Phytochemical Screening and Enzymatic and Antioxidant Activities of Erythrina suberosa (Roxb) Bark

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Background: This study aimed to evaluate the phytochemical screening of Erythrina suberosa (Roxb) bark and to analyze the enzymatic activities of its various organic fractions. Materials and Methods: Crude methanolic fraction of E. suberosa (Roxb) bark and its respective fractions were screened for the presence of different phytochemicals with different reagents. On the basis of increasing order of polarity, different organic solvents were used to obtain different fractions. Enzymatic studies were performed on crude methanolic extract of the plant. All the assays were performed under standard in vitro conditions. Results: The phytochemical analysis shows the presence of alkaloids, phenols, triterpenoids, phytosterols, and flavonoids. Phenolic compounds and flavonoids are the major constituents of the plant. In anticholinesterase assay, the percent inhibition of standard drug (eserine) was 91.27 ± 1.17 and the half maximal inhibitory concentration (IC₅₀) was 0.04 ± 0.0001. For α-glucosidase inhibition, the IC₅₀ value for Dichloromethane fraction was 8.45 ± 0.13, for Methanol fraction it was 64.24 ± 0.15, and for aqueous fraction it was 42.62 ± 0.17 as compared with standard IC₅₀ that is 37.42 (acarbose). Furthermore, results show that all fractions have potential against anti-urease enzyme, but DCM fraction of crude aqueous extract has significant IC₅₀ value (45.26 ± 0.13) than other fractions. Conclusion: Keeping in view all the results, it is evident that the plant can be used in future for formulating effective drugs against many ailments. Secondary metabolites and their derivatives possess different biological activities, for example, g. flavonoids in cancer, asthma, and Alzheimer. Furthermore, the extracts of this plant can be used in their crude form, which is an addition to the complementary and alternative treatment strategies.

KEYWORDS: Antioxidant activity, enzymatic activities, Erythrina suberosa (Roxb), phytochemicals

INTRODUCTION

Traditional or complementary medicinal system has been of great global value since the past few years.

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How to cite this article: Ahmed Z, Aziz S, Hanif M, Mohiuddin SG, Ali Khan SH, Ahmed R, et al. Phytochemical screening and enzymatic and antioxidant activities of Erythrina suberosa (Roxb) bark. J Pharm Bioall Sci 2020;12:192-200.
Traditional medicine is generally considered highly available and accessible to people in developing countries but comparatively to poor and marginalized people are commonly assumed to be most reliant on traditional medicines for their healthcare.[3] There are major differences in acceptability which have also been observed between rural and urban areas. However, those patterns have rarely been studied in Asia, and little is known on the determinants of traditional medicine use.[4] Medicinal herbs are mostly used as crude matter for extraction of active elements that are used in the synthesis of different chemicals and drugs, for example, laxatives, blood thinners, antibiotics, and antimalarial medications. For instance, taxol, vincristine, and morphine are isolated from pacific yew, periwinkle (Catharanthus roseus), and poppy (Papaver somniferum), respectively.[5,6]

One of the locally used medicinal plants, Erythrina suberosa (Roxb), known as Indian Coral Tree, Corky Coral Tree, Pangra, and Toti gul belonging to Fabaceae family, usually known as the legume, pea, or bean family, is diverse and an important economic family of flowering herbs.[7] It consists of trees, shrubs, and perennial or annual herbaceous plants, which can be identified easily by their fruit (legume) and the compound stipulated leaves. Distribution of this family is wide and is the third largest on land herbs family in terms of number of species, having approximately 751 genera and almost 19,000 known species. Erythrina suberosa (Roxb) is a medium-sized perennial tree dominant in Indian region whose leaves, flowers, fruits, and bark have significant medicinal uses.[5]

