



PHARMACOGNOSTICAL STUDY OF THE LEAF, STEM AND ROOT OF *BHRINGARAJA* (*ECLIPTA ALBA* LINN.) CULTIVATED THROUGH HYDROPONICS SYSTEM - DEEP WATER CULTURE (DWC).

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ABSTRACT

Background: *Bhringaraja* (*Eclipta alba* (L.)) is a widely used medicinal herb in Ayurveda, known for its *Rasayana* and *Keshya* properties. It balances *Pitta* and *Vata Doshas* and is cited across classical texts like Charaka Samhita, Sushruta Samhita, and Ashtanga Hridaya for treating conditions such as *Pandu*, *Kamala*, *Khalitya*, *Palitya*, *Kasa*, and *Shwasa*. Traditionally, crops are cultivated in soil-based systems; however, modern methods like hydroponics provide an effective alternative to overcome challenges such as soil-borne diseases, fluctuating yields, and decreasing arable land. Among hydroponic methods, the Deep Water Culture (DWC) is a hydroponic technique in which plant roots are suspended directly in a nutrient-rich, oxygenated water solution. An air pump supplies oxygen to the roots, preventing suffocation and promoting healthy growth and enhancing phytochemical profiles. **Materials and Methods:** For the present study, *Bhringaraja* (*Eclipta alba* (L.)) have been

selected as herbal drug. A thorough study has been carried out of Leaf, Stem and Root of *Bhringaraja* (*Eclipta alba* (L.)) Cultivated through Hydroponics system - Deep Water Culture (DWC) including its macroscopical and microscopical (Pharmacognostical) studies.

Observation & Result: In the present study Pharmacognostical Identification of *Bhringaraja* (*Eclipta alba* (L.)) was done which includes macroscopical and microscopical features. The Leaf of *Bhringaraja* (*Eclipta alba* (L.)) cultivated through Hydroponics system - Deep Water Culture (DWC) was greenish, oblong-lanceolate, pubescent in touch and characteristic odour. In the transverse section of the leaf, several features were observed, including upper epidermis, lower epidermis, vascular bundle, trichomes, Palisade cells, collenchyma and Sponge mesophyll. The stem was greenish brown, pubescent in touch and odourless. In the transverse section of the stem, several features were observed, including Epidermis, Hypodermis, Epidermal cells, Pericyclic fibre, Phloem, Xylem, and Pith. The root was creamish brown, rough in touch and odourless. In the transverse section of the root, several features were observed, including in Xylem, Medullary rays, Phloem, Pericycle, Cavity, Cork, Cortex and Endodermis. **Conclusion:** The structures which are observed here help in correct identification of *Bhringaraja* (*Eclipta alba* (L.)). In this study, *Bhringaraja* (*Eclipta alba* (L.)), cultivated through a hydroponic system using the Deep Water Culture (DWC), was botanically compared with a standard reference. No new structures were found during microscopy.

KEYWORD: Hydroponics, Deep Water Culture (DWC), *Bhringaraja* (*Eclipta alba* Linn.) Medicinal plants, Cultivation.

INTRODUCTION

The word 'Hydroponics' comes from the Greek term's 'hydro', meaning *water*, and 'ponos', meaning *labor*.^[1] Hydroponics, a soilless cultivation method that delivers nutrients directly to plants through water, has become an effective approach to address these challenges. Among the various hydroponic systems, the Deep Water Culture (DWC) is highly regarded for its effectiveness. Deep Water Culture (DWC) is a straightforward hydroponic method in which plant roots are immersed in a nutrient-rich solution, enabling high yields with minimal maintenance, while necessitating continuous oxygenation and frequent nutrient monitoring.^[2] This method provides improved control over the growing environment, increases phytochemical content, lowers the risk of soil-borne pathogens and pesticide-related harm, and promotes uniform plant growth. In medicinal plants such as *Bhringaraja* (*Eclipta alba* (L.)), it can also help preserve or even boost bioactive compounds, supporting their use in both traditional and modern therapies.

