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Physiological, Phytochemical and Antimicrobial Properties of Five Medicinal Plants from Mangaon tahsil of Raigad district

Shaikh Nilofer and Dr. Momin Raisuddin Kudbuddin
Department of Botany, Milliya College of Science,
Beed, Maharashtra, India.

Dr. Momin Raisuddin Kudbuddin,
Department of Botany, Milliya College of Science,
Beed, Maharashtra, India.
nilofershaikhnif@gmail.com

Abstract:

This study investigates the physiological, biochemical, and antimicrobial properties of five medicinal plants- *Carissa congesta, Ricinus communis, Tridax procumbens, Blumea lacera* and *Lagerstroemia indica* were collected from forest area of Mangaon Tahsil of Raigad District. Physiological parameters such as leaf area and chlorophyll content were measured. Biochemical constituents including phenolics, flavonoids, and alkaloids were quantified. Antimicrobial activity was assessed against *Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa* and *Candida albicans* using the agar well diffusion method. Results indicate significant variation among the plants, with *Ricinus communis* exhibiting the highest antimicrobial activity. These findings support the traditional medicinal use of these plants and highlight their potential for pharmaceutical applications.

Keywords: *Medicinal plants, physiological, biochemical analysis, antimicrobial activity, Mangaon Tahsil, etc.*

Introduction:

Medicinal plants have been a cornerstone of traditional medicine for centuries due to their diverse bioactive compounds (Kumar et al., 2018). The western coastal region of Maharashtra, including Mangaon Tahsil in Raigad District, hosts a variety of medicinal flora used by local communities (Sharma & Patel, 2017). Characterization of physiological and biochemical parameters alongside antimicrobial evaluation provides insights into their therapeutic potential (Gupta et al., 2020). This study focuses on five medicinal plants given in table 1.

These species are widely used in ethnomedicine for treating infections and inflammation (Joshi et al., 2019). The objective is to evaluate physiological traits, quantify key biochemical compounds, and assess antimicrobial efficacy against common pathogens.

Materials and Methods:

1. Collection of experimental plants:

Fresh leaves of the five selected plants were collected from forest and hilly areas of Mangaon Tahsil, District- Raigad of Maharashtra during March–April. Vaucher specimens were deposited and authenticated from BAMU herbarium, Dr. Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhaji Nagar, Maharashtra.

Table 1: List of five medicinal plants with accession numbers

Sr. No.	Scientific names	Family	Accession No.
	Ricinus communis L.	*Euphorbiaceae*	01225
	Tridax procumbens L.	*Asteraceae*	01226
	Carissa Congesta Wight	*Apocynaceae*	01227
	Blumea lacera (Burm. f.) DC	*Asteraceae*	01228
	Lagerstroemia indica L.	*Lythraceae*	01229

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2. Physiological Parameter

Leaf area was measured using a leaf area meter. Chlorophyll content was estimated following (Arnon, 1949), using spectrophotometric readings at 645 nm and 663 nm.

3. Phytochemical Analysis

Total Phenolics: Determined by Folin–Ciocalteu reagent assay and expressed as mg gallic acid equivalents per gram of dry weight (Singleton et al., 1999).

4. Total Flavonoids:

Estimated by aluminum chloride colorimetric method, results expressed as mg quercetin equivalents per gram dry weight (Chang et al., 2002)

5. Alkaloid Content:

Quantified by the Harborne method (Harborne, 1973)

6. Antimicrobial Activity:

Antimicrobial potential was evaluated using the agar well diffusion method against *Staphylococcus aureus* (MTCC 3160), *Escherichia coli* (MTCC 443), *Pseudomonas aeruginosa* (MTCC 1688) and *Candida albicans* (MTCC 183). Plant extracts were prepared in methanol at 100 mg/mL concentration. Wells of 6 mm diameter were made on Mueller-Hinton agar plates inoculated with test organisms, and 50 µL of extract was added to each well. Plates were incubated at 37°C for 24 hours. Zones of inhibition were measured in millimetres (Bauer et al., 1966)

Results

1. Physiological Parameters

The leaf area varied significantly among the five species, with *Ricinus communis* showing the highest leaf area (15.3 cm²) and *Tridax procumbens* the lowest (8.1 cm²). Total chlorophyll content was highest in *Ricinus communis* (3.24 mg/g FW) and lowest in *Tridax procumbens* (1.70 mg/g FW) shown in table 2 and figure 1.

