INTRODUCTION

The discovery of antibiotics is one of the most significant health-related events of modern times. Antibiotics have revolutionized the field of medicine and their discovery and subsequent use saved countless lives. However, the successful use of any antibiotic is compromised by the potential development of tolerance or resistance. The overuse and abuse of antibiotics led to the potential development of resistance among microorganisms right from their discovery (Davies and Davies, 2010). Resistance development to antibiotics and other problems such as high cost, side effects and others has resulted in an increased interest in plants and plant products as antimicrobial agents. Plants have the ability to produce a variety of metabolites. The secondary metabolites of plants have various functions like growth regulation, inter and intra-specific interactions and defence against predators, herbivores and infection. Most of these plant metabolites have shown to possess useful biological and pharmacological properties and are used as chemotherapeutic agents or serve as ingredients for the development of modern drugs. Chemotherapeutic potential of plants to treat infections is because of characteristic secondary metabolites such as phenolics, alkaloids, saponins and others produced by them. Over 50% of all modern clinical drugs are from natural origin. Vast majority (>80%) of world’s population relies on traditional medicine for their primary healthcare needs. Plants have been considered as an essential component of traditional medicines for their chemical, medicinal, and pharmacological properties. The use of plants for treatment of various infections is well known among different societies. In addition to their traditional use, the modern society has turned to plants for their use in modern medicines.

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Antibacterial and Antioxidant Activity of *Fahrenheitia zeylanica* (Thw.) Airy

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Abstract

Fahrenheitia zeylanica (Thw.) Airy is a lofty evergreen tree belonging to the family Euphorbiaceae. The present study was conducted to evaluate antibacterial and antioxidant activity of solvent extracts of leaves of *F. zeylanica*. The powdered leaf material was sequentially extracted using ethyl acetate, chloroform and methanol based on polarity. Total phenolic and flavonoid contents were estimated by Folin-Ciocalteau and Aluminium chloride colorimetric estimation method respectively. Antibacterial activity of solvent extracts was assessed by agar well diffusion method against a panel of nine bacteria. Antioxidant efficacy of solvent extracts was determined by DPPH free radical scavenging, ABTS radical scavenging and Ferric reducing assay. Methanol and ethyl acetate extracts of bark and chloroform extract of leaf contained high phenolic and flavonoid contents. Solvent extracts of bark were more effective in inhibiting test bacteria than leaf extracts. Methanol extracts of leaf and bark scavenged DPPH (with IC₅₀ value of 2.02 and 1.17µg/ml respectively) and ABTS (with IC₅₀ value of 20.89 and 3.42µg/ml respectively) radicals to high extent followed by ethyl acetate and chloroform extracts. The reducing ability was recorded highest in methanol extracts followed by ethyl acetate and chloroform extracts. Bark extracts have shown stronger scavenging and reducing power than leaf extracts. A positive correlation was observed between antioxidant activity and total phenolic contents of extracts. The solvent extracts of bark and leaf of *F. zeylanica* have shown antibacterial and antioxidant activity which may be attributed to the phytochemicals present in them. The plant can be used as a remedy for treatment of infectious diseases and oxidative stress due to free radical formation. Further, separation of bioactive compounds and determination of their biological activities are under progress.

Keywords:

- *Fahrenheitia zeylanica*
- Antibacterial activity
- Antioxidant activity
- Bark extracts
- Leaf extracts
- Total phenolics
- Flavonoids

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of traditional medicine. Ayurveda and other systems of medicine have vast record of medicinal plants being used for the treatment of various types of ailments. A vast number of plants have been screened for antimicrobial activity (Souza-Fagundes et al., 2002; Tilak et al., 2004; Steenkamp et al., 2004; Vinayaka et al., 2009; Kirbag et al., 2009).

