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Research Article

An Evaluation of the Chemical and Antibacterial Properties of the Mizo Traditional Medicine, *Erythrina stricta*

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ABSTRACT

Background: *Erythrina stricta* Roxb. is a member of the legume's family, Fabaceae, well-known among the Indian traditional healers for its numerous medicinal uses in various ailments. Different parts of the plant, such as its root, bark, leaves and flowers had been commonly used by many tribes across India. In the Mizo traditional medicine, the decoction of the bark is a remedy for various skin diseases, infection, stomach-ache and ulcers. This study was planned to authenticate the therapeutic applications upheld by the Mizo people. **Materials and Methods:** The chloroform extract of *E. stricta* bark was analysed for its secondary metabolite composition, antioxidant property and antibacterial activity against Gram-positive and Gram-negative species. **Results:** The main secondary metabolites in the plant extracts were identified as alkaloids, flavonoids and phenolic compounds. The antioxidant contents were determined as 28.86±0.95 mg/g quercetin equivalent for total flavonoid content, 9.11±0.15 mg/g gallic acid equivalent for total phenolic content, and 41.641±1.37 mg/g ascorbic acid equivalent for total antioxidant. The antioxidation capacity estimated using 2,2-Diphenyl-1-1-Picryldrazyl (DPPH) assays showed a half-maximal Inhibitory Concentration (IC_{50}) value of 13.74±3.9, comparable to that of the standard butylated hydroxytoluene at IC_{50} of 10.53±2.7. The plant extract displayed a wide-range of antibacterial potential, effectively inhibiting the growth of Gram-negative bacteria including *Klebsiella pneumoniae* and *Salmonella typhimurium*, as well as Gram-positive species such as *Bacillus cereus* and *Staphylococcus aureus*, but not the Gram-negative *Escherichia coli*. Interestingly, the plant extract was also effective against antibiotic-resistant strains. The minimum inhibitory concentrations were determined as 2.5 mg/mL against *S. aureus* and *S. typhimurium*, and 5 mg/mL against *B. cereus* and *K. pneumoniae*. **Conclusion:** The findings substantiate *E. stricta* as a medicinally valuable plant having health beneficial properties. Its effectiveness against multidrug-resistance bacteria suggests that it could be a valuable source of broad-spectrum antibacterial compound. This is the first report of *E. stricta* as an effective agent against multidrug-resistant bacteria, thereby, indicating its importance in health and pharmaceutical development.

Keywords: Antibacterial, Antioxidant, *Erythrina stricta*, Medicinal Plant, Secondary Metabolites.

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INTRODUCTION

Management of diseases and supply of health supplements are still a major issue in human welfare as many important medications are unavailable in several parts of the world, especially where they are mostly needed. In developing countries including India, shortage of essential drugs in rural and urban areas alike has been an issue affecting underprivileged (Pandey *et al.*, 2025; Shukar *et al.*, 2021). An estimate from the World Health Organization indicates that about 68% of the global population have no regular access to essential medicines (WHO, 2004). Similarly, India is also impacted by this trend with numerous studies indicating that essential medicines are poorly distributed in medical centres throughout the country (Meena and Mathaiyan, 2021; Wadhwa *et al.*, 2024). In recent times, modern medicines encounter rapid evolution and proliferation of multidrug resistance in the target pathogens which has become a major and critical barrier to the successful intervention of most complicated diseases (Balasubramanian *et al.*, 2023; Murray *et al.*, 2022). Gradual slackening the potential of synthetic drugs coupled with their growing contraindications has turned refocused attention on medicinal plants for novel and alternative treatments (Latif and Nawaz, 2025; Ranasinghe *et al.*, 2023). Medicinal plants have been used as the primary therapy for many diseases since antiquity, and many pharmaceutical drugs have been developed from important traditionally used plants. Their rich chemical constituents known as secondary metabolites are the sources of many drugs used in clinical practice (Theodoridis *et al.*, 2023). With the problems of limited pharmaceutical availability

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compounded by drug resistance, there is a perpetual need for mining unexplored medicinal plants.

