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A review on medicinal plant extract as an Antimicrobial, Antibacterial and Antifungal

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ABSTRACT
Systemic bacterial and fungal infections have increased in recent years as a result of an increase in the amount of disabling disorders that affect the immune system, such as AIDS, blood cancers, overdose, corticosteroid medications, and broad-spectrum antibiotics. Acute and subsequent candida infections with drug-resistance features, such as fluconazole, are common. Because of the frequency and spread of fungal and bacterial illnesses, the search for remedies is more intense than ever. Because of their unique biocompatibility and bioavailability, plant chemicals are beneficial in the treatment of fungal and bacterial infections. The market for new antifungal and antibacterial drugs remains tiny, although resistance to many antibiotics is growing, particularly in patients receiving long-term treatment. Given the vast antibacterial potentials of natural chemicals derived from plants and endophytes, as an alternate source remains poorly unexplored. Endophytes and medicinal plant species have primary and secondary compounds that can hinder or inactivate infections. Many researches on the antibacterial and antifungal properties of these metabolites have recently been published.
Key words: Antimicrobial, Antibacterial, Antifungal, Phytochemical, Secondary metabolites

INTRODUCTION

Natural goods such as plants, animals, and minerals have been used to treat human ailments. The future of natural product drug research will be more holistic, personalised, and incorporate the intelligent application of old and modern therapeutic techniques in a complimentary manner to maximize benefits to patients and the community (Patwardhan and Hopper, 1992). Antiseptic properties of aromatic and medicinal plants and their extracts have been documented in laboratory data since the early 2000s. In recent years, secondary plant metabolites (phytochemicals) having hitherto unknown pharmacological properties have been discovered. Activities, as a source of medical compounds, have been intensively researched (Krishnaraju et al., 2005). As a result, it is expected that phytochemicals with adequate antibacterial effectiveness would be employed to treat bacterial illnesses. Galen (AD129-200), a Greek physician, created the first pharmacopoeia, which described the appearance, qualities, and uses of many plants. Around 20% of all plants on the planet have been submitted for pharmacological or biological activity. Plants have the ability to create a huge number of organic molecules known as secondary metabolites, which are classified into many groups based on their mechanism of action, such as chemotherapeutic, bacteriostatic, bactericidal, and antimicrobial agent. There is an ongoing and pressing need to find new antibacterial agents with different chemical structures and unique mechanisms of action for emerging and reemerging infectious diseases (Parekh and Chanda, 2007). As a result, researchers are increasingly seeking for fresh leads in order to produce better drugs to combat microbial illnesses. Innovation in therapeutic target elucidation and lead structure identification is expected to drive approaches to improve and speed the combined drug discovery and development process. Plant studies in traditional and modern medicine in China provide inspiration and models for the development of new medications with superior medicinal, chemical, or physical qualities to the original molecules. The World Health Organization has also recognized the value of traditional medicine and has been actively involved in developing strategies, guidelines, and standards for plant medicines (WHO, 2002). Medicinal plant products may be effective in reducing the side effects of certain chemotherapeutic treatments, as well

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as in extending life and improving overall health (Kaushik et al., 2002). Medicinal plants are widely used in illness management around the world (Aliyu et al., 2007).The use of therapeutic plants dates back to the dawn of humanity and medicine. *Catharanthus roseus* is an important Apocynaceae medicinal plant. It is grown primarily for its alkaloids, which have anticancer properties (Jaleel et al., 2009).(Muhammad et al., (2009) discovered antibacterial activity in crude extracts of *Catharanthus roseus* components (leaves, stem, root, and flower) against clinically relevant bacterial strains. Emerging and reemerging infections, as well as the proliferation of lethal, drug-resistant types of organisms, offer a challenge to global public health in terms of treatment. Antibiotic resistance is a serious therapeutic issue, and the rate at which new antibiotics are being developed is slowing (Russell et al., 2002). Thus, the quest for novel antimicrobial drugs is critical (Gootz et al., 1990). The focus of the world's attention has switched todiscovering novel compounds, specific the development of new medications. These natural products can contribute distinct features of molecular diversity and biological functioning, both of which are required for innovative drug discovery (Nisbet and Moore, 1997). The current study focuses on evaluating *Catharathus roseus* leaf extracts for antibacterial and antifungal activities.

