



NUTRITIONAL EVALUATION, PHYTOCHEMICALS, ANTIOXIDANT AND ANTIBACTERIAL ACTIVITY OF *GERARDIANA DIVERSIFOLIA* LINN. AND *BAUHINIA VARIEGATA* LINN. WILD EDIBLE PLANTS OF WESTERN HIMALAYAS

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Abstract

The edible part of *Gerardiana diversifolia* (Leaves) Linn. and *Bauhinia variegata* Linn. (flower) used as vegetable by the villagers of Khanyara region (Dharamshala) of district Kangra. Number of bioactive constituents which contribute to a wide range of nutritional, phytochemicals, antioxidant as well as antimicrobial capacity in these edibles. The nutritional composition *i.e.* carbohydrate, protein, sodium, potassium, crude fibre and crude fats were relatively high in the *Bauhinia variegata* (6.87±0.330) mg/g, (5.646±0.313) mg/g (4.94±0.443) mg/g (19.476±0.238) mg/g (9.733±0.208)% and (0.62±0.085)% respectively as compare to the *Gerardiana diversifolia*. Anti-nutrient content that is alkaloid and phytate was high in *Gerardiana diversifolia* as compare to the *Bauhinia variegata*. Phytochemicals *i.e.* Phenol (16.746±0.077) mg, flavonoid (8.033±0.105) mg/g, tannin (1.277±0.005) mg/g, terpenoid (1.381±0.044) mg/g, ascorbic acid (0.874±0.060) mg/g, tocopherol (10.419±0.465) µg/g and carotenoids (182.24±0.623) µg/g were high in the *Gerardiana diversifolia* as compare to the *Bauhinia variegata*. Methanolic extract of *Gerardiana diversifolia* shows the higher antioxidant and antibacterial activity as compare to the *Bauhinia variegata*. From the combined results of all the activities, it can be inferred that these plants can be used as nutritional as well as medicinal purposes.

Key words: Edible plants, Nutritional, Phytochemicals, Antioxidant and Antibacterial.

Introduction

Wild edible plants played a vital role in food supplementing to maintain the diet of human beings. Due to the modernization, the knowledge about the wild edible plants has slowly turn down. In tribal areas most of the people still use these plants as a diet of their basic requirement of food. These plants used by most of the people of rural area and preserved for use in dry period or sold in market. Beside from their traditional use of food, potentially they have many benefits related to nutritional value. They are edible and having nutritional food value, which provides the minerals like sodium, potassium, magnesium, iron, calcium, phosphorus etc. They are resistant to many diseases and frequently used in various formulation of 'Ayurveda' in Indian Folk-medicine. These plants have the sufficient amount of carbohydrate, protein as well as vitamins. These plants

have the antioxidant as well as antimicrobial activity which prevent various diseases (Reddy *et al.*, 2009). Therefore, wild edible plants are very important source of food mostly for the rural community, so it should be paid in order to preserve and get better this important source of food supply. *Gerardiana diversifolia* and *Bauhinia variegata* are also the wild edible plants and used by the rural community. *Gerardiana diversifolia* is also known as giant nettle. It is an annual herb, erect attain upto 75-300 cm in tallness. The leaves are wide, lobed and alternate. The flowers are monoecious or dioecious having dense axillary inflorescences and have the fibrous root system. The leaves of *G. diversifolia* is used as an astringent. A decoction of the basal stems and roots is used as a treat for constipation and gastric troubles. The root is applied externally for treatment of cuts, swollen joints and headaches. A decoction of leaves of *G.*