Erythrina stricta Roxb. is a perennial and deciduous medium-sized tree that belongs to the family Fabaceae. Popularly known as "Indian coral tree" or "prickly coral tree" as the plant is covered with sharp and pointed prickles and native to Indian subcontinent, it is found throughout South-East Asia including Bangladesh, Cambodia, China, Laos, Myanmar, Nepal, Thailand, Tibet, and Vietnam (Murthy *et al*., 2024). The species is distinguished from other species of *Erythrina* by its vibrant red flowers blooming at its peak during February-March followed by seed pod development from April-May. *Erythrina* species are well-known in Indian traditional medicine for their biological properties which are commonly used to treat various ailments such as wounds, parasitic and microbial infections, ulcers, malaria, cancer and inflammation (Susilawati *et al*., 2023). Their pharmacological properties are mainly attributed to tetracyclic erythrinan alkaloids (Fahmy *et al*., 2019). *E. stricta* is known to be a rich source of secondary metabolites including alkaloids, flavonoids, and phenolic compounds (Asokkumar *et al*., 2008; Santiago-Figueroa *et al*., 2023). These compounds are associated with the plant's anti-inflammatory, antimicrobial, analgesic, anthelmintic, anticonvulsant, anxiolytic, insecticidal, curare-like and cytotoxic activities (Son and Elshamy, 2021).

E. stricta, specifically decoction of the bark, has unique uses in the Mizo traditional medicine. The Mizo tribe of northeast India have used it as a remedy for stomach-ache and ulcers, diabetic blisters, threadworm infection, skin infection, sores and different types of wounds (Lalawmpuii *et al*., 2023). It is known in Mizo as "*farṭuah*" because of its latex produced by an elder tree trunk, a chemical substance which has been highly valued for its medicinal uses. The plant is well established in low land, abandoned or fallow areas and along the roadside typically forming part of the secondary vegetation. Local inquiries among traditional healers indicate that it is also used to treat wounds and maggot infestations in domesticated animals. Despite the number of medicinal applications in the Mizo ethnomedicine, there are no reports to support any of the medicinal values. Therefore, the current study was designed to evaluate and validate the fundamental phytochemical components, antioxidant properties, and antibacterial activities of *E. stricta* based on the traditional medicine among the Mizo people to understand its pharmacological potentials.

MATERIALS AND METHODS

Collection and Authentication of Plant Material

The plant parts of *E. stricta* were collected from forests around Aizawl, Mizoram, India (located between 23.7307° N and 92.7173° E). The taxonomic identification of the herbarium specimen was performed by taxonomists at the Botanical Survey of India, Eastern Regional Centre, Shillong, Meghalaya, India (authentication Letter no.: BSI/ERC/Tech/2021-22/389; dated 12/1/2022). The authenticated voucher specimen was preserved and deposited in the Herbarium Repository, Department of Botany, Pachhunga University College, for future reference, under the accession no. PUC-E-21-01.

Plant Extract Preparation

Fresh plant samples were washed thoroughly 2-3 times with distilled water, cut into small pieces and shade dried at room temperature. The dried sample was homogenized into coarsely powdered using electric grinder and stored in airtight containers. The powdered sample was then subjected to successive extraction using chloroform in a Soxhlet's apparatus for 72 hr. The crude extract was concentrated by segregating the solvent in a rotary vacuum evaporator (Buchi Rotavapor® R-300). The final semisolid extract retrieved was labelled and kept in refrigerator at 4°C for further analysis.

Qualitative Phytochemical Analysis

Phytochemical analysis for identifying secondary metabolites was carried out according to the standard chemical detection methods (Shaikh and Patil, 2020). Briefly, alkaloids were tested by Mayer's test, Wagner's test, Hager's test and Dragendorff's test; flavonoids by alkaline reagent test, lead acetate test, ferric chloride test and Shinoda test; phenolics by ferric chloride test, lead acetate test, potassium dichromate test, iodine test, ellagic acid test and gelatin test; carbohydrates test by Molisch's test, Benedict's test, Fehling's test; glycosides by Liebermann's test, Salkowski's test, Keller-Kiliani test and Borntrager's test; saponins test by froth and foam tests; tannins by gelatin test, Braymer's test, sodium hydroxide test; amino acid and proteins by Biuret test, Millon's test and Ninhydrin test; phytosterols by Salkowski's test, Liebermann's test; triterpenoids by Salkowski's test; and diterpenes by copper acetate test.

Total Flavonoids Content

The amount of total flavonoids present in *E. stricta* bark was quantified based on aluminium chloride colorimetric assay with slight modification (Zhishen *et al*., 1999). Quercetin was used as a standard antioxidant to establish calibration linear with function. 1 mL of the plant extract from the stock solution (prepared at 1 mg/mL) was diluted with 2 mL of distilled water in a test tube and allowed to stand for 5 min. Then 3 mL of 5% sodium nitrite was added followed by addition of 0.3 mL of 10% aluminium chloride solution. After 6 min, 2 mL of 1.0m NaOH was added and kept for 1 hr. A set of different concentrations of standard solutions of quercetin (10, 20, 40, 60, 80, and 100 µg/mL) was prepared similarly as the same plant extract. The absorbances of reaction products were measured against blank at 510 nm in a UV-vis spectrophotometer (Labtronics LT-39, Haryana, India). The experiments were executed in triplicate. The total flavonoid

content was expressed as milligrams of quercetin equivalent per gram (mg QCE/g) of dry weight from the standard curve.

