Phytochemicals, antioxidant, and anthelmintic activity of selected traditional wild edible plants of lower Assam

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Abstract:
Objective: Clerodendrum viscosum, Eryngium foetidum, Lippia javanica, and Murraya koenigii are one among the common wild edible plants in Northeast India which are also used as anti diabetic, stomach-ache relieving drugs, etc. The present study was aimed to reveal the phytochemical, antioxidant, and anthelmintic activity of the plants.

Materials and Methods: The antioxidant capacity of methanolic extract of plants was studied by 1,1-diphenyl-2-picrylhydrazyl (DPPH), ferric reducing antioxidant power, TBARS, and total antioxidant activity (TAA). Total phenolics, flavonoids, Vitamin C, carbohydrate, and protein are also estimated following standard protocols. Anthelmintic activity of the extracts has also been studied in vitro against trematode parasites.

Results: The result showed that the methanolic extracts of plants possess a substantial quantity of alkaloids, phenolics, flavonoids, proteins, carbohydrates, and Vitamin C. Phenolics, flavonoids, vitamin C contents were found higher in C. viscosum followed by M. koenigii, L. javanica, and E. foetidum. The in vitro antioxidant assays revealed substantial free radical scavenging property in all the plants. TAA increased in the order C. viscosum > M. koenigii > L. javanica > E. foetidum. Similarly, C. viscosum displayed a better antioxidant capacity with IC50 values 29.74 ± 3.63 µg and 148.77 ± 18.38 µg for DPPH and thiobarbituric acid reactive species, respectively. In addition, the plant extracts also showed good anthelmintic activity against Paramphistomum sp. Time taken for paralysis and death were 0:56 ± 0:09 h and 1:35 ± 0:07 h for L. javanica at 50 mg/mL concentration.

Conclusion: The study therefore suggests the importance of tested plants as a natural source of free radical scavenger and plausible veterinary uses.

Key words: Anthelmintic studies, antioxidant, Assam, phytochemicals, wild edible plants

North Eastern Region (NER) of India is known for its diverse ethnicity and rich flora and fauna. Lying within the geographical area of 89°50’/E–96°10’/E and 24°30’/N–28°10’/N, Assam is one among the richest biodiversity zones of NER India. Many medicinal plants and wild edible plants have been studied for their pharmacological properties. Although a large number of literature reveals the study of ethnopharmacology in this part of India, a limited number of plants have been explored for their phytochemical and antioxidant studies. Inhibited with different tribal groups such as Bodo, Rabha, and Garo this part of Assam is full of valuable plants. Clerodendrum viscosum (local name “mwkhwna”), Eryngium foetidum (local name “gongar dhundia”), Lippia javanica (local name “onthai bajab”), and Murarya koenigii (local name “nwrsing”) are one among the most commonly used traditional plants of lower Assam used as medicine and food.

C. viscosum belonging to the family Lamiaceae is a flowering shrub widely found in tropical countries including India. With whitish-pink flower, large ovate-shaped leaves, and about 1–2.5 m height, the plant possesses many medicinal properties against several health complications such as asthma, fever, bronchitis, skin diseases, epilepsy, inflammation, tumors, worm infestation and snake bite. Antimicrobial, antinociceptive, and cytotoxic activities are also reported from the plant. Several phytochemical studies have revealed the presence of many

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bioactive molecules such as alpha-D-galactopyranoside, 4-pyranone-4-one, 2,3-dihydro-3, 5-dihydroxy-6-methyl, 2,4-dihydroxy-5,6-dimethylpyrimidine benzofuran, and 2,3-dihydro-5-hydroxymethylfurufural.10 E. foetidum (family: Apiaceae) is a commonly used spicy herb distributed in the tropical parts of the world. It has long been used to treat fever, vomiting, diarrhea, hypertension, arthritic pain, constipation, asthma, stomachache, worms, infertility complications, snake bites, diarrhea, and malaria.10 Phytochemicals such as lutein, β-carotene, chlorogenic acid, kaempferol, and caffeic acid were reported from the plants.10

