PREPARATION OF TRIDAX PROCUMBENS LEAVES AND STEM EXTRACT AND ANALYSIS OF ITS ANTIMICROBIAL ACTIVITY

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Abstract

Introduction: Coat buttons, or Tridax Procumbens, are members of the Asteraceae family. It is a perennial herb with a spreading stem that can grow to be between 8 and 30 inches long. The most common usage of this plant is as a weed and pest that has a variety of functions, including antifungal, anticoagulant, and wound healing. Local healers in India also apply them to the treatment of cuts, blisters, and boils.
Materials and Methods: To prepare the extract, 5g of T. procumbens leaves and stem powder were dissolved in 50 mL of distilled water, heated for 5 minutes, and then filtered through whatman filter paper. The agar well diffusion method was used to test the extract's antimicrobial effectiveness at different concentrations (25 µL, 50 µL, 100 µL) against more common oral pathogens.
Results: The results of the current study showed that the antimicrobial activity of T. procumbens leaves and stem extract was highest at concentration of 100 µL. The leaves extract showed maximum antimicrobial activity against S. aureus whereas the stem extract showed maximum antimicrobial activity against S. mutans.
Conclusion: The present study demonstrated an eco-friendly and cost-effective synthesis of plant extracts from stem and leaf of T. procumbens. These plant extracts showed potent antimicrobial activity against common oral pathogens assuring its effective therapeutic application in several oral infectious diseases.

Keywords: antimicrobial, developmental, innovative, sustainable, Tridax procumbens

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1. Introduction

Finding new chemical compounds with antimicrobial qualities to utilise against these germs to lessen their virulence property has been important because bacteria have a tendency to resist, which makes treating a variety of well-known infections difficult (Bhagwat, Killedar, and Adnaik 2008). Herbal remedies have been used to build medical pharmacology for centuries, and they serve as the foundation for many traditional medical systems around the world. It is simple to employ medicinal herbs because they are found to be more prevalent (Kumar, Prasad, and Iyer 2012).

An antimicrobial is a substance that either eliminates or inhibits the growth of bacteria (Jeevitha et al. 2022)(Prathap et al. 2021; Santhakumar et al. 2021; Begum, Jeevitha, and Preetha 2020)(Rajeshkumar and Jeevitha 2021; Santhakumar et al. 2021). Antimicrobial drugs can be categorised based on the microorganisms they are most effective against (Bharathi, Varalakshmi, and Gomathi 2012). Antibacterial medication toxicity in humans and other animals is typically thought to originate from their overuse, which has expedited the creation of microorganisms that are resistant to antibiotics, posing a severe threat to global public health (Jhample, Gajdhane, and Kasabe 2015).

T. procumbens, commonly known as coat buttons or tridax daisy is native to the tropical Americas, but it has been widespread to tropical, subtropical, and mild temperate regions worldwide (Andriana et al. 2019). The plant produces daisy-like white or yellow blooms with three-toothed ray florets that have a yellow core. The leaves typically have an arrowhead form and are toothed (Pai et al. 2011).

In regions with tropical or semi-tropical climates, this plant can be found in fields, meadows, croplands, disturbed areas, lawns, and by the sides of roads. It is classified as a Noxious Weed in the US and is controlled by the Federal Noxious Weed Act. Traditionally, T. procumbens has historically been used in India to treat wounds, as well as an anticoagulant, antifungal, and insect repellant. In some areas of India, traditional healers also utilize T. procumbens to cure boils, blisters, and cuts (Syed et al. 2020). An alpha hemolytic Streptococcus called Streptococcus mutans makes up the majority of the mouth cavity's natural flora. Gram-positive bacteria are present. Bacteria have a polysaccharide (glycocalyx) coating that allows it to adhere to damaged heart valves and teeth. The surface of the tooth structure in the oral cavity has biofilm on it. As commensal bacterium, S. mutans is present in this biofilm (Mir, Mahmood, and Shabeer 2016). When the amount of sugar in the diet has risen, this biofilm turns cariogenic. This leads to the formation of plaque on the tooth structure which creates an ideal environment for the growth of anaerobic bacteria (Policegoudra et al. 2014). A renewed search for antibacterial agents that work against pathogenic bacteria resistant to present antibacterials is necessary in light of the resistance issue.Thus the present study aims to prepare leaves and stem extract of T. procumbens and evaluate its antimicrobial activity against common oral pathogens.

