ON A LIVING SPECIES OF *JUGLANDICARYA* FOUND IN SOUTH YUNNAN

HSEN-HSU HU
Fan Memorial Institute of Biology, China

ABSTRACT

The characteristics of the fruit of *Rhamphocarya integrifoliolata*, both in its endocarp and its seed, are similar to those of the fruit for the fossil genus *Juglandicarya*, described by Reid and Chandler from the Eocene London Clay Flora of south-eastern England, although its fruit is much larger than that of the fossil genus. Since the London Clay Flora was mainly of a tropical rain forest closely allied in floristic composition to the Indo-Malayan flora, just as in the case of the flora of south-eastern Yunnan where *Rhamphocarya integrifoliolata* flourishes, the identification of the living genus with the fossil one is even more indubitable.

IN Juglandaceae two closely related genera are *Juglans* and *Carya*. The former is characterized by its fruit being an indehiscent drupe, with sculptured and lacunate endocarp and rugose or smooth and lobed seed. The latter is characterized by its fruit with a more or less 4-valved woody husk and by a smooth endocarp without lacunae and by a grooved seed lobed at base. In 1941 Ko-Zen Kuang published a new genus, *Rhamphocarya*, based on the material C. W. Wang collected in south-eastern Yunnan. This genus is characterized by a fruit with very thick woody 4-6-valved husk; a thick-beaked endocarp, smooth both outside and inside, without lacunae and incompletely 2-celled up to the middle; and by a smooth and grooved seed incompletely 4-lobed on the lower part. In the 4-6-valved outer husk and the non-lacunate endocarp of its fruit this genus is evidently related to the genus *Carya* from which it differs, however, in the 5-8 pendulous staminate aments and in having up to 15 stamens in each staminate flower.

In 1933 Reid and Chandler published an important palaeobotanical work, *The London Clay Flora*, in which they published a form genus of Juglandaceae, *Juglandicarya*, with 4 species. They considered these species, although clearly referable to the Juglandaceae, as being of doubtful relationship both to living genera and to one another.

Their diagnosis of the type species, *Juglandicarya Lubbocki*, is as follows:

"Endocarp globular, smooth, dehiscing into equal valves, one-loculed, one-seeded; wall without cavities. Seed erect, orthotropous, conforming to the shape of the locule, simple above, deeply 4-lobed below, contour smooth. Length about 8 mm. Length of primary lobes one half to three-fifths of the seed. Length of secondary lobes about two-fifths of the seed."

Their diagnosis of *Juglandicarya cantia* is as follows:

"Endocarp globular, smooth and without external nodulations, dehiscing into equal valves one-loculed, one-seeded; wall thick, without cavities. Seeds erect, orthotropous, conforming to the shape of the locule, simple above, two-lobed below, each lobe being slightly emarginate at base. Diameter of endocarp about 12 mm."

Their diagnosis of *Juglandicarya depressa* is as follows:

"Endocarp roundly quadrangular or circular, compressed dorsi-ventrally, fibrous externally, one-loculed, one-seeded; walls thick. Seed erect, orthotropous, conforming to the shape of the locule, simple above, deeply two-lobed below; lobes closely approximated, flat or concavo-convex, sometimes emarginate at the base."

Their fourth species, *Juglandicarya crassa*, was formerly published as *Cupressinites crassa* by Bowerbank; but they interpreted it, from a published figure by Bowerbank, as belonging to Juglandaceae, and included it in the form genus *Juglandicarya*. Since the type specimen disappeared, we need not bother with it.

Juglandicarya depressa, as the authors discussed, is of doubtful status. Its dorsi-ventrally depressed endocarp of very small size may belong to genera other than those closely related to *Juglans* and *Carya*; thus it would be unlikely to be related to *Rhamphocarya*. But *Juglandicarya Lubbocki* and *Juglandicarya cantia* have endocarp and seed

very similar to those of *Rhamphocarya*, while differing from those of both *Juglans* and *Carya*.

