



# Pharmacognosy, Nutritional Value and Antioxidant Activity of *Aglaia elaeagnoidea* (A.Juss.) Benth.

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## ABSTRACT

**Introduction:** *Aglaia elaeagnoidea* (A.Juss.) Benth. of Meliaceae is a small tree found in tropical forests. The tree yields subglobose, acidic, tan coloured edible berry. The fruits are said to be a rich source of vitamin and are used by traditional community as a source of energy and nutrition. Apart from this folk practitioners also use this as a source of fermentation initiators in the preparation of alcoholic fermentation products. **Methods:** Matured fruits collected in fruiting season are used for the study. Macro-microscopy, physicochemical standards, HPTLC, nutritional evaluation and antioxidant study carried out using standard methodology. **Results:** Tan coloured aromatic, acidic fruits, shown a thick pericarp with lignified trichomes; a thick mesocarp filled with sclerides and stones cells and a mucilaginous endosperm are distinctive macro-microscopic findings. Physico-chemical Standards, HPTLC mark the standards of the drug; whereas fruits shown the presence of carbohydrates and terpenoids compounds. Wild edible fruits proved presence of nutritional factors carbohydrates (57.10%), proteins (52.78%), and fat (0.80%) along with good amount of antioxidant property when analysed through DPPH method. Physico chemical standards and HPTLC marks the standard of the drug. The fruit shows the presence of carbohydrates and terpenoids. Wild edible fruits proved presence of nutritional factors carbohydrates (57.10%), proteins (52.78%), and fat (0.80%) along with good amount of antioxidant property when analyzed through DPPH method. **Conclusion:** Further studies may prove this fruit as a source of drug in maintenance of health.

## KEYWORDS

*Aglaia elaeagnoidea*, Antioxidant, DPPH, Macro-microscopy, Nutritional evaluation.

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*Aglaia elaeagnoidea* (A.Juss.) Benth. (Meliaceae) is commonly found small tree, among tropical forests or hills of Andhra Pradesh, Karnataka, Kerala and Andaman Nicobar Islands.<sup>[1]</sup> The plant yields subglobose, ferruginous berry, which turn orange or yellow at maturity<sup>[2]</sup>. These are edible, acidic in taste and considered as a source of *Priynagu*.<sup>[3]</sup> Fruits are said to be cooling, antipyretic, astringent, antidiarrhoeal, antidysentric, anti-inflammatory.<sup>[4]</sup> The seeds are used in painful micturition. The fruits are said to be a rich source of vitamin and are used by traditional community as a source of energy and nutrition. Apart from this folk practitioners also use this as a source of fermentation initiators in the preparation of alcoholic fermentation products.<sup>[5]</sup> This wild edible fruit possessing multiple benefits has not yet recorded scientifically. Hence a pharmacognostic study of *A. elaeagnoidea* is carried out, along with its nutritional value and antioxidant profile.

## MATERIALS AND METHODS

### Collection and identification of plant samples

Fruits of *A. elaeagnoidea* were collected in fruiting season from Gokarna, Uttarkannada district, authenticated using floras and botanists opinion, and sample deposited at SDM Centre for Research in Ayurveda and Allied Sciences (Voucher No 637/15063002). Sample preserved in FAA (Formalin +5ml+acetic acid +70% ethyl alcohol -90ml). The sample were left in FAA for more than 48 hours.<sup>[6,7]</sup>

### Macroscopy

Authenticated, fresh fruits were selected and external features of the fruits were documented using Canon IXUS digital camera. The macroscopic features, colour, specific odour, and taste were noted and recorded.<sup>[8]</sup>

### Microscopy

The preserved specimens were cut into thin transverse section using a sharp blade and the sections were stained with safranin. Transverse sections were photographed using Zeiss AXIO trinocular microscope attached with Zeiss AxioCam camera under bright field light. Magnifications of the figures are indicated by the scale-bars.<sup>[9,10]</sup>

### Physico-chemical standards

Physico-chemical standards of fruits like total ash, acid insoluble ash, water soluble ash, alcohol soluble extractive water soluble extractive were detected according to standard methodology.<sup>[11]</sup>

