

THE GENUS *TILIA* IN OKLAHOMA

Cheryl A. Lawson

Department of Botany and Microbiology, University of Oklahoma, Norman, Oklahoma

An attempt has been made to identify Oklahoma species of *Tilia* (commonly called basswood or linden) and to evaluate characters which separate species. The distribution of species within the state and a key to their identity are presented.

Jones (1), after an extensive study, recognized four American species: *Tilia americana* L., *T. caroliniana* Mill., *T. heterophylla* Vent., and *T. mexicana* Schlecht. He lists numerous synonyms, several of which have been applied in the literature to Oklahoma material. Hence, it seemed desirable to attempt an identification of the Oklahoma material with Jones' monograph. The present Oklahoma study was done primarily with herbarium specimens with some supplementary field observations.

According to Jones (1), three species, *T. americana*, *T. caroliniana*, and *T. heterophylla*, occur in Oklahoma. He cites Oklahoma collections of the first two species, but not of *T. heterophylla*. None of the Oklahoma specimens at the Bebb Herbarium, University of Oklahoma, or at the Herbarium of Oklahoma State University fits the characters of *T. heterophylla*. This fact does not definitely exclude this species. More collections may produce a specimen of it, but its distribution in Oklahoma must be extremely limited.



FIGURE 1. Distribution of *Tilia americana* in Oklahoma; ● Collection sites from herbarium specimens; + Additional sites given by Jones.

The distribution of Oklahoma species (Figures 1 and 2) given by Jones and that based on herbarium material in this study do not entirely agree. Jones' maps, which may be somewhat generalized, indicate ranges in the state slightly west of those in



FIGURE 2. Distribution of *Tilia caroliniana* in Oklahoma; ● Collection sites from herbarium specimens; + Additional sites given by Jones.

records he cites or that I have seen. We agree that the western-most record in Oklahoma is Pushmataha County for *T. caroliniana* and Nowata County for *T. americana*. Jones' Oklahoma extension for *T. heterophylla* would include Adair and Delaware Counties.

It is difficult to find useful characters for species differentiation. Characters vary within a species and some occur infrequently. On an occasional specimen one finds flowers, young fruits, bracts, and leaves. More typically, specimens consist only of leaves and perhaps a few bracts. Leaf margins are a good place to begin species determination. Incurved tips on the teeth are characteristic of *T. americana* and *T. heterophylla*, whereas they are found only in very small numbers on leaves of *T. caroliniana*. Pubescence on the undersurface of the leaf can be extremely variable, yet it is used frequently in species identification. In *T. americana*, the undersurface, for the most part, is glabrous. Tufts of simple trichomes are often found in the axils of the veins and appear most conspicuously in this species. A few scattered stellate hairs can be found between veins, and simple hairs often occur along the veins. In *T. heterophylla*, the undersurface is most often densely covered with firmly attached stellate trichomes, giv-

ing it a white appearance; tufts of axillary trichomes are not conspicuous. Jones states: "On some specimens the trichomes are sparser and looser, or less commonly the surface nearly glabrous." Of the material seen with pubescence of this type all seemed referable to *T. americana*. The stellate hairs on the undersurface of the leaves of *T. caroliniana* are easily detached. The pubescence is frequently copious, but not nearly so dense as in the typical *T. heterophylla*, and tufts of axillary trichomes may also be present. Rays of the stellate trichomes of *T. americana* and *T. caroliniana* were longer than those of *T. heterophylla* (.23 to .40 mm vs. .07 to .23 mm, respectively) in at least 80% of the specimens examined. This character should be a good taxonomic criterion, although Jones, comparing the trichomes of *T. caroliniana* and *T. heterophylla*, thought it was not usable.

Jones states there are seven to eight pairs of secondary veins in *T. americana*, seven to nine pairs of principal veins in *T. heterophylla*, and five to eight pairs of primary veins in *T. caroliniana*. The terms secondary, principal, and primary are confusing and, if used synonymously, the overlap in numbers of veins reported is too great to use as a good taxonomic character. In Oklahoma species, the number of veins originating from the base of a leaf of *T. americana* was chiefly eight, whereas in *T. caroliniana* it was generally six. Two of these radiating veins were often very small and inconspicuous. There were six to nine radiating veins per leaf in *T. americana*, while in *T. caroliniana* the range was five to eight. This character is not used by Jones, but it could serve as an aid in identification.

Species of *Tilia* are distinguishable by the styles. In *T. americana*, the style is hispidulous at a slightly thickened base. In *T. heterophylla*, hairs occur for a short distance up the style, "below the middle" according to Jones. Measurements showed the hairs to be on the proximal one-fourth to one-third of the style. In *T. caroliniana*, the style has lit-

tle or no hair below the middle or at the base, and neither *T. heterophylla* nor *T. caroliniana* has a style with a thickened base.

I consider the above characters important in identifying a specimen. Since approximately half of the 38 Oklahoma specimens examined lacked flowers or fruits, as many leaf characters as possible have been used in developing the key presented below.

KEY TO *TILIA* IN OKLAHOMA

1. Leaves glabrous, or nearly so, except for tufts of trichomes in the axils of the veins on the undersurface; teeth tips incurved.
 2. Styles hispidulous at a somewhat thickened base; stellate hairs, when present, having rays mostly .23 to .40 mm in length; number of veins originating from the base of a leaf chiefly 8, two of the veins often less conspicuous than the others ----- *T. americana* L.
 2. Styles hispidulous below the middle and without the thickened base; stellate hairs, when present, having rays mostly .07 to .23 mm in length ----- *T. heterophylla* Vent.*
1. Leaves pubescent with stellate trichomes on the undersurface; teeth tips either incurved or straight; styles without thickened base.
 3. Pubescence firmly attached and typically dense; styles hispidulous below the middle; rays of the stellate hairs mostly .07 to .23 mm in length ----- *T. heterophylla* Vent.*
 3. Pubescence loosely attached and usually not dense; styles sparsely hairy, if at all, at the base; rays of the stellate hairs mostly .23 to .40 mm in length; number of veins originating from the base of a leaf chiefly 6, two of the veins often less conspicuous than the others; teeth tips straight ----- *T. caroliniana* Mill.

*To be expected in Oklahoma

ACKNOWLEDGMENT

The author wishes to express her sincere appreciation to Dr. George Goodman for his encouragement and guidance throughout this study.

REFERENCE

1. G. N. JONES, *Taxonomy of American species of linden (Tilia)*, Illinois Biological Monographs No. 39, University of Illinois Press, Urbana, 1968.