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BANGLADESHI SCOPARIA DULCIS LEAF ETHANOLIC EXTRACT: PHYTOCHEMICAL SCREENING, ULTRA VIOLET AND FT- IR ANALYSIS

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ABSTRACT

One significant medicinal herb is *Scoparia dulcis* "Chinigura" is the local name of the plant in Bangladesh. The current study examines the ethanolic seed extract of this plant using UV and FT-IR spectroscopy as well as phytochemical screening. The plant has anti-inflammatory, anti-malarial, antidiabetic, anti-cancer, antioxidant qualities. Phytosterol, terpenoid, Flavonoid, phenolic compound, glycoside, carbohydrate, protein, tannin, gum and mucilage, alkaloid, saponin, anthoquinone are all present in the extract according to phytochemical screening. Sulfur compounds, carbonyl group (ketone), NaQSA the Sodium Salts of Quercetin 5' Sulfonic Acid, α,β unsaturated amide, nitro compound, lactams, flavones, aromaticcompound, fistin, myricetin,quercetin, chalcones, and anthocyanin types of flavonoids are all detected by the UV and FT-IR spectroscopy of the plant's leaf extract from ethanol. The bioactive compounds mentioned above primarily contribute to the plant's therapeutic properties.

KEYWORDS: FT-IR spectroscopy, flavonoids, chromophoric groups, ultra violet spectroscopy, and *Scoparia dulcis* phytochemical screening.

INTRODUCTION

In Bangladesh, *Scoparia dulcis* L. is referred to as "Chinigura" natively. This plant is a member of the Plantaginaceae family. In Taiwan and India, *Scoparia dulcis* has been used as a treatment for hypertension and diabetes mellitus, respectively (Bhandari, 1990). In addition to being used as an analgesic and antipyretic, fresh or dried plant has long used for the treatment for hepatosis, inflammation, bronchitis, hemorrhoids, diabetes, hypertension, and stomach disorders (Singh et.al.,1996). Indigenous cultures in Nicaragua employ a hot water infusion and decoction of the leaves or entire plant as a medicinal remedy for venereal illness, fevers, heart difficulties, liver problems, insect bites, stomach and menstruation issues, and malaria (Freire et. al., 1993). It has been used as a general tonic, to cleanse blood, and to help with childbirth (Hayashi et.al., 1990). According to Brazilian traditional medicine, the herb is used to heal skin wounds, hemorrhoids, bronchitis, stomach issues, and bug stings. Asian medicine uses the plant to treat high blood pressure (Ahana et.al., 2020).

Fig. 1: Bangladeshi *Scoparia dulcis* (Chinigura).

Sweet broom or *Scoparia dulcis* (Chinigura), is an upright annual plant that can occasionally last more than a year. a species that is perpetual. It typically grows 50 to 100 cm tall, has many branches, and is quite woody underneath (Jain and Sing, 1989). Originally from the Americas, the plant has spread as a weed across the tropics and subtropics, and it has become a significant medical herb practically everywhere (Paul et.al., 2017). Common weed in low- to medium-altitude populated regions along roadsides, ditch banks, and other more or less damp and shaded locations around the Philippines , tropical or native America, Asia as well as in Bangladesh (Majumder et.al., 2011).

It is frequently seen in damp areas in Bangladesh. Numerous phytoconstituents, diterpenoids, including a trace amount of an alkaloid, flavonoids, a significant amount of salicilic acid, triterpenes, tannins, b-sitosterol, alkaloids, hexaconasol, ketone, dulcitone, and amellin, have been found in this medicinal plant, *Scoparia dulcis* (Chinigura). According to a review of the literature (Majumder et.al., 2011) dulcitol from the aerial portions, triterpene and mannitol from the roots (Paul et.al., 2017). Among others, betulinic acid, daucosterol, dulcidion, benzoxazin, benzoxalinone, apigenin, amellin, amyrin, and acacetin. A diterpene and a flavone glycoside were also identified. Additionally, it contains amellin, friedelin, glutinol, scoparic acid (A, B) and C, scopadulic acid (A & B), and scopadulin. A group of Cellulose, flavonoid, steroid, quinone, starch, terpenoid, phenol, carbohydrate, fixed oil, fat and saponin were found in different solvents, according to studies (Pamunuwa et.al., 2016).

