Original Article

Pharmacognostical and phytochemical screening of root and fruit of *Ficus semicordata* Buch.-Ham. Ex Sm. – An extra pharmacopoeial drug

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Abstract

Introduction: Root and fruits of *Bhumi Udumbara* (*Ficus semicordata* Buch.-Ham. ex Sm.) are traditionally used in the treatment of aphthous complaints, leprosy, headache, abdominal diseases, bladder ailments, visceral obstruction, and various disorders. **Aim:** Present study reports the microscopic including powder microscopy, physiochemical and preliminary phytochemical characters of root and fruit of *F. semicordata.* **Materials and methods:** Root and fruit of the plant, after proper authentication, were evaluated following standard pharmacopoeial recommended procedures. **Results:** Striking characters of the *F. semicordata* root is the presence of profusely branched root-like structures, nearer to the trunk, and reaches the ground as a supporting root (aerial root or false root). The diagrammatic section of the root, circular in outline, made up of an outer cork, followed by cortex, vascular bundle, and central pseudo pith. Fruit is shortly peduncled, in pairs or clusters, globose in shape, hispid and warted surface, reddish brown in color. Loss on drying at 110°C was found to be 10.54% and 11.73% of root and fruit respectively. High-performance thin-layer chromatography results showed 2 peaks at 254 and 366 nm of root and 3 peaks at 254 and 1 peak at 366 nm of fruit respectively. **Conclusion:** *F. semicordata* is a small or medium-sized evergreen tree**,** bears a supporting root (aerial root or false root) nearer to the trunk region. Root reddish brown in color with smooth surface, prominent nodes, and internodes, presence of fruits over nodes and internodes is the key identifying character. Stone cells found in root and the presence of pollen grains, simple starch grains, and compound starch grains in fruit are the diagnostic characteristics of *F. semicordata.*

Keywords: *Anukta Dravya, Bhumi-Udumbara*, extra-pharmacopoeial, *Ficus semicordata*

Introduction

Folklore traditional medicines involve medicinally important plants and are subject of the major area of new drug discovery and research. Detailed pharmacognostical review, as a part of drug standardization, provides valuable evidence regarding morphology, microscopic and physical characters of an incomplete drug.[1] *Bhui Dumri* (F.S, Moraceae) is a small or medium-sized perennial tree, having semi-sagittate leaves, fruit is shortly peduncled, in pairs or clusters on mostly leafless, sagging, scaly branchlets from the base of the stem or the larger branches, globose in shape, hispid and warted surface, ripened reddish-brown[2,3] and is dispersed along sub-Himalayan forests, West Bengal, Odisha, Chota Nagpur, Central India, Bangladesh (Chittagong), Myanmar, being cultivated in the valleys, ravines, and on the banks of streams.[4] The root of the plant has been reported broadly for its use in the management of bladder complaints, liver ailment, headache, abdominal diseases, hyperthermia, visceral obstruction, wound, constipation, indigestion, menstrual disorder, aphthous ulcers, colic pain, leprosy, leucorrhea, and fever.[5] Its fruits are used in the cure of aphthous ulcers, leprosy, headache, diarrhea, abdominal diseases, bladder

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ailments, ulcer, visceral obstruction, constipation, indigestion, dermatological disorders, diabetes, colic pain, marasmus, jaundice, and hepatitis.[5] Although both the parts of plants are widely used by tribals, these useful parts are not yet evaluated in a scientific way for its pharmacognostical characteristics and phytochemical constituent. Hence, the root and fruit of *Ficus semicordata* has been explored, to bring comprehension on the pharmacognostical characters, and preliminary phytochemical constituents including high-performance thin layer chromatography (HPTLC) profile.

Materials and methods

Collection and preservation of the sample

Bhumi dumri known as *F. semicordata* Buch.-Ham.ex Sm was collected from natural habitat, during November 2017. A sample specimen was preserved in Pharmacognosy laboratory Phm. 6249/17–18 and also authenticated by the Botanical Survey of India (Certificate no.CNH/Tech. II/2018/11). The sample was preserved in a solution prepared from 70% ethyl alcohol: Glacial acetic acid: Formalin in the ratio of 90:5:5.[6]

Chemical and reagents

Chemicals utilized for pharmacognostical study were bought from Sigma-Aldrich and other reagents or chemicals used were of analytical grade.

