



ISSN 2456-3110

Vol 9 · Issue 11

November 2024

Journal of  
**Ayurveda and Integrated  
Medical Sciences**

*www.jaims.in*

**JAIMS**

An International Journal for Researches in Ayurveda and Allied Sciences



**Maharshi Charaka**  
Ayurveda

**Indexed**

# In Vitro Comparative Analysis of *Paranti* (*Ixora coccinea* Linn) Roots and Leaves against Bacteria causing Diarrhea

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## ABSTRACT

*Paranti* (*Ixora coccinea* Linn) is used in several regions of India, especially in rural communities, by traditional medicine practitioners to treat diarrhoea. However, no scientific data is available to justify the traditional potentials of the plant species in gastrointestinal disorders. This study evaluates the *In vitro* antibacterial activities on diarrhoea causing organisms. *In vitro* antidiarrheal activity of the decoction of leaves and roots of *Paranti* (*Ixora coccinea* Linn), was evaluated against *Salmonella para typhi* A, and *Shigella flexneri* by Agar Dilution Method and Time Kill Assay. The Agar Dilution Method showed no antibacterial activity of *Paranti* (*Ixora coccinea* Linn) root and leaf decoction against *Shigella flexneri* and *Salmonella para typhi* A at volumes ranging from 0.5 ml to 5 ml. In the Time Kill Assay, both root and leaf decoction exhibited moderate antibacterial activity against both bacteria at all time points, except for a lack of activity at 8 hours for the leaves against *Salmonella para typhi* A. These results suggest high antibacterial effectiveness, particularly in a time-dependent context, against bacteria causing diarrhoea. Thus *In vitro* antibacterial activities which support its use in traditional herbal medicine practice.

**Key words:** Antibacterial, Agar Dilution Method, Time Kill Assay, *Shigella flexneri*, *Salmonella para typhi* A.

## INTRODUCTION

*Paranti* (*Ixora coccinea* Linn), known as the Jungle Geranium, in Sanskrit it is called as *Paranti*, it is a small, evergreen shrub with bright red flowers.<sup>[1]</sup> (Flame of Woods in English, Rangan in Hindi and Bengali, Kisukare in Kannada). It grows in tropical climates across Asia, including the Indian subcontinent,<sup>[2]</sup> and has been used in traditional medicine for various ailments, like gonorrhoea, anorexia, cephalgia, sores,

chronic ulcers, gastrointestinal issues like diarrhoea and dysentery. The plant is primarily known for its antibacterial and anti-inflammatory properties,<sup>[3]</sup> which contribute to its medicinal use. *Paranti* (*Ixora coccinea* Linn) has been used in traditional medicine for the treatment of diarrhoea and dysentery, particularly in folk medicine.<sup>[4]</sup> The root and leaf decoction are prepared and administered to help reduce the frequency of loose stools and alleviate symptoms of gastrointestinal distress, owing to its astringent properties.<sup>[5]</sup>

Diarrhoea is the second leading cause of under-five mortality in the world.<sup>[6]</sup> Diarrhoea is a common gastrointestinal disorder that leads to frequent loose or watery stools. It is often caused by bacterial, viral, or parasitic infections, but can also result from food intolerances, inflammatory bowel diseases, or medications.<sup>[7]</sup> In severe cases, diarrhoea can lead to dehydration and malnutrition, particularly in vulnerable populations like children and the elderly.<sup>[8]</sup> Some antibiotics are used as antidiarrheal drug, but

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Submission Date: 14/10/2024 Accepted Date: 24/11/2024

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DOI: 10.21760/jaims.9.11.13

these drugs sometimes show some adverse effects and microorganisms are tending to develop resistance towards them. Herbal medicines are believed to be effective in curing diarrhoea, and for many years, plants and plant extracts have been used to treat various gastrointestinal ailments, including diarrhoea. One such drug is *Paranti* (*Ixora coccinea* Linn) The therapeutic effects of *Paranti* (*Ixora coccinea* Linn) are largely attributed to its phytochemical composition, which includes alkaloids, flavonoids, tannins, saponins, and terpenoids. These compounds exhibit a range of pharmacological activities, including antimicrobial, anti-inflammatory, and antidiarrheal properties. The Alkaloids Have antimicrobial and anti-inflammatory properties, helping to reduce gastrointestinal distress. Flavonoids possess antioxidant, antidiarrheal, and anti-inflammatory properties. Tannins have astringent compounds help reduce bowel movement frequency by tightening the mucous membranes of the gastrointestinal tract. However, scientific evidence to verify these claims is limited.

The objective of this research study is to Evaluate the folklore claims of diarrheagenic action of *Paranti* (*Ixora coccinea* Linn) leaves and roots against '*Shigella flexneri*' and '*Salmonella para typhi-A*' In vitro on diarrheagenic organisms using Agar Dilution Method and Time Kill Assay Methods and Compare the antibacterial efficacy of *Paranti* (*Ixora coccinea* Linn) leaves and roots.