Total Phenolic Content

The total phenolic content was estimated by Folin-Ciocalteau assay based on phosphomolybdate and phosphotungstate reactions (Singleton and Rossi, 1965). Gallic acid was used as a standard reference. 1 mL of the plant extract (at 1 mg/mL) was mixed with 5 mL of Folin-Ciocalteau reagent. After 3 min, 4 mL of 0.7m sodium carbonate solution was added to the mixture and kept at room temperature for 1 hr. Different concentrations of gallic acid (10, 20, 40, 60, 80, and 100 µg/mL) were prepared and mixed with the same reagents as described for the plant extracts. The absorbances of the final solutions were read against the blank at 765 nm. The total phenolic content was determined from the calibration curve of gallic acid and determined as milligrams of gallic acid equivalent per gram (mg GAE/g) of dry weight.

Total Antioxidant Content

The total antioxidants present in *E. stricta* bark was estimated by phosphomolybdate-vitamin (ascorbic acid) reaction (Prieto *et al*., 1999). 0.1 mL of the plant extract solution and different concentrations, viz. 10, 20, 40, 60, 80, and 100 µg/mL, of ascorbic acid were taken in separate test tubes. A reagent mixture was prepared by mixing 4 mm ammonium molybdate, 28 mm sodium phosphate and 0.6m sulfuric acid. 3 mL of the reagent was added to 100 µL of each ascorbic acid sample and the plant extract. The samples were incubated in an oven at 95°C to allow chemical reaction for 90 min. The absorbances of the solutions were measured at 695 nm. The total antioxidant content was extrapolated from the standard curve of ascorbic acid and expressed as milligrams of ascorbic acid equivalent per gram (mg ascorbic acid equivalent/gm) of the dry weight of the sample.

Free Radical-Scavenging Assay

The antioxidation potential of the plant extract was evaluated by 2,2-Diphenyl-1-Picrylhydrazyl (DPPH) free radical-scavenging reaction (Blois, 1958). From a stock solution (1 mg/ml) of the plant extract, different concentrations were prepared such as 10, 20, 40, 60, 80 and 100 µg/mL in methanol. The total volumes were made up to 3 mL each by adding methanol. 0.5 mL of 0.1 mm DPPH methanolic solution was added to all the samples. 1 mL of DPPH methanolic solution and 3 mL of methanol were used as control and blank sample. All the samples were incubated at 37°C for 30 min. Butylated Hydroxytoluene (BHT) was used as reference antioxidant. The colour intensities of the solutions were measured at 517 nm and adjusted against blank readings. The percentage of DPPH-scavenging activity was calculated from the equation:

$$\text{scavenging activity (\%)} = [(\text{Absorbance of control} - \text{absorbance of extract}) \div \text{Absorbance of control}] \times 100$$

The Half-Maximal Inhibitory Concentration (IC_{50}) was estimated from a dose-response curve prepared from $\log_{10}$ at 1, 0.5, and 0.25 mg/mL.

Antibacterial Activity

The antibacterial susceptibility test of *E. stricta* was assessed by disc diffusion method (Bauer, 1996). Six pathogenic bacteria were obtained from the American Type Culture Collection (Manassas, VA, United States) through Himedia Laboratories Private Limited, Mumbai, India. The bacteria were three Gram-negative species such as *Escherichia coli* (ATCC 10536), *Salmonella enterica* subsp. *enterica Serovar typhimurium* (*S. typhimurium*, ATCC 51812) and *Klebsiella pneumoniae* (ATCC 10031), and four Gram-positive species such as *Bacillus cereus* (ATCC 13061), *Staphylococcus aureus* 1 (ATCC 700698), *S. aureus* 2 (ATCC 11632) and *Micrococcus luteus* (ATCC 10240). The specimens were maintained by serial subculture at DBT-BUILDER National Laboratory, Pachhunga University College, Aizawl, Mizoram, India. Two different concentrations, that is, 10 and 20 mg/mL of the plant extract were made from the stock solution. Sterile Whatman filter no. 3 was punched into discs of 5-mm diameter and impregnated with the plant extract. Culture medium was prepared by dissolving Mueller-Hinton agar powder (Himedia) in distilled water. The nutrient agar was poured into petri plates and allowed to solidify at room temperature. The bacterial inoculum suspensions were then added in the media and spread uniformly to allow even growth of the bacteria. The paper discs were planted on the surface of the mediat. 1% Dimethyl Sulphoxide (DMSO) and ciprofloxacin, 2% 1× were used as negative and positive controls respectively. The plates were then incubated at 37°C for 24 hr and the areas of growth (specifically nongrowth zones) was were by measured to determine bacterial inhibition. All the tests were done in triplicates.