L. javanica (family: Verbenaceae) is another important a traditional spicy herb found to be distributed in the NER of India. The plant extracts are reported to possess healing capacity of minor ailments such as microbial infections and skin infections.11 Major phytochemicals, namely 4-ethyl-nonacosane, (E)-2 (3)-tagetenone epoxide, myrcenone, piperitenone, apigenin, cirsimaritin, 6-methoxyluteolin 4'-methyl ether, 6-methoxyluteolin, 3',4',7-trimethyl ether, 1,3,5 cycloheptatriene, and alpha-pinene were reported from the plant.12 M. koenigii (family: Rutaceae) is another commonly used spicy plant native to many Asian countries including India. Several studies have confirmed the anti-diabetic, antimicrobial, wound healing, vasodilating, antiulcer, and phagocytic activities of the plants. Phytochemical studies confirmed the presence of girinimbins, iso-mahanimbins, koenine, koenigine, koenidine, and koenimbine in the plant.13 Because of its significant medicinal and food values, the present study was designed to explore the phytochemical content, antioxidant property, and anthelmintic efficacy of C. viscosum, E. foetidum, L. javanica, and M. koenigii.

Materials and Methods

Collection, Identification, and Preparation of Crude Extract of Plants

Fresh leaves of selected traditional wild food plants, namely C. viscosum (family Lamiacaeae), E. foetidum (family Apiaceae), L. javanica (family Verbenaceae), and M. koenigii (family Rutaceae) were collected from Kokrajhar district, India. Prior permission was taken from the University and village head before the collection of sample plants. The collected plants were identified by Dr. Sanjib Baruah, Department of Botany, Bodoland University, washed with distilled water, and dried completely. Dry leaves were grounded into powdered form uniformly and soaked in 80% methanol. The solution was filtered after 24 h and fresh solvent added. The process was repeated for four times and the filtrate obtained was evaporated in a rotary evaporator. Dry, semi-solid extracts (crude extract) obtained were kept at 4°C in an airtight container for further use.

Qualitative Phytochemical Study

Phytochemical screening of the methanolic extracts of all the plants for the presence of flavonoids, phenol, reducing sugar, saponins, steroids, and tannins was carried out following the methods of Trease and Evans and Sofowora.9,10

Carbohydrate (Glucose) Assay

The presence of total carbohydrate content in plant extract was estimated following the anthrone method.11

Protein Assay

The protein content of all the plant extracts was estimated following the Lowry method.12

Vitamin C Content

The Vitamin C content was estimated by the titration method13 using 2,6-dichlorophenol indophenol as the blue dye indicator. The values were represented as a microgram ascorbic acid equivalent (AAE)/milligram plant extract.

Total Phenolic Content

The total phenolic was estimated using Folin-Ciocalteu reagent.14 The amount of total phenolic content (TPC) was calculated from a calibration curve of gallic acid and results expressed as µg gallic acid equivalent (GAE)/milligram plant extract.

Total Flavonoid Content

The flavonoid content was determined following the method of Ordonez et al. Total flavonoid content (TFC) was calculated from the standard curve of quercetin (5-25 µg/mL), and the values were expressed as microgram quercetin equivalent (QE)/milligram of plant extract.

Antioxidant Study

Total antioxidant activity (phosphomolybdate assay)

The total antioxidant activity (TAA) of the plant extract was done by phosphomolybdate method15 using ammonium molybate. The reaction mixture was incubated at 95°C for 30 min and absorbance measured at 695 nm against a blank solution. TAA was expressed as µg AAE/milligram plant extract.

1,1-diphenyl-2-picrylhydrazyl radical scavenging activity

The 1,1-diphenyl-2-picrylhydrazyl (DPPH) scavenging activity of methanolic plant extracts was estimated using DPPH.16

Ferric reducing antioxidant power assay

Ferric reducing antioxidant power (FRAP) assay was performed following the method of Benzie and Strain with slight modification a described by Iloki-Assanga et al. using TPTZ as the reducing agent. The FRAP activity of plant extracts was compared with the standard ascorbic acid.

Lipid peroxidation scavenging activity assay (thiobarbituric acid reactive species assay)

Lipid peroxidation inhibitory activity was studied following the modified thiobarbituric acid reactive species (TBARS) assay to measure the lipid peroxide formation using egg yolk homogenates as lipid-rich media.17 The coloration of the assay mixture was measured at 532 nm.