## MATERIALS AND METHODS

The Fresh leaf and root parts of *Paranti* (*Ixora coccinea* Linn) were collected from nearby surroundings of Udupi. They were authenticated by Head of Department of Research and Development. SDM Ayurveda Medical College and Hospital. Then they were shade dried and coarse powder of leaves and roots were prepared. Then one part of the thoroughly washed *Paranti* (*Ixora coccinea* Linn) roots and leaves are taken separately in different vessels and sixteen parts of water will be added and heated and is thus reduced to ¼ of the total volume.<sup>[9]</sup> The decoction obtained, is filtered and used for testing the action by *In vitro* study.

- **Bacterial Strains:** *Shigella flexneri* (clinical strain or reference strain like ATCC 12022) and *Salmonella Para typhi A* (clinical strain or reference strain like ATCC 9150)
- **Antibiotic Agent:** Ampicillin for *Shigella flexneri* and Ciprofloxacin for *Salmonella para typhi A*
- **Methods:** Agar Dilution Method<sup>[10]</sup> and Time Kill Assay Method<sup>[11]</sup>

## OBSERVATION AND RESULTS

### 1. Agar Dilution Method:

- ***Paranti* Root Decoction against *Shigella flexneri* and *Salmonella para typhi A*:**

*Paranti* (*Ixora coccinea* Linn) Root decoction (0.5 ml to 5 ml) showed no antibacterial activity against both *Shigella flexneri* and *Salmonella para typhi A* at all tested volumes. The results for all volumes were >300 mm, indicating no inhibition zones. Observed results are shown in Figure 1 and 2.

- ***Paranti* Leaves Decoction against *Shigella flexneri* and *Salmonella para typhi A*:**

*Paranti* (*Ixora coccinea* Linn) Leaves Decoction (0.5 ml to 5 ml) also showed no antibacterial activity against both *Shigella flexneri* and *Salmonella para typhi A* at all volumes. The results for all volumes were >300 mm, indicating no inhibition zones. Observed results are shown in figure 3 and 4.

### 2. Time Kill Assay

- ***Paranti* Root Decoction against *Shigella flexneri*:**

*Paranti* (*Ixora coccinea* Linn) Root decoction showed moderate antibacterial activity at all time intervals (2, 4, 6, 8, and 24 hours), with a reduction in bacterial count observed. At 24 hours, bacterial growth reduced significantly compared to the negative control. Observed results are shown in Figure 5.

- ***Paranti* Root Decoction against *Salmonella para typhi A*:**

*Paranti* (*Ixora coccinea* Linn) Root decoction showed moderate antibacterial activity at all time intervals (2, 4, 6, 8, and 24 hours), with a significant reduction in

bacterial count by 24 hours. The activity was less pronounced than the positive control (Ciprofloxacin). Observed results are shown in Figure 6.

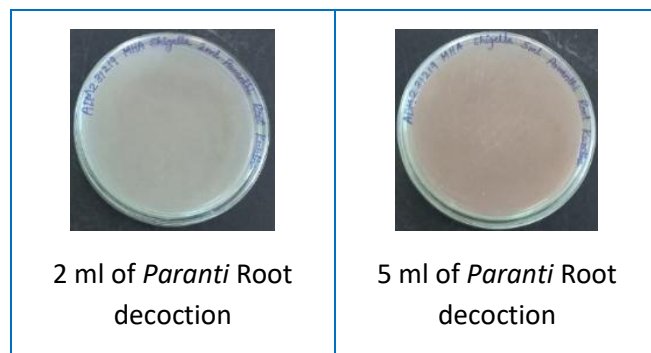
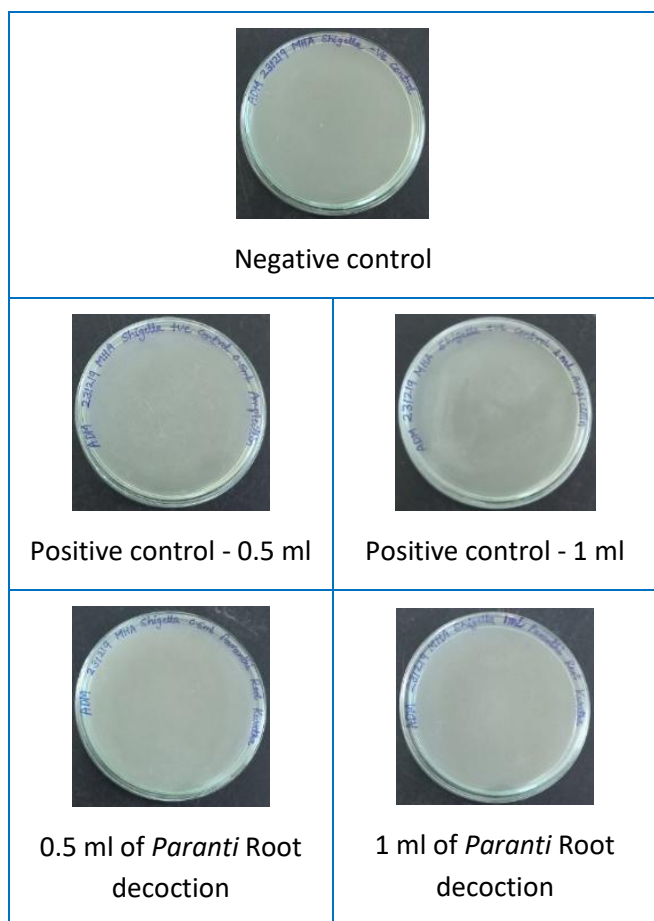
▪ **Paranti Leaves Decoction against *Shigella flexneri*:**

