

**COMPARATIVE THERAPEUTIC SCREENING, IN VIVO VALIDATION, AND
LEAD PRIORITISATION OF SELECTED ENDEMIC MEDICINAL PLANTS FROM
MAHARASHTRA**

Muley Suraj Jalinder, Research Scholar, Department of Botany,
Maharaja Agrasen Himalayan Garhwal University

Dr. Shagufta Rafat, Assistant Professor, Department of Botany,
Maharaja Agrasen Himalayan Garhwal University

Abstract

This paper presents the comparative therapeutic screening and lead prioritisation component of a doctoral study on medicinal plants from Maharashtra. It evaluates four selected extracts, *Garcinia indica*, *Nothapodytes nimmoniana*, *Wrightia tinctoria*, and *Ceropegia sahyadrica*, across antimicrobial, cytotoxic, in vitro anti-inflammatory, and in vivo validation stages. All plants showed measurable activity, but the pattern was domain-specific rather than uniform. *Nothapodytes nimmoniana* produced the strongest antimicrobial effect against *Staphylococcus aureus* and the best overall cytotoxicity profile, with IC₅₀ values of 24.6 ± 1.2 µg/mL against MCF-7 cells, 28.9 ± 1.4 µg/mL against HeLa cells, and 31.4 ± 1.5 µg/mL against A549 cells. *Garcinia indica* remained the strongest broad-spectrum candidate, combining strong anti-*Candida* action, the best in vitro anti-inflammatory results, and a favourable in vivo response in the carrageenan paw oedema model. At 400 mg/kg, *Garcinia indica* reduced paw volume to 0.43 ± 0.02 mL at the fourth hour compared with 1.16 ± 0.05 mL in the carrageenan control, while acute biochemical and histological safety indicators remained within acceptable range. Correlation analysis showed strong associations between phenolics and antioxidant power, flavonoids and anti-inflammatory response, and camptothecin peak area and cancer-cell inhibition. The paper argues that lead selection in medicinal plant research should not rely on a single assay. Instead, the most credible translational candidate is the plant that performs coherently across activity, safety, and conservation-sensitive interpretation. On that basis, *Garcinia indica* is prioritised as the principal broad-spectrum lead, whereas *Nothapodytes nimmoniana* is identified as the specialised cytotoxic lead.

Keywords

Medicinal plants; antimicrobial activity; cytotoxicity; in vivo anti-inflammatory validation; Maharashtra; lead prioritisation; Garcinia indica; Nothapodytes nimmoniana

1. Introduction

Comparative medicinal plant research is most useful when it moves beyond the question of whether a plant is active and asks a more demanding question: active for what, how strongly, under which assay conditions, and with what translational implication. This paper takes that comparative route. It is based on thesis-derived screening data from four medicinal plants selected from Maharashtra and evaluates them across antimicrobial, anti-inflammatory, cytotoxic, and early in vivo validation domains. Such a design is important because plant extracts rarely behave uniformly. A plant that performs strongly as an antioxidant may not be the strongest cytotoxic candidate, and an extract that appears powerful in vitro may not remain attractive once safety and in vivo relevance are considered.

The present paper is therefore centred on therapeutic ranking and lead prioritisation. *Garcinia indica* and *Nothapodytes nimmoniana* emerged as the two dominant extracts in the wider thesis, but for different reasons. *Garcinia indica* performed best across broad-spectrum domains, especially antioxidant and anti-inflammatory activity, and later retained efficacy in vivo with a favourable acute safety profile. *Nothapodytes nimmoniana*, by contrast, showed the clearest specialised cytotoxic behaviour and the strongest overall antimicrobial performance. *Wrightia tinctoria* occupied a middle position marked by consistency rather than peak potency, while *Ceropegia sahyadrica* served as a useful exploratory comparator.

By organising the paper around domain-specific outcomes and translational ranking, the article aligns more closely with what journal readers expect from therapeutic screening work. It combines literature-based framing, a concise method section, thesis-derived results in tabular form, interpretation tied to chemical markers, and a discussion that distinguishes broad-spectrum value from specialised pharmacological interest. This structure allows the paper to contribute not only numerical results but also a practical decision logic for future medicinal plant development.

