Natural Resources for Human Health
eISSN: 2583-1194

Original Research

Received 24 May 2026
Revised 26 June 2026
Accepted 10 July 2026

Natural Resources for Human Health 2026, Vol. 6 (7s): 64–74

KEYWORDS:
Colocasia esculenta, Alocasia macrorrhizos, Antioxidant activity, Antimicrobial activity, MTT assay.

Antioxidant, Antimicrobial and Anticancer Activities of Colocasia Esculenta and Alocasia Macrorrhizos: A Phytochemical and Pharmacological Study

Dipak P Kardile[1], Sarang S Mahamuni[2*]

[1]Assistant Professor Rajgad Dnyanpeeth's College of Pharmacy, Bhor, Savitribai Phule Pune University, Pune, Maharashtra, India 412 206,
Orcid id: https://orcid.org/0000-0002-3243-3818
[2*]Research Scholar Rajgad Dnyanpeeth's College of Pharmacy, Bhor, Savitribai Phule Pune University, Pune, Maharashtra, India 412 206,
Orcid id: https://orcid.org/0000-0001-9478-7139

ABSTRACT:

Background: Medicinal plants are important sources of therapeutic agents and continue to contribute to traditional medicine and modern drug discovery. Colocasia esculenta and Alocasia macrorrhizos, two indigenous members of the family Araceae, were investigated for their phytochemical composition and biological activities.

Objectives: To evaluate the phytochemical constituents and assess the antimicrobial, antioxidant, and cytotoxic activities of successive extracts of C. esculenta and A. macrorrhizos.

Materials and Methods: Successive extracts were prepared using solvents of increasing polarity and subjected to qualitative phytochemical screening. Antimicrobial activity was evaluated against *Staphylococcus aureus* and *Escherichia coli*, antioxidant activity was assessed using the DPPH assay, and cytotoxicity was evaluated against B16-F10 melanoma cells.

Results: Both plants contained alkaloids, flavonoids, terpenoids, saponins, phenolics, steroids, and glycosides, with variations according to solvent polarity. Petroleum ether extracts showed the highest antimicrobial activity, with inhibition zones up to 14 mm. DPPH assay showed IC_{50} values of 8.71 µg/mL for C. esculenta and 10.91 µg/mL for A. macrorrhizos. Cytotoxicity studies showed dose-dependent activity, with petroleum ether extracts exhibiting IC_{50} values of 0.7342 µL/mL and 0.5957 µL/mL, respectively.

Conclusion: The findings demonstrate that C. esculenta and A. macrorrhizos, particularly their non-polar fractions, possess promising antioxidant, antimicrobial, and cytotoxic activities. These results support their traditional medicinal importance and warrant further phytochemical and pharmacological investigations.

1. INTRODUCTION

Medicinal plants play a vital global role as sources of therapeutic compounds, contributing significantly to traditional healing systems and modern drug development. With growing concerns over drug resistance, chronic diseases, and side effects of synthetic medicines, plant-based remedies offer safer, more accessible, and sustainable alternatives. Their rich phytochemical diversity continues to inspire the discovery of new antioxidant, antimicrobial, and anticancer agents worldwide. Plants have been used for therapeutic purposes since ancient times, with roots in China, India, and Egypt (Chopda & Mahajan, 2009).

Traditional remedies include dried plant parts, water, honey, tablets, tinctures, or lotions. Approximately 80% of individuals in developing countries depend on traditional medicines for their primary healthcare, as estimated by the World Health Organization (WHO) (Akerele, 1993). Traditional medicine utilizing medicinal plants is of significant interest to 33,000 million individuals in developing countries, prompting scientific research into the biologically active compounds in these remedies for treating infectious diseases (Perumal Samy & Ignacimuthu, 2000). Native plants from India have been essential for food, medicine, and religious practices since ancient times. They are practical, nutritious, and environmentally sustainable, fostering healthier living conditions without harming soil or human health (Sazada et al., 2009). Native plants are essential natural resources, requiring minimal water and fertilizer. India hosts 15,000 plant species, representing 6% of global diversity, but climate change and human activities currently threaten these species through exploitation (Mhaiskar et al., 2020). Herbs offer therapeutic benefits for liver, central nervous system, digestive, metabolism, and cardiovascular issues due to their medicinal properties and various biological functions (Arulmozhi et al., 2007). Thorough biological assessment of plant products is essential for developing new plant-based medications, emphasizing the bioactive components in traditional medicinal herbs (Bommakanti et al., 2023). The plants contain various active substances that may offer medicinal benefits, including antioxidant and antimicrobial properties (Sharma et al., 2021). The study focuses on leveraging indigenous plants for innovative treatments of various illnesses through pharmacological examination, aiming to integrate traditional medicinal plant use with evidence-based medicine, despite the limited use of many due to their chemical characteristics and biological activity (Padmaja et al., 2009). According to the WHO 2011 (Quality Control Methods for Medicinal Plant Materials World Health Organization Geneva, n.d.) phytochemicals are crucial in pharmacognostic studies for determining drug therapeutic potential, safety, and quality control. Plants generate bioactive phytomolecules crucial for ecological interactions and adaptation, which also have significant pharmacological effects on humans. Numerous contemporary drugs and therapies are derived from these compounds (Atanasov et al., 2021). Phytochemicals are biologically active, non-nutritive compounds in plants that enhance their color, flavor, and disease resistance (Kerr, 1974). These compounds are crucial for plant defence and offer important health benefits for human consumption.