*Paranti* (*Ixora coccinea* Linn) Leaves decoction showed moderate antibacterial activity at all time points (2, 4, 6, 8, and 24 hours), with a reduction in bacterial count observed. At 24 hours, growth was reduced but not as much as the positive control. Observed results are shown in Figure 7.

▪ **Paranti Leaves Decoction against *Salmonella para typhi A*:**

*Paranti* (*Ixora coccinea* Linn) Leaves decoction showed moderate antibacterial activity at all time points (2, 4, 6, and 24 hours), with the exception of the 8-hour time point where growth appeared to increase. Activity was less than the positive control (Ciprofloxacin). Observed results are shown in Figure 8.

**Figure 1: Agar Dilution Method of Paranti Root decoction against *Shigella flexneri***



**Figure 2: Agar Dilution Method of Paranti Root decoction against *Salmonella para typhi A***

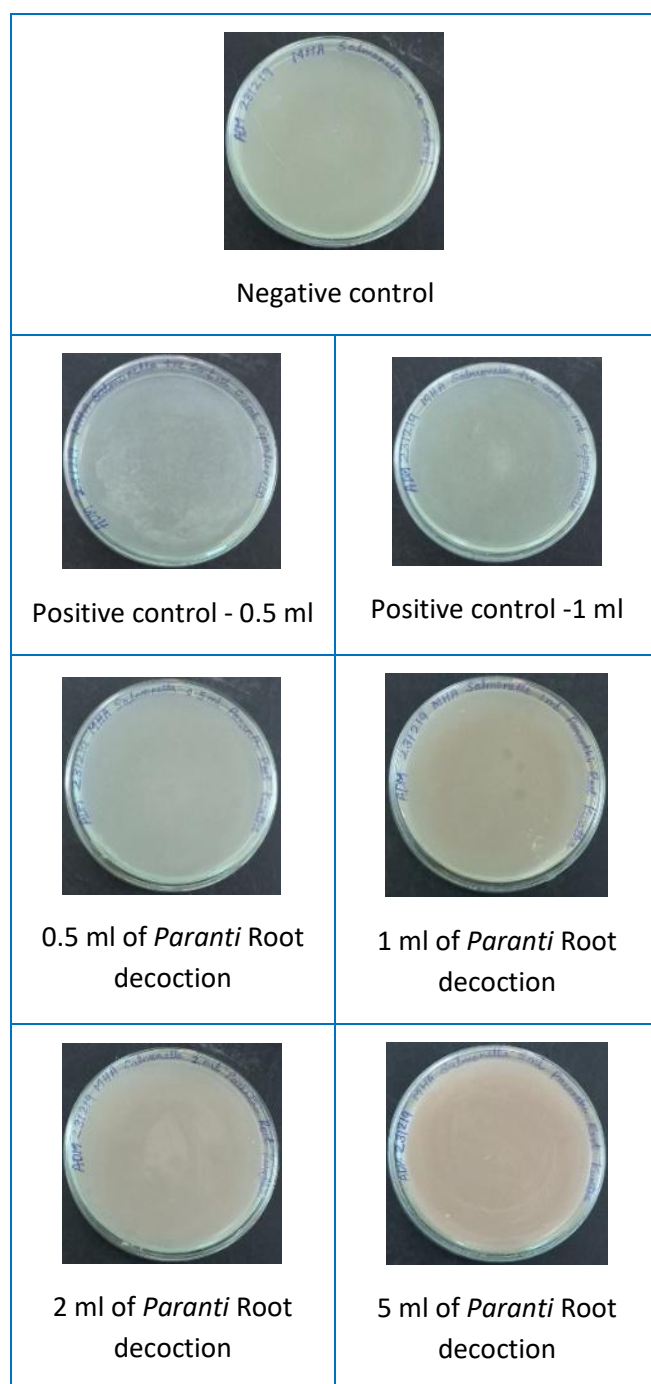




Figure 3: Agar Dilution Method of *Paranti* Leaves decoction against *Shigella flexneri*

