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Research Article

PHARMACOGNOSTIC EVALUATION OF *ABIES WEBBIANA* LEAF: A SIDDHA HERBAL INGREDIENT

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ABSTRACT

Objectives: To evaluate the therapeutic potential of *Abies webbiana* (Wall ex D. Don) Lindl, plants leaves belongs to Pinaceae family are grown in Northern India, Afghanistan, China (Tibet), Nepal, and Pakistan. It is a large tree grows up to 50 m height. Leaves of this plant are useful in Siddha and Ayurveda Systems of Medicine. It acts as an expectorant, carminative, stomachic, and tonic. It is the main ingredient in the Siddha formulations such as *Thalisathi choornam* and *Thalisadi vadagam,* which are used for respiratory problems such as cold, cough, wheezing, tuberculosis, indigestion, loss of appetite, and vatha diseases.

Methods: In this study, we have investigated the phytochemical profile, pharmacognostic characters, and gas chromatography-mass spectrometry (GC-MS) compounds of methanolic extract of *A. webbiana* leaves.

Results: Phytochemical screening showed the presence of steroids, terpenes, sugars, phenols, flavonoids, tannins, saponins, and quinones. The leaf material revealed loss on drying (6.90%), total ash (5.23%), acid-insoluble ash (0.57%), water-soluble extractive (23.79%), alcohol-soluble extractive (18.37%), and pH was 5.25. 29 compounds were detected in GC-MS analysis and benzenepropanol, 4-hydroxy-à-methyl, 2-furancarboxaldehyde, and 5-(hydroxymethyl) are the predominant components.

Conclusions: This study provides the pharmacognostic standards of *A. webbiana* leaf for their authentication and utilization in herbal medicine.

Keywords: *Abies webbiana*, Pharmacognosy, Phytochemicals, Gas chromatography-mass spectrometry, Herbal medicine.

INTRODUCTION

Abies webbiana (Wall ex D. Don) Lindl is called as *Thalisapathiri* in Tamil, *Talisapathra* or *Patradhyam* in Sanskrit, and Yew or Himalayan Silver in English. This lofty fir is widely distributed on higher ranges of Himalayas region from Kashmir to Assam states in India [1]. It is a tall evergreen coniferous tree grows up to 60 m with strong horizontally spreading branches, young shoots covered with short brown hair. Leaves are simple, densely covering the twigs spreading in all directions, each leaf 1.5-2.3 cm long; the cones are bluish in color, and the seed is winged. Leaves are aromatic and shiny, midrib in the upper surface channeled down the middle but raised beneath; with two faint white lines on either side of the midrib beneath, petiole very short, grayish-brown, terebinthine such as odor and astringent taste [2].

In Siddha system of medicine, it acts as a stomachic, carminative, expectorant, and tonic. This plant powder is ground with vinegar and applied over the head for a head ache, head heaviness, and sinusitis. Gargling the leaf powder decoction for throat pain and mouth ulcer and it is also used as a tooth powder for tooth pain [3]. It is used for a chronic cough, wheezing, fever, tuberculosis, vomiting, indigestion, gastritis, and bone fever [4]. It is the main ingredient in many Siddha formulations such as *Thalisathi choornam*, *Thalisadi vadagam*, *Thuthuvalai nei*, *Thippili rasayanam,* and *Elathi curnam* [5]. The leaves of this plant have different uses in *Ayurveda* against swasa (chronic obstructive pulmonary diseases), kasa (cough), gulma (tumor), agnimandya (hypochlorhydria), amadosha (amoebiasis), hikka (hiccup), chhardi (vomiting), krimi (helminthiasis), and mukharoga (mouth disorders) [6,7].

