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MORPHOLOGICAL, ANATOMICAL AND PHYTOCHEMICAL STUDIES ON BARK OF *AEGLE MARMELOS* (L.) CORR.

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Aegle marmelos (L.) Corr. is belongs to family Rutaceae. It is known as *Sriphala, Bael, Bela, Bilva, Bael fruit, Bill, Bilum, Bilvaphal, Sriphal* and *Bilva*. The bark is used in various ayurvedic preparations. It is also used in hypochondriasis, melancholia and palpitation of heart and stomach pain, intestinal disorders and nervous diseases. The quality of bark which available in the form of pieces or fine powder in market is doubtful. Therefore, attempts were made to standardize the bark by studying its morphology, anatomy, and phytochemistry. By applying above parameters in combination, the bark of *A. marmelos* can be standardized.

Keywords : *Aegle marmelos;* Anatomy; Morphology; Phytochemistry.

Introduction

Medicinal plants are highly effective and safe; hence their demand is constantly increasing. Every part of medicinal plant i.e. root, stem, leaves, wood, bark, flower, fruit, and seed may be employed in therapeutics. Out of these, bark is an important plant part available from tree species. The term bark refers to all tissues outside the vascular cambium of the axis, in either a primary or secondary state of growth[1,2]. Bark of *Aegle marmelos* is used for indigestion and decoction is used against intermittent fever and hypochondriasis, irritability in children[3,4]. It is also used in jaundice, epilepsy, diarrhoea, mental ailments[5], antioxidant and antidiabetic activity[6], breast cancer[7] diarrhoea, dysentery[8]. The bark is prescribed as an antitode to snake venom[9]. *Aegle marmelos* bark can be easily adulterated. As the supply of crude drug is inadequate, traders adulterate this genuine crude drug with low grade material. Attempts were made during present investigation to standardize the bark drug by using characters related with morphology, anatomy and phytochemistry.

Material and Methods

The bark was collected from authentically identified tree. It was removed with the help of cutter, chisel and hammer and bought to laboratory immediately. It was studied for morphological characters and was preserved in 70% alcohol in large jar for the Anatomical study. The sections were taken by free hand method and were double stained permanently prepared. The chemicals present in bark drugs were analyzed qualitatively as well as quantitatively[10-12].

Observations

Morphology of bark : Thickness of fresh bark ranges 15 to 26 mm and dried bark 11 to 19 mm, hard, outer surface slightly rough. Split in to rectangular or irregular pieces (Rhytidomes) and shallow grooves, travels longitudinally, outer surface ash–creamish, grayish colour, inner surface yellowish–creamish, smooth with fine texture. The dried bark curved, fracture easy, smooth and regular, taste bitter.

Anatomy of bark : T.S. of the stem bark (Fig.1) revealed the cork was the outer layer which is 60-80 layered. This layer is interrupted at certain places because of rhytidomes; cells were rectangular or polygonal, 15-20 x 15-30µ. Cortex was multilayered and composed of tangentially elongated rectangular, rarely squarish or oval cells; cells were moderately thick walled, 15-35 x 20-60µ. Some cork cells with prismatic crystals of calcium oxalate. The crystals were squarish, rhomboidal in shape. Some of them cortical cells were tanniniferous. Large patches of stone cells were randomly distributed in the cortex, stone cells were tangentially elongated, linear, oval, rarely polygonal but elongated in groups of 5-30, these patches of stone cells were associated with the prismatic crystals, and patches range 20-75 x 30-250µ. Mucillage canals were randomly distributed in upper cortex which are circular or oval, their diameter ranges from 90-130µ. Sieve elements were circular to oval and around 30-40µ in diameter, which were associated with companion cells. Fibers were in patches, which were 2-4 layered thick, tangentially elongated patches traversed by medullary rays. The