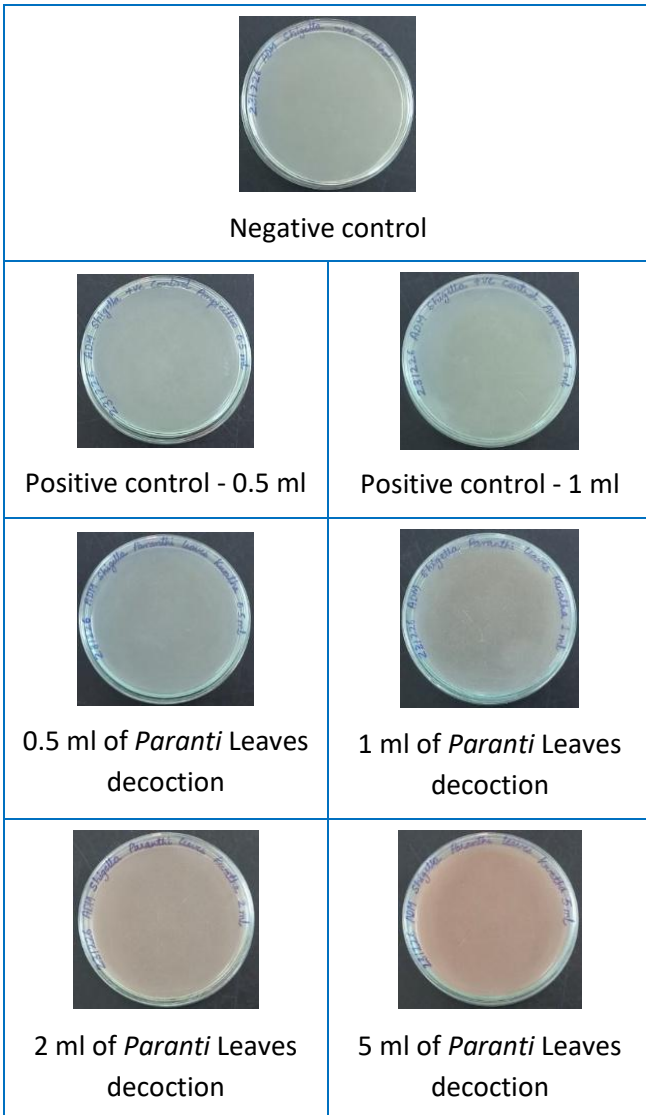


Figure 4: Agar Dilution Method of *Paranti* Leaves decoction against *Salmonella para typhi A*