Anthelmintic efficacy test

The anthelmintic efficacy study was carried out by incubating the parasites at two different concentrations of plant extracts/drug, namely 20 and 50 mg/mL phosphate-buffered saline (PBS) (for plant extract) and 5 and 10 mg/mL PBS (for albendazole).18

Statistical Analysis

All data presented as a mean ± standard deviation for at least three replications for each experiment. Statistical analysis
was performed using one-sample t-test. A correlation study was done using SPSS (SPSS® 10.0 Syntax, SPSS Inc, Chicago) software. The results are considered to be significant at $P < 0.05$. All statistical analyses were performed in Microsoft Excel, and the graphs were drawn using OriginPro8 software (OriginLab Corp., USA).

**Results**

**Methanolic Extraction and Moisture Content**
The dry weight (moisture content) and methanolic crude extract recovered from the four plants is shown in Figure 1a. Highest moisture content was found in *E. foetidum* ($\approx 88\%$), whereas *C. viscosum* possessed lowest ($\approx 65\%$) moisture content. The methanolic crude extracts recovered were $27.06 \pm 1.12$, $20.22 \pm 0.84$, and $18.23 \pm 0.53$ g/kg fresh weight for *C. viscosum*, *M. koenigii*, *L. javanica*, and *E. foetidum*, respectively. The high content of carbohydrate and protein in all the plants, likewise, the protein content of *C. foetidum* showed the lowest recovery (10.15 g/100 g dry plant powder), while *L. javanica* showed the lowest recovery (10.15 g/100 g dry plant powder).

**Qualitative and Quantitative Phytochemical Analysis**
The phytochemical content of all the four plants was shown in Tables 1 and 2. Qualitative study showed the presence of alkaloids, flavonoids, phenol, reducing sugar, saponins, steroids, and tannins in the plant extracts, while alkaloids, steroids, and tannins showed a negative result in *M. koenigii*, *C. viscosum*, and *E. foetidum*, respectively. However, in terms of percentage recovery, *E. foetidum* showed the highest methanol extract (17.42 g/100 g dry plant powder), while *L. javanica* showed the lowest recovery (10.15 g/100 g dry plant powder).

Similarly, a quantitative study revealed the presence of high content of carbohydrate and protein in all the plants (Table 2). The carbohydrate content was found to be $197.47 \pm 1.34$, $174.72 \pm 1.72$, $170.95 \pm 1.10$, and $176.75 \pm 3.56$ µg/mg extract in *C. viscosum*, *E. foetidum*, *L. javanica*, and *M. koenigii*, respectively. Likewise, the protein content of *C. viscosum*, *E. foetidum*, *L. javanica*, and *M. koenigii* were found to be $397.73 \pm 14.66$, $307.26 \pm 2.26$, $222.52 \pm 7.78$, and $228.45 \pm 7.55$ µg/mg extract, respectively. The high content of carbohydrate and protein indicates the nutritional value of the plants. Vitamin C, also known as ascorbic acid, is an important free radical scavenger. In the present study, Vitamin C was also found to be highest in *C. viscosum* ($31.25 \pm 1.02$ µg AAE/milligram extract) followed by *M. koenigii* ($23.33 \pm 1.56$ µg AAE/milligram extract), *L. javanica* ($18.75 \pm 1.02$ µg AAE/milligram extract), and *E. foetidum* ($14.17 \pm 1.17$ µg AAE/milligram extract) [Table 2]. Similarly, the TPC content of *C. viscosum* was found to be highest ($154.54 \pm 3.89$ µg GAE/milligram extract), while *E. foetidum* showed lowest both in TPC and TFC ($38.10 \pm 1.94$ µg GAE/milligram extract, $13.69 \pm 0.75$ µg QE/milligram extract) [Table 2 and Figure 1b]. Unlike TPC, the TFC was found to be highest in *M. koenigii* ($23.28 \pm 1.22$ µg QE/milligram extract) followed by *C. viscosum*, *L. javanica*, and *E. foetidum*, respectively.

In accordance with our result, several plants showed TPC in the range of 49–980 mg GAE/gram extract, while the TFC ranged from 14 to 60 mg QE/gram extract [Table 2]. The antioxidant activities of all the four plants showed good correlation between the TPC, TFC, and antioxidant activities [Table 3]. Therefore, higher content of phenolics and flavonoids could be related with the antioxidant properties of that plant.

