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Research Article

Phytochemical and Microscopical investigations on *Emblica officinalis* Gaertn.

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ABSTRACT
Emblica officinalis Gaertn. (*Phyllanthus emblica* Linn.), also known as amla, has been used in Ayurveda, the ancient Indian system of medicine. According to the main classic texts on Ayurveda, *Charak Samhita* and *Sushrut Samhita*, amla is regarded as the "best among rejuvenative herbs", and the "best among the sour fruits". In the present investigation, phytochemical screening and microscopical studies were carried out by Nikon Labphot 2 microscopic unit. The correct identification of the microscopical characters is of great interest for quality control in basic research and drug production, especially for raw materials sold by traditional herbalists.
Keywords: *Emblica officinalis*, microscopical studies, micromorphological investigations.

INTRODUCTION

Emblica officinalis Gaertn. (*Phyllanthus emblica* Linn.), also known as amla, has been used in Ayurveda, the ancient Indian system of medicine. According to the main classic texts on Ayurveda, *Charak Samhita* and *Sushrut Samhita*, amla is regarded as the "best among rejuvenative herbs", and the "best among the sour fruits"(Scartezzini et al., 2006). The fruits act as antioxidants(Chopra et al., 1956); immunomodulatory agents (Rama Rao, 1998); cytoprotective against chromium(Sairam et al., 2003); protects against oxidative stress in ischemic reperfusion injury (Rajak et al., 2004) etc. The root, bark and leaves are also used for the treatment of indigestion, diarrhea, dysentery, eczema and warts (Zhang et al., 2002). In the present investigation, phytochemical screening and microscopical studies were carried out by Nikon Labphot 2 on fruits to correctly identify the characters of the drug for quality control.

EXPERIMENTAL

The fruits of *Emblica officinalis* Gaertn. were purchased from the local market and authenticated by Dr. H.B. Singh, NISCAIR, New Delhi. The fruits were dried in shade and powdered. The dried fruit powder was used for the study.

The dried powdered plant material was extracted with methanol using the standard Soxhlet extraction procedure. The extract was screened for different classes of phytoconstituents using specific standard reagents (Farnsworth, 1966).

The powdered fruit material was used for microscopical studies. Photographs of different magnifications were taken with Nikon Labphot 2 microscopic unit. For normal observations, bright field was used. For the study of crystals, starch grains and lignified cells, polarized light was employed. Magnifications of the figures are indicated by the scale bars.

RESULTS AND DISCUSSION

Phytochemical Screening

Qualitative chemical examination of the dried fruit powder of *Emblica officinalis* revealed the presence or absence of various plant constituents. The observations were recorded in + (present) or – (absent) (Table 1).

Microscopic Studies

Anatomy of the pericarp (fruit wall)

The pericarp consisted of epicarp and mesocarp (Plate 1). The epicarp was represented by a single epidermal layer. The epidermal cells were very narrowly oblong and had prominent cuticle. Beneath the epidermis was a layer of sub-epidermal cells which were wider, tangentially oblong and occur parallel to the epidermis. Mesocarp (plates 1 & 3) was the widest part of the fruit. It consisted of several layers of parenchyma cells. The cells were homogeneous, thin walled, polyhedral in shape and compact (plates 1.1, 1.2). Scattered in the parenchymatous mesocarp were seen several vascular strands, which form a network of vascular tissues. The vascular bundles (plate 3.1). were small and varied in size and shape. Each strand had a cluster of xylem elements and a small group of phloem elements (plate 3.2). Xylem elements were highly thick walled. Phloem consisted of fairly large sieve tubes and companion cells.

Powder Microscopic Characters

Crushed rind of the fruit showed the masses of parenchymatous cells and thin pieces of epicarp or epidermal cells. Epidermal cells (surface view) appeared rectangular and hexagonal (plates 2.1, 2.2). The cells were thick (plate 2.2) and the walls were lignified. When the powder was stained with Sudan-III, many cells of the mesocarp were seen having large lipid bodies (plates 5.1,