A. webbiana leaf has been reported to exhibit antibacterial, antifungal, mast cell stabilizing, anxiolytic, antitumor, anti-inflammatory, antitussive, female antifertility, febrifuge, antispasmodic properties, central nervous system depressant actions and effective against hyperglycemia, conception, and rheumatism [7-12]. Bronchodilator and antiplatelet activities of *A. webbiana* were investigated [13,14] and evaluated the antioxidant and antimicrobial activity of *A. webbiana* extract. Effect of *A. webbiana* leaf extract on sleeping time and inflammation was analyzed [10].

Ghosh and Bhattacharya applied planar chromatographic technique using different solvent extracts and visualize the chemical diversity in *A. webbiana* leaves and detected amino acids, flavonoids, saponins, tannins, alkaloids, lipids, triterpenoids, and steroids [6]. In phytochemical screening certain chemical constituents, mainly monoterpenes (from essential oil), biflavonoid glycosides, phytosterols, and diterpene glycosides were found and a new alkaloid, namely, 1-(4'-methoxyphenyl)-aziridine, nitrogenous compound and new biflavonoid, Abiesin have been isolated [6,7,15].

Even though few works have been conducted on *A. webbiana* leaf, till date there is no information about the botanical and chemical characterization including gas chromatography-mass spectrometry (GC-MS) analysis. Since the leaf material of *A. webbiana* is often used in Indian traditional medicine, in this study, we have investigated the pharmacognostic characters of *A. webbiana* leaf material to identify and authenticate the raw material to use it as one of the ingredients of several formulations.

METHODS

Preparation of the drug

Raw drug was procured from local market, Thanjavur, Tamil Nadu, India, and identified in the NABL accredited lab of CARISM, SASTRA University and authenticated using macroscopic and microscopic studies. *A. webbiana* leaf powdered (particle size 1 mm) using a lab mill and used for further analysis.

Microscopic studies

Transverse section of *A. webbiana* was taken with the help of a razor blade, and very thin sections were chosen. Thin section was stained with different stain solutions such as toluidine blue "O," 1% phloroglucinol, Sudan red, and iodine potassium iodide [16]. The powder microscopic characters of *A. webbiana* leaf powder also studied [17]. The presence of calcium carbonate crystals was observed by taking a pinch powdered drug and treated with acetic acid (60 g/L), and the preparation was mounted and observed under a microscope. The presence of fats and fatty oils was analyzed by taking one pinch of powdered drug with 1-2 drops of Sudan red solution, heated gently and the preparation was irrigated with ethanol (750 g/L), and the slides were mounted and observed under the microscope. Mucilage was investigated by taking a pinch of powdered drug and treated with Chinese ink (1:10 with water), and the slides were mounted and observed under the microscope. For the starch test, a pinch of powdered drug was treated with iodine (0.02 M) solution, and the slides were mounted and observed under the microscope. The presence of tannins was assessed by treating a pinch of powdered drug with 1-2 drops of ferric chloride (50 g/L), and the slide was mounted and observed under the microscope.

Chemical standardization

The pH of the aqueous solution of *A. webbiana* powder (1%, W/V) was measured using the pH meter at 24.4°C. The determination of the total ash content of *A. webbiana* leaf powder was done [18]. Powder (1.0896 g) is added to a pre-weighed silica crucible and heated in the muffle furnace at 400°C for about 3 hrs. Then, the crucible was safely placed in the desiccator and allowed to cool to room temperature, and the weight is finally measured. The percentage weight of the ash is calculated using the formula (Weight of the ash/Weight of the drug×100). The percentage of acid-insoluble ash is calculated using the formula, Weight of the residue/Weight of the powder×100, where the weight of the residue is the net weight of ash.

The loss on drying (LOD) was estimated by taking 1.0605 g of powder in a pre-weighed dish and placed in the hot plate at a temperature of 105°C and the LOD was calculated using the formula (Weight of the dish before LOD–Weight of the dish after LOD/Weight of the sample×100). The alcohol and water-soluble extractives of the powder were analyzed [18]. Dry powder (1.0034 g) was taken in two beakers separately, and 50 ml of alcohol in the first beaker and 50 ml of water was added in the second one and shaken well manually. The beakers were kept aside for 24 hrs, and thereafter, 10 ml of the solution was taken and kept in hot air oven at 105°C. Finally, the percentage weight of the extract is calculated using the formula (Weight of residue/Weight of the drug×100) (Table 1).