In *Samhitas*, *Bhringaraja* is mentioned in various therapeutic contexts. It is classified under

Prakritivighatkar Dravyas for the treatment of *Krimi*, *Palitya*, *Kaphaja Kasa* and various disease conditions.

VERNACULAR NAMES OF BHRINGARAJA^[3]

Table No. 1: Vernacular name of *Bhringaraja* (*Eclipta alba* (L.)).

1.	Sanskrit	<i>Bhringaraja</i>
2.	Hindi	Babri, Bhangra, Mochkand
3.	English	Trailing Eclipta
4.	Gujarati	Bhangra, Dodhak, Kalobhangaro, Kalaganthi
5.	Marathi	Bangra, Maka
6.	Tamil	Kaikeshi, Kayanthakoru
7.	Telugu	Guntagalijeru
8.	Urdu	Bhangra
9.	Uriya	Kesarda
10.	Bengali	Keysuria, Keshori, Kesuti
11.	Kannad	Garagadasoppy
12.	Malayalum	Kyonni
13.	Punjabi	Bhangra
14.	Arabic	Kadimelbint

TAXONOMIC CLASSIFICATION OF BHRINGARAJA

Table No. 2: Toxonomic classification of *Bhringaraja* (*Eclipta alba* (L.)).

Kingdom	Plantae
Division	Spermatophyta
Subdivision	Angiosperma
Class	Dicotyledoneae
Subclass	Gamopetalae
Group	Inferae
Family	Compositae
Genus	Eclipta
Species	Alba
Binomial name	Eclipta alba L. Hassk
Synonyms	Eclipta prostata

AIM

To perform macroscopical, macroscopical (Pharmacognostical) study of Leaf, Stem and Root of *Bhringaraja* (*Eclipta alba* (L.)) cultivated through Hydroponics system - Deep Water Culture (DWC) with a specially designed protocol.

OBJECTIVE

1. To study the macroscopic features of Leaf, Stem and Root of *Bhringaraja* (*Eclipta alba* (L.)) cultivated through Hydroponics system - Deep Water Culture (DWC).
2. To study the microscopic features Leaf, Stem and Root of *Bhringaraja* (*Eclipta alba* (L.))

cultivated through Hydroponics system - Deep Water Culture (DWC).

MATERIAL AND METHODS

Bhringaraja (Eclipta alba (L.)) were cultivated through Hydroponics system - Deep Water Culture (DWC) used as a drug material. A detailed macroscopic and microscopic study of Leaf, Stem and Root of *Bhringaraja (Eclipta alba (L.))* were carried out to establish the correct identity of the *Bhringaraja (Eclipta alba (L.))* by comparing with standard reference book of Ayurvedic Pharmacopoeia of India (API), Part I, Vol. II.^[4] and Quality Standards of Indian Medicinal Plants (Vol. 9).^[5]

The work plan was as follows:

1. Plant collection and identification
2. Pharmacognosy study
 - A. Macroscopic study
 - B. Microscopic study

1. Plant Collection and Identification

Panchanga of *Bhringaraja (Eclipta alba (L.))* was collected from the hydroponic system - Deep Water Culture (DWC) established at the Medicinal Plant Cultivation and Technique Research Laboratory (MPCTRL), Government Ayurveda College, Vadodara. Fig.1.a. After the proper collection the Macroscopic & Microscopic studies were performed at Pharmacognosy laboratory of Upgraded department of *Dravyaguna Vijnana*, Government Ayurveda College, Vadodara.

2. Pharmacognosy Study

A. Macroscopic Study

The morphological studies were carried out for shape, structure, color, odour and surface of the leaf, stem and root of *Bhringaraja (Eclipta alba (L.))* cultivated through Hydroponics system - Deep Water Culture (DWC).