Four isoflavonoids have been isolated from E. suberosa (Roxb) roots, which are designated as α-hydroxyerysotrine, 4′-methoxy lico-flavanone (MLF), alpinumiso-flavone, and wighteone.[8] Moreover, a new derivative alkaloid of erythrina, (+)-11α-hydroxyerythravine was isolated from the flowers of E. mulungu. Also, from the flowers of E. mulungu, the known derivatives (+)-erythravine and (+)-α-hydroxyerysotrine were isolated.[9] In the phytochemical investigation, various alkaloidal constituents were isolated from the seeds of E. suberosa (Roxb). These alkaloids include erythraline, erysodine, erysotrine, and hypaphorine. Erysotrine was found to occur naturally and was isolated for the first time from natural source.[10]

The bark of E. suberosa (Roxb) is locally used in India for diarrhea as a paste along with other plants.[11] The bark of E. suberosa (Roxb) has been used as antitumor agent and along with that its bark has also been used for some liver disorders from early ages.[12] Alkaloids isolated from the flowers of E. suberosa (Roxb) were investigated for anxiolytic properties in a research and the results showed significant effect that was performed on Swiss albino male mice. Compound known as erythraline is α4, β2-nicotinic receptors antagonist and has prominent anxiolytic effect.[13] The crude aqueous extract of flowers of E. suberosa (Roxb) shows potential spasmylocytic, bronchodilatory, and antioxidant effect.[10] From the alcoholic extract of stem bark of E. suberosa (Roxb), certain flavonoids were isolated. Human promyelocytic leukemia HL-60 cells were used to investigate their biological activity, showing apoptosis-inducing effect.[13] In this study, flavonoids from E. suberosa (Roxb) bark were found to be the most potent cytotoxic agent with the half maximal inhibitory concentration (IC50) of 20 IM in human leukemia HL-60 cells. In spite of apoptosis, these flavonoids significantly inhibited nuclear transcription factor (NF-κB) and STAT (signal transducer and activator of transcription) signaling pathway.[12]

### Materials and Methods

#### Plant collection

The plant was collected locally and identified by botanist. Voucher specimen was taken and kept in the university herbarium. The total weight of the freshly collected bark was 10 kg, which was subjected to shade drying and powdered by grinding mill.

#### Plant extraction

Powder drug (950 g) was extracted with 80% methanol for 21 days. The extract was filtered using fourfold muslin sheath followed by Whatman filter paper no. 42 (125 mm). The process of extraction was repeated thrice. Major portion of solvent was evaporated at 40°C using water bath, whereas the remaining solvent was completely evaporated using rotary evaporator under reduced pressure. A dark brown semisolid extract was obtained weighing 100 g.

#### Fractions extracted with different organic solvents

Crude bark extract of E. suberosa (Roxb) was subjected to fractionation with different organic solvents depending upon increasing order of polarity, for example, dichloromethane, ethyl acetate, and methanol.

#### Phytochemical screening of Erythrina suberosa (Roxb) bark

Crude methanolic fraction of E. suberosa (Roxb) bark and its respective organic fractions were screened for the presence of different phytochemicals, for example, alkaloids, saponins, glycosides, phenols, and tannins with the help of different reagents as mentioned.[13-15]
Tests for alkaloids

1 mL solution of extracts/fractions were acidified with 10% dilute acetic acid in two separate test tubes.[15] To the first test tube few drops of freshly prepared Mayer’s reagent were added, whereas to the second test tube few drops of Dragendorff’s reagent were added. The appearance of cream-colored precipitates with Mayer’s reagent or reddish-brown precipitate with Dragendorff’s reagent confirmed the presence of alkaloids.[14]

Tests for saponins

Lead acetate test

Few drops of lead acetate were added to the test tubes containing 2 mL of methanolic extract of *E. suberosa* (Roxb) bark and its organic fractions. Appearance of white precipitates confirmed the presence of saponins.[14]

Froth test

Crude methanolic extract of *E. suberosa* (Roxb) bark and its organic fractions were dissolved in methanol. Sample solutions were shaken well and allowed to stand for 15 min. Persistent froths were observed, which confirmed the presence of saponins.