Minimum Inhibitory Concentration

The Minimum Inhibitory Concentration (MIC) of the plant sample against different bacteria was determined by agar disc diffusion method (Jorgensen and Ferraro, 2009). A series of concentrations, viz. 2.5, 5, 7.5, 10, 12.5 and 20 mg/mL, of the plant extract was prepared along with an antibiotic disc of ciprofloxacin, 2%, 1× and 1% DMSO. Mueller-Hinton agar was prepared for the culture media. The different concentration of the plant extract and the control samples were impregnated on the surface of the culture media. The lowest concentration that prevents the visible growth of the test microorganisms was recorded after 24 hr of incubation.

RESULTS

Chemical detection from 11 group tests revealed the presence of important phytocompounds in the chloroform extract of *E. stricta* bark (Table 1). Nine classes of secondary metabolites were detected in the plant extract that included alkaloids, flavonoids,

phenols, carbohydrates, glycosides, tannins, triterpenes and proteins and amino acids. Only two groups, namely saponins and diterpenes, were not detected. The result shows that *E. stricta* bark is a rich source of potential bioactive compounds that could be implicated with the plant's diverse medicinal uses.

The concentration of flavonoid in the chloroform extract of *E. stricta* bark was quantified and estimated from the calibration curves of standard quercetin obtained from different sets of concentration (Figure 1). Regression equation (y=0.0061x + 0.0114) and correlation coefficient (R^2=0.9995) revealed good linearity response. From the standard graph, the amount of total flavonoid content was found to be 28.86±0.95 mg QCE/g. This indicates high content of flavonoids that could be the sources of the bioactive compounds in *E. stricta* bark.

A standard graph of gallic acid revealed good linearity response with regression equation (y=0.1711x – 0.0219) and correlation coefficient (R^2=0.9905) for the estimation of total phenolic content (Figure 2). The total phenolic content was found to be 9.11±0.15 mg GAE/g.

The total antioxidant content of *E. stricta* extract was calculated at 41.64±1.37 mg AAE/g from the calibration curve of standard ascorbic acid (Figure 3). The graph showed regression equation (y=0.027x + 0.0219) and correlation coefficient (R^2=0.9776) which indicate good linearity response for the estimation of total antioxidant capacity.

DPPH scavenging activity of *E. stricta* extract and standard antioxidant, BHT, are shown in Figure 4. The inhibition percentage of both the plant sample and BHT increases with increased concentration indicating concentration-dependent free radical-scavenging activities. BHT showed slightly higher efficacy at all concentrations tested (Figure 4A). IC_{50} was calculated from dose-response curve prepared from $\log_{10}$ (Figure 4B). The plant extract showed IC_{50} of 13.74±3.9 while BHT showed 10.53±2.7. The lower the IC_{50} value, the higher was the antioxidant activity, hence, the plant extract had slightly but comparable inhibitory action.

The chloroform extract of *E. stricta* bark effective against both Gram-positive and Gram-negative bacteria, except *E. coli*. Six concentrations, such as 2.5, 5.0, 7.5, 10.0, 12.5 and 20 mg/mL, of the plant extract were tested for the six bacterial strains (Table 2). The negative control, 1% DMSO did not affect the proliferation of any of the bacteria and they grew uniformly in the culture media. The positive control, ciprofloxacin was highly effective indicating high values for the zones of inhibitions, but not against the two strains of *S. aureus*. This showed that *S. aureus* were antibiotic-resistant strains. Ciprofloxacin's efficacy was in the order *E. coli* > *S. typhimurium* > *B. cereus* > *K. pneumoniae*. It is remarkable that *E. stricta* bark was effective against the ciprofloxacin-resistant *S. aureus*.