Extract preparation

For preparing extract, 10 g of dry powdered material was taken with 100 ml of hexane, chloroform, ethyl acetate, ethanol, methanol, and water separately in individual conical flasks. The mixer was kept for 24 hrs at room temperature (37°C). Then, the contents were filtered through a filter paper placed on the funnel, and the volume of the extract was noted and the extracts thus obtained were used for phytochemical screening.

Phytochemical screening

The presence of phenolic compounds was identified by taking 1 ml of extract with 5 ml alcohol and a pinch of ferric chloride. The presence of alkaloids was detected using Dragendorff's' test, in which, 0.5 ml of extract was taken with 0.2 ml of acetic acid and 1 ml of Dragendorrf's reagent and shaken well. The presence of flavonoids was detected by adding 2 ml of extract with 1 ml of hydrochloric acid and a pinch of magnesium turnings and boiled for few minutes. The terpenoids were detected by taking 0.5 ml of extract with tin pellet and 0.2 ml of thionyl chloride and heated gently. The extract (0.5 ml) was mixed with 0.1 ml of lead acetate and observed for tannins. To identify the presence of saponins, 0.5 ml of extract was mixed with 5 ml of distilled water and shaken vigorously. For confirming the presence of steroids, the extract (0.5 ml) and 0.5 ml of acetic anhydride were taken and few drops of concentrated sulfuric acid were added. To know the presence of quinones, 0.5 ml of extract was added with 0.1 ml of sulfuric acid. For coumarins test, 0.5 ml of extract was mixed with 0.2 ml of sodium hydroxide. The extract (0.5 ml) was mixed with Fehling's (A and B) to reveal the presence of sugars.

GC-MS analysis

Extract preparation for GC-MS, 10 g of dry powdered material was taken with 100 ml of methanol in conical flasks. The mixer was kept for 24 hrs at room temperature (37°C). Then, the contents were filtered through a filter paper placed on the funnel and the volume of the extract was noted. The extracts were kept in the water bath 3 hrs for drying. After drying, the methanol extract was analyzed using gas chromatographic system coupled with mass spectrometry (Perkin Elmer, Model: Clarus-500). Silica capillary column (30 m×0.25 mm, 0.25 µm film thicknesses, Elite-5 MS non-polar fused) was used. Oven temperature was programed with an increase of 6°C/minutes to 150°C; injector temperature was 280°C; carrier gas was helium with the flow rate of 1 ml/min. Sample (1.4 µl) was injected with split ratio of 1:10. Ionization energy 70 ev was used in the electron ionization mode; ion source temperature was set at 160-200°C, mass was scanned in the range of 40-450 amu. The resulted mass spectrum was compared with inbuilt NIST library database and fragments of various compounds present in the extracts were identified.

RESULTS AND DISCUSSION

Microscopic studies

Transverse section leaf revealed the presence of upper and lower epidermis, vascular bundle, and oil-containing cells (Fig. 1a). Upper epidermis is made up of single layer of round shaped thick walled cells with thick cuticle. Upper epidermis is followed by two layers of elongated palisade parenchyma cells, which is followed by several large sized brown colored several oil-containing cells present (Fig. 1b). Lower epidermis is made up of single layered papillose cells with thick cuticle (Fig. 1c). Open vascular bundle present in the center of the leaf. Xylem is present in the adaxial side, whereas phloem present in abaxial side of the leaf. Xylem is made up of 3-4 layered lignified cells which consisting of xylem tracheids and xylem fibers. Phloem is made up of several layered compressed cells (Fig. 1d). Round shaped parenchyma cells were seen in the right and left side of the vascular bundle. The vascular bundle is surrounded by a group of small and large sized oil-containing cells. Simple and compound, round, oval and polygonal shaped starch grains were seen in parenchyma cells. The epidermal cells were noticed to contain tannins.