Tests for tannins

Ferric chloride test

Few drops of 5% ferric chloride (FeCl₃) solution were added to crude methanolic extract of *E. suberosa* (Roxb) bark and its organic fractions, respectively, resulting in bluish black color, which confirmed the presence of tannins.[14]

Test for cardiac glycosides (Keller–Killani’s test)

Crude methanolic extract of *E. suberosa* (Roxb) bark and its fractions were taken separately in a test tube and treated with 2 mL of glacial acetic acid, respectively. To the test tubes, 1 mL FeCl₃ followed by 1 mL of concentrated sulfuric acid were added, resulting in the formation of reddish black layer that indicated the presence of cardiac glycosides.[14]

Test for terpinoids (Salkowski’s test)

Crude methanolic extract of *E. suberosa* (Roxb) bark and its organic fractions were taken separately in test tubes (5 mL each); 3 mL chloroform was added, respectively, to each test tube followed by addition of 3 mL concentrated sulfuric acid (H₂SO₄) carefully. The presence of terpenoids was confirmed by the reddish-brown color of the interface.[16]

Test for flavonoids

Crude methanolic extract of *E. suberosa* (Roxb) bark and its organic fractions were taken separately in test tubes. 5 mL of dilute ammonia solution was added to the aqueous filtrate of each extract. Then concentrated H₂SO₄ was added carefully. Appearance of yellow color was observed indicating the presence of flavonoids.[15]

Test for phenols

Crude methanolic extract of *E. suberosa* (Roxb) bark and its organic fractions were taken separately in test tubes. Few drops of 5% FeCl₃ were added to each test tube, which resulted in bluish black color, thus confirming the presence of phenols.[12]

Tests for reducing sugars

Benedict’s reagent

Crude methanolic extract of *E. suberosa* (Roxb) bark and its organic fractions were taken separately in test tubes (5 mL each). To each test tube, 5 mL of Benedict’s reagent was added; the mixture was placed over hot water bath to boil for 5 min. Resulting in reddish-brown precipitates indicated the presence of carbohydrates.[12]

Fehling reagent

Crude methanolic extract of *E. suberosa* (Roxb) bark and its organic fractions were taken separately in test tubes (1 mL each), to which few drops of Fehling reagent were added and boiled over hot water bath giving brick red precipitates, which indicated the presence of reducing sugars.[12]

Test for phytosterols

Crude methanolic extract of *E. suberosa* (Roxb) bark and its organic fractions were taken separately in test tubes (2 mL each). Each fraction was treated first with chloroform (2 mL) and then concentrated sulfuric acid (2 mL). To this solution, dilute acetic acid (few drops) and 3 mL of acetic anhydride were added. Appearance of bluish green color showed the presence of phytosterols.

Enzymatic activities

Crude extract of *E. suberosa* (Roxb) bark was studied for the inhibition of following enzymes: (1) acetyl cholinesterase inhibition assay, (2) urease inhibition assay, and (3) α-glucosidase inhibition assay.

Acetyl cholinesterase inhibition assay

The study was performed on crude methanolic extract of *E. suberosa* (Roxb) bark and its organic fractions. All equipment used in the following study were clean and incubated for 5 min at 37°C. A total volume of 100 μL reaction mixture was prepared containing 60 μL of disodium phosphate of 50-mM concentration (as a buffer with 7.7 pH value), test sample having volume of 10 μL with 0.5 mM concentration and enzyme having volume of 10 μL with 0.005 concentration.

