

A PRELIMINARY REPORT ON THE COMPARATIVE ANATOMY OF THE EUCOMMIACEAE

OSWALD TIPPO

University of Illinois, Urbana, Illinois

The Eucommiaceae consist of but one species, *Eucommia ulmoides* Oliv. This tree is a native of temperate China but is widely cultivated in Europe and in the United States for it is hardy as far north as Massachusetts. Recently, Hanley (4) described the qualities which make this plant a very desirable ornamental.

This tree may reach a height of sixty feet and may attain a girth of five feet. In growth habit it is like some of the elms. The leaves likewise resemble elm leaves. The plant is dioecious and the flowers are naked. The male flower consists of a group of about ten stamens; the female flower of two fused carpels, one of which usually aborts. Two ovules are attached at the top of the carpel. The fruits are samaras and resemble elm fruits in general appearance. An additional feature and one of some taxonomic importance, is the presence of latex in the bark and in the leaves.

The family is of much interest to the phylogenist for it has been placed in several different orders by systematists. In the first edition of "Die natürlichen Pflanzenfamilien", Engler and Prantl (2) place the genus *Eucommia* in the Trochodendraceae in the order Magnoliales. In the second edition of this treatise, *Eucommia* is put in a separate family in the order Rosales and near the Hamamelidaceae. Wettstein (8), in his second edition of the "Handbuch der systematischen Botanik", classifies the family in the Hamameliales, near the Hamamelidaceae. In his fourth edition, Wettstein places the family in the Urticales, near the Ulmaceae. Hutchinson (5) puts the family in the Hamamelidales, near the Hamamelidaceae. Bessey (1) places the family near the Hamamelidaceae in the Rosales. Hallier (3) classifies the genus *Eucommia* in the Hamamelidaceae of the Amentiflorae.

The present investigation was undertaken in the hope that the study of the

anatomy of the groups involved, might contribute to the solution of the problem of the proper taxonomic position of the Eucommiaceae. The six samples, on which this report is based, were all taken from mature trees, growing in such widely separated localities as China, England, Massachusetts and Illinois.

Growth rings are present in all specimens. The wood is diffuse-porous, but there is a tendency toward ring-porosity in some of the samples. The pores are extremely small (ranging in diameter from 20 to 35 μ ; mean 25 μ), angular, and thin-walled. The pores are mostly solitary, with but a few multiples and clusters. Thick-walled tracheids make up the ground-mass of the wood. The parenchyma distribution is terminal and diffuse. The rays are chiefly uniseriate and biseriate, rarely triseriate. The rays are nearly homogeneous, but would be designated heterogeneous IIB under the ray classification of Kribs (6). The vessel elements have simple perforation plates. These elements are medium-sized in length (ranging from 225 to 420 μ ; mean 325 μ) and have spiral thickenings. The end walls of the vessel members form angles of 20° to 60°. The intervacular pitting is mostly opposite with some alternate.

The author had previously (7) studied the anatomy of the Hamamelidaceae and of the Urticales and, therefore, was in a position to make comparisons between the Eucommiaceae and the families with which they have been classified. On the basis of this study and of the previous investigation cited above, the writer came to the conclusion that the Eucommiaceae belong in the Urticales near the Ulmaceae. Among the reasons for this conclusion are the following: The Eucommiaceae and the families of the Urticales have simple perforation plates, while the Hamamelidales have scalariform perforation plates. The Eucommiaceae and the families of

the Urticales have short vessel elements, whereas the Hamamelidaceae have very long (1089 μ or over) vessel elements. The Eucommiaceae and the families of the Urticales have relatively high types of rays (i. e. IIB), while the Hamamelidaceae have primitive rays—heterogeneous I and IIA. There is a tendency toward ring-porosity in the Eucommiaceae. This tendency is not present in the Hamamelidaceae but is found in the Urticales. The alternate intervacular pitting of the Eucommiaceae is suggestive of the Urticales rather than of the Hamamelidaceae which are characterized by scalariform and transitional intervacular pitting. Furthermore, latex, present in *Eucommia*, is not found in the Hamamelidaceae but is common in the Moraceae.

Many features of the external morphology of *Eucommia ulmoides* may be listed in support of the conclusion advanced above. It has already been pointed out that the general habit, that the leaves, that the fruits are elm-like. These characters are, no doubt, responsible for the very appropriate specific name—*ulmoides*. In addition, *Eucommia* is dioecious as are some members of the Ulmaceae. The flowers are naked as are the flowers of some members of the Moraceae. The two fused carpels, the abortion of one carpel, the pendulous ovules—all are characters suggestive of the Ulmaceae.

The conclusion here presented has some measure of support from taxonomic sources for Wettstein (8), in the fourth edition of his "Handbuch", places the Eucommiaceae in the Urticales. H. Harms (2), writing in the second edition

of "Die natürlichen Pflanzenfamilien", points out that *Eucommia* possesses several characteristics which link it to the Hamamelidaceae and several which indicate affinity with the Ulmaceae. He places the Eucommiaceae in the Hamamelidales but, in so doing, makes the very significant statement that it cannot be denied that the genus *Eucommia* might just as well, perhaps even still better, be placed in the order Urticales. The present writer agrees that the Eucommiaceae have many characters which suggest the Hamamelidaceae on the one hand and the Urticales on the other. The probable explanation for this situation is that the two groups—the Hamamelidaceae and the Urticales—are much more closely related than is ordinarily recognized. The writer is of the opinion that the Hamamelidaceae gave rise to the Urticales and that the Eucommiaceae form a connecting link between the two groups.

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