The results of powder microscopic studies of *A. webbiana* were showed in the Fig. 2. The presence of prismatic calcium oxalate

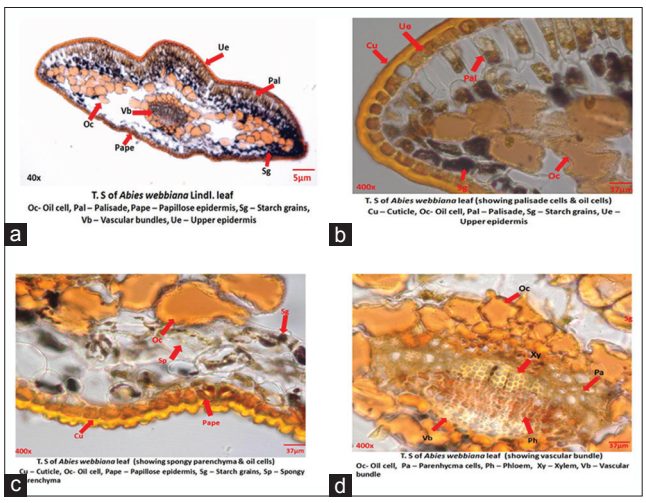

Fig. 1: (a-d) Transverse section of *Abies webbiana* leaf

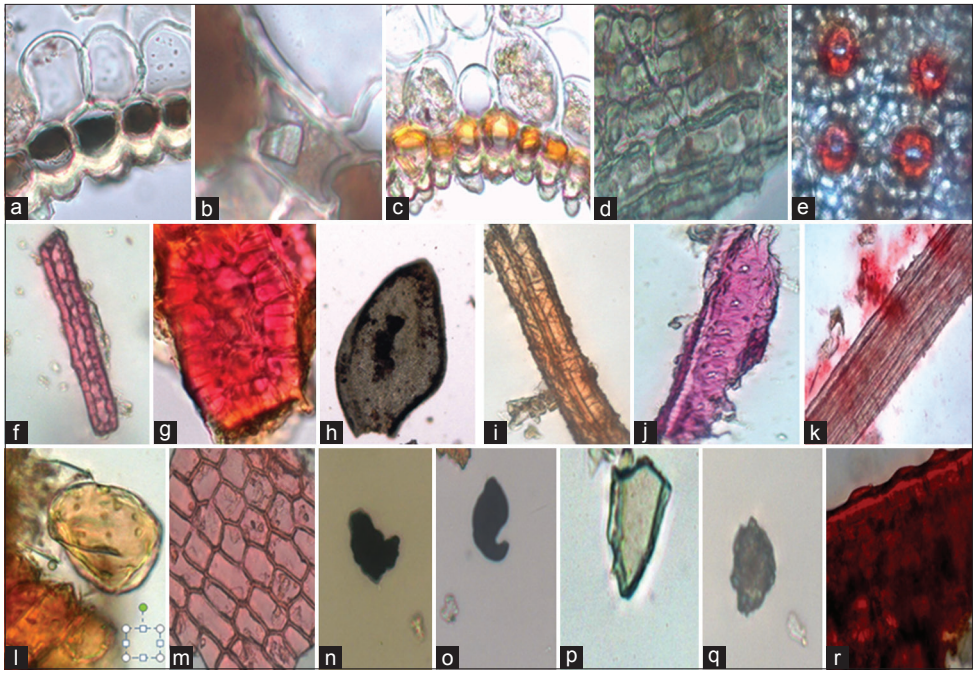

Fig. 2: Powder microscopic images of *Abies webbiana* leaf. (a) Tannin-containing cells, (b) parenchyma cells with prismatic calcium oxalate crystals, (c) pappilose parenchyma, (d) crystal fibers, (e) stomata, (f) elongated sclereids, (g) macro sclereids, (h) scaly leaf, (i) tracheids with spiral thickening, (j) tracheids with bordered pitted thickening, (k) bundle of fibers, (l) glandular trichome, (m) epidermis, (n) compound starch grains, (o) simple starch grains, (p) prismatic calcium oxalate crystals, (q) druses type of calcium oxalate crystal, and (r) epidermis with wavy cuticle

