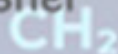


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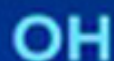


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A Documentation on Phytochemical Investigations for Some Primary and Secondary Metabolites Present in Fruits of *Drypetes Roxburghii* (wall.)

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Abstract

Medicinal value of a plant depends to a large extent on phytochemicals present in it. The biochemical profile of mature and immature fruits of *Drypetes roxburghii* was assessed by making an estimation of some of primary and secondary metabolites present in it. Among the tested primary phytochemicals carbohydrates, starch, protein, lipids were present in sufficient amount. Saponins, tannins, flavonoids, phytosterols, terpenoids, alkaloids, cardiac glycosides were present but carotinoids were absent in the fruits. All the phytochemicals except tannins were present in higher concentration in mature fruits than the immature fruits. As all the secondary phytoconstituents have unique therapeutic uses possibly their presence in significant amount made this particular plant medicinally precious.

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Keywords: *Drypetes roxburghii*; Therapeutic uses; Primary metabolites; Secondary metabolites.

Introduction

The medicinal and other useful properties of plant species diversely present in this blue planet have gradually been unfolded to human knowledge base either by scrupulous observation or by serendipity. From the early stages of civilization a fair knowledge of medicinal properties of local plants was known to primitive men. Those age old concepts are well documented and systematically arranged in Ayurveda (ancient Indian medical science), traditional Chinese medicinal practices etc. Today, global consumers are embracing these traditional herbal preparations, dietary supplements, and functional foods due to their purported disease prevention activity and therapeutic properties. This social trend and awareness along with a huge business prospect encouraging diverse industries and scientific communities for intense research on complementary and alternative medicines.

Every plant contains varieties of naturally occurring phytochemicals. According to their functions in plant metabolism, phytochemicals are broadly classified into two groups, viz. primary and secondary constituents. Primary phytochemicals

comprise common sugars, amino acids, proteins etc. while secondary phytochemicals includes alkaloids, terpenoids, saponins, phenolic compounds, flavonoids, tannins and so on. Though primary phytochemicals are related with metabolism of plants, secondary phytochemicals are generally involved in defense mechanism.

The chapter is dedicated for the discussion on the primary and secondary phytochemicals present in immature and mature fruits of *Drypetes roxburghii* along with their appropriate detection and estimation methodologies.

Drypetes roxburghii is a moderate-sized evergreen tree of family Euphorbiaceae and found throughout India. Trees are generally up to 20 m in height. Colour of bark is dark grey, whitish when young with horizontal lenticels. Branches are usually pendent; brown or blackish, slender, pubescent. Leaves are simple, alternate; stipule small, lateral. Fruits are drupe type, 1.3-2 x 1.5 cm, ovoid-ellipsoid, and white tomentose. Seed normally one, crustaceous; pedicels 6-25 mm long [1].



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Different parts of this tree have various medicinal uses. The leaves are refrigerant and procreant and are useful in catarrh, fever and sterility. Seeds are sweet, acrid, procreant, refrigerant. It is ophthalmic laxative, anti-inflammatory, aphrodisiac and diuretic, and has been used for many conventional medical applications such as treatment of ulcers of the mouth, stomach, hot swellings, small pox and also useful in burning sensation, ophthalmopathy, hyperdipsia, elephantiasis, constipation, strangury, azoospermia, habitual abortion, sterility [2,3].

Materials and methods

Study area

This study was executed at Burdwan (23°16'N, 87°54'E), West Bengal, India.

Collection of fruits

Fresh immature and mature fruits of *D. roxburghii* were collected from the trees growing within the campus of The University of Burdwan, Burdwan at the time period of October to December of year 2013 and 2014. Fruits were initially cleaned in the laboratory with distilled water and dried before each biochemical assay.

Estimation of primary biochemicals

Qualitative and quantitative estimations for existing biochemicals in the fruits of *D. roxburghii* were conducted separately for both immature and mature fruits following standard procedures. Preparation of fruit extracts

One gram of dried fruits were crushed separately, mixed with 10 ml ethanol and boiled for 10 min in water-bath to prepare the extracts. The fruit extracts were then centrifuged by Remi Research grade Centrifuge instrument at 2000 rpm for 20 minutes. The supernatant liquid and pellet were separated for different studies. To remove the pigment, supernatants were passed through charcoal powder and filtered through Whatman No. 41 filter paper.