### Nutritional value assessment

Estimation of total fat, crude fibre, total protein, reducing and non-reducing sugar, total sugar were measured as per standard protocol.<sup>[11]</sup>

### Preliminary phytochemical tests

Tests to find the presence of alkaloid, steroid, carbohydrate, tannin, flavonoids, saponins, terpenoid, coumarins, phenol, carboxylic acid, amino acids, resins, and quinine were done as per standard methodology.<sup>[11]</sup>

### HPTLC

One gram of powdered samples were dissolved in 10 ml ethanol and kept for cold percolation for 24h and filtered. 4, 8 and 12µl of the above samples were applied on a pre-coated silica gel F254 on aluminum plates to a band width of 7 mm using Linomat 5 TLC applicator. The plate was developed in toluene: ethyl acetate (5.0: 1.0). The developed plates were visualized in UV 254nm, 366 nm and then derivatised with vanillin sulphuric acid reagent and scanned under UV 254 nm, 366 nm and 620 nm following derivatisation. R<sub>f</sub>, colour of the spots and densitometric scan were recorded.<sup>[12]</sup>

### Antioxidant study

Antioxidant study of *A. elaeagnoidea* fresh fruit juice was conducted by DPPH (2, 2-Diphenyl-1-picrylhydrazyl) method using vitamin C as standard.<sup>[13]</sup>

## RESULTS AND DISCUSSION

### Macroscopy

Macroscopic photographs along with scientific records will prove as quick reference catalogue in drug identification.<sup>[13]</sup> Standard colour, shape, size and odour mentioned will from as drug identification tools. Fruits were subglobose, pear shaped, trilobular berry, 3 to 4 cm in length and 3 to 3.5cm in diameter, apex centrally depressed, whereas base attached with a rim of calyx teeth. Pedicel short attached to base. Fruit pericarp tan coloured, easily openable with slight pressure, exposing thin papery partition between three loculi. Odour characteristic and aromatic, taste sweet turning to astringent (Figure 1).

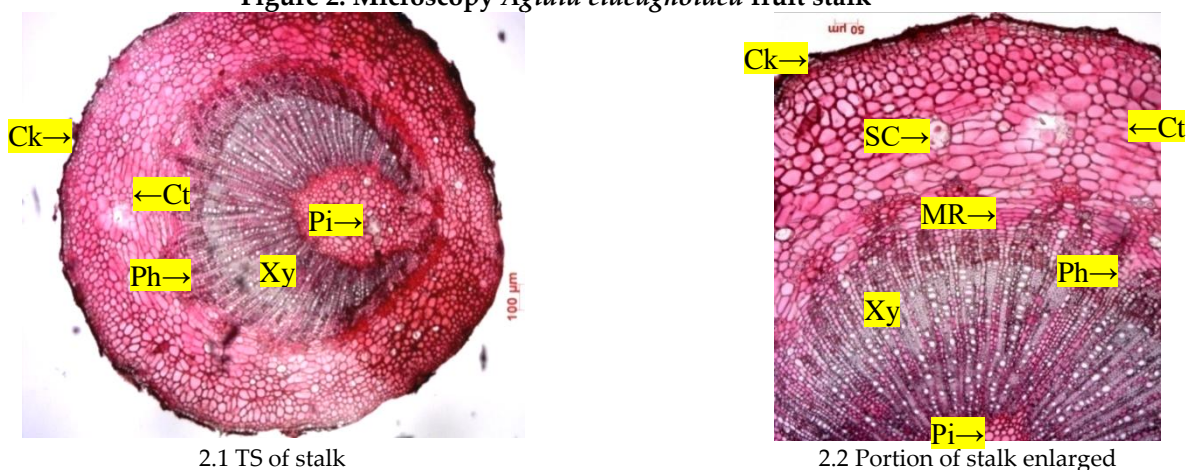
Figure 1. Macroscopy of *Aglaia elaeagnoidea* fruit



### Microscopy

TS of stalk is circular to oval in outline with irregularly elevated outermost dark brown cork tissue, wide cortex, vascular region and central pith (Figure 2.1) When region of TS is enlarged the outermost cork tissue is seen in 3 to 5 layers; cortex is formed by thick walled parenchyma without much inter cellular space and the cortex is embedded with few isolated or groups of stone cells with narrow lumen. There is a well developed lignified cylinder of xylem with ring of cambium separating it from phloem which is traversed with fibres and medullary rays. In the centre there is pith formed majorly by parenchyma and few stone cells of the type described in cortex (Figure 2.2).

