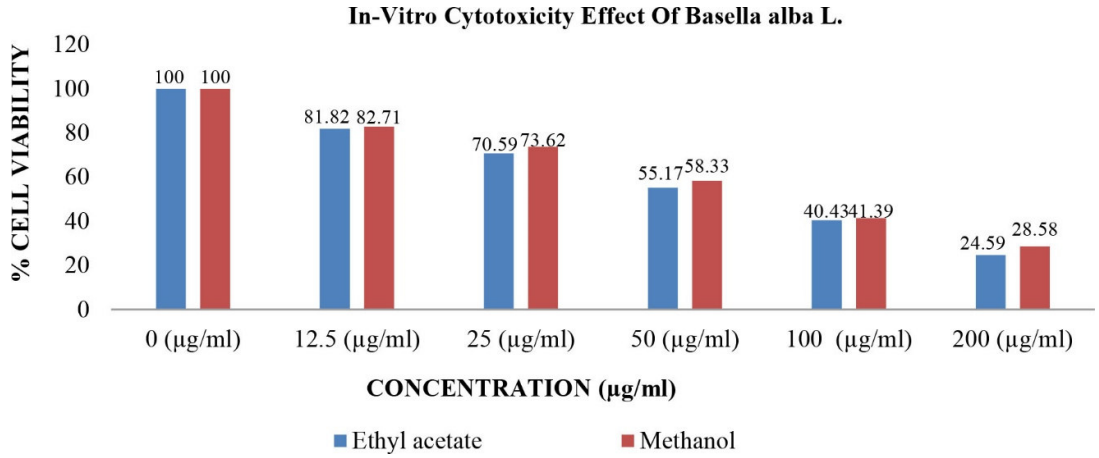

Fig 2: In-vitro cytotoxicity effect of *Basella Alba L.*

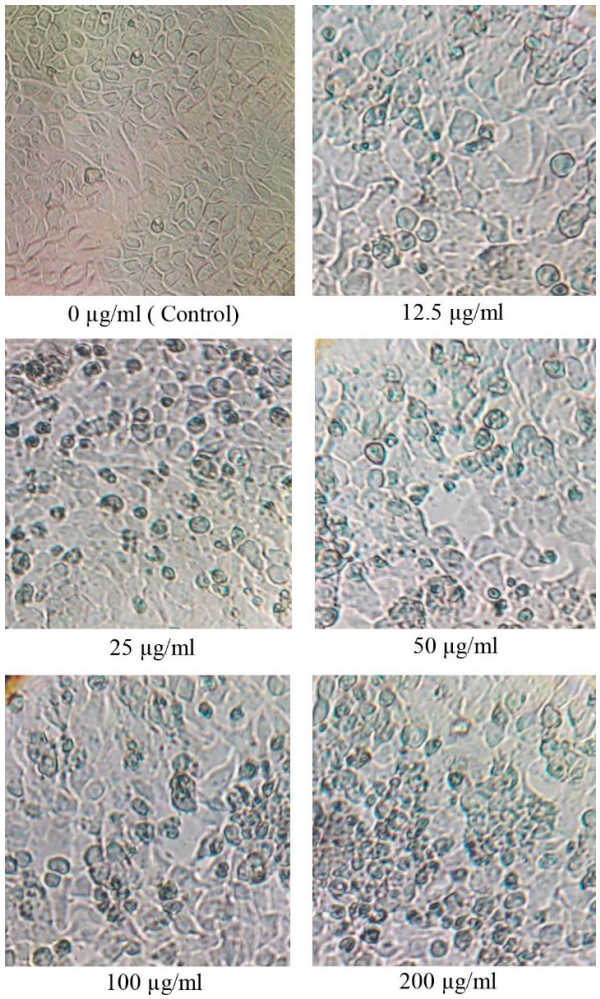

Fig 3: The cytotoxicity levels of Ethyl acetate sample against MCF7 cell lines

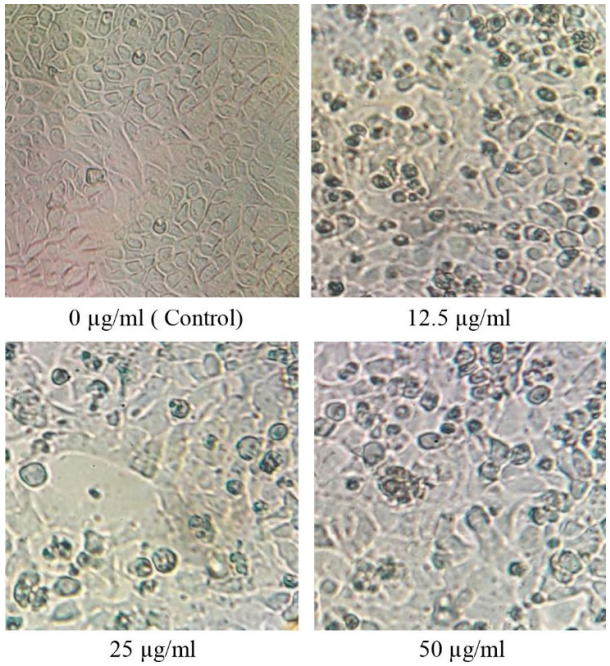

Fig 4: The cytotoxicity level of Methanol sample against MCF7 cell lines

CONCLUSION

The present in-vitro study demonstrates that various extracts of *Basella Alba L.* exhibit significant cytotoxic activity against human breast cancer MCF-7 Cell lines.

The extracts produced a concentration dependent decrease in cell viability as assessed by the MTT assay.

Among the tested extracts the ethyl acetate extract showed comparatively higher anticancer potential as evidenced by a lower IC_{50} value, followed by Methanolic extract.

The observed anticancer activity may be attributed to the presence of bioactive phytoconstituents such as phenolic compounds, flavonoids which are known to exert ant proliferative effects on cancer cells.

The IC_{50} based evaluation provides substantial preliminary evidence supporting the anticancer potential of *Basella Alba L.*

Hence, the findings suggest that *Basella Alba L.* possesses in-vitro anticancer activity against breast cancer cells and warrants further investigation through mechanistic studies and in-vivo evaluation to validate its therapeutic potential

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