OBSERVATIONS

Table No. 3: Macroscopic study of leaf, stem and root of *Bhringaraja (Eclipta alba (L.))* cultivated through Hydroponics system - Deep Water Culture (DWC).

No.	Macroscopic Characters	Observation					
		Leaves	Fig.no.	Stem	Fig.no.	Root	Fig.no.
1.	Shape and	Oblong-	1.c	Cylindrical ^[7]	1.b	Cylindrical ^[8]	1.d

	structure	Lanceolate ^[6]					
2.	Colour	Green ^[9]	1.c	Greenish brown ^[10]	1.b	Creamish brown ^[11]	1.d
3.	Odour	Characteristic ^[12]	-	Odourless ^[13]	-	Odourless ^[14]	-
4.	Surface	Pubescent ^[15]	1.c	Pubescent ^[16]	1.b	Rough ^[17]	1.d
5.	Taste	Astringent	-	-	-	-	-

B. Microscopic Study

The free hand transverse section of the Leaf, Stem and Root of *Bhringaraja* (*Eclipta alba* (L.)) was taken and slide was prepared separately using reagents Saffranine and Iodine. Various microscopic structures of transverse section (T.S.) of the Leaf, Stem and Root of *Bhringaraja* (*Eclipta alba* (L.)) were evaluated.

OBSERVATIONS

Table No. 4: Microscopic study of the Leaf, Stem and Root of *Bhringaraja* (*Eclipta alba* (L.)) cultivated through Hydroponics system - Deep Water Culture (DWC).

No.	Part	Characteristics of <i>Bhringaraja</i> (<i>Eclipta alba</i> (L.))	Figure no.
1.	Leaf	Upper epidermis	Fig.2.a
2.		Lower epidermis	Fig.2.b
3.		Vascular bundle	Fig.2.c
4.		Palisade cells	Fig.2.d
5.		Trichomes	Fig.2.e
6.		Collenchyma	Fig.2.b
7.		Sponge mesophyll	Fig.2.f
8.	Stem	Epidermis	Fig.3.a
9.		Hypodermis	Fig.3.a
10.		Epidermal cells	Fig.3.a
11.		Xylem	Fig.3.d
12.		Pith	Fig.3.e
13.		Cavity	Fig.3.b
14.		Cortex	Fig.3.b
15.		Endodermis	Fig.3.c
16.		Pericyclic fibre	Fig.3.c
17.		Phloem	Fig.3c
18.	Root	Xylem	Fig.4.a, 4.b
19.		Medullary ray	Fig.4.a
20.		Phloem	Fig.4.b
21.		Pericycle	Fig.4.b
22.		Endodermis	Fig.4.b
23.		Cork	Fig.4.c
24.		Cortex	Fig.4.c
25.		Cavity	Fig.4.c

RESULTS AND DISCUSSION

Bhringaraja (Eclipta alba (L.)) is an important plant which is used in many diseases mentioned in Ayurvedic system of Medicine literature.

In the present study Pharmacognostical identification of *Bhringaraja (Eclipta alba (L.))* cultivated through Hydroponics system - Deep Water Culture (DWC) was done which included macroscopical & microscopical features of the same.

The Leaf of *Bhringaraja (Eclipta alba (L.))* cultivated through Hydroponics system - Deep Water Culture (DWC) was Greenish in colour, oblong-lanceolate, pubescent in touch and characteristic odour. In the transverse section of the leaf, several features were observed, including upper epidermis, lower epidermis, vascular bundle, trichomes, Palisade cells, collenchyma and Sponge mesophyll.

The Stem of *Bhringaraja (Eclipta alba (L.))* cultivated through Hydroponics system - Deep Water Culture (DWC) was greenish brown, pubescent in touch and odourless. In the transverse section of the stem, several features were observed, including Epidermis, Hypodermis, Epidermal cells, Pericyclic fibre, Phloem, Xylem, and Pith.