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diversifolia is used to treatment of fever and its ashes are utilized in the treatment of ringworms and eczema (Njogu *et al.*, 2011). *Bauhinia variegata* is the deciduous tree. The tree is small to modest sized and having light pink flowers in month between February to april (Noatay, 2001). Young buds of the *Bauhinia variegata* are used for making a variety of delicious pickles. Presence of phenol content in young buds which provide a source of dietary antioxidants (Latif and Shinwari, 2005). Bark and buds of *Bauhinia variegata* tree have their medicinal uses Buds are used in preparation of flour and also used in the flavouring agent (Sharma, 2003; Yadava and Reddy, 2003). The gum obtained from the bark and seeds contains amino acids are utilized as pulse in tribal areas of North-eastern and Central India (Karuppanan *et al.*, 1997). The plant species have high amount of phytochemicals with high antioxidant value and potent to microbial activity towards gram positive and gram negative bacteria. The oxidation induced by reactive oxygen species (ROS) can result in disruption of cell membrane, mutation, which can spread various diseases such as, liver injury, cardiovascular disease, diabetes, infertility, gastrointestinal, ulcerogenesis, asthma, rheumatism and neurodegenerative diseases (Negi *et al.*, 2012). By consumption of wild edibles possesses such defense mechanism, as antioxidant nutrients and enzymes which inhibits the harmful properties of Reactive oxygen species (Divya and Anita, 2012).

Materials and Methods

The edible part of *Gerardiana diversifolia* (Leaves) Linn. and *Bauhinia variegata* Linn. (flower) were collected in March 2018 from the Khanyara region (Dharamshala) of district Kangra, Himachal Pradesh. Collected plants were washed with distilled water, and dried with blotting paper, chopped to small pieces before drying at 60°C for 72 hours until constant weight was obtained. These plants were grounded into the fine powder by mortar pestle and put in the glass bottle and kept at 4°C in refrigerator and used for the further nutritional and phytochemical analysis.

Extract preparation

2 gm of the fine powdered of both the samples were soaked in 20 ml methanol and kept at orbital shaker for 48 hrs, filtered and filtrate was evaporated and dried at 40°C at water bath and used the extract for antioxidant and antibacterial activity.

Determination of Carbohydrates

Weighed 100 mg of sample and homogenized by 2 ml of 2.5 N HCl in test tube and boiled in water bath for two hours and cooled to room temperature. In 0.2 ml of

plant extract added 500 µL of distilled water and 4 mL anthrone reagent. The mixture was heated in water bath for 8 min. and cooled. The green color of mixture was read at 630 nm using UV/visible spectrophotometer. The carbohydrate content was calculated from the calibration curve of glucose and the results were expressed as 1g of glucose equivalents per mg of sample. (Hedge and Hoefreitter, 1962).

Determination of Protein

Weigh 100 mg of sample and grond it with a pestle and mortar in 2mL of the phosphate buffer. Centrifuged and used the supernatant for protein estimation. In 200 µL added 3 mL of alkaline copper sulphate reagent, mixed well and allowed to stand for 10 min and then added 0.5 mL of Folin-Ciocalteau's reagent and mixed properly. The reaction mixture was kept at room temperature under dark condition for 30 min. The blue color of reaction mixture was read at 660 nm using UV/visible spectrophotometer. The protein content of sample was calculated from the calibration curve of Bovine Serum Albumin (BSA) and the results were expressed as 1g of BSA equivalents per mg of plant extract (Lowry *et al.*, 1951).

Determination of Sodium and Potassium

Potassium and sodium in the acid-digest of plant sample was determined using Flame photometer. Weighed 500 mg dried plant sample in 100 ml of conical flask. Added 10 ml of concentrated HNO₃ and kept for about 6-8 hrs or overnight at a covered place for pre-digestion. After pre-digestion when the solid sample was no more visible, added 10 ml of conc. HNO₃ and 2-3 ml HClO₄. Kept on a hot plate in acid proof chamber having fume exhaust system and heated at about 100°C for first 1 hr and then raised the temperature to 200°C. Continued digestion until the contents became colorless and only white dense fumes appeared. Reduced the acid contents to about 2-3 ml by continuing heating at the same temperature. Filtered through Whattman No. 42 filter paper into a 100 ml volumetric flask. Gave 3-4 washings of 10-15 ml distilled water and made volume 100 ml. Measured Na⁺ and K⁺ concentrations in the filtrate using Flame photometer. Recorded the flame photometer readings for each of the working standards of Na and K after adjusting blank to zero. Drawn a standard curve by plotting the readings against Na and K readings (Halstead Essex- Corning 410 model).

Determination of Crude Fibres

Sample (1g) was digested by boiling with 50 mL of 1.25% H₂SO₄ solution for 30 min, then filtered under pressure. The residue rinsed three times with boiled water.

