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Issue No. 7
Winter 1996

M. Nigel Wright & Lisa A. Wright, Editors
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The International Oak Society is a registered,
nonprofit organization.

MISSION STATEMENT

To further the study, sustainable management, preservation, appreciation, and dissemination of knowledge to the public about oaks (genus *Quercus*) and their ecosystems.

GOALS

1) To advance the state of scientific knowledge regarding oaks and oakland ecology.

2) To locate, preserve and catalog significant oak-related literature.

3) To facilitate the location and distribution of living material for propagation of oaks.

4) To foster communication among members via a journal, other mailings, and periodic meetings.

5) To promote the study, and development, naming and distribution of superior cultivars and cultivar groups for horticultural use, and the study of oaks for the production of timber, mast, and other useful products.

6) To sponsor the preservation, display, and interpretation of oak-related traditions, art and lore; and encourage development and curation of appropiate and useful collections of oak-related pieces, such as wood samples, taxonomic specimens, or historic oak artifacts.

7) To develop the capability and to serve as a registrar authority for oak cultivars, historic and champion oak trees, ancient oak groves, unusual or rare oak specimens, or objects of significance involving oaks.

8) To provide information regarding the use, preservation, and appreciation of oaks, and successful techniques for oak culture and management.

9) To encourage, recognize and honor outstanding achievements by individuals and organizations, members and non-members, in advancing these goals of the International Oak Society.

Cover: *Quercus oglethorpensis* at The Morton Arboretum. M. Nigel Wright

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JOURNAL OF THE INTERNATIONAL OAK SOCIETY

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LETTER FROM THE EDITORS

After finishing our previous First Conference Proceedings issue of the *Journal* (Issue #6), we found it difficult to summon the same breadth of articles as that monumental issue had attained. Indeed, just the task of compiling the information was cause for a mini-vacation. When it was finally finished and back from the printers, it was thrilling to see the issue in its final state. We set Issue #6 on the shelf and stood back in admiration of what was accomplished, not only in this publication, but also as a society of members sharing a common concern and interest in the genus *Quercus*; the dream that a handful of enthusiasts could only imagine, awoke to the early revelations of what we know now as the International Oak Society. From this small number of pen-pals exchanging seed, this Society has published seven professional journals, and will have co-sponsored two conferences by the end of 1997. Our Society has secured a balanced infrastructure of board members, who worked in 1996 to obtain a legal non-profit status and to establish the official mission statement and goals (please see inside front cover of this journal issue). Membership representation has expanded worldwide to over 400 members and individual Chapters are being formed by enthusiastic members in Europe.

These changes and growth may not have been apparent to most of our members who probably feel that communication with the membership through the *Journal* is sporadic and is too long between intervals of publication. People have asked us "what is happening with the Society?"; or, " I haven't heard anything since the last *Journal* ?"; or, "do we still exist?". These rightfully placed questions have made the organizational Board examine the problem of just a few people producing the *Journal* and managing membership records for a worldwide group.

Because our Society has expanded and changed over five years of its existence, we have updated membership services and orientation to coincide with our growth. We now have a part-time person fulfilling membership management duties. The Journal Office has more time to concentrate on the *Journal* and . . . .

In order to communicate and distribute current information about our Society to members, beginning in 1997, the *Journal* will be published once a year; however, in addition, we will distribute a more informal newsletter twice a year to update, acknowledge and inform members more appropriately of Society events, business, worldwide activities, field trips, conferences, new members, etc. We feel that the newletter will fill a gap that has been missing in communication with our members. Expect to see the first newletter in March, 1997.

As with any society, a lot of the output of the group depends greatly on the input from its members (forgive the cliché, but it is true). Referring to the Authors' Guidelines on the inside back cover of this issue, we have set "rules" not only to make the *Journal* a professional publication, but also protect the Society.

Additionally, we would like to remind our members, as in earlier issues, that we need original material from them in order to print a *Journal.* Please read the Contributor's Guidelines; perhaps already you have material for us!

Articles, stories, photographs, and slides may be sent to the Journal Office for review for a future publication of the *Journal.* Please send material to IOS, Journal Office, P.O. Box 310, Pen Argyl, PA 18072-0310, USA. Your original material will be returned upon request.

Lookng ahead, 1997 will be a very important year for the International Oak Society! Many improvements and activities will take place, including the Second Conference in California, that will breed new energy and excitement. Also this year, we will be printing a revised Issue #1 into our current journal format.

Furthermore, we would like to announce that as of January 1, 1997, we are accepting Visa and Mastercard for membership payments and renewals in order to make it easier for international membership.

We thank all of our members for your patience and understanding, and furthermore, impress upon you that our Society is growing at a healthy pace. We are constantly examining our position, membership and the Society as a whole in order to make improvements to benefit all members.

M. Nigel and Lisa A. Wright

Quercus rysophylla from *Les Chênes* by Camus

THE CLOAK OF THE OAK

by David J. Ellis

Live oaks (*Quercus virginiana*) are one of the most striking natural features in the landscape of the southeastern coastal plain. In most settings the majestic trees, often draped in a delicate mantle of silvery gray Spanish moss (*Tillandsia usneoides*), are cherished for their stolid strength and the graceful spread of their branches. But in swamps and river bottoms, live oaks can take on a primeval, even eerie look, especially at dusk or when mist rises around the thick trunks and the bedewed moss dangles heavily from the boughs.

Live oaks are evergreen oaks that thrive in the sandy soil and salt air of the coastal plain from Virginia south to southern Florida and then west into Texas and northeastern Mexico. They are remarkable for having stubby, often buttressed trunks that quickly diverge into nearly horizontal branches, spreading up to 120 feet (33m) in diameter with a rounded crown to 50 feet (14 m) tall. The smooth-edged, elliptical leaves are a dark, glossy green above and pale green beneath. The tree produces yearly crops of small, elongate, dark brown acorns.

A member of Bromeliaceae, or the bromeliad family, Spanish moss is an essentially rootless epiphyte that takes its water and nutrients from the air. It is commonly seen clinging to trees, walls, and even power lines throughout its native range, which in North America parallels not only that of live oak but also extends south to Argentina and Chile.

Usually found in clusters, individual Spanish moss plants are thread-like strands that can reach 100 feet long. Each strand is punctuated at short intervals by nodes that bear a few narrow leaves and minuscule green to purple flowers with a subtle fragrance that can only be detected when they are blooming en masse. The spreading of the tiny seeds is facilitated by inch-long silky threads with tiny barbs that help the seed cling to rough-barked trees. The plant is also spread through fragments carried by wind or by birds, which used the moss for their nests.

Although Spanish moss is seen on a variety of tree species, it seems to particularly thrive on *Quercus virginiana*. Naturalists disagree about the reasons for this association, however, and also about whether Spanish moss can be detrimental to its tree hosts. "Some people say this is an example of a nonparasitic pathogen--that if you get too much moss on a tree it can block photosynthesis," says Don Gardner, Director of Savannah, Georgia's Park and Tree Department. "Maybe there have been instances where that has occurred, but I don't believe it's the case the majority of the time." Gardner believes the idea that moss can be detrimental to trees originates from an inverse correlation. "I think Spanish moss can be an indicator of vigor, but not a determinant of vigor," he says. "When a tree goes into decline, the leaves may get smaller and fewer. The result is that the tree moves less in the wind and there is less opportunity for the moss to be shaken out."

Craig Martin, a professor of botany at the University of Kansas in Lawrence who has been doing research on *Tillandsia* for about 20 years, believes the primary reasons Spanish moss has an affinity for *Quercus virginiana* are that the oaks' rough, gnarly bark allows the moss to take a firm hold on the tree, and that the moss may be taking up nutrients that leach out of the oaks' leaves. "Epiphytes rely totally on aerial input for their nutrients, which they get from dust particles and whatever leaks out of what they are growing on," he says. Martin states that trees with needle-like foliage, such as pines, lose fewer nutrients than oaks. Martin's research has also shown that Spanish moss grows best in light shade. The dense overhand of live oak branches may provide more shade than is available on more vertically structured trees.

Quercus virginiana, often aided and abetted by their ornamenting moss, have a strong place in the history, literature, and lore of the South. Among the famous oaks are the Jefferson Davis Oak in Gulfport, Mississippi, under which the former president of the Confederacy is said to have made a speech in 1886 urging Southerners to forget the past and work toward a united future. The Treaty Oak in Austin, Texas, is the last of a group of *Quercus virginiana* under which Native Americans held councils, dances and ceremonies, and under which city founder Stephen F. Austin was said to have made the first boundary line agreement between Native Americans and settlers. The Austin tree made national news in 1989 following a deliberate poisoning incident from which the tree has never fully recovered.

Live oaks are also connected with literature achievements. The Evangeline Oak in St. Martinsville, Louisiana, was named in honor the Henry Wadsworth Longfellow's poem, "Evangeline," which memorialized the plight of a group of French Canadians deported from Nova Scotia to Louisiana in 1755.

Both species at one time had commercial value. The heavy timber of live oaks was prized by shipbuilders until the middle of the 19th century, and Spanish moss was used as a stuffing for mattresses and upholstery into the early part of this century. Other materials have come along to fill those niches, but Southern horticulturists say the charismatic combination of the live oak and Spanish moss is earning its keep by wowing first-time visitors to the Southeast.

This article first appeared in the June 1995 issue of American Horticulturist *(now known as* The American Gardener*), published by the American Horticultural Society.*

Quercus macrocarpa x *montana*. An young example of a Marquez hybrid growing in Michigan. Photo by Ken Asmus

STORING VIABLE OAK POLLEN

by Miguel B. Marquez

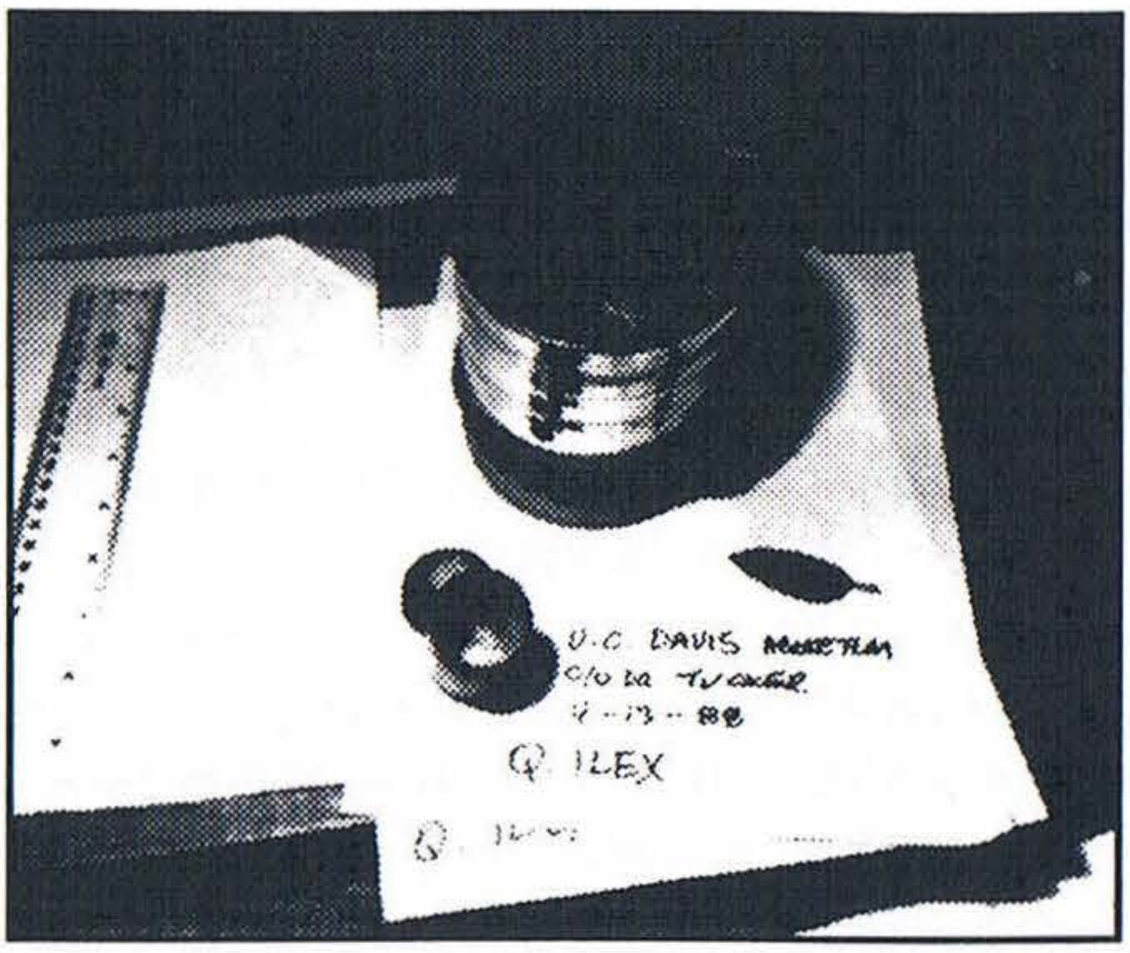
One of the most important requirements for success in controlling pollination of oak is to have viable pollen on hand (when its female flowers become receptive to pollen). Oaks normally need to be pollinated by another oak of the same family with the help of the wind or insects that transfer the pollen from the paternal oak to the maternal oak. However, control pollination requires that pollen from a desired white oak species to be available and viable when the female flowers of the maternal oak (of the same species) have become receptive to pollen. Pollen of the white oak family that has been properly collected, sieved, securely sealed in a container, and stored in the refrigerator will remain viable for over two months. But if the pollen is dried to about 50 percent humidity and stored in the freezer instead, it will retain about 30 percent of its viability after 12 months of storage. Normally, pollen is used within two weeks, however, for example, if it is received by mail from a cooler part of the country, where it is too late to pollinate a chosen maternal oak, then the exotic oak pollen will have to be processed and stored in a freezer until next year.

Oak male and female flowers

Male and female flowers, being very different from each other and growing on the same oak, but separately, make it easy to recognize them. Male flowers (called staminate) grow from between the new leaf stems and last year's branches, or on the tips of the same branches. They hang as 1 to 5 inches (2.5cm to 12.7cm) long catkins that are made up of hundreds of round, green, pinhead-size capsules (called anthers) which are full of pollen grains. Growing separately from the male flowers are the oak female flowers (called pistillate), which grow from between this year's new leaf stems and branches. They are 1/8 to 1/4 inch green ovules supported upwardly without stems or on stems that are 1/4 to 1 inch long. Female flower ovules become receptive to pollination when they change from green to tan or another color and their styles turn moist and sticky.