The whole parts of the plant (Leaf, Stem, Root, flower) has medicinal values. Leaf part has Anti-hyperglycemic, thrombolytic/Clot lysis Effect, antiviral, anticancer, antibacterial activity (Sing et.al., 1996). Stem part shows Antidiabetic activity. Flower part has Thrombolytic/Clot lysis Effect and Anti-malarial activity. Fruit has Larvicidal activity. Bark has Anti-diabetic activity. Seed has Anti-Diabetic/Increased Insulin Secretion. Aerial part has Analgesic and anti-inflammatory activity (Langeswaran et.al., 2012).

In Taiwan and India, Scoparia dulcis has been used as a treatment for hypertension and diabetes mellitus, respectively. In addition to being used as an analgesic and antipyretic, the fresh or dried plant has long been used as a treatment for hepatitis, inflammation, bronchitis, hemorrhoids, diabetes, hypertension, and stomach disorders. Indigenous cultures in Nicaragua the leaves or complete plant are infused with hot water and used as a therapeutic cure in Nicaragua for venereal disease, fevers, heart problems, liver disorders, insect bites, stomach and menstrual problems, and malaria. In addition to being a general tonic, it has been used to cleanse blood and help with childbirth (Abere et.al., 2015).

MATERIAL AND METHODS

Collection with identification of plant sample

In March 2018, the taxonomist at the Bangladesh National Herbarium in Dhaka recognized fresh leaves of *Scoparia dulcis* (Chinigura) that had been taken from Chamta village in the Natore area of Bangladesh. 45934 voucher specimen no. had deposited there.

Plant materials preparation

After being cleaned of filth, the plant's leaves were allowed to air dry followed by oven-dried at less than 45℃—to prepare it for grinding. After screening, the 20 mesh powder was placed in an airtight container with a label for identification and stored for later use in a dry, cool, and dark environment.

Solvents and Chemicals

In these investigations, chemicals and solvents of analytical or laboratory quality were employed. The suppliers of all solvents along with regents used in this studies from BDH (England) and E. Merck (Germany).

Preparation of EtOH Extract of the plant leaf

For EtOH extraction, 120 g of powered leaf material is immersed in appropriate solvents with increasing polarity, such as ethanol, and then allowed to sit at room temperature for five days while being shaken and stirred periodically. During this time, the majority of the plant material's extractable chemicals will dissolve in the solvent and be extracted as a solution. A rotary evaporator was then used to dry these extracts, yielding 2.0 g of ethanol extract. Resulting extract was then put through a preliminary phytochemical screening process to identify different plant ingredients using techniques recommended by established methodologies (Harwood and Moody, 1989: Bohm, 1998; Caius, 1986; Cooke, 1958; Durry, 2010). Spectral analyses using Ultra-Violet and Infra-Red were performed to identify flavonoids and chemical and functional phytochemicals group in extract. (Shahin et.al., 2014; Heneczkowski et.al., 2001; Saraswathi et.al., 2012).

RESULTS AND DISCUSSIONS

Phytochemical screening

A group of compounds like Tannin, alkaloid, flavonoid, glycoside, phytosterol, terpenoid, phenolic compound, carbohydrate, fixed oil, lipid, protein, gum,mucilage all were present into the ethanolic extract of *Scoparia dulcis* (Chinigura) leaves. **Table 1** displays the findings.

Table 1: Ethanolic extract of *Scoparia dulcis* (Chinigura) Leaf;s Phytochemical Screening.