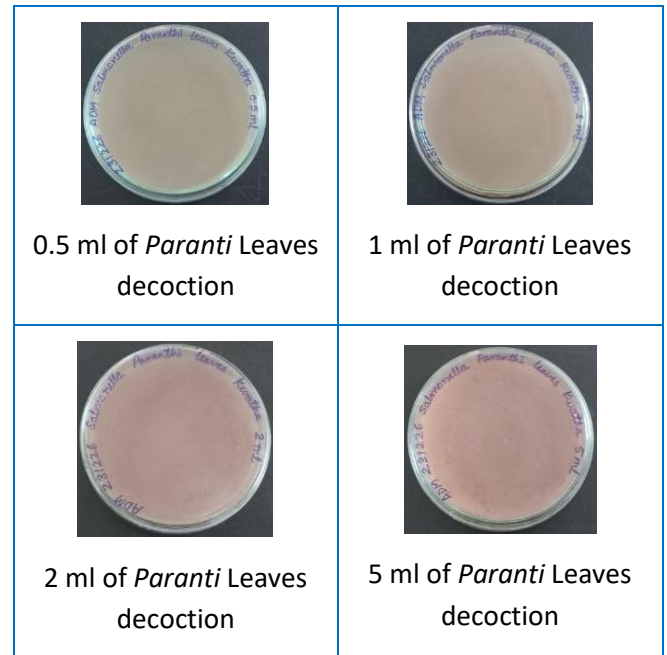
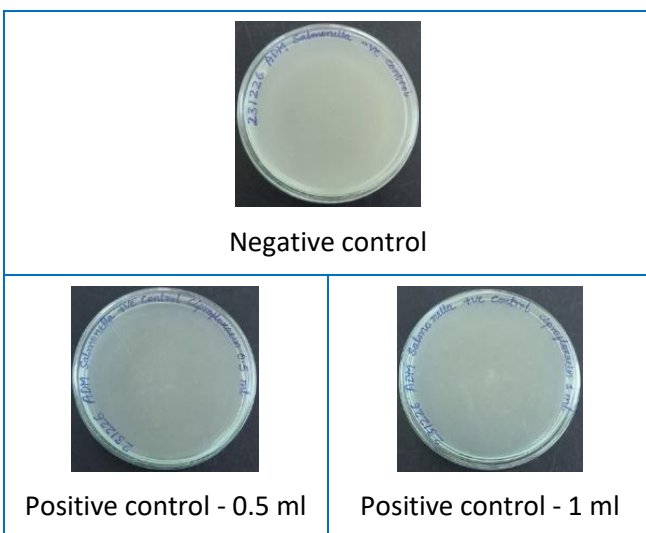
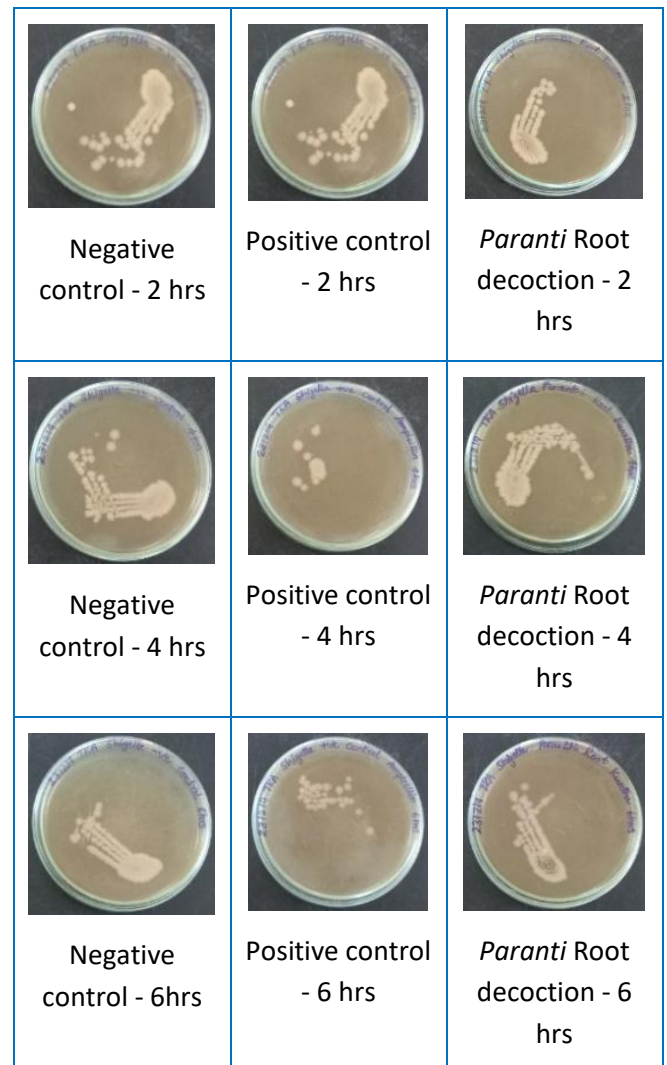


Figure 5: Time Kill Assay of *Paranti* Root decoction against *Shigella flexneri*



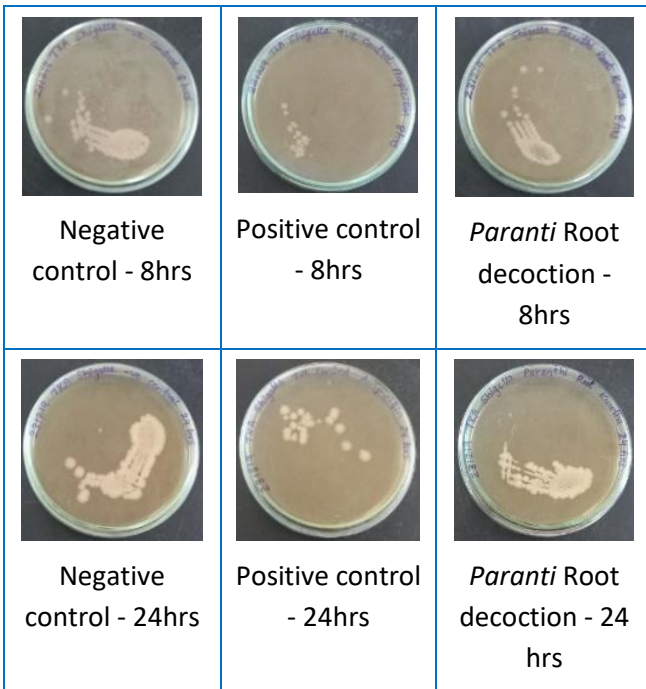


Figure No 6: Time Kill Assay of Paranti Root decoction against *Salmonella para typhi A*

