

# Preliminary Pharmacognostic and Phytochemical Studies on leaves of *Artocarpus heterophyllus*

Om Prakash\*, Ritika Srivastava, Rajesh Kumar, Shivam Mishra, Shivam Srivastava

Department of Pharmacognosy, Kamla Nehru Institute of Management and Technology, Sultanpur, Uttar Pradesh 228118, India

Date Received: 19<sup>th</sup> October 2015; Date Accepted: 29<sup>th</sup> October 2015 Date published: 2<sup>nd</sup> November 2015

E-mail: opverma2007@gmail.com

**Abstract:** The aim of the present study to evaluate preliminary pharmacognostic investigation of leaves of *Artocarpus heterophyllus* were carried for organoleptic parameters followed by evaluation based on morphological, microscopical, physicochemical, phytochemical and chromatographical characteristics. The *Artocarpus heterophyllus* lam. is a species of tree of the mulberry family Moraceae, known by other names jackfruit (English) and kathal (Hindi) reported to possess antibacterial, anti-inflammatory, antidiabetic, antioxidant and immunomodulation properties. *Artocarpus heterophyllus* is an important source of chemicals of morin, dihydromorin, cynomacurin, artocarpin, isoartocarpin, cyloartocarpin, artocarpesin, oxydihydroartocarpesin, artocarpetin, norartocarpetin, cycloartinone, betulinic acid, artocarpanone and heterophylol which are useful in fever, boils, wounds, skin diseases, convulsions, diuretic, constipation, ophthalmic disorder and snake bite.

**Keywords:** *Artocarpus heterophyllus* Lam. Moraceae, Qualitative chemical examination

**Introduction:** *Artocarpus heterophyllus* Lam is commonly known as Jackfruit, Kathal, Kanthal. The leaves of *Artocarpus heterophyllus* Lam. (Moraceae) are useful in fever, boils, wounds, and skin diseases etc (1). The *Artocarpus heterophyllus* Lam. possesses anti-inflammatory (2), Antifungal (3) anti-helminthes (4), Anti-diabetic (5) antibacterial (6), immunomodulator (7) anti allergic (8) and antioxidant (9) as reported in various texts based on In-

dian traditional medicine system (10, 11). The *Artocarpus heterophyllus* contains various chemical constituents as several flavones colouring matters, morin, dihydromorin, cynomacurin, artocarpin, isoartocarpin, cyloartocarpin, artocarpesin, oxydihydroartocarpesin, artocarpetin, norartocarpetin, cycloartinone and artocarpanone (12). The heart wood on analysis yields moisture 6.7%, glucosides 38.0%, lipids 0.7%, albumin 1.7% and cellulose 59.0 % (13). The plant also contains free sugar (sucrose), fatty acids, ellagic acid and some essential Amino acids like Arginine, Cystine, Histidine, Leucine, Lysine, Methionine, Theonine, Tryptophan etc. (14). Bark from main trunk contains betullic acid and two new flavone pigments, cycloheterophyllin (15). Triterpenic compounds like cycloartenyl acetate, cycloartenone are also reported (16). Heterophylol a phenolic compound with novel skeleton was obtained from *Artocarpus heterophyllus* (17, 18).

## Material and Methodology

### Collection of Plant material

Leaves of *Artocarpus heterophyllus* lam were collected from local area of Sultanpur, Uttar Pradesh and authenticated from Taxonomic division of N.B.R.I. Lucknow and a voucher specimen was deposited for future references (ref. no.: NBRI/CIF/Re./08/2008/32).