Rhamphocarya has a smooth, globular to ellipsoid, one-loculed and one-seeded endocarp with thick wall without cavities. Its seed is erect, orthotropous, conforming to the shape of the locule, simple or emarginate above, deeply two-lobed below, the lobes again being shallowly two-lobed by a secondary septum. Its contours are smooth. These characteristics are similar to those of *Juglandicarya*; only the size of the endocarp is much larger. But Lubbock in his work "On seedlings" suggested that in the ancestral forms of *Juglans* the nuts were smaller than in the living species (1892, vol. ii, p. 512). So the smaller size of the fruit cannot be considered as a critical characteristic to separate *Rhamphocarya* from *Juglandicarya*. We have small-fruited *Carya cathayensis* and *C. tonkinensis* living contemporaneously with large-fruited *C. Pecan* and *C. texana*. What is to be regretted is the absence of the characteristic thick husk in the fossil species. But the characteristic endocarp and seed warrant the transfer of the living species to the fossil genus *Juglandicarya*. Hence the new combination.

Juglandicarya integrifoliolata, comb. nov.
Carya Tsiangiana[1] Chun in herb: Shun Chung Lee, For. Bot. China, 238 (1935), nom. nud.
Rhamphocarya integrifoliolata Kuang, Icongraphie Florae Sinicae, Vol. I, No. 1 (1941).

The flowers and fruits of this species are very variable, even on the same trees. Thus Kuang found in C. W. Wang, No. 87073, the type of flowering specimen, the male flowers with up to 15 stamens; but in an isotype in the herbarium of the Fan Memorial Institute, the male flowers bear only 5-6 stamens, while in C. W. Wang, No. 89690, the male flowers have 10-15 stamens. The husk of the fruit is either 4 or 6-valved. The nuts are either pyriform or subrounded, some with a very long and slender beak up to 2·5 cm. long, some with rather short beak very broad at base. The size of the nut varies from 4 to 6 cm. long, 2·7 to 6 cm. broad. In general two distinct types of fruits can be distinguished; one pyriform and laterally compressed, with a linear basal scar constricted at both ends; the other subrounded and not laterally compressed, with a broad oval basal scar only slightly or not at all constricted. In a nut with a large triangular basal scar it denotes evidently an endocarp made up with 3 carpels. The axis with placenta and septum sometimes runs up to the middle of the cell cavity, sometimes up to three-fourths of the cavity. The secondary septum may be little or more developed. The secondary wall projections are widely separated as in the case of *Carya*, thus leaving two rather deep longitudinal grooves on each lobe of the seed. Testa of the seed is pitted externally, and internally smooth and traversed by a few conspicuous branching longitudinal fibres. The seed in drying up shrinks internally, thus becoming undulately hollow, a feature usually found neither in *Juglans* nor in *Carya*.

Altogether *Juglandicarya integrifoliolata* is more closely related to the genus *Carya* than to *Juglans*. Its great variability, both in flowers and in fruits, suggests its hybrid origin, perhaps being an intergeneric hybrid between *Carya* and *Juglans*. But the similarities between the fruits of the living species and those of the fossil species *Juglandicarya Lubbockii* and *J. cantia* trace its ancestry up to the remote age of lower Eocene time.

The smooth endocarp and the smooth 2-lobed seed of *Juglandicarya integrifoliolata* suggest also those of the fossil genus *Caryojuglans Kirchheimer*, but the lacunate wall of the endocarp of the latter precludes it from being congeneric with the living species.

The identification of *Rhamphocarya* with the fossil genus *Juglandicarya* is especially significant in the study of ancient phytogeography. It has been shown that the London Clay Flora "was mainly that of a tropical rain forest closely allied in floristic composition to the existing Indo-Malayan flora". The flora of southern Yunnan and the adjacent province, Kweichow, where *Juglandicarya integrifoliolata* flourishes is also allied in floristic composition to the

1. *Carya Tsiangii* Chun ex Lee, Forest Bot. China, 238 (1935), in erroneous topograph "*Carya Tsiangiana*", nom. nud.
Kweichow: San-hua, in light woods, Y. Tsiang No. 6369, tree 13 m. high, 4 dm. D.B.H., bark dark grey, branchlets lenticellate, leaflets mostly 9, deep lustrous green above, light green below, fruit green; Aug. 9, 1930.
This species, of which the description is apparently not published, is named after Professor Y. Tsiang who first found this interesting plant in 1930. Lee (l.c.) enumerated this plant and noted as follows, "Large tree, discovered in Yunnan and Kweichow recently".— W. C. Cheng.

existing flora of Indo-Malaya. This fact strengthens my contention that the living genus *Rhamphocarya* is congeneric with the fossil genus *Juglandicarya*.