Estimation of total soluble carbohydrate

The amount of soluble carbohydrates was measured by applying slightly modified Anthrone method [4]. The clear supernatants were mixed with 4 ml of anthrone. After completion of the reaction the absorbance was measured at 630 nm by UV-Vis spectrophotometer (Shimadzu model 1800). As the method is non-stoichiometric in nature, it is necessary to prepare a calibration curve using a series of standards of known carbohydrate concentration. There are linear relationships between the absorbance and the amount of sugar in every sample. From the calibration curve, the amount of total soluble carbohydrate in the experimental solution could be estimated.

Estimation of starch

The amount of starch was measured also by Anthrone method with necessary modification. To estimate the starch components, 0.5 g of the sample *i.e.* dried collected fruits were homogenized in hot 80% ethanol to remove the soluble sugars. The residue was homogenized and centrifuged after washing with hot 80% ethanol (repeated five times) till the washing did not give color with Anthrone reagent. The residue was dried in a water bath. Thereafter 5.0 ml of distilled water and 6.5 ml of 52% perchloric acid was added to it. The extraction procedure was continued using fresh perchloric acid until 100 ml of the supernatant was collected. 4 ml of Anthrone reagent was added

to 1 ml of the diluted supernatant (0.2 ml supernatant + 0.8 ml distilled water) and the amount of starch was measured in the UV visible spectrophotometer read at 630 nm.

Estimation of total protein

The method of Lowry *et al.*, (1951) [5] was followed for the measurement of total proteins in the samples. In this method, copper ions are employed to react with the peptide bonds of the proteins under alkaline conditions and oxidation of aromatic protein residues occur resulting in the change of the color of the sample solution in proportion to protein concentration, which can then be measured using spectrophotometric techniques. For estimation of total soluble proteins in immature and mature fruits, a suitable volume of pellets were suspended separately in 5% TCA (Trichloroacetic acid) solution at 0-5°C in an ice bath for 10 minutes. 1 ml of that solution was added to another 1 ml of 10% TCA and centrifuged at 5000 rpm for 45 min. The supernatants were discarded and the pellets were re-extracted once with absolute ethanol and twice with hot ethanol – ether mixture, every time discarding the supernatant. Then the pellets were treated with alkaline copper reagent (alkaline sodium carbonate: copper sulphate-sodium potassium tartarate solution (50: 1 in v/v) and the Folin-Ciocalteu reagent (a mixture of phosphotungstic acid and phosphomolybdic acid). Level of total protein was measured against a reagent blank of bovine serum albumins from the concentration of the reduced Folin-Ciocalteu reagent measured by absorbance at 750 nm.

Estimation of total lipid

The total lipid content of the fruits of *D. roxburghii* was estimated according to the procedure adopted by Folch *et al.*, (1957) [6]. 1 g of fresh fruits was homogenized in 20 ml chloroform: methanol (1:2 v/v) mixture for 10 min in cell homogenizer. The extract was filtered after vigorous shaking and the residues were mixed again with 25 ml chloroform: methanol mixture and stirred for 30 min. They were then filtered and all the filtrates were combined. The entire filtrates were passed through activated charcoal to remove the chlorophyll. The sample was then shaken with 0.9% aqueous sodium chloride solution to remove the non-lipid contaminants. The extracted lipid was dried in desiccators and weighed in an electronic balance machine (± 0.01 mg).

Preliminary qualitative screening of some secondary phytochemicals

The immature and mature fruits were air-dried and ground into uniform powder using a mixer-grinder machine. The aqueous extract of each sample was prepared by soaking 100 g of dried powdered samples in 200 ml of distilled water for 12 h. The extracts were filtered using Whatman filter paper No 42 (125 mm). Chemical tests were carried out by either using the aqueous extract or the powdered specimens directly following standard established protocols mentioned in literatures to identify the secondary constituents.

Test for tannins

This test was performed by applying the Ferric chloride method. 0.5 g of the dried powdered sample was taken into a 100 ml Earlenmayer flask and 20 ml of distilled water was added. The mixture were boiled for five minutes, cooled and then filtered. Two drops of 5% ferric chloride was added to it and observed for brownish green or a blue-black coloration which would indicate the presence of tannins [7].

Test for flavonoids

The detection of flavonoids was performed according to three methods described by Sofowara (1993) [8] and Harborne (1973) [9].