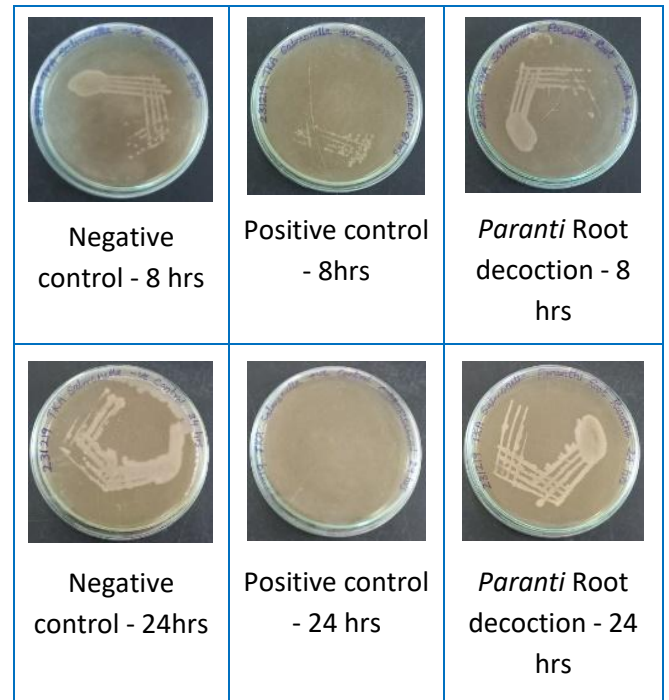
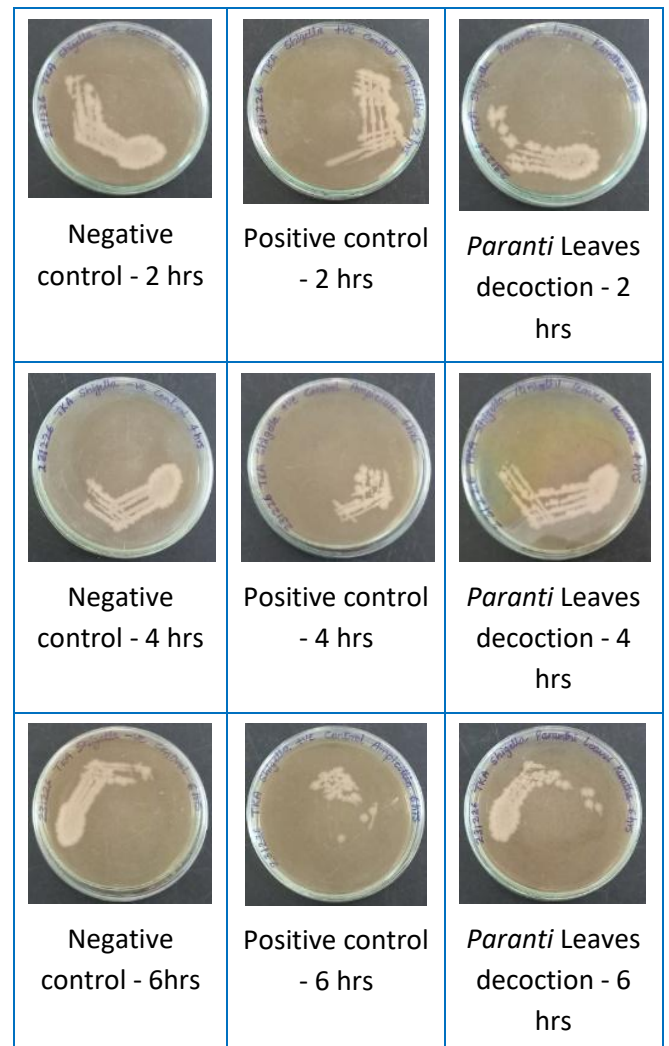
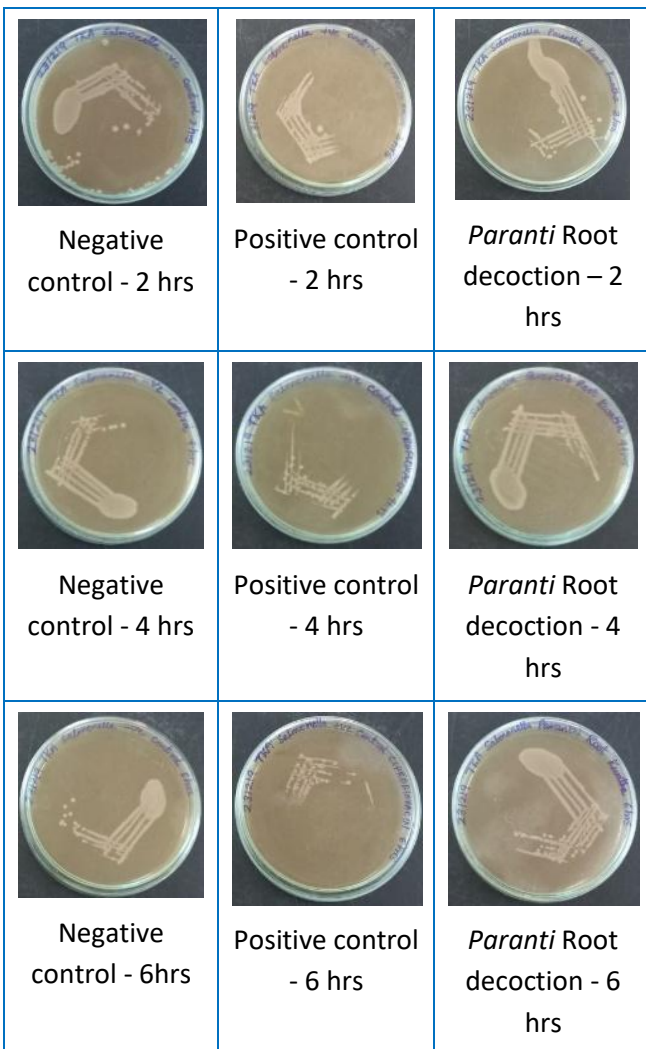