crystals and tanniferous cells were also found. Starch grains are simple round, oval, and polygonal in shape. The presence of tracheary elements with spiral and pitted thickening along with bundle of fibers was observed. Epidermal cells were present with beaded cell walls and sunken stomata; guard cells and epidermal cells are lignified. Surface view of the rectangular epidermal cells and some cells embedded with brown content are also seen. Groups of sclereids with the wide lumen, striated thick walled and branched pits were also seen. Oil-containing cells and crystal fibers were also observed in *A. webbiana* powder.

Chemical standardization

LOD test procedure concludes the amount of volatile matter (i.e., water drying off from the drug). The LOD of *A. webbiana* leaf material was 6.90%, indicates the presence of low level of moisture content in the drug, which will be useful to prevent the microbial spoilage of herbal drugs. As per Ayurvedic Pharmacopoeia of India [1], total ash and acid-insoluble ash of *A. webbiana* should be less than 6 and 0.5% and our results are in agreement with the levels (5.23% and 0.57%, respectively). Water-soluble and alcohol-soluble extractives of *A. webbiana* leaf powder were found to be 23.79% and 18.37%, respectively, and these results fall within the range denoted by Ayurvedic Pharmacopoeia of India [1] (Alcohol-soluble extractive is not less than 14% while water-soluble extractive is not less than 15%).

The pH of the herbal aqueous extract is one of the physical parameters which could be used to find out the quality of the medicinal herbs. The pH value of liquid is defined as the common-logarithm of the hydrogen ion concentration. The aqueous extract of *A. webbiana* leaf powder exhibited slightly acidic pH (5.25). In general, the herbal extract with neutral pH is desirable to use as medicine and if the pH falls either extreme acidic or alkaline range the drug is unfit for consumption.

Phytochemistry

Phytochemical screening revealed the presence of sterols, terpenes, sugars, phenols, flavonoids, tannins, saponins, and quinones in the methanol extract of *A. webbiana* (Table 2). Hexane extract showed

Table 1: Chemical standardization of *Abies webbiana* leaf powder

Serial number	Parameters	Results (%)	Reference values (%)
1	LOD	6.90	-
2	Total ash	5.23	Not more than 6
3	Acid-insoluble ash	0.57	Not more than 0.5
4	Water-soluble extractive	23.79	Not less than 15
5	Alcohol-soluble extractive	18.37	Not less than 14
6	pH	5.25	-

LOD: Loss on drying

the presence of saponins and quinones, whereas only quinones were found in chloroform and ethyl acetate extracts. Sterols, terpenes, phenols, and flavonoids were noticed in ethanolic extract while in water extract presence of sterols, sugars, and saponins were identified. The presence of these phytochemical constituents might be responsible for the therapeutic properties exhibited by this plant. Sterols act as anti-inflammatory, antispasmodic, analgesic, and antidiuretic agent [19], and they also enhance fertility [20,21]. Terpenes are antibacterial, analgesic, and anti-inflammatory agents [22,23].

Phenols are naturally occurring compounds in plants. Plant phenols are groups of antioxidant that reduce various stages of cancer process [24]. Pharmacologically, phenols give security against cardiovascular disease and prevent oxidative damage to biomolecules such as DNA, lipids, and proteins, which play a role in chronic diseases such as cancer and cardiovascular diseases [25]. Flavonoids have antifatigue, antihyperlipidemic activity, radical scavenging activity, and iron chelating activity [26]. Tannins are a general explanatory name for a group of polymeric phenolic substances competent of tannin leather or precipitating gelatin from solution. Tannins have antibacterial, antifungal, analgesic, and anti-inflammatory activities [22,27].