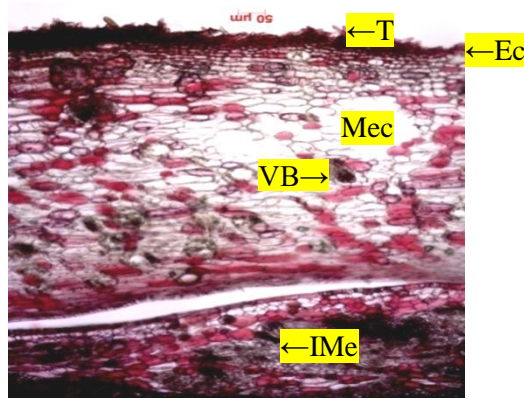
Figure 2. Microscopy *Aglaia elaeagnoidea* fruit stalk



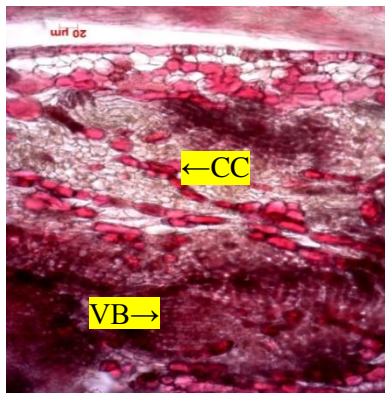
Ck - Cortex; Ct - Cortex; MR - Medullary ray; Ph - Phloem; Pi - Pith; SC - Stone cells; Xy - Xylem

TS of pericarp shows an outer layer of epidermis bearing simple trichomes, 4 to 5 rows of compact hypodermal tissues and wide mesocarp formed by loosely arranged parenchyma embedding vascular bundles (Figure 2.1). When a region of TS is enlarged the mesocarp is divided into outer and inner regions; the parenchyma cells contain dark brown contents, starch grains and crystals; vascular bundles are embedded in this region (Figure 2.2 and 2.3).

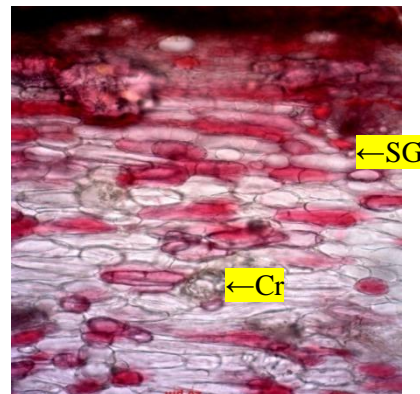
**Figure 2. Microscopy *Aglaia elaeagnoidea* pericarp**



2.1 TS of pericarp showing outer and inner mesocarp



2.2 Inner mesocarp

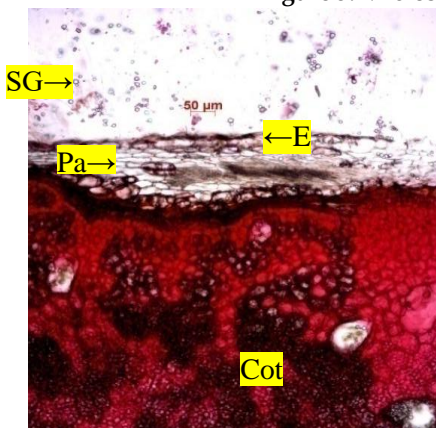


2.3 Mesocarp portion enlarged

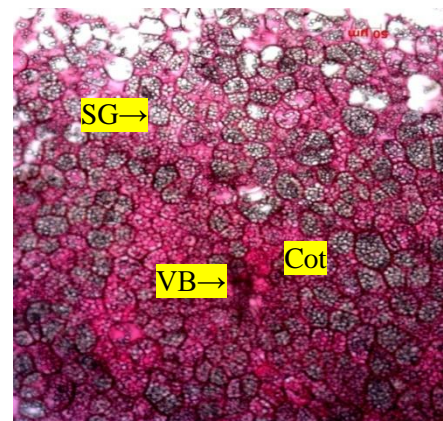
CC – content cell; Ec - Epicarp; IMe – Inner mesocarp; Mec – Mesocarp; SG – starch grains; T – trichome; VB – vascular bundle

TS of seed shows outermost epidermal cells with thickened outer wall followed by thin walled compactly arranged parenchyma towards outer side and enlarged cells towards inner side. The major area of the section is occupied by polygonal parenchyma with abundant simple starch grains forming the cotyledon, few vascular bundles being embedded in this region (Figure 3).

