

**Research Article**

## **OCCURRENCE OF *GARCINIA* - LIKE FOSSIL FRUIT FROM THE DINOSAURIAN SEDIMENTS (UPPER CRETACEOUS), PISDURA, MAHARASHTRA, INDIA**

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### **ABSTRACT**

Reports of plant fossils mainly comprising different species of leaves belonging to the family Clusiaceae, have been described from the Tertiary sediments of India by Lakhanpal and Bose (1951), Lakhanpal (1964), Agarwal (1991, 2002), Ambwani (1991), Prasad (1994), Awasthi and Mehrotra (1995), Prasad and Awasthi (1996) and gave a detailed account of fossil clusioid leaves. As regards occurrence of silicified woods, Bande and Khatri (1980) described from the Deccan Intertrappean beds of Mandla District, Madhya Pradesh. However, from the older sediments of New Jersey, Crepet and Nixon (1998) recovered plant parts of this family and gave a historical account of clusioid taxa. The present investigation comprises a fossil fruit impression from the dinosaurian sediments of Pisdura, Maharashtra, India and forms the first report from this area. The specific name of the present fossil is derived from the locality where it is recovered and assigned as *Garcinia pisduraensis* sp. nov.

**Keywords:** *Garcinia*, Fossil, Upper Cretaceous

### **INTRODUCTION**

Fossil plants referable to the family Clusiaceae are mostly recorded from different Tertiary sediments of India. Though a few reports are also made from the older sediments of India and other parts of the world. Lakhanpal and Bose (1951) reported fossil leaves from the Tertiary sediments of Barmer, Rajasthan, later Lakhanpal (1964) described fossil leaves (*Garcinia barooahii*) comparable to the extant leaves of *Garcinia lancaefolia* Roxb.; Dalvi and Kulkarni (1982) recovered *Garcinia*-like leaf cuticles from the Ratnagiri beds, Maharashtra; Agarwal (1991, 2002) recovered a few *Garcinia* -like leaves (*Garcinia neyveli*ensis, *G. praediversifolia* and *G. palaeovalifolia*) from the Miocene sediments of Neyveli Formation, Tamil Nadu.; Ambwani (1991) found some fossil leaves from the Palaeocene sediments of north East India; Prasad (1994) recovered *Garcinia ecombogia* leaves from the foot hills of Himalaya. While Chaudhary and Tandon (1949) described fossil wood belonging to Clusiaceae from the Upper Miocene of Assam, whereas Bande and Khatri (1980) reported wood of Guttiferae (Clusiaceae) from the Deccan Intertrappean beds of Mandla District, Madhya Pradesh. Friis *et al.*, (1987) (in Crepet and Nixon, 1998) described fossil seeds from the Late Cretaceous (Turonian) sediments of New Jersey, showing characters similar to the genus *Clusia*. The authors postulated that this genus gave rise to *Palaeoclusia*, the fossil that could not be treated as primitive, but characters closely related to Clusiaceae.

### **MATERIALS AND METHODS**

#### **Description**

A fossil fruit impression showing resemblance with the extant genus *Garcinia*, a member of Clusiaceae (The mangosteen family), was recovered from the Upper Cretaceous sediments of well known dinosaurian locality of Pisdura, Maharashtra, India (Figure-1). Recovery of this fossil was made from the basal part of the hillock exposed with red-brown to gray color sediments. The sediments rich in coprolites associated with mollusk shells, fragmentary dinosaur bones and rare presence of other plant mega fossils. The coprolites so found in this area indicate richness of plant debris as undigested remains of the plants. Some of these coprolites include softer parts (leaf fragments), tiny seeds and a few lignified tissues. The present fossil was found as impression on a rock piece (Pl, 1, Figures A & F). It shows nine deep grooves (referable to the lobes of the fruit); the partition grooves run from base to apex. The shape of the fruit is

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globose to subglobose and the size ranges to about 3 cm diameter. Each lobe measures one cm broad (possibly contain one seed in it). The exocarp of the fruit is 1mm thick; an attachment scar is seen at the basal part of the fruit. As the fossil fruit is in the state of an impression, other morphological details except the superficial characters of the pericarp can be revealed. The characters of the fruit such as shape, size and numbers of the lobes clearly indicate affinity with the fruit of extant family Clusiaceae (Table 1; Plate-1, Figures A-C).