- 2 ml filtrate of aqueous extracts of fruits were taken in test tubes, few drop of dilute NaOH solution was added to it. Appearance of intense yellow colour in the test tube which disappears on standing after addition of dilute H_2SO_4 indicates the presence of flavonoids.
- 2 ml filtrate in test tube was added with 5 drops of 1% aluminium (metallic aluminium powder) solution. Appearance of yellow colouration would indicate the presence of flavonoids.
- 2 gm of the powdered fruits of each type was heated with 20 ml of ethyl acetate over a steam bath for 3 min. They were then filtered and 4 ml of each filtrate was shaken with 1 ml of dilute ammonia solution. Appearance of yellow colouration would suggest the presence of flavonoids in the samples.

Test for saponins

Frothing test was followed for detection of saponins. 2 g of the powdered sample was boiled in 20 ml of distilled water on a water bath. After filtration of the extract a part was transferred into another test tube and shaken vigorously and left to stand for 10 minutes. Formation of thick persistent froth indicates the presence of saponins. 2 drops of olive oil was mixed with the frothing and shaken vigorously. Appearance of creamy mass of small bubbles would substantiate the presence of saponins.

Test for alkaloids

1 g of powdered fruit were boiled with water and 10 ml hydrochloric acid on a water bath and filtered separately. The pH of the filtrates was adjusted by ammonia solution to about 6-7. A very small quantity of freshly prepared Mayer's reagent (potassiummercuric iodide solution) was added to them and observation was made appearance of cream coloured precipitate which would indicate presence of alkaloids.

Test for steroids (Liebermann Burchard reaction)

Two ml of acetic anhydride was added to 0.5 g methanolic extract of the plant samples with 2 ml H_2SO_4 . Observation was made for the change in colour from violet to blue or green which would indicate the presence of steroids (phytosteroids).

Test for terpenoids

For identification of terpenoids Salkowski test was followed. 2 gm dried plant materials of both types were mixed with 10 ml chloroform and after 10 minutes they were filtered. With 2 ml of those filtrates concentrated sulfuric acid was added. Presence of reddish brown coloration at the inter faces would indicate the presence of terpenoids.

Test for cardiac glycosides

This estimation was done by the Keller-Killani test. Five ml of the ethanol extracts of both samples were dissolved in 5 ml distilled water and then treated with 2 ml of glacial acetic acid containing one drop of ferric chloride solution. They were underlaid with 1 ml of concentrated sulphuric acid. Observation was made for advent of brown ring at the interface which would dictate deoxysugar characteristic of cardenolides, violet ring be-

low the brown ring and a greenish ring gradually throughout thin acetic acid layer.

Test for carotenoids

1 g of dried fruit samples were extracted with 10 ml of chloroform in separate test tubes with vigorous shaking. The mixtures were filtered and 85% sulphuric acid was added to the filtrates. Appearance of blue colour at the interface would indicate presence of carotenoids.

Preliminary quantitative screening of some secondary phytochemicals

Estimation of saponins

Saponin content of the samples was measured by double solvent extraction gravimetric method [9]. 2 g of both samples were boiled in 50 ml of 20% ethanol solution for 90 minutes with periodic acid agitation in a water bath separately. After cooling of the mixtures diethyl ether was added to them and stirred to mix well. The aqueous layer from both test tubes were collected and treated with equal volume of n-butanol. The precipitates were recovered and weighed.

Estimation of tannins

Van-Burden and Robinson (1981) [10] method was adopted for estimation of tannins. From the dried crushed fruits 500 mg was weighted and put into a 200 ml conical flask. Distilled water (50 ml) was added to that and shaken for 1 hour in a mechanical shaker. Then it was filtered into a 50 ml volumetric flask made up to the mark. 5 ml of filtrate was pipette out into a test tube and mixed with 2 ml solution of FeCl_3 (0.1 M) in 0.1 N HCl and potassium ferrocyanide (0.008 M). The absorbance was measured at 120 nm within 10 minutes. For both the samples the same procedure was followed.

Estimation of flavonoids

The quantitative determination of flavonoids in both immature and mature fruits was done by the method of Boham and Kocipai- Abyazan (1994) [11]. 10 g of plant samples were extracted repeatedly with 100 ml of 80% aqueous methanol at room temperature. They were then filtered through Whatman filter paper No. 42. The filtrates were transferred into two crucibles and evaporated to dryness over a water bath. The dry residues were weighted.