**Figure 3. Microscopy *Aglaia elaeagnoidea* seed**



TS through outer region of seed



TS through inner region of seed

Cot - cotyledon; En - Epidermis; Pa – Parenchyma; SG – Starch grains

Anatomical findings serve as excellent standards for authentication of medicinal plants.<sup>[14]</sup> The histological pattern obtained from microscopic observation of this species will help in authentication of this plant material even in dried crude drug form.

#### Physico-chemical and nutritional value

These are a measure of purity along with physical and chemical contamination.<sup>[16]</sup> The results obtained for the individual parameter of fruits are discussed. Loss on drying (15.82%), total ash (5.58%), acid insoluble ash (0.0996%), water soluble ash (4.68%), alcohol soluble extractive value (0.77%) and water soluble extractive value (8.71%). Wild edible fruits are source of rich nutrition and discovering their nutritional value is a great task ahead of herbal drug researchers. Fruits of *A. elaeagnoidea* showed nutritive value for fats (0.80%), protein (52.78%) and carbohydrate (57.10%) (Table 1).

**Table 1. Physico-chemical standards of *Aglaia elaeagnoidea***

Parameter	Results
Loss on drying	15.82
Total Ash	5.58
Acid Insoluble Ash	0.0996
Water soluble Ash	4.68
Alcohol soluble extractive value	0.77
Water soluble extractive value	8.71
Fat	0.80
Protein	52.78
Carbohydrate	57.10

Results n = 3, % w/w

#### Preliminary phytochemical tests

Secondary metabolites are ergastic matters, nonliving inclusions of the cells produced during the metabolic activities of the protoplast. Along with nutritive function, these also serve in diverse biological function.<sup>[15]</sup> Preliminary phytochemical tests will give an account of these biological matters present in the test drug. Alcoholic extract of *A. elaeagnoidea* fruits were subjected to preliminary phytochemical study, according to standard protocol. The tests were conducted to detect the presence of alkaloids, steroids, tannins, flavonoids, saponins, coumarins, phenol, carboxylic acid, amino acids, resins and quinone (Table 2).

**Table 2. Preliminary phytochemical test of ethanolic extract of fruits of *Aglaia elaeagnoidea***

Test	Result
Alkaloid	-
Steroid	-
Carbohydrate	+
Tannin	-
Flavanoids	-
Saponins	-
Terpenoid	+
Coumarins	-
Phenol	-
Carboxylic acid	-
Amino acids	-
Resins	-
Quinone	-

- Absent, + Present

By HPTLC fingerprinting different colored bands corresponding to different compounds at different R<sub>f</sub> values were obtained. Single spot at 254 nm and 8 spots each under 366 nm and 620 nm after derivatisation were observed by TLC photo-