REFERENCES

KUANG, K. ZEN (1941). Icongraphia Florae Sinicae.
KIRCHHEIMER, F. (1938). Ein Beitragezur Kenntnis der alttertiarflora des Harzvorlandes. *Planta*. **27** (5).
REID, E. M. & CHANDLER, M. E. J. (1933). The London Clay Flora. (Brit. Mus.). *London*.
WALTON, JOHN (1940). An Introduction to the Study of Fossil Plants. *London*.

EXPLANATION OF PLATES

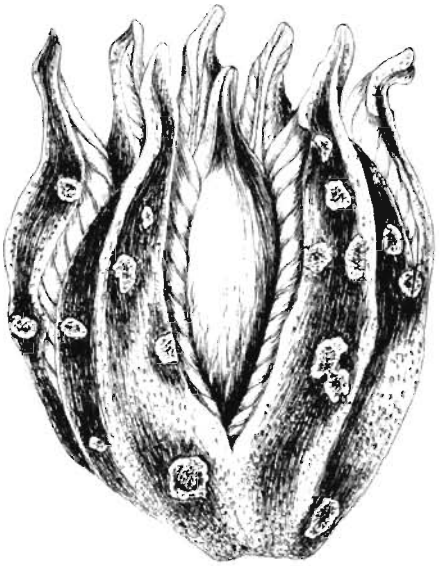
(*All figures natural size*)

PLATE 1

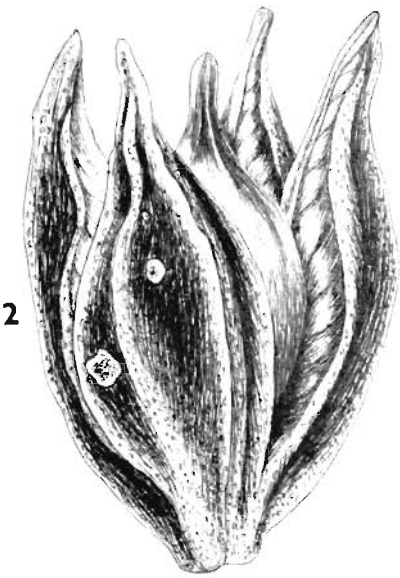
1. A tricarpellate fruit with a 6-valved husk.
2. A bicarpellate fruit with a 4-valved husk.
3. An unusual small fruit with a long beak.
4. Basal view of a fruit with a narrow basal scar.
5. Basal view of a fruit with a broad oval basal scar.
6. Basal view of a tricarpellate fruit with a triangular basal scar.

PLATE 2

7. Longitudinal section of a fruit showing the septum and placenta with a narrow secondary septum and wall outgrowth, with the seed *in situ*.
8. The counter-half of the same fruit showing the broad wall outgrowth and one half of the hollow seed.
9. Longitudinal section of a fruit showing the large placenta and broad wall outgrowth, with the seed *in situ* showing the emarginate upper part.
10. The counter-half of the same fruit showing the large placenta with a broad secondary septum, with the seed *in situ*.
11. Longitudinal view of an endocarp showing the septum and placenta reaching three-fourths of the cell cavity.
12. Cross-section of a fruit showing the septum and placenta and the widely separate wall outgrowth, with the hollow seed *in situ*.