All the above were added to well-1, respectively, followed by prereading at 405 nm. The mixture of the contents...
was incubated for 10 min at 37°C after which reaction was initiated by the addition of 10 μL of 0.5 mM substrate acetylthiocholine iodide for Acetylcholine. At the end, 10 μL dithio nitrobenzoic acid with 0.5 mM concentration was added and incubated for further 15 min at 37°C. At 405 nm, absorbance was measured again through 96-well plate reader (Synergy HT, BioTek, Winooski, USA). Eserine of 0.5 mM concentration was applied as positive control. The following formula was used to calculate percent inhibition (% inhibition):

\[
\text{Inhibition} \, (%) = \frac{\text{Control} - \text{test}}{\text{Control}} \times 100
\]

Through serial dilutions from 0.5, 0.25, 0.125, 0.625, 0.03125, up to 0.015625 mM of the compound, IC₅₀ values were determined. With the help of graph, using EZ-Fit enzyme kinetics software (Perrella Scientific, MA, Amherst), the concentrations showing 50% or more inhibition were considered as IC₅₀. All the values were presented as mean of three independent replicates.[17]

**Urease inhibition assay**

This assay was performed on crude bark extract of *E. suberosa* (Roxb) bark and its organic fractions. All the equipment used were rinsed and incubated for at least 5 min at 37°C.

An assay mixture of 85 μL was prepared by adding the following:

1. Phosphate buffer solution (PBS) 10 μL (pH 7.0).
2. Sample solution of 10 μL volume.
3. 25 μL of enzyme solution concentration 0.135 units.

All these contents were added, respectively, in 96-well plate, followed by preincubation at 37°C for 5 min. To the aforementioned 96-well plate, 40 μL stock solution of 20 mM concentration was added and incubated once again at 37°C for 10 min. After incubation, 115 μL of phenol-hyper-chlorite reagent was added in each well, which was freshly prepared by mixing 70 μL alkali with 45 μL phenol. Incubation was done for further 10 min to develop color. Absorbance was measured using 96-well plate reader (Synergy HT, BioTek) at 625 nm. For calculation of IC₅₀ and %age inhibition, the same method was followed as mentioned for choline-esterase assay. Thiourea was taken as positive control.[17]

**α-Glucosidase inhibition assay**

This assay was performed on crude bark extract of *E. suberosa* (Roxb) and its organic fractions. All the equipment used were rinsed and incubated for at least 5 min at 37°C.

Sample solution of 60 μL and 50 μL of 0.1 M PBS having pH 6.8 containing α-glucosidase solution of 0.2 U/mL concentrations was put in 96-well plate and placed in an incubator for 20 min at 37°C. To the aforementioned each 96-well plate, 50 μL of 5 mM ρ-nitrophenyl-α-D-glucopyranoside (PNPG) solution in 0.1 M PBS having pH 6.8 was added and incubated again at 37°C for 20 min. After incubation process, reaction was stopped by the addition of 160 μL of 0.2-M sodium carbonate into all wells of the plate. At 405 nm, absorbance was recorded by microplate reader (Synergy HT, BioTek). Percent inhibition and IC₅₀ of samples were calculated by using the following formula:

% inhibition = control – test / control × 100

IC₅₀ of samples were calculated with the help of EZ-Fit enzyme kinetic software (Perrella Scientific, MA, Amherst). By serial dilutions of compounds to different concentrations, that is, from 0.5, 0.25, 0.125, 0.625, 0.03125, up to 0.015625 mM, IC₅₀ values were calculated. With the help of graph, the concentration at which the inhibition was 50% or more was calculated as IC₅₀. Acarbose was positive control in the study. All values are mean of three independent variables.[18]

**Antioxidant activity of *Erythrina suberosa* (Roxb) bark**

Antioxidant activity of *E. suberosa* (Roxb) bark was performed on crude extract and its fractions. For each fraction, 1 mg per mL stock solution was prepared in methanol. Dilutions from 1000 μg/mL to 500, 250, 125, 62.5, 31.25, 15.62, and 7.81 μg/mL were prepared by serial dilution method. 1 mL methanol solution of Diphenyl picrylhydrazyl in concentration of (1 mg/mL) was mixed with each 1 mL of diluted solutions. After incubation for 30 min at 25°C in darkness, absorbance was recorded at 517 nm. The assay was performed in triplicates and %age inhibition was measured by using following formula:

% inhibition = Ac – As / Ac × 100

Quercetin and propyl gallate were used as positive control.[21,22]

**Results phytochemical analysis**

Crude bark extract of *E. suberosa* (Roxb) bark and its organic fractions were studied for phytochemical screening with different reagents. Results are mentioned in Tables 1–3.