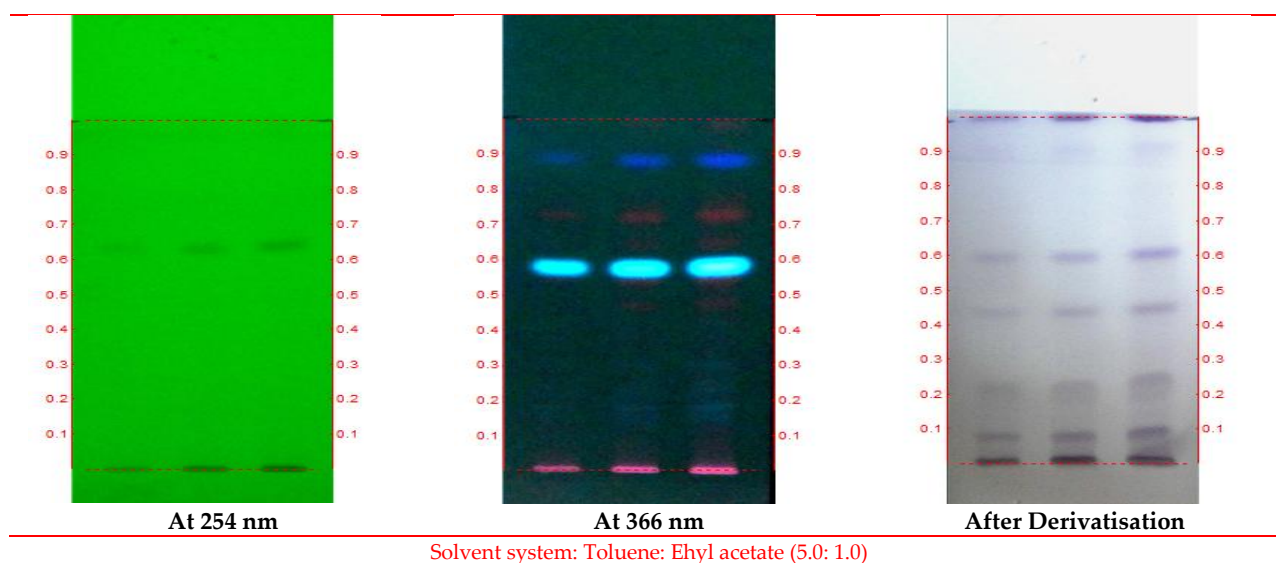
documentation (Table 3 and Figure 4).  $R_f$  values by densitometric scan was obtained at different wavelengths, 16 peaks at 254 nm, 11 at 366 nm and 6 at 620 nm were recorded for fruits of *A. elaeagnoidea* (Figure 5).

**Table 3.  $R_f$  values of ethanolic extract of fruits of *Aglaia elaeagnoidea***

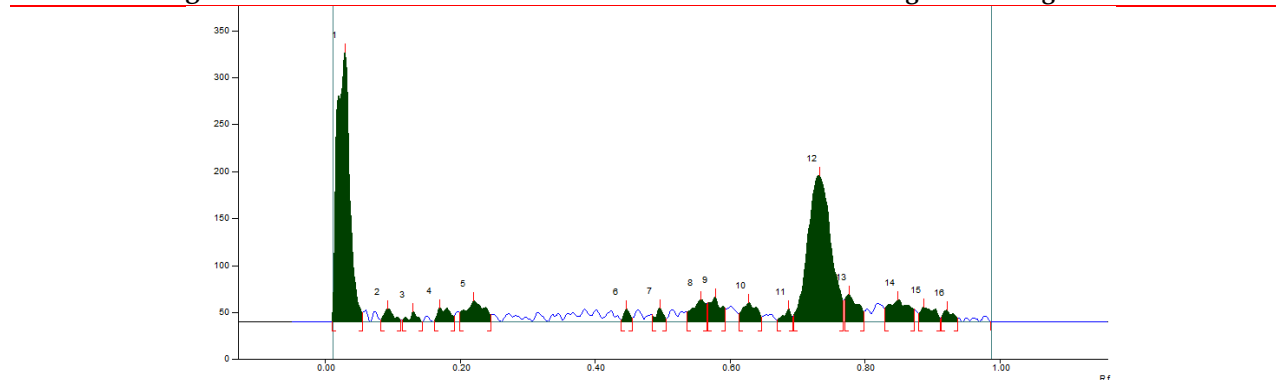
At 254 nm	At 366 nm	After Derivatisation
-	-	0.09(D. purple)
-	0.15 (FL. blue)	-
-	0.18 (FL. blue)	0.19 (D. purple)
-	-	0.23 (D. purple)
-	0.30 (FL. blue)	-
-	-	0.44 (D. purple)
-	0.48 (FD. red)	-
-	0.58 (F aqua. blue)	0.61 (D. purple)
0.63(D. green)	-	-
-	0.65 (FD. red)	-
-	0.73 (FD. red)	-
-	0.89 (FD. blue)	0.90 (D. purple)