Figure 7: Time Kill Assay of Paranti Leaves decoction against *Shigella flexneri*.



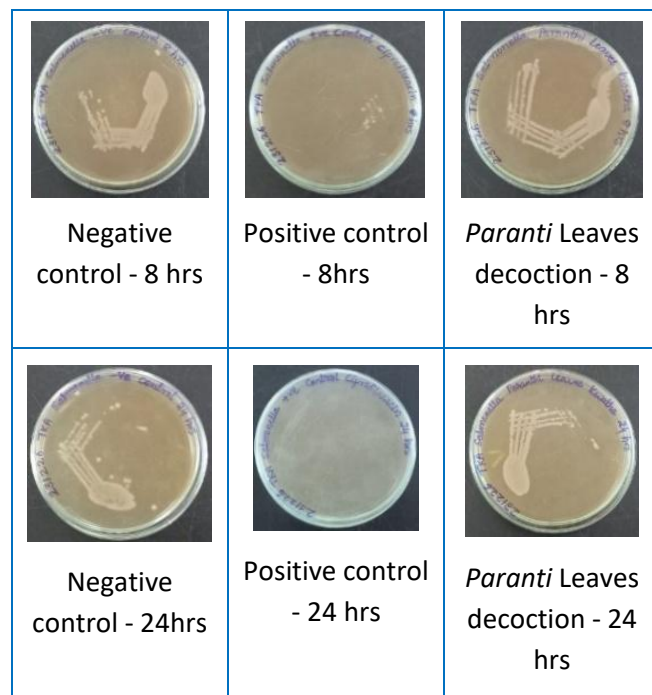
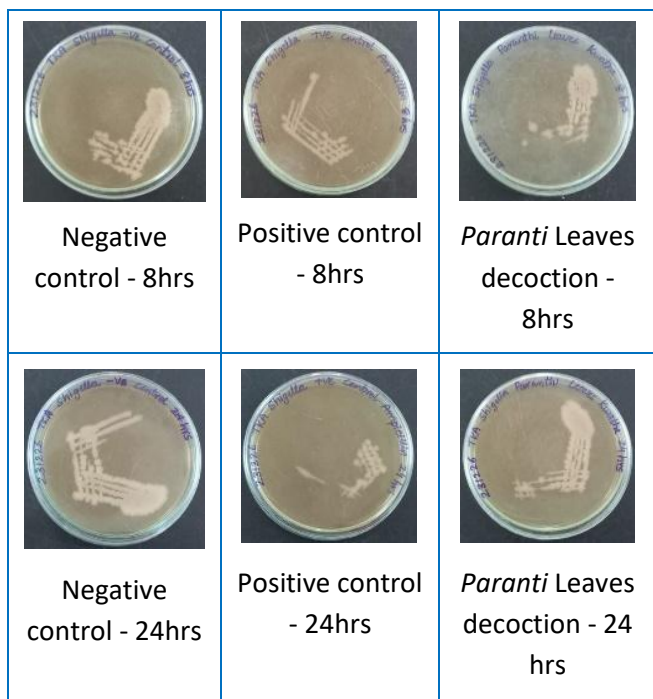
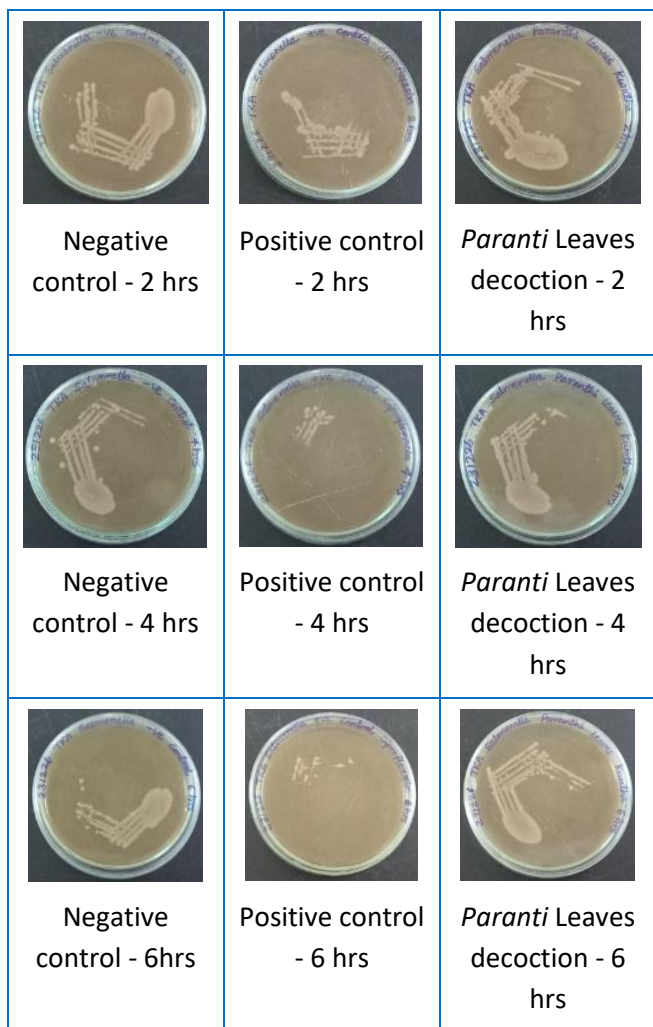