**Anti-urease assay of *Erythrina suberosa* (Roxb) bark**

Methanolic extract of *E. suberosa* (Roxb) bark was analyzed against urease enzyme;
### Table 1: Phytochemical analysis of crude extract of *Erythrina suberosa* (Roxb) bark

| S. no. | Phytochemicals | Test | Observation | Results |
|--------|----------------|------|-------------|---------|
| 1      | Alkaloids      | Dragendorff’s reagent | Reddish-brown ppts | ++++    |
|        | Mayer’s reagent | Yellowish ppts | +++   |
|        | Wagner’s reagent | Reddish-brown ppts | ++++   |
| 2      | Flavonoids    | Shinoda’s test | Red pink color | ++     |
|        | Alkaline reagent | Yellow color | ++ |
| 3      | Phenol        | FeCl₃ | Bluish black color | ++++ |
| 4      | Saponins      | Froth test | Persistent froth | +++   |
|        | Lead acetate test | White precipitates | +++   |
| 5      | Triterpenoids | Salkowski’s test | Reddish interface | +++   |
| 6      | Carbohydrates | Fehling’s test | Brick red ppts | ++ |
| 7      | Glycosides    | Keller–Killian’s test | Brown-ring interface | ++ |
| 8      | Tannins       | FeCl₃ test | Black color | +++ |
|        | Gelatin test | White ppts | +++ |
| 9      | Reducing sugar | Fehling’s reagent | Red ppts | + |
|        | Benedict’s reagent | Orange red ppts | + |
| 10     | Phytosterols  | Salkowski’s test | Brown ring | ++ |

FeCl₃ = ferric chloride, ppts = precipitates
++++ indicates the strength of the test in phytochemical analysis of crude extract

### Table 2: Phytochemical analysis of DCM fraction

| S. no. | Phytochemicals | Test | Observation | Results |
|--------|----------------|------|-------------|---------|
| 1      | Alkaloids      | Dragendorff’s reagent | Reddish-brown ppts | +++   |
|        | Mayer’s reagent | Yellowish ppts | +++   |
|        | Wagner’s reagent | Reddish-brown ppts | ++++   |
| 2      | Phenol        | FeCl₃ | Bluish black color | +++ |
| 3      | Triterpenoids | Salkowski’s test | Reddish-brown interface | +++ |
| 4      | Tannins       | FeCl₃ test | Black color | +++ |
|        | Gelatin test | White ppts | +++ |
| 5      | Phytosterols  | Salkowski’s test | Brown ring | ++ |
| 6      | Flavonoids    | Shinoda’s test | Red pink color | ++ |
|        | Alkaline reagent | Yellow color | ++ |

FeCl₃ = ferric chloride, ppts = precipitates
+++ indicates the strength of the test in phytochemical analysis of dichloromethane extract

### Table 3: Phytochemical analysis of MeOH fraction

| S. no. | Phytochemicals | Test | Observation | Results |
|--------|----------------|------|-------------|---------|
| 1      | Alkaloids      | Dragendorff’s reagent | Reddish-brown ppts | ++++ |
|        | Mayer’s reagent | Yellowish ppts | +++   |
|        | Wagner’s reagent | Reddish-brown ppts | ++++   |
| 2      | Flavonoids    | Shinoda’s test | Red pink color | ++     |
|        | Alkaline reagent | Yellow color | ++ |
| 3      | Phenol        | FeCl₃ | Bluish black color | ++++ |
| 4      | Saponins      | Froth test | Persistent froth | +++   |
|        | Lead acetate test | White precipitates | +++   |
| 5      | Triterpenoids | Salkowski’s test | Reddish-brown interface | +++ |
| 6      | Carbohydrates | Fehling’s test | Brick red ppts | ++ |
| 7      | Glycosides    | Keller–Killian’s test | Brown-ring interface | ++ |
| 8      | Tannins       | FeCl₃ test | Black color | +++ |
|        | Gelatin test | White ppts | +++ |
| 9      | Reducing sugar | Fehling’s reagent | Red ppts | + |
|        | Benedict’s reagent | Orange red ppts | + |
| 10     | Phytosterols  | Salkowski’s test | Brown ring | ++ |