2. Materials and Methods

T. procumbens plant was procured and the leaves and stem parts were segregated (Fig 1). The leaves and stem parts are grounded separately to fine powder. To create the extract, 5g of T. procumbens leaves and stem powder were combined with 50 mL of distilled water, individually dissolved, and heated for 5 minutes. The solution was filtered using whatman filter paper to obtain the extract (Fig 2). The agar well diffusion method was used to test the extract's antimicrobial effectiveness against oral pathogens. The antimicrobial activity of different concentrations of leaves extract of T. procumbens was tested against S. mutans, S. aureus, P. aeruginosa and C. albicans. The antimicrobial activity of different concentrations of stem extract of T. procumbens was tested against S. mutans, E. faecalis and C. albicans. On Mueller Hinton agar, the bacterium's pure culture was subcultured. Gel puncture was used to create wells on the agar plates that were 9 mm in diameter, and sterile cotton swabs were used to evenly swab each strain onto the different plates. Standard antibacterial agent was placed into one well of each plate using a sterile micropipette, and extract in three different concentrations was added to the remaining three wells. Onto Rose Bengal agar, the C. albicans isolates were subcultured. The extract was then put into three wells on the agar plate, followed by a standard antifungal disc (voriconazole) into the remaining well. The different zones of inhibition were detected and recorded after 24 hours of incubation at 37 degrees Celsius. The concentration with maximum zone of inhibition indicates the highest antimicrobial activity.

(a) (b)

Figure 1. T. procumbens leaves and stem parts

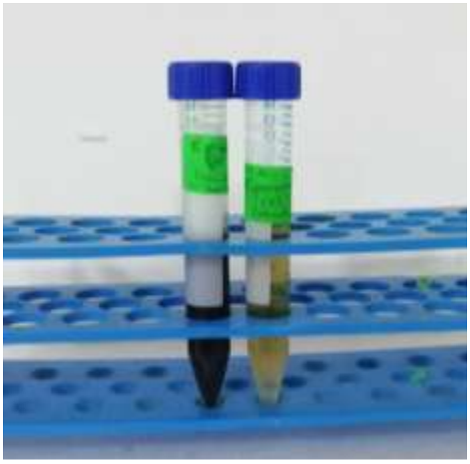
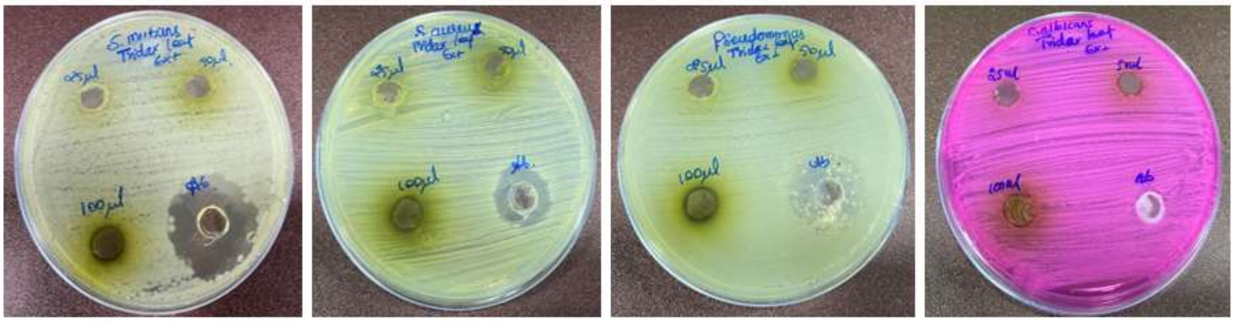


Figure 2. T. procumbens leaves and stem extract

3. Results

The antimicrobial activity of different concentrations of leaves and stem extract of T. procumbens was tested against common oral pathogens. Table 1 and 2 shows the zone of inhibition exhibited by various concentrations of leaves extract and the stem extract of T. Procumbens respectively. The zone of inhibition of T. procumbens leaves extract was maximum at concentration of 100 µl against S. mutans (12±0.32 mm), S. aureus (20±0.34 mm) and P. aeruginosa (12±0.56 mm). Zone of inhibition of 10 mm was seen at various concentrations against C. albicans (Fig. 3 and 4). The stem extract of T. procumbens showed a maximum zone of inhibition at 100 µl concentration against S. mutans (20±0.42 mm) and C. albicans (11±0.54 mm). Zone of inhibition of 10 mm was seen at various concentrations against E. faecalis (Fig. 5 and 6).



(A) (B) (C) (D)

Figure 3. Antimicrobial activity of leaves extract of T. Procumbens against (A) S. mutans, (B) S. aureus, (C) P. aeruginosa and (D) C. albicans.