\*F- fluorescent; D – dark; L – light

**Figure 4. HPTLC Photodocumentation of ethanolic extract of fruits of *Aglaia elaeagnoidea***

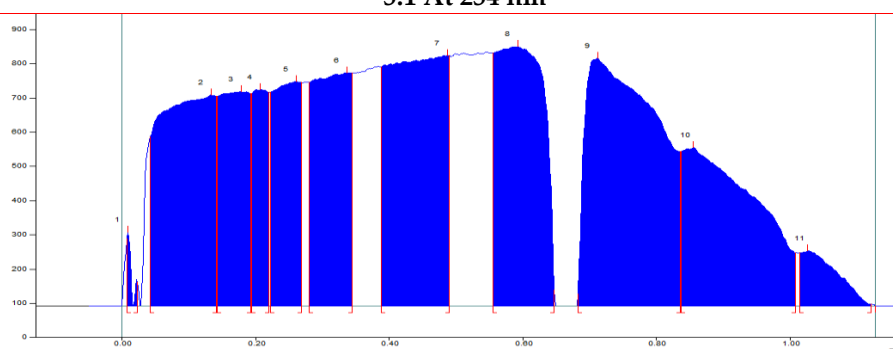


**Figure 5. Densitometric scan of ethanolic extract of fruits of *Aglaia elaeagnoidea***



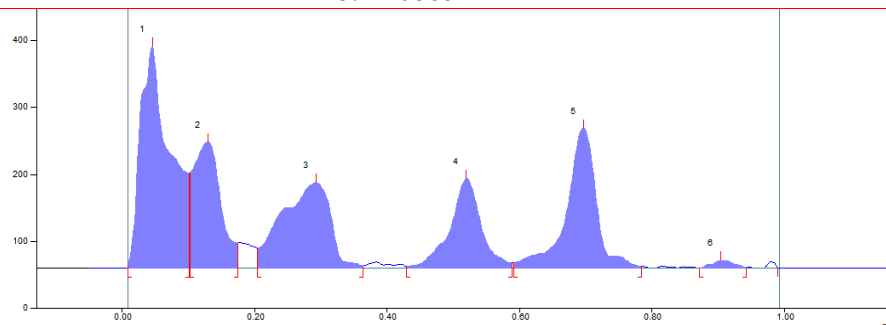
Peak	Start Position	Start Height	Max Position	Max Height	Max %	End Position	End Height	Area	Area %
1	0.01 Rf	0.0 AU	0.03 Rf	287.1 AU	41.21 %	0.06 Rf	9.6 AU	3863.0 AU	34.88 %
2	0.08 Rf	2.1 AU	0.09 Rf	13.5 AU	1.94 %	0.11 Rf	2.1 AU	144.0 AU	1.30 %
3	0.11 Rf	2.2 AU	0.13 Rf	10.8 AU	1.55 %	0.15 Rf	0.1 AU	88.0 AU	0.79 %
4	0.16 Rf	0.8 AU	0.17 Rf	14.9 AU	2.14 %	0.19 Rf	5.8 AU	193.3 AU	1.75 %
5	0.20 Rf	9.9 AU	0.22 Rf	22.1 AU	3.17 %	0.25 Rf	7.6 AU	434.8 AU	3.93 %
6	0.44 Rf	2.1 AU	0.45 Rf	13.6 AU	1.95 %	0.46 Rf	4.1 AU	89.5 AU	0.81 %
7	0.49 Rf	7.6 AU	0.50 Rf	14.7 AU	2.10 %	0.51 Rf	2.6 AU	115.3 AU	1.04 %
8	0.54 Rf	10.7 AU	0.56 Rf	23.5 AU	3.37 %	0.57 Rf	18.9 AU	330.8 AU	2.99 %
9	0.57 Rf	20.1 AU	0.58 Rf	26.4 AU	3.79 %	0.59 Rf	14.6 AU	329.9 AU	2.98 %
10	0.61 Rf	8.9 AU	0.63 Rf	20.1 AU	2.89 %	0.65 Rf	5.0 AU	307.6 AU	2.78 %
11	0.67 Rf	1.7 AU	0.69 Rf	13.5 AU	1.93 %	0.69 Rf	5.3 AU	105.9 AU	0.96 %
12	0.70 Rf	6.7 AU	0.73 Rf	155.6 AU	22.34 %	0.77 Rf	22.8 AU	3797.8 AU	34.29 %
13	0.77 Rf	23.4 AU	0.78 Rf	29.4 AU	4.23 %	0.80 Rf	10.5 AU	396.5 AU	3.58 %
14	0.83 Rf	14.6 AU	0.85 Rf	23.8 AU	3.41 %	0.87 Rf	13.3 AU	504.9 AU	4.56 %
15	0.88 Rf	8.6 AU	0.89 Rf	15.5 AU	2.23 %	0.91 Rf	3.1 AU	240.6 AU	2.17 %
16	0.91 Rf	4.9 AU	0.92 Rf	12.2 AU	1.75 %	0.94 Rf	4.3 AU	133.7 AU	1.21 %