Pharmacognostical study

Macroscopic study

Macroscopic observations were made with the naked eyes and with the help of a dissecting microscope. The samples were cleaned properly and macroscopic study of the root and fruit was carried out with the help of a quasmo binocular compound microscope.

Organoleptic

Raw samples were assessed for their numerous characters such s color, texture, odor, and taste.[7]

Microscopic evaluation

Freehand segments of numerous parts of roots were taken. First observed in distilled water and then stained with phloroglucinol and Conc. HCl. Photographs were also taken using microscope, attached with Kodak easy share C140, 8.2 megapixels ×3 optical/×5 digital zoom HD camera.

Physicochemical parameters and qualitative analysis

The powder of root and fruit was evaluated for physicochemical, i.e., pH, loss on drying, total ash value, water soluble extractive value and alcohol soluble extractive value, following conventions recommended by Ayurvedic pharmacopeia of India.[8] For qualitative examination, secondary metabolites dissolved in water and alcohol extract were carried out following standard procedures.[9-11]

High-performance thin layer chromatography

Methonalic extracts of root and fruit were dealt to HPTLC study.[12] A number of solvent system were tried to find out the best mobile phase. The solvent system used for the reading is Chloroform: Ethyl Acetate: Formic Acid (5:4:3 v/v) giving the best resolution and maximum number of spots.

Chromatographic conditions

The application mode was Camag Linomat V, Development chamber used was of Camag Twin trough chamber. Precoated Silica Gel 60F 254 plates were used. Chamber saturation was done for 30 min. Development time was 10 min. the plate was scanned in CAMAG TLC Scanner 3 with D2 and W lamp, Tungsten lamp as detectors and Win cats software was used for data analysis.

Spray reagent

One percent vanillin sulphuric acid (40 + 10) (Rankem, USA). The plate was derivatized by 1% Vanillin sulfuric acid and then heated in a hot air oven at 105°C till complete color development.

Scanning and detection of spots

The air-dried chromatoplate was developed at 254 nm and 366 nm to obtain planer chromatogram. Scanning was performed by CAMAG HPTLC densitometer, absorbance was made at 254 m and 366 nm and Rf value were noted.

Results

Root macroscopy

The root is profusely branched, nearer to the trunk region bears root-like structures, when it reaches the ground develops as a supporting root (aerial root or false root). The root is hard, cylindrical, cut pieces measuring about 5–10 cm in length and 0.5–1.5 cm in diameter; Outer reddish brown color with smooth surface, nodes, and internodes are prominent, fruits are present over nodes and internodes. Inner dark brown with smooth surface, fracture is short, fractured surface is creamish [Figure 1a]. It has a characteristic odor.

Organoleptic characters

Color externally reddish brown, internally dark brown; odor characteristic; taste astringent.

Microscopic study

The diagrammatic section is circular in outline, made up of outer cork, followed by cortex, vascular bundle, and central pseudo pith.

Detailed T.S. shows that the outer cork made up of several layer tangentially elongated compactly arranged cork cells which are heavily loaded by tannin content and also found rhomboidal crystals of calcium oxalate followed by large cortex made up of parenchyma cells heavily loaded by starch grains, yellow content. Many lactiferous ducts are also found in the cortical zone.

Stone cells are largely occupied in the cortical zone in the form of groups. These stone cells are rounded and oval in shape and pitted in nature. Cortex and single-layer endodermis leads to

vascular bundle. Some of the isolated groups of pericyclic fibers are also observed in the cortical region [Figure 1b-e].

Vascular bundle open and collateral radially arranged. Phloem situated above the xylem made up of sieve elements and fibers. Xylem made up of xylem fibers and parenchyma. Some of the xylem vessels are intra-axillary pitting are also observed. The following region of the xylem vessels is separated by unevenly accumulated pockets of pericyclic fibers. Medullary rays are multi-seriate, tangentially elongated tabular cells filled with starch grain and calcium oxalate crystals. A central pseudo pith is formed due to aerial branches reaching to the ground and acting as a root. The pith cells are parenchymatous and loaded with starch grains and crystals. Some of the pith cells are pitted and lignified [Figure 1f-n].