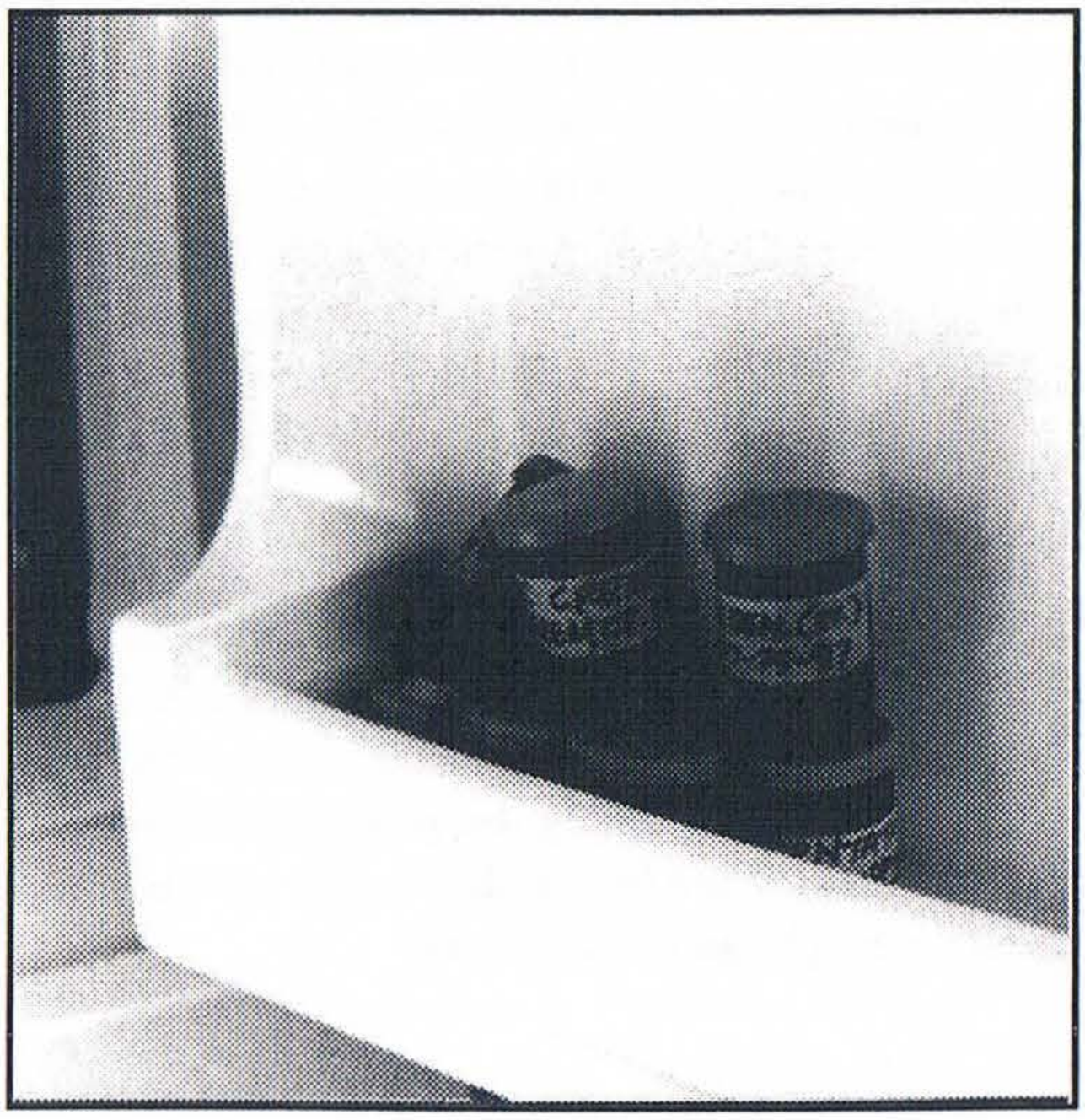
Ripe oak male flower catkins

Male oak catkins (staminate flowers) are ready for harvesting when a few of their anthers look shriveled or pollen dust may be seen adhering to the catkins of the surrounding new growth. With a pair of small scissors, cut the oak catkins (a few at a time) until a handful is collected in a bag similar in size to an empty, plastic bread bag, in which they are protected from outside elements and can be easily carried. Carry the bag with the oak catkins indoors to a safe place away from direct sunlight and wind drafts.

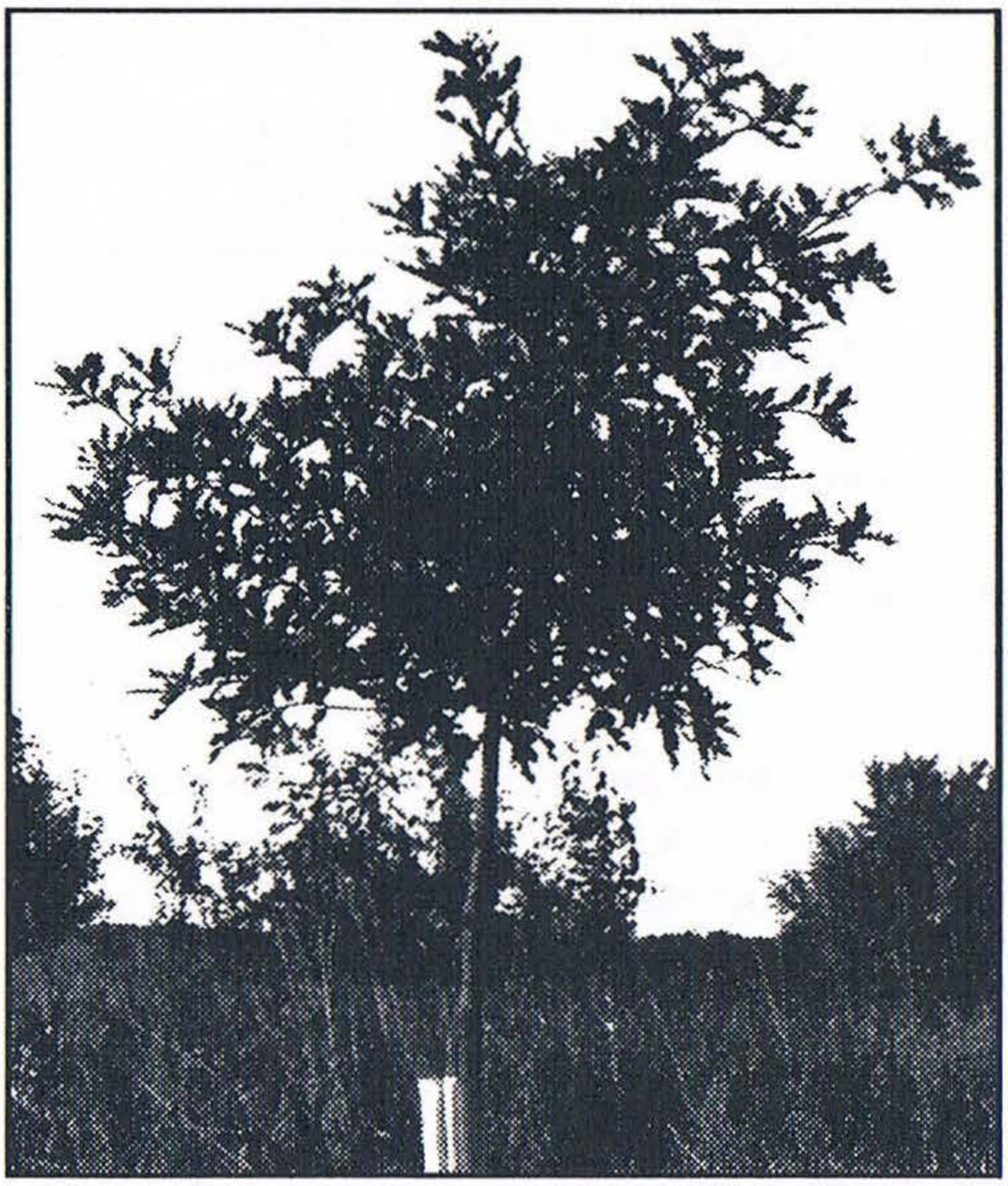


Oak pollen collection

Pour the oak male flower catkins into a 16 ounce volume coffee can with a double thickness nylon hose sieve held stretched with a strong rubberband or a tire tube strip at the open end of the can. Place the homemade sieving can on top of two sheets of typing paper. Raise the sieve end with a couple of plastic bottle caps to hasten drying of the catkins. Make sure the total contents are placed on a flat, dry surface and let the catkins dry for about eight hours to force them to release their pollen. After eight hours of drying, move the first sheet of paper to one side, and shake the sieving can vigorously towards the center of the second sheet of paper, being careful not to spill any pollen. If no pollen is collected on the paper, let the catkins dry for another eight hours. Eight hours later, pick up the sieving can and repeat the vigorous shaking that should sieve the fine pollen grains, released by the dry, spent catkin anthers onto the center of the flat sheet of paper. Carefully, without spilling the pollen, pick up the paper and bend it in front to a small oval-shaped opening by holding it together from the top with the left hand to form a semi-funnel. At the same time, place the sieving can on top of the second sheet of paper to keep any pollen from being lost. Place the small opening of the semi-funneled paper onto the mouth of a small container, similar to an empty 35 mm film container. Hold both the funnel and container with the left hand. Tapping the underside of the semi-funnel with the right hand will cause the pollen to slide to the center of the funneled paper and then into the small container. If the oak catkins still have unopened anthers, let them dry in their sieving can, and store their sieved pollen in its sealed plastic container in the refrigerator until next morning. At that time, repeat the sieving, collecting, and storing procedures of the pollen. Pollen in a sealed container stored in the refrigerator will remain viable for about two months.



Photos by Miguel Marguez



Quercus macrocarpa x *virginiana*. An young example of a Marquez hybrid growing in Michigan. Photo by Ken Asmus

If the pollen cannot be used until next year, then it will have to be dried by placing it with its container uncapped inside a large container that has a drying agent, such as calcium chloride. The large container is sealed with its contents inside and placed in the refrigerator for about six hours. The oak pollen having lost about 50 percent of its humidity after drying for eight hours in this manner is now ready to be transferred to the to the freezer for storage until next year. When oak pollen is sealed tightly in its container after drying and stored in the freezer for up to 12 months, the pollen will retain about 30 percent viability and can still fertilize enough female flowers that will produce a fair enough crop of hybrid acorns for planting and testing.

Next year, however, before using the oak pollen, it must have its humidity increased back to normal by placing it with its container uncapped inside a larger container that has a smaller container half full of water. Place the uncapped pollen container inside the humidifying container, being careful not to spill or wet the pollen. Seal the humidifying container with its contents enclosed and set it in the refrigerator for about eight hours. Moisture in the pollen is restored to normal after eight hours of this type of humidifying treatment. The reconditioned oak pollen can now be stored in the refrigerator with its container capped and should be used within two or three weeks before it loses its viability. ❧

Miguel Marquez one of the Society's first members, is a avid grower and hybridizer of oaks for many years now. His emphasis is on larger-sized acorns for both human and wildlife consumption. He lives and works in El Paso, Texas, USA.

THE REPRODUCTIVE BIOLOGY OF *QUERCUS*, WITH AN EMPHASIS ON *Q. RUBRA*

by Robert A. Cecich

My original intent in this paper was to present a chronology of events for the reproductive biology of northern red oak (*Quercus rubra* L.) based on a review of the literature. However, because there is so little information available about northern red oak, results from studies of other species of *Quercus* will be included to provide some continuity. This may lead some readers into a false sense of security about what we really know of the pathway from flowers to seed maturation in northern red oak.

There are two major subgeneric groups of North American oaks: Section *Quercus* (formerly *Lepidobalanus*) or the white oaks, and *Lobatae* (*Erythrobalanus*) or the red oaks. These two groups differ structurally and chemically. However, we will concern ourselves only with differences in the reproductive cycle. Simply put, the white oaks require only one growing season from the time of pollination to acorn maturation. The red oaks, however, require two growing seasons. [Editor's note: There are a few exceptions to this rule, such as *Quercus agrifolia, Q. hypoleucoides*; the third major North American subgeneric group, Section *Protobalanus* or golden oaks, also requires two growing seasons.] Pollination occures in the first season, and the ovule primordia remain as placentae or rudimentary bulges until the following growing season, when the ovules develop, fertilization is accomplished, and the acorns mature. These structures and processes will be the primary focus of this paper.

Pistillate Flowers

Acorns develop from fertilized pistillate (female) flowers. Because there has been little demand for oak breeding programs, there has been little desire to understand and manipulate the reproductive cycle. Our knowledge has been provided almost exclusively by botanists with an academic interest in studying a structure or process, and not by foresters with an interest in managing trees. Thus, the descriptions of the flower must use specific botanical terminology. The developmental morphology of the unfertilized pistillate flower of *Q. rubra* was described by Langdon (1939) and Sattler (1973); their interpretations are combined in this part of the paper.

The pistillate flower originates as a stalk or inflorescence in the axil of a developing leaf primordium during the summer before pollination, and contains several bracts arranged spirally on its axis. After the inflorescence and bracts overwinter, floral apices differentiate in the axils of each of the lower, opposite bracts of the inflorescence, and then flatten and assume a three-cornered appearance as a result of growth occurring at their periphery. The individual flower, partially enclosed by a cupular involucre of inbricating scales, consists of a cup-shaped perianth tube, non-diverged from the walls of a three-celled ovary that bears three

stigmatic styles. The involucre is first formed as a few separate primordia in the axils of the bracts located at the based of the floral apex. Three inner perianth members are initiated simultaneously between the outer perianth members, and all then are raised up on a common base as three gynoecial (carpel) primordia arise on the broad flat apex opposite the outer perianth members. The carpel primordia differentiate into the three stigmas.

In the first growing season, further ovary maturation occurs about one month after pollination. The young ovary becomes closed as a result of the appression of the three gynoecial primordia as they are carried up with the extending ovary wall. Concurrently, growth between and at the base of the gynoecial primordia initiates the three septa, which eventually become appressed at only their upper inner margins. Two placentae form initially as slight protrusions along the base and on each side of a septum. In each of the three locules or chambers of the ovary, there are two placentae--one from each septum (figure 1). The ovules will develop from these placental bulges in the second growing season (Sattler 1973). Botanically speaking, an ovule is a megasporangium; i.e., a structure that bears the megaspore mother cell (MMC) (Davis 1966).