Free radicals such as superoxide radical, hydroxyl radical, peroxy radical and nonradical species such as hydrogen peroxide that are produced by various means such as radiations, chemical reactions and several redox reactions involving various compounds results in oxidative stress. These radicals contribute to protein oxidation, DNA damage and lipid peroxidation in living systems and are involved in many diseases such as cancer, cardiovascular diseases, diabetes, liver cirrhosis, neurological disorders such as Parkinson’ and Alzheimer’s disease and others (Dasgupta and De, 2004; Choi et al., 2007). Cells have several antioxidant defense mechanisms that help in prevention of damaging effect produced by free radicals. These include antioxidant enzymes viz., superoxide dismutase, catalase, glutathione oxidase and small molecules such as vitamin C and vitamin E (Fridovich, 1999; Ganapaty et al., 2012). However, under pathological conditions, there is an extra requirement for antioxidants from exogenous sources because of ineffectiveness of antioxidant defence or overproduction of free radicals (Halliwell, 1994). Strong restrictions have been placed on the use of synthetic antioxidants such as BHT, BHA and gallates due to their potential adverse effects. This led to an increasing interest in natural products having antioxidant properties. Plants have been considered as richer sources of antioxidants. Polyphenols including flavonoids have shown to be excellent products having antioxidant properties. Plants have been placed on the use of synthetic antioxidants such as BHT, BHA and gallates due to their potential adverse effects. These radicals contribute to protein oxidation, DNA damage and lipid peroxidation in living systems and are involved in many diseases such as cancer, cardiovascular diseases, diabetes, liver cirrhosis, neurological disorders such as Parkinson’s and Alzheimer’s disease and others (Dasgupta and De, 2004; Choi et al., 2007). Cells have several antioxidant defense mechanisms that help in prevention of damaging effect produced by free radicals. These include antioxidant enzymes viz., superoxide dismutase, catalase, glutathione oxidase and small molecules such as vitamin C and vitamin E (Fridovich, 1999; Ganapaty et al., 2012). However, under pathological conditions, there is an extra requirement for antioxidants from exogenous sources because of ineffectiveness of antioxidant defence or overproduction of free radicals (Halliwell, 1994). Strong restrictions have been placed on the use of synthetic antioxidants such as BHT, BHA and gallates due to their potential adverse effects. This led to an increasing interest in natural products having antioxidant properties. Plants have been considered as richer sources of antioxidants. Polyphenols including flavonoids have shown to be excellent antioxidants due to their proton donating ability (Da Steenkamp et al., 2013; Vinayaka et al., 2013; Rekha et al., 2004; Tilak et al., 2004; Kekuda et al., 2011; Junaid et al., 2013).

*Fahreinheitia zeylanica* (Thw.) Airy (syn. *Ostodes zeylanicus* (Thw.) Muell. Arg) belonging to family Euphorbiaceae and is distributed in South India. It is distributed in W. Ghats of Wynnad, Anamalais, Atapadi hills of the Malabar and hills of Travancore. It is a lofty evergreen tree with long petioled leaf, distantly serrate, leaf blade 11-32x5-10cm, oblong-ob lanceolate having shallowly serrates and racemes are dioecious in nature. Calyx lobes orbicular, dorsally coniculate; petals larger, oblong, yellow; stamens 20; ovary villous; fruit schizocarp, brown, stellate-tomentose; wood white, soft and perishable; flowering and fruiting in March-May (Gamble, 1993; Gowda, 2004). In a previous study, we have shown inhibitory potential of cow urine extract of leaf of *F. zeylanica* against *Pythiumaphanidermatum*, *Fusarium oxysporum* f.sp. *zingiberi* and *Ralstonia solanacearum* isolated from rhizome rot of ginger (Rakesh et al., 2013). The present study was carried out to estimate contents of phenolics and flavonoids and determine the antibacterial and antioxidant activity of solvent extracts of leaf and bark of *F. zeylanica*.

**MATERIALS AND METHODS**

**Collection and Extraction of Plant Material**

The plant *F. zeylanica* was collected in forests of Hulikal region, Shivamogga district, Karnataka, India during December 2012 and authenticated by Dr. Vinayaka K.S. The voucher specimen (SRMN/MB/Fz-35) was deposited in the department herbaria. For extraction, a known quantity of the shade dried and powdered leaf material (50g) was extracted with chloroform, ethyl acetate and methanol on polarity basis in a Soxhlet extraction assembly. The extracts were filtered through 4-fold muslin cloth followed by Whatman No. 1 filter paper, concentrated in vacuum under reduced pressure and dried in the desiccator (Kekuda et al., 2013).

**Total Phenolic Content**

The content of total phenolics in solvent extracts was determined by Folin-Ciocalteau reagent (FCR) method. Here, a dilute concentration of extracts (0.5 ml) was mixed with 0.5 ml of FC reagent (1:1) and 2 ml of sodium carbonate (7%). The tubes were allowed to stand for 30 minutes and the optical density was measured at 765nm using UV-Vis spectrophotometer. A standard curve was plotted using different concentrations of Gallic acid (standard, 0-1000 μg/ml) and the total phenolic content of solvent extracts was expressed as μg Gallic Acid Equivalents (GAE) from the graph (Kekuda et al., 2013).