**Antioxidant Activity**
In the present study, *C. viscosum* displayed the highest TAA ($147.19 \pm 2.42$ µg AAE/milligram extract) followed by *M. koenigii* ($82.37 \pm 1.80$ µg AAE/milligram extract), *L. javanica* ($48.57 \pm 3.07$ µg AAE/milligram extract), and *E. foetidum* ($30.35 \pm 1.96$ µg AAE/milligram extract) respectively [Table 2]. Similarly, methanolic extract of *C. viscosum* showed the strongest DPPH activity with IC$_{50}$ value $29.74 \pm 3.63$ µg, while *E. foetidum* showed the lowest activity with high IC$_{50}$ value $546.23 \pm 26.73$ µg. All the plant extracts and standard ascorbic acid showed concentration-dependent activity [Figure 2a].

The reducing ability ($\text{Fe}^3+ \text{to Fe}^2+\)$ of plant extract revealed concentration-dependent activity [Figure 2b]. The reducing potential of the tested extracts was observed over a concentration range 25–100 µg/mL. The trend of reducing potential was significantly ($P < 0.05$) lower than the standard ascorbic acid. Like other assays, *C. viscosum* showed high FRAP activity, while *E. foetidum* showed the lowest reducing power among all the plants. The scavenging of lipid peroxides by the plant extracts and ascorbic acid is presented in Figure 2c. The percentage inhibition of lipid peroxides increased with the increase of plant concentration. The IC$_{50}$ value indicated that *C. viscosum* possessed strongest (148.77 ± 18.38 µg) inhibitory activity among all the plants. However, the reference chemical showed better activity (100.17 ± 3.07 µg). In many literature, the high-lipid peroxidation activity of the plants extracts has been correlated with high phenolic content and number of the hydroxyl group in the compounds. In the present study, all

![Figure 1](image-url): (a) Moisture content and alcoholic extract of tested plants and (b) total phenolic and flavonoid contents of methanolic extracts of tested plants.
Table 1: Phytochemical screening of methanolic extracts of Clerodendrum viscosum, Eryngium foetidum, Lippia javanica, and Murraya koenigii

| Phytochemicals | Reagents/chemicals | Observation | Results |
|----------------|--------------------|-------------|---------|
| Alkaloids      | Wagner's reagent   | Brown/red ppt | + + + – |
| Phenols        | FeCl₂              | Blue green color | + + + + |
| Reducing sugar | Fehling's solution | Orange red ppt | + + + + |
| Steroids       | Liebermann-Burchard test | Bluish green | – + + + |
| Tannins        | FeCl₃              | Blue green ppt | + – + + |

Qualitative detection of phytochemicals, + = Present, – = Absent, ppt = precipitate

Table 2: Phytochemical contents and IC₅₀ values for free radical scavenging assays of methanolic extracts of Clerodendrum viscosum, Eryngium foetidum, Lippia javanica, and Murraya koenigii

| Phytochemicals contents/IC₅₀ values | Clerodendrum viscosum | Eryngium foetidum | Lippia javanica | Murraya koenigii | Standard chemical |
|-------------------------------------|-----------------------|------------------|----------------|-----------------|------------------|
| Carbohydrates (µg/mg extract)       | 197.47±1.34           | 174.72±1.72      | 170.95±1.10    | 176.75±3.56     |                  |
| Protein (µg/mg extract)             | 397.73±14.66          | 65.58±5.26       | 222.52±7.78    | 228.45±7.55     |                  |
| Vitamin-C (µg AAE/mg extract)       | 31.25±1.02            | 14.17±1.17       | 18.75±1.02     | 23.33±1.56      |                  |
| TPC (µg GAE/mg extract)             | 154.54±8.39           | 38.10±1.94       | 53.18±2.24     | 100.01±5.83     |                  |
| TFC (µg QE/mg extract)              | 22.57±1.35            | 13.69±0.75       | 17.85±1.03     | 23.28±1.22      |                  |
| TAA (µg AAE/mg extract)             | 147.19±2.42           | 30.35±1.96       | 48.57±3.07     | 82.37±1.80      |                  |
| DPHH, IC₅₀ (µg)                     | 29.74±3.63            | 546.23±32.62     | 69.50±7.36     | 160.85±7.60     | 6.31±0.13*       |
| TBAR, IC₅₀ (µg)                     | 148.77±18.38          | 387.60±29.68     | 363.83±32.62   | 155.47±21.87    | 100.17±3.07*     |

