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Research Article

Pharmacognostical Studies on the Leaves of *Dodonaea viscosa* (L) Jacq

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ABSTRACT
Dodonaea viscosa Linn. (Sapindaceae) is an evergreen shrub distributed throughout in India. It has been used traditionally in the treatment of various diseases such as malaria, ulcers, dysmenorrhoea, rheumatism, sprains, bruises, burns and wounds. The present study deals with the pharmacognostical evaluation of leaves of *Dodonaea viscosa* Linn. Macromorphology and microscopy (transverse section, powder microscopy and quantitative microscopy) were studied to establish the salient diagnostic features. Physico-chemical characters like ash and moisture content, extractive values and crude fibre content of the leaf samples were determined and reported. Various pharmacognostical and physico-chemical parameters studied have pivotal roles in identification, authentication and establishment of quality parameters of this plant material.

Keywords: *Dodonaea viscosa*; Physico-chemical parameters; Microscopy; Lamina.

INTRODUCTION

Dodonaea viscosa Linn. (Sapindaceae) is an evergreen shrub or small tree distributed throughout in India. This plant is commonly known as Hop bush plant in English and Sinatha in Hindi[1]. The stem, leaves, seeds, roots, bark and aerial parts are used in traditional medicine. Traditionally the leaves are used in the treatment of fever, malaria, ulcers, diarrhea, dysmenorrhoea, rheumatism, sprains, bruises, burns and wounds[2]. It is proved to have antibacterial, antiviral, analgesic, anti-inflammatory, antiulcer and antioxidant activity[3]. Literature showed the presence of flavonoids, diterpenoid acids, saponins, P-coumarin acid ester, sterols, essential oils and tannins[4]. The macroscopic and microscopic study of a medicinal plant is the first step towards establishing the identity and the degree of purity of such materials. Lack of proper standards of medicinal plants may result in the usage of improper drugs which in turn will cause damage not only to the individual using it, but also to respect gained by the well known ancient system of medicine and the entire work on the plant becomes invalid. Thus, in recent Years there has been an emphasis in pharmacognostical standardization of medicinal plants of therapeutic potential. So, the present study was undertaken to standardize *Dodonaea viscosa* (L.) Jacq. pharmacognostically which helps in the correct identification of the drug.

MATERIALS AND METHODS

The fresh healthy plant leaves of *Dodonaea vicosa* Linn. were collected from the Alagarkovil Hills, Madurai, TamilNadu, India. The plant was identified and authenticated by DR. P. Jayaraman, Botanist, Plant anatomical research centre, Chennai and a voucher specimen number PARC/2010/2169. The paraffin embedded specimens were sectioned with the help of Rotary Microtome to 10-12 µm thickness. Dewaxing of the sections was done by customary procedure[5,6]. The sections were stained with Toluidine blue which is a polychromatic stain. Photographs of different magnifications were taken with Nikon labphoto 2 microscopic Unit[7,8]. Quantitative microscopy such as stomatal number, stomatal index, vein islet number, vein termination number and palisade ratio were observed for the leaf[9]. Leaves were shade dried, powdered, sieved and used for organoleptic, microscopic and physico-chemical analysis as per standard procedure[10].

RESULTS

Macroscopy

The organoleptic and morphological features of the leaf of *Dodonaea viscosa* were observed. Leaves are Simple, lanceolate, acute at both ends, narrowed to distinct petiole, stipulate, entire margin and symmetrical base. The midrib prominent with closely arranged lateral nerves and pinnately parallel venation. The Color is dark green on the upper surface and pale green on the lower surface with no odour and sour taste. Upper surface is shining, more or less viscid with yellowish resinous exudation.

Anatomy of the leaf

The leaf consists of a thick conical midrib and uniformly thick lamina (Fig. 1). The midrib is semicircular and slightly raised on the adaxial side and prominently thick

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and conical on the abaxial side. The adaxial epidermis cells are small and possess conical cuticular spines. The abaxial epidermis cells are squarish in shape and some of the cells have spiny cuticle. The ground tissue consists of about five layers of small collenchyma cells and thin, compact angular parenchyma cells. The vascular system includes as adaxial horizontal band and an abaxial arc of vascular elements. The adaxial system consists of several rows of angular thick walled xylem elements with transverse of phloem elements which has a thick arc of sclerenchymatous cap. The abaxial system also consists of a semicircular mass of thick walled angular xylem elements and thin arc of phloem elements. Cup shaped arc of sclerenchyma cells occur beneath the abaxial strand.