The minimum inhibitory concentrations of *E. stricta* bark extract against different bacteria indicated MIC of 2.5 mg/mL against *S. aureus* 1, *S. aureus* 2 and *S. typhimurium*, while it was 5 mg/mL against *K. pneumoniae* and *B. cereus*. Both strains of *S. aureus* are antibiotic resistant, and hence, the plant extract was effective at the lowest possible concentration tested in the study.

DISCUSSION

The secondary metabolites of plants are the primary sources of biochemically active compounds that contribute to different pharmacological effects and developed into pharmaceutical drugs (Wawrosch and Zotchev, 2021). These phytochemical compounds possess a strong novel biological behaviour to treat different human-health related diseases also employed in the production of nutrition and health supplements (Simsek and Whitney, 2024). In this present analysis, chloroform extract of *E. stricta* was found to contain major classes of phytochemical constituents.

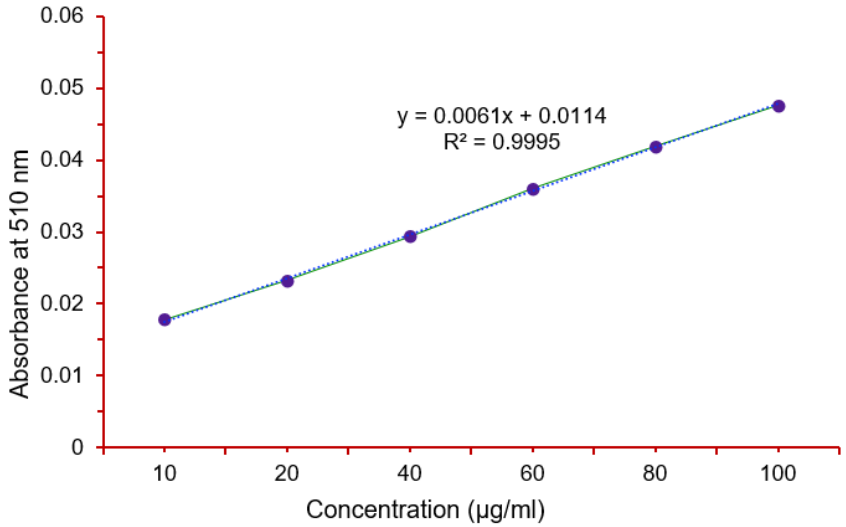

Figure 1: Standard graph of quercetin used for determining total flavonoid content. Values are in means±standard deviations of the means (*n*=3).

Table 1: Secondary metabolites detected from the chloroform extract of *E. stricta* bark.

Sl. No.	Phytochemicals	Name of test	Extract indication
1.	Alkaloids	Dragendorff's test	+
		Hager's test	+
		Mayer's test	+
		Wagner's test	+
2.	Flavonoids	Alkaline reagent test	–
		Lead acetate test	+
		Ferric chloride test	+
		Shinoda test	–
3.	Phenols	Lead acetate test	+
		Potassium dichromate test	+
		Gelatin test	+
4.	Carbohydrates	Molisch's test	–
		Benedict's test	+
		Fehling's test	+
5.	Glycosides	Liebermann's test	–
		Salkowski's test	+
		Keller-Kiliani test	–
		Borntrager's test	–
6.	Saponins	Froth test	–
		Foam test	–
7.	Tannins	Gelatin test	+
		Braymer's test	–
		Sodium hydroxide test	+
8.	Amino acids and proteins	Biuret test	+
		Millon's test	+
		Ninhydrin test	–
9.	Phytosterols	Salkowski's test	+
		Liebermann's test	+
10.	Triterpenoids	Salkowski's test	+
11.	Diterpenes	Copper acetate test	–

[+] Indicated presence, (–) indicates absence.

The result is in accordance with the composition of the previous research work by Akter *et al.*, using four different extracts (Akter and Barnes, n.d.). However, in similar studies conducted by Umamaheswari *et al.*, the phytochemicals present are phenolics, alkaloids, flavonoids and saponins where saponins was absent in this current phytochemical analysis (Umamaheswari *et al.*, 2009). These differences in phytochemical composition can be attributed to the differences in parts used of the plant, geographic region, environmental factor, climatic condition and the types of solvent used (Asokkumar *et al.*, 2008; Hayat *et al.*, 2020).

