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Phytochemical screening of *Solanum nigrum* L, *S. myriacanthus* Dunal, *Solanum melongena* and *Averrhoa bilimbi* in Bangladesh

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Abstract

The main purpose of this study was to evaluate the phytochemical screening on leaf extract of *Solanum nigrum* L, *S. myriacanthus* Dunal, *Solanum melongena* and *Averrhoa bilimbi* which were from 3 districts in Bangladesh. Three districts were selected such as Khulna, Jessore and Satkhira. The phytochemical constituents like tannins, proteins, alkaloids, flavonoides and saponins of these species in dry and shady areas were investigated qualitatively. The results reveal that the proteins and alkaloids are more abundant on *Solanum melongena* and *Solanum nigrum* L respectively of shady areas. Tannins and Alkaloids are also abundant on *S. myriacanthus* Dunal of dry areas. Other phytochemical constituents such as saponins, flavonoides are more or less presence in these species of the study areas with proteins, alkaloids and tannins.

Keywords: Phytochemicals, *Solanum nigrum* L, *S. myriacanthus* Dunal, *Solanum melongena* and *Averrhoa bilimbi*.

1. Introduction

Plants are playing an important role in the drug sections. Homeopathy, Ayurveda and in traditional medicine since time immemorial. Now- a-days plants are playing a significant role in modern medicine study. These plants are used in various researches and have very low side effects than the synthetic drugs. Now-a-days traditional folk medicines which are obtained from natural sources are used by 85% population in developing country [1]. In Bangladesh, about 80% populations are living in rural areas near to the natural resources, [2].

Medicinal plants contain various complex chemical substances of different composition [3]. Medicinal plants provide the raw materials which are helpful for internal pharmaceuticals [4]. During this time the phytochemicals research is very helpful to find out new anti-infective agents from higher plants considering physiological action [5].

We should know about the chemical constituent of plant because knowledge about these may help us to discover the actual valuable remedies [6]. Photochemical and polyphenols (phenolic acid, Hydrolysable tannins and Flavonoids) show antioxidant properties, anti-carcinogenic and anti-mutagenic effects [7]. The bioactive chemical constituents into plants like alkaloids, tannin, flavonoids, phenolic composition etc. are responsible for physiological and biochemical actions in the human body [8, 9]. Natural products from plants are also show antitumor and antioxidant activity [10]. Plant constituents have ecological and physiological role [11].

Solanum nigrum L is an annual herbaceous plant which belongs to the family Solanaceae. Usually black nightshades are considered for this. These plants are usually 10 to 15 cm long, with a semi-climbing, green, smooth stem. The opposite leaves are uniformly oval in shape and are slightly cogged. It is widely found in the river bund, wet woods, waste land, quagmire, old field, ditches road side and in wet cultivated land.

Solanum myriacanthus is an annual herbaceous plant which is belongs to the family Solanaceae. It is also known as *Solanum khasianum*. These herbaceous is also familiar as Kotahi bengena in Assamese. From top to bottom these herbs are 1-2 cm tall. A lot of hairy pilose are attached in stem. Leaves are simple 18 to 22 cm long, prickly on both surfaces, flowers are white in color and ripe berry globes are yellow in color. It is widely found in the river bund, road sides and waste plus. It can be cultivated in tea fields and it slightly found from other cultivated fields.

Solanum melongena plays an important role in the treatment of typical human diseases from the ancient period of time. *Solanum melongena* (Eggplant) which is commonly known as melongene. In Southeast Asia, South Africa and South Asia, it is called brinjal [12-15]. This plant is also called eggplant because the fruits of the plant are looked like small white eggs (Eu-Sol: Eggplant history). American, Australian English and sometimes Canadian English it is known as "eggplant" or in British English and Canadian English as "aubergine" cause it bears a same name fruit which has a long history of using as a vegetable through cooking [16].

Averrhoa bilimbi is a long-lived tree which is belongs to the family Oxalidaceae. Locally it is known as bilimba. Trees are usually 5-10 m tall, with a short trunk soon distributing into a number of upright sections. Leaves are 30-60 cm long, with 12-36 sub-opposite leaflets. The leaves are 1.2-1.25 cm wide, upper side is medium-green and under side is pale in color. The ellipsoid fruits are bright-green or yellowish-green when unripe and when it ripe, it becomes ivory or nearly white in color. The skin surface of fruit is very thin, glossy and soft, Jelly like and juicy and extremely acid [17]. It is widely found in Indonesia, Malaysia, as exotic in Brazil, Argentina, Australia, Colombia, Cuba, India, Jamaica, slightly cultivated in Myanmar, Philippine, Sri Lanka, Thailand, Venezuela and US [17].