Lamina

The lamina is dorsiventral. The adaxial epidermis consists of thick cylindrical cells with prominent cuticle. At certain places are seen shallow depression in which are seen short, subsessile peltate glandular trichomes (Fig. 2). The abaxial epidermis cells are thin and squarish in shape. The palisade cells are adaxial in position. They form a dense zone of two layers of darkly stained cells. The spongy mesophyll includes lobed small cells which interlinked with each other and form aerenchymatous tissue. The lamina is 170µm thick.

Adaxial epidermis

The paradermal section showed the adaxial epidermal cells are polygonal in outline with thin and straight anticlinal walls (Fig. 3). The adaxial epidermis is apostomatic.

Abaxial epidermis

The abaxial epidermis is stomatiferous and the stomata are cyclocytic with the subsidery cells enriching the guard cells. The number of subsidery cells varies from 4 to 6 cells. The epidermal cells are elongated and rectangular in shape. Their anticlinal walls are thin and straight (Fig. 4).

Venation pattern of the lamina

The main veins and major lateral veins are thick and the veinlets are uniformly thin. The veinlets form wide areas of vein islets. The terminations are mostly unbranched, occasionally they fork into 2 units at the tip. Calcium oxalate druses are sparsely seen within the islets (Fig. 5)

Petiole

The petiole is triangular with two lateral wings and one abaxial wing. The petiole consists of thick squarish epidermal cells with short conical outer tangential walls. Inner to the epidermis occurs a distinct band of palisade cells. The palisade zone is absent in the abaxial part of the petiole (Fig. 6). The wings have mesophyll tissues and distinct circular small vascular bundles. The ground tissue is parenchymatous, thin walled and compact. The vascular system consists of a thick hollow, closed cylinder of xylem and phloem. In the outer part of the vascular cylinder occurs phloem. The xylem cylinder consists of short, radial lines of xylem elements and xylem fibres. The xylem elements are circular and thick walled. The central part of the petiole is occupied by parenchymatous, angular, thin walled, compact parenchyma cells.

Powder microscopy

Long, narrow thick walled lignified fibres with tapering ends (Fig. 7a) and large spherical masses of druses of calcium oxalate crystals are frequently seen in the powder (Fig. 7b). Small pieces of abaxial epidermal peeling are seen in the powder with numerous cyclocytic stomata (Fig. 7c). Small pieces of adaxial epidermal part with polygonal cells are also seen in the powder (Fig. 7d). Crystals and foliar sclereids are observed abundant in the veins of the leaf (Fig. 7e & 7f).

Quantitative microscopy

The observed values for Stomatal number, Stomatal index, Vein-islets number, Vein termination number and Palisade ratio are given in Table 1.

Physico-chemical analysis

The physiochemical characterizations of *D.viscosa* leaf powder are shown in Table 2.

DISCUSSION

The quality control of crude drugs and herbal formulation is of paramount importance in justifying their acceptability in modern system of medicine. But one of the major problems faced by the herbal drug industry is non-availability of rigid quality control profile for herbal material and their formulations. Standardization is an essential measurement for ensuring the quality control of the herbal drugs and also encompasses the entire field of study from birth of a plant to its clinical application. *Dodonaea viscosa* (sapindaceae) has many medicinal and therapeutic actions that have been scientifically validated and documented. The present investigation deals with all the physico-chemical and pharmacognostical perspectives of its leaves. The organoleptic evaluation depicts that leaves are Simple, lanceolate, acute at both ends and narrowed to distinct petiole, stipulate with entire margin

Table 1: Quantitative microscopic data of leaves of *Dodonaea viscosa.*

S. No.	Parameters	Value in 1 sq.mm(average of 10 fields)
1.	Stomatal number Abaxial	25.1- 34.1 - 40.3
2.	Stomatal index Abaxial	5.3 - 8.6 - 9.1
3.	Vein-islets number	5.7 - 7.2 - 8.3
4.	Vein termination number	9.8 - 11.1 - 14.5
5.	Palisade ratio	4.2 - 5.3 - 7.2

Table 2: Physico-chemical analysis of *Dodonaea viscosa* leaf powder.