Table 1: Physicochemical parameters of root and fruit powder of *Ficus semicordata*

Test	Root (%)	Fruit (%)
Loss on drying at 110°C	10.54	11.73
Ash value	4.33	5.97
Water soluble extract	5.9	10.4
Methanol soluble extract	6.40	4.56
pH	6.0	6.0

Root powder microscopy

Organoleptic characters

Root powder color is light brownish; odor, woody; taste, astringent; texture, fibrous.

Diagnostic powder characters of root shows the presence of simple fibers, stone cells with tannin, cork cell in surface view, parenchyma cell with tannin content, latex content, brown content, septate fibers, pitted rounded stone cell, rhomboidal crystals, prismatic crystals, lignified pitted angular stone cells, group of lignified fibers, silica deposition, fragment of trichomes, and starch grain with hilum [Figure 2a-p].

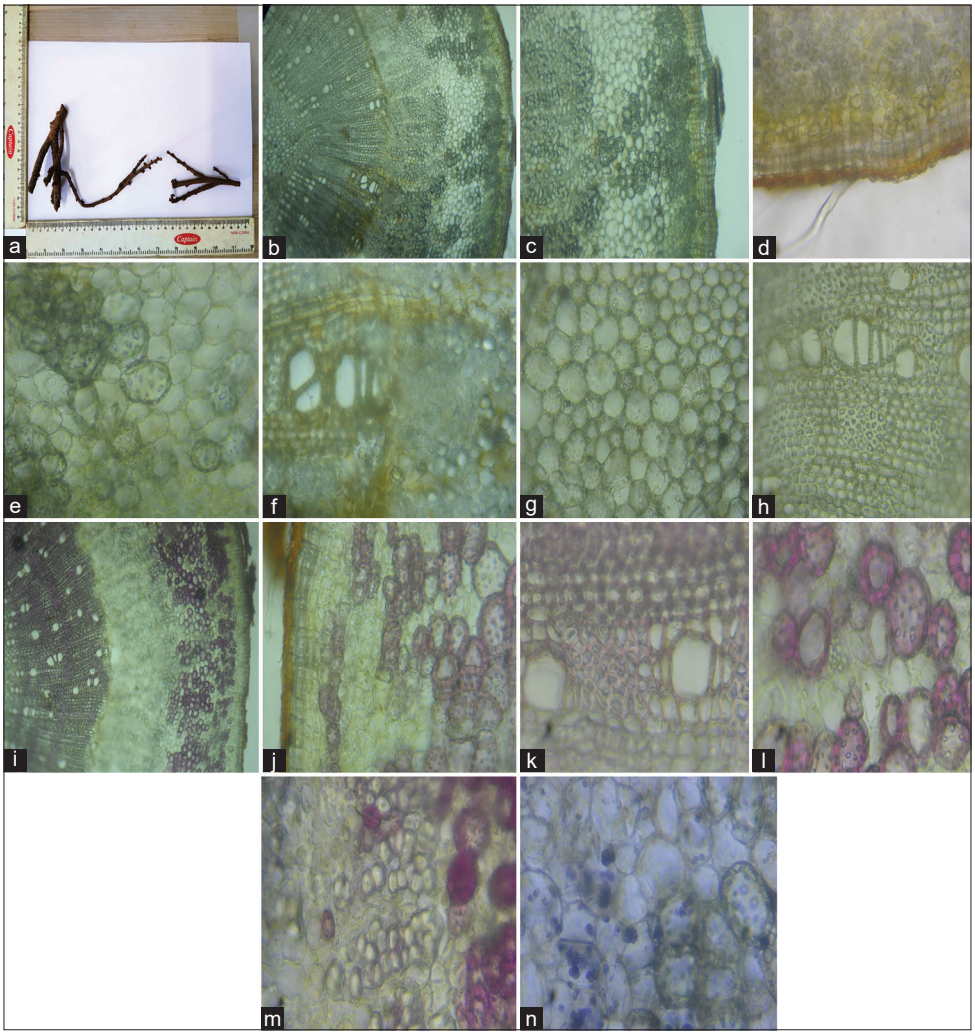