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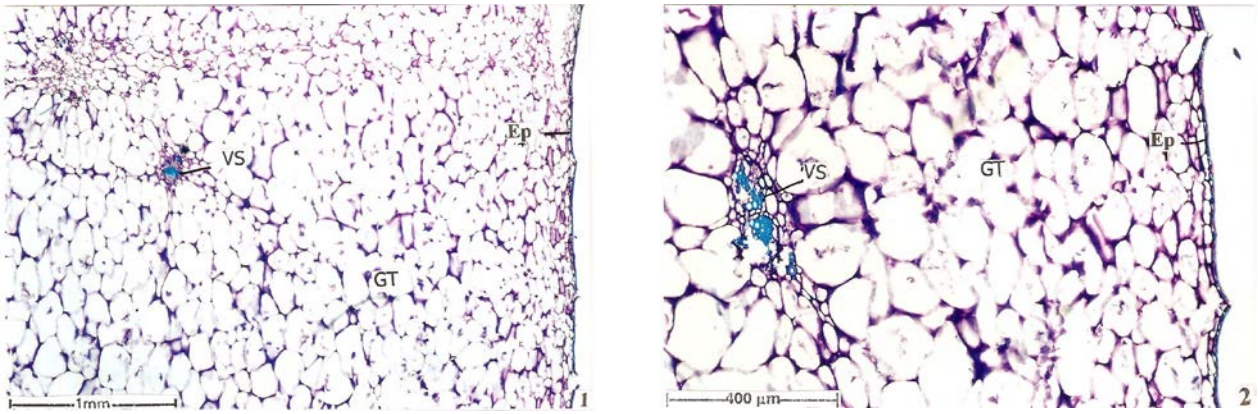
Plate 1: Anatomy of The Pericarp

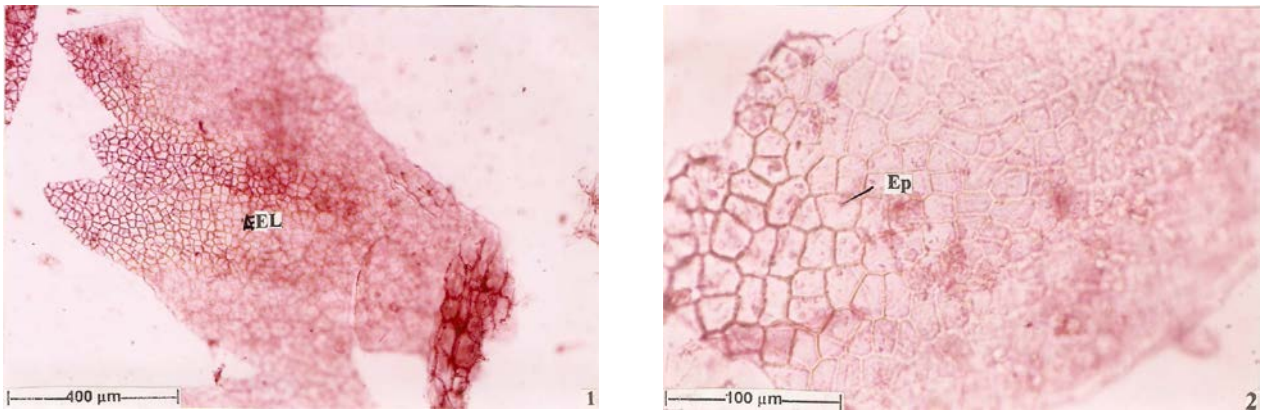


T.S of the pericarp under low magnification[1.1]

Enlarged pericarp tissues[1.2]