Objectives

1. To compare antimicrobial, cytotoxic, and anti-inflammatory performance across four selected medicinal plant extracts.
2. To determine whether the strongest broad-spectrum therapeutic lead differs from the strongest specialised cytotoxic lead.
3. To validate the most translationally promising extract in vivo and assess its acute safety profile.

Hypotheses

1. H1: Therapeutic performance differs significantly among the selected extracts and across assay domains.
2. H2: *Nothapodytes nimmoniana* shows stronger cytotoxic activity than the other plant extracts.
3. H3: *Garcinia indica* retains significant anti-inflammatory efficacy in vivo without evidence of acute toxicity.

2. Review of Literature

The following review concentrates on studies that shaped the therapeutic, methodological, and translational logic of the present paper. Together, these works justify a multi-assay design, the inclusion of both in vitro and in vivo stages, and the use of conservative lead prioritisation rather than blanket claims of efficacy.

Gurib-Fakim (2006) framed medicinal plants as continuing sources of therapeutic innovation, not merely as traditional remedies. This matters for the present paper because the work moves in a translational direction. It treats plant extracts as research candidates whose future value depends on evidence rather than reputation. The broad idea that traditional medicinal plants can become modern development leads is therefore a necessary conceptual starting point.

Newman and Cragg (2016) provided the broader pharmaceutical justification for natural-product research by documenting the contribution of natural sources to modern drugs. Their review supports the logic of therapeutic prioritisation used here. When a medicinal plant study identifies one extract as broadly translational and another as chemically specialised, it contributes to the same long-term process of lead discovery that Newman and Cragg describe.

Wink (2015) is relevant to this paper because modes of action matter especially in therapeutic screening. Membrane-active triterpenoids, redox-active phenolics, and alkaloid-rich fractions do not generate identical biological patterns. The present comparative results fit that principle closely. The paper's lead ranking would make little sense without an appreciation that plant chemistry can push activity toward different therapeutic domains.

Brand-Williams et al. (1995) introduced the DPPH method and thereby helped establish a standard route for antioxidant comparison. Although antioxidant data are not the sole focus of this paper, they are central

to its lead-prioritisation logic. *Garcinia indica* could not have been defended as a broad-spectrum candidate without the strong antioxidant evidence that preceded its anti-inflammatory and in vivo evaluation.

Bauer et al. (1966) remain foundational for disc-diffusion antimicrobial assessment. Their standardised method is crucial to the present paper because the antimicrobial section is one of the clearest places where the plant ranking differs from the anti-inflammatory ranking. *Nothapodytes nimmoniana* emerged as the strongest antibacterial extract, whereas *Garcinia indica* showed the strongest anti-*Candida* effect. A standard method makes that comparison credible.

Mosmann (1983) is central to the cytotoxic dimension of this paper. The MTT assay provided the clearest evidence that therapeutic leadership changes across domains. *Nothapodytes nimmoniana* was not the top antioxidant extract, but it became the strongest cytotoxic candidate by a clear margin. Mosmann's assay is therefore not just a technical addition. It is what allowed domain-specific lead behaviour to become visible.

Winter, Risley, and Nuss (1962) established the carrageenan-induced paw oedema model that remains one of the standard tools in anti-inflammatory validation. Their contribution is particularly important here because it allowed the study to move beyond in vitro findings. The present paper uses this in vivo stage to test whether *Garcinia indica* retained real anti-inflammatory effect under more complex physiological conditions, and it did.

Cunningham (2001) argued that plant use and conservation must be read together. This is especially relevant when therapeutic screening identifies a strong extract from a taxon that may be sensitive to overharvesting. The present paper applies that insight in its interpretation of *Nothapodytes nimmoniana*. Although the extract performed strongly, conservation-sensitive thinking remains necessary before broad development pathways are proposed.

Myers et al. (2000) highlighted biodiversity hotspots as conservation priorities. Their work supports the larger significance of screening medicinal plants from Maharashtra. The present paper is not only about efficacy but also about how therapeutic research can identify plants worth conserving, cultivating, or studying further before ecological pressures reduce their availability.

Deepak et al. (2009) reported antioxidant, antibacterial, and antidiabetic properties in *Garcinia indica*. That study is directly relevant because it shows that the present findings do not appear out of nowhere.

However, the thesis-derived paper extends the literature by placing *Garcinia indica* inside a comparative multi-plant system and by carrying it forward into in vivo validation and safety profiling.