The Root of *Bhringaraja (Eclipta alba (L.))* cultivated through Hydroponics system - Deep Water Culture (DWC) was creamish brown, rough in touch and odourless. In the transverse section of the root, several features were observed, including in Xylem, Medullary rays, Phloem, Pericycle, Cavity, Cork, Cortex and Endodermis.

CONCLUSION

In conclusion, the pharmacognostic characterization of the of *Bhringaraja (Eclipta alba (L.))* cultivated through Hydroponics system - Deep Water Culture (DWC) sample confirms the identity of the plant as a *Bhringaraja (Eclipta alba (L.))*. Microscopical observation of leaf, root and stem of *Bhringaraja (Eclipta alba (L.))* reveals the presence of Upper epidermis, Lower epidermis, Hypodermis, Vascular bundle, Palisade cells, Trichomes, Collenchyma, Epidermis, Endodermis, Paricyclic fibre, Sponge mesophyll, Phloem, Xylem, Pith, Medullary ray, Cavity, Cork, and Cortex. Thus, it provides valuable information for the correct identification of the plant No new structure found rather than standard reference given for identify of *Bhringaraja (Eclipta alba (L.))*.

Plate No. 1: Images of Macroscopy of the leaf, stem and root of *Bhringaraja* (*Eclipta alba* (L.)) cultivated through Hydroponics system - Deep Water Culture (DWC).



Fig 1.a



Fig 1.b

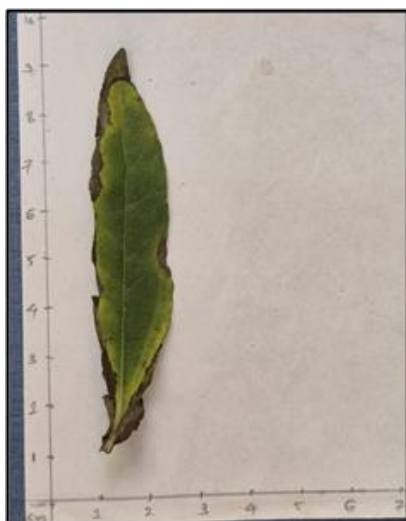


Fig. 1.c



Fig. 1.d.

Fig. No. 1: DWC system and Macroscopy of Leaf, Stem Root of *Bhringaraja* (*Eclipta alba* (L.))

Plate No. 2: Images of Microscopy of the Leaf, Stem and Root of *Bhringaraja* (*Eclipta alba* (L.)) cultivated through Hydroponics system - Deep Water Culture (DWC).

