

Insect gall impression on fossil angiosperm leaf

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Distinct impressions of circular shaped structures over the surface of leaf lamina of *Sophora benthamii* Sterm. (= *Sophora acuminata* Benth.) of the family Fabaceae recovered from Late Cenozoic sediments of Mahuadanr Valley of Palamu District, Bihar for the first time demonstrate the presence of insect gall in the Tertiary flora of India.

Key-words- Insect gall, angiosperm, leaf, Tertiary, India.

THE Upper Tertiary sedimentary sequence exposed on the left bank of Birha River, South of Rajdanda village in Mahuadanr Valley of Palamu District, Bihar (see Map in Bande & Srivastava 1990) contains well preserved plant fossils of dicotyledonous angiosperm leaves, fruits, flowers and silicified woods in association with animal fossils of fish, birds and insects (Puri & Misra 1982). The flora is known by twenty seven species belonging to twenty four genera of seventeen dicotyledonous families (Prakash *et al.* 1988; Bande & Srivastava 1990; Srivastava & Bande 1992; Srivastava *et al.* 1992).

One of the leaf impressions recovered from fresh collection of plant fossils from the area by one of us (GPS) shows insect gall over the surface of lamina.

Family - *Fabaceae*

Genus - *Sophora* Linn.

Sophora benthamii Sterm.

Figures 1-4

Leaf - Solitary specimen, showing more than 3/4 part of leaf impression. The preserved length of leaf is 10.5 cm and 3.0 cm wide at its widest part; narrow oblong in shape, apex acute, base not preserved, margin entire; texture chartaceous; venation pinnate, brochidodromous; primary vein stout, straight, secondary veins (2°) with acute angle of divergence, uniform, alternate, tertiary



Figure 1. Fossil leaf of *Sophora benthamii* Sterm. Arrows indicate the position of insect gall, BSIP Museum no. 37554A, Natural size.



Figure 2. Extant leaf of *Sophora benthamii* Sterm. showing similarity with fossil leaf.

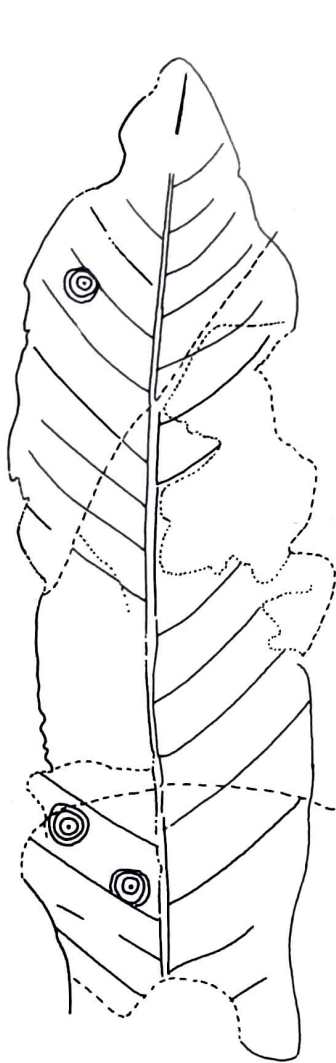


Figure 3. Line drawing of fossil leaf showing three distinct impressions of insect gall. Natural size.

Figure 4. Enlarged portion of leaf showing nature, organization and position of single insect gall. X4

veins (3°) RR, reticulate, closely spaced, alternate; quaternary veins thick; areoles well developed, irregularly oriented, quadrangular, veinlet not seen.

Specimen no. - BSIP Museum No. 37554A

Locality - Birha River Section, Mahuadanr Valley, Palamu District, Bihar, India.

Age - Late Tertiary

Remarks - External morphological features of fossil leaf i.e. size, shape, texture and brochidromous venation pattern are similar with the extant leaves of *Sophora bentharii* Sterm. (= *Sophora acuminata* Benth., F.R.I. Dehradun, Herbarium Sheet No. 5440/24305). Fossil leaf of this genus is being reported for the first time from Cenozoic flora of India.

Insect gall (Figs. 1, 3, 4): One side of leaf lamina possesses three distinct impressions of insect gall

over the surface. Galls are situated in between two secondary veins but do not show any association with vein or margin. They are circular in shape, small size, 2-4 mm in diameter, rough surface showing peripheral thickening and centrally raised exit pore.

The nature and organization of insect galls are comparable with the leaf galls produced by Hymenoptera insects of the family Cynipidae. However, exact relationship is difficult to ascertain because *Sophora* has restricted distribution in India and records of leaf galls or gall inducing insects are not available in extant flora. Nevertheless, galls are quite close with the insect gall of fossil angiospermic leaves reported by Straus (1977; Pl. 1, figs. 24, 25, 27; Pl. 2, fig. 39) and Scott *et al.* (1994; Gall type 18; figs 26.2h; 26.3a).

DISCUSSION

It is often difficult to recognise insect gall in fossil flora. Development, organization and diversity of insect gall have been dealt by Rohfritsch and Shorthouse (1982). Records of fossil galls are compiled by Boucot (1990), Larew (1992) and Scott *et al.* (1994). While describing the fossil history they have discussed obscure nature and preservation of insect galls in plant fossil assemblages, however, Scott *et al.* (1994) have provided morphological criteria to describe and recognise the galls, accordingly they have classified fossil angiospermic leaf galls into 25 types and listed the recent analogue of gall inducing insect.

The occurrence of insect galls or any other activities of insects in plant fossil assemblages of India are poorly known. *Glossopteris* flora from Lower Permian strata of Raniganj Coalfield shows the evidence of insect damaged leaves, mining activity and possibility of insect galls over the surface of *Glossopteris* leaves (Srivastava 1988, 1996) but such activities are practically unknown in the fossil flora of any other horizons of India. The available record of insect gall in the flora of Late Tertiary indicates the evidence of insect plant interaction in Cenozoic flora of India.

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