Values are expressed as ±SD with three replications (n=3) for each experiment. *Ascorbic acid as standard chemical. AAE=Ascorbic acid equivalent, TPC=Total phenolic content, TFC=Total flavonoid content, QE=Quercetin equivalent, DPHH=1,1-diphenyl-2-picrylhydrazyl, TBars=Thiobarbituric acid reactive species, SD=Standard deviation

Table 3: Pearson’s correlation between the phytochemical contents of antioxidant activity in the plant extracts of Clerodendrum viscosum, Eryngium foetidum, Lippia javanica, and Murraya koenigii

| Phytochemicals | AA | TPC | TFC | TAA | DPHH | TBARS |
|----------------|----|-----|-----|-----|------|-------|
| AA             | 1.00 |     |     |     |      |       |
| TPC            | 0.902*/0.866*/ | 1.00 |     |     |      |       |
|                | 0.994*+/0.982*|     |     |     |      |       |
| TFC            | 0.927*/0.866*/ | 0.674+/1.000*| 1.00 |     |      |       |
|                | 0.952*/0.921* | 0.979*/0.978*|     |     |      |       |
| TAA            | 0.993*/0.756* | 0.945*/0.982*| 0.878*/0.982*| 1.00 |      |       |
|                | 0.982*/0.994* | 0.996*/0.997*| 0.993*/0.958*|     |      |       |
| DPHH           | 0.941*/0.831* | 0.702*/0.998*| 0.999*/0.998*| 0.896*/0.992*| 1.00 |      |
|                | 1.000*/0.975* | 0.995*/0.916*| 0.954*/0.813*| 0.983*/0.946*|     |       |
| TBARS          | 0.923*/0.905* | 0.666*/0.996*| 1.000*/0.996*| 0.873*/0.963*| 0.999*/0.989*| 1.00 |      |
|                | 0.864*/0.932* | 0.912*/0.984*| 0.976*/1.000*| 0.943*/0.966*| 0.866*/0.829*|     |       |

*Clerodendrum viscosum, Eryngium foetidum, Lippia javanica, Murraya koenigii. AA=Ascorbic acid, TPC=Total phenolic content, TFC=Total flavonoid content, TAA=Total antioxidant activity, DPHH=1,1-diphenyl-2-picrylhydrazyl, TBARS=Thiobarbituric acid reactive species

The four plants showed a strong correlation between AA, TPC, TFC, TAA, DPHH, and TBARS. The presence of high TPC and TFC showed good TAA in all the plants. In C. viscosum, TPC showed slightly lower correlation with AA, DPHH, and TBARS activity. Similarly, the TFC of plants was found to be directly correlated with TBARS activity [Table 3].

Anthemelmintic Activity

The presence of several phytochemical contents and high antioxidant activity indicates plausible biological activity. In vitro mortality study showed potential anthelmintic activity against trematode parasite, Paramphistomum sp. When the parasites were exposed to different concentrations of plant extracts (20 and 50 mg/mL PBS), a dose-dependent anthelmintic activity was observed in all the plants. Among the four plants L. javanica showed strongest anthelmintic activity [Table 4]. The time taken for paralysis and death at 50 and 20 mg/mL concentration was 0:56±0.09 h, 1:35±0.07 h and 1:36±0:11 h, 2:28±0:13 h, respectively. M. koenigii showed lowest anthelmintic activity against the parasite. Reference drug, ALB showed better activity compared to all the plants. The time taken for paralysis and death at 10 mg/mL of albendazole.
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was 1:53 ± 0:08 h and 2:47 ± 0:13 h, which is more or less similar to the mortality time of \textit{L. javanica} at 20 mg/mL [Table 4]. The control parasites lived up to 41:37 ± 0:28 h.