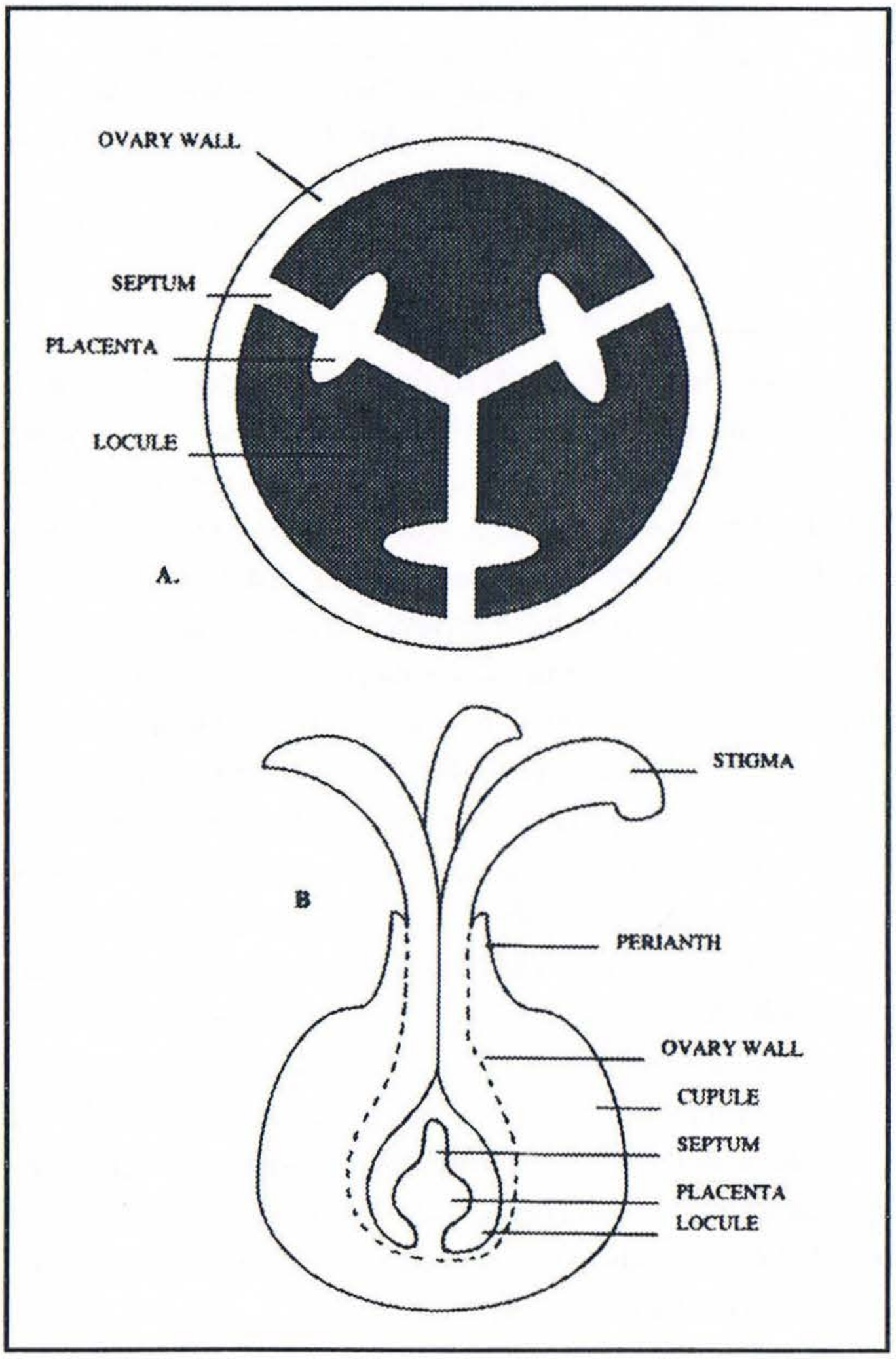


Figure 1. *A* Q. rubra *pistillate flower at the time of pollination. 1A. Cross section of an ovary, showing three septa that divide the ovary into three locules or chambers. A locule contains two placentae or primordial bulges, each of which will differentiate into an ovule. Only one of the six ovules will mature into an acorn. 1B. Longitudinal section of a flower at the time of pollination, with two of the three locules shown.*

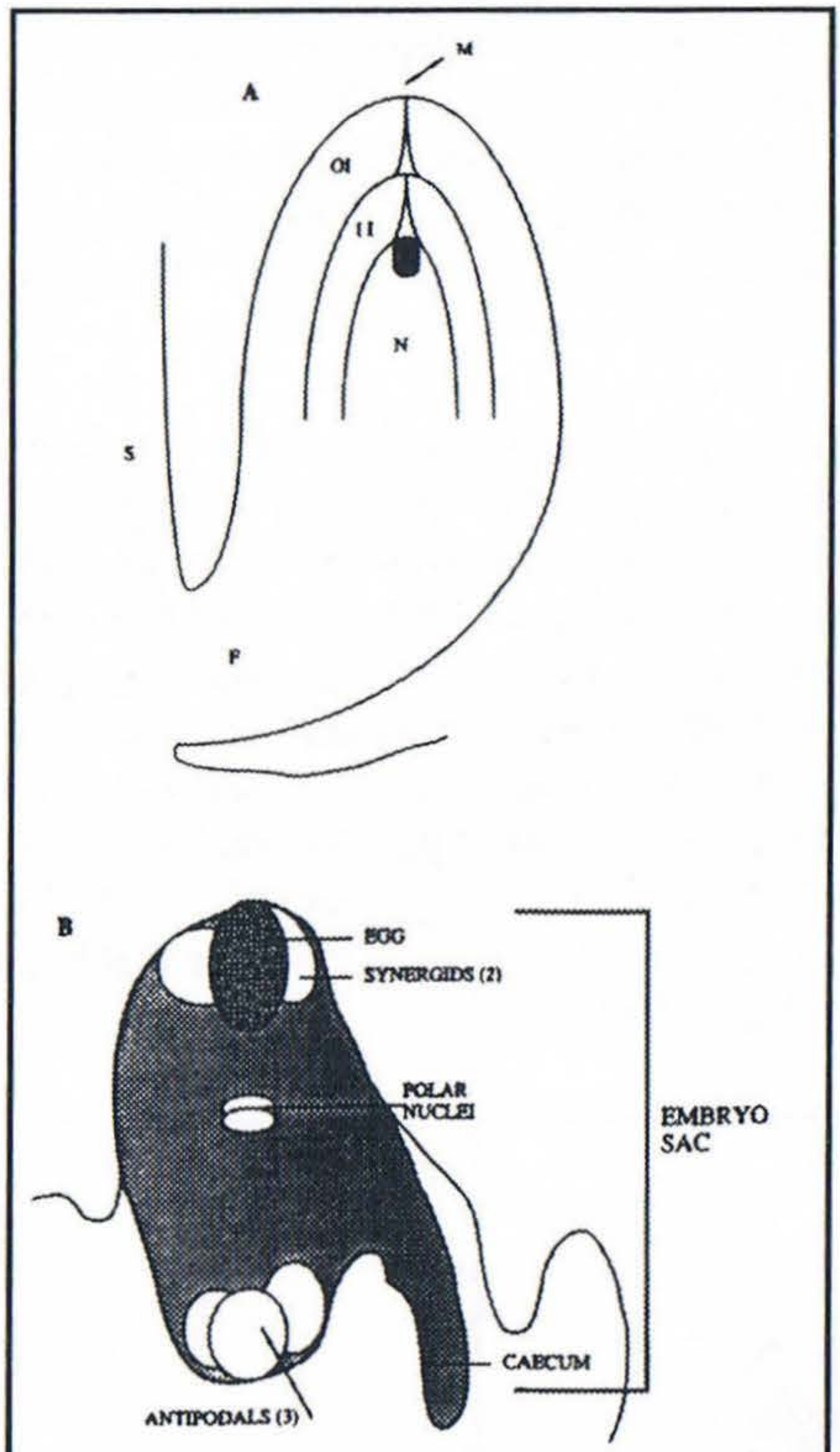


Figure 2. *An ovule of* Q. rubra *just before fertilization. 2A. The nucellus (N) is surrounded by the inner integument (II) and the outer integument (OI). The funiculus (F) attaches the ovule to the septum (S). 2B. The embryo sac contains the egg nucleus and the seven other nuclei. Upon fertilization, the egg and the pollen gamete fuse to become a zygote; and the two polar nuclei, which previously had fused to become the central cell, fuse with the other pollen gamete to become the triploid endosperm.*

Between late July of the first season and early April of the second, only the cupule (the future acorn cup) develops further, enclosing the flower during the winter, with only lignified vestiges of the styles and perianth above its rim. By early May of the second season, the ovary wall has expanded, the placental axis has elongated, and the ovules bear the rudiments of the inner and outer integuments (Langdon 1939). By mid-May the nucellus is now covered by the inner and outer integuments, which have elongated over the end of the nucellus and have formed a "hole" called the micropyle. At the time of fertilization, the margins of the outer integument, toward the open end, greatly increase in height and form a lip (Sattler 1973). This is the route through which the pollen tube approaches the embryo sac (Benson 1894). Major food reserves of starch and lipid are located almost exlusively within the outer integument, while the inner integument is virtually void of food reserves (Mogensen 1973). The MMC undergoes meiosis or reduction-division, producing four haploid cells, only one of which survives to become the functional megaspore. By a series of mitotic divisions, the megaspore gives rise to the megagametophyte or embryo sac, an eight-nucleate structure at the tip of the nucellus (figure 2). A feature of the *Q. rubra* nucellus during growth of the megagametophyte is the appearance of a central strand of procambial elements that extend through the base of the nucellus and are continuous with the vascular tissues of the raphe and funiculus (Langdon 1939).

Once the embryo sac is formed, fertilization of its egg and central cell via germinating pollen must occur for seed development to continue. During fertilization, the pollen tube discharges two haploid gametes into the embryo sac. One fuses with the egg to produce a diploid zygote; the other gamete fuses with the 2N central cell (formed by the earlier fusion of the two polar nuclei) to prodce the 3N (triploid) endosperm. Following fertilization, a free-nuclear endosperm grows before the first division of the zygote occurs (Hjelmqvist 1953, 1957; Brown aand Mogensen 1972). In general, as the endosperm becomes cellular, the embryo begins to differentiate (Singh and Mogensen 1976), moving quickly through the heart-shaped stage (figure 3).

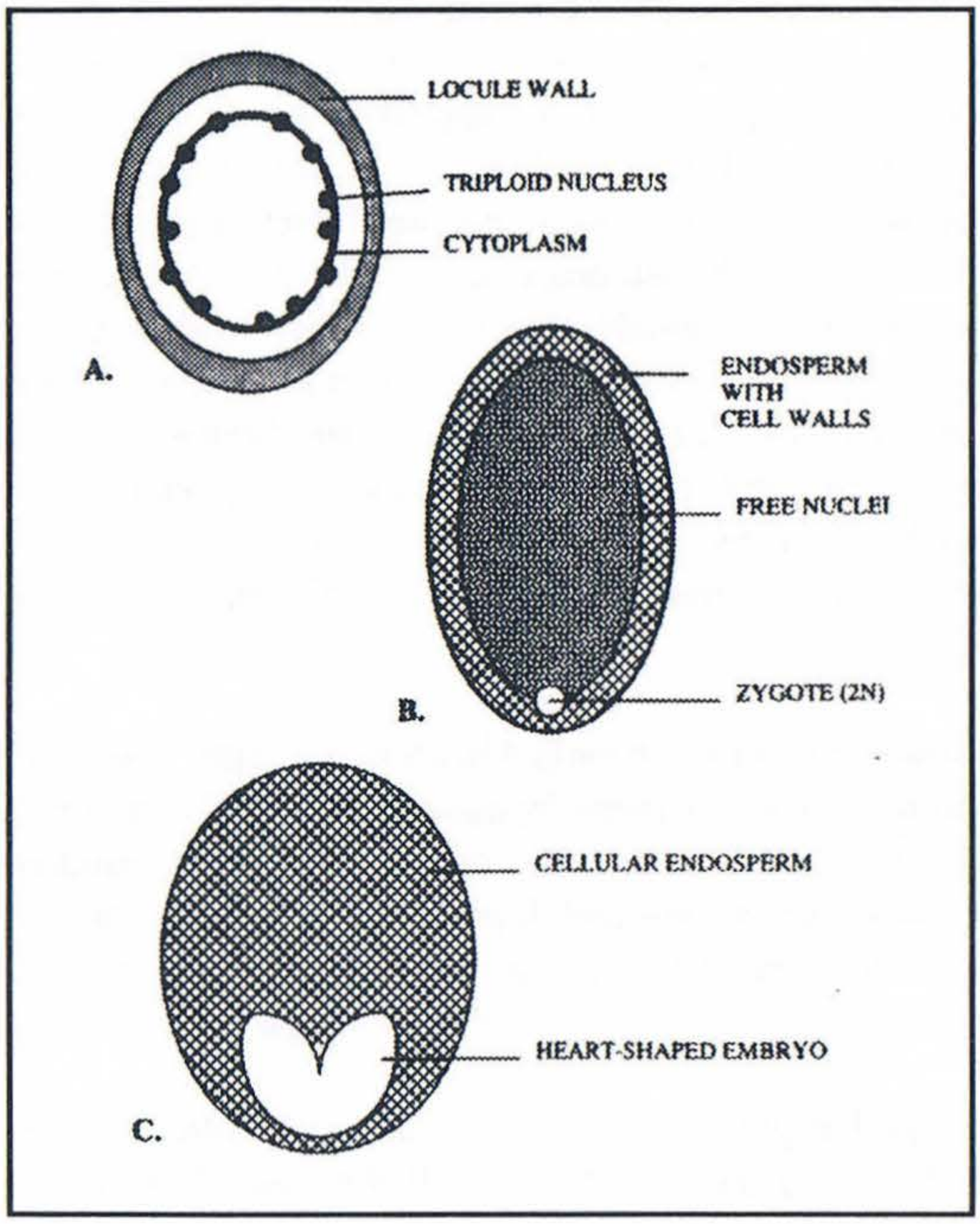


Figure 3 *Some embryological stages of* Q. rubra. *3A. The free nuclear endosperms. Nuclei are triploid (3N) and exist in a common cytoplasm; i.e., there are no cell walls separating the nuclei. 3B. As the endosperm begins to form cell walls centripedally between the free nuclei, the diploid zgote begins to grows into a proembryo. 3C. The embryo is at the heart-shape stage when the endosperm becomes completely cellular. The "wings" of the embryo are the cotyledons that will grow and eventually fill most of the acorn.*

Information about later embryo and cotyledon growth of acorns is very limited. Mogensen (1965) provided the most detailed picture in his comparative study of *Q. alba* and *Q. velutina*. One major difference he noted between the two species was that the epicotyl apex of *Q. alba* produced from three to five leaf primordia before acorn maturity, but *Q. velutina* produced none. Stairs (1964) also found no leaf primordia in mature embryos of *Q. coccinea*.

Staminate Flowers

When we mention flowers, we tend to think only of the pistillate flower that gives rise to the acorn. But there is another flower on the tree: the staminate or male flower that is the source of pollen.