Estimation of Phenolics

The method of Bray and Thrope (1954) [12] was followed for determination the level of phenolics. The amount of phenols (hydrolysable and condensed tannins) in both types of fruits was determined from each of the leftover in the carbohydrate estimations. The extracts were taken in test tubes, and to them 1 ml Folin-Ciocalteu reagent and 2 ml of 20% sodium-carbonate solution was added. The solutions were diluted up to 25 ml with water and phenol levels were estimated following standard method against a known level of pyrocatechol.

Estimation of alkaloid

The method prescribed by Harborne (1973) [9] was used for estimation of alkaloids. Dried crushed fruits (5 g) were taken into a 250 ml beaker. 200 ml of 10% acetic acid in ethanol was added to that beaker and allowed to stand for 4 h in covered condition. Then it was filtered and the extract was concentrated on a water bath to one-quarter of the original volume. Concen-

trated ammonium hydroxide was added drop wise to the extract until the precipitation was complete. The whole solution was allowed to settle and the precipitation was collected. It was washed with dilute ammonium hydroxide and then filtered. The residue is the alkaloid, which was dried and weighed. Same procedure was followed for both the samples.

Estimation of Steroids

5 gm of fruit sample was homogenized in 100 ml 4:1 Methanol-water mixture and filtered by Whatman No.1 filter paper. The filtrate was evaporated (40°C) to $1/10^{\text{th}}$ of its original volume in a rotary evaporator and acidified with 2M H_2SO_4 . The filtrate was further extracted with chloroform (x 3) and the chloroform part was collected discarding the aqueous portion. Chloroform part was dried and weighed. Following the same procedure amount of steroids in both the samples were estimated.

Estimation of total Terpenoids

100 g of plant fruit powders (both immature and mature) were soaked in alcohol for 24 hours separately and filtered. The filtrates were extracted with petroleum ether. The ether extracts were noted as total terpenoid estimated [13].

Estimation of cardiac glycosides

The method described by El-Olemy *et al.*, (1994) [14] for evaluation of cardiac glycoside using Buljet's reagent was followed for this purpose. 1g fine powders of both immature and mature fruits were soaked in 10ml of 70% alcohol for 2 hours and then filtered. The extracts obtained was then purified using lead acetate and Na_2HPO_4 solution before the addition of freshly prepared Buljet's reagent (containing 95 ml aqueous picric acid + 5 ml 10% aqueous NaOH). The difference between the intensity of colours of the experimental and blank (distilled water and Buljet's reagent) samples gives the absorbance and is proportional to the concentration of cardiac glycosides.

Estimation of ash and moisture content

Mature fresh fruits were weighed 10.5 gm. Then they were placed in a hot- air oven at $50^{\circ}\text{C} \pm 0.5^{\circ}\text{C}$ for 72 hours. After complete drying the fruits were weighed again and the difference in weight between fresh and dried fruits indicated the moisture content of fruits.

1.6-1.8 gm oven-dried fruits were placed in muffle furnace at $450^{\circ}\text{C} \pm 10^{\circ}\text{C}$ for 20 min in a crucible. The produced ash was soaked with 2 ml distilled water and placed in a watch glass for drying at 110°C for 2 hours and then weighted. The percentages of ash and ash-free weight of fruits were determined from the average of three replicates. Same procedure was followed for estimation of ash and moisture content of immature fruits also.

Results

In this section findings of the above experiments have been documented. **Table 1** embodies an account of some primary biochemicals that are present in the mature and immature fruits of *D. roxburghii*. It is evident from the table that the amount of soluble carbohydrate, starch, protein and lipid are always present in higher concentration in mature fruits than the immature fruits.

Table 2 represents the results of qualitative analysis of phytochemicals in mature and immature fruits of *D. roxburghii*. In

both cases saponins, tanins, flavonoids, phenols, alkaloids and phytosterols are present but carotinoids are absent. Quantitative analyses of some secondary phytochemicals in the fruits of *D. roxburghii* have been depicted in Table 3. Secondary phytochemicals are also present in slightly higher concentration in mature fruits than in immature fruits except tanins. Table 4 represents the percentage of ash and moisture content of the fruits of *D. roxburghii*. While the ash and moisture content of immature fruits are 5.66 % and 52.11 % those are 7.09 % and 57.19 % respectively in mature fruits which are again higher than the immature fruits.