Figure 1: (a) Fresh root, (b) periderm, cortex, V.B., (c) multilayered periderm, stone cells, (d) periderm, cortical cells with rhomboidal and prismatic crystals, (e) pitted Stone cells, (f) phloem, xylem and medullary rays, (g) pitted parenchyma cells with starch grains, (h) xylem, pericyclic fibres and medullary rays, (i) stained Periderm, Cortex, V.B., (j) stained multilayered periderm, (k) stained xlem, percyclic fibers and medullary rays, (l) lignified pitted stone cell, (m) pericyclic zone, (n) parenchyma cell with starch grain

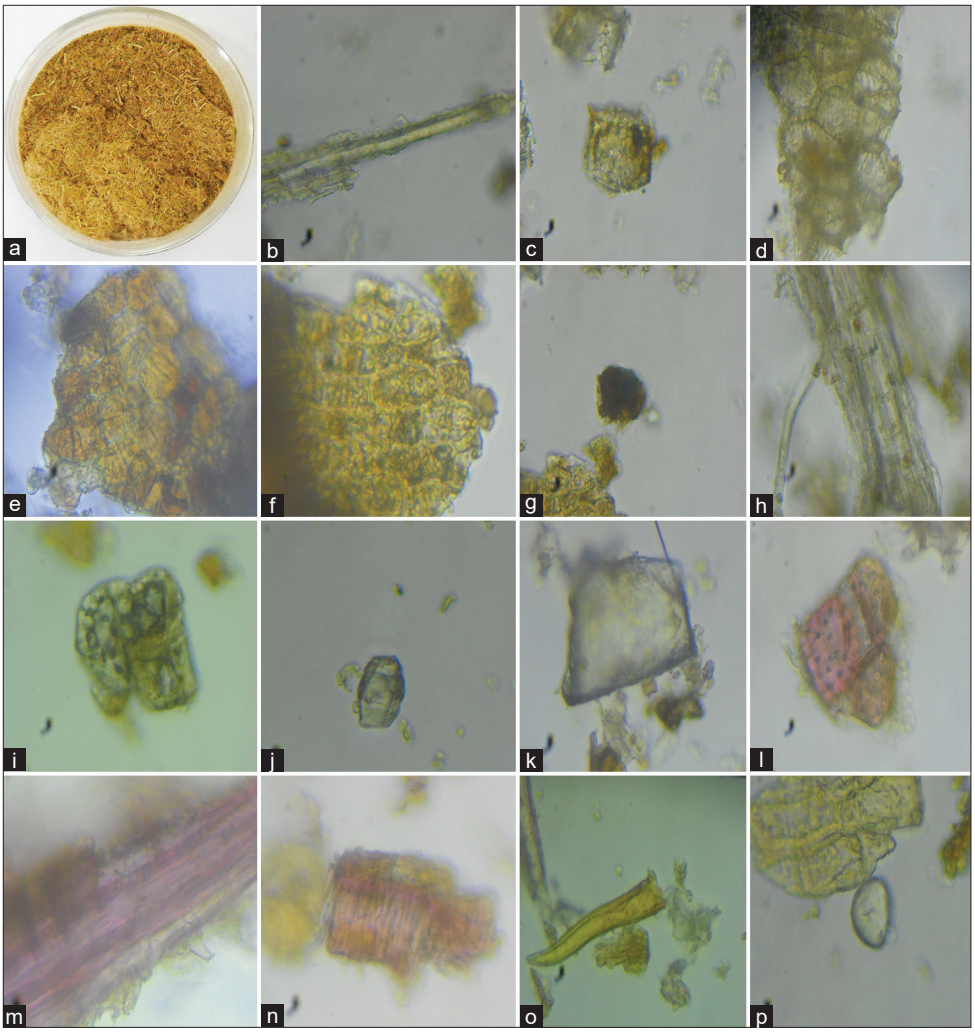

Figure 2: (a) Dried root powder, (b) simple fibers, (c) stone cells with tannin, (d) cork in surface view, (e) parenchyma cell with tannin content, (f) latex content, (g) brown content, (h) septed fibres, (i) pitted rounded stone cell, (j) rhomboidal crystals, (k) prismatic crystals, (l) lignified pitted angular stone cells, (m) lignified fibres, (n) silica deposition, (o) fragment of trichomes, (p) starch grain with hilum