The quantitative estimation of total phenolic and total flavonoid content in this study was 9.11±0.15 mg GAE/g and 28.86±0.95 mg QCE/g respectively. The results of our studies are comparable to those of Asokkumar *et al.* (2008) who reported the quantification of the leaves of *E. stricta* using ethanol extract. The phenolic and flavonoids compounds are well known to have a strong positive correlation with multiple biological and pharmacological effects including antioxidant and antibacterial properties (Chagas *et al.*, 2022; Mehmood *et al.*, 2022). Several flavonoid compounds have been investigated for pharmaceutical developments as antibiotics (Lin *et al.*, 2022; Zhang *et al.*, 2025), and many have been approved through clinical trials for various diseases (Xu *et al.*, 2024). In addition, it has also been reported that several species of the genus *Erythrina* contained a wide variety of alkaloids and phenol-related compounds which play the critical role in traditional usage and pharmaceutical potentiality (Son and Elshamy, 2021). Therefore, the current work validates and

Table 2: **Bacterial growth (values in zones of inhibition measured in mm) after exposure to dimethyl sulfoxide, standard antibiotic and the chloroform extract of *E. stricta* bark.**

Bacteria	*E. stricta* bark extract						Ciprofloxacin	DMSO
	2.5 mg/mL (25 µg/disc)	5 mg/mL (50 µg/disc)	7.5 mg/mL (75 µg/disc)	10 mg/mL (100 µg/disc)	12.5 mg/mL (125 µg/disc)	20 mg/mL (200 µg/disc)	2 mg/mL	1 mg/mL
Bacillus cereus	0.00±0.00	6.27±0.02	7.03±0.05	7.20±0.01	7.32±0.01	8.44±0.08	13.43±0.28	0.00±0.00
Escherichia coli	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	0.00±0.00	17.17±0.17	0.00±0.00
Klebsiella pneumoniae	0.00±0.00	6.43±0.01	7.13±0.03	7.39±0.03	7.51±0.01	8.06±0.07	12.18±0.10	0.00±0.00
Staphylococcus aureus 1	6.35±0.05	7.10±0.12	7.22±0.01	7.53±0.03	8.27±0.02	8.68±0.11	00.00±0.00	0.00±0.00
Staphylococcus aureus 2	7.41±0.02	8.04±0.12	8.18±0.01	8.21±0.02	8.38±0.02	8.53±0.03	00.00±0.00	0.00±0.00
Salmonella typhimurium	7.68±0.16	8.12±0.13	8.16±0.02	8.21±0.01	8.33±0.02	9.06±0.03	16.00±0.06	0.00±0.00

Data are expressed as means±standard deviations of the means (*n*=3).Abbreviations: DMSO: Dimethyl sulfoxide.

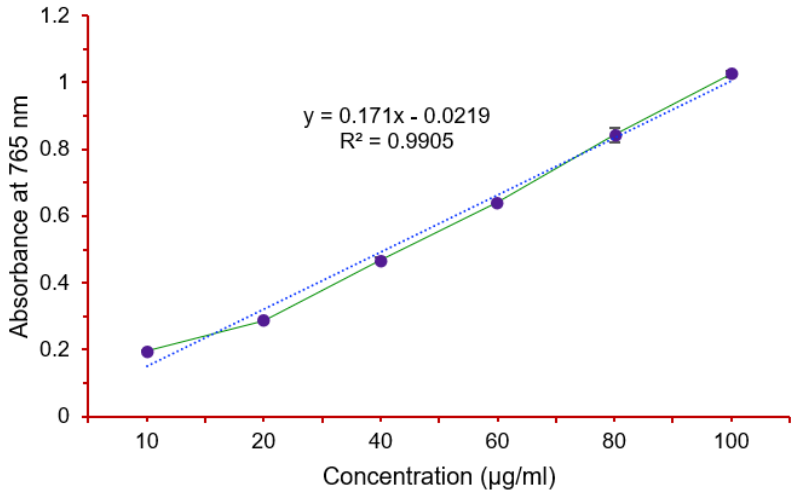

Figure 2: Standard graph of gallic acid used for determining total flavonoid content. Values are in means±standard deviations of the means (*n*=3).