**Total Flavonoid Content**

The content of total flavonoids of solvent extracts was estimated by Aluminium chloride colorimetric method (Kekuda et al., 2013). Here, a dilute concentration of extract (0.5ml) was mixed with 0.5ml of methanol, 4ml of water, 0.3ml of NaNO2 (5%) and incubated for 5 minutes at room temperature. After incubation, 0.3ml of AlCl3 (10%) was added and again incubated at room temperature for 6 minutes. 2ml of 1M NaOH and 2.4ml of distilled water were added and the absorbance was measured against blank (without extract) at 510nm using UV-Vis spectrophotometer. A calibration curve was constructed using different concentrations of Catechin (standard, 0-120 μg/ml) and the flavonoid content of extracts was expressed as μg Catechin equivalents (CE) from the graph.

**Antibacterial Activity**

Agar well diffusion technique was employed to determine inhibitory efficacy of solvent extracts against three Gram positive bacteria viz., *Staphylococcus aureus* NCIM-2079, *Bacillus cereus*NCIM-2016 and *B. subtilis*NCIM-2063 and six Gram negative bacteria viz., *Pseudomonas aeruginosa*NCIM-2242, *Escherichia coli*NCIM-2685, *Vibrio cholerae*MTCC-3905, *Shigella flexneri*NCIM-4924, *Klebsiella pneumoniae*NCIM-2957 and *Xanthomonas campestris*. The test bacteria, maintained on sterile Nutrient agar slants were inoculated into sterile Nutrient broth tubes and incubated overnight at 37°C. The broth cultures were aseptically swabbed on sterile Nutrient agar plates using sterile cotton swabs. Using sterile corks borer, wells of 6mm diameter were punched in the inoculated plates and 100µl of solvent extracts (50mg/ml of 10% DMSO), standard (Streptomycin, 1mg/ml) and DMSO (10%) were transferred into respectively labelled wells. The plates were incubated at 37°C aerobically for 24 hours and the zone of inhibition formed around the wells were measured (Kekuda et al., 2013). The experiment was repeated twice and the average value was recorded.
Antioxidant Activity

DPPH Free Radical Scavenging Assay

The radical scavenging effect of solvent extracts was studied by DPPH free radical scavenging assay. Briefly, 2 ml of different concentrations (2.5-100 µg/ml) of solvent extracts and ascorbic acid (standard) was mixed with 2 ml of DPPH solution (0.004% in methanol) in labelled tubes. The tubes were incubated at room temperature in dark for 30 minutes and the optical density was measured at 517 nm using UV-Vis spectrophotometer. The absorbance of the DPPH control was also noted. The radical scavenging ability of the solvent extracts was calculated using the formula: Scavenging activity (%) = [(Ao – Ae) / Ao] x 100, where Ao is absorbance of DPPH control and Ae is absorbance of DPPH and extract/standard combination (Kekuda et al., 2013). The IC50 value for each of the extracts was calculated. IC50 denotes the concentration of extract required to scavenge 50% of DPPH free radicals.

ABTS Radical Scavenging Activity

The efficacy of leaf and bark extracts to scavenge ABTS (2,2’-azino-bis[3-ethylbenzthiazoline-6-sulphonic acid]) radicals was determined by employing the protocol used by Vivek et al. (2013). The ABTS radical was generated by mixing 7 mM ABTS stock solution with 2.45 mM potassium persulfate. The mixture was kept in the dark for 12–16 hours at room temperature. The resulting solution was diluted with distilled water to an absorbance of 0.70 at 730 nm. 1 ml of different concentrations of leaf and bark extracts (2.5-100μg/ml) were added to 4ml of ABTS solution and the tubes were incubated for 30 minutes at room temperature followed by measuring the absorbance at 730nm. Ascorbic acid was used as reference standard. The radical scavenging activity was calculated using the formula:

Scavenging activity (%) = (Control–Test /Control) x 100

Where control is the absorbance of the ABTS solution without extract/standard and test is the absorbance of ABTS solution in the presence of extract/standard. The IC50 value for each of the extracts was calculated. IC50 denotes the concentration of extract required to scavenge 50% of ABTS free radicals.