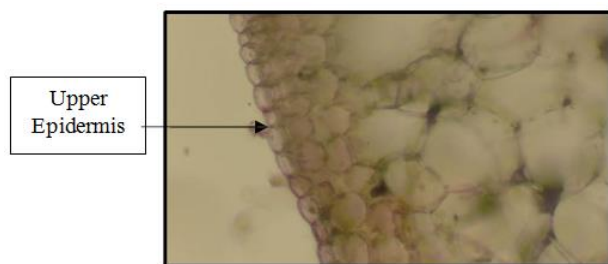


Fig. 2.a

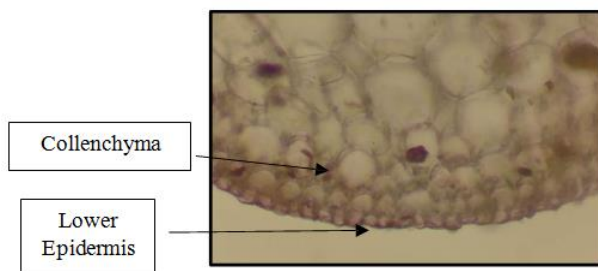


Fig. 2.b

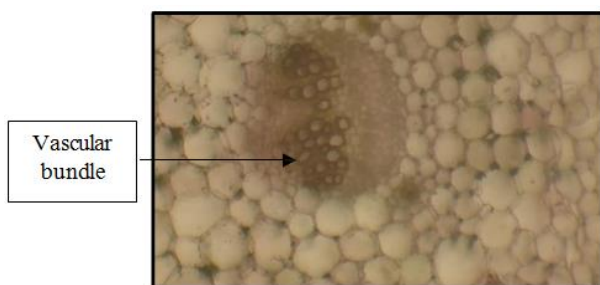


Fig. 2.c

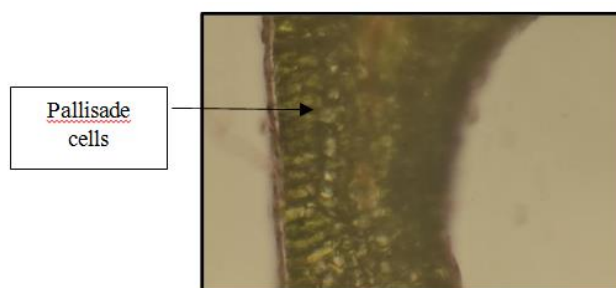


Fig. 2.d

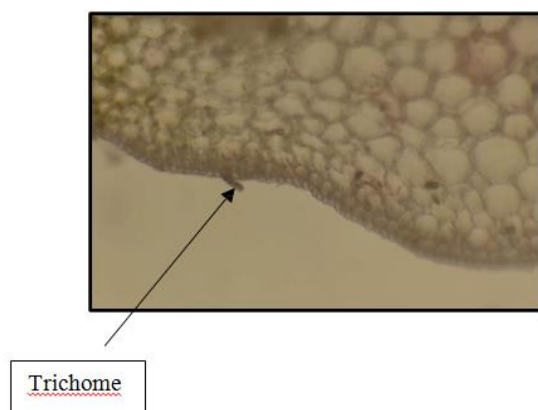


Fig. 2.e

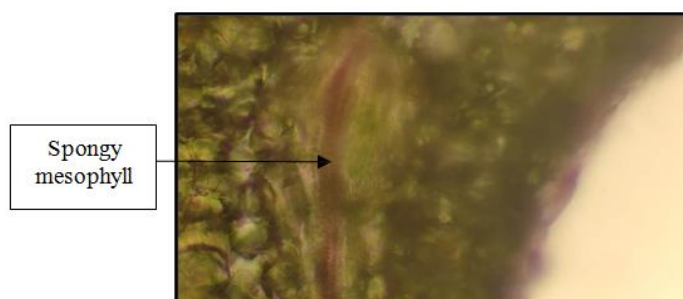


Fig. 2.f

Fig. No. 2: T.S. of Leaf of *Bhringaraja* (*Eclipta alba* (L.)).