## RESULTS AND DISCUSSION

### Comparison and Discussoin

**Table 1: Shows comparable different species of extant genus *Garcinia* to that of fossil species (*Garcinia pisduraensis* sp nov.) Data for modern *Garcinia* from the flora of British India (Hooker, 1892)**

Taxa	Fruit size	No of lobes	Ecology	Fossil Records
<i>G. bancana</i> Miq.	Very large	5 lobes	Tropical of Malacca, Island ,Banca	Not known
<i>G.dulcis</i> (Roxb)Kurz	Berry size 1 inch	5 lobes	Tropical of Malacca	Not known
<i>G. heterandra</i> Wall.	Large sub-globose	4 lobes	Tropical Forests of Pegu, Tanasserim	Not known
<i>G.lanceifolia</i> Roxb.	Small plum size	6-8 seeds	Silhet, Assan	Barmer, Rajasthan (cf, <i>G.barooahii</i> ) <i>Lakhanpal, 1964(leaf)</i>
<i>G.mangayi</i> Hook.	Large	4-6 lobes	Tropical Evergreen Forests	Not known
<i>G. paniculata</i> Roxb.	Large cherry	4 lobes	Andaman Islands	Not known
<i>G.xanthchymus</i> Hook.	Very large 6" berry	1-4 lobes	Evergreen wet deciduous forests	Not known
<i>G. morella</i> (gaertn)Desr	Medium size cherry-like	4 lobes	Tropical of Khasi hills, Malabar, Sri Lanka	Not known
<i>G.cowa</i> , Roxb ex Chosy	Large berry	4-8lobes	Assam,Bengal, Andaman Islands	<i>G.nepalensis</i> (leaf) Prasad, 1990
<i>G. travancorica</i> Beddome	Large as walnut	4-6 lobes	Western Peninsula, Travancore	Not known
<i>G.homobronania</i> Pierre.	Large 2-3 inch , ovoid up to 3" size	8-9 lobes	Malaya Peninsula	Not known
<i>G. atroviridis</i> Griff.	Up to 2-3 inch , globose	9 lobes	Upper Assam, Twang	Not known
<i>Garcinia pisduraensis</i> sp. nov.	Large ,4 cm, impression (half part) seeds not seen	9 lobes	Pisdura ,near Nagpur, Maharashtra	Pisdura, near Nagpur, Maharashtra, India

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**Comparision of fossil with extant *Garcinia* Linn:** Based on the characters of fossil species such as size of the fruit, smooth nature of exocarp and presence of 9 lobed fruit with basal attachment scar, indicates its similarity with the fruits of the family Clusiaceae (see Table-1). It has been observed that out of a large number of species of the genus *Garcinia* viz. *G. arcinia artoviridis* Griff., *G. bancana* Miq., *G. dulcis* (Roxb.) Kurz., *G. heterandra* Wall., *G. homobronania* Pierre, *G. mangayi* Hook., *G. paniculata* Roxb., Hook., *G. morella* Desr., *G. cowa* Roxb. and *G. travancorica* Beddom, show morphological similarity in one or other characters . It has been inferred here that the present species is more close to *G. artoviridis* and *G. homobronania*. Both the species are large in size ranging from 3 to 4 cm and bear 8 to 9 lobes respectively. *G. artoviridis* bears 9 lobes and almost same size (Plate 1; Figures A & C).

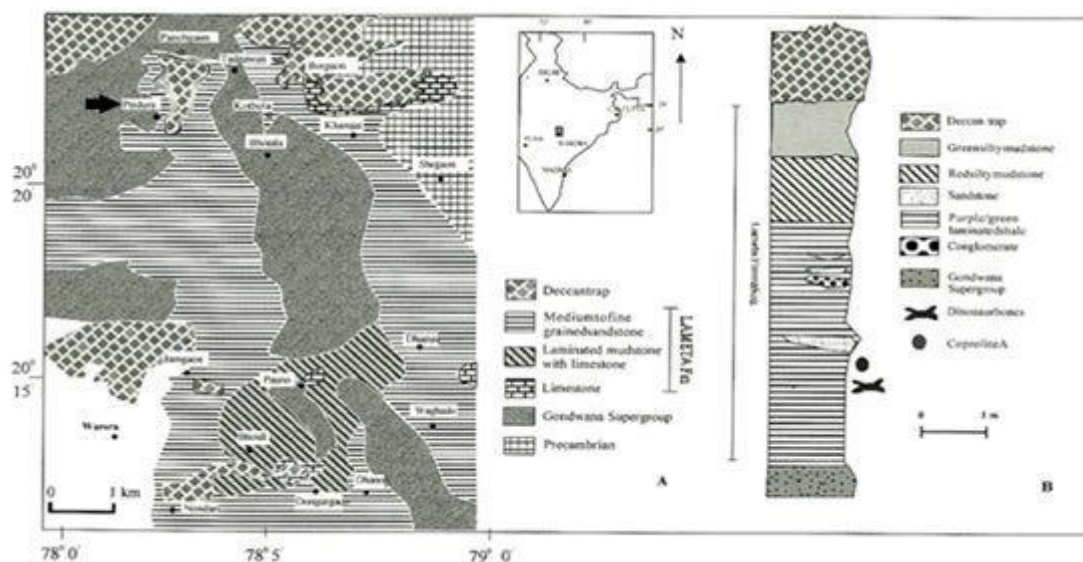


Figure 1: Map showing location from where the specimens were collected (after Ghosh *et al.*, 2003)