Table 1: Antimicrobial activity of T. procumbens leaves extract against oral pathogens

	Zone of inhibition (mm)			
	25µL	50µL	100µL	Ab
S. mutans	10±0.46	10±0.54	12±0.32	28±0.42
S. aureus	11±0.12	12±0.22	20±0.34	18±0.24
P. aeruginosa	10±0.26	10±0.32	12±0.56	25±0.12
C. albicans	10±0.32	10±0.42	10±0.22	11±0.34

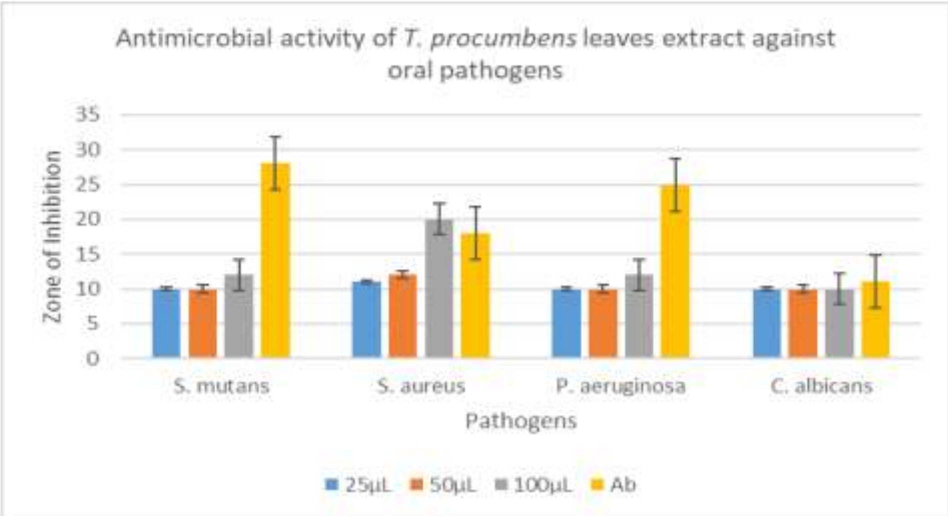


Figure 4: Comparison of antimicrobial activity of different concentrations of T. procumbens leaves extract against oral pathogens

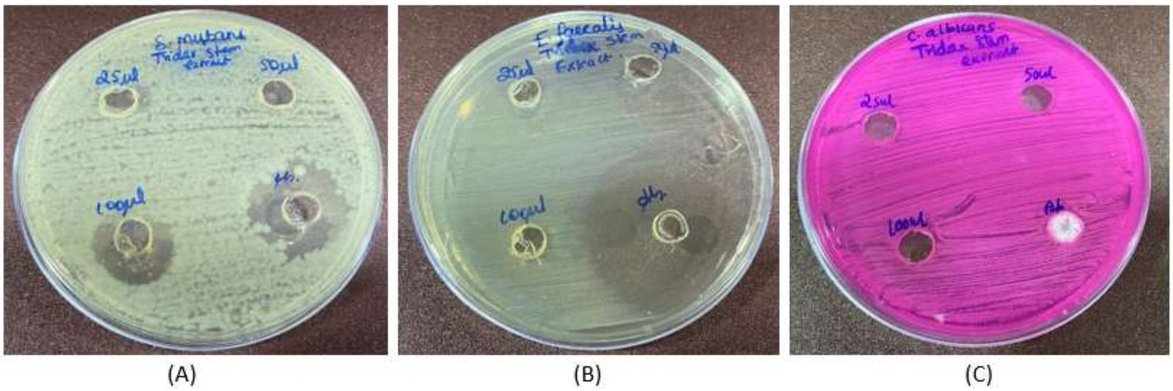


Figure 5. Antimicrobial activity of leaves extract of T. Procumbens against (A) S. mutans, (B) E. faecalis and (D) C. albicans.

Table 2: Antimicrobial activity of T. procumbens stem extract against oral pathogens

	Zone of inhibition (mm)			
	25μL	50μL	100μL	Ab
S. mutans	10±0.52	10±0.32	20±0.42	25±0.54
E. faecalis	10±0.54	10±0.32	10±0.32	11±0.22
C. albicans	10±0.54	10±0.32	11±0.54	40±0.32