Table 1: The quantitative account of some primary biochemicals in the fruits of *Drypetes roxburghii*.

Primary biochemical	Immature fruits(mg/g)	Mature fruits(mg/g)
Carbohydrate	6.78 \pm 0.12	7.80 \pm 0.39
Starch	17.15 \pm 0.11	18.36 \pm 0.26
Protein	37.55 \pm 0.25	38.20 \pm 0.17
Lipid	0.77 \pm 0.38	0.92 \pm 0.25

Table 2: Qualitative analysis of phytochemicals in mature and immature fruits of *D roxburghii*.

Immature fruits	Mature fruits	Plant part
+	+	Saponins
+	+	Tanins
+	+	Flavonoids
+	+	Alkaloids
+	+	Phytosterols
+	+	Terpenoids
+	+	Cardiac glycosides
-	-	Carotenoids

+: Presence of Phytochemicals, -: Absence of Phytochemicals

Table 3: Qualitative analysis of phytochemicals in mature and immature fruits of *D roxburghii*.

Secondary biochemical	Immature fruits(mg/g)	Mature fruits(mg/g)
Saponins	0.065 \pm 0.001	0.072 \pm 0.001
Tannins	0.36 \pm 0.017	0.046 \pm 0.003
Flavonoids	0.210 \pm 0.001	0.240 \pm 0.001
Alkaloids	0.41 \pm 0.001	0.45 \pm 0.003
Phytosterols	0.004 \pm 0.001	0.009 \pm 0.001
Terpenoids	0.022 \pm 0.001	0.0303 \pm 0.001
Cardiac glycosides	0.039 \pm 0.02	0.042 \pm 0.028
Carotinoids	0.00 \pm 0.00	0.00 \pm 0.00

Table 4: Percentage of ash and moisture content of the fruits of *Drypetes roxburghii*.

Content	Immature fruits	Mature fruits
Ash	5.66 %	7.09 %
Moisture	52.11 %	57.19 %

Discussion

India is a country which possesses a rich assortment of medicinal plants and they are being used as therapeutic agents from years. Medicinal values of plants are attributed by the phytochemicals and other chemical constituents present in them. These phytochemicals are responsible for ethnopharmacological activities of most medicinal plants. Proper evaluation of phytochemicals are essential prior to applying those in therapeutic use though the amount and quality of the phytochemicals may vary depending on climatic conditions like change of temperature, water stress, sun light etc. seasonal variation, nutritional status, presence of ecotype variations, growth stage, use of fertilizers, use of herbicides etc. [15] Many works have been published by various workers in the field of phytochemical analysis of different plants [16-19].

The soluble carbohydrate in plant is utilized for metabolism, energy production, growth and maintenance in different forms. The presence of carbohydrate in the fruits of *D. roxburghii* in appreciable amount makes it edible and rich in food value. Reserved carbohydrates like starch are transformed to soluble carbohydrates to maintenance respiration, making adaptive responses to soil deficits, pathogen attacks and herbivory [20-22]. The fruits of *D. roxburghii* like other usual fruits also serve as good repository of starch. Among the vital macromolecules proteins are of greatest importance as they serve as the building component as well as a major determinant in controlling plant growth rate and reproduction [23-28]. As the plants allocate the resource materials in fruits, they tend to be rich in proteins which have been justified by the higher percentage of protein that is present in the fruits of *D. roxburghii* also. Lipid which is a component of cell membrane structure is also a unique medium for energy storage and provides calories for metabolism. The fruits of *D. roxburghii* contain 0.77 mg/g and 0.92 mg/g lipids in immature and mature forms respectively. Many authors [19,29] have identified seasonal fluctuation of lipid in different parts of other plants but as this fruit is seasonal itself, the variation in amount of different phytochemicals along with lipid present in it could not be traced.