Ferric Reducing Assay

The reducing power of solvent extracts was determined by ferric reducing assay. Here, various concentrations of solvent extracts (2.5-100 µg/ml) in 1 ml of methanol were mixed with 2.5 mL of phosphate buffer (200 mM, pH 6.6) and 2.5 ml of potassium ferricyanide (1%) in separate and labelled tubes. The tubes were placed in water bath for 20 minutes at 50°C, cooled rapidly and mixed with 2.5 ml of trichloroacetic acid (10%) and 0.5 ml of ferric chloride (0.1%). The amount of iron (II)-ferricyanide complex formed was determined by measuring the formation of Perl’s Prussian blue at 700 nm after 10 minutes. The increase in absorbance indicates increased reducing power. Ascorbic acid was used as reference standard (Kekuda et al., 2013).

Statistical Analysis

The experiments were conducted in triplicates. The results are represented as Means±Standard deviation. The IC50 values were calculated by Origin 6.0 software.

RESULTS

Phenolic and flavonoid contents were high in ethyl acetate and methanol extracts of bark when compared to leaf. Chloroform extract of leaf contained high phenolic and flavonoid content than chloroform extract of bark (Table 1).

| Extract       | Total Phenolic Content (µg GAE/mg) | Total Flavonoid Content (µg CE/mg) |
|---------------|-----------------------------------|------------------------------------|
| Leaf          | Bark                              | Leaf                               | Bark                                |
| Ethyl Acetate | 25.00±0.2                         | 040.0±0.1                          | 16.25±0.1                           | 22.25±0.2                           |
| Chloroform    | 31.25±0.2                         | 015.0±0.2                          | 22.50±0.2                           | 16.25±0.1                           |
| Methanol      | 85.00±0.1                         | 107.5±0.1                          | 12.50±0.2                           | 41.25±0.2                           |

Result of antibacterial activity of solvent extracts of leaf and bark is shown in Table 2. All the test bacteria were found to be susceptible to solvent extracts. Overall, solvent extracts of bark were more effective in inhibiting test bacteria than leaf extracts. Ethyl acetate extracts of leaf and bark caused marked inhibition of test bacteria followed by chloroform and methanol extracts. S. aureus and P. aeruginosa were inhibited to higher extent among Gram positive and Gram negative bacteria respectively. Inhibition of test bacteria by Streptomycin was higher than that of solvent extracts. There was no inhibition observed in case of DMSO.

Table 2: Antibacterial activity of solvent extract.

| Test Bacteria | L-C | L-E | L-M | B-C | B-E | B-M | STR |
|---------------|-----|-----|-----|-----|-----|-----|-----|
| S. aureus     | 2.2±0.1 | 2.2±0.2 | 1.6±0.0 | 2.4±0.2 | 2.5±0.0 | 1.6±0.0 | 4.1±0.1 |
| B. cereus     | 1.4±0.0 | 1.4±0.0 | 1.2±0.0 | 1.4±0.0 | 1.4±0.0 | 1.3±0.0 | 3.6±0.0 |
| B. subtilis   | 2.2±0.2 | 2.3±0.2 | 1.4±0.0 | 2.2±0.1 | 2.2±0.2 | 1.6±0.0 | 4.1±0.2 |
| P. aeruginosa | 1.9±0.1 | 2.0±0.2 | 1.5±0.1 | 2.1±0.1 | 2.3±0.1 | 1.6±0.1 | 4.1±0.1 |
| E. coli       | 1.6±0.1 | 2.0±0.1 | 1.5±0.1 | 2.1±0.0 | 2.2±0.1 | 1.7±0.1 | 3.0±0.2 |
| V. cholerae   | 1.3±0.1 | 1.5±0.1 | 1.1±0.1 | 1.9±0.0 | 2.0±0.1 | 1.6±0.1 | 4.2±0.1 |
| X. campestris | 1.5±0.1 | 1.7±0.1 | 1.3±0.0 | 2.0±0.1 | 2.2±0.2 | 1.4±0.2 | 4.0±0.0 |
| S. flexneri   | 1.2±0.0 | 1.2±0.1 | 1.1±0.1 | 1.3±0.1 | 1.5±0.0 | 1.2±0.1 | 3.9±0.1 |
| K. pneumoniae | 1.3±0.1 | 1.5±0.1 | 1.2±0.0 | 1.6±0.0 | 1.7±0.1 | 1.4±0.0 | 3.6±0.1 |