Figure 8: Time Kill Assay of Paranti Leaves decoction against *Salmonella para typhi A*

DISCUSSION

*Ixora coccinea*, commonly known as Paranti, is a plant traditionally used in Ayurveda and Folk medicine for its gastrointestinal benefits, particularly in treating diarrhoea and dysentery. Its therapeutic effects are attributed to its rich phytochemical profile, including alkaloids, flavonoids, tannins, saponins, and terpenoids, which are known for their antimicrobial, anti-inflammatory, and astringent properties.<sup>[12]</sup> The Alkaloids Have antimicrobial and anti-inflammatory properties, helping to reduce gastrointestinal distress. Flavonoids possess antioxidant, antidiarrheal, and anti-inflammatory properties. Tannins have astringent compounds help reduce bowel movement frequency by tightening the mucous membranes of the gastrointestinal tract. In this study, the antibacterial activity of Paranti (*Ixora coccinea* Linn) root and leaf decoctions was evaluated against *Shigella flexneri* and *Salmonella para typhi A*, two common pathogens responsible for diarrhoeal diseases.

The results from the Agar Dilution Method indicated that neither the root nor leaf decoctions of Paranti (*Ixora coccinea* Linn) exhibited significant antibacterial activity against the tested bacteria. Despite testing a range of concentrations (0.5 ml to 5 ml), no inhibition zones were observed, suggesting that the decoctions





did not prevent bacterial growth under these conditions. However, the Time Kill Assay, which measures the bactericidal effect over time, showed moderate antibacterial activity. Both root and leaf decoctions were effective in reducing bacterial counts at all time intervals (2, 4, 6, 8, and 24 hours). Although the root decoction demonstrated a more pronounced effect than the leaf decoction, both exhibited a significant reduction in bacterial growth by 24 hours, particularly in *Shigella flexneri*. The antibacterial effect was weaker than that of the antibiotic controls (Ampicillin for *Shigella flexneri* and Ciprofloxacin for *Salmonella para typhi A*), but it was still notable. These findings suggest that root decoction of test drug have significant suppression of bacterial growth, supporting its traditional use as a treatment for diarrhoea.

## CONCLUSION

The study demonstrated that the decoctions of both the Root and Leaves of *Paranti (Ixora coccinea* Linn) possess moderate antibacterial activity against *Shigella flexneri* and *Salmonella para typhi A*, as shown by the Time Kill Assay. While no antibacterial effects were observed in the Agar Dilution Method, the Root and Leaf decoctions were able to reduce bacterial growth over time, suggesting their potential as a natural remedy for diarrhoeal diseases. Although their efficacy was lower than that of synthetic antibiotics, the moderate antibacterial activity observed warrants further research into the plant's pharmacological properties and its potential therapeutic applications in treating gastrointestinal infections.

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**How to cite this article:** Aarthy Tikka, Vijayalaxmi PB. In Vitro Comparative Analysis of Paranti (*Ixora coccinea* Linn) Roots and Leaves against Bacteria causing Diarrhea. *J Ayurveda Integr Med Sci* 2024;11:87-93. <http://dx.doi.org/10.21760/jaims.9.11.13>

**Source of Support:** Nil, **Conflict of Interest:** None declared.

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