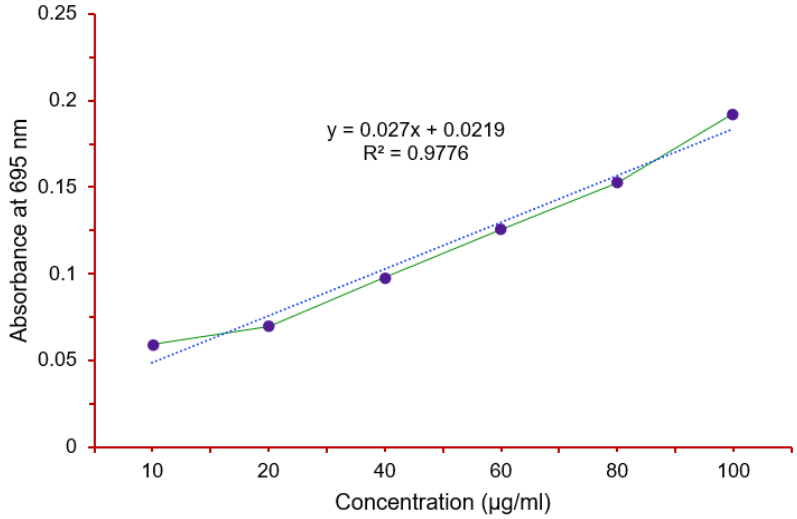

Figure 3: Standard graph of ascorbic acid used for determining total flavonoid content. Values are in means±standard deviations of the means (*n*=3).

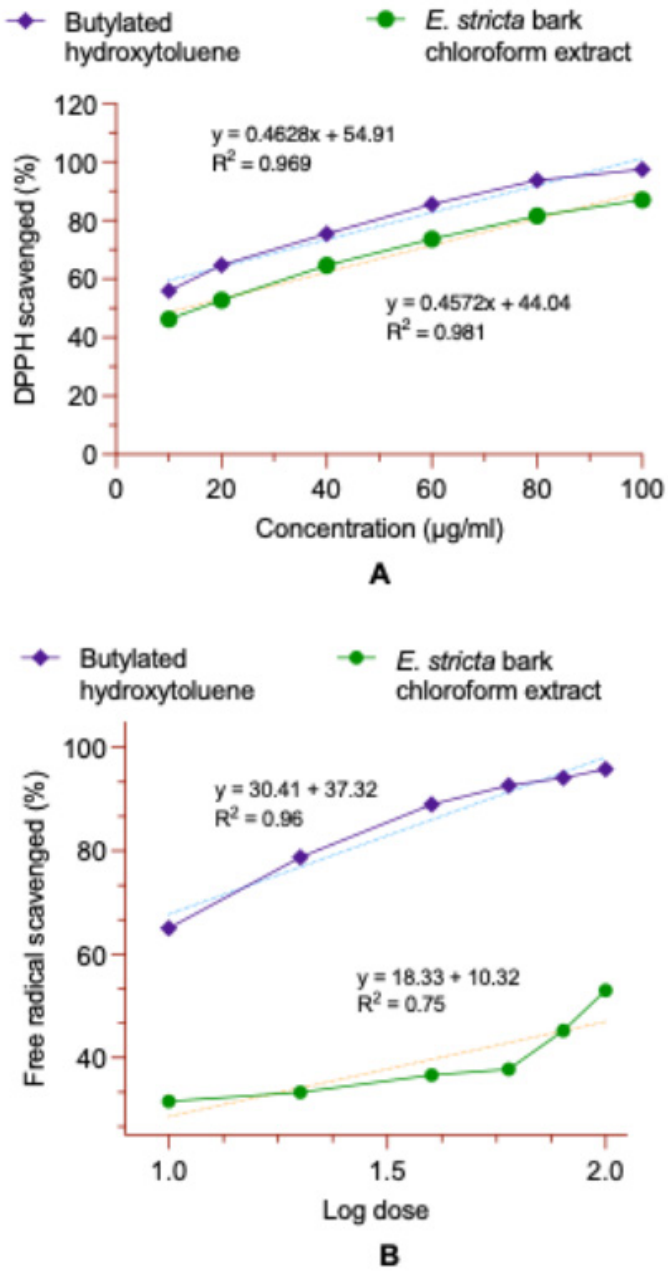

Figure 4: DPPH-scavenging action of *E. stricta* chloroform extract and standard Butylated Hydroxytoluene (BHT). (A) Dose-response curve comparing the plant extract and standard antioxidant. (B) Log dose curve for determining IC_{50}. Values are in means±standard deviations of the means (*n*=3).

strongly support the benefits and usage of *E. stricta* in traditional medicine for various treatment.