**Discussion**

Plants have always been a rich source of phytochemicals and also possess several biological activities. The medicinal property of a plant depends on the presence of various secondary metabolites such as phenolics, terpenoids, or alkaloids. Flavonoids for instance are a secondary metabolite that exhibit tremendous medicinal property including antioxidant, anti-inflammatory, anticancer, antibacterial, and antiviral activity.\(^{[20]}\) The present study revealed the presence of important phytochemical contents such as phenols, flavonoids, and tannins from the tested plants. Similar to the present study, recent studies by De \textit{et al.} on several medicinal plants also revealed the presence of a similar type of phytochemicals.\(^{[21]}\) The presence of high content of phenolic compounds was found to be correlated with higher antioxidant property of the plant. The presence of high phenolic contents in \textit{C. viscosum} and \textit{M. koenigii} indicates its better antioxidant capacity compared to others. In the present study, protein content was found to be significantly higher compared to carbohydrate in all the tested plants. Similarly, Zhang \textit{et al.} have also reported high protein content in fresh leaves of \textit{M. koenigii}.\(^{[22]}\) The medicinal property of plant can also be correlated with the presence of Vitamin C. Crude extract of all the plants showed the substantial quantity of Vitamin C. Recent studies by Mahapatra \textit{et al.} on 15 plant species showed the variable quantity of ascorbic acid ranging from 150 µg to as high as 535 µg/g of fresh weight.\(^{[23]}\)

Free radicals, also known as reactive oxygen species (ROS), are generated in the body during biological metabolism. ROS contribute many disorders in human including diabetes and cancer. Antioxidant molecules have the capacity to control or

**Table 4: \textit{In vitro} anthelmintic and mortality activity of plant extracts against trematode parasite**

| Test doses (mg/mL PBS) | \textit{Clerodendrum viscosum} (h) | \textit{Eryngium foetidum} (h) | \textit{Lippia javanica} (h) | \textit{Murraya koenigii} (h) |
|------------------------|-----------------------------------|---------------------------------|------------------|----------------------------------|
|                        | Paralysis | Death | Paralysis | Death | Paralysis | Death | Paralysis | Death | Paralysis | Death |
| 50                     | 1:12±0:11 | 2:01±0:07 | 4:18±0:07 | 4:53±0:14 | 0:56±0:09 | 1:35±0:07 | 4:34±0:07 | 5:11±0:11 |
| 20                     | 2:11±0:06 | 2:43±0:25 | 5:03±0:07 | 5:56±0:15 | 1:36±1:1 | 2:28±0:13 | 5:37±0:08 | 6:23±0:14 |

Albendazole (mg/mL PBS) | Paralysis (h) | Death (h) |
|------------------------|----------------|------------|
| 10                     | 1:53±0:08 | 2:47±0:13 |
| 5                      | 3:31±0:12 | 4:22±0:09 |

Time of mortality is represented in hours. All the values are found to be statistically significant at \(P<0.05\) between the two tested concentrations \((n=3)\). Results were expressed in±SD. Control \textit{Paramphistomum} incubated at PBS only lived for 41:37±0:28 h. PBS=Phosphate-buffered saline, SD=Standard deviation
neutralize those free radicals. The most significant pathway is the scavenging of free radicals in which free radical chain reactions are interrupted by phenolic compounds by its redox properties. Among all the four plants, Clerodendrum viscosum was found to possess better ROS neutralizing capacity. Antioxidant activities were increased with the increase of plant concentration indicating dose-dependent activity. Similar to the present study, several studies showed an increasing trend of reducing power with the increase of plant concentrations.[10,18] The reducing capacity of the extracts may function as an indicator of potential antioxidant activities through the action of breaking the free radical chain by donating hydrogen atom.

Helminthiasis is a serious disease of human and poultry farming in South-East Asia including India. Although several commercial drugs are available in market because of their side-effects, the medicinal plant has been appreciated as an alternative source of anthelmintic drugs. A large number of studies have confirmed the effectiveness of many plants possessing anthelmintic activity. Many other studies have also revealed the effect of plant extracts on the enzymes activities of plants.[18] In the present study, L. javanica showed better anthelmintic property compared to other plants.

**Conclusion**

The presence of phytochemicals such as total phenolics, alkaloids, flavonoids, steroids, saponins, and tannins in C. viscosum, E. foetidum, L. javanica, and M. koenigii provides some scientific evidence for the biological activities and also accounts for the pharmacological use of the plants. The presence of high phenolic, flavonoid compounds, and Vitamin C could be attributed to its pharmacological activity associated with free radicals. Furthermore, an antioxidant study by TAA, DPPH, FRAP, and TBARS also showed the high potential of scavenging free radicals. The present data would certainly help to ascertain the potency of the tested parts of the plants for medicinal use and functional food and nutraceuticals applications. Therefore, further investigations are needed for the isolation and identification of the active components and to elucidate its mechanisms of action, as well as their potential role in the biological activity, and antioxidant activities as well.

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**Conflicts of Interest**

There are no conflicts of interest.

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