



# Assessment of *In vitro* Antibacterial and Anti-inflammatory activities of Sri Lankan medicinal plant *Jeffreyca zeylanica* (Pupula)

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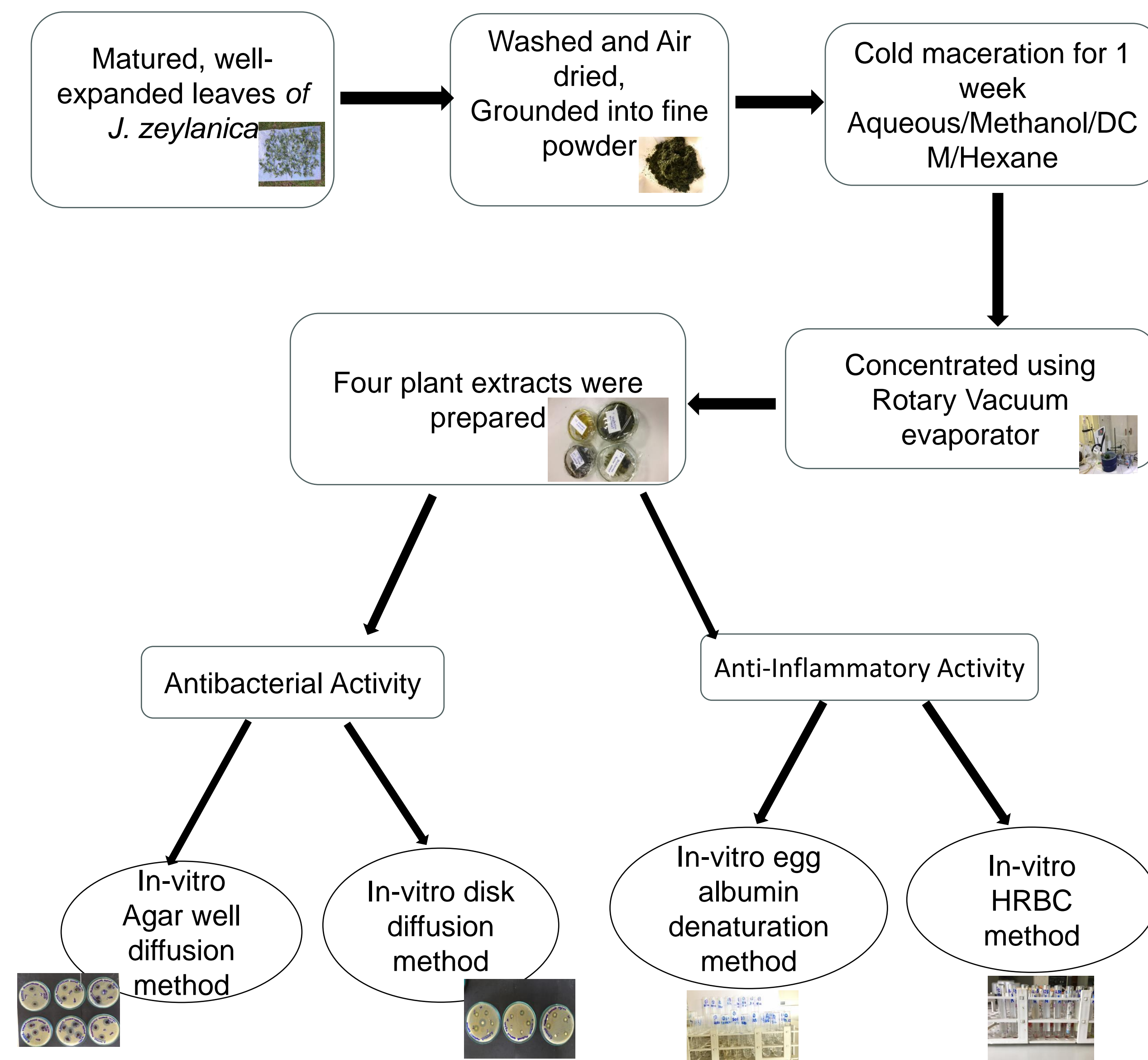
## ABSTRACT