L-Leaf; B- Bark; E- Ethyl acetate; M- Methanol; STR- Streptomycin
The efficacy of solvent extracts of leaf and bark to scavenge free radicals was assessed by employing the DPPH radical scavenging model and the results are shown in Figure 1. It was found that the methanol extracts scavenged radicals markedly followed by ethyl acetate and chloroform extracts. Here also, bark extracts scavenged radicals more efficiently than leaf extracts. However, the scavenging effects of solvent extracts were lesser than that of ascorbic acid. The IC\textsubscript{50} for L-C, B-C, L-E, B-E, L-M and B-M extracts was 52.7, 41.4, 4.46, 4.06, 2.02 and 1.17µg/ml respectively. Ascorbic acid scavenged DPPH free radicals dose dependently with an IC\textsubscript{50} value of 2.27µg/ml.

![Figure 1: DPPH radical scavenging activity of solvent extracts.](image1)

The result of ABTS radical scavenging effect of leaf and bark extracts is shown in Figure 2. The extracts have shown dose dependent scavenging of ABTS radicals. The radical scavenging effect of bark extracts was higher than that of leaf extracts. Among solvent extracts, methanol extracts scavenged radicals more efficiently followed by ethyl acetate and chloroform extracts. The IC\textsubscript{50} for L-C, B-C, L-E, B-E, L-M and B-M extracts was 350.87, 248.99, 335.28, 98.58, 20.89 and 3.42µg/ml respectively. Ascorbic acid scavenged ABTS free radicals in a dose dependent manner with an IC\textsubscript{50} value of 3.27µg/ml. The scavenging of ABTS radicals by extracts was weaker when compared to scavenging of DPPH radicals.

![Figure 2: ABTS radical scavenging activity of solvent extracts.](image2)

The reducing power of solvent extracts was determined by ferric reducing assay and the results are depicted in Figure 3. It was observed that the absorbance increased with increase of the concentrations of extracts. The reducing ability was recorded highest in methanol extracts followed by ethyl acetate and chloroform extracts. Among bark and leaf, bark extracts were shown to possess high reducing ability than that of leaf extracts. Overall, the reducing powers of solvent extracts were higher than that of ascorbic acid.
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DISCUSSION

Infectious diseases, caused by a number of bacteria, viruses, parasites and fungi are due to a complex interaction between the pathogen, host and the environment. The discovery of antibiotics from microbes and their subsequent use had eradicated the infections that once ravaged the humankind. Traditional antibacterial therapy using antibiotics from microbial sources or their synthetic derivatives is going through a crisis due to development of resistance to existing agents. The first pathogen that has become resistant to almost all known antibiotics is *Staphylococcus aureus* and has posed a global threat already for a number of years. Other examples for antibiotic resistant bacteria are vancomycin resistant enterococci, multidrug resistant tuberculosis and others. Moreover, these bacteria have the tendency to transmit the resistance gene and this has become a serious issue in the field of medicine (Ojala et al., 2000; Hemaiswarya et al., 2008; Davies and Davies, 2010). Plants with medicinal values have been used for centuries as remedies for human diseases. They contain components of therapeutic value which are the secondary metabolites. Traditional healers from various parts of the world use these plants in various formulations as anti-infective agents. Several plants containing volatile oils, polyphenols and alkaloids as active constituents are utilized as popular folk medicines, while others gained popularity in the form of finished products collectively named phytomedicines. Antimicrobials of plant origin have enormous therapeutic potential. They are effective in the treatment of infectious diseases while simultaneously mitigating many of the side effects that are often associated with synthetic antimicrobials (Al-Bakri and Afifi, 2007; Cowan, 1999; Poornima et al., 2012a). On screening plant extracts and other natural products for antimicrobial activity, it has been shown that higher plants are a potential source of new anti-infective agents as well as serving drug discovery from natural products for primary lead compounds (Ojala et al., 2000). In the present study, we have determined antibacterial activity of solvent extracts of leaf and bark of *F. zeylanica* against a panel of pathogenic bacteria. The extracts have shown marked effect on the bacteria. The plant materials were extracted with three solvents based on polarity. Ethyl acetate extracts were more inhibitory to test bacteria. The inhibitory efficacy of extracts might be related to the phytochemical constituents present in them. Here, no correlation was observed between the antimicrobial activity and phenolic and flavonoid contents.