5.1 At 254 nm



Peak	Start Position	Start Height	Max Position	Max Height	Max %	End Position	End Height	Area	Area %
1	0.01 Rf	196.6 AU	0.01 Rf	215.8 AU	3.44 %	0.02 Rf	69.5 AU	1059.4 AU	0.35 %
2	0.04 Rf	493.3 AU	0.13 Rf	616.1 AU	9.83 %	0.14 Rf	12.3 AU	36285.5 AU	12.12 %
3	0.14 Rf	612.6 AU	0.18 Rf	626.4 AU	10.00 %	0.19 Rf	20.7 AU	19902.1 AU	6.65 %
4	0.20 Rf	620.8 AU	0.21 Rf	631.9 AU	10.08 %	0.22 Rf	23.8 AU	10686.8 AU	3.57 %
5	0.22 Rf	624.8 AU	0.26 Rf	656.2 AU	10.47 %	0.27 Rf	53.1 AU	19327.2 AU	6.45 %
6	0.28 Rf	653.4 AU	0.34 Rf	681.8 AU	10.88 %	0.35 Rf	80.0 AU	27472.2 AU	9.17 %
7	0.39 Rf	698.4 AU	0.49 Rf	732.4 AU	11.69 %	0.49 Rf	32.3 AU	45826.0 AU	15.30 %
8	0.56 Rf	739.2 AU	0.59 Rf	757.8 AU	12.09 %	0.65 Rf	46.5 AU	39347.3 AU	13.14 %
9	0.68 Rf	35.8 AU	0.71 Rf	723.0 AU	11.54 %	0.84 Rf	50.8 AU	56467.6 AU	18.86 %
10	0.84 Rf	451.1 AU	0.86 Rf	463.1 AU	7.39 %	1.01 Rf	55.9 AU	36673.1 AU	12.25 %
11	1.02 Rf	155.1 AU	1.03 Rf	161.8 AU	2.58 %	1.12 Rf	5.0 AU	6391.4 AU	2.13 %

5.2 At 366 nm



Peak	Start Position	Start Height	Max Position	Max Height	Max %	End Position	End Height	Area	Area %
1	0.01 Rf	3.5 AU	0.05 Rf	331.4 AU	33.12 %	0.10 Rf	41.8 AU	10765.5 AU	31.10 %
2	0.10 Rf	142.2 AU	0.13 Rf	188.1 AU	18.80 %	0.18 Rf	37.4 AU	5631.2 AU	16.27 %
3	0.20 Rf	29.6 AU	0.29 Rf	127.4 AU	12.73 %	0.36 Rf	3.3 AU	6671.5 AU	19.28 %
4	0.43 Rf	2.7 AU	0.52 Rf	133.4 AU	13.34 %	0.59 Rf	8.2 AU	4489.8 AU	12.97 %
5	0.59 Rf	8.3 AU	0.70 Rf	208.5 AU	20.84 %	0.79 Rf	2.2 AU	6776.6 AU	19.58 %
6	0.87 Rf	0.1 AU	0.90 Rf	11.6 AU	1.16 %	0.94 Rf	0.6 AU	276.8 AU	0.80 %

5.3 At 620 nm

### Antioxidant study

Antioxidant study of *A. elaeagnoidea* fruits was conducted by DPPH (2, 2-Diphenyl-1-picrylhydrazyl) method using Vitamin C as standard. Juice of *A. elaeagnoidea* fruit at 10µg /ml of concentration showed 67.19% of inhibition. The percentage inhibition of vitamin C after 200µg /ml upto 1mg/ml concentration showed almost similar percentage of inhibition. However percentage inhibition of fresh juice of *A. elaeagnoidea* fruit (crude) showed gradual increase in percentage inhibition as the concentration increased. Over all *A. elaeagnoidea* fruit showed moderate percentage of inhibition, thus presence of good amount of antioxidant principle (Figure 9).