Antibiotic resistance, global health risks, and absurd consequences of anti-inflammatory drugs are significant complications. As an alternative plant can be used. *Jeffreyca zeylanica* an endemic plant in Sri Lanka was selected to evaluate antibacterial and anti-inflammatory activities, because of its ethnomedical value and economical. *J. zeylanica* leaves were air-dried, then macerated and plant extracts were prepared using vacuum evaporation. Plant extracts were made using aqueous, methanol, dichloromethane, and hexane as solvents. To detect antibacterial activity Agar well diffusion and Disc diffusion methods were used. To assess anti-inflammatory activity egg albumin denaturation and Human Red Blood Cell (HRBC) membrane stabilization methods were used. The antibacterial activity of the plant extracts was evaluated against *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and *Escherichia coli*. In both methods, plant extracts effectively inhibited the activity of *S. aureus*. In the agar well diffusion method, methanolic extract indicated the highest inhibition zone of 29.33±0.33 mm and high effectiveness with EC<sub>50</sub> of 39.05 mg/ml. In the disc diffusion method, dichloromethane extract indicated the highest zone of 14.66±0.33 mm, and the most effective activity was indicated by methanolic extract with an EC<sub>50</sub> of 200 mg/ml. Both methods used Gentamicin (40mg/mL, 10µg) as the positive control. In the protein denaturation method, hexane extract indicated the best potential activity with IC<sub>50</sub> of 154.9 µg/ml. In the HRBC method, the highest potency was indicated by dichloromethane extract with IC<sub>50</sub> of 154.0 µg/ml. Diclofenac sodium was the reference drug to evaluate the anti-inflammatory activity. The above results indicate that plant *J. zeylanica* has potential antibacterial and anti-inflammatory activity.

## Introduction

In novel medicine synthetic antibiotics are used to treat bacterial infections. Nowadays bacterial infections have a large impact on the public health sector. In synthetic medicine, Non- Steroidal Anti- Anti-inflammatory drugs (NSAIDs) are commonly used to manage pain and inflammation. However, these NSAIDs can cause severe adverse effects. As an alternative to these synthetic antibiotics and NSAIDs nowadays people tend to use plant extracts with antibacterial and anti-inflammatory effects. Plant *Jeffreyca zeylanica* is an herbaceous plant that is endemic to Sri Lanka. This plant is a Member of the family ASTERACEAE. The plant Exhibits a variety of ethnomedical traits, such as being Used to treat a variety of infections and diseases, to treat fractions and encourage bone fusion, Applied to boils, To treat asthma and leg eczema, For food poisoning, diarrhea, and dysentery, Used to treat wounds and abscesses, As an anti-venom.

## Methodology



## Results and discussion

### Anti bacterial Activity

Well diffusion method				Disc diffusion method			
Extract	Bacteria	Highest zone of inhibition (mm)	EC 50	Extract	Bacteria	Highest zone of inhibition (mm)	EC 50
Aqueous	<i>S. aureus</i>	21.33±0.33	193.3 mg/mL	Aqueous	<i>S. aureus</i>	No zone of inhibition	-
Methanol		29.33±0.33	39.03 mg/mL	Methanol		14.33±0.33	200.0 mg/mL
DCM		23.66±0.33	124.5mg/mL	DCM		14.66±0.33	287.7 mg/mL
Hexane		13±0.57	312.0 mg/mL	Hexane		9.66±0.33	215.1 mg/mL
Aqueous	<i>P. aeruginosa</i>	24±0.57	183.0 mg/mL	Aqueous	<i>P. aeruginosa</i>	No zone of inhibition	-
Methanol		17.33±0.33	1392.0 mg/mL	Methanol		12.33±0.33	5.236 mg/mL
DCM		No zone of inhibition	-	DCM		10.33±0.33	296.8 mg/mL
Hexane		No zone of inhibition	-	Hexane		10±0	270.2 mg/mL
Aqueous	<i>E. coli</i>	11.33±0.33	174.1 mg/mL	Aqueous	<i>E. coli</i>	No zone of inhibition	-
Methanol		12.66±0.33	39.01 mg/mL	Methanol		11±0.57	233.0 mg/mL
DCM		No zone of inhibition	-	DCM		No zone of inhibition	-
Hexane		No zone of inhibition	-	Hexane		11.33±0.33	272.4 mg/mL