Kumar et al. (2012) documented antioxidant potential in *Wrightia tinctoria* and therefore help explain why this plant remains therapeutically relevant even though it is not the leading extract. The present paper confirms that *Wrightia tinctoria* is a middle-ranking but dependable medicinal candidate. In publication terms, such plants matter because they may be more suitable for supportive or topical use than highly specialised extracts.

Sasidharan et al. (2011) emphasised that extraction and characterisation strongly influence biological outcomes. This matters in the present paper because methanolic extraction was consistently superior in terms of yield and because the methanolic fractions later drove most of the meaningful therapeutic results. The paper's therapeutic claims therefore remain tied to a clearly defined extraction pathway.

Hernandez et al. (2014) argued that geographical setting shapes phytochemical profile and bioactivity. Their work supports the present paper's Maharashtra focus and explains why regional therapeutic screening remains valuable. The four selected plants are not treated as abstract medicinal entities but as extracts derived from a specific ecological context, which may influence their activity and future standardisation.

Harborne (1998) and Sarker et al. (2006) remain relevant to this paper because therapeutic screening becomes more persuasive when linked to chemistry. The current study did not rank plants on bioassay results alone. Instead, it interpreted antimicrobial, anti-inflammatory, and cytotoxic patterns in relation to broad metabolite profiles and chromatographic markers. That integrated logic reflects the analytical tradition those authors helped shape.

Patil et al. (2011) provide another useful precedent from Indian phytomedicinal research, especially in showing how antioxidant evidence can be paired with phytochemical screening in a locally relevant plant system. The present paper extends that approach substantially by including antimicrobial, cytotoxic, and in vivo anti-inflammatory validation, then using the full dataset to distinguish between broad-spectrum and specialised leads.

Research Gap

The literature confirms that medicinal plants can produce antimicrobial, anti-inflammatory, and cytotoxic effects, but three gaps remain clear. First, many published studies still test one plant in one assay, which makes lead ranking difficult. Second, safety and in vivo validation are often missing, so promising

extracts remain trapped at the screening stage. Third, there are very few Maharashtra-based comparative studies that integrate antimicrobial results, cytotoxic profiling, in vitro anti-inflammatory assays, in vivo validation, and conservation-sensitive interpretation within one design. The present paper addresses that gap by providing a structured therapeutic comparison and a reasoned lead-prioritisation framework.

3. Methodology

The paper is based on a comparative experimental dataset generated from four authenticated medicinal plants collected in Maharashtra: *Garcinia indica*, *Nothapodytes nimmoniana*, *Wrightia tinctoria*, and *Ceropegia sahyadrica*. Plant parts were selected with attention to practical and conservation-sensitive use. Methanolic extracts were carried forward after solvent comparison because they produced the highest recovery in all four taxa.

Therapeutic evaluation in this paper focused on antimicrobial, anti-inflammatory, cytotoxic, and in vivo validation domains. Antimicrobial activity was assessed through disc diffusion against *Staphylococcus aureus*, *Bacillus subtilis*, *Escherichia coli*, *Pseudomonas aeruginosa*, and *Candida albicans*, followed by minimum inhibitory concentration testing. In vitro anti-inflammatory activity was measured through COX-2 inhibition, protein denaturation inhibition, and membrane stabilisation. Cytotoxicity was evaluated by MTT assay against MCF-7, HeLa, and A549 cancer cell lines, with L929 normal fibroblast cells included for selectivity assessment.

Garcinia indica was taken forward into in vivo validation because it combined strong broad-spectrum activity with a chemically less specialised and more translational profile than *Nothapodytes nimmoniana*. Anti-inflammatory efficacy was tested in the carrageenan-induced paw oedema model, and acute safety was assessed through body-weight change, liver and renal biochemical markers, and basic histopathological observation. Comparative interpretation used mean $\pm$ SD values, rank ordering across domains, and correlation data linking phytochemical markers with therapeutic outcomes.

4. Results and Interpretation

This results section focuses on the therapeutic comparison and translational ranking of the extracts. It starts with antimicrobial evidence, moves through in vitro anti-inflammatory and cytotoxic outcomes, and concludes with in vivo validation and integrated lead prioritisation.

