Pharmacognostic study of different stages i.e., bud [Bala], middle and mature stages of 
[Terminalia chebula Retz.] harītakī phala

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Abstract
Objective: To investigate Macroscopic and Microscopic study of Different stages of Harītakī [Terminalia chebula Retz.] phala i.e., Bud [Bala] stage, Middle stage, Mature stage. Plant species which is well mentioned in Ayurvedic classics. This plant is also used in various medicinal preparations and is effective in treatment.

Methods: Macroscopic and Microscopic study of Harītakī [Terminalia chebula Retz.] phala i.e., Bud [Bala] stage, Middle stage, Mature stage.

Results: Macroscopic and Microscopic study of Different stages of Harītakī [Terminalia chebula Retz.] phala i.e., Bud [Bala] stage, Middle stage, Mature stage showed distinct variations in Sclerides, Parenchymatous cells, Fibres, Xylem vessels and Major Microscopic difference was noted between Bala Harītakī Phala and Mature Harītakī phala.

Conclusion: Pharmacognostic study of Harītakī Phala of different stages is helpful to ensure its Identity, Authenticity, Purity, Quality and Efficacy of the drug.

Keywords: Harītakī, Pharmacognosy, Bala harītakī, vibhitaki

Introduction
Harītakī [Terminalia chebula Retz.] belongs to family Combretaceae. A moderate sized and large deciduous tree. It is Mainly found in Punjab, Assam, Bihar, Karnataka, Western ghats, Tamil Nadu, Bombay, Kerala, Andhra Pradesh, Madhya Pradesh and Orissa. At present the fruits are procured commercially from many reserved forests of India. It has been used traditionally for curing various ailments. It acts as Doṣa Anulomana, Dīpana, Pācanā, Āyuṣyas, Vayasthāpana, Medhā, Smṛtibuddhi Balaprada, Rasayana, Malasāraka, Yogavahini, Lekhana and Vātanulomana. The potential Wound healing property¹, Anti-microbial property², Anti-aging³ property of Harītakī Fruit were evaluated in different studies mentioned here, Few to mention “The Ethanolic extract of Terminalia chebula fruit in Wound healing on Albino rats at different concentration.”

Materials and Methods
Aim: To study the Pharmacognostic study of different stages of Harītakī phala i.e Bud stage, Middle stage, Mature stage of Harītakī.

Plant material: Procurement and preparation of drug namely
Different stages of Harītakī phala i.e., Bud stage [Bala Harītakī], Middle stage, Mature stage of Harītakī.

Collection of drugs
Bud stage, Middle stage, Mature stage of Harītakī phala are collected from the drug collector and the fruits were dried in shade for 15 days. After proper drying the fruits, they were collected.

Image 1: Different stages of harītakī phala and powders of different stages of harītakī phala
Pharmacognostic study
Pharmacognosy of a plant gives a comprehensive knowledge regarding its method of identification and determination of quality and purity of the raw drugs. Every species has its own characteristic features which determine the authenticity of that particular drug. So, it becomes helpful to determine the authenticity of that particular drug and also to differentiate even closely related species of the same Genus or the same family. It is also found that often Bud [Bala] stage Harī takī is sold in place of Mature Harī takī in the name of Bala Harī takī, in the same way Vibhitaki is used in place of Bala Harī takī. It is observed that in place of Mature Harī takī phala, Bud [Bala] stage of Harī takī is substituted in markets from where the physicians of today and drug manufacturers procure their raw drug for daily requirements. Thus, there is urgent need to undertake Pharmacognostical study of the drug.

Pharmacognostic study
- Macroscopic Study
- Microscopic Study
- Powder Study

Observations and Results
The Pharmacognostic study of present work has been divided into 3 stages.

1. Bala Harī takī - Immature / Bud stage of Harī takī.
2. Madhyama Harī takī - Middle stage of Harī takī.

This study was postulated with reference of Bala Harī takī and Harī takī mentioned in few Samhitas and Nighantus. So, the idea of the present thesis was to study the structural difference in the different stages of Harī takī by looking into its Microscopic parts.
The Present Macroscopic and Microscopic study was done at S.V. Ayurvedic college, Tirupati and reports of it are mentioned below.