Table 2: Phytochemical profile of methanolic extract of *Abies webbiana* leaf

Serial number	Compounds	Hexane	Chloroform	Ethyl acetate	Methanol	Ethanol	Water
1	Sterols	-	-	-	+	+	+
2	Terpenes	-	-	-	+	+	-
3	Sugars	-	-	-	+	-	+
4	Alkaloids	-	-	-	-	-	-
5	Phenols	-	-	-	+	+	-
6	Flavonoids	-	-	-	+	+	-
7	Tannins	-	-	-	+	-	-
8	Saponins	+	-	-	+	-	+
9	Quinones	+	+	+	+	-	-
10	Coumarins	-	-	-	-	-	-

Table 3: Phytocomponents detected in the methanol extract

Serial number	Peak name	Retention time	Peak area	Peak area (%)
1	Name: Propanoic acid, 2-oxo-, methyl ester Formula: $C_4H_6O_3$ MW: 102	2.87	7204766	0.7676
2	Name: Furfural Formula: $C_5H_4O_2$ MW: 96	3.42	501764	0.0535
3	Name: 2-Furanmethanol Formula: $C_5H_6O_2$ MW: 98	3.75	3905145	0.4161
4	Name: 2-Cyclopenten-1-one, 2-hydroxy- Formula: $C_5H_6O_2$ MW: 98	4.88	2588093	0.2757
5	Name: 2,4-Dihydroxy-2,5-dimethyl-3(2H)-furan-3-one Formula: $C_6H_8O_4$ MW: 144	5.74	1340004	0.1428
6	Name: 1,4-Dioxane, 2-methyl-3-methylene- Formula: $C_6H_{10}O_2$ MW: 114	7.44	1915514	0.2041
7	Name: 2,5-Dimethyl-4-hydroxy-3(2H)-furanone Formula: $C_6H_8O_3$ MW: 128	7.73	1953841	0.2082
8	Name: 3-Acetylthymine Formula: $C_7H_8N_2O_3$ MW: 168	8.35	4544862	0.4842
9	Name: 4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl- Formula: $C_6H_8O_4$ MW: 144	9.67	10481657	1.1167
10	Name: 2-Furancarboxaldehyde, 5-(hydroxymethyl)- Formula: $C_6H_6O_3$ MW: 126	11.81	84619728	9.0154
11	Name: Hexanoic acid, 3-hydroxy-, methyl ester Formula: $C_7H_{14}O_3$ MW: 146	12.20	8775495	0.9349
12	Name: 2-Methoxy-4-vinylphenol Formula: $C_9H_{10}O_2$ MW: 150	13.44	2476747	0.2639
13	Name: 2-Propenoic acid, 3-phenyl-, methyl ester Formula: $C_{10}H_{10}O_2$ MW: 162	14.88	2361859	0.2516
14	Name: Benzaldehyde, 3-ethoxy- Formula: $C_9H_{10}O_2$ MW: 150	15.41	6697106	0.7135
15	Name: 2-Propenoic acid, 3-phenyl- Formula: $C_9H_8O_2$ MW: 148	16.57	3167118	0.3374
16	Name: Phenol, 2-methoxy-4-propyl- Formula: $C_{10}H_{14}O_2$ MW: 166	16.89	326929	0.0348
17	Name: D-Allose Formula: $C_6H_{12}O_6$ MW: 180	19.10	6634424	0.7068

(*Contd...*)