Ep: Epidermis; GT: Ground Tissue; VS: Vascular Strand

Plate 2: Fragment of The Epicarp

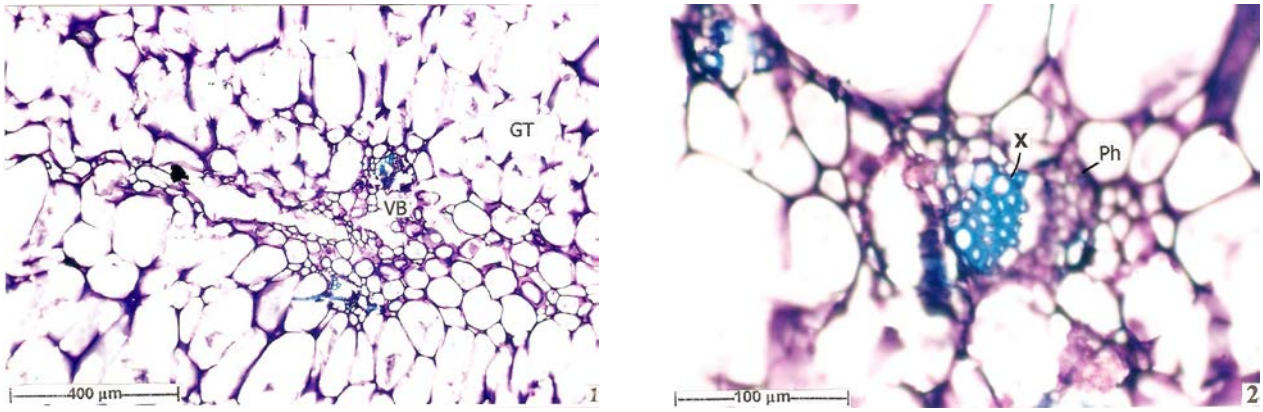


Cells under low magnification [2.1]

Enlarged cells showing cell wall structure [2.2]

Ep: Epidermal Cells

Plate 3: Structure of the Vascular Strands in the Mesocarp

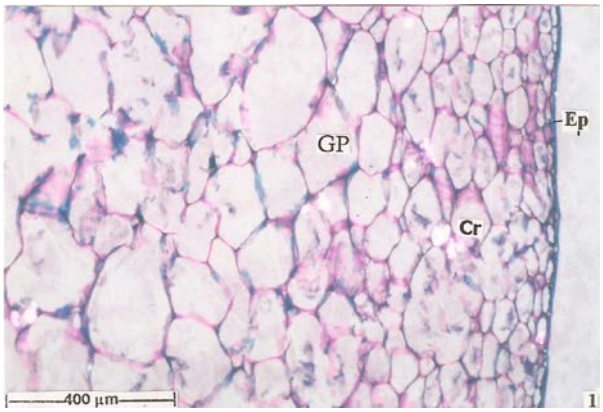


Vascular strand and the ground tissue[3.1]

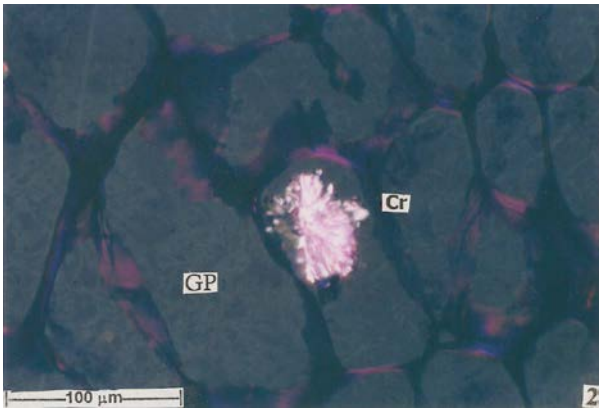
Enlarged vascular strand showing xylem and phloem [3.2]

GT: Ground Tissue; Ph: Phloem; VB: Vascular Bundle; X: Xylem

Plate 4: T.S of the Pericarp Showing the Crystal Aggregation



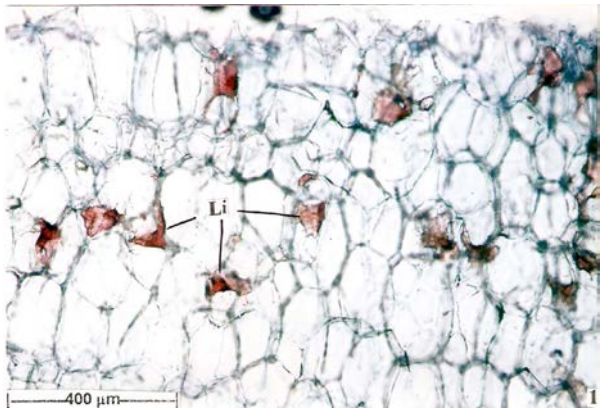
T.S of pericarp under bright field microscope [4.1]