Table 2: Results of qualitative analysis of *Ficus semicordata* root and fruit bark

Test for	Applied test	Water extract		Alcohol extract	
		Root	Fruit	Root	Fruit
Tannin	Lead acetate	+	+	+	+
Reducing sugar	Fehling's test	+	+	+	+
Glycoside	Keller-Killiani test	+	+	+	+
Amino acid	Ninhydrin test	−	−	−	−
Flavonoids	Lead acetate test	+	−	+	−
Alkaloids	Dragondorff's test	+	+	+	+
	Wagner's test	+	+	+	+
Carbohydrate	Molish test	+	+	+	+
Phenolic compounds	Lead acetate	+	+	+	+
Steroid	Salkowaski test	+	−	+	−
Saponin	Foam test	−	−	−	−
	Lead acetate test	−	−	−	−
Protein	Biuret's test	−	−	−	−

+: Present, −: Absent

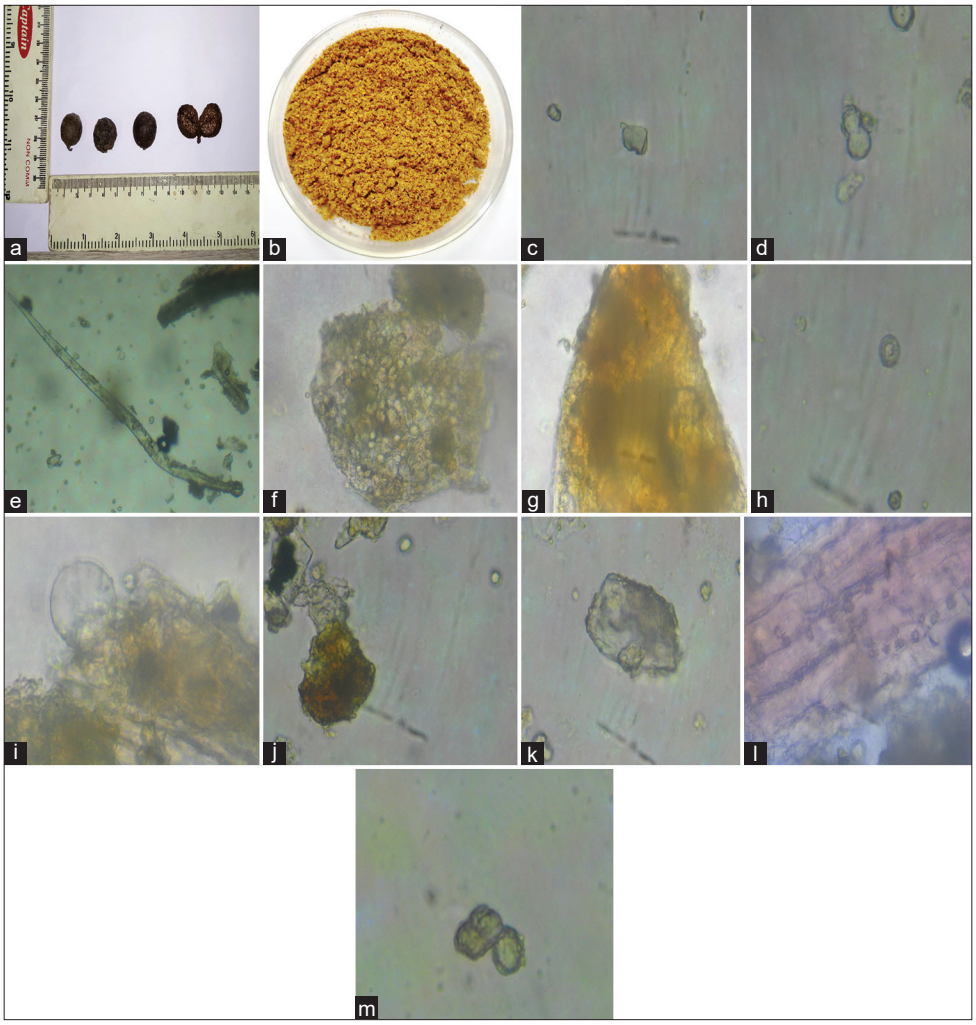

Figure 3: (a) Measurement of fresh fruit, (b) dried fruit powder, (c) simple starch grains, (d) compound starch grains, (e) simple trichome, (f) epicarp cell with starch grains, (g) fragment of mesocarp cell, (h) aleurone grain, (i) oil globules, (j) starch grain with brown content, (k) fragment of cystolith, (l) lignified wavy parenchyma, (m) pollen grains

Table 3: Retardation factor values obtained at short ultraviolet light (254 nm) and long ultraviolet light (366 nm) of *Ficus semicordata* root and fruit

Rf at 254 nm		Rf at 366 nm	
Root	**Fruit**	**Root**	**Fruit**
0.01	0.01	0.01	0.01
0.31	0.30	0.94	-
-	0.78	-	-

UV: Ultraviolet, Rf: Retardation factor

Fruit macroscopic study

Fruit is globose or pyriform in shape, hispid and warted surface, often bearing irregular bracts on the sides, reddish brown in color, inner many mature ovules situated on the fleshy receptacles, several individual fruits are yellowish-orange color and measures 0.5–2.5 cm diameter, odor aromatic and sweetish to sour [Figure 3a].

Organoleptic characters

Color reddish brown; odor aromatic; taste sour.

Powder microscopy

Organoleptic characters

Fruit powder color is brownish; odor aromatic; taste sour, sharp, and texture fibrous.

Diagnostic powder characters of fruit show the presence of simple starch grains, compound starch grains, simple trichome, epicarp cell with starch grains, fragment of mesocarp cell, aleurone grain, oil globules, starch grain with brown content, fragment of cystolith, lignified wavy parenchyma and pollen grains [Figure 3b-m].

Physico-chemical analysis

The results of the physico-chemical analysis are presented in Table 1. Loss on drying of root and fruit at 110°C is 10.54% and 11.73%, respectively. The ash value and water soluble extract are found to be more in fruit than in root.

Qualitative tests

Details of the result after qualitative analysis of root and fruit are presented in Table 2. Presence of tannin, reducing sugar,