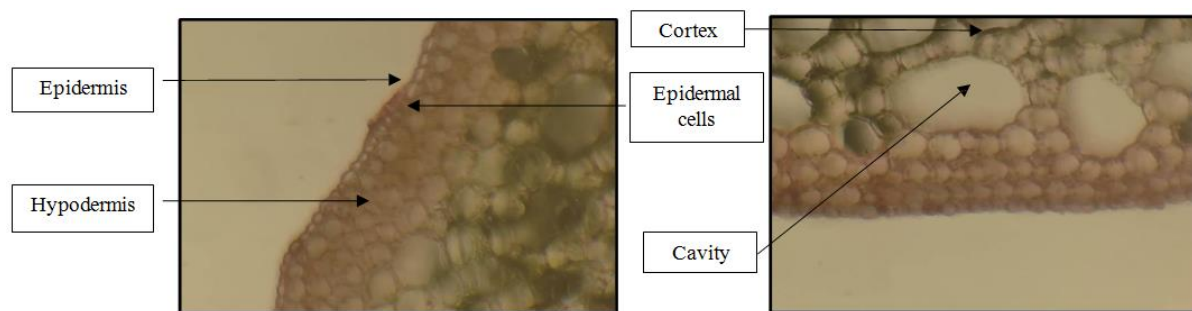


Fig. 3.a

Fig. 3.b



Fig. 3.c

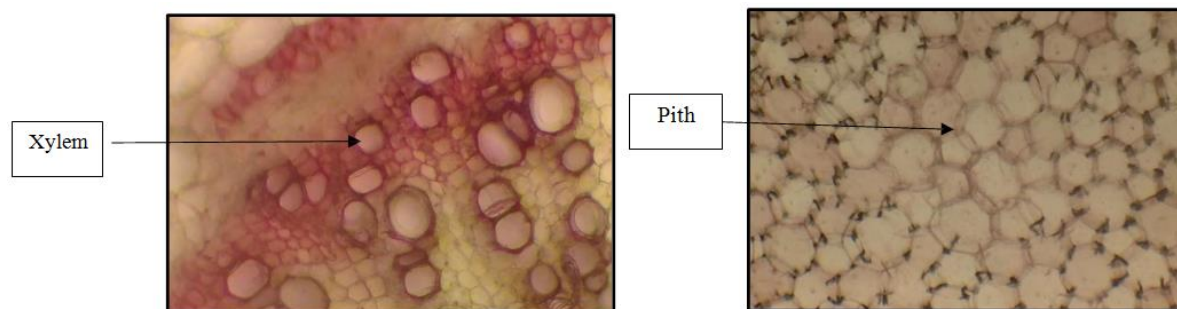


Fig. 3.d

Fig. 3.e

Fig. No. 3: T.S. of Stem of *Bhringaraja* (*Eclipta alba* (L.))

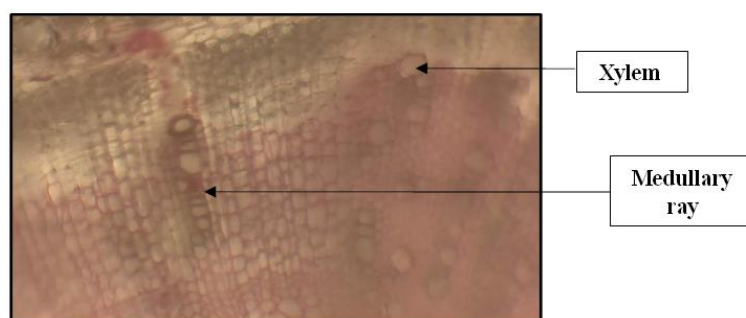


Fig. 4.a

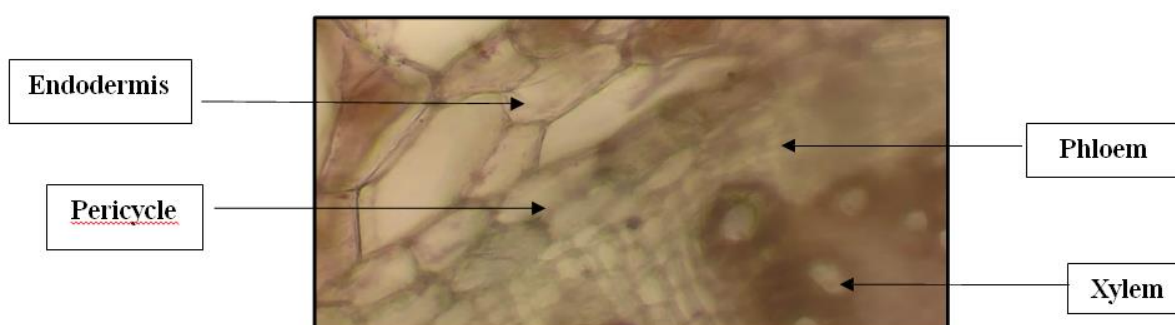


Fig. 4.b



Fig. 4.c

Fig. No. 4: T.S. of Root of *Bhringaraja* (*Eclipta alba* (L.))

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