### Anti-inflammatory Activity

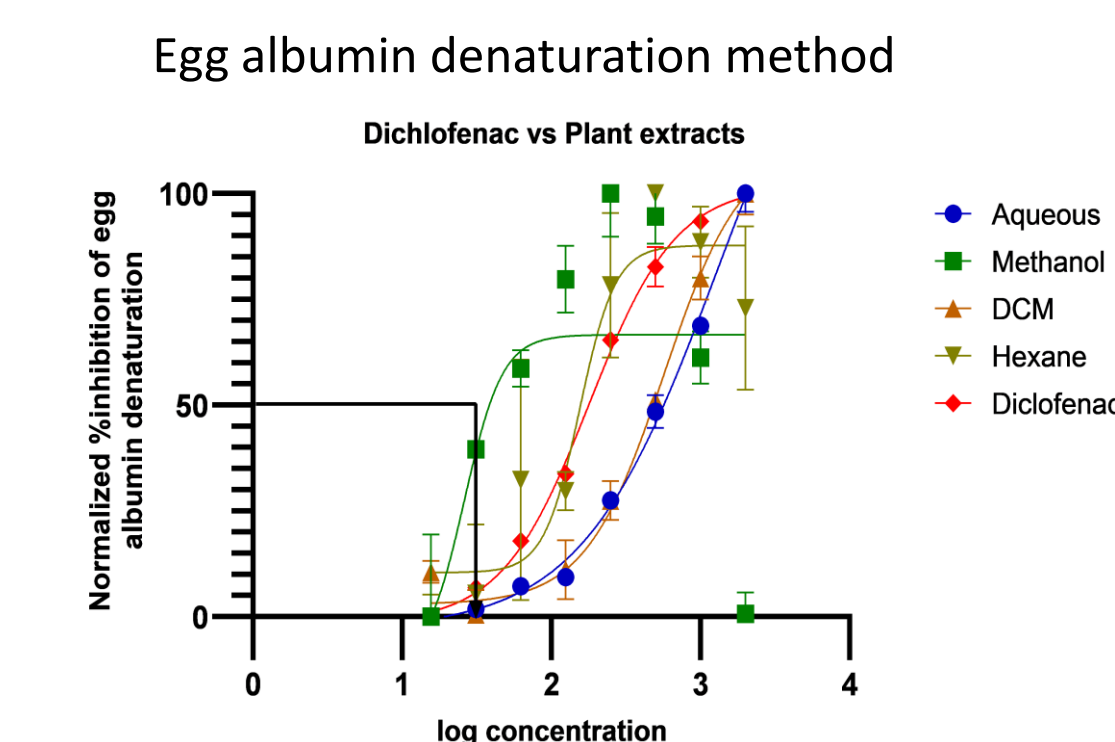


Fig.1 Normalized % inhibition of egg albumin denaturation of the reference drug diclofenac, aqueous extract, methanol extract, DCM extract, and hexane extract of *J. zeylanica* leaves.

	Diclofenac sodium	Aqueous	Methanol	DCM	Hexane
IC <sub>50</sub>	179.2 µg/mL	1297.0 µg/mL	26.14 µg/mL	568.1 µg/mL	154.9 µg/mL
P value	0.0098	0.0382	0.0054	0.0351	0.0075
R squared	0.9979	0.9962	0.3812	0.9898	0.9114