Sl.No	**Test of Plant constitution / Reagents**	**Results**	*Sl .No*	**Test of Plant constitution Reagents**	**Results**
1.	**Alkaloids**		8.	**Carbohydrate Types**	
	• Mayer's Reagents	+		• Glucose	-
	• Wagner's Reagents	+		• Fructose	-
	• Hager's Reagents	+		• Galactose	-
2.	**Carbohydrates**			• Lactose	+
	• Molisch's Test	+		• Starch	+
	• Benedict's Reagents	+	9.	**Glycosides**	
	• Fehling Solution	+		• Keller killiani test	+
3.	**Terpenoids**	+	10.	**Phytosterols**	
	• Salkowski Test	+		• Liebermsnn's test	+
4.	**Fixed oil and Fats**		11.	**Saponins**	
	• Spot Test	+		• Foam test	-
5.	**Phenolic compounds**		12.	**Tannins**	+
	Ferric Choloride Solution	+		Lead acetate solution	
6.	**Proteins**	+	13.	**Amino acids**	
	Xanthoprotic Test	+		Ninhydrine reagents	+
	Biuret Test	+	14.	**Flavonoids**	
7.	**Gums and Mucilages**			Con H_2SO_4+ Magnisium ribbon	+
	Alcoholic precipitation	+	15.	**Anthraquinones**	
	Molisch's test	+		Borntrager's test	-

UV Spectroscopy

Scoparia dulcis (Chinigura) ethanolic leaf extract's UV spectrum was observed between 273-292 nm. Due to the aromatic structure of compounds and aldehydes, the UV spectrum exhibits weak absorption bands at 292.28 nm. Flavone and fistein kinds of flavonoids are shown by these weak bands. Quercetin is shown by the absorption band at 289.66 nm and 288.80 nm, which was due to the 3° amines and the polyene (β-carotene). Presence of an amide group (protein) is indicated by the distinctive wide band at 287.80 nm. Band at 285.60 nm indicates presence aniline's presence, (amino groups). At 284.20 and 283.42 nm, the distinctive band is caused by the aldehyde and ketones groups. Flavone and fistein kinds of flavonoids are shown by these distinctive bands. The presence of an aldehyde group is shown by the bands at 282.2, 281.84, and 281.10 nm. The ketones group is responsible for sharp peak at 280.26 nm, 278.20 nm, and 277.84 nm. The existence of an alkene group is shown by the band at 274.82 nm and 273.30 m. Three different kinds of flavonoids—flavone, fisetin, and quercetin—are detected by UV spectroscopy (**Fig. 2** & **Table 2**).

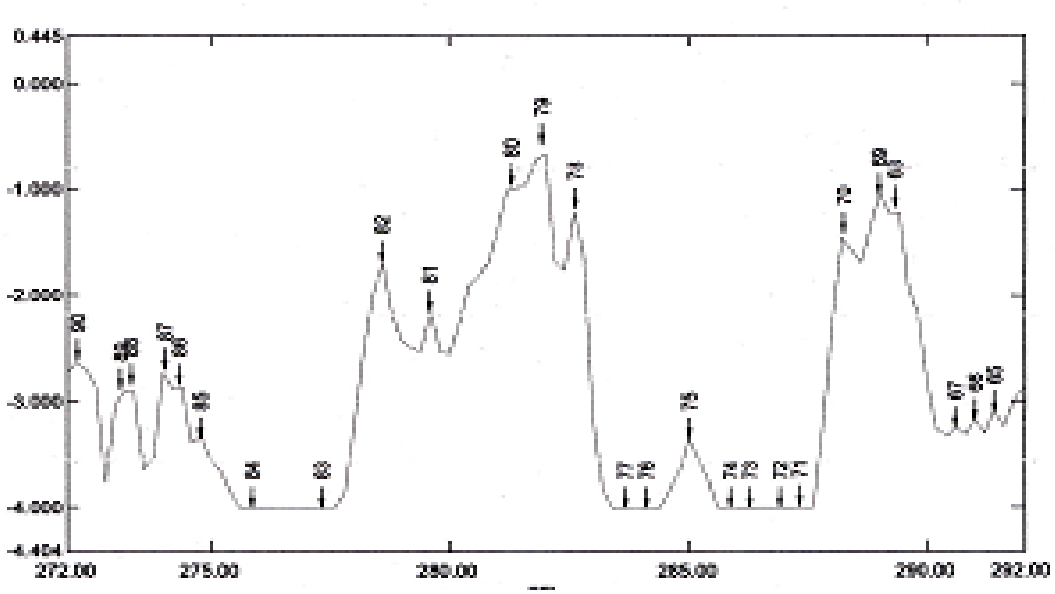

Fig. 2: Ethanolic extract of Leaf *Scoparia dulcis* (Chinigura): UV Spectrum.