This process was repeated using 50 mL of 1.25% Sodium hydroxide solution. The final residue was then dried at 100°C, cooled in room temperature and weighed (C1). It was thereafter incinerated in a muffle furnace at 550°C, for 3 h, then cooled at room temperature and reweighed (C2) (Aina *et al.*, 2012).

The percentage crude fibre was calculated as:

$$\% \text{ Crude fibre} = \frac{C1 - C2}{\text{Weight of original sample}} \times 100$$

Determination of crude Fats

Sample (1g) was extracted in 25 mL of diethyl ether and placed on shaker for 24 h. The extract was filtered and ether extract collected in a previously weighed (W1) beaker. It was thereafter equilibrated with 100 mL diethyl ether and shaken for another 24 h, the filtrate was collected in the same beaker (W1). The ether was concentrated to dryness in a water bath and dried at oven at 40–60°C and the beaker was reweighed (W2) (Unuofin, 2017).

The crude fat content was calculated as:

$$\% \text{ Crude fat} = \frac{W2 - W1}{\text{Weight of original sample}} \times 100$$

Determination of Alkaloid

1g of sample mixed with 25 mL of 10% acetic acid in ethanol. The mixture was covered and kept for stand for 2 h. Mixture was filtered and filtrate placed on a water bath to a quarter of its original volume. Concentrated ammonium hydroxide was added in drops to the extract until precipitation was completed. The solution was allowed to settle, washed with diluted ammonium hydroxide and then filtered. Collected residue was dried and weighed (Omoruyi *et al.*, 2012) and alkaloid content was calculated using the equation:

$$\% \text{ Alkaloid} = \frac{\text{Weight of precipitate}}{\text{Weight of original sample}} \times 100$$

Determination of Phytate

1g sample weighed and to it, 50 mL of 2% HCl was added and keep to stand for 2 h, and then filtered. 25 mL of the filtrate was placed in a 250 mL conical flask with 5 mL of 0.3% ammonium thiocyanate solution used as indicator. 53.5 mL of distilled water was added to give the desired acidity. This was then titrated with standard iron III chloride solution (0.001 95 g of iron per mL) until a brownish yellow colour developed for 5 min. (Damilola *et al.*, 2013).

Phytic acid was calculated as:

$$\text{Phytic acid (\%)} = \text{titre value} \times 0.001 95 \times 1.19 \times 100$$

Determination of Phenols

100 mg of sample was homogenized with 2 ml of methanol. Centrifuged at 10,000 rpm for 10 minutes, collect the supernatant. Took 200 µl of supernatant, added 1 ml of Folin-Ciocalteu reagent and allowed to stand for 2 min. After that 1 ml of 35% Na₂CO₃ solution was added to the mixture and made 10 ml of final volume with distilled water. The reaction mixture was incubated in dark for 30 min at room temperature and absorbance was read against reagent blank. The total phenolic content was expressed in terms of mg of gallic acid equivalents (GAE) per gram of extract (Jia *et al.*, 1998).

Determination of Flavanoids

100 mg of sample was, homogenized with 2 ml of methanol. Centrifuged at 10,000 rpm for 10 minutes and collected the supernatant. 200 µl of the plant extracts were made upto 1.5 ml using distilled water and added 75 µl of 5% NaNO₂. The reaction mixture was kept to stand for 5 min and added 150 µl of 10% AlCl₃ to it. The reaction mixture was mixed well and incubated for 5 minutes at room temperature. 0.5 ml of 1M sodium hydroxide was added and absorbance was read against reagent blank at 510 nm. The results were expressed as mg of rutin equivalents (RE) per gram of extract. (Jia *et al.*, 1998).

Determination of Tannins

100 mg of sample was, homogenized with 2 ml of methanol. Centrifuged at 10,000 rpm for 10 minutes and collected the supernatant. To 1 mL of supernatant mixed with 0.5 mL Folin's phenol reagent and then added 5 mL of 35% Na₂CO₃ and the mixture was kept to stand for 5 min at room temperature. The blue color developed was read at 640 nm using UV/visible spectrophotometer. The tannin content was calculated by calibration curve of gallic acid and the results were expressed as gallic acid equivalent (mg/g) (Schanderl, 1970).