## Results

### Pharmacognostic studies

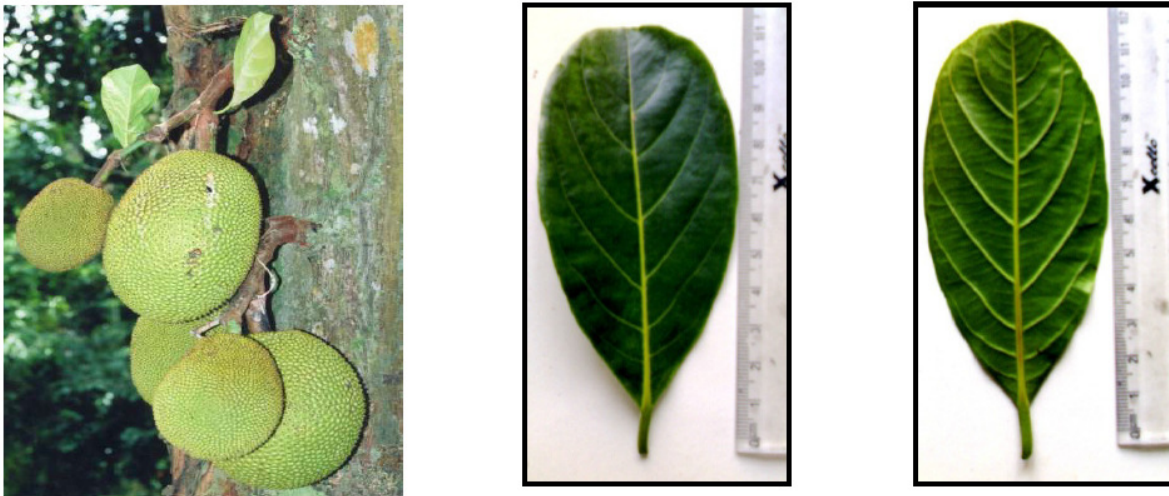
Morphology of fresh leaves was studied. Microscopy of stained and unstained transverse sections of fresh leaves was performed. Leaves were dried under shade, powdered to 60#, stored in airtight containers and used for powder study and quantitative microscopy (Table2).

### Phytochemical study

Leaves were comminuted to powder and extracted with methanol, water and hexane by using Soxhlet Extractor. The extracts were concentrated under reduced pressure using Rota vapor. Various phytoconstituents present in the leaves were detected by their respective chemical tests using the appropriate extracts (19) (Table4).

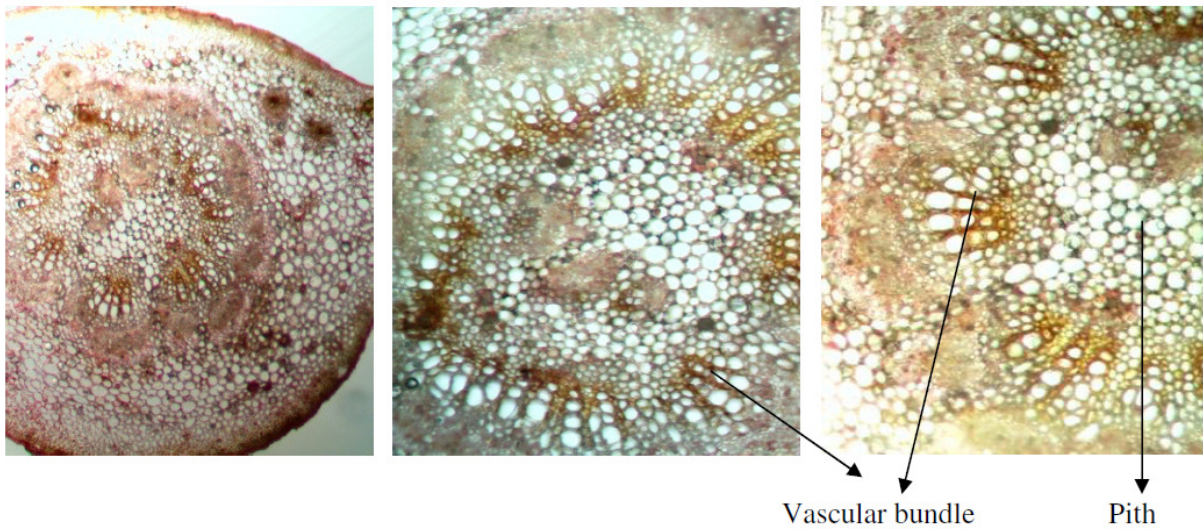
### Morphology

Fresh plant material was taken for various macroscopic, organoleptic evaluations like colour, odour, size, shape, taste, appearance etc. The diameter of leaves is about 6.0 cm -7.0 cm. The leaves are characterized by dark green in colour, odorless with characteristic in taste. *Artocarpus heterophyllus* has simple leaves, alternate in arrangement. Shape is elliptic to oval with an entire margin, blunt apex, tapers to base, glabrous surface, Netted pinnate venation.