Table 2: EtOH extract of *Scoparia dulcis* (Chinigura) leaf UV Spectrum Analysis.

Sl. No	Wavelength [nm]	Abs.	Chromophoric groups	Types of flavonoid
1.	292.28	0.068	Aldehyde(-CHO)	Flavone &Fistein
2.	289.66	0.070	3°amine and Polyene (β-Carotain)	Quercetin
3.	288.80	0.071	3°amine and Polyene(β-Carotain,)	Quercetin
4.	287.80	0.070	Amide group (protein).	
5.	285.60	0.066	Amino group (Aniline)	
6.	284.20	0.021	Ketone (=C=O), aldehyde (CHO)	Flavone, Fistein
7.	283.42	0.055	Ketone (=C=O), aldehyde (CHO)	Flavone, Fistein
8.	282.20	0.005	-CHO	Flavone, Fistein
9.	281.84	0.015	-CHO	Flavone, Fistein
10	281.10	0.115	-CHO	Flavone, Fistein
11.	280.26	0.017	=C=O	Flavone, Fistein
12.	278.20	0.393	=C=O	Flavone, Fistein
13.	277.84	0.402	=C=O	Flavone, Fistein
14.	274.82	0.646	Alkene (Naphthalene)	-
15.	273.30	0.255	Alkene (Naphthalene)	-

Fourier Transform Infra Red Spectroscopy

Present investigation suggested, alkyne C-H bending vibration quercetin and amides is indicated by peak 677.74 cm^{-1} into the FT-IR spectrum of EtOH extract of *Scoparia dulcis* (Chinigura) leaves. Gem disubstituted olefinic group, C-H bending vipbrations, and aromatic substitution are the causes of the strong peak at 895.15 cm^{-1}. The existence of quercertin is once again confirmed by this peak. The appearance of sulfur compounds, S=O stretching vibrations, thio-carbonyl groups, sulfoxides, NaQSA, is indicated by extremely sharp signal at 1036.04 cm^{-1}. The prominent peak at 1089.91 cm^{-1} further supports the existence of the thiocarbonyl group, sulfur compounds, and NaQSA.

A sulfur chemical that is highly effective against microorganisms. The existence of C-N Stretching vibrations and aliphatic amine functional group are shown by 1254.23 cm^{-1} in the FT-IR spectra. The substance's aromatic character, and a group of sulphonamide, gem dimethyl group, nitro compound in the type of myricetin are all indicated by the peak at 1366.08 cm^{-1}. The presence of $C\text{-}CH_3$ bending, flavonoids mainly myricetin, gem dimethyl groups, nitro/sulfur molecule, is once again confirmed by the distinctive peak at 1456.99 cm^{-1}. Peaks at 1654.71 cm^{-1} , 1733.90 cm^{-1} in FT-IR spectrum demonstrate the existence of the C-H bend and -C=C-Stretch functional groups of Alkanes and Alkenes.

The emergence of peaks at 2853.78 cm^{-1} & 2974.87 cm^{-1} indicates the presence of the C-H stretching vibrations as well as aldehyde groups and alkane grups. The comparable C-H stretch is at 2925.24 cm^{-1}. A distinct hump at 3400.37 cm-1 corresponds to stretching vibrations of 1°, 2° amines, Amides, and N-H. Three different types of flavonoids are found in the FT-IR spectra of an ethanolic extract of *Scoparia dulcis* (Chinigura) leaves: myricetin, NaQS Aquercetin. (**Table 3** and **Fig. 3**).