Determination of Terpenoids

100 mg of sample was, homogenized with 2 ml of methanol. Centrifuged at 10,000 rpm for 10 minutes and collected the supernatant. In 100 µl supernatant added 3 ml of the chloroform. Added 200 µl of the concentrated sulphuric acid and solution incubated at room temperature for 1.5-2h in dark, during incubation a reddish brown colour precipitate formed. Supernatant of reaction mixture decanted without disturbing the precipitate. 3 ml of the 95% methanol added and vortex thoroughly until all the precipitate completely mix in methanol. The absorbance observed at 538 nm against blank *i.e.*, 95% methanol. Linalool was used as the standard for estimation. The terpenoid content was calculated by the calibration curve of linalool and results were expressed as linalool

equivalents (mg/g). (Ghorai *et al.*, 2012).

Determination of Ascorbic acid

Ascorbate was extracted into 4% TCA by homogenizing 1g of sample in it and total volume was made 10 ml with 4% Tri-carboxylic acid. The supernatant obtained after centrifugation at 2000 rpm for 10 mins was treated with a pinch of activated charcoal, shaken well and kept for 10 mins. Centrifugation was repeated once again to remove the charcoal residue. The volumes of the clear supernatants obtained were noted. 1ml of aliquots of the supernatant were taken for the assay. Total volumes were made to 2 ml with 4% Tri-carboxylic acid. 0.2 to 1.0 ml of the working standard solution were pipetted into clean test tubes, the volumes made up to 2.0 ml with 4% TCA. 500 µl DNPH reagent was added in all test tubes, by addition of two drops of 10% thiourea solution. Formation of osazones after incubation at 37°C for 3 hours. These osazones were dissolved in 2.5 ml of 85% sulphuric acid, in cold. After 30 minutes incubation, absorbance of samples read at 540 nm and the levels of ascorbic acid in the samples were determined using the standard graph and expressed as ascorbate mg/g (Roe and Keuthar, 1943).

Determination of Carotenoids

Weighed 5 to 10 g of the sample. Saponify for about 30 minutes in a shaking water bath at 37°C after extracting the alcoholic KOH. Transferred the saponified extract into a separating funnel containing 10 to 15ml of petroleum ether and mixed well which took the carotenoid pigments into the petroleum ether layer. Transferred the lower aqueous layer to other separating funnel and petroleum ether extract containing the carotenoid pigments to an amber colored bottle. Repeated the extraction of the aqueous phase similarly with petroleum ether, until it is colorless. Discard the aqueous layer and added a small quantity of sodium sulphate in petroleum ether layer to remove turbidity. Noted the final volume of the petroleum ether extract and diluted if needed by a known dilution factor. The absorbance at 450nm was noted in a spectrophotometer using petroleum ether as a blank (Zakaria *et al.*, 1979).

$$\text{Carotenoids } (\mu\text{g}) = P \times 4 \times V \times 100 W$$

P = Optical density of the sample

V = Volume of the sample

W = Weight of the sample

Determination of Tocopherol

100 mg Sample was mixed slowly with 0.1 N sulphuric acid and kept at room temperature for overnight and then filtered. 1.5 ml of tissue extract, 1.5 ml of xylene was

added and centrifuged. Then 1.0 ml of xylene was separated and mixed with 1.0 ml of 2, 2-pyridyl and the OD was noted at 460 nm. In the beginning, 0.33 ml FeCl₃ was added with blank and mixed well. After 15 min, the test and standard was read against the blank at 520 nm (Rosenberg, 1992).