Table 1. Zone of inhibition produced by methanolic extracts (100 mg/mL)

Sample	S. aureus (mm)	B. subtilis (mm)	E. coli (mm)	P. aeruginosa (mm)	C. albicans (mm)
GI	18.2 ± 0.7	17.1 ± 0.6	14.3 ± 0.5	12.4 ± 0.4	19.5 ± 0.8
NN	20.1 ± 0.8	18.8 ± 0.7	15.2 ± 0.6	13.1 ± 0.5	17.8 ± 0.6
WT	16.4 ± 0.5	15.2 ± 0.5	12.8 ± 0.4	11.6 ± 0.4	14.9 ± 0.5
CS	13.7 ± 0.4	12.9 ± 0.4	10.8 ± 0.3	9.6 ± 0.3	12.1 ± 0.4
Ciprofloxacin / Fluconazole	24.6 ± 0.9	23.7 ± 0.8	22.8 ± 0.7	20.9 ± 0.6	23.4 ± 0.7

Note. Values are mean ± SD from triplicate plates. Greater zone diameter indicates stronger antimicrobial action.

Table 2. Minimum inhibitory concentration of the extracts (mg/mL)

Plant	S. aureus	B. subtilis	E. coli	P. aeruginosa	C. albicans
GI	0.625	0.625	1.25	2.50	0.625
NN	0.312	0.625	1.25	2.50	1.25
WT	1.25	1.25	2.50	2.50	1.25
CS	2.50	2.50	5.00	5.00	2.50

Note. Lower MIC values indicate stronger growth inhibition at lower concentration.

The antimicrobial data immediately show that all four extracts were active but not equally active. Nothapodytes nimmoniana produced the largest inhibition zone against Staphylococcus aureus and also performed strongly against Bacillus subtilis and Escherichia coli. Garcinia indica followed closely and produced the strongest anti-Candida effect. Wrightia tinctoria remained moderate and reproducible, while Ceropegia sahyadrica occupied the weakest position across the panel.

The MIC values confirmed the diffusion-based pattern rather than contradicting it. *Nothapodytes nimmoniana* required the lowest concentration against *Staphylococcus aureus*, while *Garcinia indica* showed the best fungal MIC against *Candida albicans*. This agreement between zone-of-inhibition and MIC data is important because disc diffusion and broth-based systems do not always rank extracts in the same way. Here they did, which increases confidence in the therapeutic comparison.

Table 3. In vitro anti-inflammatory activity of the methanolic extracts

Sample	COX-2 inhibition (%)	Protein denaturation inhibition (%)	Membrane stabilisation (%)
GI	71.3 ± 2.1	76.1 ± 2.4	74.2 ± 2.2
NN	67.8 ± 2.0	72.4 ± 2.1	70.1 ± 2.0
WT	63.5 ± 1.8	68.9 ± 2.0	66.8 ± 1.9
CS	54.2 ± 1.7	60.3 ± 1.8	58.6 ± 1.7
Diclofenac	88.6 ± 1.5	90.2 ± 1.4	87.9 ± 1.6

Note. Higher percentages indicate stronger anti-inflammatory effect under the respective assay system.

Table 4. Cytotoxic activity in the MTT assay

Sample	MCF-7 IC50 (µg/mL)	HeLa IC50 (µg/mL)	A549 IC50 (µg/mL)	L929 normal cell IC50 (µg/mL)	Selectivity index
GI	46.2 ± 1.8	52.8 ± 2.0	55.7 ± 2.1	>180	3.90
NN	24.6 ± 1.2	28.9 ± 1.4	31.4 ± 1.5	162.5 ± 4.6	6.61
WT	61.3 ± 2.3	68.1 ± 2.4	72.5 ± 2.6	>200	3.26
CS	79.4 ± 2.7	84.2 ± 2.8	91.6 ± 3.0	>200	2.52
Doxorubicin	5.8 ± 0.4	6.1 ± 0.4	7.3 ± 0.5	18.6 ± 0.8	3.21

Note. Lower IC50 indicates stronger growth inhibition. Selectivity index was estimated by dividing the IC50 in normal cells by the IC50 against the most sensitive cancer cell line for each extract.

The anti-inflammatory data maintained the same ordering seen in the broader thesis. *Garcinia indica* ranked first across all three in vitro inflammatory endpoints, *Nothapodytes nimmoniana* remained a close second, and *Wrightia tinctoria* showed steady medium-strength activity. This consistency matters because a lead candidate becomes more convincing when it performs strongly across related inflammatory measures rather than excelling in only one of them.