Catharanthus roseus (Madagascar periwinkle) is a *Catharanthus* species that is native to Madagascar. Synonyms include *Vinca rosea*. *Ammocallis rosea* and *Lochnera rosea* are common English names, as are cape periwinkle, rose periwinkle, Rosy periwinkle, and "old-maid." It is called as "nithyakalyani" in India. *C.roseus* had 70 alkaloids, several of which are biologically active, according to research conducted in the 1950s.(Parameswari, P*, et al., 2015). While initial studies for its use in diabetes mellitus were disappointing, the discovery that it produced myelosuppression (decreased bone marrow activity) led to its investigation in mice with leukaemia, whose longevity was extended by the administration of a vinca preparation.

"Vinca rosea" is also known by the scientific name C.roseus. Vincristine is derived from C.roseus vinca alkaloids. It is a mitotic inhibitor that is utilised in cancer treatment.Parameswari.P* and colleagues (2015).C.roseus is an important medicinal plant of the apocynaceae family that contains over 70 different types of alkaloids and chemotherapeutic agents that are effective in treating various types of cancer, including breast cancer, lung cancer, uterine cancer, melanomas, hodgkin's and non-hodgkin's lymphoma.(Parameswari. P* and colleagues, 2015) It is commonly known as *Vinca rosea*, *Ammocallis rosea*, and *Lochnera rosea*. *C.roseus* is a native Indian herb that grows wild in the Indian subcontinent of southern Asia. *C.roseus* has two common names, which are called after their bloom colours: pink: Rosea, and white: Alba. The leaves of *C.roseus* have traditionally been used as medicine to treat menorrhagia, rheumatism, dyspepsia, indigestion, dysmenorrheal, diabetes, hypertension, cancer, menstrual problem, skin illnesses, bleeding diarrhoea, and contains sedative and antiviral effects. Historically, the herb has been used to treat a wide range of ailments. For ages, it was utilised as a folk cure for diabetes in Europe. The juice from the leaves was used to treat wasp stings in India. The herb was boiled in Hawaii to form a poultice to stop bleeding. It was employed as an astringent, diuretic, and cough cure in China. It was used as a homemade cold cure in Central and South America to relieve lung congestion and inflammation. Throughout the plant's leaves, there are about 70 different chemical constituents, including indole alkaloids, ajmalicine, serpentine, and reserpine. C.roseus possesses antihypertensive and antispasmodic effects due to the presence of these alkaloids.(Kabesh et al., 2015) Vinblastine, a kind of alkaloid derived from C.roseus, is used to create current chemotherapeutic agents with pain-relieving effects. Apocyanaceae is a plant native to the Caribbean that has traditionally been used to treat a variety of ailments. European herbalists utilised the plant to treat everything from headaches to diabetes.(Kabesh et al., 2015) A wound is a physical, chemical, microbiological, or immunological insult that disrupts the anatomical structure of normal living tissues and their functioning. It is a wound healer. Kabesh, K., et al. (2015).

Systemic bacterial and fungal infections have increased in recent years due to an increase in the number of debilitating diseases immune system such as AIDS, blood malignancies, overdose, corticosteroid drugs, broad-spectrum antibiotics specifically in the case of multidrug-resistant bacteria, etc. (Wright, G. D., & Sutherland, A. D. 2007). For example, acute and subsequent candida

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infections with drug-resistance features, such as fluconazole, are common (Debruyne, D., & Ryckelynck, J. P. 1993). As a result, it is critical to apply alternative effective compounds, specifically primary and various secondary metabolites of medicinal plants (carotenoids, alkaloids, phenolic compounds, and flavonoids; Figure 1a)(Panche, A. N., Diwan, A. D., & Chandra, S. R. 2016)., and fungal endophytes (Rodriguez, R. J et al.,2009)(Figure 1b) for treatment and prevention of fungal and bacterial infections without side effects of antibiotics (Westphal, J. F., Vetter, D., & Brogard, J. M. 1994).