Primary metabolites in plants are essential for cell formation and maintenance, while secondary metabolites, including volatile oils, aid specific plant species in environmental interactions and medicinal properties (Eissa et al., 2024). Bioactive substances like phenolics, flavonoids, terpenoids, and alkaloids are crucial in various fields like pharmacology, medicine, agriculture, and food business due to their diverse physiological reactions (Rivero-Montejo et al., 2021). Alkaloids are a diverse class of nitrogenous secondary metabolites found in many medicinal plants. They often have vigorous physiological activity, especially on the nervous system. (Collins et al., 2021). Plant alkaloids contribute to antimicrobial, analgesic, and anti-inflammatory effects, and also play a role in pain relief and fever reduction (Rashed et al., 2003). Terpenes, a diverse class of phytochemicals, are composed of isoprene units and have pharmacological properties like antibacterial, anti-inflammatory, anticancer, analgesic, antiviral, and neuroprotective actions in medicinal plants (Elshafie et al., 2023). Phenolic compounds, found in plants, significantly influence color, flavor, and taste. They have anti-inflammatory, antioxidant, and antihepatotoxic properties. Flavonoids, the largest group of naturally occurring phenols, are involved in nitrogen fixation and flower pigmentation. Over 5000 identified flavonoids are extracted from various plants (Samanta Amalesh, & Das Gouranga, 2011). Plant species contain high concentrations of saponins, amphipathic glycosides with a single structure and soap-like foaming when shaken in aqueous solutions (Mollejon & Tibe Chapter, 2019). Herbal medicines and medicinal plants, including their extracts with isolated chemical substances, show diverse biological activities useful in treating serious illnesses (Palanisamy et al., 2018). The plant Colocasia esculenta, commonly known as taro, is primarily cultivated for its edible corms and is classified within the Araceae family (Goncalves et al., 2013). Predominantly found in Southeast Asia, it thrives in tropical and subtropical climates and is known by various local names such as Arbi and Eddode (Li et al., 2014). Taro is recognized for its significant nutritional value, surpassing that of rice and other root vegetables, rich in essential nutrients, while its corms are low in fat and protein but contain fiber, starch, and anthocyanins, which help alleviate stomach discomfort (M Alcantara, 2013), (Lewu et al., 2009). Additionally, C. esculenta possesses various pharmacological properties and has been utilized in traditional medicine for its chemical and biological constituents (Pereira et al., 2015).

This study focuses on isolating, characterizing, and evaluating the pharmacological potential of bioactive phytomolecules from specific indigenous medicinal plants, highlighting the lack of scientific validation for their phytochemical composition and pharmacological activities despite rich ethnobotanical knowledge

2. MATERIALS AND METHODS

2.1 Selection and Collection of Plant Material

The harvesting of Colocasia esculenta (Plant A) and Alocasia Macrorrhizos (palnt B) was conducted during their flowering stages in specific villages (Mendes et al., 2017). The harvested plant material was dried and ground into a powder to ensure optimal levels of active ingredients (Arnold & Schepers, 2004). The powder, weighing 500 gm, was stored in glass containers to maintain its quality (Salminen, 2003). Selected solvents for extraction included polar options like water, methanol, and ethanol, and nonpolar options such as hexane and dichloromethane, with a total solvent system that comprised various compounds for effective extraction.

2.2 Phytochemical screening of Both Plant A and Plant B extracts

The phytochemical screening of both Plant A and Plant B extracts was conducted using a series of standard qualitative tests to identify major secondary metabolites such as alkaloids, glycosides, flavonoids, phenolic compounds, saponins, and tannins. For the detection of alkaloids, Dragendorff's and Mayer's reagent tests were used; the formation of reddish-brown and white precipitates respectively indicated the presence of alkaloids (S. Sasidharan, Y. Chen, D. Saravanan, K.M. Sundram, 2011), (Harborne, 1998) (Trease & Evans, 2002). Glycosides were tested using Ferric chloride and Keller-Killiani tests, where greenish-blue and reddish-brown colorations confirmed their presence (Sasidharan et al., 2011; Kokate, 2013). Flavonoids were confirmed through the Shinoda and Alkaline reagent tests, producing reddish-brown and yellowish-green colors respectively (Boham & Kocipai, 1994; Trease & Evans, 2002). Phenolic compounds were identified using Ferric chloride and Lead acetate tests, yielding greenish-blue coloration and white precipitate formation (Kokate, 2013). For saponins, both the Foam test and Hemolysis test were performed; the stable froth formation and hemolysis of red blood cells indicated positive results (S. Sasidharan, Y. Chen, D. Saravanan, K.M. Sundram, 2011, Trease & Evans, 2002). Tannins were detected through Ferric chloride and Gelatin tests, producing blue-green coloration and precipitate formation respectively (Harborne, 1998,). Additionally, complementary tests such as Hager's test for alkaloids, Alkaline reagent test for flavonoids, Lead acetate test for phenolic and tannin compounds, Foam test for saponins, and Salkowski's test for terpenoids and steroids were employed (Harborne, 1998). The qualitative results provided preliminary evidence of the diverse phytochemical composition in both plant extracts, supporting their potential pharmacological significance.

2.3 Antimicrobial study

The antimicrobial activity of Plant A and Plant B extracts was assessed using the agar well diffusion method against *Staphylococcus aureus* (ATCC 25923) and *Escherichia coli* (ATCC 25922), with erythromycin as the standard drug (Al-Kaf et al., 2019; Elmosallamy et al., 2021). Mueller–Hinton agar medium was prepared, sterilized at 121°C for 15 minutes, poured into Petri plates, and allowed to solidify. A stock solution of 1000 μg/mL was prepared by dissolving 10 mg of each plant extract in DMSO, filtered through a 0.2 μm membrane. The bacterial inoculum was evenly spread on the agar surface, wells were bored, and 100 μL of each sample was added. Plates were incubated at 37°C for 18–24 hours, and zones of inhibition around the wells were measured to evaluate the antimicrobial potential of the extracts compared to the standard.

Table 1. Sample code for Extract of Plant A and B

Solvent System	Sample code for Extract of Plant A	Sample code for Extract of Plant
Petroleum ether	Extract A1	Extract B1
n- Hexane	Extract A2	Extract B2
Diethyl Ether	Extract A3	Extract B3
Ethyl acetate	Extract A4	Extract B4
Dichloroethane	Extract A5	Extract B5
Ethanol	Extract A6	Extract B6
Aqueous	Extract A7	Extract B7

2.4 Antioxidant Activity

The antioxidant activity of both Plant A and Plant B extracts was evaluated using the DPPH (2,2-diphenyl-1-picrylhydrazyl) radical scavenging assay following the method of (Rahman et al., 2012). The required materials included DPPH reagent (Sigma-Aldrich), methanol (HPLC grade), a UV-Vis spectrophotometer (Shimadzu UV-1800), quartz cuvettes, and a microplate reader. Ascorbic acid was used as the standard, and fourteen successive extracts of each plant served as test samples. A 0.025 mg/mL DPPH solution was prepared by dissolving 2.5 mg of DPPH in 100 mL of methanol. Standard ascorbic acid solutions (0.1–1.0 mM) and test extract solutions (0.1–1.0 mg/mL) were also prepared. In the assay, 1 mL of DPPH solution was mixed with 1 mL of either the test or standard solution and incubated at room temperature for 30 minutes. The absorbance was measured at 517 nm using a UV-Vis spectrophotometer. The percentage antioxidant activity was calculated as

$$\text{Antioxidant activity (\%)} = [(\text{A control} - \text{A sample}) / \text{A control}] \times 100$$

where a decrease in absorbance indicated free radical scavenging. The IC_{50} value, representing the concentration required to inhibit 50% of DPPH radicals, was determined graphically (R, Jyothi, M, 2018).