The polyphenols of plants have many groups of compounds containing Hydroxyl group (-OH) as their functional group which shows hydrogen-donating antioxidant, reducing agent, metal chelators and quenching the singlet and triplet oxygen (Chen *et al*., 2024; Dumanović *et al*., 2021). Besides, these plantpolyphenols play pivotal role in reducing the risk of human-health diseases by scavenging the free radicals which contribute to strong protection for the immunity. Excessive production of reactive oxygen species and reactive nitrogen species during metabolism leads to oxidative stress and lipid peroxidation causing injury to biologically relevant molecules (Ansari *et al*., 2025). These cytotoxic effects of free radicals at high concentration initiate deleterious process changing the structure and function of biomolecules which generate multiple chronic diseases such as carcinogenesis, inflammatory diseases, aging, cataract and cardiovascular diseases (Jomova *et al*., 2023). However, numerous plants provide natural antioxidants which impede the oxidative harm of free radicals and retard long-term diseases. In contrast to synthetic antioxidant, they have adverse effects both in human and animals while naturally occurring antioxidant are more harmless and safer used to control the imbalance between

free radicals and antioxidant for proper physiological function (Rahaman *et al.*, 2023). The present findings revealed that the chloroform extract of *E. stricta* possess a significant antioxidant activity in comparison with standard butylated hydroxytoluene that scavenged free radicals depicted effectively. The susceptibility was performed using the widely used quick method DPPH free radical scavenging assay. It has also been reported that *E. stricta* was a good source of natural antioxidant and traditionally used by many communities for more than a decade (Akter and Barnes, n.d.; Asokkumar *et al.*, 2008).

Several plants of the genus *Erythrina* from different parts of the world has been tested for antibacterial activity (Herlina *et al.*, 2025). *E. stricta* is a lesser known species and has been poorly studied although its potential antibacterial property had been predicted (Yakin *et al.*, 2025). We found that the chloroform extract of *E. stricta* was effective against different Gram-positive and Gram-negative pathogenic bacteria. Similar to our observation, Akter *et al.* reported that different extracts of *E. stricta* were not active against *E. coli* (Akter and Barnes, n.d.). However, Hussain *et al.* reported the use of n-hexane and ethyl acetate extracts could inhibit *E. coli* (Hussain *et al.*, 1970). This could be expected since different solvents extract different bioactive compounds from the same plant and plant part (Félix *et al.*, 2015). A notable finding in our study was the effectiveness the chloroform extract of against antibiotic-resistant *S. aureus.* The bacterial strains used were specifically methicillin-sensitive *S. aureus* 1 and methicillin-resistant *S. aureus* 2. Our experiment showed that both strains were resistant to ciprofloxacin and that *E. stricta* extract was effective against even the multidrug-resistant bacteria. Our data indicate the importance of *E. stricta* as a potential and promising lead for phytocompounds that could be developed into health supplements and antibacterial agents. Thus, further exploration would be necessary to understand the complete pharmacological property of the plant.

CONCLUSION

Erythrina stricta is a well-known medicinal plant among the Mizo people of northeast India, who use the bark for the treatment stomach problems, skin diseases, parasitic and microbial infections. The bark extract was found to contain alkaloids, amino acids and proteins, flavonoids, phenols, phytosterols, tannins, and triterpenoids which are likely accountable for its therapeutic properties. It indicated a high antioxidant property as shown by estimations of total antioxidant, total phenolics, and flavonoid content. It showed antioxidation activity by effectively scavenging DPPH free radicals. It also exhibited significant antibacterial activity against Gram-positive and Gram-negative bacteria. Moreover, it showed effectiveness against multidrug resistant *S. aureus* strains. The findings not only validate the traditional usage of this medicinal plant but also suggest the significant potential of the plant as an important precursor for the development of novel or improved drug.

ABBREVIATIONS

Ascorbic Acid Equivalent: American Type Culture Collection; **BHT:** Botanical Survey of India; **DMSO:** Gallic Acid Equivalent; **IC_{50}:** Half-maximal inhibitory concentration; **MIC: DPPH:** 2,2-diphenyl-1-picrylhydrazyl; **QCE:** Quercetin equivalent.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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AUTHORS CONTRIBUTIONS

Conceptualization: KLC and P. B. L.; Experiments: LLP and LBT; Data analysis: LLP; Supervision: KLC and P. B. L.; Funding: KLC; Manuscript writing: LLP and KLC.

SUMMARY

Erythrina stricta is a medicinal plant in the Mizo culture for the treatments of different diseases including infections and gastrointestinal disorders. The bark extract, as used in the Mizo traditional medicine, was found to have high contents of total antioxidants, flavonoids and phenols. The antioxidant property was further supported by DPPH scavenging assay that indicated activity equivalent to that of the standard antioxidant, butylated hydroxytoluene. It showed effective antibacterial activity against Gram-negative bacteria and Gram-positive species. It was remarkably effective against two strains of antibiotic-resistance bacterium. Thus we found for the first time the plant as a potential source of broad-spectrum antibiotic that is effective against multidrug-resistant bacteria.

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