

VASCULAR PLANT MORPHOLOGY

LABORATORY 9

Ginkgoales

The Ginkgoales can be traced as far back as the Permian, where the genus *Trichopitys* represents the group. Representatives were widespread during the Mesozoic, but became increasingly restricted in distribution through the Tertiary. Today there is but one extant species, *Ginkgo biloba*, the maidenhair tree. Although *Ginkgo* is a popular ornamental tree of worldwide distribution, it apparently has survived only in cultivation. Up to about 1800 it was found only in Chinese monasteries.

Young *Ginkgo* trees have a conical shape similar to many conifers, but older trees produce a rounded crown. Both long shoots and short (spur) shoots are present, and the plants are deciduous. *Ginkgo* is strictly dioecious, with the ovulate or pollen producing structures borne on the short shoots. The leaves have a distinctive fan shape and open-dichotomous venation. The distal leaf margin may be entire, bilobed (hence the species name), or rarely dissected into a larger number of lobes.

Examine seedlings and herbarium specimens of *Ginkgo biloba*. Note the long shoot and short shoot distribution, and the mode of leaf attachment. How does this compare to the situation you have seen in *Pinus*, *Larix* and other conifers? Diagram a section of branch indicating the long shoots, short shoots, and leaves. Now examine an individual leaf. Do not take it from the herbarium sheet. Isolated leaves are present in the laboratory for closer examination. Identify the petiole and blade. Diagram a segment of leaf near the distal margin and indicate the venation pattern.

Make a transverse section of the petiole. What is the distribution of the vascular tissues?

Examine a cross section of a *Ginkgo* stem. Is this a long shoot or a short shoot. How can you tell? Diagram the stem, indicating the tissues present. How does this axis compare to that of *Pinus*? What term would you use to describe the secondary xylem?

The pollen of *Ginkgo* is produced in lax strobili. Each strobilus consists of a central axis and spirally arranged sporophylls. There are typically two terminal pollen sacs on each microsporophyll. Examine a pollen strobilus in longitudinal section. What is the disposition of the microsporophylls and pollen sacs? Diagram the cone section. Now examine an individual pollen sac. How large is it? How thick is the wall? Can you identify the individual pollen grains? Diagram a single pollen sac that is cut in a median plane.

Examine a preserved specimen of a pollen strobilus. Note the arrangement of the microsporophylls. Remove a microsporophyll and examine it more closely. Draw the sporophyll with the attached microsporangia (pollen sacs). Break open a pollen sac and examine the pollen grains. Can you identify the distal sulcus. Draw a typical pollen grain.

The ovules of *Ginkgo* are borne on branching structures that occur on short shoots. Examine

the herbarium specimen with attached ovulate structures. How are they positioned in relation to the leaves? Diagram a short shoot with attached ovulate structures and vegetative leaves.

Preserved ovulate structures are also present in the laboratory. Examine a specimen with immature ovules. Identify the ovule and subtending collar. Now examine an ovulate structure bearing mature ovules or seeds. Have both ovules developed or is one abortive? Diagram a mature and an immature ovule with subtending collar. There is one ovulate stalk set aside for dissection. If you wish you may cut a section of the stalk. Compare the vascular configuration with that of the leaf petiole, and with the stem. Does this suggest the nature of this structure?

Examine a prepared slide of a young ovule with the megagametophyte in the free nuclear-stage. Draw the ovule at this stage. Now examine a prepared slide of a *Ginkgo* seed with an embryo. Identify the layers of the integument, the nucellus, megagametophyte tissue, and embryo. Draw the seed, indicating the various parts.

Now examine the embryo more closely. Can you identify the epicotyl, cotyledons, hypocotyl and radicle. Draw the embryo as it would look if removed from the seed. *Ginkgo* seeds are present in the laboratory. If you wish you may dissect a seed.

Review the micro- and megagametophyte development of *Ginkgo*, and also the development of the embryo. How do these developmental sequences compare to those of the other seed plants we have studied?