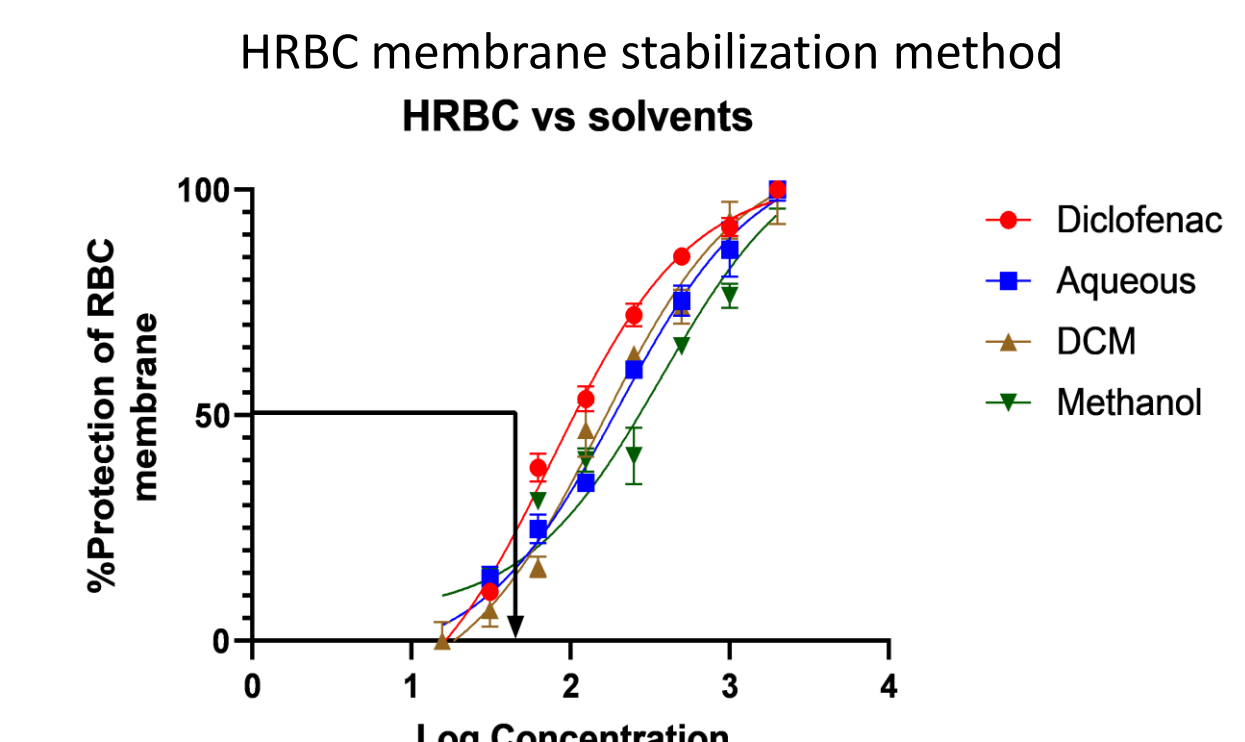


Fig. 2 Normalized % stabilization of the Human RBC membrane with reference drug diclofenac sodium and aqueous, methanol, DCM extracts of *J. zeylanica* leaves.

	Diclofenac sodium	Aqueous	DCM	Methanol
IC <sub>50</sub>	77.05 µg/mL	199.5 µg/mL	154.0 µg/mL	371.9 µg/mL
P value	0.0037	0.0063	0.0104	0.0056
R squared	0.9929	0.9873	0.9787	0.9431

## Anti-bacterial activity

Gram positive *S. aureus* is the most susceptible organism → Cell wall structure, no outer membrane

Methanolic extract was most effective in both well & disc diffusion method → More polar secondary metabolites of the plant are contributed

## Anti-inflammatory activity

Hexane, most potential anti-inflammatory activity using egg albumin method → Less/nonpolar compounds of leave extracts are contributed more for anti-inflammatory activity

DCM, most potential anti-inflammatory activity using HRBC method

## Conclusion

- The study suggests the possible antibacterial and anti-inflammatory activity of aqueous, methanol, DCM & hexane leaves extracts of *Jeffreyca zeylanica*.
- More polar solvent extracts (aqueous, methanol) showed better results in the agar well diffusion method and disk diffusion method.
- Hexane leaves extract of *J. zeylanica* indicates the highest potential anti-inflammatory ability using the protein denaturation method.
- DCM leaf extract of *J. zeylanica* indicated the highest potential activity using HRBC membrane stabilization.
- The existence of nonpolar phytochemical compounds in *J. zeylanica* leaves (triterpenoids, flavonoids, lupanol) is favorable for the plant's anti-inflammatory activity.

## References

- Anti-inflammatory effect of leaves of *Vernonia zeylanica* in lipopolysaccharide-stimulated RAW 264.7 macrophages and carrageenan-induced rat paw-edema model (2021)
- Antidiabetic Activity of Widely Used Medicinal Plants in the Sri Lankan Traditional Healthcare System: New Insight to Medicinal Flora in Sri Lanka', *Evidence-Based Complementary and Alternative Medicine* (2021)
- In vitro* effects of aqueous extracts of five Sri Lankan medicinal plants on human erythrocyte membrane stabilization activity (2015)
- In vitro*, antioxidant activity of methanolic extracts of leaves of *Indigofera indica* and stem bark of *Stereospermum suaveolens* grown in Sri Lanka (2015)
- Lack of *in vitro* anti hyaluronidase activity of methanolic leaf extract of *Indigofera tinctoria* L and methanolic stem bark extract of *Stereospermum suaveolens* DC (2015)
- Rich diversity & potential medicinal value of endemic Sri Lankan plant: *Jeffreyca zeylanica* (2022)
- Antibacterial activity of water extracts of different parts of *Morinda citrifolia* grown in Sri Lanka (2016)