Fig.1. T.S. of bark with modullary rays in *A. marmelos.*

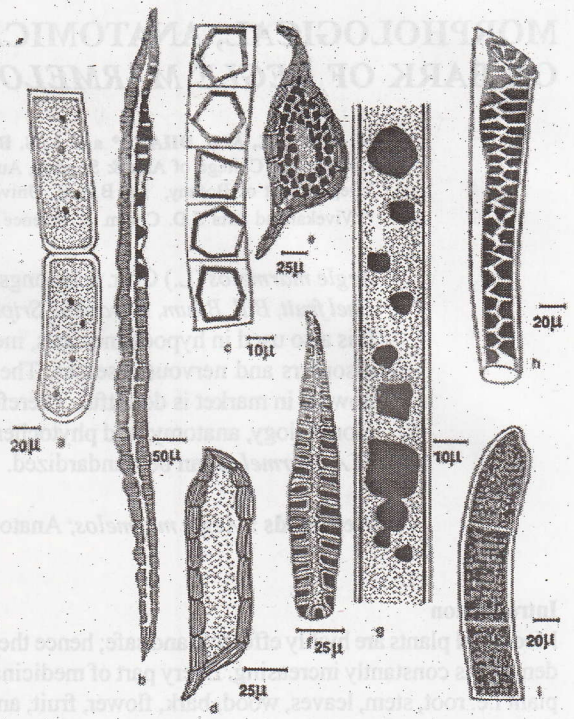

Fig.2. Macerated cells of *Aegle marmelos* Fig. a- Parenchymatous cells, b-Fibre, c- Crystals in row, d- Stone cell with large lumen, e-Stone cell with two beaks, f-Stone cell with one beak, g-Latex cell, h- Sieve element, i-Cells with yellow inclusions.

patches of fibers were arranged in concentric rings in secondary phloem. Phloem parenchyma is irregular in shape, moderately thick walled and loosely arranged. Some of the sieve elements were tangentially compressed and forming tangentially elongated sclerenchyma.

*Maceration of Bark :*Maceration of bark revealed rectangular, moderately thick walled cells 25-30 x 90-110µ with starch grains. The cells were in chain (Fig.2a). The fibres were very thick walled, the walls of the fibres wavy, variously thickned. Some fibres were crystalline fibres. The crystals were associated with them. Fibres measured 1150-1600µ in length (Fig .2b). Crystals were squarish to rectangular 15-20 x 20-25µ including polygonal prismatic crystals (Fig.2c). Stone cells of various types and of various steps of their development. Moderatly thick-walled cells with large lumen 25-40 x 150-200µ with thin striations of the cell wall. The cells with beak at one or both ends (Fig.2d). Some stone cells were oval to ovate, elongated with beak at both ends. The cells were very thick walled, imprignated with some black chemical substances, lumen small (Fig.2e). A third kind of stone cells with very thick walled, such cells were narrow, tapering at one end which were measured 25-40 x 200-275µ, lumen of such cells was very thin (Fig.2f). Latex cells which were linear, straight, about 20µ thick measured up to 8000µ in length. It contains various substances of various sizes (Fig.2g). Sieve elements were 20-50µ in diameter and 220-280 in length. End walls were oblique with sclariform sieve plates (Fig.2h). Rectangular cells in a chain and highly imprignated with yellow coloured substances measuring from 20-40 x 50-80µ (Fig.2i).

Phytochemistry : The chemicals present in bark drugs were analyzed qualitatively as well as quantitively following[10-12]. Occurrence or absence of specific chemicals may give the criteria to standardize the bark drug. The chemical composition, extractive values and distribution of phenolic acids are given in Table 1, 2 and 3.

Conclusion

Anatomical features including cork, cortex and secondary phloem, macerated cells like fibres, crystalline fibres,

Table 1. Phytochemistry of bark.

Chemical composition	% of DM
Dry Matter (DM)	62.50
Total Ash	10.55
Nitrogen (N)	1.50
Water soluble Nitrogen	0.62
Carbohydrates	73.58
Total Sugar	3.25
Reducing Sugar	1.19
Non Reducing Sugar	2.06
Crude Fiber (CF)	20.15
Crude Fat (C Fat)	6.5
Cellulose	29.20
Hemi cellulose	7.2
Lignin	2.9
Tannins	14.5
Calcium (Ca)	4.48
Phosphorus (P)	0.112
Potassium (K)	0.409

Table 2. Extractive values.

Solvents	Percentage
Water	8.04
Methanol	7.80
Alcohol	3.80
Benzene	1.60
Petro. Ether	0.36
Chloroform	1.94
Acetone	2.02

Table 3. 3. Distribution of Phenolic Acid.

Phenolic acid	Status
Vanilic acid	+
Syringic acid	+
Ferulic acid	+
Protocatechuicacid	-
P-hydroxy benzoic acid	-
P-coumaric acid	-
Phloretic acid	-
Melilotic acid	-

different stone cells, parenchymatous cells, latex cells, sieve elements, and cells with inclusions form the criteria for the standardization of *A. marmelos* bark. Other important phytochemical parameters are considered as strict parameters. Presence of vanilic acid, syringic acid and ferulic acid are also used as criteria. The above all parameters in combinations determine genuinity or authenticity of the *A. marmelos* bark.

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