

Liriodendron in the Miocene of America and Eastern Asia

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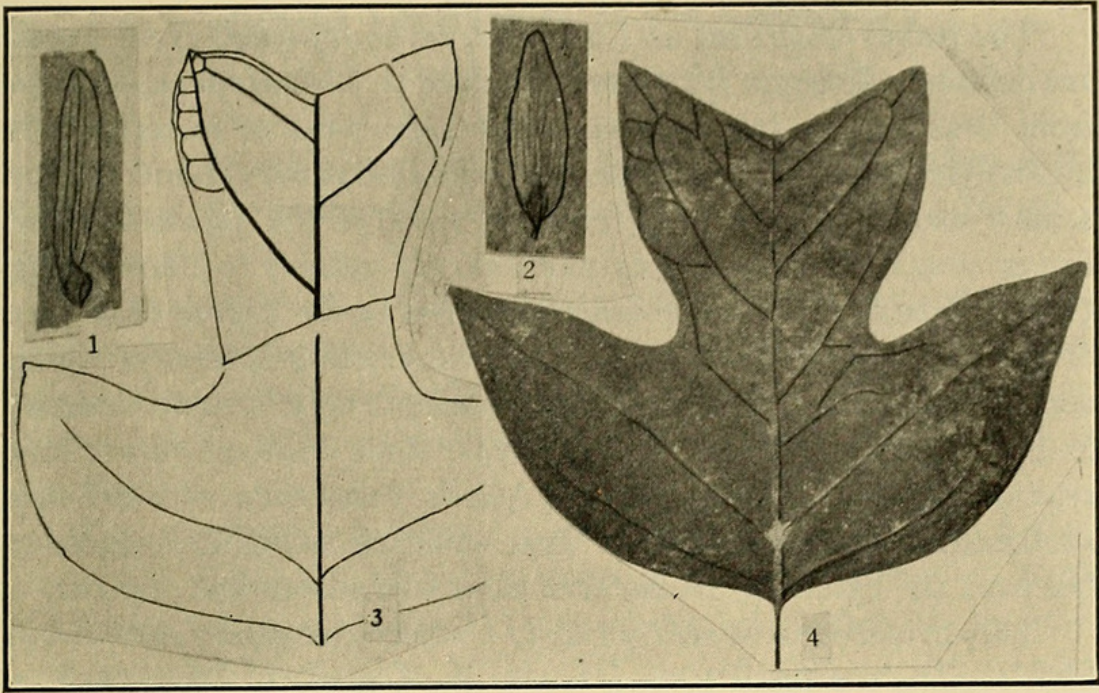
More or less complete accounts of the geological history of the Tulip tree (*Liriodendron*) have been frequently attempted and a fairly detailed summary (1) was presented in 1923, but "time marches on" and discovery is not halted by the publication of a book, in fact, quite the reverse is true. In particular the last few years have seen various gaps in the record closed, especially in the Tertiary of western North America. My first scientific paper, published in 1896, was on the leaves of *Liriodendron* and the variations in the leaves of our existing species of the eastern United States has been an annual pleasure.

Liriodendron was abundant and varied in the upper Cretaceous of the western interior of North America, but no indubitable records of Tertiary age from this continent have been available until recently. It is true that Chaney ascribed a leaf fragment (2) from the Eagle Creek formation to this genus in 1920 but this record, although probably correct, lacks conclusiveness; and the same may be said of another fragmentary specimen from the upper Eocene of British Columbia which I recorded (3) in 1926. In 1929, however, I published an account (4) of a Miocene species—*Liriodendron hesperia* from the Latah Miocene formation of the State of Washington. This was based upon perfect characteristic carpels which are essentially modern in their features. More recently Brown has figured additional carpels from this same locality together with a fragmentary leaf (5).

Among the Latah Miocene materials remaining in my hands are several specimens of carpels from the type locality and a leaf fragment from the Latah at Vera a few miles distant.