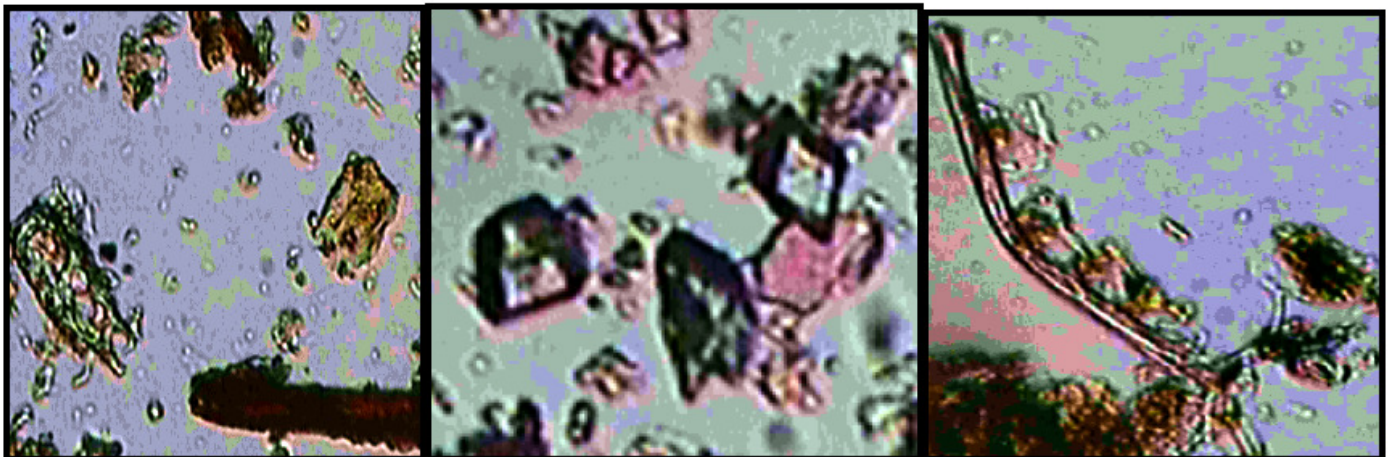


a) *Artocarpus heterophyllus* (b) Inner View (c) Outer View

**Fig 1: Morphology: Leaves of *Artocarpus heterophyllus***



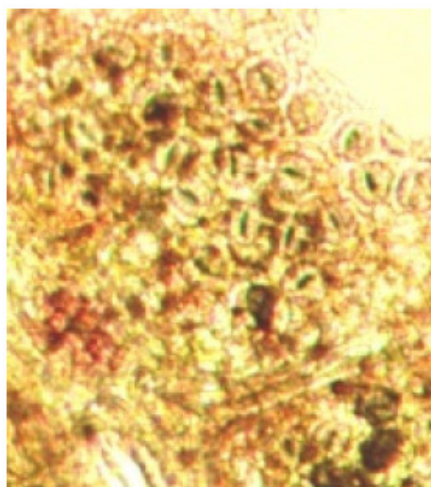
**Fig 2: Transverse section of *Artocarpus heterophyllus* leaf stained with phloroglucinol HCL**



**Fig 3: Powder microscopy of leaf of *Artocarpus heterophyllus* stained with acetic acid**

**Table 1: Microscopical evaluation of leaves of *Artocarpus heterophyllus***

S. No.	Stain	Observation	Result
1.	Iodine Solution	Blue colour	Simple Starch grains present
2.	Phloroglucinol + HCl	Red colour	Lignified cells present
3.	Safranin	Pink colour	Lignified cells present
4.	Acetic acid	Insoluble	Prismatic Calcium oxalate crystals

**Fig 4: LS of *Artocarpus heterophyllus* leaf stained with iodine****Table 2: Quantitative microscopy of leaf of *Artocarpus heterophyllus***

S. No	No of stomata/sq. mm	No of trichomes/sq. mm	Length of trichomes (in $\mu$ )
1.	6	4	0.15
2.	9	6	0.32
3.	8	3	0.02
4.	10	7	0.49
5.	7	3	0.022

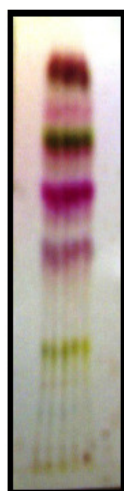
**Table 3: Physio-chemical parameters of *Artocarpus heterophyllus***

S No.	Parameters	Leaf
		Values % w/w
1.	Total ash	8.0
2.	Acid insoluble ash	13.25
3.	Water soluble ash	12.88
4.	methanol soluble extractive value	30.36
5.	Water soluble extractive value	29.23