Saponins are secondary metabolites which are amphipathic glycosides in nature and found in abundance in various plant species. Structure of saponins is defined by their composition of one or more hydrophilic glycoside structure combined with a lipophilic triterpene derivative [30]. Saponins are used as dietary supplements and nutritional substance. They have use in therapeutic purposes [31] and serve as antimicrobial agents. The activity of fruit of *D. roxburghii* against azoospermia, habitual abortion, sterility [2,3] etc might be due to presence of saponins in fruits as some saponins have importance due to their relationship with compounds as hormones [32]. The tannin compounds are widely distributed in many species of plants and are found in leaf, bud, seed, root, and stem tissues. They provide protection from predation, acts as pesticide and play important role in plant growth regulation [33]. They are respon-

sible for dry and puckery feeling in the mouth following the consumption of unripened fruit [34]. Destruction or modification of tannins with time plays an important role in the ripening of fruit. Flavonoid is a plant phenolic which is soluble in water. It provides pigments for flower coloration. In higher plants it also helps in UV filtration, nitrogen fixation. It acts as a chemical messenger or physiological regulator and functions in cell cycle inhibition. It is used as therapeutic agent for its anti-cancerous properties [35], anti-inflammatory activities [36]. It is effective against lower intestinal tract dysfunctions [37] and heart diseases. The presence of flavonoids in the fruit of *D. roxburghii* probably makes it effective against ulcers of the mouth, stomach and constipation.

Alkaloids are a group of naturally occurring chemical compounds produced by a large variety of organisms, including bacteria, fungi, plants and animals. They are considered as secondary metabolites in plants and are related to protection. Various alkaloids have pharmacological effects and are used as medications, as recreational drugs, or in cultural rituals. Cocaine, caffeine, nicotine etc are used as the local anesthetic and stimulant, morphine is used as analgesic. Berberine has the antibacterial property whereas vincristine acts as anti-cancer compound. Beside this reserpine works against hypertension, vincamine is used as vasodilator, quinidine serves as anti-arrhythmia compound, ephedrine have therapeutic effects in controlling asthma. The antimalarial drug quinine is also alkaloid in nature. We traced alkaloids from the fruits of the study plant which may be responsible for anti mosquito effect of the plant against both immature and mature forms [38].

The terpenoids are a large and diverse class of naturally occurring organic chemicals, derived from five-carbon isoprene units assembled and modified in thousands of ways. These lipids can be found in all classes of living things, and are the largest group of natural products. Plant terpenoids are used extensively for their aromatic qualities. Terpenoids contribute to the scent of eucalyptus, the flavors of cinnamon, cloves, and ginger, the red color in tomatoes and the yellow color in sunflowers. Well-known terpenoids include citral, menthol, camphor, salvinorin A in the plant *Salvia divinorum*, and the cannabinoids found in *Cannabis*.

Carotenoids are the tetra terpenoid organic component that occur naturally in the chloroplasts and chromoplasts of plants species and few other photosynthetic organisms like algae, bacteria, and some types of fungus but generally cannot be manufactured by species in the animal kingdom. In two classes of carotenoid, xanthophylls and carotenes, about 600 forms are present. Carotenoids commonly absorb blue light which is used in photosynthesis and protect chlorophyll from photodamage. In our study we could not trace the presence of carotenoids.

Cardiac glycosides are found as secondary metabolites in many plants species. As it is mainly used in the treatment of heart diseases or cardiac diseases this particular type of glycosides is named as cardiac glycosides. During cardiac failure, they increase the cardiac output by increasing the force of contraction by calcium-induced calcium release. Ouabain, digoxin etc are the example of cardiac glycosides which are used as drugs [39]. As the fruits of *D. roxburghii* also contain cardiac glycosides trials could be made for its clinical uses.

D. roxburghii contains a rich source of minerals which is indicated from high ash content of this plant. Similar type of quan-

titative analyses were also done by Ijeh *et al.*, (2007) [40] with the leaves of *Hyptis suaveolens*, Chandra *et al.*, (2009) [41] with the leaves of *Cestrum nocturnum*, Chowdhury *et al.*, (2011) [15] with the leaves of *Solanum villosum* etc.

In a developing country like India, large number of people lives below the poverty line and for obvious reasons they can't afford the modern expensive imported medicines. The World Health Organization supports the use of conventional alternative medicines provided they are established to be effective and safe [42]. Herbal medicines are relatively safe for human use and environment friendly too [43]. Medicinal plants are cheap, easily available and thus the medicines produced from them would be affordable by poor people. Preliminary phytochemical surveys and the knowledge of the chemical constituents of plants are desirable to understand herbal drugs and their preparations. From that point of view the phytochemical investigation of fruits of *Drypetes roxburghii* in our study reveals the presence of various potential phytochemical constituents which may be useful for pharmaceutical industries and could be used as an effective nutraceutical.

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