The IC_{50} value (concentration required to inhibit 50% of DPPH radicals) was determined graphically or using the formula:

$$IC_{50} = (\text{Log}(EC_{50}) - \text{Log}(50)) / (\text{Log}(100 - Y) - \text{Log}(Y))$$

This method is widely recognized for assessing antioxidant capacity in herbal formulations and plant extracts (Nugroho et al., 2025).

2.5 Cytotoxicity Evaluation Using MTT Assay

The cytotoxic potential of the plant extracts was evaluated using the MTT assay on B16-F10 melanoma cells. The cells were cultured in Dulbecco's Modified Eagle Medium (DMEM) supplemented with non-essential amino acids (NEAA) and 10% fetal bovine serum, maintained at 37 °C in a humidified 5% CO_2 atmosphere with medium renewal every 2–3 days to ensure healthy growth (Danciu et al., 2013). For the assay, cells were seeded in 96-well plates at a density of 1×10^5 cells/well and incubated for 24 hours. After reaching half confluence, the medium was replaced with fresh medium containing nine concentrations of the test extract, while control wells received only the culture medium. Following another 24-hour incubation, cells were examined microscopically for morphological changes, after which 10 µL of MTT reagent (5 mg/mL in PBS) was added to each well and incubated for 4 hours at 37 °C to allow formazan formation. The medium was then replaced with 100 µL of DMSO to dissolve the formazan crystals, and absorbance was recorded at 570 nm using a microplate reader. Cell viability (%) was calculated as

% Cell Survival = (Absorbance of Test / Absorbance of Control) × 100

and the IC_{50} value, indicating the concentration required to inhibit 50% of cell growth, was determined from the dose–response curve using logarithmic regression analysis.

3. RESULTS

3.1 Phytochemical Analysis

The preliminary phytochemical screening of Plant A and Plant B revealed notable differences in the distribution of bioactive compounds across various solvent extracts. In Plant A, alkaloids and saponins were present mainly in the methanol and aqueous extracts, indicating their high affinity for polar solvents. Flavonoids appeared only in the ethyl acetate extract, while tannins, phenolics, and glycosides were detected exclusively in the dichloroethane extract, reflecting moderate polarity. Terpenoids and steroids were widespread across non-polar to polar extracts, suggesting their broad solubility range. In contrast, Plant B exhibited a richer and more diverse phytochemical profile across multiple solvents. Alkaloids, flavonoids, tannins, saponins, phenolic compounds, and glycosides were detected in several extracts, particularly diethyl ether, ethyl acetate, methanol, and water, indicating a broader distribution of both polar and non-polar constituents. Terpenoids and steroids were also present in multiple extracts, similar to Plant A. Overall, Plant B showed greater phytochemical diversity across solvents, whereas Plant A displayed more selective distribution of constituents tied to specific polarity ranges.

3.2 Antimicrobial Activity

The antibacterial activity of extracts from Plant A and Plant B against *Staphylococcus aureus* and *E. coli* demonstrated varying inhibition levels depending on the solvent used. For *Staphylococcus* aureus, petroleum ether extracts yielded the highest inhibition (14±0.1 mm) for both plants, nearing the standard (17±0.1 mm), with Plant A performing slightly better in non-polar solvents. In contrast, Plant B showed superior inhibition in ethyl acetate and dichloroethane extracts. Against *E. coli*, the highest inhibition was also observed in petroleum ether extracts (14±0.2mm) but was lower than the standard (19±0.3 mm), with Plant B exhibiting slightly better activity in n-hexane and aqueous solvents. Overall, the findings indicate solvent-dependence in antimicrobial activity, with both plants showing moderate to strong effects, particularly in petroleum ether and n-hexane extracts. As shown in figure 1,2 and 3.