The origin of the staminate flowers is similar to that of the pistillate flowers, except that the inflorescence or catkin on which they are assembled differentiates from a meristem in the axil of a bud scale, not a leaf. The first sign of differentiation of the staminate inflorescence primordium in those white oak species studied appeared from late May to July. The inflorescence is without appendages until late June or early July, when meristematic areas appear on the axis (Merkle *et al.*1980). These floral apex primordia appear before or coincident with the subtending bract primordia (Turkel *et al.* 1955). However, Sattler (1973) found that the ovate-shaped floral apex of the staminate flower in *Q. rubra* was initiated in the axil of a small ridge-shaped bract close to the apex of the inflorescence, just the opposite of where the female apex forms on its inflorescence. The perianth members arise on the flanks of the floral apex in a spiral sequence; however, the sequence of stamen initiation is quite regular. The stamen primordia apear on the apex opposite the perianth members from mid-July to late July. By fall, these stamen primordia grow into immature anthers and filaments. The overwintering condition of the slightly lobed anther is that of a homogeneous parenchymatous mass.

Anther development resumes in early March to late April, varying by species and location. In higher plants, the parenchymatous mass differentiates into the sporogenous mass, its cell numbers increase mitotically, and eventually they undergo meiosis to become microspores and, finally, pollen grains. For oaks, there is only a pictorial account of meiotic stages *per se* as provided by Stairs (1964). Thus, there is a need for research on the entire topic of oak pollen development.

Dehiscence of pollen grains occurs about six weeks after differentiation of the anther tissues begins (Turkel *et al.* 1955). Before leaf flush, the staminate inflorescence of *Q. rubra,* bearing numerous staminate flowers, elongates and emerges from the bud scales as the familiar catkin (Vogt 1969). At first the catkins are erect and clustered, but they soon elongate further and droop (figure 4). During maturation of the male flowers, the female flowers continue to develop in the axils of expanding leaves of the new shoot.

One to two weeks after the catkins appear, the small anther sacs split open to expose the pollen grains (figure 5). Pollen shedding is usually complete in 3 to 4 days. The time of pollen shed is probably the best local index of the beginning of the visible portion of the seed production cycle. If relative humidity is high at time of pollen maturity, the pollen sacs may not split open. Wolgast (1972), using growth chambers, demonstrated that relative humidity at the time of pollen shed and stigma receptivity can limit the size of an acorn crop. No pistillate flowers survived when relative humidity exceeded 61 percent because the anther sacs did

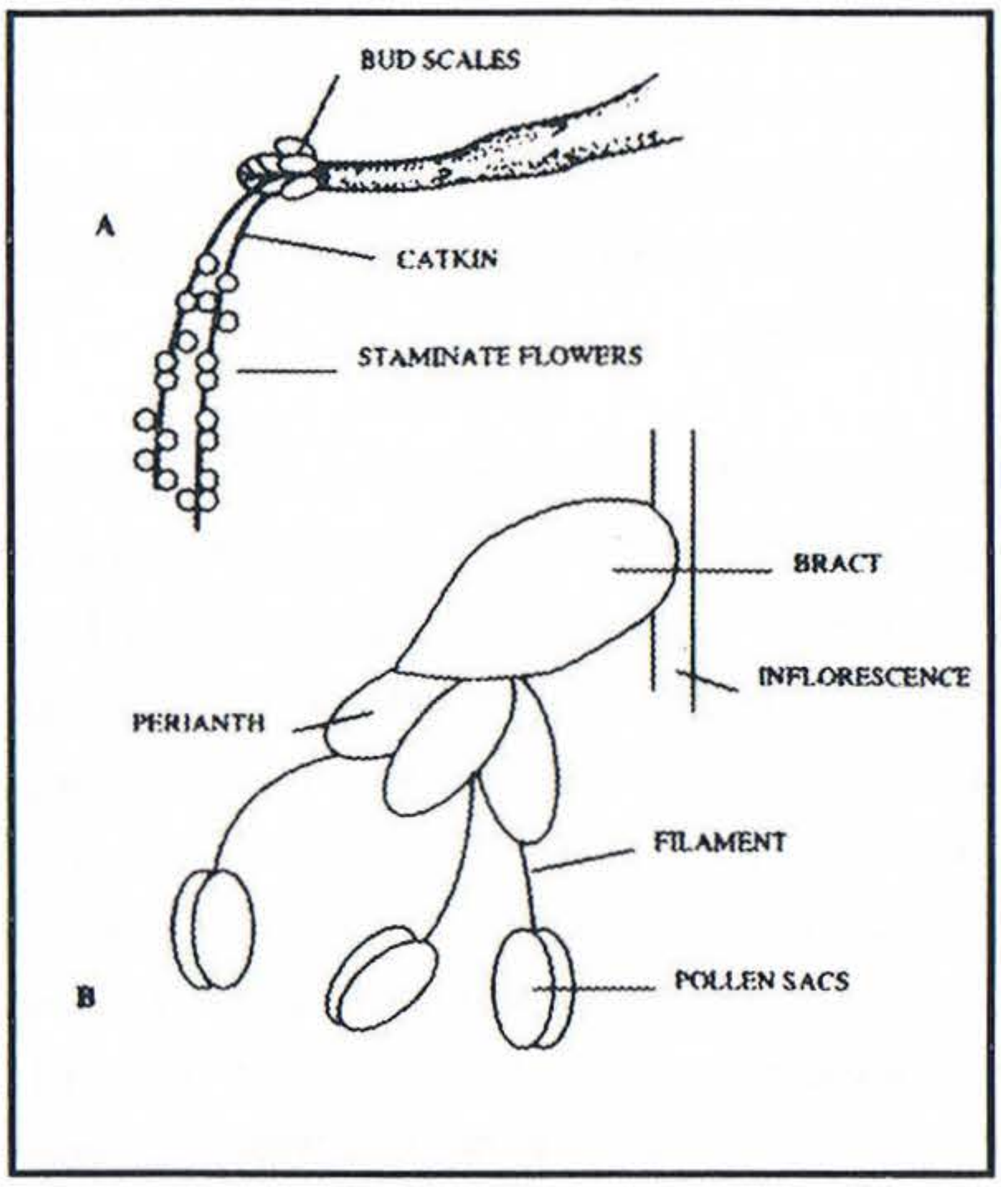


Figure 4. *Catkins (infloresscences) (A) emerge from the axils of bud scales. Staminate flowers (B), bearing the pollen grains, are assembled along the length of the catkin.*

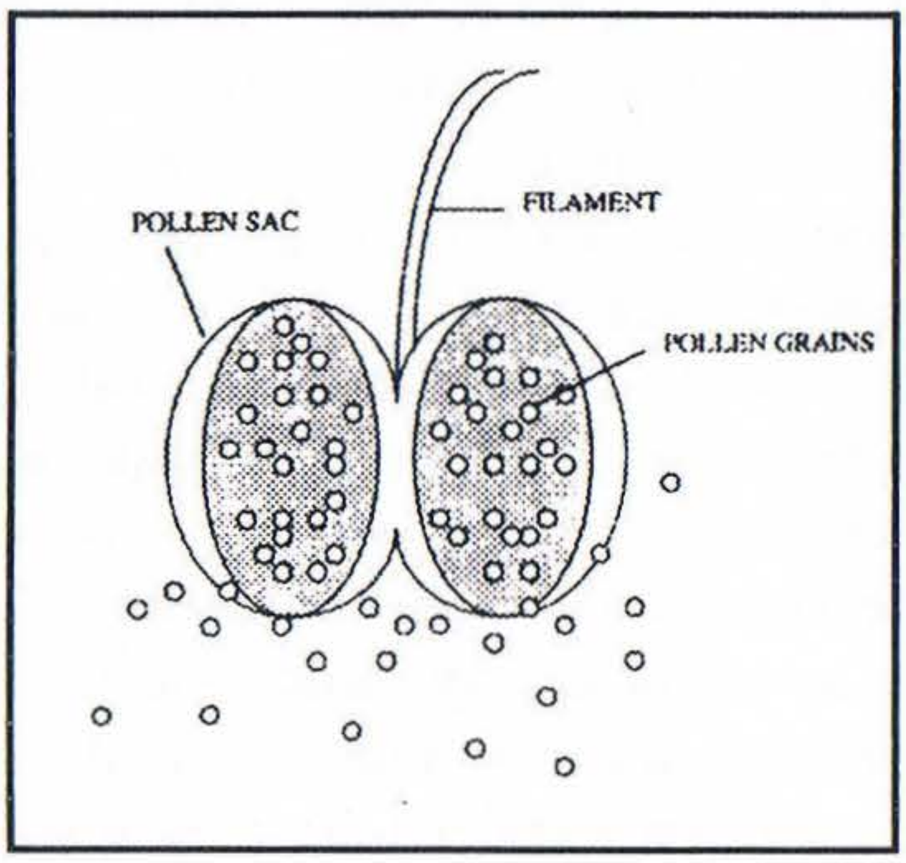


Figure 5. *Pollen grains are released from the pollen sacs when suitable temperature and relative humidity conditions have been met.*

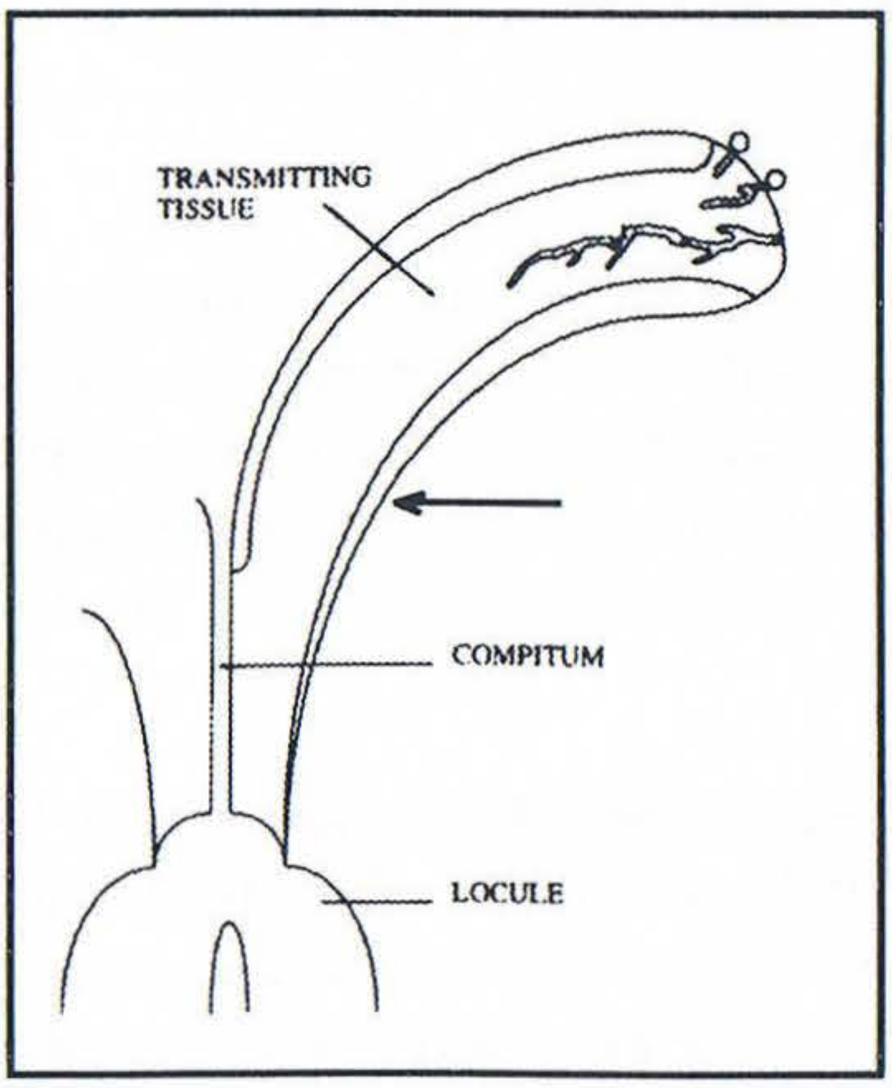


Figure 6. *The stigma of a flower receives the pollen grains during pollination. After the pollen grains germinate, the pollen tubes grow partially through the transmitting tissue of the stigmas and cease growth after several weeks (arrow). In the second growing season, pollen growth resumes and the tubes enter the compitum, a free space between the three styles, where they proceed into the locule to fertilize the egg.*

not open; but about half the flowers matured into acorns when realtive humidity was lower. Continued cool, rainy weather may cause overripe male flowers to fall from the trees without shedding, resulting in a poor seed crop. Variation in date of flowering within a crown and among trees within a stand may offset some of the pollen loss related to weather conditions.

There have been conflicting observations about the dynamics of pollen tube growth after the pollen grain lands on the stigmatic surface. For instance, Benson (1894) did not find pollen tubes in *Q. robur*, a white oak, until just before fertilization. Jovanovic and Tukovic (1975) observed that pollen germination in *Q. robur* was completed within 24 hours, but fertilization occurred 6 to 7 weeks later, suggesting that pollen tube growth did not proceed until the ovule had completed development. In contrast, Allard (1932) observed that, "When pollen reaches the stigma of members of the white oak group, the growth of the pollen tube containing the male cells follows an uninterrupted advance into the tissues of the style until the ovules are fertilized." These conflicting observations of pollen tube behavior for members of the same section and species suggested that an investigation of this anomoly was required. Cecich (unpublished data) observed pollen tube growth in *Q. rubra, Q. velutina* and *Q. alba* with fluorescence microscopy. All three species had the same pattern of pollen tube growth soon after the pollen grains landed on the stigmas of the pistillate flowers. Within 24 hours, the pollen tube germinates from the pollen grain and penetrates the epidermis of the stigma. A callose plug is synthesized to seal off the contents of the tube from the pollen grain and the pollen grain falls off the stigma. The pollen tubes grow through the transmitting tissue of the stigma for about three weeks, when they cease growth just above the juncture of the three stigmas (figure 6). The white oak pollen tubes resume growth toward the ovules in early June and enter the locules. Fertilization is accomplished by about June 15. In the two red oak species, *Q. rubra* and *Q. velutina,* the pollen tubes ceased growth, as noted, until the following growing season when pollen tube growth resumed and fertilization occurred in late May (*Q. rubra*) and late June (*Q. velutina*). Allard (1932) also found that, in the red oak group, the pollen tubes ceased growth at the base of the style until the following spring when the ovules were fertilized.

Factors Affecting Reproductive Success

Acorn crops are the product of a long, arduous journey from the initiation of the flower primordium to the mature acorn. The differentiation of reproductive structures extends from the primordium stage in late May (year one), through pollen shed and female receptivity (year two), and finally fertilization, embryogenesis, and maturation (year three). Over that length of time, what causes an acorn crop to succeed or fail?