Antimicrobial activity

Catharanthus roseus extract antimicrobial activity against pathogenic organisms examined, ethanolic fractions produced higher results when compared to other organisms tested to other fractions tested. Among the eight species studied, *E.coli (*MTCC- 443) and *Klebsiella oxytoca* (MTCC- 4676) produced the best results (table-1) and (Figure-1). The table shows the antifungal activity of *C. roseus* plant leaves extract produced by the disc diffusion method. The antifungal activity of the leaves extract was tested against *Aspergillus niger*, *Aspergillus flavus*, *Aspergillus fumigates*, *Candida albicans*, and *Penicillium species*. Among the studied species, *Aspergillus flavus* produced the best results. *Catharanthus roseus* ethanolic extract outperformed the pathogen *Aspergillus flavus*. Balouiri, M., Sadiki, M., and S. K. Ibnsouda (2016) (Table 2) and Figure 2. C- Control, S- Sample, Antibiotic (Nystatin). Herbalism is an ancient practise. Plants are a repository for diverse biomolecules that are responsible for various biological processes. India has a diverse plant biodiversity. Throughout the world, several plants have been studied for various biological functions. Given the diversity of higher plants, the number of plants evaluated for antibacterial and antifungal activity has increased. As can be seen from the literature review, this plant has mostly been explored for its anti-cancer and anti-diabetic qualities. (J. Finlay, L. Miller, and J. A. Poupard, 2003) Until now, relatively little research has been conducted on the antimicrobial effects of plant extracts. As a result, our research focuses on the antimicrobial characteristics of leaf extracts. These extracts may not find therapeutic utility in the near future, but they can certainly be employed as a preventative agent in areas where certain diseases are endemic, if not pandemic. The results show that the leaf extract included several indole alkaloids as well as some phenolic components.) The antibacterial effects of phenolic compounds are well established.Moore, A. J., and colleagues (1996)

Table 1: Catharanthus roseus extract has antimicrobial properties.

Antibacterial activity	**Zone of Inhibition (mm)**					
Name of the bacteria	**Water**	**Ethanol**	**Methanol**	**Acetone**	**Hexane**	**Butanol**
Escherichia coli	-	6.3	-	1	-	-
Kelbsiella oxytoca	-	1.6	8	-	T	-
K. pneumoniae	-	-	T	1	-	T
Proteus mirabilis	-	8	-	1	-	-
Pseudomonas aeruginosa	T	T	1	-	-	-
Salmonella typhi	-	1	6.2	T	1	T
S. paraatyphi	T	3	1	-	-	-
Staphylococcus aureus	-	-	7.3	1	1	-