FeCl₃ = ferric chloride, ppts = precipitates
++++ indicates the strength of the test in Phytochemical analysis of Methanol extract
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Anticholinesterase assay of *Erythrina suberosa* (Roxb) bark

Crude methanolic extract of *E. suberosa* (Roxb) bark and its organic fractions were subjected to *in vitro* anticholinesterase assay in comparison with standard drug eserine. Their % inhibition as well as IC$_{50}$ (µg/mL) were calculated as shown in Figure 2.

**In vitro α-glucosidase assay of *Erythrina suberosa* (Roxb) bark**

Methanolic extract of *E. suberosa* (Roxb) bark and its organic fractions were subjected to *α*-glucosidase enzyme; their % inhibition at 0.5 mg/mL and IC$_{50}$ (µg/mL) were calculated as given in Figure 3.

Antioxidant assay

Antioxidant activities of crude aqueous methanol extract of *E. suberosa* (Roxb) bark and its organic fractions were performed following DPPH method; their % inhibition at 0.5 mg/mL and IC$_{50}$ (µg/mL) were calculated as shown in Figure 4.

**DISCUSSION**

Phytochemical analysis of crude methanolic extract of bark as well as its various organic fractions showed that it is rich in alkaloids, phenols, and saponins, whereas reducing sugars, flavonoids, tannins, and triterpenoids are also present. Secondary metabolites and their derivatives possess different biological activities; for example, flavonoids provide protection against cancer, heart attack, asthma, and Alzheimer’s diseases. Because of complicated and diversified nature of phytoconstituents of plants, it is difficult to evaluate the nature of compound responsible for antioxidant activity of a crude extract and different organic fractions of plants. Phenolic compounds and flavonoids are present as major constituents in plants and are very

![Figure 1: Graph plotted between % inhibition on the x-axis and the half maximal inhibitory concentration (IC$_{50}$) on the y-axis in comparison with thiourea as standard drug](image1)

![Figure 2: Graph plotted between % inhibition on the x-axis and the half maximal inhibitory concentration (IC$_{50}$) on the y-axis in comparison with eserine as standard drug](image2)
important medicinally. The constituents belonging to this class mainly possess antioxidant activity and are, therefore, assessed for the said activity. Phenolic compounds express their antioxidant potential by scavenging radicals, taking the singlet oxygen, and donating a hydrogen atom. For screening of antioxidant potential of samples,[25] DPPH assay was used, which is a well-known, fast and sensitive method.[25] In this technique, purple-colored DPPH solution is reduced into yellow-colored diphenyl-picrylhydrazine in the presence of hydrogen-donating antioxidants. The antioxidant potential of the samples[20] is directly proportional to the hydrogen-donating capacity of the sample resulting in less absorbance. The crude methanolic extract of *E. suberosa* (Roxb) bark and its organic fractions were also tested for antioxidant activities. The IC$_{50}$ calculated for aqueous extract was $335.3 \pm 0.21$, and organic fractions has shown negligible values as compared with a standard (propyl gallate) IC$_{50}$ that was $46.38 \pm 0.11$ µM.