The tocopherol content in the sample was calculated using the formula

$$\text{Tocopherol } (\mu\text{g}) = \text{Reading at } 520\text{nm} - \text{Reading at } 450\text{nm} / \text{Reading of standard at } 520\text{nm} \times 0.29 \times 15$$

The 2, 2-azinobis (3-ethylbenzthiazoline)-6-sulfonic acid (ABTS) assay

The 2, 2-azinobis (3-ethylbenzthiazoline)-6-sulfonic acid (ABTS) free radicals scavenging assay was used to determine the antioxidant potential of extracts Solutions in 100 ml methanol were prepared for ABTS (7 mM) and potassium persulphate (2.45 mM) These two solutions were thoroughly mixed for the preparation of free radicals and kept in the dark overnight. Around 3 ml of stock solution was taken and its absorbance at 745 nm was set to 0.76 (control solution). Approximately 300 µl of the test sample was mixed with 3 ml of 2, 2'-azino-bis (3-ethylbenzothiazoline-6-suplhonic acid solution and kept at 25°C for 15 min. The absorbance of the solution was read at 745 nm. For the preparation of various ascorbic acid dilution same procedure was followed (positive control) (Re *et al.*, 1999).

The data was collected in triplicates, and the formula used to measure the percentage of ABTS free radicals scavenging activity was:

$$\% \text{ Inhibition} = (\text{Ac-As}/\text{Ac}) \times 100$$

2, 2-diphenyl-1-picrylhydrazyl (DPPH) assay

Radical scavenging behavior of the extract DPPH. DPPH solution was prepared by dissolving 20 mg 2, 2-diphenyl-1-picrylhydrazyl in 100 ml (stock solution) methanol. 3ml was taken from this solution, and its absorbance at 515 nm (control solution) was set to 0.75. To prevent free radicals, the DPPH stock solution was coated with aluminum foil and incubated in the dark condition for 24 hours. 5 mg of each extract was dissolved in 5 ml methanol for stock solutions preparation. Different dilutions (25, 50, 75 and 100 µl/ml) were prepared from stock solutions through serial dilution. Approximately 2 ml of each dilution was mixed with a solution of 2 ml DPPH and kept for 15 min in darkness. Ascorbic acid was used as a typical antioxidant compound in all the assays for comparative analysis. The percentage inhibition of DPPH free radical by extracts was calculated using the following formula (Barros *et al.*, 2007).

$$\% \text{ Inhibition} = (\text{Ac}-\text{As}/\text{Ac}) \times 100$$

where Ac is the OD of the control and As is the OD of the extract/standard. The scavenging activity of samples was expressed as IC_{50} value, which represented the effective concentration of extract/standard required to scavenge 50% of DPPH radicals.

Antibacterial activity

Antibacterial activity of collected plants by using Disc diffusion assay (Razmavar *et al.*, 2014).

Collection of test organisms

The bacterial strains used in this study e.g. *Escherichia coli* (MTCC 82), *Staphylococcus aureus* (MTCC 96) were obtain from parasitology laboratory of Shoolini University of Biotechnology and Management Sciences, Solan, India. These strains were grown in nutrient broth and were incubated at 37°C for 14–16 h.

Antibacterial activity of plants extract

The disk diffusion method is used to evaluate antimicrobial activity of the each plant extract. The plant extract residues (100mg) were dissolve in 1 ml of 10% DMSO, then loaded over sterile filter paper discs (8 mm in diameter) to obtain final concentration of 50µl/disc. Filter paper discs loaded with 10il of streptomycine was used as positive control. The plates were kept in the fridge at 4°C for 2 hrs. to permit plant extracts diffusion then incubated at 35°C for 24 hrs. The occurrence of inhibition zones were measured by measuring scale, observed and showed as antibacterial activity of extract.

Statistical analysis

For all the studies parameters standard deviation of three replication (n = 3) were calculated using Microsoft excel.

Results and Discussion

Nutraceutical composition

Nutritional composition of *G. diversifolia* and *B. variegata* were shown in table 1. The carbohydrate

Table 1: Nutritional composition of *Gerardiana diversifolia* and *Bauhinia variegata*.

