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International Journal of Pharmaceutical Chemistry and Analysis

Journal homepage: https://www.ijpca.org/

Original Research Article

Comparative antibacterial and antifungal activities of *Cinnamomum Tamala* Nees & Eberm. and *Taraxicum officinale* leaf extract

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ARTICLE INFO

Article history:
Received 14-12-2022
Accepted 18-01-2023
Available online 01-04-2023

Keywords:
Antibacterial
Antifungal
Leaf extract
Cinnamomum tamala
Taraxicum officinale

ABSTRACT

Present study proposed to analyse the antibacterial and antifungal activities of *Cinnamomum tamala* Nees & Eberm. And *Taraxicum officinale* leaf extract against well-known pathogenic bacteria *(Proteus Vulgaris, Pseudomonas aeruginosa, Salmonella Newport* and *Salmonella stanley)* and *fungi (Rhizopus stolnifer, Pencillium digitatum, Pencillium notatum* and *Aspergillus niger)* . Extract was prepared in 70% ethanol using soxhelt extraction unit. Paper disc diffusion method was used for antibacterial and antifungal activities of extract. The culture was maintained in nutrient agar medium during the whole experiment. Penicillin and tetracycline were used as standard antibiotics for comparative antibacterial assessment of extracts and sabaround's browth medium was for assessment of antifungal activities of extract. *Mycostatin* taken as standard to compare the antifungal activities. Results of the current study revealed that leaf extract can be used in the formulation of antibacterial and antifungal drugs.

1. Introduction

Conventional plant derived medicines are yet the demand of the people at global level to protect themselves. In Asia, Africa, and Central and South America information about the role of medicinal plants is well documented and easily available. In other countries plant based medicines are used according to the rules of regulation in different conventional healthcare systems. More than a decade, medicinal plants have been used as sources of various bioactive components of curative value and these are used as alternative medicine for the treatment of various ailments. World Health Organization (WHO) reported that medicinal plants are considered as good source for the formulation of various drugs. Therefore, the investigation of medicinal plants should be conducted to understand their medicinal value.[1] In India, the Ayurvedic system is a type of medicinal therapeutic system formulated from plants/parts and derived bioactive components and morphological, pharmacological, and pharmacognostical analysis. This may provide better way to understand their active pathways and mode of action. Although, there are huge medicinal diversity of medicinal plants in tropical and temperate, but their chemical characterization has not been explored completely.

In India, the use of medicinal plants is increasing day by day, most of the people under different indigenous system of medicines like Siddha, Ayurveda, and Unani.[2] In India about 4.5 million of plant species have been reported, whereas only 250,000-500,000 plant species have been examined phytochemically for their pharmaceutical or pharmacological activity.[3] The phytochemicals or plant extract can be used for the treatment of various health

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https://doi.org/10.18231/j.ijpca.2023.007

ailments as well as development of new discovery in pharmaceutical industries.[4]

World Health Organization (WHO) reported that about 80% of the people in the world rely on conventional system of medicine to combat the diseases at primary level. Due to the presence of various biological active ingredients in medicinal plants defines their medicinal value.[5] These compounds are mainly divided into two types viz. primary and secondary metabolites. The secondary metabolites show various pharmacological activities such as anti-oxidative, anti-allergic, antibiotic, hypoglycaemic and anti-carcinogenic. The cellular damage caused by xenobiotics might be reversed by using secondary metabolites formulated supplements.[6]

Plants have been used as complementary sources of medicines from centuries against various ailments due to their antioxidant, hypoglycaemic, hypolipidemic, hepatoprotective, neuroprotective, and nephroprotective activities, various therapeutics are prepared from medicinal plants for the treatment of diabetes and related complications.[7–15] Marvellous research has been conducted on pharmacotherapy, because traditional options of treatment could be better substitute of allopathic drugs, due various reasons such as ease of availability, cost-effective and devoid side defects,[16,17] Pilot study revealed that *Cinnamomum tamala* and *Taraxicum officinale* leaves contains various bioactive components, these bioactive components might be helpful to combat worsen reproductive disorder. Considering the medicinal profile of these two leaf extract. Current research work aimed to appraise the antibacterial and antifungal activity of *Cinnamomum tamala* Nees & Eberm and *Taraxicum officinale* leaf extracts.