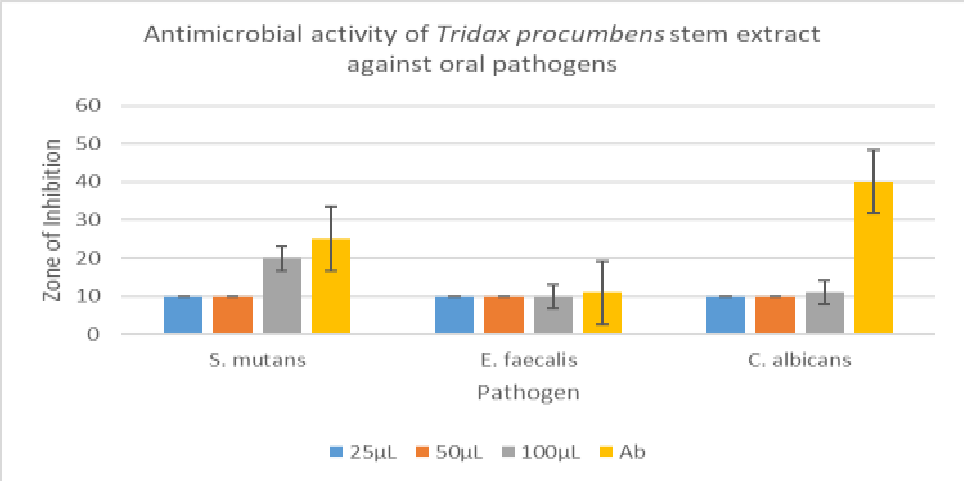


Figure 6: Comparison of antimicrobial activity of different concentrations of T. procumbens stem extract against oral pathogens

4. Discussion

The present study observed the efficacy of aqueous extracts of leaves and stem parts of T. procumbens as antibacterial agents against more common oral pathogens. Previous literature have reported antimicrobial activity of ethanolic and aqueous extracts of T. procumbens. The fact that different solvents have differing capabilities to extract phytoconstituents based on their solubility and polarity can be used to explain the difference in activity between the aqueous and alcoholic extracts (Kamble and Dahake 2015). Traditional healers and practitioners of the Unani and Ayurveda medical systems have employed T. procumbens as a phytomedicine. This customary application results from the plant's alleged antibacterial properties (Joshi and Badakar 2012). Alkaloids, flavonoids, tannins, and saponins have all been implicated in the antibacterial activity of T. procumbens. Only gram negative non-fermenters like P. aeruginosa demonstrated very good antibacterial activity in some investigations on the ethanolic extract.(Mundada and Shivhare 2010). The in vivo antibacterial efficacy of T. procumbens against P. aeruginosa in experimental animals is also extensively documented. In contrast to these results, other investigations have shown that Tridax extracts are also effective against various bacteria, including Proteus, E. coli, S. aureus, and Klebsiella pneumoniae. Several things could have caused these disparities to appear. One explanation is because conventional bacterial strains and bovine pathogens rather than human pathogens were used in these experiments..(Kumar, John, and Narayanan 2015).

Several of the isolates were found to be multi-drug resistant to commonly used antibiotics and are commonly implicated in nosocomial infections (Krishnan, Pandian, and Kumar S 2015; Ramesh Kumar et al. 2011; Felicita 2017b; Kumar 2017; Felicita 2017a; Sivamurthy and Sundari 2016; Sekar et al. 2019; Johnson et al. 2020; Jain, Kumar, and Manjula 2014; Keerthana and Thenmozhi 2016).

A few investigations demonstrated that flower extract had antibacterial action whereas leaf extract had no effect on E. coli or S. aureus (Taddei and Rosas-Romero 2000). The present study demonstrated excellent antibacterial activity of leaves extract against S. aureus and the stem extract against S. mutans at 100 µL concentration. Increase in concentration showed an increase in microbial inhibition.

Other variables that may affect the nature of the active principles contained in the extract include variations in the extraction techniques, such as cold versus hot percolation methods, and the types of solvents utilized. Hence, comparing extracts made from various plant parts and using various types of solvents would help to improve the processes for the strongest antibacterial action.

Differences in the timing of plant collection could also account for a difference in activity when compared to previous research. The therapeutic potential of medicinal plants is derived from their numerous bioactive phytochemical components (Syed et al. 2020). The current research is essential for developing plant-based antimicrobial medicines in the pharmaceutical industry since microbes are evolving drug resistance.

Results for phytochemical screening of T. procumbens indicate the presence of the following phytochemicals in both acetone and methanolic leaf extract, suggesting that they may also have beneficial medicinal antioxidant properties: tannins, alkaloids, saponins, flavonoids, phenols, steroids, anthocyanins, proteins, amino acids, and carbohydrate constituents. A powerful haemostatic drug may be created from the leaves' aqueous extract because it also demonstrated improved blood coagulation activity (Kumar, Prasad, and Iyer 2012).

As a result, T. procumbens leaves and stem extracts have significant medicinal value and excellent therapeutic promise for treating microbial infections. By using more thorough examination of bioactive components, it will help in the development of superior pharmaceutical formulations. Further studies should focus on evaluating its biological activities and developing into formulations for various infectious diseases and wound healing.

5. Conclusion

The present study demonstrates that an eco-friendly and cost effective synthesis of plant extracts from stem and leaf of Tridax procumbens. These plant extracts showed potent antimicrobial activity against oral pathogens assuring its effective therapeutic application in several infectious diseases.

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Conflict of Interest:
The authors declare that there were no conflicts of interest in the present study.

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