1] Harī takī mature stage
Name of the Sample: Harī takī
Scientific Name: Terminalia chebula Retz.
Family: Combretaceae
Plant part: Pericarp of Fruit

Drug description: Dried, Yellowish-brown colour, ovoid fruits with longitudinal ribs and wrinkles

Macroscopic properties
Size: Length: 25 to 35 mm (Ref: 20-35 mm); Width: 15 to 30 mm (Ref: 13-25 mm)
Shape: Ovoid
Colour: Yellowish-brown
Odour: Not characteristic
Taste: Astringent

Fruits ovoid in shape, Yellowish-brown in colour, externally exhibiting wrinkles and longitudinally ribbed, pericarp is fibrous, about 3 to 4 mm in thickness and non adherent to the seed.

Microscopic properties
I. T.S. of Pericarp: Transverse Section of Pericarp is done by Free hand Section cutting and Simple staining procedure and findings are as mentioned below.
Transverse section of Pericarp shows mainly three parts (A). Epicap (B.) Mesocarp (C). Endocarp

A. Epicarp
- Pericarp externally covered by a layer of Epicarp
- Epicap represented by a single layer of Epidermis, composed of a layer of cells whose tangential and upper portions of radial walls are thickened, several of them divided in to two by a thin septa.

B. Mesocarp
- Inner to the Epicarp, Mesocarp is present
- Mesocarp composed of 2 to 3 layers of collenchymatous cells without any intercellular spaces
- It is Followed by a broad zone of parenchyma in which groups of sclereids, elongated fibres in bundles and vascular strands are scattered
- Fibres are elongated, lignified with peg like outgrowths
- Some of the cells are containing rosette crystals of calcium oxalate, tannins and some other are having starch grains

C. Endocarp
- Mesocarp followed by Endocarp
- Endocarp composed of several layers of thin-walled polygon parenchymatosus cells
- In the region of Endocarp several isolated and groups of sclereids of various shapes and sizes are present, mostly sclereids are elongated and thick walled
- Several simple round to oval starch grains are observed in the parenchymatosus cells of Endocarp.
2) Harītakī bud stage
Name of the Sample: Bud stage of Harītakī
Scientific Name: *Terminalia chebula* Retz.
Family: Combretaceae
Plant part: Pericarp of Fruit

**Drug description:** Dried, black colour, ovoid fruits with prominent ridges and More Wrinkles.

**Macroscopic Properties**
- **Size:** Length: 15 to 20 mm (Ref: 15-20 mm); Width: 10 to 20 mm (Ref: 8-15 mm)
- **Shape:** Ovoid
- **Colour:** Blackish colour
- **Odour:** Not characteristic
- **Taste:** Astringent

Fruits ovoid in shape, Black in colour, externally exhibiting wrinkles and longitudinally ribbed, pericarp is fibrous, about 2-3 mm in thickness.

**Microscopic properties**

I. T.S. of pericarp: Transverse Section of Pericarp is done by Free hand Section cutting and Simple staining procedure and findings are as mentioned below.

Transverse section of Pericarp shows mainly three parts (A). Epicarp (B.) Mesocarp (C). Endocarp

A. Epicarp
- Pericarp externally covered by a layer of Epicarp
- Epicarp represented by a single layer of Epidermis, composed of a layer of cells whose tangential and upper portions of radial walls are thickened

B. Mesocarp
- Inner to the Epicarp, Mesocarp is present
- It is Followed by less broad zone of parenchyma in which groups of sclereids, Xylem elements, elongated fibres in bundles.

C. Endocarp
- Mesocarp followed by Endocarp
- Endocarp composed of few layers of thin-walled polygonal parenchymatous cells

3) HARĪtakī middle stage
Name of the Sample: Harītakī Middle stage
Scientific Name: *Terminalia chebula* Retz.
Family: Combretaceae
Plant part: Pericarp of Fruit

**Drug description:** Dried, Yellowish-green colour, ovoid fruits with longitudinal ribs and wrinkles

**Macroscopic Properties**
- **Size:** Length: 15 to 30 mm (Ref: 15-30 mm); Width: 15 to 30 mm (Ref: 13-25 mm)
- **Shape:** Ovoid
- **Colour:** Yellowish-green
- **Odour:** Not characteristic
- **Taste:** Astringent
Fruits ovoid in shape, Yellowish-green in colour, externally exhibiting wrinkles and longitudinally ribbed, pericarp is fibrous, about 3 to 4 mm in thickness and non adherent to the seed.

**Microscopic properties**

**I. T.S. of pericarp:** Transverse Section of Pericarp is done by Free hand Section cutting and Simple staining procedure and findings are as mentioned below.