The latter is not especially like the leaf fragment which Brown figured from the Spokane locality, but having in mind the well-known variation in the leaves of the existing species it seems improbable that more than a single species was represented in Latah time.

The question will perhaps arise in the mind of some starry eyed botanist lacking a chronological sense why these Miocene leaves are not specifically identical with the existing species? and the answer is, or so it seems to me, that they could be, only you would be faced with the insuperable difficulty, at least to me, of consider-



ing that the existing species originated in Mid-Cretaceous times, since the latter can certainly for the most part be matched by variants among the leaves of the existing species, which is a pre-Darwinian conception of the fixity and immortality of species which is as outmoded at the present time as is Noah's flood. The accompanying illustrations show two carpels of *Liriodendron hesperia* from the Brickyard locality at Spokane (Figs. 1, 2), a fragmentary leaf from the Vera locality that is referred to the same species (Fig. 3) and a similar leaf of *Liriodendron tulipifera* from a spring shoot of a sapling (Fig. 4). The resemblances between the last, both in form and venation are obvious.

There are two existing species of *Liriodendron*—one in central China and our familiar tree of the southeastern United States—those two regions that are botanically so similar and share so many arborescent genera that are found only in these two regions (*e.g.*, *Gordonia*, *Hicoria*, *Magnolia*, *Sassafras*, *Nyssa*, etc.).

In this connection attention should be called to two *Liriodendron* leaves recorded (6) by Endo in 1934 from the Neogene of Japan under the name of *Liriodendron honsyûensis*, and also to carpels which Endo has described (7) from the Miocene of Korea (Tyôsen) as *Liriodendron meisenensis* and which he states differ from those of *L. hesperia*. These discoveries in Japan and Washington state help to bridge the gap of about 160° of longitude between our existing *Liriodendron tulipifera* Linné and *L. chinensis* Sargent.

The leaves described as *Liriodendron honsyûensis* from Japan are definitely different from those ascribed to *Liriodendron hesperia* from Washington, but because of the sparseness of material it is impossible to know their respective limits of variation and for the same reason it cannot be determined whether the Japanese fossil leaves should be regarded as more closely related to the existing Chinese tree, and the same remark applies to the degree of affinity of *Liriodendron hesperia* as between the existing species of China and that of the southeastern United States. There is some evidence in the Mesophytic floras of our Pacific slope Miocene of a closer relationship with existing eastern Asiatic floras than with existing southeastern American floras. This evidence is highly suggestive but from the nature of the material cannot be susceptible of proof.

This evidence is of two sorts, (1) where the genus survives in both regions the fossil form is more like a modern Asiatic than a modern American species. Examples are *Castanea orientalis* Chaney and *Castanea crenata* Sieb. and Zucc. of Japan; *Styrax* n.sp. Berry and *Styrax japonicum* Sieb. and Zucc. of Japan; *Betula largei* Knowlton and *Betula luminifera* Winkler; *Rhus merrilli* Chaney and *Rhus sylvestris* Sieb. and Zucc.; *Malus idahoensis* Brown and *Malus prunifolia* Willd.; *Fraxinus idahoensis* Brown and *Fraxinus inopinata* Ligels. and *platypoda* Oliver of eastern Asia. (2) where the genus is no longer represented in America. Examples are *Ailanthus americana* Ckl. and *Ailanthus glandulosus* Desf. of China, *Paliurus hesperius* Berry and *Paliurus orientalis*; *Cercidophyllum crenatum* (Unger) Brown and *Cercidophyllum japonicum* Sieb. and Zucc.; *Keteleeria heterophylloides* (Berry) Brown and *Keteleeria davidiana* Beissner; *Dipteronia americana* Brown and *Dipteronia sinensis* Oliver; *Trapa americana* Knowlton and the Asiatic *Trapa bicornis* L. and *bispinosa* Roxburg.

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