*In vitro* enzymatic assays, that is, anticholinesterase, anti-urease, and α-glucosidase, were carried out on crude as well as different organic fractions of *E. suberosa* (Roxb) bark. The most important enzyme responsible for the carbohydrates digestion is α-glucosidase, which is present in the intestinal membrane surface. The inhibitors of α-glucosidase cause the retardation of D-glucose liberation of lipopolysaccharides and disaccharides from dietary complex carbohydrates resulting in suppression of postprandial hyperglycemia, which ultimately causes delay in the absorption of glucose.[26,29] The inhibitory activity of crude aqueous extract of *E. suberosa* (Roxb) bark and its fractions toward α-glucosidase was significant, whereas DCM fraction showed a very strong inhibitory activity more than standard. The IC$_{50}$ value for DCM fraction was $8.45 \pm 0.13$, for MeOH fraction it was $64.24 \pm 0.15$, and for aqueous fraction it was $42.62 \pm 0.17$ as compared with standard IC$_{50}$ that is 37.42 (acarbose). From this, it can be concluded that molecules in DCM fraction

![Figure 3: Graph plotted between % inhibition on the x-axis and the half maximal inhibitory concentration (IC$_{50}$) on the y-axis in comparison with acarbose as standard drug](image1)

![Figure 4: Graph plotted between % inhibition on the x-axis and the half maximal inhibitory concentration (IC$_{50}$) on the y-axis](image2)
can be considered against diabetes, which needs further investigation.

In anticholinesterase assay, the % inhibition of standard drug (eserine) was 91.27 ± 1.17 and IC$_{50}$ was 0.04 ± 0.0001, whereas result of crude aqueous methanol extract and its different organic fraction were negligible. An enzyme urease helps to hydrolyze urea to ammonia and carbon dioxide, hence used medically against bacteria (Helicobacter pylori), which are one of the major causes of peptic ulcer.[27] Crude aqueous methanol extract of bark as well as their organic fractions were subjected to anti-urease activity and results were compared with standard drug thiourea. Percent inhibition and IC$_{50}$ were calculated and compared with standard drug. Percent inhibition of crude aqueous extract of bark, its methanol fraction, and DCM fraction are 94.48 ± 0.16, 67.31 ± 0.21, 96.23 ± 0.17, and 98.21 ± 0.18 (standard), respectively. IC$_{50}$ of crude aqueous methanol extract, DCM fraction, and MeOH fraction are 72.35 ± 0.12, 45.26 ± 0.13, and 134.82 ± 0.16, respectively, which were compared with standard IC$_{50}$ (21.25 ± 0.15). Result shows that all fractions have potential against this enzyme, but DCM fraction of crude aqueous extract has significant IC$_{50}$ value (45.26 ± 0.13) than other fractions.

**Limitations**

This research was carried out using financial support by COMSATS University Islamabad, Abbottabad Campus, Islamabad, Pakistan but due to short time period and limited resources we were not able to further study this plant for its cytotoxic behavior.

**Future implications**

Alkaloids are widely used for the treatment of various ailments; for example, vincristine and taxols are used as anticancer drugs.[29] Phytochemical analysis suggested that E. suberosa (Roxb) has enough number of these compounds, which can guide us to interesting new lead compounds. Looking at the IC$_{50}$ value of DCM fraction against α-glucosidase inhibition assay, it can be concluded that molecules in DCM fraction can be considered against diabetes, which needs further investigation. DCM fraction of methanolic extract has potential to treat ulcer and gout, which needs to investigate molecule(s) responsible for such activity. Erythrina suberosa (Roxb) bark showed significant antioxidant activity, which offers potential opportunities for the future anticancer studies of this plant.

**Conclusion**

Keeping in view all the results, it is evident that the plant can be used in future for formulating effective drugs against many ailments. These results need further elaborative and higher scale studies, which can be of prime importance in introducing these chemicals for treatment of various diseases. Furthermore, the extracts of this plant can be used in their crude form, which is an addition to the complementary and alternative treatment strategies.

**Data availability statement**

The data related to the research are provided in the article.

**Acknowledgement**

We would like to thank COMSATS staff for their support. Furthermore, SA appreciates Universiti Sains Malaysia fellowship for their support.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

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