Transverse section of Pericarp shows mainly three parts (A). Epicarp (B.) Mesocarp (C). Endocarp

**A. Epicarp**
- Pericarp externally covered by a layer of Epicarp
- Epicarp represented by a single layer of Epidermis, composed of a layer of cells whose tangential and upper portions of radial walls are thickened.

**B. Mesocarp**
- Inner to the Epicarp, Mesocarp is present
- Mesocarp composed of 2 to 3 layers of collenchymatous cells without any intercellular spaces
- It is Followed by a broad zone of parenchyma in which groups of sclereids, elongated fibres in bundles and vascular strands are scattered

**C. Endocarp**
- Mesocarp followed by Endocarp
- Endocarp composed of several layers of thin-walled polygonal parenchymatous cells

In the region of Endocarp several isolated and groups of sclereids of various shapes and sizes are present, mostly sclereids are elongated and thick walled.

**Powder analysis of three stages of harī takī**

**Mature stage of Harī takī:**

**Powder analysis:** Powder Analysis is carried out by clarifying the powder in chloral hydrate solution and prepared Glycerin mount, Iodine solution mount and Saffranin solution mount and the following characters are identified.

**Organoleptic properties**

- **Colour:** Light Brown
- **Odour:** Slightly pungent but Not characteristic
- **Taste:** Astringent
- **Texture:** Fine Powder

**Microscopic characters**

- Simple starch grains of various shapes and sizes.
- Fragments of Vessels with simple pitted thickenings
- Xylem fibres with peg like outgrowths, Fragments of parenchymatous tissue
- Isolated and groups of sclereids in various shapes and sizes

**Bud stage of Harī takī**

1) **Organoleptic properties**
- Texture: Rough to touch, free flowing.
- Odour: Pleasant
- Colour: Greenish black
- Taste: Astringent

2) **Microscopic characters**
   - Xylem fibres with peg like outgrowths.
   - Isolated and less groups of sclereids in various shapes and size.

**Middle stage of Harī takī**

i) **Organoleptic properties**
- Texture: Slightly Rough.
- Odour: Pleasant.
- Colour: Light yellowish.
- Taste: Astringent.

ii) **Microscopic characters**
   - Fragments of Vessels with simple pitted thickenings
   - Xylem fibres with peg like outgrowths.
   - Isolated and groups of sclereids in various shapes and sizes

**Powder analysis of Harī takī phala**

- Odour: Pleasant
- Colour: Greenish black
- Taste: Astringent

- Xylem fibres with peg like outgrowths.
- Isolated and groups of sclereids in various shapes and size.
Conclusion: It is to conclude that the Pharmacognostic Study was done on 3 different stages of Haritaki as there is a lot of substitution of Mature Haritaki with Bala Haritaki and in place of Bala Haritaki with Vibhitaki phala \(^4, 5\) which is Drupe like 2-4.5 cms long and 1.2 – 2.5 cms broad, Blackish with five longitudinal ridges and the Market value of Bala Haritaki \(^6\) (40 Rs/kg) is very high compared to Mature Haritaki Phala in certain areas. This made us to study the Pharmacognostic study to identify Authentic purity of different stages of Haritakt.

- On comparative study of different stages of Haritaki it was found that Bala Haritaki Phala is small in size with prominent ridges of 2.5 cms in length, Dark blackish to brown in colour of varying sizes, has more wrinkles compared to others.
- The Madhyama Haritaki Phala is Dark brown in colour with prominent ridges, more Oval, Globose in shape compared to Bala Haritaki Phala of 2.5 cms in length, where as Mature Haritaki Phala is Yellowish brown in colour with Longitudinal ridges and wrinkles between 2.5-3.5 cms in length, obovoid from a broad base.
- The Major Microscopic difference noted between Bala Haritaki Phala and Mature Haritaki phala are mentioned below.
- Sclerides in region of endocarp are less in density in Young ones compared to Matured Haritaki.
- Distribution of Calcium oxalate crystals in the parenchymatous cells of the endocarp is less in Young ones compared to Matured Haritaki.
- Fibres are less lignified in Young ones, when compared to Matured Haritaki.
- Wall thickening of Xylem vessels is less prominent in Young ones when compared to Matured Haritaki.

After Pharmacognostic studies, it was noted that there is difference in structure of Bud Stage Haritaki [Bala Haritaki], Middle stage of Haritaki, Mature stage of Haritaki. Structurally Mature Haritaki is well developed than other stages of Haritaki.
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