2. Materials and Methods

2.1. Preparation of extract

Cinnamomum tamala Nees & Eberm and *Taraxicu officinale* plant material (leaves) were collected from Jogindernagar, Mandi (H.P.) and Shopian (J&K), India and the plant leaves were identified by a botanist.

The plant leaves were washed in potassium dichromate and then d.H_2O to cleanse the leaves. Then leaves were allowed to dry under shade and dried leaves were crushed by using grinder to make fine powder. Followed by the preparation of extract in 70% ethanol using Soxhlet extractor (Popular Traders) at ambient temperature. The extract was dried at room temperature and was stored in a refrigerator at 4^oC for further use. The percent yield of *Cinnamomum tamala* Nees & Eberm and *Taraxicum officinale* were 68.6% and 64.4% respectively. The dried extract was stored in a refrigerator at 4^oC till further evaluation of antibacterial and antifungal activities.

2.2. Preparation of culture media for antibacterial studies of hydroalcoholic leaf extract of Cinnamomum tamala Nees & Eberm and Taraxicum officinale

In the whole experiment the Nutrient agar medium was used for maintenance of the culture and also for analysis, NaCl (2.5g), Peptone (10g), Leaf extract (10g) and d. H_2O (500 ml). About 5ml of sterilized nutrient agar was transferred into sterilized Petri plates and allowed to cool at standard conditions followed by their incubation along with bacterial colony at room temperature for 40 to 72 hours depends on the optimum growth of fungi.

Hydro-alcoholic leaf extract of *Cinnamomum tamala* Nees & Eberm and *Taraxicum officinale* were used for examination of antibacterial activity. Following bacterial species viz. *Proteus vulgaris, Pseudomonas aeruginosa, Salmonella Newport and Salmonella Stanley.* Penicillin and tetracycline were used Standard for comparison.

2.3. Preparation of culture media for assessment of antifungal activities of Hydroalcoholic leaf extract of Cinnamomum tamala Nees & Eberm and Taraxicum officinale

The Sabaroud's browth was used the experimental work for the maintenance of the culture and also for study of antifungal activity, viz. Peptone (5g), Glucose (10g) and Distilled water (500 ml). 5 ml of sterilized sabaroud's agar was transferred into sterilized petri plates and cooled at standard conditions followed by their incubation with the fungi at room temperature to 24 to 48 hours depends on the optimum growth of fungi.

The medium which is employed has the Hydroalcoholic leaf extract of *Cinnamomum tamala* Nees & Eberm and *Taraxicum officinal*e were used for examination of antibacterial activity. The antifungal activity of *Cinnamomum tamala* and *Taraxicum officinale* was tested by paper disc diffusion method. Following bacterial species viz. *Rhizopus stolonifer, Pencillium digitatum, Pencillium notatum and Aspergillus niger.* ***Mycostatin*** was used as standard for comparison.

3. Results

3.1. Determination of antibacterial activity of hydro alcoholic leaf extracts Cinnamomum tamala (CT) and Taraxicum officinale (TO)

The antibacterial activity was examined of hydro-alcoholic leaf extract at different dilutions using ethylene glycol as solvent at concentration of 5ml/mg of phosphate buffer saline (w/v). The antibacterial activities of leaf extract (*Cinnamomum tamala* and *Taraxicum officinale*) were documented in Tables 1, 2, 3 and 4.

Table 1: Antibacterial activity of CT hydro-alcoholic leaf extract.

S. No.	Bacteria	Diameter of zone of inhibition (mm) Dilutions			
		CT hydro-alcoholic leaf extract	1:5	1:10	1:15
1	*Proteus vulgaris*	1.5	1	0	0
2	*Pseudomonas aeruginosa*	5.0	5	4.5	3.5
3	*Salmonella Newport*	5.0	4.5	3.0	2.5
4	*Salmonella Stanley*	2.0	2	1.5	0

Table 2: Antibacterial activity of TO hydro-alcoholic leaf extract.