S. No	Parameters	Percentage (%w/w)
I	Ash Values	
	Total ash	2.52 ± 0.11
	Acid insoluble ash	0.46 ± 0.03
	Water soluble ash	0.87 ± 0.04
	Sulphated ash	0.82 ± 0.04
II	Solubility	12.51 ± 0.98
	Water soluble extractive	16.89 ± 1.3
	Alcohol soluble extractive	
III	Crude fibre content	2.25 ± 1.51
IV	Loss on drying	4.56 ± 1.03

Values are expressed as Mean ± SD of triplicates

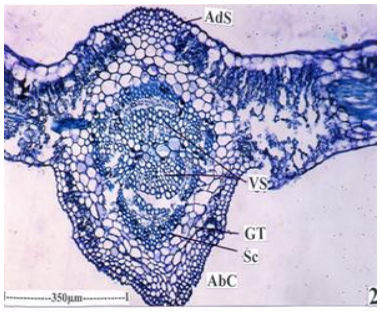


Figure 1: Anatomy of the midrib
AbS -Abaxial side, AdS- Adaxial side, GT - Ground tissue, Sc – Sclerenchyma, Vs-Vascular strand

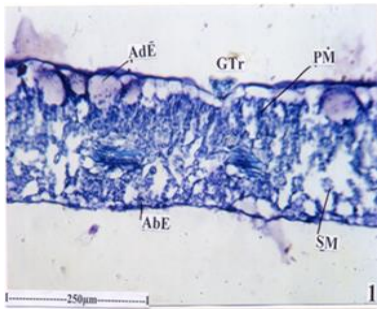


Figure 2: Transverse section of lamina
AdE- Adaxial epidermis, GTr - Glandular trichome, PM- Palisade cells, SM - Spongy mesophyll, AbE - Abaxial epidermis

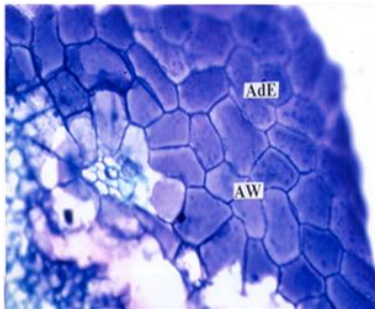


Figure 3: Adaxial epidermis in surface view
AdE – Adaxial epidermis, AW - Anticlinal wall

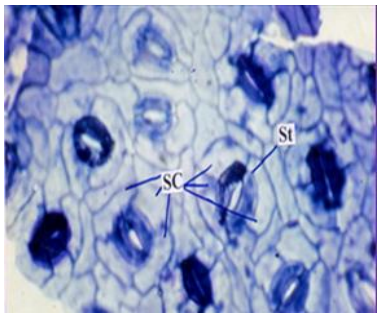


Figure 4: Abaxial epidermis in surface view
SC- Subsidery cell, St – Stomata

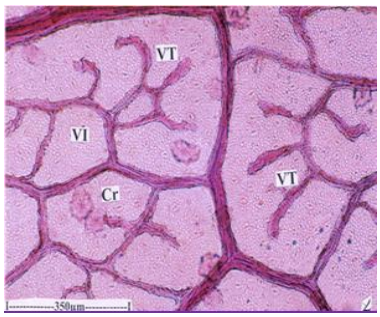


Figure 5: Venation pattern
VI - Vein islets, VT - Vein terminations.
Cr- Crystals.