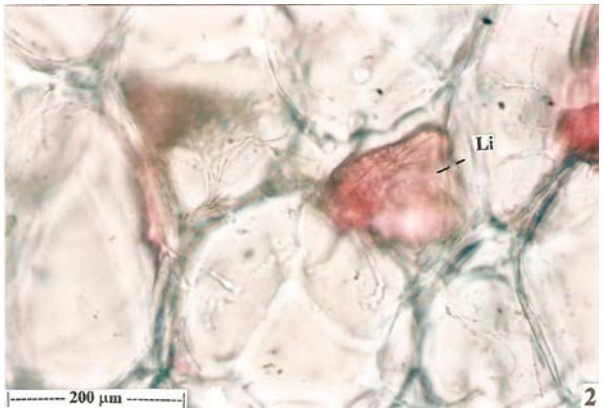
T.S of pericarp under polarized light microscope showing rosette shaped crystal mass[4.2]

Ep: Epidermis; Cr: Crystal; GP: Ground Parenchyma

Plate 5: Powder Microscopic Structure of the Pericarp



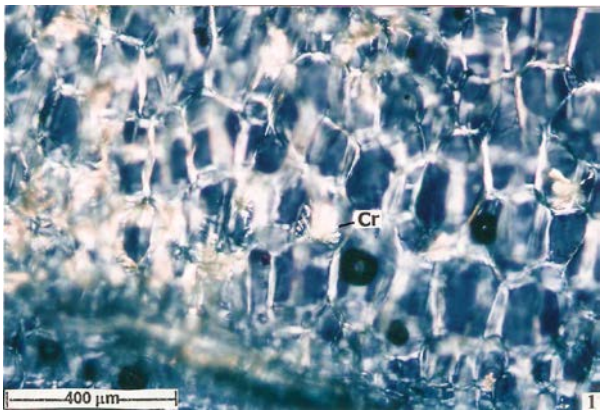
Ground parenchyma cells stained with Sudan-III to show the lipid bodies [5.1]



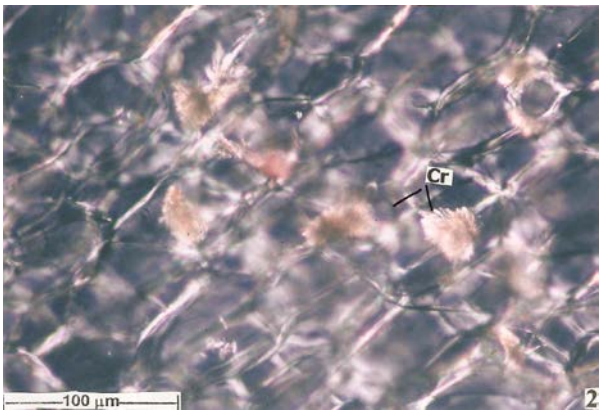
ged lipid bodies[5.2]

Li: Lipid

Plate 6: Crystal Distribution in the Pericarp Cells



Crystals under bright field microscope stained with toluidine blue [6.1]



Crystals under polarized microscope showing the Position and distribution pattern of the crystal masses[6.2]

Cr: Crystal

Table 1: Phytochemical screening of *Emblica officinalis*

Plant Constituent Test / Reagent used	Observations
Alkaloids	
Hager's reagent	+
Wagner's reagent	+
Mayer's reagent	+
Carbohydrates and Glycosides	+
Molisch's reagent	+
Fehling solution	+
Benedict's reagent	+
Iodine test	+
Libermann-Burchard's test	+
Legal's test	
Fixed oils and fats	
Spot test	–
Saponification test	–
Saponins	
Foam test	–
Tannins	
Ferric chloride solution	+
Lead acetate solution	+
Proteins	
Millon's reagent	–
Ninhydrin reagent	–

5.2). These lipid bodies represented the characteristic feature of the fruit.

When the powder was viewed under polarized light microscope, rosette calcium oxalate crystals were observed (plates 4.1, 4.2, 6.1, 6.2). These were numerous, minute and had adhered to the cell walls. The aggregate of needle crystals appear bright under dark background when viewed in the polarized light.

CONCLUSION

The morphological identification of Emblica officinalis, in powdered form, may be very difficult or even impossible by macroscopical observation alone. Microscopical investigation may contribute to the characterization of this medicinal plant.

The features observed have, thus, given useful data for the characterization of Emblica officinalis fruits and altogether help in the identification of commercial drug samples and of fragments in which the different macroscopical characters of the species are not generally distinguishable.

The present study therefore draws attention to the importance of correct identification of the microscopical characters of drugs for quality control in basic research and drug production, especially for raw materials sold by traditional herbalists.

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