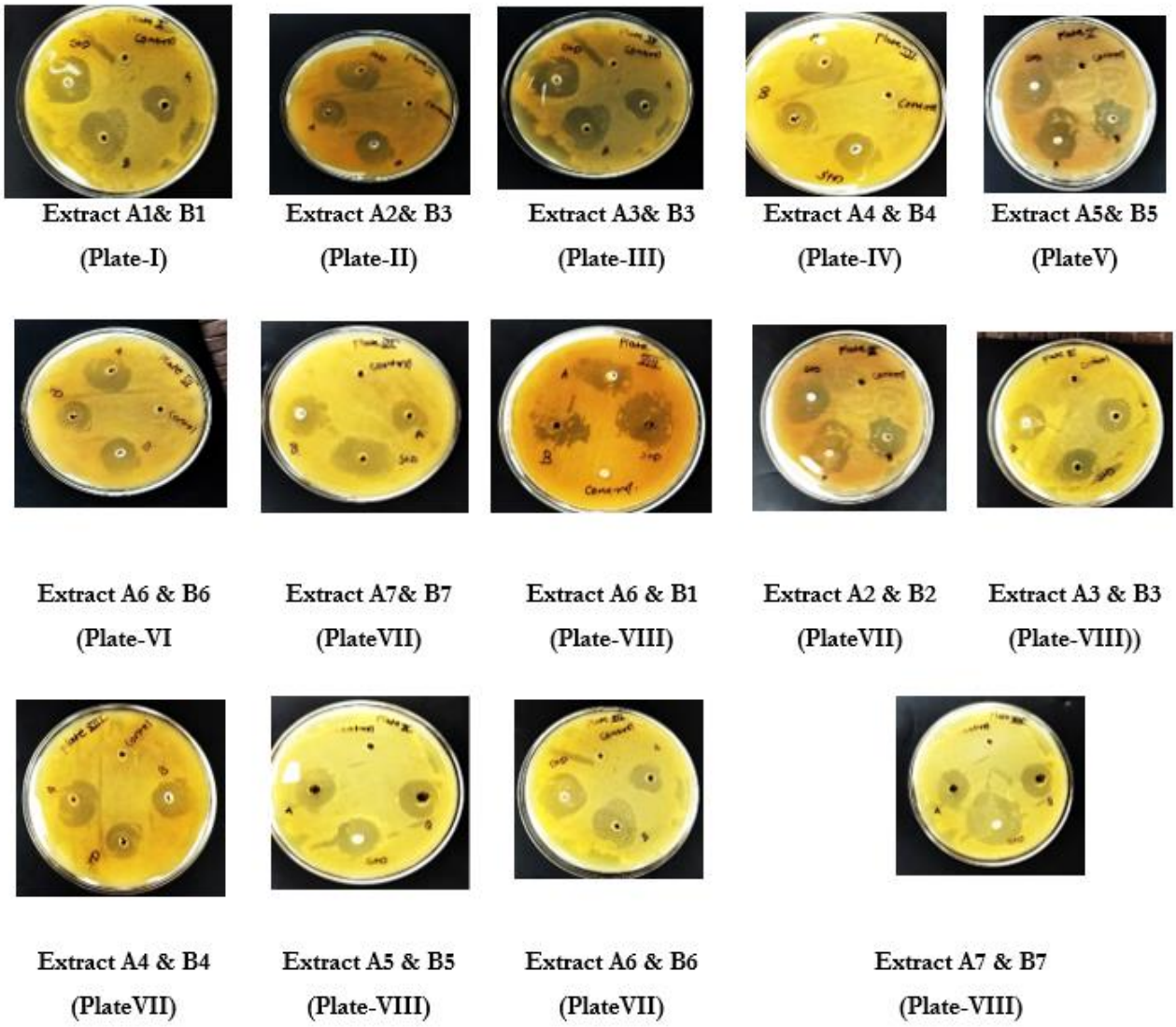

Figure 1: Antimicrobial activity of 01-14 Extract samples against *Staphylococcus aureus* & *E. coil*

Natural Resources for Human Health
eISSN: 2583-1194

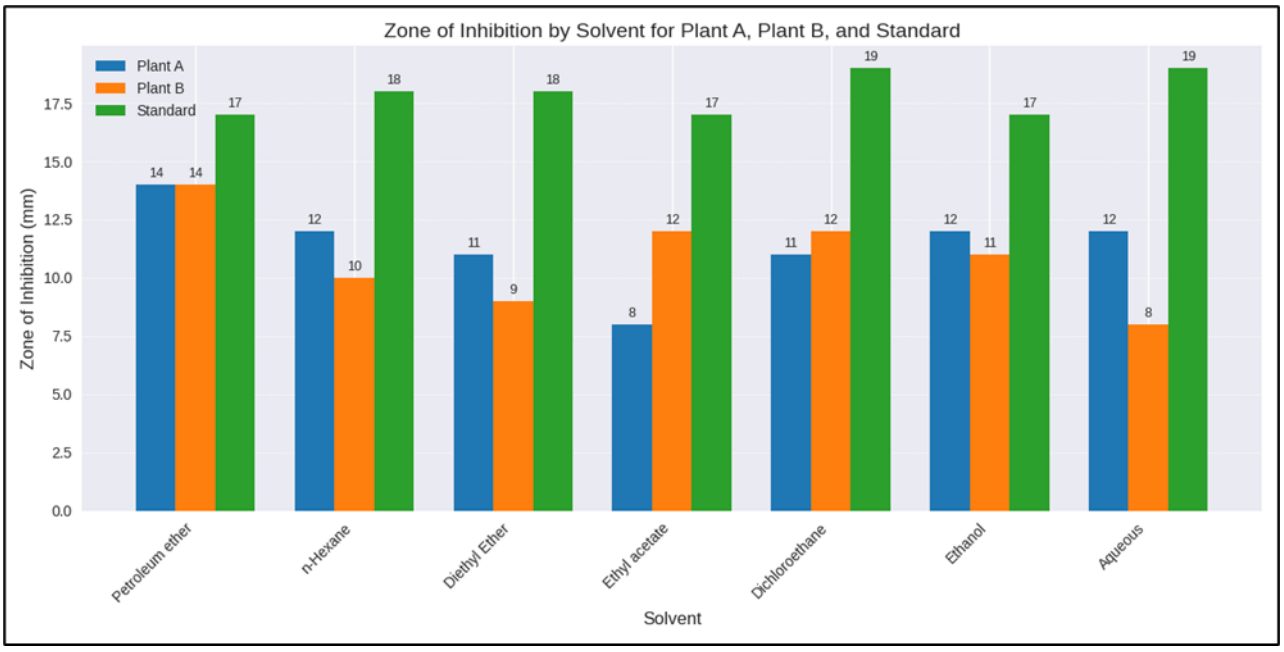

Figure 2: Graphical presentation antimicrobial activity of 01-14 Extract samples against (*Staphylococcus aureus*)