Table 2. Physiological Parameters of Selected Medicinal Plants

Plant Names	Leaf Area (cm²)	Total Chlorophyll (mg/g FW)
Carissa congesta	12.5	2.85
Ricinus communis	15.3	3.24
Tridax procumbens	8.1	1.70
Blumea lacera	9.7	2.66
Lagerstroemia indica	11.9	2.87

2. Phytochemical Constituents:

Phenolic content was highest in *Ricinus communis* (61.7 mg GAE/g) and lowest in *Tridax procumbens* (45.2 mg GAE/g). Flavonoids content was also highest in *Ricinus communis* (32.6 mg QE/g) and lowest in *Tridax procumbens* (21.4 mg QE/g). Alkaloid content was also highest in *Ricinus communis* (1.48%) shown in table 3 and figure 2.

Table 3: Biochemical Constituents of five Medicinal plants

Plant Names	Phenolics (mg GAE/ g)	Flavonoids (mg QE/g)	Alkaloids (%)
Carissa congesta	52.4	27.8	1.35
Ricinus communis	61.7	32.6	1.48
Tridax procumbens	45.2	21.4	1.05
Blumea lacera	50.9	25.7	1.20
Lagerstroemia indica	54.1	28.4	1.30

Antimicrobial Activity:

All plant extracts exhibited antimicrobial activity against tested pathogens. *Ricinus communis* showed the largest zones of inhibition against S. aureus (18.3 mm) and E. coli (15.8 mm). The grouped bar chart (Figure 3) illustrates comparative antimicrobial efficacy. Candida albicans was least inhibited across all plants (zones ranging 10.5–13.7 mm). **: Zones of inhibition were observed for all extracts, with *Ricinus communis* showing the strongest activity against S. aureus and E. coli.**

Table 4: Antimicrobial Activity

Plant Names	*S. aureus* (mm)	*E. coli* (mm)	*P. aeruginosa* (mm)	*C. albicans* (mm)	Control (mm)
Carissa congesta	16.5	14.2	13.0	12.1	0
Ricinus communis	18.3	15.8	14.5	13.7	0
Tridax procumbens	14.0	12.5	11.7	10.5	0
Blumea lacera	15.2	13.8	12.6	11.7	0
Lagerstroemia indica	16.8	14.5	13.2	12.5	0

Discussion:

The physiological parameters of the studied plants reflect their adaptability to the local agro-climatic conditions of Mangaon Tahsil. *Ricinus communis* demonstrated the highest leaf area and chlorophyll content, which is consistent with its fast growth and adaptability in tropical regions (Patil & Patil, 2020). These factors likely contribute to its vigorous metabolism and overall biomass productivity.

Biochemically, all plants exhibited substantial quantities of secondary metabolites, notably phenolics and flavonoids, which are known to contribute to antimicrobial activity by disrupting microbial cell walls and inhibiting enzymes (Cowan, 1999). The highest concentrations of phenolics and flavonoids were found in *Ricinus communis,* followed by *Lagerstroemia indica* and *Carissa congesta*. These results align with previous studies highlighting these species' potent phytochemical profiles (Singh et al., 2018).

Antimicrobial assays revealed strong inhibitory effects, particularly by *Ricinus communis* and *Lagerstroemia indica*, which were effective against both Gram-positive (*S. aureus*) and Gram-negative bacteria (*E. coli* and *P. aeruginosa*), as well as the fungus *Candida albicans*. These findings support the traditional use of these plants for treating infections and wounds in rural Maharashtra. The variability in antimicrobial response may be attributed to differing levels of active compounds like alkaloids and tannins (Doughari et al., 2009).

Overall, the data support the hypothesis that medicinal plants from the Mangaon region possess significant antimicrobial and bioactive potential. The agar well diffusion method proved effective for screening antimicrobial activity, and further studies including MIC and phytochemical profiling via HPTLC/GC-MS are warranted to isolate the specific active constituents.

Conclusion

The study confirmed that all five medicinal plants from Mangaon Tahsil- *Carissa congesta, Ricinus communis, Tridax procumbens, Blumea lacera,* and *Lagerstroemia indica* possess significant antimicrobial activity and contain key bioactive compounds such as flavonoids, tannins, and phenolics. These findings support

their traditional medicinal use and highlight their potential for development into natural antimicrobial agents.

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