S. No.	Bacteria	Diameter of zone of inhibition (mm) Dilutions			
		TO hydro-alcoholic leaf extract	1:5	1:10	1:15
1	*Proteus vulgaris*	3.0	2.5	2.0	1.5
2	*Pseudomonas aeruginosa*	4.0	3.5	2.5	1.0
3	*Salmonella Newport*	8.0	7.5	6.5	5.5
4	*Salmonella Stanley*	6.5	5.0	4.5	4.0

Table 3: Showing minimum inhibitory concentration of CT hydro-alcoholic leaf extract.

S. No.	Bacteria	Minimum inhibitory concentration (CT hydro-alcoholic leaf extract)		
		Penicillin (x 10 mg/ml)	Tetracycline (x 10 mg/ml)	CT leaf extract (mg/ml)
1	*Proteus vulgaris*	0.18	0.3	7.5
2	*Pseudomonas aeruginosa*	0	0	1.5
3	*Salmonella Newport*	0.15	0.2	2.0
4	*Salmonella Stanley*	0.16	0.3	7.0

Table 4: Showing minimum inhibitory concentration of TO hydro-alcoholic leaf extract.

S. No.	Bacteria	Minimum inhibitory concentration (TO hydro-alcoholic leaf extract)		
		Penicillin (x 10 mg/ml)	Tetracycline (x 10 mg/ml)	CT leaf extract (mg/ml)
1	*Proteus vulgaris*	3.0	0.7	9.5
2	*Pseudomonas aeruginosa*	4.0	0.9	3.5
3	*Salmonella Newpor*	8.0	2.3	4.2
4	*Salmonella Stanley*	6.5	1.2	8.5

Table 5: Showing antifungal activity of CT hydro-alcoholic leaf extract.

S. No.	Fungi	Diameter of zone of inhibition (mm) Dilutions			Mycostatin (10 g/ml)
		CT hydro-alcoholic leaf extract	1:5	1:10	1:15	
1	*Rhizopus stolnifer*	7.5	6.0	5.5	5.0	1.0
2	*Penicillium digitatum*	5.0	4.5	3.5	2.0	9.0
3	*Pencillium notatum*	5.5	6.0	5.0	4.5	7.0
4	*Aspergillus niger*	2.0	5.0	4.5	4.0	7.0

Table 6: Showing antifungal activity of TO hydro-alcoholic leaf extract.

S. No.	Fungi	Diameter of zone of inhibition (mm) Dilutions				Mycostatin (10 g/ml)
		TO hydro-alcoholic leaf extract	1:5	1:10	1:15	
1	*Rhizopus stolnifer*	5.5	7.5	6.3	5.8	5.0
2	*Penicillium digitatum*	6.3	6.5	5.1	4.1	7.0
3	*Pencillium notatum*	9.1	7.2	6.8	4.9	8.0
4	*Aspergillus niger*	8.8	7.9	7.3	5.2	3.6

3.2. Determination of antifungal activity Cinnamomum Tamala (CT) and Taraxicum officinale (TO)

The antifungal activity of leaf extracts was examined at different dilutions using ethylene glycol as solvent at a concentration of 5 ml/mg of phosphate buffer saline (w/v). Filter paper disc protocol was used to study antifungal activity. Filter papers were soaked with different concentrations followed by their drying at 40^{o}C. The zone of inhibition was expressed as average of maximum dimension in 4 different directions (5&6).