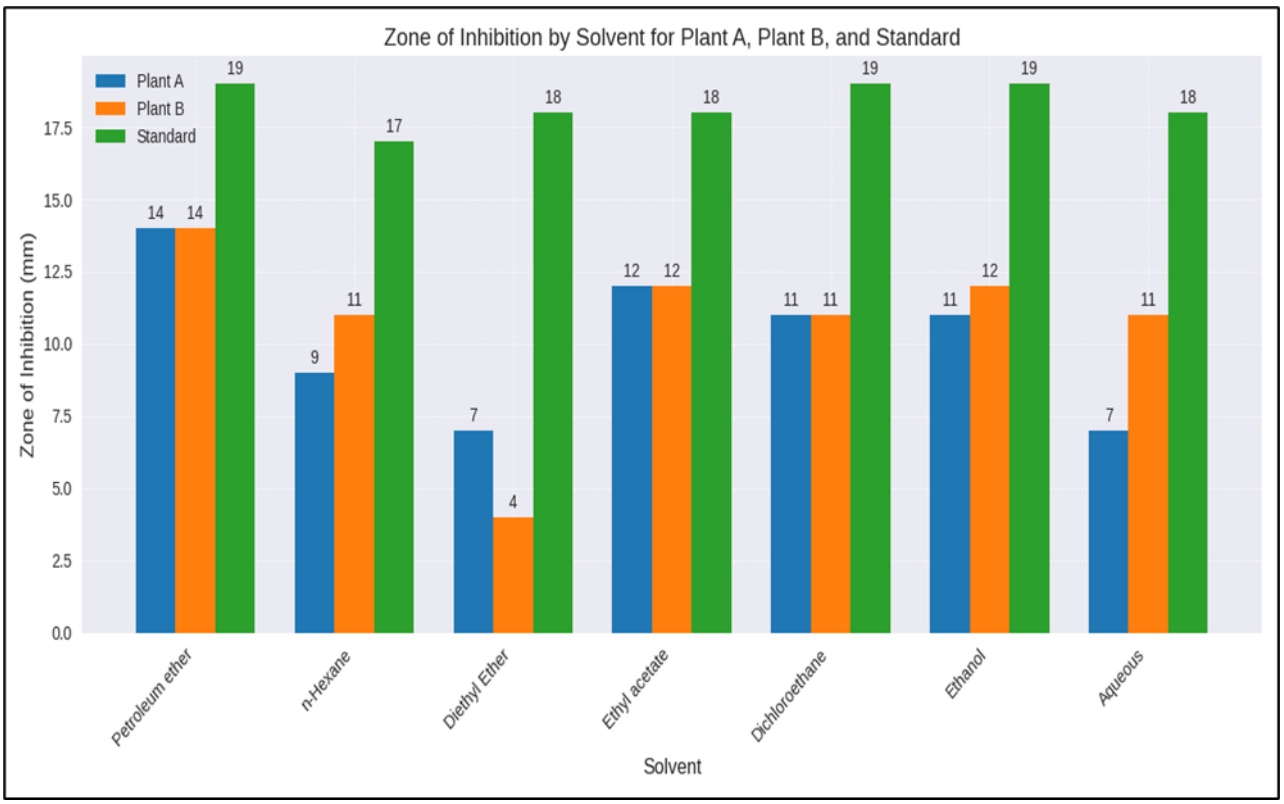

Figure 3: Graphical presentation antimicrobial activity of 01-14 Extract samples against (*E. Coli*)

Both Plant A and Plant B demonstrated antimicrobial activity against *Staphylococcus aureus* and *E. coli*, with inhibition zones between 7–14 mm. Petroleum ether extracts exhibited the strongest antibacterial effects (14±0.2 mm). Other solvents showed moderate effects, while aqueous and diethyl ether extracts were weaker. Statistical analysis indicated no significant difference in mean inhibition zones between the two plants ($p = 0.79$). Solvent type influenced activity for *E. coli*, and plant source affected

results for both. Petroleum ether extracts showed the highest antibacterial potential, emphasizing the need for careful selection of plant species and solvents in developing antimicrobial agents.

3.3 Antioxidant Activity

The DPPH assay results indicate that both Plant A and Plant B possess antioxidant activity, with varying effectiveness based on the extraction solvent. Plant A showed the highest potential in petroleum ether (IC_{50} = 8.71 µg/mL) and ethyl acetate (IC_{50} = 14.19 µg/mL), indicating strong free radical scavenging. Plant B also demonstrated notable activity in petroleum ether (IC_{50} = 10.91 µg/mL), but generally had weaker antioxidant effects in other solvents. Extracts from diethyl ether and aqueous solvents had higher IC_{50} values (> 60 µg/mL), indicating lower efficiency. Overall, petroleum ether extracts were the most effective for both plants, with Plant A consistently showing greater scavenging activity across different solvent fractions. As shown in figure 4.

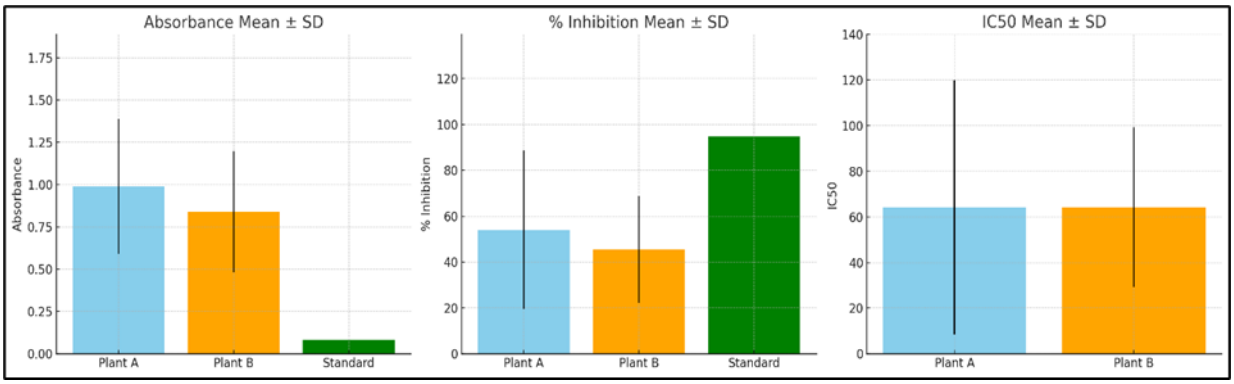

Figure 4: Mean and SD of Absorbance, %Inhibition, and IC_{50} for Plant A, Plant B, and Standard

The antioxidant analysis revealed that both Plant A and Plant B show significant free-radical scavenging activity, with petroleum ether extracts being the most potent. Plant A's extract (A1) demonstrated the highest antioxidant effect, with an IC_{50} value of 8.71 µg/mL, while Plant B's extract (B1) had an IC_{50} of 10.91 µg/mL. Despite Plant A showing slightly better absorbance and % inhibition, statistical analysis indicated no significant differences between the two plants ($p > 0.05$). Petroleum ether was confirmed as the optimal solvent for extracting antioxidant compounds, surpassing other solvents. Overall, both plants exhibit valuable antioxidant properties, with Plant A marginally stronger yet statistically comparable to Plant B.

3.4 Cytotoxicity Evaluation Using MTT Assay

The MTT assay demonstrated that both Plant A and Plant B exhibit cytotoxic activity in a dose-dependent manner, with the level of potency varying significantly according to the extraction solvent used. For Plant A, the petroleum ether extract showed the strongest cytotoxic effect with the lowest IC_{50} value (0.7342 µL/mL), indicating high anticancer potential at very low concentrations. Other solvents such as n-hexane (IC_{50} = 36.50 µL/mL), dichloroethane (IC_{50} = 33.34 µL/mL), and ethanol (IC_{50} = 18.66 µL/mL) also exhibited moderate to strong cytotoxicity. In contrast, extracts prepared with ethyl acetate, diethyl ether, and water showed weak cytotoxicity, reflected in exceptionally high IC_{50} values. Similarly, for Plant B, the petroleum ether extract demonstrated the highest cytotoxic potency with the lowest IC_{50} value (0.5957 µL/mL), followed by n-hexane (1.169 µL/mL) and diethyl ether (1.608×10^{-7} µL/mL), all indicating strong inhibition of cell viability. Ethyl acetate (IC_{50} = 3.942 µL/mL) and dichloroethane (IC_{50} = 36.50 µL/mL) extracts showed moderate activity, whereas ethanol and aqueous extracts displayed weaker cytotoxic responses with higher IC_{50} values. As shown in figure 5.