2. Materials and Methods

Plant collection and identification

We collected *Solanum nigrum* L, *S. myriacanthus* Dunal, *Solanum melongena* and *Averrhoa bilimbi* from different location of Khulna, Satkhira and Jessore districts. These samples were free from disease and were collected from dry and shady areas. This plant materials were identified as per method [18] and herbarium deposited in department of pharmacy, Manarat International University, Dhaka-1216, Bangladesh.

Preparation of plant material

The leaves were washed randomly 5-6 times with fresh water in running temperature. Leaf material was the air dried under sunlight shade. After shade drying the plant material was grinded in the mixture. After this preparation we collected the powder and kept in small plastic bags with proper labeling.

Extraction of plant material

Preparation of aqueous extracts

We weighed 5gm of sample using an electronic balance and 5gm of plant material were crushed in 25ml of sterile water. Then we heat the sample at 50-60 °C and it was filtered by Whitman filter paper no.1. Then centrifuged was done for 15 minutes at 2500rpm. Filtrate was collected in sterile bottles. Then it collected at 5 °c in refrigeration until use [19].

Preliminary phytochemical analysis

Sample was carried out according to the methods [20]. We found alkaloid, saponin, tannins flavonoides and protein by phytochemicals analysis of the crude powder of the *Solanum nigrum* L, *S. myriacanthus* Dunal, *Solanum melongena* and *Averrhoa bilimbi* [21] that are given below.

Test for alkaloids

In 10ml methanol we took 200mg of plant material and then filtered. Then 2ml of filtrate were taken and added 1% HCL with steam 1ml filtrate and 6 drops Dragendroffs reagent. Orange precipitates indicated the presence of alkaloids.

Test for saponins

We take approximate 0.5 ml filtered and added 5ml distilled water. It shown frothing persistence that indicated presence of saponins.

Test for tannins

In 10ml distilled water we took 200mg plant material and then filtered. Then 2 ml of filtered taken and added 2 ml Fecl3 Blue. Black precipitate indicated the presence of Tannins and Phenols.

Test for flavonoids

In 10 ml ethanol we took 200 mg plant material and then filtered. Then 2 ml of filtered taken and added concentrated HCL and magnesium ribbon. Pink Tomato, Red color indicated the presence of flavonoids Glycoside.

Test of protein

4-5 ml of plant extract were taken and added few drops of Melons reagent and mixing properly and heat. We found which precipitate was formed and the precipitate turn's brick red after boiling.

3. Results

By analytical study different phytochemical constituents analysed from *Solanum melongena*, *Averrhoa bilimbi*, *Solanum nigrum* L and *S. myriacanthus* Dunal are shown in table 1, 2, 3 and 4.

Table1 showed that Tannins were abundant on leaf extract of *Solanum melongena* in the shady area of Jessore district where protein was also abundant in shady area and moderately presence in dry area of 3 districts. Alkaloid, Flavonoids and Saponin were moderately presence in shady area with present in dry area of 3 districts.

Table 1: Qualitative phytochemical Screening of *Solanum melongena*

Name of the Phytochemicals	Khulna		Jessore		Satkhira	
	Dry area	Shady area	Dry area	Shady area	Dry area	Shady area
Tannins	+	++	+	+++	+	++
Protein	++	+++	++	+++	++	+++
Alkaloid	+	++	+	++	+	++
Flavonoids	+	++	+	++	+	++
Saponin	+	++	+	++	+	++

Note book: +++ = abundant, ++= moderately presence, + = present

In table 2, the result revealed that tannins and protein were moderately presence in dry area with present of tannins in shady area where protein was abundant in shady area of Khulna and Jessore without Satkhira. Alkaloid, Flavonoids and Saponin were moderately presence in shady area with present in dry area of 3 districts.

Table 2: Qualitative phytochemical Screening of *Averrhoa bilimbi*

Name of the Phytochemicals	Khulna		Jessore		Satkhira	
	Dry area	Shady area	Dry area	Shady area	Dry area	Shady area
Tannins	++	+	++	+	++	+
Protein	++	+++	++	+++	++	++
Alkaloid	+	++	+	++	+	++
Flavonoids	+	++	+	++	+	++
Saponin	+	++	+	++	+	++

Note book: +++ = abundant, ++= moderately presence, + = present

In this study table 3 had represented that tannins and protein were present in dry area with moderately presence of Protein

in shady area of 3 districts where Tannins were abundant on leaf extract of *Solanum nigrum* L in the shady area of Khulna and Jessore districts and moderately presence in Satkhira. Flavonoids and Saponin were moderately presence in shady area with present in dry area of 3 districts. But alkaloid was abundant in shady area with present in dry area of 3 districts.