4. Discussion

Evolution of antibacterial and antifungal molecules developed the foundation to treat microbial infections. Since, last decade several agents have been randomly tested against the various infections, but development of drug resistance in microbes) bacteria and fungi has become a challenge for researchers. Hence, Development of new and potential drugs for the treatment of microbial diseases. One of the best substitutes in the current era, plant or their products are used for the treatment of diseases in animals, due to numerous benefits such as biodegradability, availability, low toxicity and cost-effectiveness.[18] The findings of present study analysed the antibacterial and antifungal activities of *Cinnamomum tamala* and *Taraxicum officinale.* The leaf extract of *Cinnamomum tamala* and *Taraxicum officinale* displayed strong activity against different bacteria and fungi. Leaf extract of *Cinnamomum tamala* and *Taraxicum officinale* showed antibacterial activities against Proteus vulgaris, *Pseudomonas aeruginosa, Salmonella Newport* and *Salmonella Stanley.* This antibacterial activity of *Cinnamomum tamala* and *Taraxicum officinale* might be due to the abundance of different Polyphenols, flavonoids and flavones and flavonols. The Minimum Inhibitory Concentration (MIC) of leaf extract was examined for 4 bacterial species *(Proteus vulgaris, Pseudomonas aeruginosa, Salmonella Newport* and *Salmonella Stanley)* against the positive control *Pencillium notatum* as standard. It was found that leaf extracts of both plant showed considerable antibacterial activity, however, significantly higher antibacterial activity was seen in *Salmonella newport.* "The minimum inhibitory concentration was also found in the same bacterial strain that was 0.15. The *Cinnamomum tamala* and *Taraxicum officinale* leaf extract were found to be active against *Pseudomonas aeruginosa, Salmonella Newport* and to retain its activity even at dilution of 1:15.

The minimum inhibition concentration (MIC) showed that the leaf extract of *Cinnamomum tamala* Nees & Eberm and *Taraxicum officinale* against various bacterial species *Proteus vulgaris, Pseudomonas aeruginosa, Salmonella newport* and *Salmonella Stanley* bacterial species. This reveals that treatment of plant extract inhibits the growth of bacterial, due to the abundance of various biologically active ingredients viz. phenols, tannins, flavonoids, alkaloids and cardiac glycosides.[19] Previous studies also reported that people in rural areas used to treat diseases by conventional approaches against the microbial infections.[20]

Leaf extracts of *Cinnamomum tamala* and *Taraxicum officinale* was examined against the different fungi such as *Rhizopus stolonifer, Penicillium digitatum, Pencillium notatum* and *Aspergillus niger.* The findings depicted that plants contains valuable compounds which inhibits the growth of fungi. The leaf extract showed activity against *Pencillium naotatum* and *Rhizopus stolonifer* and retained the activity at dilution of 1:15. Hence, it can infer that plants can be used to treat various fungal diseases[21] (Favela-González et al., 2020). Findings of our study coincide with pervious finding, which reported that presence of bioactive components makes the plant makes the plant extract pharmacologically viable.[19] These finding demonstrated that *Cinnamomum tamala* and *Taraxicum officinale* might be used for the formulation of potential antibiotics to combat the pathogenesis of various fungal diseases. These findings agreements with earlier studies Mishra and Verma (2014), who reported that presence of bioactive components in plants results in the inhibition of fungal growth.[22]

5. Conclusion

Various drugs have been synthesized from the *Cinnamomum tamala* and *Taraxicum officinale* which comprises the pool of natural therapeutics devoid of any side defects as observed in various allopathic drugs. However, from last particularly in India more and more focus is given towards

the use of local sources for the treatment of diseases. Considering the results of current study it has been that *Cinnamomum tamala* and *Taraxicum officinale* might be used for the treatment of various microbial diseases.

6. Acknowledgment

Authors are grateful to department of life sciences and Allied Health Sciences, Sant Baba Bhag Singh University, Jalandhar, Punjab, India and Department of Biosciences, Himachal Pradesh University, Shimla, Himachal Pradesh, India.

7. Author Contribution

All authors contributed equally.

8. Source of Funding

This research was not supported any funding agency.

9. Conflict of Interest

None.

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Cite this article: Bhatti N, Hajam YA, Kumar R, Singh S, Kumari I. Comparative antibacterial and antifungal activities of *Cinnamomum Tamala* Nees & Eberm. and *Taraxicum officinale* leaf extract. *Int J Pharm Chem Anal* 2023;10(1):39-43.