Except for deep freezes in late spring (Sharp 1958, Sharp and Sprague 1967, Goodrum *et al.* 1971, Wolgast and Trout 1979), does the weather affect differentiation? Probably the most important factor controlling the emergence of pistillate flowers in the spring and their receptivity is temperature, which directly or

indirectly influences flower emergence through branch and leaf elongation. Emergence of the staminate inflorescence and shedding of pollen are known to increase or hasten with rising temperatures and to slow with decreasing temperatures (Romashov 1957). Rainy weather, associated with decreased temperature, also decreased pollen dispersal. Mature pollen is more resistant to frost than anthers or the filaments of the catkins (Sharp 1958, Sharp and Sprague 1967). Pollen tube growth also may be affected by temperature, thus influencing the northern boundaries for the species range (Jicinska and Koncalava 1978). Sork *et al.* (1993) studied flower and acorn production in the same population of *Q. rubra, Q. velutina, and Q. alba* for eight years. They suggested that these three species have inherent cycles of reproduction that are modified by weather conditions--*Q. velutina* with a two-year cycle, *Q. alba* with a three-year cycle and Q. rubra with a four-year cycle. However, they concluded that the patterns of acorn production were not simply responses to weather events, but were also a function of prior reproduction history.

Genetic control over seed production in oaks has been demonstrated by a number of investigators. During six year of observation, Grisez (1975) found no *Q. rubra* seed crops that were better than poor. He did not observe flower crops because pistillate flowers were difficult to see from the ground. Grisez stated that his observations confirmed other reports that seed-producing capacity is, to a large extent, genetically controlled by the female parent. Farmer (1981) found that in a given year, seed production among clones of *Q. rubra* was most highly correlated with the percentage of pistillate flowers that were fertilized; while year-to-year differences were associated with variation in the number of flowers. He believed that fecundity could be increased by selecting high-yielding clones in a grafted orchard. Grafting of oak scions selected from mature, flowering individuals can be readily accomplished and, thus, flowers can be made quickly available (Irgens-Moller 1955). Ledig *et al.* (1971) and Wright (1953) also found much tree-to-tree variation in reproductive ability.

Schlarbaum and Rhea (unpublished data) evaluated flowering in a 17-year-old *Q. rubra* seedling seed orchard in Tennessee. They selected light-, medium-, and heavy-flowering trees and counted all pistillate flowers. The majority of flowers were located in the upper one-third of the crown of each tree, and flower numbers did not differ among the four quadrants in a crown. Sharp and Chisman (1961) found that pollen catkins were evenly distributed across the crown of mature *Q. alba*. I also have observed the latter in *Q. alba, Q. rubra,* and *Q. velutina.*

Insects can have a big impact on acorn crops. Most accounts are about weevils (*Curculio* spp. and *Conotrachelus* spp.) as they destroy acorn crops (Gibson, 1964, Kearby *et al.* 1986). However, weevils do not oviposit until midsummer, when the embryo's cotyledons are enlarging. Most of the potential seed crop has been lost through flower abortion before then (Cecich 1993; Cecich *et al.* 1991), suggesting that weevils are not the major insect cause of poor acorn crops. Treehoppers (Membracidae) are another group of insects that deserve attention. These sucking insects can spend their entire life cycle in the crown of an oak tree (Kopp

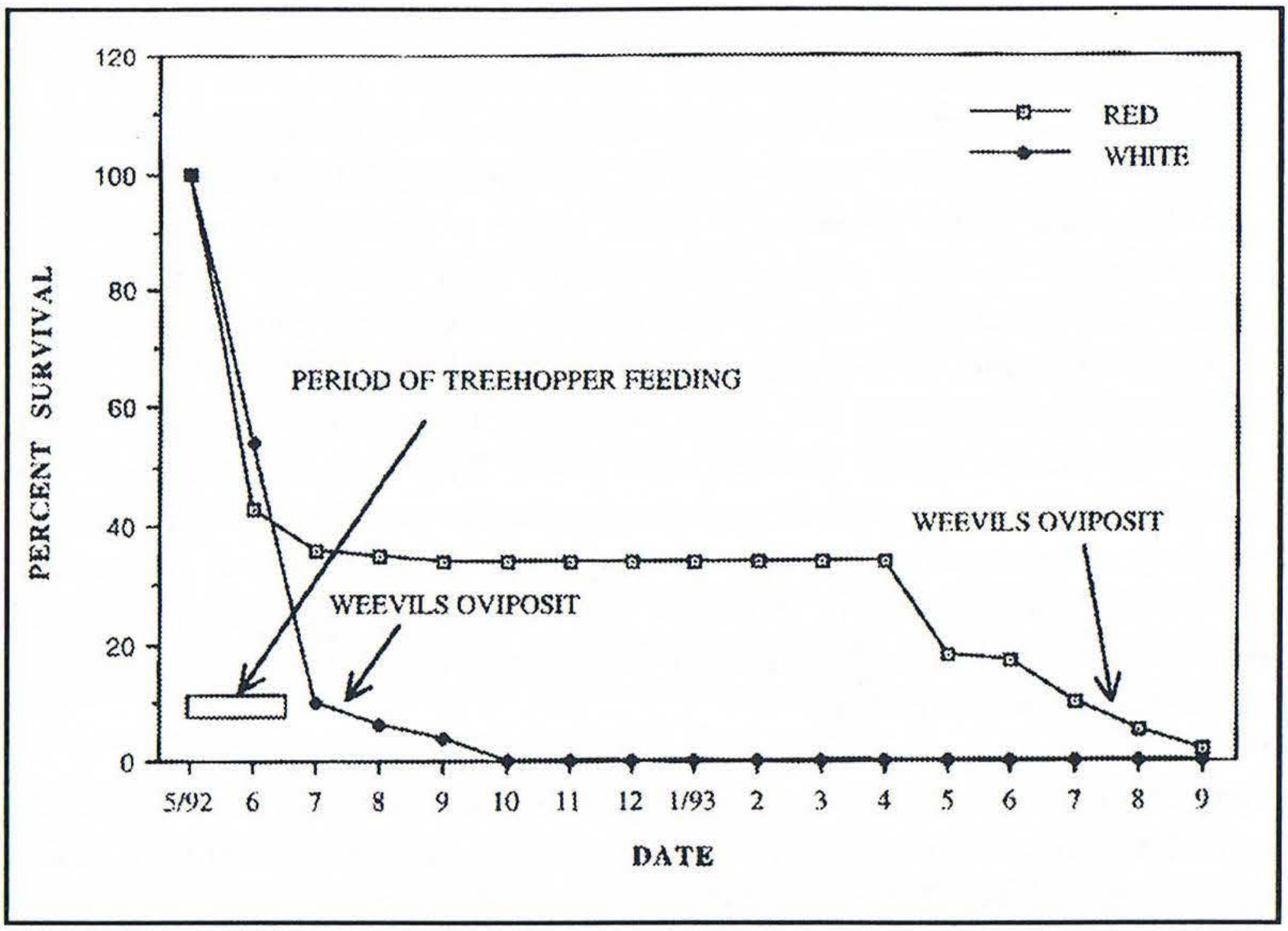


Figure 7. *A typical survival curve of oak pistillate flowers. White oak takes one growing season to produce its acorn crop; red oak requires two. Most of the flower loss occurs in May and early June, when treehoppers are actively feeding. Inadequate pollination may also contribute to the early abortion. Weevils oviposit after most of the potential seed crop has aborted. In either species of oak, less than 5 percent of the flowers usually survive to become acorns.*

and Yonke 1973a,b,c, 1974). The late instars and young adults actively feed on any meristematic tissue, *including flowers*, during May and early June, just when most of the flower abortion happens (fig. 7). We observed these insects feeding on flowers that then died one week later (Cecich *et al.* 1991). Controlled feeding experiments are being done at this time to better elucidate the role of treehoppers in flower abortion.

Several authors have concluded that the size of an acorn crop is not related to the size of a flower crop; i.e., the appearance of numerous pistillate flowers in the spring does not guarantee numerous acorns (Sharp 1958, Sharp and Chisman 1961, Wright 1953, Gysel 1956, Cecich *et al.* 1991, Sork and Bramble 1993). Factors that inhibit or enhance flower development, pollination, fertilization, and embryogenesis appear to be more important in determining the success of a seed crop.

Little information is available about the reproductive biology of *Q. rubra.* In fact, no complete detailed life history for any species of oak has been written. Therefore, our knowledge of oak flowering biology is based on a few reports about selected events in only a few species. These references are often conbined to tell

a developmental "story" about a hypothetical oak--an oak that probably does not exist. Before we try to interpret how various factors influence the production of flowers and acorns, we must develop a solid understanding of the reproductive cycle of individual species. The fragmented information about oak flowering does not give us an accurate picture of the flowering process, but it does indicate where the shortcomings and opportunities exist. We then can ask meaningful questions and do the appropriate research. We must study the biology of *Q. rubra* if we are truly interested in managing *Q. rubra* acorn crops. ❧

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A VISIT TO KALININGRAD, RUSSIA

by Eike Jablonski

After decades of rigorous restrictions upon travel through the former Soviet Union, "glasnost" and "perestroika" made it possible for me to visit many of the interesting and beautiful places in this country.

One of the oldest cities on the shores of the Baltic Sea is the city of Kaliningrad (until 1945 its name was Königsberg). German monks founded Königsberg as a monastery in the 13th Century due to its strategic importance. As early as 1544, the University was founded, which still exists today. Kaliningrad is also the capital of the Kaliningrad Republic, which is part of Russia today. Kaliningrad was and still remains the capital of culture in the whole region. Immanuel Kant, the well known philosopher, was born here and held his lessons at the University. In addition some famous botanists had been working at the University throughout its history.

Besides Kaliningrad, there are some smaller towns found within this tiny state, e.g. Baltijsk, Sovetsk and Cernjahov.

Kaliningrad is situated on the Bay of Gdansk, south of Lithuania. Besides the influence of the sea, the climate shows remarkable peculiarities:

- a harsh winter with temperatures below -20°C (-4°F)
- a long winter from November to March
- a short-term spring
- remarkable differences within the average temperatures in one month
- first frost sometimes the first week of September
- last frost temperatures between mid-April and mid-June
- average temperatures during the year are 7.0 - 7.5°C (45°F)
- average rainfall is about 600mm (24 inches)

The two native oaks of Kaliningrad are *Quercus robur* and *Q. petraea*. Both of them can reach heights up to 25m (91ft) here and often have excellent trunks, which are highly valued for timber.

If one walks through the streets of Kaliningrad, one will notice the beautiful alleys of trees, of which many are planted with oaks. In addition to *Quercus robur*, you will be able to find its cultivar 'Fastigata', and also *Q. rubra* and *Q. palustris*.

Within the vicinity are many beautiful parks. One of the largest ones is the Park Kultur (culture park). Here one can find a large number of the two native species and also some cultivated species and forms. In many places the Turkish oak (*Q. cerris*) can be found and can reach a height of 20m (73ft). Also *Q. macranthera* is not rare, with some if these specimens more than 100 years old and 15-20m (55-73ft) tall. *Quercus bicolor* is found only in two locations, but these two specimens are fine ones with a height about 17m (62ft).

Another American oak, the bur oak, *Q. macrocarpa*, is planted quite frequently. Large specimens up to 21m (76 ft) can be found at the zoo, where, besides some Siberian tigers, one can trace a fine collection of cultivated trees.

In 1922 the German Dendrological Society held their annual meeting in Königsberg. They visited the zoological garden and wrote in their yearbook about the two *Quercus macrocarpa*, planted around 1895, when the zoo was first opened to the public. *Quercus imbricaria* is also listed in the report, but today cannot be found. The Hungarian (Italian) oak, *Q. frainetto*, still grows in some localities. In the report of the German dendrologists, there was also one specimen of *Quercus frainetto* x *Q. pubescens* found in the botanical garden. This hybrid does not remain today either. Some other listed species, such as *Q. mongolica, Q. libani, Q. pyrenaica*, or the evergreen *Quercus* x *turneri* 'Pseudoturneri', were all growing at the Botanical School Garden in 1922, but do not exist today. Perhaps this garden was destroyed in World War II or the trees were cut down for firewood afterwards.

Of the sessile oak, *Q. petraea*, a few forms are cultivated in Kaliningrad. One beautiful *Q. petraea* 'Mespilifolia' grows in the Park Kultur and reaches 17m(62ft). In the botanical garden of the University, two *Q. petraea* 'Laciniata', were planted around the turn of the Century and are now more than 17m tall. At the same place you will find *Q. petraea* ssp. *iberica*, one of the several subspecies of the sessile oak.

The English oak, *Q. robur*, has been in cultivation for centuries. As a result of selection (and breeding in a few cases), several dozen forms are existing. The zenith of the collection of cultivars was at the end of the last Century, when botanists, nurserymen and foresters collected every nontypical form they could find. At that time some nurseries had more than 100 forms of *Quercus robur* in cultivation.

Some of the old *Q. robur* cultivars still remain in Kaliningrad. The golden oak, *Quercus robur* 'Concordia', is well known for its golden (or very light green) foliage, but it is not supposed to be as hardy as the species. However, the fine specimen in Kaliningrad, 10m (36ft) tall and vigorous, has been withstanding the harsh winters for decades.

Quercus robur 'Cucullata' with spoon-like leaves is growing in a few places, one being Tubdispanzer Park in Primorsk, a small harbor town 20km (12 miles) west of Kaliningrad. Very similar to this one is *Quercus robur* 'Cucullata Macrophylla', of which trees up to 20m (73ft) can be found.

Quercus robur 'Fastigiata' and the similar, but more slender, 'Cupressoides', are growing in almost every park and in many old gardens. One specimen of*Quercus robur* 'Pectinata', a slow growing cultivar, grows in a small park and reaches a height of 10m (36ft) and is quite an old tree.

Quercus x *turneri* 'Pseudoturneri' (Camus)

In two localities one may glimpse the weeping oak, *Quercus robur* 'Pendula', which can be beautiful, but most of the cultivated 'Pendula' are not really "weeping" oaks. Often they look like a tree which does not know how to grow properly, and therefore, many of this form seem like a weak, simple oak. There are, however, a few good forms grafted from good material, and one of them with good form is in the center of Svetlij.

One of the rare cultivars is *Quercus robur* 'Umbraculifera'. In the Netherlands it was cultivated before 1879, but nowadays it is seldom seen. A fine specimen grows in Sovetsk, northeast of Kaliningrad on the border of Lithuania in their Park Kultur. This form has a round-shaped branching habit.

This is only a glimpse of the many oaks that grow in and around Kaliningrad, which was closed a long time to visitors. Furthermore, not only will you see interesting oaks, but also friendly people everywhere. ❧

Eike Jablonski is a member of our Society and lives in Luxembourg. He moved there from his native Germany last year in order to accept a position as lecturer at a small botanical garden, where he also in charge of its foundation. He teaches various subjects of horticulture and dendrology.