Table 3: ***Continued***

Serial number	Peak name	Retention time	Peak area	Peak area (%)
18	Name: 2-Butanone, 4-(4-hydroxyphenyl)- Formula: $C_{10}H_{12}O_2$ MW: 164	19.99	114714608	12.2217
19	Name: Benzenepropanol, 4-hydroxy-à-methyl-, (R)- Formula: $C_{10}H_{14}O_2$ MW: 166	20.88	523524032	55.7763
20	Name: Phenol, 4-(2-propenyl)- Formula: $C_9H_{10}O$ MW: 134	21.42	1782100	0.1899
21	Name: Phenol, 4-(ethoxymethyl)-2-methoxy- Formula: $C_{10}H_{14}O_3$ MW: 182	22.43	27994092	2.9825
22	Name: Benzeneacetic acid, 4-(1,1-dimethylethyl)-, methyl ester Formula: $C_{13}H_{18}O_2$ MW: 206	22.96	11613530	1.2373
23	Name: Benzeneacetic acid, 4-hydroxy-3-methoxy-, methyl ester Formula: $C_{10}H_{12}O_4$ MW: 196	24.62	3340505	0.3559
24	Name: 2-Cyclohexen-1-one, 4-hydroxy-3,5,6-trimethyl-4-(3-oxo-1-butenyl)- Formula: $C_{13}H_{18}O_3$ MW: 222	26.42	4997756	0.5325
25	Name: 3,7,11,15-Tetramethyl-2-hexadecen-1-ol Formula: $C_{20}H_{40}O$ MW: 296	26.68	7132554	0.7599
26	Name: Benzenepropanoic acid, 3,4-dihydroxy- Formula: $C_9H_{10}O_4$ MW: 182	27.33	10915640	1.1630
27	Name: 3-O-Methyl-d-glucose Formula: $C_7H_{14}O_6$ MW: 194	27.78	2151998	0.2293
28	Name: n-Hexadecanoic acid Formula: $C_{16}H_{32}O_2$ MW: 256	30.41	36698544	3.9099
29	Name:(Z) 6,(Z) 9-Pentadecadien-1-ol Formula: $C_{15}H_{28}O$ MW: 224	34.71	44254192	4.7148

Saponins are traditionally used as detergents, pesticides, and molluscicides, in addition to their industrial application as foaming and surface active agents and also have beneficial health effects [22]. It is applied for treating fungal and yeast infections. These compounds provide natural antibiotics, which help the body to fight infections and microbial invasions, and also exhibit anti-inflammatory effect, hemolytic activity, and cholesterol binding properties [28]. Quinones have many biological effects such as anticancer, antimicrobial, and anti-inflammatory effects and are used as laxatives and also to treat fungal skin diseases [29].

GC-MS analysis

GC-MS analysis of methanolic extract of *A. webbiana* was shown in Table 3. The GC-MS profile indicated the presence of 29 phytochemical compounds. It specifies more quantities of some phytochemicals such as benzene propanol (55.77%), 2-butanone (12.22%), furancarboxaldehyde (9.01%), pentadecadien (4.71%), and n-hexadecanoic acid (3.90%).

In this study, we have detected benzenepropanol as the major compound out of 29 phytoconstituents. It is an aromatic alcohol with many chemical names such as 3-phenyl-1-propanol, 3-phenylpropan-1-ol, hydrocinnamyl alcohol, and 3-phenylpropyl alcohol [30]. It is a colorless liquid, smells like hyacinths and tastes similar to apricot. It occurs in many fruits and berries, cinnamon, some types of balsam, tobacco smoke, and *Cynodon dactylon* [31]. Antimicrobial and antioxidant properties of this compound have been reported [31,32]. 3-Phenylpropanol is typically used as a perfume for applications such as antiperspirants, creams-lotions, lipsticks, talcum powder, tablet soap, shampoo, hair conditioner, bath/shower gel, detergent powder, liquid detergent, fabric softener, candles, and incense.

Another major compound of methanolic extract of *A. webbiana* is 2-butanone. It is also known as methyl ethyl ketone, which is an organic compound. This colorless liquid ketone has a sharp, sweet odor reminiscent of butterscotch and acetone. It is produced industrially on a large scale and also occurs in trace amounts in nature [33]. It is soluble in water and is commonly used as an industrial solvent [34]. Previously, it was identified in coriandrum flowers [35].