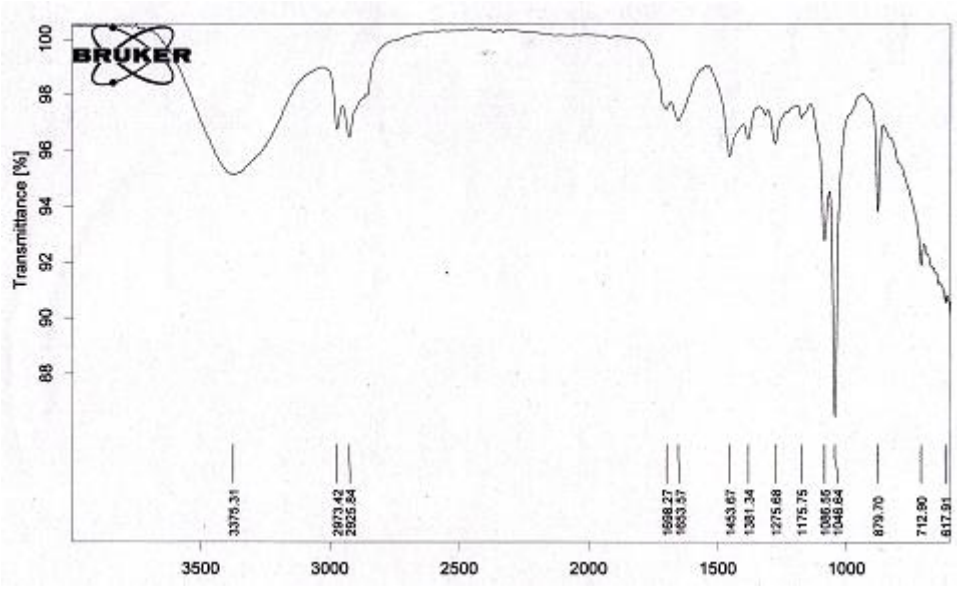

Fig. 3: Ethanolic extract of *Scoparia dulcis* (Chinigura) leaf FT-IR Spectrum.

Table 3: FT-IR spectroscopy of ethanolic extract of *Scoparia dulcis* (Chinigura) leaf.

Sl. No.	Peak value (cm^{-1})	Bonding Type	Functional Group	Types of Flavonoids
1.	677.74	C-H bending	Alkyne	Quercetin
2.	895.15Sharp	C-H bending vibration	Aromatic substitution, olefinic group, gem-distributed,	Quercetin
3.	1036.04	S=O stretching vibration	Sulfur compounds, Thiocorbonyl group sulfoxides.	NaQSA
4.	1089.91	S=O stretching vibration	Thio corbonyl group, Sulfur compounds,	NaQSA
5.	1254.23	Stretching vibration (C-N)	Aliphatic amine	
6.	1366.08 Strong	C-N stretch	Aromatic and sulphonamide, Nitro compounds, gem-dimethyl group.	Myricetin
7.	1456.99	C-H Bending vibration	Alkanes	
8.	1654.71	Stretching vibration (-C=C-)	Alkenes	
9.	1733.90	C=O Stong	Ester	
10.	2853.78	C-H Stretching vibration	Aldehyde	
11.	2925.24	Stretching vibration (C-H)	Alkanes	
12.	3400.37	Stretching vibration (N-H)	1°, 2° amines, & Amides	

CONCLUSION

The present findings has been yielded prior knowledge for the determination of the chemical composition of *Scoparia dulcis* (Chinigura) leaves. The principal components that contribute to the therapeutic value of plants are chromophoric and functional groups, glycosides, fixed oil, flavonoids, alkaloids, lipids, phytosterols, terpenoids, phenolic compounds, and tannins. These bioactive chemicals' presence in plant extract attests to the plant's proper application in traditional medicine. This is also true when creating new medications by isolating particular compounds.

Conflict of Interest: There is no conflict of interest.

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