OGLETHORPE AND THE OGLETHORPE OAK

by Allen J. Coombes and W. Nigel Coates

On Friday March 11th, 1994, a young oak tree from Georgia in the southern United States was planted in the walled garden at the Meath Home in Godalming, Great Britain, to commemorate one of Godalming's most famous sons, General James Oglethorpe. This project, a result of collaboration between Hampshire County Council and Waverley Borough Council, was instigated by Waverley's Heritage Officer, Miss Geraldine Molony. The connection between this picturesque Surrey town and an oak from America's "Peach State" may seem rather tenuous, but the tree chosen for the planting was, very appropriately, the Oglethorpe oak (*Quercus oglethorpensis* W.H. Duncan). A few years previously, the Sir Harold Hillier Gardens and Arboretum, which holds the National Collection of Oaks, had managed to obtain seed of this distinct and unusual species collected in Georgia and were pleased to be able to donate a young tree for the planting. The place of planting was also significant, for the Meath Home was originally Westbrook Place, the home of James Oglethorpe.

James Edward Oglethorpe, reputedly the last person to shoot snipe in Piccadilly, was born in 1696, the son of Theophilus Oglethorpe, who that year had taken the oath of loyalty to William III and settled in Godalming, Surrey, where he had earlier bought the manor of Westbrook. The family were keen supporters of Jacobite cause, particularly James' sisters, Anne and Eleanor, who were involved in several plots, and there were even rumors that Prince Charles Edward secretly visited Westbrook to plan the 1745 rebellion. James himself kept aloof from such matters and after education at Eton and Corpus Christi College, Oxford, spent his early life as a soldier in Europe. He returned to Godalming at the age of 25 to take up his inheritance and succeed his brother as member of Parliament for the Haslemere division, soon earning a reputation as an ardent social reformer, particularly concentrating on the injustices of the prison system. He found time to interest himself in local affairs and is recorded as donating a guinea here and there to local causes, and he added to his estate by building a great wall of local Bargate stone to enclose a vineyard, which soon became well known for its white wine. Some years later the wall was pressed into use by the Oglethorpe sisters as a fortification to protect Westbrook in the event of Government reprisals following a possible Jacobite uprising; there is still a house nearby called the Little Fort.

Above Oval portrait of James Oglethorpe (reproduced with permission of Oglethorpe University Archives).

Meanwhile, the idea of forming a new colony in America had been suggested and Oglethorpe was one of the prime movers in the project. It would be named after King George II and would occupy the space between the Carolinas and the Spanish settlers in Florida - far enough south to grow grapes and to produce silk, for it was reported that mulberry trees to provide food for silkworms were likely to flourish in the area. Georgia thus became the 13th British colony in America. Godalming's wealth was founded on wool, so there were plenty of local people skilled in producing textiles, and some of these, with others attracted by national advertising of the opportunity to start a new life, made up the 120 settlers who sailed with Oglethorpe from Gravesend in November 1732. They reached their goal on February 12th (1733), still annually celebrated as Georgia Day, and within a few weeks had laid out the rectangular street plan of the city of Savannah. Each family was given three lots, space for a house, a 5-acre garden on the edge of the settlement and 45 acres in the neighboring countryside to be cleared for farming. On the edge of the town, Oglethorpe created the 10-acre Trustees' Garden to try to find the best conditions for growing mulberries and other plants, now acknowledged as the first agricultural research station in America.

In a letter to Sir Hans Sloane, dated September 19th, 1733, Oglethorpe apologized for not having time to "make a collection of such things as might be agreeable to one of your curiosity." He did, however, send specimens and some 38 collections are held in the Sloane Herbarium at the Natural History Museum (H.S. 316, ff. 40-48). Annotated with pre-Linnean names in Oglethorpe's own hand, these consist of a variety of mainly herbaceous plants but certainly include a specimen of poison ivy (*Rhus radicans* L.).

The Trustees' Garden had auspicious beginnings. With sponsorship from Sir Hans Sloane, the Society of Apothecaries, and advice from Philip Miller of the Chelsea Physic Garden, many plants of potential commercial importance were introduced, including white mulberries, oranges, peaches, figs, pomegranates, olives, vines and cotton, as well as vegetables to supply the needs of the expanding colony. Cotton and peaches still remain two of the major commercial crops of Georgia. Unfortunately, the garden soon became neglected and many plants were killed in a hard frost in March 1738. It continued to supply mulberry trees, which were available to planters free of charge, until about 1748, but was eventually abandoned and converted to residential use in 1755. A bronze marker, commemorating the 250th anniversary of the founding of the garden, was erected on the site in 1983.

The local natives, the Yamacraw tribe, responded favorably to the colonists' overtures of friendship and when Oglethorpe returned to England he took with him 10 of them, including Chief Tomochichi. They met the trustees of the colony, the King and Queen, and caused quite a stir in Godalming when their host took them to dinner at the White Hart.

On his second voyage, James was accompanied by the brothers John and Charles Wesley, family friends who were going to minister to the spiritual needs of the colonists and the natives. The government's idea of funds for running the new colony proved miserly and the estate at Westbrook had to be mortgaged to raise the necessary money to keep it going. Once back in Georgia, Oglethorpe founded the settlements of Frederica on the coast and Augusta further up the Savannah River; he then made one more quick trip to England to try to raise a regiment to meet the growing threat of Spanish invasion. The expected blow fell in 1742; the invaders were defeated at the battle of Bloody Marsh and driven back into Florida, for which achievement James Oglethorpe was rewarded with promotion to the rank of Brigadier General.

The next year he returned to England for the last time and married Elizabeth Wright, an heiress who lived at Cranham in Essex; they spent their honeymoon at Westbrook but then returned to London where the General made friends among the literary set, which included Doctor Johnson and Oliver Goldsmith. He did a little more soldiering in Europe in the service of Frederick the Great, then retired to Cranham where he died at the age of 88.

Portraits of Oglethorpe are surprisingly uncommon. That figured here, known as the "oval portrait," is undoubtedly the finest likeness of Oglethorpe in existence and is thought to have been passed down in the Carstairs family from a female friend of the General. He also was painted by Sir Joshua Reynolds in 1780 for the Duke of Rutland, but the original was destroyed in a fire in Belvoir Castle. The oval portrait, which was probably painted after the General's return from Georgia in 1743, is thought to show the General in his late forties and has an interesting history.

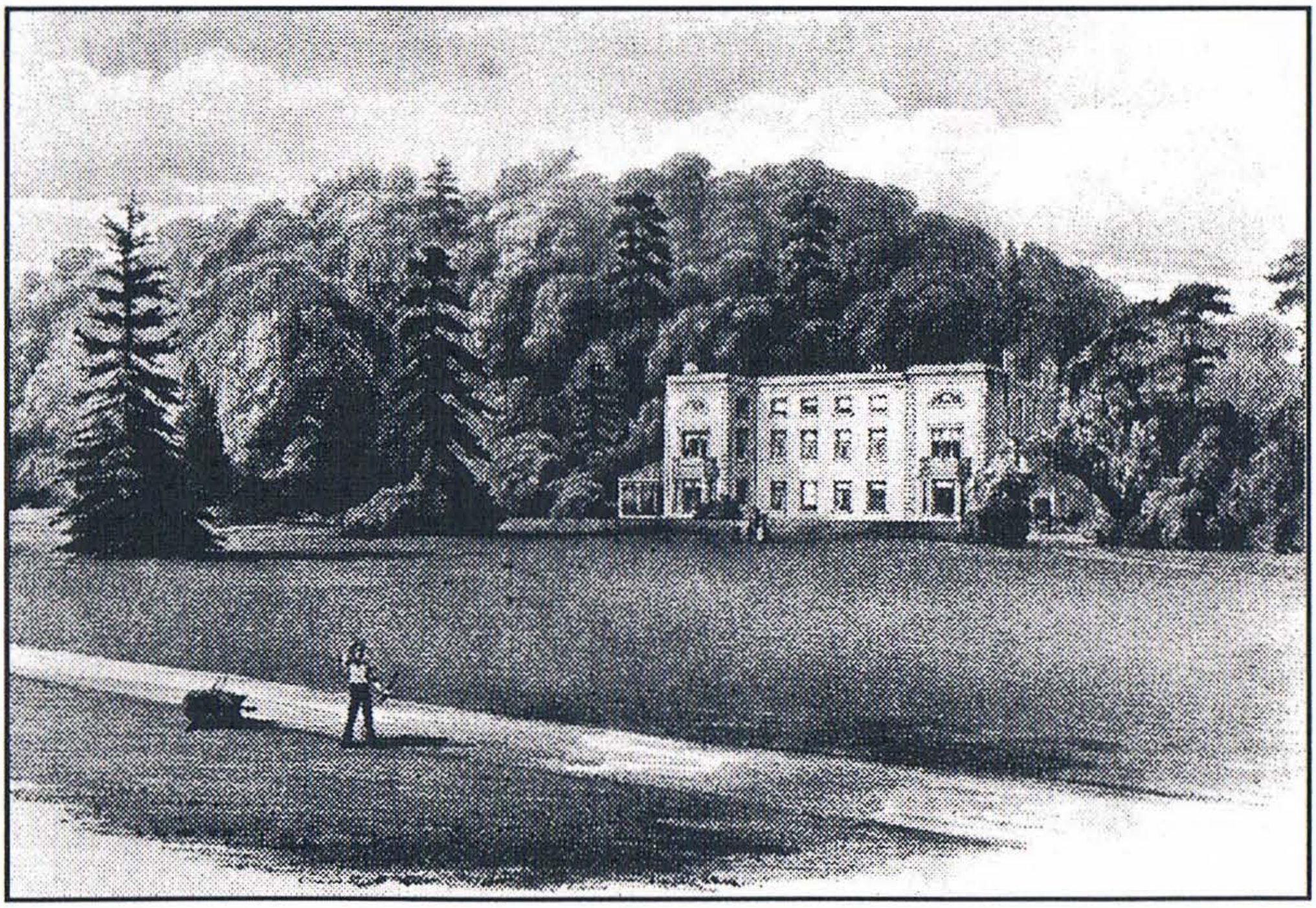
Much of the interest in Oglethorpe today is due to the work of Dr. Thornwell Jacobs of Oglethorpe University. Originally chartered in 1835 near Milledgeville, Georgia, as a living memorial to Oglethorpe, the University was destroyed in the Civil War but refounded by Jacobs in the early 1910s in Atlanta. Jacobs developed a keen interest in Oglethorpe and in 1922 visited key sites in England associated with him. On learning that the site of Oglethorpe's tomb was unknown, he resolved to return and discover it. Although the church of All Saints in Cranham, Essex, was demolished and rebuilt between 1873 and 1875, Jacobs visited the site in 1923 and found the tomb of Oglethorpe and his wife Elizabeth who died two years after him.

In 1924, Jacobs returned to England to purchase portraits of James and Elizabeth Oglethorpe and again in 1932 when the oval portrait was put up for sale in London by Captain Carstairs. Jacobs purchased this for $5000 and together with a portrait of the first Earl of Egmont, first president of the Georgia Trustees, which he purchased at the same time, it was unveiled at Oglethorpe University in February 1933 as part of the bicentennial celebrations of the founding of Georgia. Later that year, Oglethorpe's image from the painting was reproduced on a commemorative stamp issued by the U.S. Post Office.

The revived Oglethorpe University in Atlanta was modelled on Corpus Christi College, Oxford, of which Oglethorpe had been an undergraduate member and which awarded him an honorary masters degree in 1731 for his work on prison reform. Jacobs commissioned a copy of the portrait by New York artist Charles F. Naegle, and together with Lewis Oglethorpe, a member of the General's family, and Oglethorpe's biographer Amos Ettinger, presented it to the College in 1934 after which they visited, amongst other places, Westbrook Place in Godalming.

There are still good contacts between Godalming and Georgia and mutual visits are frequent. The Friends of Oglethorpe has been established in Godalming since 1982 when a party of Americans unveiled a plaque in Godalming Parish Church to commemorate the 250th anniversary of Oglethorpe's departure for Georgia. For 1996, the tercentenary of Oglethorpe's birth, the City of Savannah proposed the restoration of the Trustees' Garden on its original site.

He is still honored in the State which grew from his colony; his statue stands in a square in the center of Savannah, the map of Georgia shows Fort Oglethorpe City and Oglethorpe County, while Oglethorpe University was founded in Atlanta. It would surely please the General's philanthropic heart to know that his house in Godalming has been run for 100 years as a home for epileptics, and it is good to record that last year it was presented with an Oglethorpe oak to grow in the walled garden that the founder of Georgia knew so well,



Westbrook Place circa 1800

Quercus oglethorpensis
Painting by Siriol Shirlock from a plant in the Sir Harold Hillier Gardens and Arboretum

While James Oglethorpe's involvement with Georgia goes back more than 250 years, the Oglethorpe oak is a relative newcomer to the genus, described too late to be featured in *The American Oaks* by Trelease or Sargent's two-volume work, *The Trees of North America,* but in time to be included in a list of additions and corrections in *Les Chênes* by Mme. A. Camus. It was originally noticed as distinct as late as 1940 by Wilbur H. Duncan of the University of Georgia in Athens, who, in the company of Professors G.N. Bishop and A.D. McKellar, found trees growing in abundance on Buffalo Creek near Lexington, Georgia. These trees had previously been thought to be *Q. imbricaria* Michx. (shingle oak) but further investigation by Duncan showed them to represent an unnamed species which he described as *Q. oglethorpensis.* An earlier collection made by T.G. Harbison from Elbert Co., Georgia, was also referred by Duncan to this species. The name does not commemorate James Oglethorpe directly, but Oglethorpe County, in which the tree were found and the type specimen was collected. In 1950 Duncan reported the finding of *Q. oglethorpensis* by Professor Bishop in Greenwood County, South Carolina.

The Oglethorpe oak makes a large tree to 25m (91 ft) or more in the wild, the young shoots sparsely covered with stellate hairs and glands at first, then becoming smooth and deep red in winter. The deciduous, elliptic to obovate leaves to 13cm (5 inches) long are usually without teeth and often with wavy margins, but can be slightly lobed, particularly on vigorous shoots of the second flush (as seen

in the illustration). They emerge bronze-tinged, becoming a rich glossy green, and remain on the tree late into autumn when they can turn briefly red then brown. When they first emerge they are dotted with short-stalked red glands above and with sparse stellate hairs, becoming glabrous, while the undersides are thinly covered with persistent stellate hairs. The acorns mature the first year and are ovoid, about 11mm long and 1/3 enclosed in the cup, which is sessile or shortly stalked. Although originally confused with *Q. imbricaria* Michx. (a red oak), the Oglethorpe oak is not closely related to that species and is, in fact, a white oak. It is considered by Duncan to be a relict species closely related to *Q. margaretta* Ashe, and a tree found by Duncan in Oglethorpe County., Georgia, appears to be a hybrid with this species.