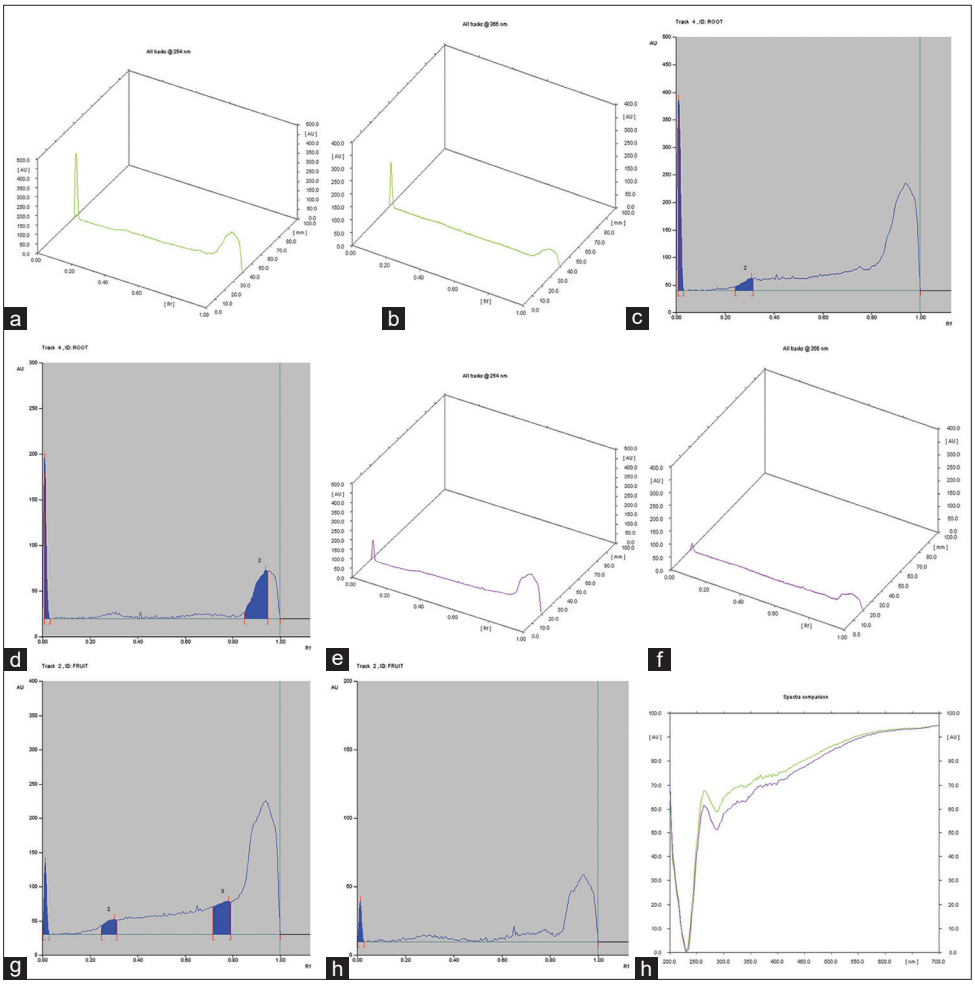

Figure 4: (a) 3D display of root at 254 nm, (b) 3D display of root at 366 nm, (c) peak display of root at 254 nm, (d) peak display of root at 366 nm, (e) 3D display of fruit at 254 nm, (f) 3D display of fruit at 366 nm, (g) peak display of fruit at 254 nm, (h) peak display of fruit at 366 nm, (i) spectral comparison root (0.31 Rf) and fruit (0.30 Rf). 3D: Three-dimensional

glycoside, alkaloids, carbohydrate, and phenolic compounds in aqueous as well as methanolic extract of root and fruit whereas flavonoids and steroid are only present in the aqueous as well as methanolic extract of root.

High performance thin layer chromatography

The Rf values are mentioned in Table 3. The methanol extract of root shows 2 peaks at 254 and 366 nm respectively, whereas, the methanol extract of fruit shows 3 peaks and 1 peak at 254 and 366 nm respectively. Similar spectra of root at 0.31 Rf and fruit at 0.30 Rf were observed [Figure 4a-i].

Discussion

F. semicordata, bears supporting root (aerial root or false root) nearer to the trunk region, areal roots of some *Ficus* species shows remarkable development and may start life as epiphytes.[13] T. S. of *F. semicordata* root shows outer cork made up of several layer tangentially elongated compactly arranged cork cells which are heavily loaded by tannin content and also found rhomboidal crystals of calcium oxalate followed by large cortex made up of parenchyma cells heavily loaded by starch grains, yellow content. A central pseudo pith is formed due to aerial branches reaching the ground and acting as a root.

Fruit is shortly peduncled, in pairs or clusters, drooping, from the base of the stem or from the larger branches, globose in shape, hispid and warted surface, often bearing irregular bracts on the sides with many mature ovules situated on the inner side of fleshy receptacles are the key identify characters. The results obtained from physicochemical parameters, qualitative and HPTLC study will aid as standardization principles providing data regarding the authentication of the plant *F. semicordata* root and fruit.

Conclusion

F. semicordata is a small or medium-sized evergreen tree. Root reddish brown in color with smooth surface, prominent nodes, and internodes, presence of fruits over nodes and internodes is the key identifying character. The present observation of pharmacognostical, physicochemical results, phytochemical, and HPTLC results will aid in further authentication and act as standards for quality affirmation.

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Conflicts of interest

There are no conflicts of interest.

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