One of the widely used methods for determining radical scavenging activity of various kinds of substances is DPPH assay. This assay is based on quenching of stable free DPPH radicals. The assay uses commercially available and stable free radical which is soluble in methanol. DPPH is relatively stable nitrogen centered free radical that accepts an electron or hydrogen to become a stable diamagnetic molecule. In its radi cal form DPPH shows an absorption peak at 517nm, which disappears on reduction by an antioxidant compound. DPPH radicals react with suitable reducing agents as a result of which the electrons become paired off forming the corresponding hydrazine. The solution therefore loses colour stoichometrically depending on the number of electrons taken up(Blois, 1958; Di Mambro et al., 2003; Chatterjee et al., 2005; Kekuda et al., 2010; Kekuda et al., 2011; Poornima et al., 2012b; Rekha et al., 2012). In this study, the bleaching of the DPPH solution increased with increasing amount of extract in a given volume of solution. Methanol extracts of leaf and bark were shown to scavenge free radicals to higher extent than ethyl acetate and chloroform extracts.

ABTS radical scavenging is one among popular in vitro antioxidant assays which measures the radical scavenging nature of several types of compounds including herbal extracts (Katalinic et al., 2006; Pawlaki et al., 2010; Li et al., 2011; Huang et al., 2012; Vivek et al., 2013; Pavithra et al., 2013). On interaction with ABTS radical, antioxidants either transfer electrons or hydrogen atoms to ABTS and thereby neutralizing the free radical character of ABTS (Huang et al., 2005; Huang et al., 2012). In our study, the bark extracts were shown to exhibit high scavenging potential when compared to leaf extracts. The scavenging effect might be attributed to high phenolic contents (Vivek et al., 2013).

The antioxidant potency of compounds has been related to their reducing potential. This method has been employed for determining reducing property of various kinds of samples. In this study, the reducing potential of solvent extracts was evaluated using ferric reducing assay. The reducing potency is generally associated with...
the presence of substances called reductones, which exert antioxidant action by breaking the free radical chains, via hydrogen atom donation. Reductones are reported to prevent peroxide formation, by reacting with certain precursors of peroxides. In this assay, the presence of reductants in the samples would result in the reducing of Fe$^{3+}$ to Fe$^{2+}$ by donating electron. The amount of Fe$^{2+}$ complex can be measured by measuring the formation of Perl's Prussian blue at 700 nm. Increasing absorbance indicates an increase in reductive ability (Chung et al., 2006; Meir et al., 1995; Kekuda et al., 2010; Kekuda et al., 2011; Rekha et al., 2012). It was found that the reducing powers of solvent extracts increased with increase in the concentration. Overall, bark extracts showed more reducing potential than leaf extracts. Methanol extract exhibited stronger reducing potential than other solvent extracts. The reductive abilities of extracts were higher than that of ascorbic acid.

Recent studies have shown that consumption of fruits, vegetables, barks, roots, nuts, seeds, whole grains can reduce the risk of chronic diseases produced due to oxidative stress. This protective effect of plants and plant based products may be attributed to the presence of natural antioxidants such as vitamin C, vitamin E, carotenoids, polyphenolics and flavonoids (Diplock et al., 1998; Choi et al., 2007; Kaviarasen et al., 2007). Polyphenols, including flavonoids, form a large group of naturally occurring components in plant kingdom and are present in almost every part of the plants. These compounds are of considerable interest in various fields such as medicine, food and pharmacy because of wide range of biological activities including antioxidant activity. The antioxidant activity of phenolic compounds is chiefly due to their redox potential. These compounds act as reducing agents (free radical terminators), hydrogen donors, metal chelators and singlet oxygen quenchers (Cook and Samman, 1996; Kaviarasen et al., 2007). In our study, the methanol extracts of leaf and bark were found to contain high phenolic and flavonoid content than other two extracts. Methanol extracts have scavenged free radicals more efficiently and exhibited stronger reducing potential in ferric reducing assay. The results are in justification with earlier studies which correlated the total phenolic content of plants with their antioxidant activity (Tilik et al., 2004; Behera et al., 2006; Coruh et al., 2007; Rekha et al., 2012; Kekuda et al., 2012; Kekuda et al., 2013; Vivek et al., 2013). A positive correlation between the antioxidant efficacy and phenolic content of extracts was observed in the study.

CONCLUSION

The present study highlights the antioxidant and antibacterial efficacy of extracts of leaf and bark of *F. zeylanica*. The plant can be used as a remedy for treatment of infectious diseases and also for prevention and control of diseases which originate by oxidative stress due to free radical formation. Further, isolation of active principles and determination of their biological activities are under progress.

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