Overall, petroleum ether was identified as the most effective solvent for extracting cytotoxic compounds from both plants, producing the lowest IC_{50} values and therefore the strongest anticancer activity. These findings highlight the presence of potent non-polar bioactive constituents in both Plant A and Plant B, making petroleum ether extracts the most promising candidates for further anticancer investigations.

Natural Resources for Human Health
eISSN: 2583-1194

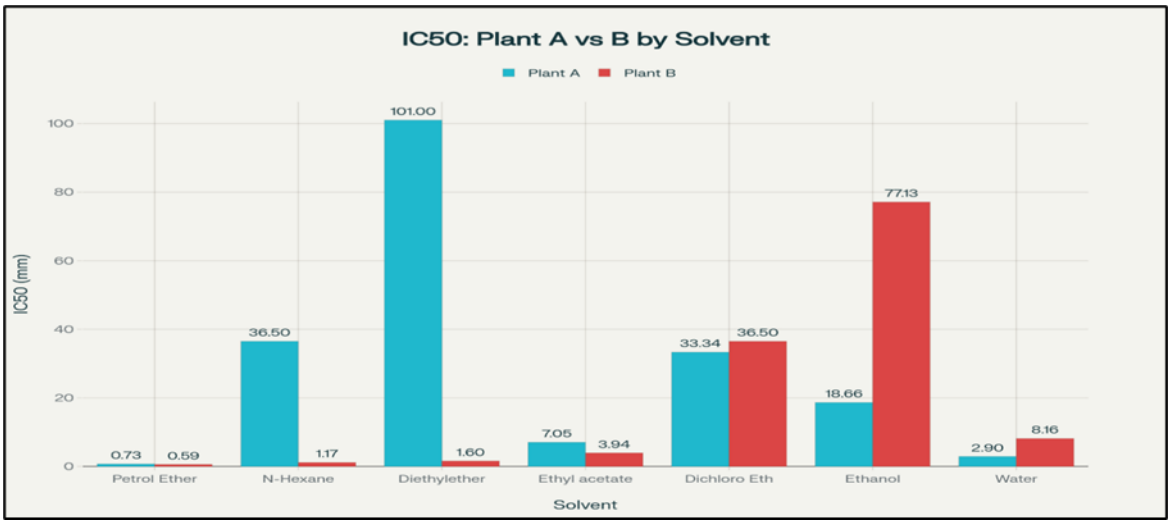

Figure 5: IC_{50} score to study the cytotoxicity in Plant A and Plant B among the various solvents

The comparative cytotoxicity evaluation of Plant A and Plant B across different solvent extracts shows that both plants possess anticancer potential, though the strength of activity varies considerably with solvent polarity. Petroleum ether emerged as the most potent extract for both plants, yielding the lowest IC_{50} values (0.73 µg/mL for Plant A and 0.59 µg/mL for Plant B), with a statistically significant difference between them ($p = 0.02$), indicating higher sensitivity of Plant B to non-polar cytotoxic constituents. Other solvents—such as n-hexane, diethyl ether, and ethyl acetate—showed noticeable differences in IC_{50} values between the two plants; however, these differences were not statistically significant when grouped overall ($p = 0.52$). ANOVA further revealed that solvent type had a strong influence on cytotoxic parameters (absorbance and cell survival) for both plants ($p < 0.05$), demonstrating that solvent polarity significantly affects extraction of bioactive compounds. Overall, while both plants exhibit comparable cytotoxicity profiles, petroleum ether extracts consistently show the strongest anticancer activity, highlighting non-polar phytochemicals as the primary contributors to cytotoxic effects in both Plant A and Plant B.

4. DISCUSSION

The findings of the present study provide strong evidence that Colocasia esculenta (Plant A) and Alocasia macrorrhizos (Plant B) possess significant pharmacological potential, as reflected in their phytochemical composition and biological activities. The preliminary phytochemical screening revealed the presence of diverse secondary metabolites, including alkaloids, flavonoids, terpenoids, steroids, saponins, phenolics, and glycosides, which are known contributors to antioxidant, antimicrobial, and cytotoxic effects. These variations in phytochemical distribution across solvents also highlight the influence of solvent polarity on phytochemical extraction efficiency. (S. Sasidharan, Y. Chen, D. Saravanan, K.M. Sundram, 2011) also used various methods like we used for phytochemical screening of secondary metabolites. Correspondingly, the biological assays antimicrobial, antioxidant, and cytotoxicity showed that both plants exhibited measurable activity, with petroleum ether consistently yielding the most potent extracts across all three evaluations. This indicates that key bioactive compounds in both species are predominantly non-polar in nature. Similar to our study (Mostafa et al., 2018) worked on antimicrobial activity of some plant extracts against bacterial strains. The antimicrobial properties of plant extracts were tested against *Bacillus cereus*, *Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa*, and *Salmonella typhi* using an agar disc diffusion method. Ethanolic extracts from Punica granatum and Syzygium aromaticum exhibited significant antibacterial activity, particularly against *S. aureus* and *P. aeruginosa*, with minimum inhibitory concentrations ranging from 2.5 to 5.0 mg/ml. These findings suggest that these plant extracts could serve as effective natural preservatives, mitigating the health risks associated with chemical agents. (Khalid et al., 2022) worked on antioxidant, antimicrobial, and anticancer activities of Sisymbrium officinale plant extract. The research assessed its total phenolic and flavonoid contents, as well as its antioxidant, antimicrobial, and anticancer activities. The plant was sourced from a local market, extracted using 99% ethanol and ultrasonication, and tested against three bacteria: two gram-positive (*Streptococcus and Staphylococcus*) and one gram-negative (*E. coli*). Results indicated that S. officinale is rich in polyphenols and flavonoids, exhibiting significant antioxidant activity (DPPH inhibition of 193.7 ± 3.4) and strong antimicrobial effects (inhibition zones of 10 mm against *E. coli* and 14 mm against *Streptococcus*).