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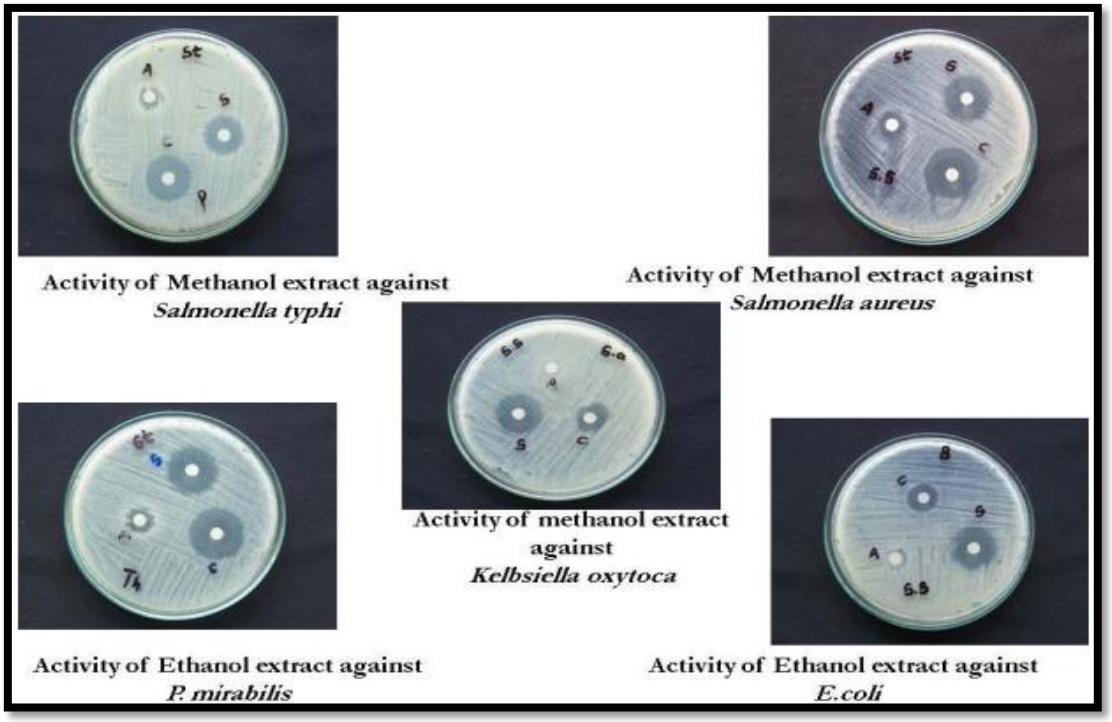

Fig:1 Pathogens with antimicrobial activity

Antifungal activity

The use of plants and plant extracts in medicinal or folk medical practise. Botanical medicine, medical herbalism, herbal medicine, herbology, and phytotherapy are all terms for herbalism. Herbal medicine can sometimes incorporate fungal and bee products, as well as minerals, shells, and animal parts (Ramani, 2008). Many plants produce chemicals that are beneficial to the health of people and other animals. Aromatic substances include phenols and their oxygen-substituted derivatives, such as tannins. Many are secondary metabolites, with at least 12,000 identified, accounting for less than 10% of the total. In many situations, these chemicals (especially alkaloids) act as plant defence mechanisms against microbes, insects, and herbivores. Many of the herbs and spices used to season food by humans include therapeutic properties. Catharanthus roseus is the Madagascar periwinkle. It is a tropical herb or subshrub that is grown as a garden plant all over the world. Ruiz, (2009) From the separation and purification of multiple Catharanthus alkaloids to laboratory and clinical testing, and the subsequent sale of two of them, the development of periwinkle anticancer medications marks a spectacular success story in the field of plant-derived pharmaceuticals. These alkaloids have quickly become two of the most valuable cancer chemotherapeutic therapies available in the short time since they were first used in clinical trials. The Madagascar periwinkle was chosen as one of 440 plants to be studied as part of an Eli Lilly plant screening programme for plant-derived pharmaceuticals. The plants were chosen based on carefully evaluated claims of folkloric use and alkaloid content. Alkaloids, which are complex nitrogen-containing plant chemicals, are frequently biologically active. They are the most prevalent active components in a wide range of plant-based medicines.

Table 2: Antifungal activity *Catharanthus roseus* extracts (mm)

Test organism	Water	Ethanol	Methanol	Acetone	Hexane	Butanol
Aspergillus niger	-	4.2	T	-	-	T
Aspergillus flavus	-	3	-	T	-	-
Aspergillus fumigatus	-	1.8	-	0.8	-	-
Candida albicans	T	1.6	0.5	-	-	-
Penicillium species	-	3.3	-	-	T	T