Parameters	<i>Gerardiana diversifolia</i>	<i>Bauhinia variegata</i>
Carbohydrate (mg/g)	6.523±0.085	6.87±0.330
Protein (mg/g)	5.423±0.184	5.646±0.313
Sodium (mg/g)	3.563±0.509	4.94±0.443
Potassium (mg/g)	15.141±0.526	19.476±0.238
Crude fibre (%)	4.233±0.152	9.733±0.208
Crude fat (%)	0.379±0.008	0.62±0.085

Values are expressed as mean ± SD, n = 3.

content from the standard glucose curve was calculated using the equation: $y = 1.297x - 0.050$, while the protein content was calculated using the standard BSA curve using the equation: $y = 1.041x + 0.080$. Sodium and potassium content from the standard sodium and potassium were calculated using equation $y = 0.230x + 1.657$ and $y = 3.173x + 15.27$ respectively. Carbohydrate content, protein content, sodium content, potassium content, crude fibre and crude fat was relatively high in *B. variegata* as compare to the *G. diversifolia*. Nutritional parameters studied in the present study shows that *Bauhinia variegata* have high nutritional composition as compare to the *Gerardiana diversifolia*.

(Dhyani and Gupta, 2016) reported that the carbohydrate and protein content in the leaves of *Bauhinia purpurea* was 66.82g/100g and 15.19 g/100g respectively. (Marimuthu and Dhanalakshmi, 2014) observed that the carbohydrate and protein content in the flower of *Bauhinia purpurea* L. were 43.33±2.30 and 13.39±0.23 mg/g.

Teixeira *et al.*, (2013) observed that the fibre and fats content in the raw Seeds of *Bauhinia cheilantha* was 45.3±0.4% and 8.7± 0.1% respectively. Seal *et al.*, (2014) revealed that the sodium and potassium content in the wild edible fruits of Meghalaya state *viz.* *A. gomeziana*, *B. sapida* and *G. cissiformis*. Sodium content in these species were 0.21±0.003, 0.66±0.005 and 0.17±0.004 mg/g while potassium content was 6.16±0.16, 17.52±0.15 and 46.33±0.67 respectively.

Anti-nutritional composition

Anti -nutritional composition of *G. diversifolia* and *B. variegata* were shown in the table 2. Alkaoid content was high in *G. diversifolia* (1.643±0.015) % as compare to the *B. variegata* (0.563±0.0152)% and phytate content also high in *G. diversifolia* (1.306±0.098) % as compare to the *B. variegata* (0.842±0.123)%.

Dhyani *et al.*, (2016) revealed that the phytate content found in leaves of *Bauhinia purpurea* was 4.8mg/100g. Unuofin *et al.*, (2017) reported that the alkaloid content in wild edible plant *Kedrostis africana* was (0.30 ± 0.08)%.

Phytochemicals factors

Table 2: Anti-nutritional composition of *Gerardiana diversifolia* and *Bauhinia variegata*.

Parameters	<i>Gerardiana diversifolia</i>	<i>Bauhinia variegata</i>
Alkaloid (%)	1.643±0.015	0.563±0.0152
Phytate (%)	1.306±0.098	0.842±0.123

Values are expressed as mean ± SD, n = 3

Phytochemical analysis of wild edible plants *G. diversifolia* and *B. variegata* were shown in the table 3. The total phenolic content from the standard gallic acid curve was calculated using the equation: $y=0.741x+0.1326$, while the total flavonoid content was calculated using the standard rutin curve using the equation: $y=0.965x+0.036$. The total tannin and terpenoid content from the standard gallic acid and linalool were using the equation: $y=1.501x-0.102$ and $y=1.018x+0.047$ respectively. Ascorbic acid content from the standard ascorbic acid curve was calculated using the equation: $y=0.85x+0.059$. Tocopherol content from the standard tocopherol was using the equation: $y=0.988x-0.028$. Phytochemicals that were Phenol, flavonoids, tannin, terpenoid, amino acid, tocopherol and carotenoids content were high in *G. diversifolia* as compare to *B. variegata*.

Table 3: Phytochemicals analysis *Gerardiana diversifolia* and *Bauhinia variegata*.

Parameters	<i>Gerardiana diversifolia</i>	<i>Bauhinia variegata</i>
Phenol (mg/g)	16.746±0.077	6.386±0.058
Flavonoid (mg/g)	8.033±0.105	3.896±0.115
Tannin (mg/g)	1.277±0.005	0.353±0.011
Terpenoid (mg/g)	1.381±0.044	1.279±0.049
Ascorbic acid (mg/g)	0.874±0.060	0.940±0.111
Tocopherol (µg/g)	10.419±0.465	10.161±0.213
Carotenoids (µg/g)	182.24±0.623	142.51±0.607

Values are expressed as mean ± SD, n = 3.