Oglethorpe oak is of very restricted distribution in the wild with its main range in a few counties in the Piedmont of northeast Georgia and neighboring western South Carolina. It is found on poorly drained bottom land and neighboring slopes, uplands and stream terraces associated with *Acer rubrum* L., *Acer saccharum* Marsh. subsp. *leucoderme* (Small) Desmarais, *Celtis laevigata* Willd., *Fraxinus pennsylvanica* Marsh., *Quercus alba* L., *Q. falcata* Michx. and *Q. pagoda* Raf. (*Q. falcata* Michx. var. *pagodifolia* Elliott). In the wild it is susceptible to chestnut blight. Until an extensive study of its distribution by Haehnle and Jones, Oglethorpe oak was known from only 45 stations. They added another 100 to this, and considered that its absence form five of the previously recorded localities was due to land clearance for agricultural development. It was also suggested that although populations of Oglethorpe oak had probably not been seriously affected since its discovery, it was likely that prior to this, agricultural development had reduced the range of the species and its population density. The Georgia Department of Natural Resources describe it as threatened in the wild and its habitat has suffered clearance for agriculture and forestry.

Oglethorpe oak has also been reported from other States. The population found near Copenhagen, Louisiana, is, according to Dr. Kevin Nixon, *Q. sinuata* Walt. (*Q. durandii* Buckl.), but what appears to be *Q. ogelthorpensis* was reported by Wiseman from three sites in the Bienville National Forest, Scott and Jasper Counties, Mississippi.

In cultivation, both in North America and Britain this species in uncommon. Plants growing at the Sir Harold Hillier Gardens and Arboretum date from two accessions, firstly, plants grafted onto *Q. robur* and planted in the early 1980s; and secondly, plants derived from seed collected in the Oconee National Forest in Jasper County, south of Monticello, Georgia in late 1988 by Marshall Adams. The Meath Home plant derives from the latter collection. In spite of its southern American origin, this species is proving reasonably hardy in cultivation and at the Sir Harold Hillier Gardens and Arboretum ; the oldest specimens have made bushy plants up to 3.5m tall with a spread of 4.5m, often branching from just above the base.

In Britain young shoots of this species are frequently damaged by frost during winter, when temperatures typically reach -5°C (23°F) or below but this is probably due to the lack of sufficient summer heat to ripen the growth adequately rather than winter cold which can be just as or more intense in the southern United States. As a result of winter damage here the plants grow slowly and usually produce numerous young shoots in summer from the frost-damaged wood.

That the poor performance of this species in Britain is due to lack of summer heat rather than low winter temperatures is clearly shown by plants growing at the Morton Arboretum in Illinois. There, plants grown from seed collected in Greenwood County, South Carolina, have reached 3m (11ft) tall in 15 years. In the severe winter of 1993-94, following ideal conditions for wood ripening the previous autumn, little injury was incurred even when temperatures fell to -30°C (-22°F). However, growth that occurs late in autumn and does not ripen properly can be injured at temperatures of -19°C (-4°F). Also in Illinois, at Guy Sternberg's Starhill Forest, near Petersburg, this species grows slowly but has survived the coldest winters undamaged. Further south, Oglethorpe oak grows more vigorously and on the campus of the University of Georgia, Athens, 10-12 year old trees have reached 6m (22ft) tall and 5m (18ft) in spread with coarse, scaly bark; the leaves remaining until late autumn when they turn brown and (on these young trees) remain through winter. Planted trees can also be seen at the Oglethorpe County Courthouse, Lexington, Georgia.

Judging by specimens in the Kew herbarium, collected by Duncan near Lexington, Oglethorpe County, Georgia in 1942, this species comes into leaf much earlier in its native habitat than it does in Britain. Whereas at the Sir Harold Hillier Gardens and Arboretum, it is normally well into May before the foliage starts to emerge, a flowering specimen (Duncan 4761) collected on April 18th, already had the young leaves opening while a specimen in full leaf (Duncan 5532) was collected on July 12th. In cultivation in Savannah, Georgia, the leaves emerge in mid-to-late March.

Although the Oglethorpe oak is unlikely to make a tree suitable for landscape use either in Britain or the United States, its historical associations with James Oglethorpe, as well as its rarity, make it of great interest. It should certainly be more widely planted, in the southern United States at least; what better way would there be to commemorate the tercentenary of the General's birth, in 1996. Oglethorpe oak is very rarely available from nurseries but in the United States plants grown from wild source seed can currently be obtained from Woodlanders Inc., 1128 Collecton Avenue, Aiken, South Carolina 29801. Goodness Grows Nursery, P.O. Box 311, Lexington, Georgia 30648, plans to have plants grown from seed collected by Dr. Wilbur Duncan, who named the species in 1940, ready for sale in 1996. Seed is sometimes obtainable on a small scale, as it was at the seed exchange following the First Oak Conference held by the International Oak Society at the Morton Arboretum in October 1994. ❧

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OAKS IN SWEDEN

by Lennarth Jonsson

In the Scandinavian languages, the word for "oak" is "ek/eg," which is derived from the ancient Scandinavian "igja," meaning "reverence or respect." From ancient times the oak has had a special position for the people in this remote part of the world. The oldest *Quercus robur* in Sweden today is about 1,000 years old (one in Denmark is about 400 years old) and has a circumference of 13.5m (50 ft). The largest *Q. petraea* has a circumference of 10m (36 ft).

Nowhere else in the world does the genus *Quercus* grow indigenously as far north as in Scandinavia. Keep in mind that the southernmost point of Scandinavia is (latitudinally) the north of Newfoundland. The Hudson Bay has the same latitude as Scandinavia!

In Scandinavia there are two indigenous species: *Q. robur* and *Q. petraea*. The oaks have generally a good plasticity, i.e. they stand variations of daylight, soil, humidity and many other conditions, but they demand light and heat. In warmer periods after the Glacier Epoch, the oaks were much more common in Scandinavia and also grew much farther north. An oak requires a certain length of growing season to mature its acorns. It seems that this is achieved where the average temperature is at least +10°C (50°F) for four months. Consequently, the northern border of *Q. robur* parallels the isotherm along the Norwegian coast up to about 63°N through Sweden between 59° - 61°N and Finland-Karelia up to 61°N.

Although *Q. robur* is one of the more heat-demanding trees in northern Europe, this species is unusually indifferent to varied temperatures. In its northwestern corner (Ireland and Scotland), the July average is about +14°C (58°F) and in January around +8°C (38°F); whereas, in the Russian plains on its eastern border, the corresponding temperatures are +24°C (76°F) and -15°C (3°F), respectively. In Scandinavia these temperatures are between those extremes. Cool summers are common but usually not as cold in winter due to the influence from the Atlantic.

Q. robur is very hardy because it survives along the far northern coasts of Sweden and Finland; that would qualify it for a breeding program with tender and outstanding species. Its hardiness is astonishing because the genus must be of subtropical/tropical origin. [A test in western Java proved that *Q. robur* still has tropical tolerance (1,500 m (5,460 ft) above sea level). It grew as an evergreen without any dormancy (J.A. Romberg, *Meritstems, Growth and Development*, 1963). *Fagus* and *Abies* did not survive.] The tendency of northern species to keep their leaves in winter might be a lasting evergreen quality? The deeply lobed leaves that the deciduous species have are uncommon until recent ages according to C.W. Wang, *The Forest of China.*

Quercus petraea is somewhat more southern in Scandinavia and is not wild in the Stockholm area and Finland. The eastern border of *Q. petraea* in Europe is from East Prussia to Moldavia. It is a suboceanic species and less common in Scandinavia where it grows in poorer and shallower soils than *Q. robur*. However, both species often grow in the same areas because of very variable conditions within a short distance in southern Sweden. Due to this, pure stands of *Q. petraea* are rare.

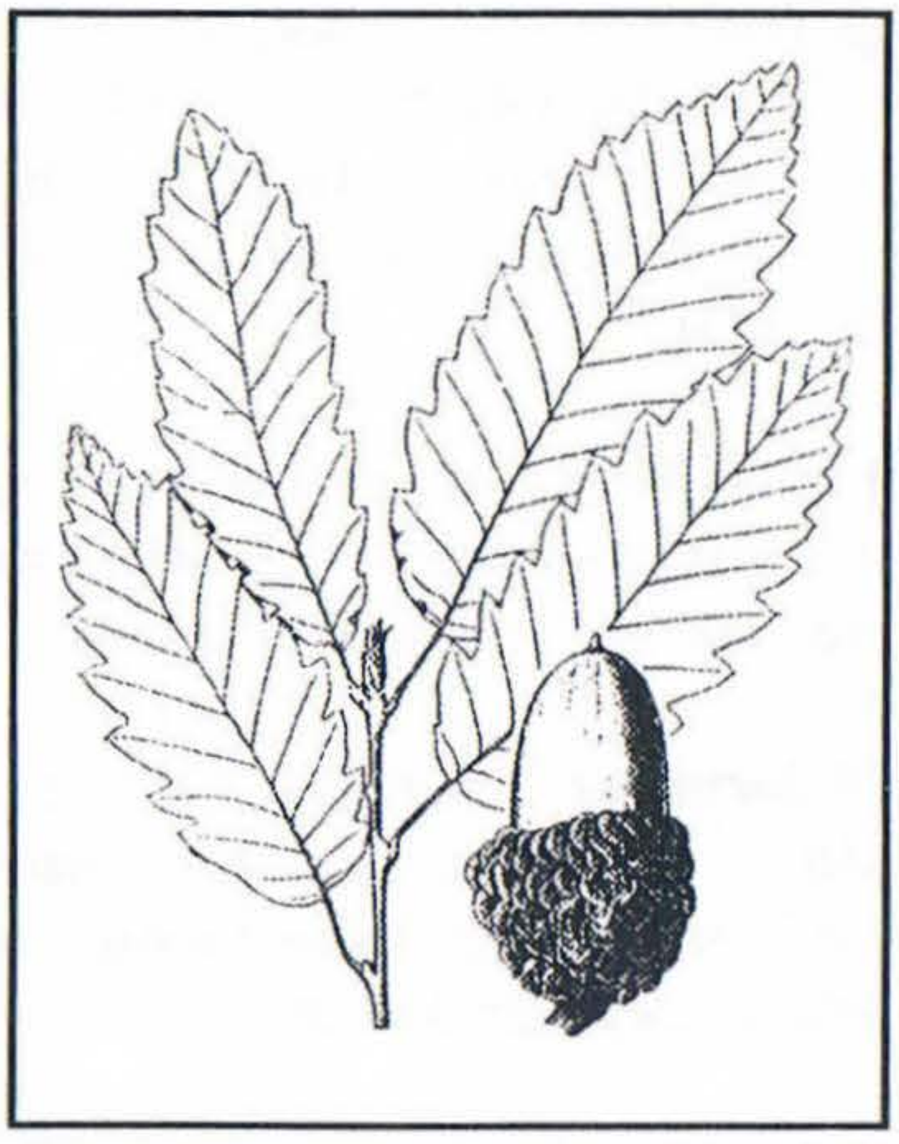
In Sweden several oak species have been grown and may have the potential of being grown. More common exotics grown in southern Sweden are: *Q. castaneifolia, Q. cerris, Q. coccinea, Q. frainetto, Q. macranthera, Q. palustris* and *Q. rubra*. However, any named clones, as far as I know, have not been planted in Scandinavia, except perhaps in private gardens.

Q. accutissima - Provenances of this species grown in Sweden have proved to be tender and can only be planted in the mildest parts of Scandinavia, in sheltered and well-drained sites having lime soil.

Q. alba - To manage this species in Sweden, only northeastern strains should be tested as they are supposedly best adapted to our conditions. This species will often become a small, slow-growing tree with thick branches. It grows best in southeastern Sweden, along the southernmost coast of the Baltic Sea up to Öland (about 56° 30'N), where the local climate has a more continental character. The reason to grow it in Sweden is for its silver-white bark of older trees and its beautiful autumn colors. It is difficult to establish due to deep roots.

Q. bicolor - Because it needs long, hot summers, it is less suitable in Sweden, though it is a highly attractive tree. Only advisable to try in southeastern Sweden. In both Stockholm and Copenhagen, 15m (50.6ft) specimens are reported. Any fall color can only rarely be seen because it requires warm and fairly dry American autumns.

Q. castaneifolia - This species is native to southeastern Caucasus and northern Iran, where it grows in river valleys and on hillsides together with *Fagus orientalis*. It is a mesophytic species and can stand persistent droughts which are common in southeastern Sweden in April through June. Consequently, it requires well-drained soil. It can be grown in the milder zones in Sweden. In Caucasus it grows to a 50m (182ft) high tree having a diameter up to 1.5m (5.5ft), but the tallest specimen in Scandinavia is a 100 year old tree in the Botanic Garden in Copenhagen. This tree has a circumference of 4.5m (16ft) and is 19m (70ft) high and equally wide. Much taller specimens cannot be expected to grow here.



Quercus castaneifolia (from Dippel: Krüssmann)

Q. cerris - This species of the Balkans and Turkey is resistant to strong winds and is relatively hardy in Sweden if specimens of hardy provenances are planted. In Stockholm the species will grow 15m (55ft) tall and will fruit more often than our native species. *Q. cerris* is relatively mesophytic and often grows on hillsides and in deep sandy soil. In cultivation it is rarely found in lime soils. Small seedlings should be covered in winter as the shoots mature late in the season. Its deep roots make it easier to establish itself than our native species. The wood is less useful and will not become very old, only about 200 years old.

Q, coccifera - Not hardy in Sweden.

Q, coccinea - This species has the best fall color in Sweden, though very late in the season if it is not in a favorable site. It can be planted in our milder zones, but only the hardiest provenances should be used; these are said to be found in Tennessee and North Carolina. A consequent searching for reliably early autumn-coloring clones should be carried through. There is a selection 'Splendens' known for its good color but its hardiness in Sweden is doubtful. The tree tolerates windy conditions very well.

Q. dentata - The experiences from growing this species in Sweden are varied. Most commonly the trees will become small, thin, have several trunks and a gaunt habit. Also freezing of the annual shoots can be common. Only the hardiest provenances should be planted in sunny and sheltered sites. One of the better specimens reported is 3.5m (13ft) tall. Korean collections of other genera have proved to be very successful in Scandinavia and that might be a reason to find Korean provenances even in this case or collect from the sand dunes on the shores of Hokkaido, where it grows together with *Rosa rugosa.* The hybrid with *Q. ponticum, Q.*x *pondium* has proved to have better development than *Q. dentata.*

Q. ellipsoidalis - Very rarely planted but should be hardy at least from provenances of Manitoba.

Q. frainetto - This species from the Balkans is very drought tolerant where it grows in the mountains of Serbia. It grows best in a warm, deep lime soil that is reasonably drained. In milder parts of Sweden it may even grow better than *Q. robur.* Specimens of 25 to 30m (91-109ft) tall are known in southern Sweden (Scania).