**Table 4: Phytochemical screening of various extracts of leaves of *Artocarpus heterophyllus***

Class of Phyto-Constituents	Name of test	Extract		
		Water	Methanol	Hexane
Alkaloids	Mayers test	-	-	-
	Wagner's test	-	+	-
	Dragendorff's test	-	-	-
Glycoside	Bronrger test	-	+	-
	Modified brontr. test	-	+	+
Steroids	Salkowski test	+	+	+
	Vanillin HCl	+	+	-
Tannins & Phenols	Ferric chloride	+	+	-
	Sod. Hydroxide	-	-	-
Flavinoids	Shinoda test	+	+	+
	Molisch test	+	-	-
Carbohydrates	Mayers test	-	-	-

Hints: Where, (+) Present, (-) Absent



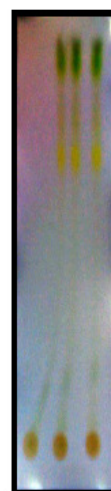
(Fig. 4)



(Fig. 5)



(Fig.6)



(Fig.7)



(Fig.8)

**Fig.9 TLC Profile for Methanolic extracts of leaves of *Artocarpus heterophyllus***

**Table5- TLC Profile for methanolic extracts of leaves of *Artocarpus heterophyllus***

S.No.	Type of Seco. Metabolites	Solvent System	Detecting agent	R <sub>f</sub> Value
1.	Glycosides	Toluene: Ethyl acetate (70: 30) (Fig. 4)	Anisaldehyde	0.24, 0.44, 0.57, 0.70, 0.86
		Chloroform: Benzene (9: 1) (Fig. 8)	Anisaldehyde	0.29, 0.45, 0.59, 0.69, 0.88
2.	Alkaloids	Benzene: Methanol (95: 5)	Anisaldehyde	0.22, 0.28, 0.37, 0.54
		Benzene: Methanol (80: 20) (Fig. 5)	Anisaldehyde	0.20, 0.33, 0.68, 0.83
3.	Flavanoids	Chloroform: Methanol (10: 1) (Fig.6)	Anisaldehyde	0.18, 0.37, 0.50, 0.69, 0.88
4.	Steroids/ Triterpenoids	Chloroform: Acetone (7: 3) (Fig. 7)	Anisaldehyde	0.50, 0.68, 0.78, 0.84

**Microscopical Characters:**

Qualitative microscopic evaluation was carried out by taking transverse sections of fresh leaves of *Artocarpus heterophyllus*. The thinnest section was selected and cleared by boiling with chloral hydrate solution for 20 mins and then carefully stained with Phloroglucinol and HCl (1:1)

Thin transverse section of the fresh leaves through the lamina and the midrib is observed for the presence/absence of various cell organelles like vascular bundles, epidermal cell, Trichomes, parenchyma cells. Longitudinal section of fresh leaves was observed for presence of stomata.

It was found that 3 to 5 vascular bundles are present with compact lines of xylem elements and abaxial phloem elements.

**Powder Microscopy**

On staining with different stains like Iodine, Phloroglucinol hydrochloric acid, Safranin and Acetic acid after Glycerin mounting following powder characters were observed (10X) (Fig. ).

**Quantitative Microscopy:**

Quantitative leaf microscopy to determine stomata number, stomata index, was carried out on epidermal strips. Peels were removed mechanically using forceps. They were stained in 1% Safranin mounted in glycerin. With the help of compound microscope it was found that the paracytic stomata were reported on both surface while

maximum are present on lower epidermis. The average numbers of stomata per square millimeter were found to be between 6 to 10 per sq. mm. The average number of trichomes per square millimeter was found to be 3-7 and length of multi cellular trichomes was found to be between 0.022 to 0.15 mm.

**Physicochemical Evaluation:**

Powdered leaves are evaluated for parameters total ash, acid insoluble ash, water soluble ash, methanol soluble extractive, water-soluble extractive values.

**Thin layer chromatography**

The methanolic extract was subjected to thin layer chromatography to assess the presence of number of constituents in extract. In this technique the Silica gel-G (for TLC) was used as an adsorbent and plates were prepared by spreading technique, then air dried for an over-night and activated for one hour at 110°C and used Table 5.

**Conclusion**

The present work deals with the microscopic, physicochemical and phytochemical evaluation of the leaves of *Artocarpus heterophyllus*. A diagnostic character of powder includes Cork cells, Stone cells, Prismatic calcium oxalate crystals and reticulated xylem vessels with wide phloem. Phytochemical analysis showed the presence of important classes of phytoconstituents like glycosides, flavanoids, alkaloids, sterols, triterpenoids and carbohydrates etc. This indicates that the plant can be useful for treating different diseases because the therapeutic activity of a plant is due to the presence of particular class of active com-

pounds. This would guide the way for isolation of phyto-constituents, therapeutic investigations and standardization of formulations containing its leaf material.