Together, these results align with earlier reports on the medicinal significance of *Araceae* family plants and reinforce the potential of these indigenous species as sources of natural therapeutic agents.

5. CONCLUSION

The current study shows that Colocasia esculenta (Plant A) and Alocasia macrorrhizos (Plant B) have great pharmacological potential, as evidenced by their unique phytochemical profiles and detectable antioxidant, antibacterial, and cytotoxic properties. Both plants had broad-spectrum antibacterial activity, with petroleum ether extracts showing the greatest suppression against Staphylococcus aureus and E. coli. The antioxidant test demonstrated substantial free-radical scavenging activity, notably in the petroleum ether fractions, with Plant A showing somewhat higher potency but no statistical difference from Plant B. Cytotoxicity testing revealed that non-polar extracts, particularly petroleum ether, had the highest anticancer activity, indicating the presence of significant bioactive components. Overall, our findings support the traditional applications of these indigenous plants and highlight their potential as natural antioxidant, antibacterial, and anticancer agents. More isolation, characterisation, and mechanistic research are needed to advance their medicinal utility.

ACKNOWLEDGEMENTS

Authors are thankful to Principal, Rajgad Dnyanpeeth's College of Pharmacy, Bhor, Pune (Maharashtra) for providing necessary facilities to carry out the research work.

AUTHOR CONTRIBUTIONS

Sarang S. Mahamuni: Conceptualization, Investigation, Methodology, Laboratory Analysis.

Dipak P. Kardile: Data Curation, Formal Analysis, Supervision, Writing—Review & Editing.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ETHICS STATEMENT

Ethical approval was not required for this study.

DATA AVAILABILITY STATEMENT

Data supporting the findings of this study are available from the corresponding author upon reasonable request.

REFERENCES

[1] Chopda, M.Z., Mahajan, R.T., 2009. Wound healing plants of Jalgaon district of Maharashtra state, India. *Ethnobotanical Leaflets* 13, 1–32.

[2] Akerele, O., 1993. Nature's medicinal bounty: Don't throw it away. *World Health Forum* 14, 390–395.

[3] Perumal Samy, R., Ignacimuthu, S., 2000. Antibacterial activity of folklore medicinal plants used by tribals in Western Ghats of India. *Journal of Ethnopharmacology* 69, 63–71. doi:10.1016/S0378-8741(98)00156-1.

[4] Sazada, S., Verma, A., Rather, A.A., Jabeen, F., Meghvansi, M.K., 2009. Preliminary phytochemical analysis of some medicinal and aromatic plants. *Advances in Biological Research* 3, 188–195.

[5] Mhaiskar, M.N., 2020. An assessment of native plants and their medicinal uses. *International Journal of Research and Analytical Reviews* 10, 30–34.

[6] Arulmozhi, S., Mazumder, P.M., Ashok, P., Narayanan, S.L., 2007. Pharmacological activities of Alstonia scholaris Linn. (Apocynaceae): A review. *Pharmacognosy Reviews* 1, 163–170.

[7] Bommakanti, V., Ajikumar, A.P., Sivi, C.M., Prakash, G., Mundanat, A.S., Ahmad, F., et al., 2023. An overview of herbal nutraceuticals: Extraction, formulation, therapeutic effects and potential toxicity. *Separations* 10, 177. doi:10.3390/separations10030177.

[8] Sharma, H., Rai, A.K., Dahiya, D., Chettri, R., Nigam, P.S., 2021. Exploring endophytes for in vitro synthesis of bioactive compounds similar to metabolites produced in vivo by host plants. *AIMS Microbiology* 7, 175–199. doi:10.3934/microbiol.2021012.

