A LIST OF DIAGNOSTIC CHARACTERISTICS FOR DESCRIPTIONS OF DICOTYLEDONOUS WOODS

OSWALD TIPPO, *University of Illinois, Urbana, Illinois*

During the course of investigations of the wood anatomy of a number of dicotyledonous families (23, 24), the writer has had occasion to compile an extensive list of the important diagnostic features of wood. In the belief that this compilation may be of use to beginners, and perhaps of some interest to professional wood anatomists, the writer has prepared it for publication. This catalogue includes the important phylogenetic features (5, 14, 15, 16, 17, 23) as well as those whose phyletic value is not yet established, but yet which have proven to be of taxonomic import.

As far as the writer knows, but two other lists of this character have been published. Clarke (11) has designed a short list for a card sorting device and Record and Chattaway (19) have published a more extensive list for the same purpose.

Frequent citations of the more important, especially the more recent, papers have been made throughout the present list. Particular attention should be drawn to the important "Glossary of terms used in describing woods" (12) prepared by the Committee on Nomenclature of the International Association of Wood Anatomists and to the books by Record (18) and Brown and Panshin (3).

LIST OF DIAGNOSTIC FEATURES.

Name of plant (indicate if young or mature by Y or M).
Number of wood.
Geographical distribution.
Growth rings—present or absent.
  Width in μ (measure 10 or more).
    Range Example: 30-40 μ
    Most frequent range 35-38 μ
    Mean 37 μ
Tracheids and fibers.
  Tracheids—(See 2).
    Ordinary type.
    Vasicentric tracheids.
    Vascular tracheids.
  Fiber-tracheids.
  Septate fiber-tracheids.
  Libriform wood fibers.
  Septate wood fibers.
  Gelatinous fibers.—(See 20).
  Wall thickness (radial wall)—(See 9).
    Very thin—lumen much greater than thickness of walls.
    Thin—lumen greater than thickness of walls.
    Thick—lumen less than thickness of walls.
    Very thick—lumen almost completely closed.
  Size of pits—measure at least 10.
    Minute.
    Small.
    Large.
  Length—measure 100 from macerations (Record No. of measurements) (See 13, 21, 22).
    Range.
    Most frequent range.
    Mean, with standard error.
      Standard deviation, with standard error.
  Spiral thickenings, present or absent.
Vessels
  Number per sq. mm. (in X-section)—count 10 or more fields.
    Range.
    Most frequent range.
    Mean.
  Pore distribution.
    Solitary pores. } Record % in each category
    Pore multiples. } and no. of pores in the group-
    Pore clusters. } ings. (Ex. clusters $90\%^{2-4}$).
    Pore chains. } Sample 10 or more fields.
  Diffuse-porous.
  Semi-ring-porous.
  Ring-porous.
  Angular or circular in X-section.
  Thin or thick wall—measure a few walls.
  Diameters—measure 100 in X-section (tangential diameter).
    Record no. of measurements. (See 9, 13, 21, (22). If ring-porous, take 50 in the early wood and 50 in the late wood.
    Range.
    Most frequent range.
    Mean, with standard error.
      Standard deviation, with standard error.
  Tyloses, present or absent.
    Few or many in sections.
    Few or many in individual vessels.
    Thin or thick walls (sclerotic).
    Contents.
    Pits.
  Perforation plates—(See 14).
    Exclusively scalariform.
    Scalariform and simple.
    Simple and vestiges of scalariform.
    Simple.
    Reticulate—(See 4).
    Foraminate
  Number of bars (in scalariform perforation plates).
    Range.
    Most frequent range.
  Width of perforations (if scalariform).
    Range.
    Mostly.
  Perforations bordered or not (if scalariform)—(See 15).
    Complete border.
    Border to middle.
    Border at ends.
    Non-bordered.
  End walls.
    Oblique—express as angle. (Ex. 50° -80°).
    Transverse.
  Intervascular pitting—(See 16).
    Scalariform.
    Transitional.
    Opposite.
    Alternate.
    Sparse or crowded.
    Size of pits—(See 19).
      Minute—less than 4 μ
      Small—less than 7 μ
      Medium—7-10 μ
      Large—over 10 μ
      Very large—over 15 μ
    Shape of pits.
      Circular.
      Square.
      Pentagonal, etc.
  Gum deposits in vessels.
    Color, abundance, location.
  Striations on vessels.

Vessel-parenchyma pitting.
Scalariform.
Transitional.
Opposite.
Alternate.
Size—(See 19).
Fine—not more than 7 μ
Medium—7 to 10 μ
Coarse—more than 10 μ
Shape.
Circular, oval, elongated.
Unilaterally compound.
Length of vessel elements (total body length)—(Measure 100 from macerations). Record No. of measurements. (See 7, 13, 21, 22).
Range.
Most frequent range.
Mean, with standard error.
Standard deviation, with standard error.
Spiral thickenings.