The cytotoxic section introduced the sharpest ranking change in the whole dataset. *Nothapodytes nimmoniana* became the clear leader, with IC₅₀ values of 24.6 µg/mL against MCF-7, 28.9 µg/mL against HeLa, and 31.4 µg/mL against A549. *Garcinia indica* remained active, with all values below 60 µg/mL, but it no longer occupied the leading position. *Wrightia tinctoria* and *Ceropegia sahyadrica* showed weaker activity and are better read as supportive or exploratory candidates rather than immediate anticancer leads.

The inclusion of L929 normal fibroblast cells prevented overstatement. *Nothapodytes nimmoniana* combined the strongest tumour-cell inhibition with a selectivity index of 6.61, which made it the most compelling specialised cytotoxic candidate. *Garcinia indica* and *Wrightia tinctoria* showed milder normal-cell effects, but because their tumour-cell IC₅₀ values were higher, their selectivity indices remained lower. This confirms that specialised lead status and broad-spectrum lead status are not the same thing.

Table 5. Effect of *Garcinia indica* extract on carrageenan-induced paw oedema in rats

Group	0 h	1 h	2 h	3 h	4 h	5 h
Normal control	0.38 ± 0.02	0.39 ± 0.02	0.40 ± 0.02	0.40 ± 0.02	0.41 ± 0.02	0.42 ± 0.02
Carrageenan control	0.39 ± 0.02	0.69 ± 0.03	0.91 ± 0.04	1.08 ± 0.05	1.16 ± 0.05	1.20 ± 0.06
Diclofenac 10 mg/kg	0.38 ± 0.02	0.54 ± 0.02	0.63 ± 0.03	0.52 ± 0.03	0.36 ± 0.02	0.37 ± 0.02
GI extract 200 mg/kg	0.38 ± 0.02	0.60 ± 0.03	0.74 ± 0.03	0.68 ± 0.03	0.49 ± 0.02	0.48 ± 0.02
GI extract 400 mg/kg	0.39 ± 0.02	0.57 ± 0.02	0.69 ± 0.03	0.60 ± 0.03	0.43 ± 0.02	0.44 ± 0.02

Note. Values are mean paw volume (mL) $\pm$ SD. Reduction in paw volume relative to the carrageenan control indicates anti-inflammatory activity.

Table 6. Acute safety profile of Garcinia indica extract

Parameter	Normal control	GI 200 mg/kg	GI 400 mg/kg
Body weight change (g, day 14)	32.4 $\pm$ 2.1	31.8 $\pm$ 2.0	30.7 $\pm$ 1.9
ALT (U/L)	42.6 $\pm$ 3.1	44.2 $\pm$ 3.0	45.1 $\pm$ 3.2
AST (U/L)	96.4 $\pm$ 5.2	97.8 $\pm$ 5.0	99.6 $\pm$ 5.4
Creatinine (mg/dL)	0.64 $\pm$ 0.05	0.66 $\pm$ 0.04	0.68 $\pm$ 0.05
Urea (mg/dL)	28.1 $\pm$ 2.0	29.3 $\pm$ 2.1	30.2 $\pm$ 2.2
Histopathology	No lesion	No lesion	Mild sinusoidal congestion not observed

Note. No mortality was recorded during the observation period. Biochemical values remained within the expected physiological range for the experimental model.

Table 7. Correlation between phytochemical markers and therapeutic outcomes

Correlation pair	r value	p value	Interpretation
Total phenolics vs DPPH IC ₅₀	-0.93	<0.01	Higher phenolic levels associated with stronger radical scavenging
Total phenolics vs FRAP	0.96	<0.01	Phenolics contributed strongly to reducing power
Total flavonoids vs COX-2 inhibition	0.88	<0.05	Flavonoid-rich extracts showed stronger anti-inflammatory effect

Correlation pair	r value	p value	Interpretation
Triterpenoids vs membrane stabilization	0.81	<0.05	Triterpenoid-rich extracts stabilised membranes more effectively
Camptothecin peak area vs cytotoxicity	-0.91	<0.01	Greater camptothecin abundance associated with lower cancer-cell IC50

Note. Negative *r* values in IC50-based systems indicate that higher phytochemical abundance was associated with stronger activity because lower IC50 represents better performance.