[9] Padmaja, V., Srisailam, K., Reddy, V.M., 2009. Pharmacognostic and preliminary phytochemical investigations on Holoptelea integrifolia. *Pharmacognosy Journal* 1, 71–74.
[10] World Health Organization, 1998. Quality control methods for medicinal plant materials. Geneva: WHO.
[11] Atanasov, A.G., Zotchev, S.B., Dirsch, V.M., Orhan, I.E., Banach, M., Rollinger, J.M., et al., 2021. Natural products in drug discovery: Advances and opportunities. *Nature Reviews Drug Discovery* 20, 200–216. doi:10.1038/s41573-020-00114-z.
[12] Kerr, M.W., 1974. Phytochemical methods. *Biochemical Society Transactions* 2, 756. doi:10.1042/bst0020756.
[13] Eissa, F.A., Kumosani, T.A., Barbour, E.K., Alshareef, N.O., El-Say, K.M., Moselhy, S.S., 2024. Phytochemical analysis of selected indigenous plants and essential oils by GC-MS for antibacterial, antiproliferative and anti-inflammatory activity. *Pharmacognosy Research* 16, 727–732. doi:10.5530/pres.16.4.84.
[14] Rivero-Montejo, S.J., Vargas-Hernandez, M., Torres-Pacheco, I., 2021. Nanoparticles as novel elicitors to improve bioactive compounds in plants. *Agriculture* 11, 134. doi:10.3390/agriculture11020134.
[15] Collins, S.P., Liu, D., Jenkins, C.A., Storrow, A.B., Levy, P.D., Pang, P.S., et al., 2021. Effect of a self-care intervention on 90-day outcomes in patients with acute heart failure discharged from the emergency department: A randomized clinical trial. *JAMA Cardiology* 6, 200–208. doi:10.1001/jamacardio.2020.5763.
[16] Rashed, A.N., Afifi, F.U., Disi, A.M., 2003. Simple evaluation of the wound healing activity of a crude extract of Portulaca oleracea in mice. *Journal of Ethnopharmacology* 88, 131–136. doi:10.1016/S0378-8741(03)00194-6.
[17] Elshafie, H.S., Camele, I., Mohamed, A.A., 2023. A comprehensive review on the biological, agricultural and pharmaceutical properties of plant secondary metabolites. *International Journal of Molecular Sciences* 24, 3266. doi:10.3390/ijms24043266.
[18] Samanta, A., Das, G., Das, S.K., 2011. Roles of flavonoids in plants. *International Journal of Pharmaceutical Sciences and Technology* 6, 12–35.
[19] Mollejon, C.V., 2019. Nutritional and nutraceutical content of Alocasia macrorrhizos. 7, 584–652.
[20] Palanisamy, P., Bakthavatchalam, P., Karthikeyan, M., Gnanasekaran, A., Basalingappa, K.M., 2018. Taro (Colocasia esculenta): An overview. *Journal of Medicinal Plants Studies* 6, 156–161.
[21] Goncalves, R.F., Silva, A.M.S., Silva, A.M., Valentao, P., Ferreres, F., Gil-Izquierdo, A., et al., 2013. Influence of taro (Colocasia esculenta L. Schott) growth conditions on phenolic composition and biological properties. *Food Chemistry* 141, 3480–3485. doi:10.1016/j.foodchem.2013.06.009.
[22] Li, H.M., Hwang, S.H., Kang, B.G., Hong, J.S., Lim, S.S., 2014. Inhibitory effects of Colocasia esculenta constituents on aldose reductase. *Molecules* 19, 13212–13224. doi:10.3390/molecules190913212.
[23] Alcantara, R.M., 2013. Nutritional value and phytochemical components of taro (Colocasia esculenta) powder and processed foods. *Journal of Nutrition & Food Sciences* 3, 207. doi:10.4172/2155-9600.1000207.
[24] Lewu, M.N., Adebola, P.O., Afolayan, A.J., 2009. Effect of cooking on proximate composition of seven accessions of Colocasia esculenta tubers. *International Journal of Food Sciences and Nutrition* 60, 81–86. doi:10.1080/09637480802477683.
[25] Pereira, P.R., Silva, J.T., Vericimo, M.A., Paschoalin, V.M.F., Teixeira, G.A.P.B., 2015. Crude extract from taro (Colocasia esculenta) as a natural source of bioactive proteins stimulating haematopoietic cells. *Journal of Functional Foods* 18, 333–343. doi:10.1016/j.jff.2015.07.014.
[26] Mendes, D.S., Pereira, M.C.T., Nietsche, S., Silva, J.F., Rocha, J.S., Mendes, A.H., et al., 2017. Phenological characterization and temperature requirements of Annona squamosa L. in Brazilian semiarid region. *Anais da Academia Brasileira de Ciências* 89, 2293–2304. doi:10.1590/0001-3765201720170205.
[27] Arnold, S.L., Schepers, J.S., 2004. A simple roller-mill grinding procedure for plant and soil samples. *Communications in Soil Science and Plant Analysis* 35, 537–545. doi:10.1081/CSS-120029730.
[28] Salminen, J.P., 2003. Effects of drying, storage, extraction solvent and analysis method on yield of birch leaf hydrolysable tannins. *Journal of Chemical Ecology* 29, 1289–1305. doi:10.1023/A:1024249016741.
[29] Sasidharan, S., Chen, Y., Saravanan, D., Sundram, K.M., Latha, L.Y., 2011. Extraction, isolation and characterization of bioactive compounds from plant extracts. *African Journal of Traditional, Complementary and Alternative Medicines* 8, 1–10.
[30] Harborne, A.J., 1998. Phytochemical methods: A guide to modern techniques of plant analysis, 3rd ed. Springer, London.
[31] Evans, W.C., 2002. Trease and Evans pharmacognosy, 15th ed. W.B. Saunders, Edinburgh.

[32] Kokate, C.K., Purohit, A.P., Gokhale, S.B., 2013. Pharmacognosy, 47th ed. Nirali Prakashan, Pune.

[33] Boham, A.B., Kocipai, A.C., 1994. Flavonoid and condensed tannins from leaves of Hawaiian Vaccinium and Vicalycinium vaticulum. *Pacific Science* 48, 458–463.

[34] Al-Kaf, A.G., Taj Al-Deen, A.M., ALhaidari, S.A.A., Al-Hadi, F.A., 2019. Phytochemical analysis and antimicrobial activity of Colocasia esculenta (taro) medicinal plant leaves used in folk medicine for treatment of wounds and burns in Hufash District Al Mahweet Governorate–Yemen. *Universal Journal of Pharmaceutical Research* 4(2). doi:10.22270/ujpr.v4i2.254.

[35] Elmosallamy, A., Eltawil, N., Ibrahim, S., Hussein, S.A.A., 2021. Phenolic profile: Antimicrobial activity and antioxidant capacity of Colocasia esculenta (L.) Schott. *Egyptian Journal of Chemistry* 64(4), 2165–2172. doi:10.21608/ejchem.2021.56495.3213.

[36] Rahman, M.M., Hossain, M.A., Siddique, S.A., Biplab, K.P., Uddin, M.H., 2012. Antihyperglycemic, antioxidant and cytotoxic activities of Alocasia macrorrhizos rhizome extract. *Turkish Journal of Biology* 36, 574–579. doi:10.3906/biy-1112-11.

[37] Jyothi, R., Muthukumar, S.M.K., 2018. Assessment of antioxidants and phytoactives in extracts of Colocasia esculenta. *International Journal of Trend in Scientific Research and Development* 2, 2887–2893. doi:10.31142/ijtsrd15731.

[38] Nugroho, G., Desmiaty, Y., Sumiyati, Y., Suherman, S., Lim, H., 2025. Phenolic content and antioxidant activity of Colocasia esculenta in commercial herbal products. *Scientific Phytochemistry* 4, 33–39. doi:10.58920/sciphy0401288.

[39] Danciu, C., Falamas, A., Dehelean, C., Soica, C., Radeke, H., Barbu-Tudoran, L., et al., 2013. Characterization of four B16 murine melanoma cell sublines: Molecular fingerprint and proliferation behavior. *Cancer Cell International* 13, 75. doi:10.1186/1475-2867-13-75.

[40] Mostafa, A.A., Al-Askar, A.A., Almaary, K.S., Dawoud, T.M., Sholkamy, E.N., Bakri, M.M., 2018. Antimicrobial activity of some plant extracts against bacterial strains causing food poisoning diseases. *Saudi Journal of Biological Sciences* 25, 361–366. doi:10.1016/j.sjbs.2017.02.004.

[41] Khalid, M., Amayreh, M., Sanduka, S., Salah, Z., Al-Rimawi, F., Al-Mazaideh, G.M., et al., 2022. Assessment of antioxidant, antimicrobial and anticancer activities of Sisymbrium officinale plant extract. *Heliyon* 8, e10477. doi:10.1016/j.heliyon.2022.e10477.