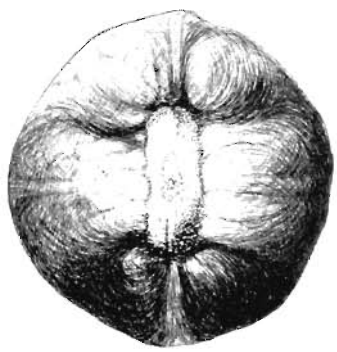


1

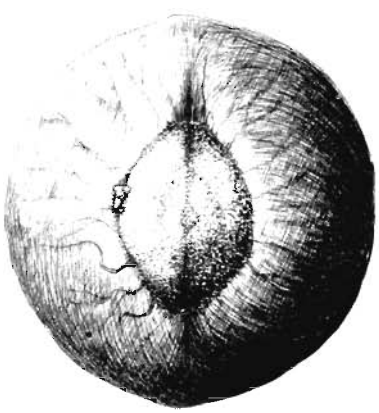


2

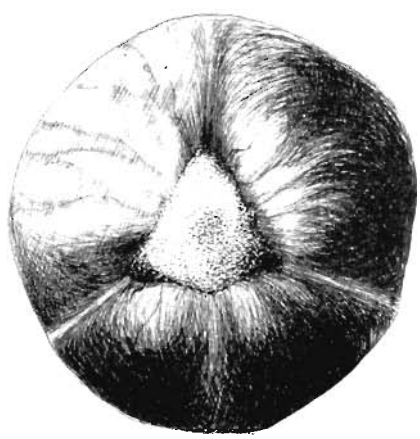
3



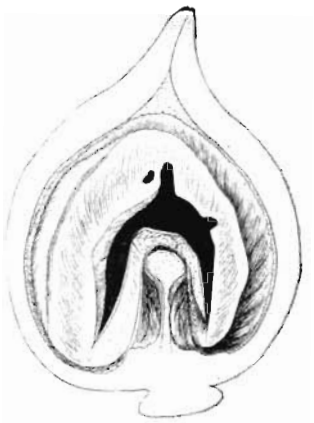
4



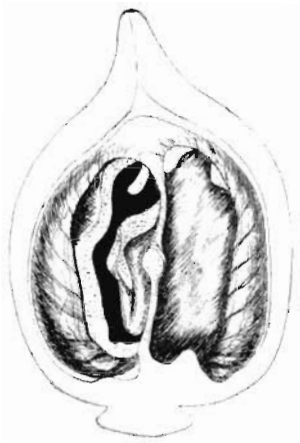
5



6

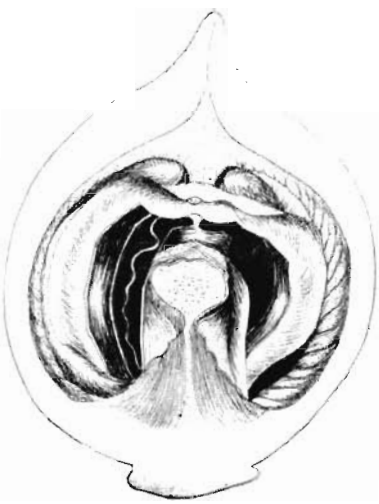


7

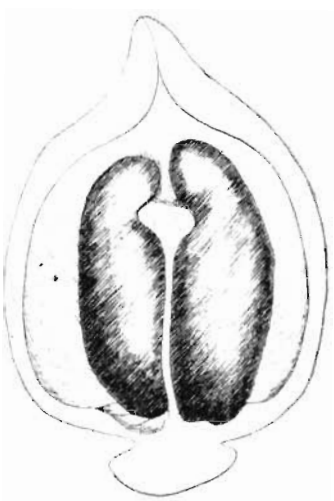


8

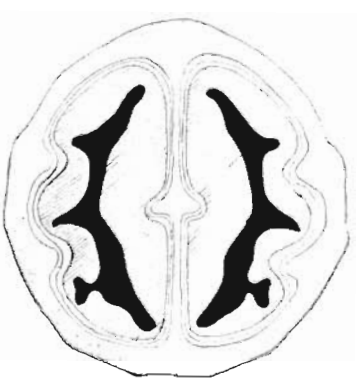
9



10



11



12