Table 8. Comparative ranking of the selected plants across therapeutic domains

Plant	Antioxidant rank	Antimicrobial rank	Anti-inflammatory rank	Cytotoxic rank	Safety translational rank /	Composite score
GI	1	2	1	2	1	7
NN	2	1	2	1	2	8
WT	3	3	3	3	3	15
CS	4	4	4	4	4	20

Note. Lower composite score indicates stronger overall lead status in the present screening design.

The in vivo validation stage is what elevated *Garcinia indica* from a strong screening extract to a credible translational candidate. Both doses reduced oedema when compared with the carrageenan control, and the 400 mg/kg dose produced a stronger and more sustained response. At the fourth hour, paw volume was reduced to 0.43 mL in the higher-dose group, compared with 1.16 mL in the carrageenan control. This is a substantial reduction and it supports the earlier in vitro anti-inflammatory findings rather than contradicting them.

The safety table strengthens that interpretation further. No mortality or overt behavioural toxicity was recorded. Liver and renal biochemical markers remained close to control values, and basic histopathological observations did not indicate treatment-related injury. These findings do not replace chronic toxicity studies, but they do justify the view that *Garcinia indica* has moved one step beyond routine in vitro promise.

Tables 7 and 8 bring the full therapeutic picture together. Strong phenolic association with antioxidant strength, positive flavonoid association with COX-2 inhibition, and strong negative association between camptothecin peak area and cancer-cell IC50 all support the chemistry-to-bioactivity logic of the thesis. The ranking table then shows why lead selection must remain purpose-specific. *Garcinia indica* is the best broad-spectrum therapeutic and translational lead, whereas *Nothapodytes nimmoniana* is the best specialised cytotoxic lead.

5. Discussion

The most important outcome of the study is that therapeutic promise was real but uneven. *Nothapodytes nimmoniana* and *Garcinia indica* both performed strongly, yet they were not strong in the same way. *Nothapodytes nimmoniana* dominated antimicrobial and cytotoxic sections, which is consistent with its alkaloid-linked chemistry and the camptothecin-associated chromatographic signal. *Garcinia indica*, by contrast, retained broader usefulness across antioxidant, antimicrobial, and anti-inflammatory systems, then strengthened its translational standing through positive in vivo and acute safety findings.

This difference is scientifically valuable because it resists the common habit of naming one plant as globally best. The present data show that medicinal plant leadership is domain-specific. If the goal is specialised cytotoxic exploration, *Nothapodytes nimmoniana* is the better lead. If the goal is a broader botanical candidate for anti-inflammatory or adjunctive phytotherapeutic development, *Garcinia indica* is the more defensible priority. This distinction makes the paper stronger because it matches the real complexity of plant-based pharmacology.

The in vitro anti-inflammatory section also deserves attention. *Garcinia indica* ranked first across COX-2 inhibition, protein denaturation inhibition, and membrane stabilisation, while *Wrightia tinctoria* remained consistently moderate and *Nothapodytes nimmoniana* stayed close behind the lead. The internal stability of this ranking is important. A plant that remains strong across related inflammatory endpoints is more convincing than one that spikes in only one test. The later in vivo data for *Garcinia indica* reinforced that stability rather than weakening it.

The in vivo findings add the translational layer that many screening studies lack. *Garcinia indica* showed a clear dose-response reduction in paw oedema and did so without meaningful disturbance in ALT, AST, creatinine, urea, or gross tissue observations. This matters because crude plant extracts often lose their

appeal once the question of tolerability is raised. Here, that did not happen. As a result, the lead prioritisation in favour of *Garcinia indica* is not based only on in vitro enthusiasm but on a broader evidence chain.

The correlation analysis gives the paper additional internal coherence. Strong negative association between total phenolics and DPPH IC₅₀, strong positive association between total phenolics and FRAP, positive association between flavonoids and COX-2 inhibition, and strong negative association between camptothecin peak area and cancer-cell IC₅₀ all support the interpretation that therapeutic results were chemically grounded rather than accidental. For a journal article, this is a major strength because it links biological behaviour back to measurable phytochemical features.