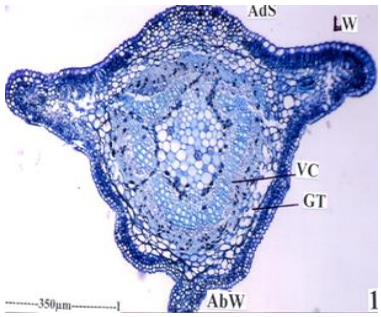
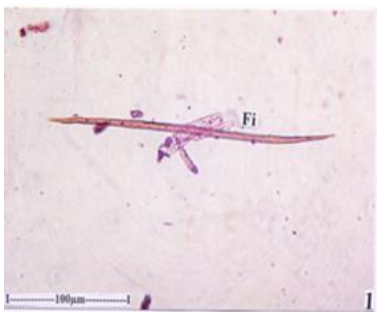
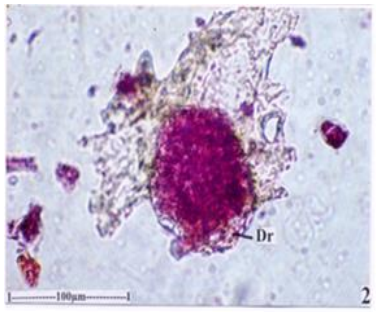


Figure 6: Anatomy of petiole
AbW - Abaxial wing, GT – Ground tissue, LW - Lateral wings, VC - Vascular cylinder,WB - Wing bundle



a



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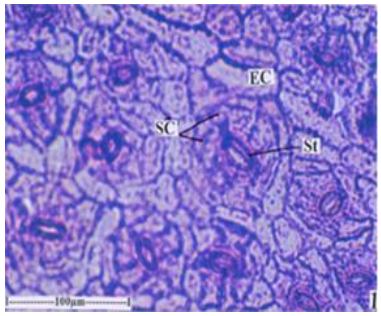

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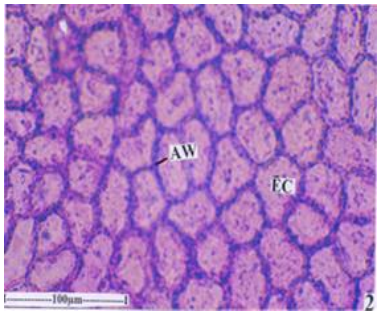

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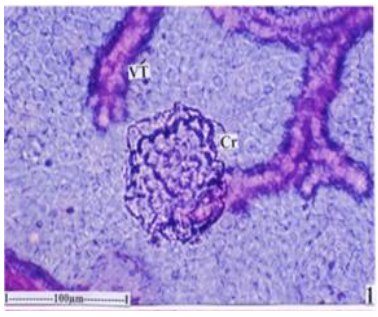

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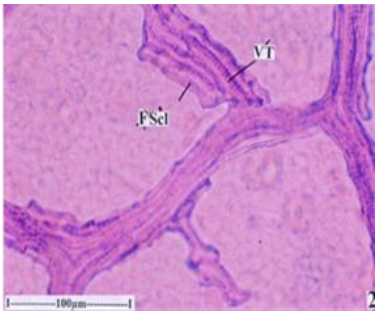

f

Figure 7: Powder microscopy
Dr – Druses, EC- Epidermal cells, Fi – Fibres, SC- Subsidery cells, St- Stomata, AW - anticlinal wall, Cr- Crystals, FScl - Foliar sclerids, VT - Vein terminations.

and symmetrical base. The microscopical analysis shows that a leaf consists of adaxial and abaxial epidermis with cyclocytic stomata and glandular trichomes. Mesophyll cells constitute palisade cells and spongy parenchyma

along with concentric vascular bundles surrounded by sclerenchyma. The diagnostic features of power microscopy include druses of calcium oxalate, fibres, xylem vessels, cyclocytic stomata and foliar sclerides. Quantitative microscopic data are useful for identifying the different species of genus and also helpful in the determination of the genuineness of the plant. The physico-chemical parameters are mainly used in judging the purity and quality of the drug. The results obtained will infer quality in terms of its moisture content, ash content, extractive values which are normally found as standard values for a particular plant.

CONCLUSION

Pharmacognostical data of *Dodonaea viscosa* will provide the standards for its identification and authentication. The other parameters which are useful in the establishment of its quality control are physico-chemical parameters and leaf constants. The data obtained in the current study will serve as an indication of quality of *Dodonaea viscosa* for quality control and standardization of this herbal drug in future.

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