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Fossil Phylloxerid Plant Galls From the Lower Eocene

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*FOSSIL PHYLLOXERID PLANT GALLS

From the Lower Eocene

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Fossil Plant galls were encountered in an investigation of sandstone outcrops of the Upper Wilcox formation at Lafe, Arkansas. These deposits consist of very fine, buff-colored to whitish sandstone. Great detail of a structural nature is recorded in individual specimens. The deposit must represent the central area of a large lake or lagoon that was fed by streams with a moderate current. All coarse material in suspension had been filtered out or settled out, before the area of the deposit had been reached by the diminishing current. Apparently, finer particles then slowly settled out after being in suspension for some time. Individual sand grains are all of the same size. Another factor that lends support to the supposition that the area of the deposits was some distance from land, is the fact that the fossils are sparse and are chiefly the casts of stems, leaves and fruits of aquatic, emergent plants. Dicotyledonous leaves exist here and there; most have entire margins. In the last analysis, monocotyledons dominate.

Galls incited by insects are very scarce in the fossil record to date. Berry (1916) cites two examples from the lower Eocene and specifically locates them in the beds of the Wilcox from Lagrange formation near Puryear, Tennessee. Collins (1925) refers to them as found in the lower Eocene, and in another work Berry (1931) cites Wilcox specimens. Brooks (1955) received specimens collected in the area near Puryear, Tennessee and reviews the literature on the status of the fossil record of both galls and other types of injury to angiosperm fossil leaves. In fact, to the best knowledge of the author, these are the only papers there are on any reference to fossil insect galls from the lower Eocene. The remaining six papers in the Tertiary literature are in reference to galls found in the Oligocene Epoch from Florissant, Colorado: Scudder (1886), Cockrell (1908), Brues (1910) and Kinsey (1919); Hoffman (1932) has described Miocene galls and Brues (1946) refers to an observation of Cretaceous insect galls. None of the galls described in the preceding works resemble the galls presented here. All evidence of the specimens collected by the author, point to one insect family, namely, the Phylloxeridae.

The Phylloxerids belong to the insect order, Homoptera, the family Phylloxeridae and the subfamily Phylloxeridinae. This family

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of aphids that attack modern hickories, for the most part produce a great variety of plant galls. Felt (1940) states that 29 kinds of galls on *Carya* can be attributed to this family alone, and others appear on *Quercus* and *Juglands*, not to mention the long known forms that infest the leaves and roots of *Vitis*.

Most phylloxerid galls have an orifice that is usually found on the surface of the gall, exposed on the lower side of the leaf. According to Comstock (1949) the orifice is produced by the emergence of a young generation of aphids that hatch from the egg-packed gall. The eggs are laid by a wingless, agamic, stem-mother aphid whose activity initiates the growth of the gall to its mature size. In some forms, galls of this type are armed around the orifice and rim of the gall, by spines or bristle-like plant hairs.

The fossil galls in question, lie well within the limits of size, shape and other characteristics exhibted by present-day phylloxerid galls that occur on plants belonging to the *Junglandaceae* and specifically in the genus *Carya*. In fact, the fossil forms presented here have characteristics very close to the gall produced by *Phylloxera rimosalis* Perg. on hickory, described and illustrated by Felt.

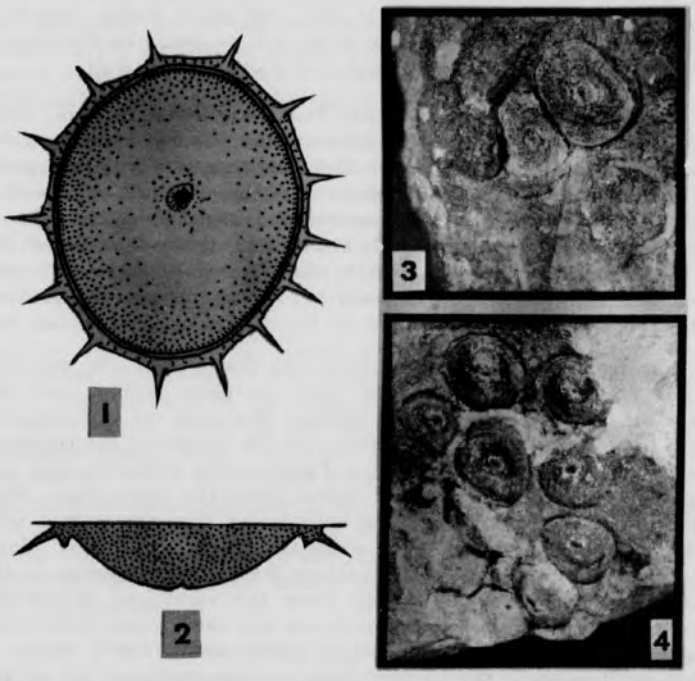
The mature fossil galls average 9mm. long and 6 to 7mm. wide. The conical body of the gall is 2-3mm. high. Young to older galls range in length from 2 to 12mm. Three to four of the larger galls show raised and rimmed margins with compression of equally-spaced spines or bristles, 14 in number and attached at their bases to the flange-like rim of the gall. The orifice at the summit of the cone in the mature galls, ranged in diameter from 0.75mm. to 2.5 mm. The fossil galls are clustered in aggregates as are modern galls.

The leaf compressions on which the fossil galls are situated, are not detailed enough to show their complete outline, and the margins of the leaves are not too distinct. However, the leaf margins appear to be serrulate and not entire. On the suface of the compressions are many casts of leaf hairs. Perhaps this indicates that the underside of the leaf is exposed rather than the upper side. Most of the species in the *Juglandaceae* have leaves that are clothed with hairs on the underside, at least when the leaves are young. Many retain this hirsute nature in the mature leaves. Some species in the modern flora have minute glands along the veins and distributed among the plant hairs. These fossil forms also show gland distributed along the only midrib visible in these compressions. As a result of the above dscussion, the author makes no commitment as to the generic designation of the fossil leaf compressions because they are too fragmentary. In the light of the present day restriction of this type of gall on a number of species in the family *Juglandaceae*, it seems likely in the author's opinion that these leaf compressions

do represent some genus in this plant family. It has been shown by past studies of other authors, i.e. Berry (1916). (1924) and (1930a), (1930b), Knowlton (1922), MacGinitie (1941) and Potbury (1935) that genera of the *Juglandaceae* were prevalent throughout the Eocene epoch.

In Fig. 1, a complete restoration of the mature fossil gall is illustrated, as seen from above with its rim fringed with spines. Fig. 2 is a diagrammatic vertical section of the fossil gall. Figs. 3 and 4 are photographs of the total number of young and mature fossil gall specimens studied in this work. Specimens illustrated in Figs. 3 and 4 (L 66031 and L 64101) are in the Paleobotanical Herbarium of Arkansas State University Museum.

In conclusion, the author wishes to thank Dr. Harvey E. Barton for his analysis and comments on these fossil specimens.



Figs. 1-4: Fig. 1, Restotration of Fossil Gall, Fig. 2, Vertical section of gall, Fig. 3 and 4, Fossil gall specimens. X1.25

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