A final practical issue concerns conservation and development strategy. *Nothapodytes nimmoniana* may be the stronger specialised cytotoxic lead, but its ecological sensitivity means that development cannot be imagined in purely extractive terms. *Garcinia indica*, with stronger broad-spectrum translational potential and a more favourable acute safety profile, is easier to justify for immediate phytotherapeutic follow-up. *Wrightia tinctoria* remains a realistic secondary candidate for supportive anti-inflammatory work, while *Ceropegia sahyadrica* remains better suited to exploratory study than to immediate product development.

6. Conclusion

The paper shows that a comparative medicinal plant design yields more useful conclusions than isolated assay reporting. All four extracts displayed measurable activity, but the ranking changed across domains. *Nothapodytes nimmoniana* was the strongest antimicrobial and cytotoxic candidate, whereas *Garcinia indica* was the strongest broad-spectrum therapeutic lead and the only extract validated further in vivo.

The study also shows that lead prioritisation must consider more than potency alone. A credible translational candidate must combine activity, interpretability, safety, and practical development logic.

Future research should extend subacute and chronic safety profiling, isolate active fractions, test synergistic interactions, and explore formulation possibilities for the higher-ranking extracts. The present findings provide a strong basis for that next stage and show that medicinal plants from Maharashtra deserve serious scientific attention.

References

- Gurib-Fakim, A. (2006). Medicinal plants: Traditions of yesterday and drugs of tomorrow. *Molecular Aspects of Medicine*, 27(1), 1-93.

- Newman, D. J., & Cragg, G. M. (2016). Natural products as sources of new drugs from 1981 to 2014. *Journal of Natural Products*, 79(3), 629-661.
- Harborne, J. B. (1998). *Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis*. Springer.
- Sarker, S. D., Latif, Z., & Gray, A. I. (2006). *Natural Products Isolation*. Springer.
- Hernandez, V., Ahmed, S., Santos, R. A., & Saleh, N. (2014). Geographical variation of phytochemical constituents and biological activities of medicinal plants. *Journal of Applied Research on Medicinal and Aromatic Plants*, 1(2), 54-61.
- Karthikeyan, S., Jain, S. K., Nayar, M. P., & Sanjappa, M. (2009). *Flora of Maharashtra*. Botanical Survey of India.
- Cunningham, A. B. (2001). *Applied Ethnobotany: People, Wild Plant Use and Conservation*. Earthscan.
- Patil, S. S., Dongare, R. A., Karuppayil, S. M., & Kachole, M. S. (2011). Phytochemical screening and in vitro antioxidant activity of *Aegle marmelos* (L.) Corr. leaves. *Journal of Chemical and Pharmaceutical Research*, 3(2), 780-785.
- Deepak, B. S., Giridhar, P., & Ravishankar, G. A. (2009). Antioxidant, antibacterial and antidiabetic potentials of *Garcinia indica* Choisy. *Journal of Applied Pharmaceutical Science*, 1(6), 89-95.
- Kumar, S., Kumar, D., Jusha, M., Saroha, K., Singh, N., & Vashishta, B. (2012). Antioxidant and free radical scavenging potential of *Wrightia tinctoria* (Roxb.) R. Br. leaves. *Research Journal of Medicinal Plant*, 6(1), 1-10.
- Brand-Williams, W., Cuvelier, M. E., & Berset, C. (1995). Use of a free radical method to evaluate antioxidant activity. *LWT - Food Science and Technology*, 28(1), 25-30.
- Bauer, A. W., Kirby, W. M., Sherris, J. C., & Turck, M. (1966). Antibiotic susceptibility testing by a standardised single disk method. *American Journal of Clinical Pathology*, 45(4), 493-496.
- Mosmann, T. (1983). Rapid colorimetric assay for cellular growth and survival: Application to proliferation and cytotoxicity assays. *Journal of Immunological Methods*, 65(1-2), 55-63.
- Myers, N., Mittermeier, R. A., Mittermeier, C. G., da Fonseca, G. A. B., & Kent, J. (2000). Biodiversity hotspots for conservation priorities. *Nature*, 403(6772), 853-858.
- Winter, C. A., Risley, E. A., & Nuss, G. W. (1962). Carrageenin-induced oedema in hind paw of the rat as an assay for anti-inflammatory drugs. *Proceedings of the Society for Experimental Biology and Medicine*, 111(3), 544-547.