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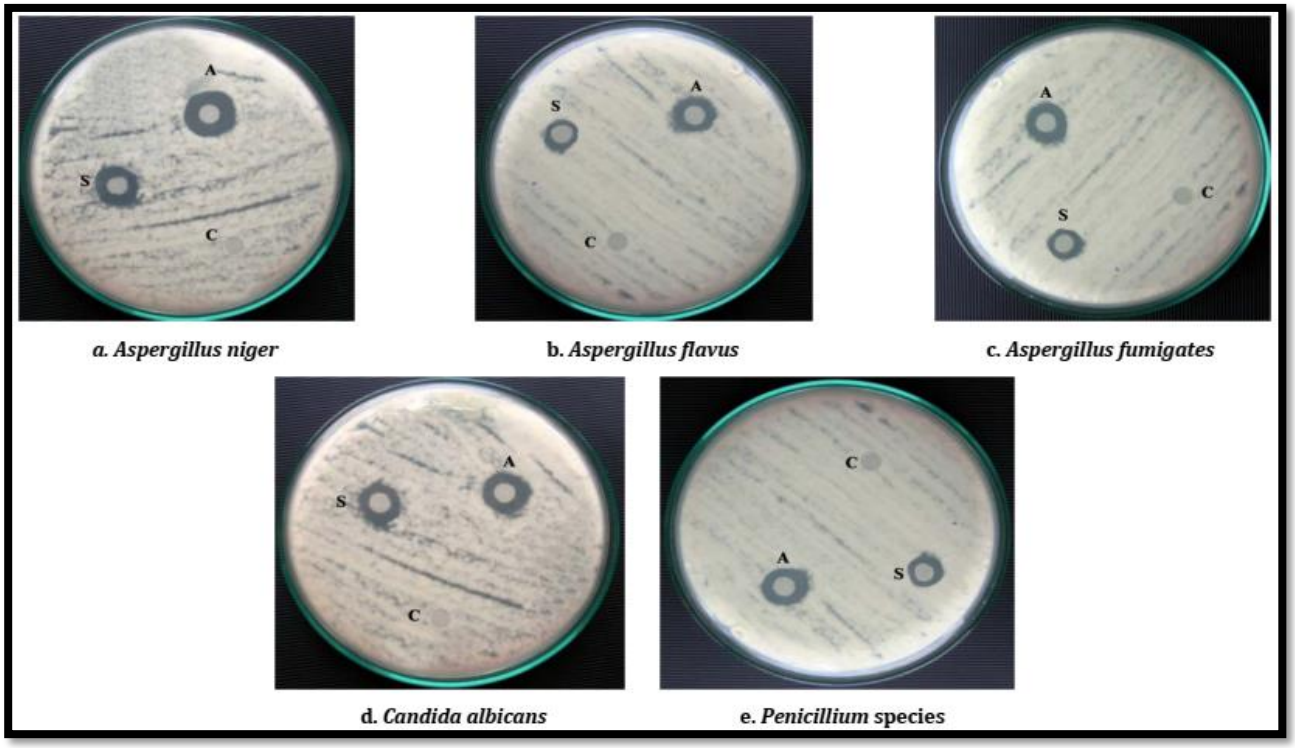

Fig. 2: Antifungal activity of *Catharanthus roseus* (Ethanolic extract)

Conclusion

The endeavour to identify therapies has intensified due to the incidence and spread of fungal and bacterial illnesses. Because of their unique biocompatibility and bioavailability, plant chemicals can be beneficial in the treatment of fungal and bacterial infections. *Catharanthus roseus*, a medicinal herb, was obtained from the garden. To perform in vitro bioassays, the plant leaf, flower, and stem were extracted using organic solvents. The phytochemical analysis of all organic solvent extracts revealed the presence of important phytoconstituents such as alkaloids and tannin to varied degrees. Plant extracts exhibit antibacterial and antifungal action in vitro. All four extracts from selected plant species were potent against bacteria to varied degrees, with the exception of the ethyl acetate extract, which showed no bacterial suppression. *C. roseus* methanolic plant extract was found to actively inhibit bacteria at varied inhibitory levels. The methanolic plant extract of *C. roseus* was found to be more active against the fungus species tested. *Catharanthus roseus* leaves contain secondary metabolites such as alkaloids. It has also been confirmed that the leaf extract can be utilised to treat infections caused by the fungus Aspergillus spp. as well as other fungal disorders. The findings suggest that *Catharanthus roseus*, which has a traditional use in treating microbial infections, could be investigated for novel potential antibiotics.

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