**Table 4. DPPH scavenging of fruits of *Aglaia elaeagnoidea***

Concentration	% inhibition	
	Vitamin C	<i>A. elaeagnoidea</i>
10 µg	69.53465015	67.1911617
20 µg	76.19685303	67.59290258
50 µg	88.14864412	68.79812521
100 µg	90.25778373	72.3803147
200 µg	91.26213592	73.15031804
400 µg	91.93170405	78.80816873
500 µg	92.1995313	80.08034818
1000 µg	92.29996652	86.4412454

Antioxidants are the molecules that quench free radical damage, there by stabilizing the cells and preventing the damage.<sup>[16]</sup> There are several nutrients in food that contain antioxidants and these found to be essential elements in prevention of hazardous diseases like cancer, cardiovascular diseases etc.

### CONCLUSION

New drug research, adding scientific documentation of quality standards of a drug is a need of the hour. Pharmacognostic features, nutritional value and antioxidant profile of wild edible fruits of *A. elaeagnoidea* has been studied. Further study based on these published facts may prove this fruit as a source of drug in maintenance of health.

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### CONFLICT OF INTEREST

Nil

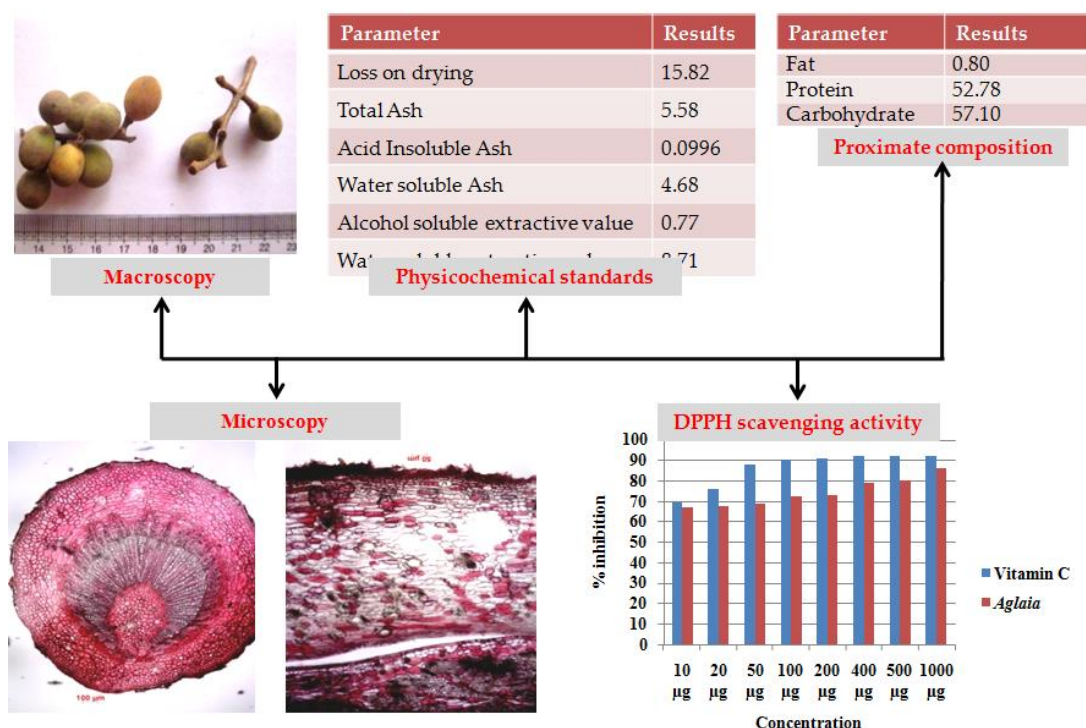
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## GRAPHICAL ABSTRACT



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