Table 3: Qualitative phytochemical Screening of *Solanum nigrum* L

Name of the Phytochemicals	Khulna		Jessore		Satkhira	
	Dry area	Shady area	Dry area	Shady area	Dry area	Shady area
Tannins	+	+++	+	+++	+	++
Protein	+	++	+	++	+	++
Alkaloid	++	+++	++	+++	++	+++
Flavonoids	+	++	+	++	+	++
Saponin	+	++	+	++	+	++

Note book: +++ = abundant, ++ = moderately presence, + = present

By qualitative analysis in table 4, tannins were abundant on leaf extract of *Solanum myriacanthus* Dunal in dry area of 3 districts with present of shady area of Khulna and Jessore and moderately presence in Satkhira. Protein and Flavonoids were moderately presence in dry area and present in shady area of 3 districts. Alkaloid was abundant in dry area and moderately presence in shady area of 3 districts. Saponin was abundant in dry area of Jessore with moderately presence of Khulna and Satkhira but Saponin was also present in shady area of Khulna and Satkhira with moderately presence of Jessore.

Table 4: Qualitative phytochemical Screening of *Solanum myriacanthus* Dunal

Name of the Phytochemicals	Khulna		Jessore		Satkhira	
	Dry area	Shady area	Dry area	Shady area	Dry area	Shady area
Tannins	+++	+	+++	+	+++	++
Protein	++	+	++	+	++	+
Alkaloid	+++	++	+++	++	+++	++
Flavonoids	++	+	++	+	++	+
Saponin	++	+	+++	++	++	+

Note book: +++ = abundant, ++ = moderately presence, + = present

4. Discussion

In this study the qualitative screening was performed for phytochemical constituents on leaf extract of *Solanum nigrum* L, *S. myriacanthus* Dunal, *Solanum melongena* and *Averrhoa bilimbi* that helped to find out the presence of alkaloids, saponin, tannins, flavonoids, proteins etc. The synthetic derivatives of these constituents are used as medicinal agent, because they have analgesic and antibacterial effects [22, 23]. They have physiological activity into host cell. In recent study, it is proved that the alkaloids content in *Solanum nigrum* L. and *Solanum myriacanthus* Dunal, *Solanum melongena* and *Averrhoa bilimbi* could be have medicinal values. Saponins are very important glycosides with soapy characteristics [24]. Coagulating red blood cell, precipitating, haemolytic activity, cholesterol binding properties, bitterness and formation of aqueous solution are the properties of saponin [25, 11]. The leaf extract of these plants have also medicinal activity. Tannins (tannic acid) are present in many plant foods. It is water soluble polyphenols and helps to precipitate proteins. By lacking of nutritional, Protein and by precipitating microbial protein tannins prevent, the microorganisms development. For this reason tannins are used as antimicrobial agent [26]. Fungi, Yeast, Bacteria and Viruses cannot grow easily due to tannins [27]. The plants which contain tannins are helped for inflammation of mouth throat, skin and diarrhoea [28]. Tannins

are also helpful for healing of wounds and in flamed mucous membrane [29]. Flavonoids are important to prevent oxidant cell damage having anticancer activity due to water soluble antioxidant and free radical scavengers [30, 11]. Flavonoids have anti-inflammatory activity [11]. So, these plants are used for the treatment of wounds, burn and ulcers. So, these plants have many medicinal properties [31, 32].

5. Conclusion

In this study it is revealed that the leaves of *Solanum nigrum* L, *S. myriacanthus* Dunal, *Solanum melongena* and *Averrhoa bilimbi* are important natural source for useful drugs. Because these plants contain phytochemicals. In the treatment of many disease these plant can be utilized and used in the pharmaceutical and cosmetic industries. By performing more studies on the crude extract of these plants proper drug development is possible.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

MA and FF carried out the plants from different places of Khulna, Jessore and Satkhira. MA, SFB and SSF also carried out conception and design of the study. MA, MAHK and FA wrote the manuscript. MA, SSF, SFB and FA revised the manuscript. All authors read and approved the final manuscript. Whereas MA = Md. Ashrafudoulla, SFB = Sm Faysal Bellah, FA = Feroz Alam, SSF = Sayed Sakib Faisal, MAHK = Md. Abdullah Hil Kafi and FF = Farhan Fuad.

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