### Acknowledgement

Authors are thankful to Shri Vinod Singh, Manager, Kamla Nehru Institute of Management & Technology, Sultanpur, Uttar Pradesh, India for providing the laboratory facilities to carry out the research work.

### References:

1. Rahman, A.M., Nahar, N., Mian, A.J., Mosihuzzaman, M., 1999. Variation of carbohydrate composition of two forms of fruit from jack tree (*Artocarpus heterophyllus* L) with maturity and climatic conditions. *Food Chem.* 65: 91-97
2. Fang, S.C., Hsu, C.L., G.C. Yen. Anti-inflammatory effects of phenolic compounds isolated from the fruits of *Artocarpus heterophyllus*. *J Agric Food Chem.*2008; 56(12): 4463-4468.
3. Trindade, M.B., Lopes, J.L., Soares Costa, A., Monteiro Moreira, A.C., et al. Structural characterization of novel chitin-binding lectins from the genus *Artocarpus* and their antifungal activity. *Biochim Biophys Acta.*2006;1764(1): 146-52.
4. Sharma, W., Trivedi, P.C. Nematocidal and nematostatic response of aqueous extract of certain plants of semi arid niche. *Curr. Nematol.*1995; 6: 45-53.
5. Fernando, M. R., Nalinie Wickramasinghe, S. M. D., Thabrew, M. I., et al. Effect of *Artocarpus heterophyllus* and *Asteracanthus longifolia* on glucose tolerance in normal human subjects and in maturity-onset diabetic patients. *J. Ethnopharmacol.*1991; 31(3): 277-282.
6. Omoloso, M. R., Kihara, M. Antibacterial activity of *Artocarpus heterophyllus*. *Fitoterapia.*2003;74(5): 501-505.
7. Kabir, S. Jacalin, a jackfruit (*Artocarpus heterophyllus*) seed-derived lectin of versatile applications in Immunobiological research. *Journal of Immunological Method* 1998; 212(2): 193-211.
8. Bolhaar, S.T., Ree, R., Bruijnzeel-Koomen, C.A., Knulst, A.C., et al. Allergy to jackfruit, a novel example of Bet v 1-related food allergy. *Allergy.*2004;59(11): 1187-92.
9. Ko, F.N., Cheng, Z.J., Lin, C.N., Teng, C.M., 1998. Scavenger and antioxidant properties of prenylflavones isolated from *Artocarpus heterophyllus*. *Free Radic Biol Med.* 25(2): 160-168.
10. Anonymous. The Wealth of India: A dictionary of Indian raw materials and industrial products: New Delhi: Publication and information directorate CSIR New Delhi: 445-453, (1985)
11. Sethi, P.D., Identification of drugs in pharmaceutical formulations by thin layer chromatography, 2<sup>nd</sup> Edn. CBS Publishers and distributors:1-30,(2005)
12. Rao, R.,Varadan, A.V.,Venkataraman, M.,1973. Colouring matter of the *A. hetetophyllus*. *Indian J. Chem.* 11:298-299.
13. Perkin and Cope., 1895. The constituents of *Artocarpus integrifolia*. *J. Chem. Soc.* 67: 937-944.
14. Pavanasivam, G., Uvais, M.,Sultanbawa, S.,1973. Cycloartenyl acetate, cycloartenol and cycloartenone in the bark of *Artocarpus species*. *Phytochemistry.* 12(11): 2725-2726.
15. Chawdhary, F.A., Raman, M.A., 1997. Distribution of free sugars and Fatty acids in Jackfruit. *Food chemistry.* 60(1): 25-28.
16. Barik, B.R., Bhaumik, T., A.K., Kundu, A.B., 1997. Triterpenoids of *Artocarpus heterophyllus*. *J. Indian Chemical Soc.* 74: 163-164.
17. Lin,C.N., and Lu,C.M., 1993. Heterophyllol: a phenolic compound with novel skeleton from *Artocarpus heterophyllus*. *Tetrahedron letters.* 34(17): 8249-8250.
18. Prakash, O., Kumar, R., Mishra, A., Gupta, R., 2009. *Artocarpus heterophyllus* (Jackfruit): An overview. *Pharmacognosy reviews.*3: 353-358.
19. Feigl F, Identification of individual organic compound In: Spot tests in organic analysis.,4<sup>th</sup> Edn, Elsevier London :237-245,(1956)