Vascular rays.
Abundance—No. per mm. (tangential section).
Type—(See 17).
Heterogeneous I.
Heterogeneous IIA.
Heterogeneous IIB.
Heterogeneous III.
Homogeneous I.
Homogeneous II.
Homogeneous III.
Width (No. of cells wide).
Range.
Most frequent range.
Height.
Uniseriate rays.
Range.
Most frequent range.
Multiseriate rays.
Range.
Most frequent range.
Pitting (between ray cells and other parenchyma cells).
Size.
Number—few, many, clustered.
Lignified, or not.
Perforated ray cells—(See 6).
Intercellular canals.
Latex tubes.
Oil cells.
Crystals-type, etc.
Aggregate rays.
Sheath cells.
Tile cells.
Sclerotic ray cells.

Xylem parenchyma
Abundance.
Sparse, abundant, or absent.
Distribution—(See 12).
Diffuse.
Terminal.
Initial—(See 10).
Metatracheal—record No. of cells wide.
Vasicentric.
Aliform.
Confluent.
Pitting (between xylem parenchyma cells.).
Size.
Number—few, many, or clustered.
Fusiform parenchyma cells.
Septate parenchyma cells.
Chambered parenchyma cells.
Crystals—type, etc.
Lignified.
Sclerotic parenchyma cells.

Other Features.
Storied structure—state which elements.
Crystals present.
Location, type, etc.
Pith flecks.
Intercellular canals (gum, resin, or oil).
Vertical or horizontal, or both.
Normal or traumatic.
Included phloem—(See 8).
Vestured pits (in vessel elements, tracheids, or fiber tracheids)—(See 1).
Fibriform vessel members—(See 25).
Disjunctive tracheids.
Disjunctive parenchyma cells.
Photographs.
Indicate slide and location on slide.

LITERATURE CITED

1. Bailey, I. W., The cambium and its derivative tissues. VIII. Structure, distribution, and diagnostic significance of vestured pits in dicotyledons. Journ. Arnold Arb. 14:259-273. 1933.
2. ....., The problem of differentiating and classifying tracheids, fiber-tracheids, and libriform wood fibers. Tropical Woods, 45:18-23. 1936.
3. Brown, H. P., and A. J. Panshin, Commercial timbers of the United States. McGraw-Hill Book Co., New York. 1940.
4. Chalk, L., Multiperforate plates in vessels, with special reference to the Bignoniaceae. Forestry (Jour. Soc. of Foresters of Gr. Br.) 7:16-25. 1933.
5. ....., The phylogenetic value of certain anatomical features of dicotyledonous woods. Annals Bot. N. S. 1:409-428. 1937.
6. ....., and M. M. Chattaway, Perforated ray cells. Proc. Royal Soc. London B 113:82-92. 1933.
7. ..... and ....., Measuring the length of vessel members. Tropical Woods 40:19-26. 1934.
8. ..... and ....., Identification of woods with included phloem. Tropical Woods 50:1-31. 1937.
9. Chattaway, M. M., Proposed standards for numerical values used in describing woods. Tropical Woods 29:20-29. 1932.
10. Chowdhury, K. A., Terminal and initial parenchyma cells in the wood of *Terminalia tomentosa* W. and A. New Phytol. 35:351-358. 1936.
11. Clarke, S. H., A multiple-entry perforated-card key with special reference to the indentification of hardwoods. New Phytol. 37:369-374. 1938.
12. Committee on Nomenclature. International Association of Wood Anatomists., Glossary of terms used in describing woods. Tropical Woods 36:1-12. 1933.
13. Desch, H. E., Significance of numerical values for cell dimensions. Tropical Woods 29:14-20. 1932.
14. Frost, F. H., Specialization in secondary xylem of dicotyledons. I. Origin of vessel. Bot. Gaz. 89:67-94. 1930.
15. ....., Specialization in secondary xylem of dicotyledons. II. Evolution of end wall of vessel segment. Bot. Gaz. 90:198-212. 1930.
16. ....., Specialization in secondary xylem of dicotyledons. III. Specialization of lateral wall of vessel segment. Bot. Gaz. 91:88-96. 1931.
17. Kribs, D. A., Salient lines of structural specialization in the wood rays of dicotyledons. Bot. Gaz. 96:547-557. 1935.
18. Record, S. J., Identification of the timbers of temperate North America. Wiley & Sons, New York. 1934.
19. ....., and M. M. Chattaway, List of anatomical features used in classifying dicotyledonous woods. Tropical Woods 57:11-16. 1939.
20. Rendle, B. J., Gelatinous wood fibers. Tropical Woods 52:11-19. 1937.
21. ....., and S. H. Clarke, The problem of variation in the structure of wood. Tropical Woods 38:1-8. 1934.
22. ....., and ....., The diagnostic value of measurements in wood anatomy. Tropical Woods 40:27-37. 1934.
23. Tippo, O., Comparative anatomy of the Moraceae and their presumed allies. Bot. Gaz. 100:1-99. 1938.
24. ....., The comparative anatomy of the secondary xylem and the phylogeny of the Eucommiaceae. Amer. Jour. Bot. 27:832-838. 1940.
25. Woodworth, R. H., Fibriform vessel members in the Passifloraceae. Tropical Woods 41:8-16. 1935.