(Marimuthu and Dhanalakshmi, 2014) revealed that the phenol and flavonoid content in the leaf of *Bauhinia purpurea* were 41.66±1.52 GAE mg/g and 43.0±2.0 QE mg/g.

Verma et al., (2012) reported that the ascorbic acid content of green bud of the *Bauhinia variegata* was 4.39mg/100g.

Hegazy et al., (2013) reported that the tannin content of wild edible fruits such as *Arbutus pavarii*, *Nitraria retusa* and *Ficus palmate* were 3.12±0.96, 1.71±0.48, 2.27±0.15 mg/g respectively.

Theng et al., (2013) reported that terpenoid content in tuber of *Pueraria tuberosa* was 1.32%.

Prasad et al., (2018) reported that the ascorbic acid of the wild edible *P. hirta* was 108.40±0.32, *E. thymifolia* 88.48±0.95 and *P. indica* 77.49±1.83 mg/100g and tocopherol content of *P. hirta*, *E. thymifolia* and *P. indica* was 13.48±0.83, 24.95 ±1.10 and 9.13 ±0.28 mg/g respectively.

(Carvalho, 2012) reported the total carotenoids content of landrace pumpkins (*Cucurbita moschata*

Duch) was 404.98µg/g.

Antioxidant activity

IC50 value of *G. diversifolia* and *B. variegata* by ABTS and DPPH assay were shown in the table 4. IC50 value of *B. variegata* was higher as compare to the *G. diversifolia* in both ABTS as well as DPPH assay. Higher the IC50 value shows the low antioxidant activity while lower the IC50 value shows the high antioxidant activity.

Table 4: Antioxidant activity IC50 value of *Gerardiana diversifolia* and *Bauhinia variegata* by ABTS and DPPH assay.

Parameters	<i>Gerardiana diversifolia</i>	<i>Bauhinia variegata</i>	Standard (Ascorbic acid)
ABTS (IC50 µg/ml)	1.819	4.588	0.682
DPPH (IC50 µg/ml)	2.396	3.674	0.851

Values are expressed as mean ± SD, n = 3

Seal et al., (2015) reported the IC50 value of methanolic extract of *P. esculenta* and *S. nigrum* by DPPH and ABTS was 1.37±0.02, 1.03±0.001µg/ml and 0.18±0.01, 0.19±0.001 µg/ml respectively.

Antibacterial activity

Antibacterial activity of *G. diversifolia* and *B. variegata* were shown in the table 5. Antibacterial activity of *G. diversifolia* was high against *E. coli* as well as *S. aureus* as compare to the *B. variegata*.

Table 5: Antibacterial activity of *Gerardiana diversifolia* and *Bauhinia variegata*.

Bacterial strain	<i>Gerardiana diversifolia</i>	<i>Bauhinia variegata</i>	Positive control
<i>E. coli</i>	21.866±0.152	16.133±0.152	29.066±0.115
<i>S. aureus</i>	14.266±0.257	13.066±0.115	31.933±0.115

Values are expressed as mean ± SD, n = 3

Njogu et al., (2011) observed that Antimicrobial activity of the root and stem extracts of *Girardinia diversifolia* against *E. coli* and *S. aureus*. Zone of inhibition against the *E. coli* and *S. aureus* were 8.3mm and 8.2mm respectively.

Sharma et al., (2015) reported that the antibacterial activity of methanolic extract (10mg/ml) of *Bauhinia variegata* against *Staphylococcus aureus*, *Bacillus subtilis*, *Salmonella typhi* and *E. coli* and these strains shows the zone of inhibition were 12mm, 11mm, 10mm and 10mm respectively.

Conclusion

Based on the above findings it can be ascertained that these wild edibles can be used as a source of

nurtrition, antioxidant and antibacterial capacity. This knowledge of nutritional composition antioxidant and antibacterial activity of these plants will be useful in selecting plants as nutritional supplements as well in developing antioxidant based drugs. *Girardinia diversifolia* and *Bauhinia variegata* should be considered as plants with great potential in the food, nutritional and pharmaceutical industries.

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