2-furancarboxaldehyde has other chemical names such as 2-furaldehyde, furfural, furan-2-carbaldehyde, 2-furancarboxaldehyde, and furaldehyde. Furfural is an organic compound derived from a variety of agricultural byproducts including corncobs, oat, wheat bran, and sawdust. The name furfural comes from the Latin word furfur, meaning bran, referring to its usual source. Furfural is a heterocyclic aldehyde, with the ring structure. It is a colorless oily liquid with the odor of almonds, which quickly darkens when exposed to air. It is one of the components found in vanilla. The n-hexadecanoic acid was reported to show various biological activities such as antioxidant, hypocholesterolemic, nematicide, antiandrogenic, hemolytic, antibacterial, cytotoxic, and as 5-alpha reductase inhibitor and flavoring agent [35,36] also indicated the use of this compound in cosmetics, antipsychotic medication, and pesticide.

Phenol, 4-(ethoxymethyl)-2-methoxy derivative is present in various plants and is known for its antibacterial and anti-inflammatory

activities [37]. 2-Cyclopenten-1-one identified in *Aloe barbadensis* Miller [38]. 4-H-pyran-4-one, 2, 3-dihydro-3,5-dihydroxy-6-methyl, 2-Propenoic acid were reported in *Erythropalum scandens* Bl., Bijdr plants tender shoots [39]. Methyl ester (z, z, z) has anti-inflammatory and antiarthritic properties as reported by earlier workers [40]. Benzaldehyde, 3-ethoxy was reported to possess antioxidant and cytoprotective properties [41]. D-allose exhibited antioxidant activity [42]. Benzeneacetic acid is also called as phenylacetic acid and has a strong antisickling activity. It found in foods and has been associated with astringency, discoloration, and inhibition of some enzyme activity. It also known to provides the human body with an extra line of defense against bacterial and viral attacks and thereby boosting the immune system [43].

Hexanoic acid is also called as caproic acid, and its antifungal and flavor role was reported [44]. 3, 7, 11, 15-tetramethyl-2-hexadecen-1-ol was noted in *Allamanda cathartica* L. [44]. Phytol is an acyclic diterpene alcohol that can be used as a precursor for the manufacture of synthetic forms of vitamin E and vitamin K in addition to its antimalarial activity [35]. Benzenepropanoic acid is otherwise called as phenylpropanoic acid or hydrocinnamic acid and hydrogenated cinnamic acid derivative products are mainly used to inhibit or prevent cerebral insufficiency or enhance recognition. 3-O-methyl-d-glucose is used as preservative [45], which was also identified in the plant *A. cathartica* [44]. Hexadecanoic acid has antioxidant property [46], whereas pentadecadien has antiplasmodial and cytotoxic activities [47].

CONCLUSION

In this study, we have evaluated the pharmacognostical characters of *A. webbiana* leaf, which is the important herbal ingredient in several Siddha and Ayurveda formulations. Botanical characteristics of *A. webbiana* leaf were reported based on the observation of transverse section and powder microscopy results. Chemical standards, such as LOD, ash content, and extractive values, were determined for *A. webbiana* leaf. Phytochemical screening revealed the presence of large number of compounds such as sterols, terpenes, phenols, flavonoids, tannins, saponins, and quinones only in the methanol extract of *A. webbiana*. The GC-MS profile indicated the presence of 29 phytochemical compounds and more quantities of benzene propanol, 2-butanone, furancarboxaldehyde, pentadecadien, and n-hexadecanoic acid. Thus, this current study provides the scientific evidence for the presence of various phytoconstituents, which might be responsible for the reported medicinal properties of this plant. The pharmacognostic characters observed from the present study could be useful in the identification and authentication of this drug.

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