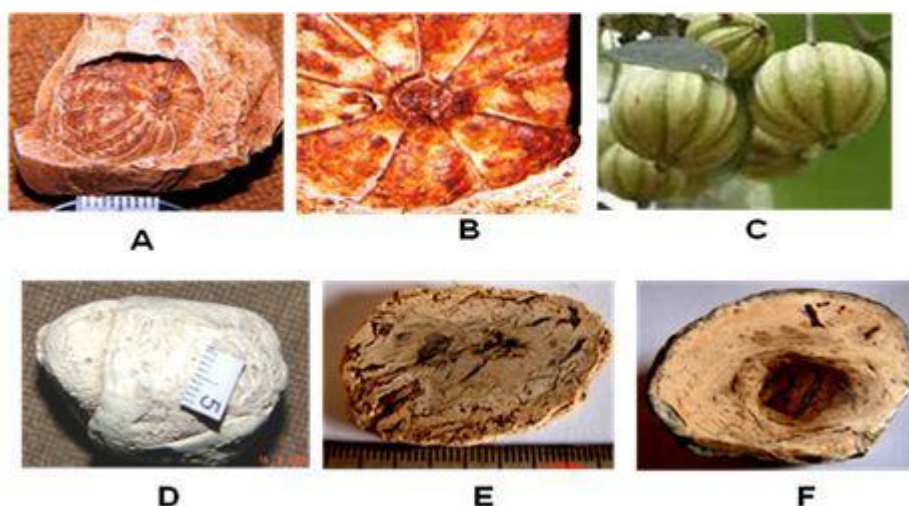


Plate 1: Figure A: Fossil *Garcinia*-like fruit impression showing 9 lobe pericarp with basal attachment scar, B. same magnified to show the pericarp chamber partitions x2, C. Extant fruits of *Garcinia artoviridis* showing chambered partitions of the fruit and basal attachment, D. Coprolite (B-type) from the Upper Cretaceous locality (Pisidura), E. Cross section of the coprolite showing vegetal remains, F. Coprolite in cross section shows tiny undigested fragments of plants and a seed-like structure in the centre

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According to Hutchinson (1969) the family Clusiaceae is almost entirely tropical in distribution but a few taxa are found in Yunan (China) and Natal except for the genus *Garcinia*. It is rare in Africa but better represented in Madagascar. Occurrence of *Garcinia* in dinosaurian sediments at Pisdura suggests prevalence of tropical environment around the dwelling sites of herbivorous dinosaurs. It is presumed that the plants of Clusiaceae family found at Pisdura could have been the edible food for these animals. It further adds that occurrence of undigested seeds of Arecaceae and Capperidaceae found in the dinosaurian coprolites (Ambwani and Dutta, 2003, 2007); a fossil dicot wood (*Ailathoxylon*) (Mukherjee, *et al.*, 2011); presence of an arecoid palm wood (*Palmoxydon lametaei* (Dutta *et al.*, 2011) and a gymnosperm wood (*Araucarioxylon*) (Mukherjee, 2014) from this locality, support as a food material and congenial environment for dwelling of these animals at Pisdura. Presence of grass like plants in this area inferred the development of grazing habit of the sauropods during the Lameta formation at Pisdura (Prasad *et al.*, 2005).

Baker (1978) (in Friis *et al.*, 1987) postulated that during the Late Cretaceous expansion of herbivorous dinosaurs such as Hedrosaurus, Ankylosaurus groups arose only after the origin of angiosperms in Mid - Cretaceous and specialized an angiosperm diet; Ghosh *et al.*, (2003) gave an account using isotopic techniques suggesting that dinosaurs (Sauropods) of Pisdura area were the consumers of C3 plants as their diet. Later this hypothesis was also followed by Jain and Sahni (1985); Mohabey (1991), Mohabey and Samant (2003); Bajpai (1996); Ambwani, *et al.*, (2003); Ambwani and Dutta (2003); Kar *et al.*, (2004); Dutta and Ambwani (2007); Dutta *et al.*, (2011) and Mukherjee (2014) by adding more information of the plants fossils from this area.

#### Specific Diagnosis

#### Family- Clusiaceae

#### Genus- *Garcinia* Linn

#### Species- *Garcinia pisduraensis* sp nov.

**Diagnosis:** Fossil fruit specimen as impression, fruit (berry-like), seeds many, shape of globose to sub-globose; fruit diameter about 3-3.5 cm; pericarp deeply lobed (9 lobes present), furrows run from base to apex; 1mm broad, texture smooth; a polygonal shaped basal pedicel scar present.

**Holotype:** DM/dino/0001; Center of Advance Study in Geology, Lucknow University, Lucknow.

**Locality:** Pisdura, Maharashtra, India.

**Horizon & Age:** Lameta Formation, (Upper Cretaceous).

**Etymology:** The specific epithet is designated after the locality name.

### ACKNOWLEDGEMENT

The authors are thankful to the Department of Science and Technology, New Delhi for providing financial support to carry out the present work under the project (SR/WOS-A/ES-04/2013). Thanks are also due to the head, Centre of Advance Study in Geology, Lucknow University, Lucknow for providing infrastructural facilities and the Director, Birbal Sahni Institute of Palaeobotany, Lucknow for library facilities.

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