Q. gambellii - Nothing is reported on this species in Sweden. Probably only possible in southeastern Sweden where the local climate is on the drier and sunnier side of the rain shadow of the Atlantic winds.

Q. garryana - There is a 100 year old tree about 20m (73ft) high in the Botanic Garden in Copenhagen. Provenances from Vancouver Island, having relatively cool summers, are recommended for Germany; perhaps also they might be suitable for Scandinavia also.

Q. glandulifera - A very attractive oak that is very doubtfully hardy in Scandinavia. Possibly, it may grow only in the mildest zones of Sweden.

Q. hartwissiana - This oak is native to a small strip along the southern and eastern Black Sea where the precipitation is over 100cm (40in). Only a few areas in Scandinavia have that much, at least regularly. In Copenhagen there is a 15m (55ft) tall tree over 100 years old.

Q. ilex - This species is not hardy in Scandinavia, of course.

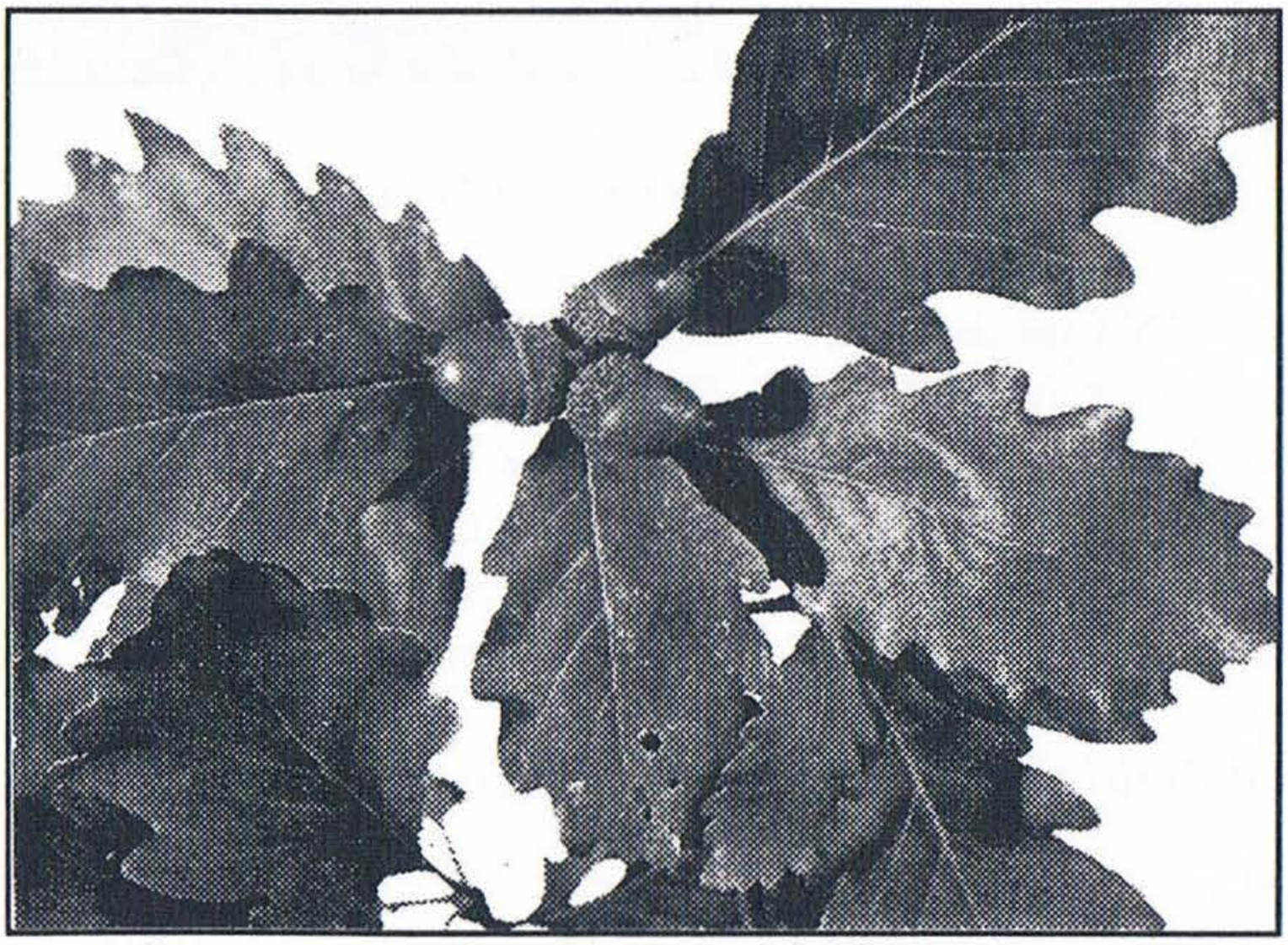
Q. ilicifolia - This interesting shrub, having an odd branching habit and ornamental leaves, might be tested on sheltered sites in the mildest zones. No experiences of growing this species has been reported in Sweden.

Q. imbricaria - In Germany this species can grow to 20m (73ft) within 40 years and there is a 17m (62ft) high specimen about 70 years old in Charlottenlunds Arboretum in Denmark. It should be possible to grow in the two mildest zones over here.

Q. libani - In the Botanic Garden in Copenhagen, there is a beautiful 6m (22ft) tall specimen. It may be possible to plant in alkaline soil on the most favorable sites in Sweden.

Q. lyrata - If there would be any opportunity to grow this species it should be in southeastern Sweden.

Q. macranthera - In its native area, this species is reported to grow as a dwarf shrub at the altitude of 3,000m (10,920ft). This very ornamental oak was frequently planted early this Century in town parks in southern Sweden. It is a relatively fast grower, and has a beautiful crown, and hardy in Stockholm, where it sometimes has mature acorns.



Quercus macranthera Photo: Archivbild (Krüssmann)

Q. macrocarpa - This attractive species grows in Manitoba, where it is frost free for 100 days and the precipitation is only 37cm (15in). Given this fact, there might be a good opportunity to find provenances suitable for Scandinavia. This species has been very difficult to establish in northern and western Europe. For Scandinavia, collections from Nova Scotia should cope with our climate in south-eastern Sweden. In the Botanic Garden in Copenhagen, there is a 100 year old tree 13m (47ft) high and 15m (55ft) wide, which has an irregular habit with large, twisted branches.

Q. marilandica - Due to its interesting leaves, it might be worthwhile to test this species in southernmost Sweden in a dry and sheltered sites with sandy soil.

Q. mongolica - In Europe the Japanese variety *grosseserrata* is more often planted than the type, however, in northern and central Europe, it develops poorly and the shoots are often frozen back. Northern provenances are much better and in the Botanic Garden in Gothenburg, there are some good specimens.

Quercus mongolica var. grosseserrata (Krüssmann)

Q. mue hlenburgii - An attractive tree but probably only possible to grow in southeastern Sweden in sheltered sites having a lime soil.

Q. nigra - In Germany provenances from Maryland and Delaware are recommended but only in the mildest zone on drier sites. It is hard to tell if these will be cold tolerant for Scandinavia.

Q. palustris - This species was not damaged by the record cold winters during World War II, even in Stockholm. If northern provenances are used, it can be widely planted in southern Sweden, if not in too windy of a site. Its autumn color in Sweden is far later than in the U.S. due to our cool summers and damp autumn weather. Perhaps clones more suitable for the Scandinavian climate would improve its value here. In Denmark it is planted as a street tree.

Q. pedunculiflora - Probably hardy in southern Sweden but very close to *Q. robur.*

Q. phellos - This species is damaged in Germany in cold winters. Because it can be damaged at -25°C (-12°F), it is only the hardiest clones that might be possible in the most favorable sites in southernmost Sweden.

Q. pontica - This species from the Black Sea near Georgia and Turkey is considered to be the most beautiful of the southern European oaks. It should be hardy on warm, sheltered sites in the milder zones.

Q. prionides - May be possible in southeastern Sweden.

***Q. montana* (*Q. prinus*) -** As one of the white oaks, it is astonishingly hardy in southern Sweden and Germany. It is even very drought resistant in cultivation.

Q. pubescens - The more north it grows, the more it favors alkaline soils. It is possible to grow in milder zones.

Q. pyrenaica - This species has an elegant habit and has conspicuous male catkins. It is only hardy in a sheltered sites of the mildest zones.

Q. rubra - This is the most common of the exotic oaks in Scandinavia. It is hardy farther north than the natural distribution of *Quercus robur.* Sometimes it grows more vigorously than our native oaks, like in Scania, where there are specimens that have grown 20% better. There are specimens in Stockholm that are 20m (73ft) tall and produce regular crops of viable acorns. Provenances from cold areas in Canada are suitable for Scandinavia. As for autumn color, it is not as lovely in Scandinavia or western Europe as in America, and the leaves only turn brown. The best opportunity for a conspicuous autumn show is on a sunny and sandy site. This is why it is advised in Scandinavia to prune *Q. rubra* regularly to get a more showy shrub rather than a tree, until a reliable autumn-coloring form is found. It has been more resistant to mildew and *Tortrix viridana* than the native *Q. robur.* Even the variety 'Aurea' is planted in shaded places as it requires protection from intensive sun to keep its yellow leaves.

Q. stellata - For Germany provenances from Pennsylvania and New York are recommended, but usually difficult to get established here due to hardiness.

***Q. trojana* -** This species from the Balkans might be tested on sheltered sites having lime soil in the mildest zone. Probably not easier to grow in Scandinavia than *Q. libani*.

Q.* x *turneri - This hybrid of *Q. robur* and *Q. ilex* is the only evergreen oak that can be planted outdoors in Scandinavia (perhaps also *Q.* x *hispanica* 'Ambrozyana'). This British hybrid can grow up to 10m (36ft) tall in southern Sweden which is half the height at which it grows in England. In record cold winters, the leaves are frozen brown but it recovers. The variety 'Pseudoturneri' is also grown but only rarely. In Gothenburg there are two specimens of 4m and 5m (15ft and 18ft) tall

Quercus pontica Photo:Archivbild (Krüssmann)

and also in Alnarp two specimens are about 14m (50ft) tall. This hybrid can be planted in sheltered sites in our two mildest zones.

Q. velutina - This species is very rarely planted in Sweden but might be hardy in our two mildest zones.

The Danish National Arboretum at Hörsholm (just north of Copenhagen along the coast) has several oak species growing. The soil is clay, rich in loam. The local climate is better than most places in Scandinavia. Of the white oaks, which are difficult to establish over here due to cool and short summers [the temperatures very rarely will exceed 25°C (73°F) and on the average are 18°C (54°F)], *Q. montana* (formally *Q. prinus*) grows the best. The results are mixed for *Q. alba* and *Q.mongolica*, while *Q. bicolor* and *Q. macrocarpa* unsatisfactorily have developed. The Asian species *Q. aliena* and *Q. glandulifera* have been seriously damaged by frost.

Most soils in Scandinavia are acid and in this Century even more have become acid due to prevailing southwestern winds from the heavy industrial regions in western Europe. Only Scania and the Danish islands are rich lime-clay loam. Because this is also the mildest region in Scandinavia, it might limit the opportunity to grow tender oaks requiring an acid soil.

This was a very short survey of exotic oaks mainly in Sweden. As you may see, in order to grow the most attractive oaks, provenances and varieties must be selected with much care so that the results with the genus *Quercus* (those on the borderline of hardiness) will be satisfactory in Scandanavia.

Breeding with *Q. robur* from provenances in Scandinavia should give a better chance for attractive oaks to grow in cold regions both in Scandinavia and in Canada, but this calls for intimate cooperation between keen and enthusiastic members of the International Oak Society to exchange scion material of outstanding cultivars as well as pollen. I hope that people living near good collections or promising regions which have varied oak flora, will find an interest in this challenge. ❧

Lennarth Jonsson is a Swedish amateur oak collector who is interested in varieties of Quercus *that are hardy in Sweden and have good, early autumn color and also those that have odd leaves. He is mainly concerned in species from provenances with cold tolerances. He is also interested in someone who can supply him with scionwood. Anyone who can help or would like to discuss these interests further, may contact him at the following address: Lindenäsvägen 8, S-37145 Karlskrona, Sweden. Tel/Fax# 46 455 25449.*

Work Cited

Efvergren, Rolf. 1987. *Eken* (The Oak). Swedish University of Agricultural Sciences, Institute of Landscaping, Alnarp .

THE FIRST MEETING IN EUROPE

by Hugh Angus

On October 28, 1995, some 40 International Oak Society members and guests gathered at the Sir Harold Hillier Gardens and Arboretum in Great Britain for what promised to be a fascinating day. The Gardens hold one of the National Collections of *Quercus* in Britain (there are three altogether) and currently grows more than 250 different species and cultivars. This was the first event to be organized in Great Britain for our Society members and the fact that participants came from as far as France, Belgium, the Netherlands, Luxembourg and Germany bodes well for future events on this side of the Atlantic. We were certainly not disappointed. The day was organized and led by Allen Coombes, botanist at the Gardens and serves as vice-president on the Interim Board of the International Oak Society.

After meeting up with old friends and getting to know new ones, the tour started with a visit to the Gardens' Propagation Unit, where Duncan Goodwin showed the group where numerous oaks, some brought back from the First Conference of our Society in 1994, were being raised from seed. A tour of the collection followed starting with some of the large-leaved oaks such as *Q.* 'Pondaim' and *Q. pontica* as well as what all agreed was a very handsome form of *Q.* x *bushii*. Later in the day, the hybrid of *Q. pontica* with *Q. robur* (*Q.* x *hickelii*) was also seen fruiting heavily. Acorns were a particular feature of the tour, as it had been an exceptional year, and the unusually large fruits of *Q. libani* proved quite an attraction. Perhaps one of the most striking sights of the day was the specimen of the bold-leaved, evergreen *Q. rysophylla* from Mexico.

After the tours and a very fine lunch, members were able to help themselves to seed, which several had provided, as well as swap plants and stories about oaks. As the day drew to a close, our thoughts turned to the 1996 event. In the end, it was decided that Westonbirt Arboretum in Gloucestershire would host the event on Sunday, October 5, 1996.

OAK OPEN DAY AT WESTONBIRT ARBORETUM

by Allen J. Coombes

Some 40 Society members and guests attended a meeting at the Forestry Commission's Westonbirt Arboretum in Gloucestershire, England, on October 5, 1996, where tours of the collection were led by Curator Hugh Angus and retired Curator John White. This splendid collection was started in 1829 and, after passing to Sir George Holford, it went through three generations of his family before being taken over by the Forestry Commission.

Westonbirt Arboretum covers some 240 hectares and has some 17 miles of paths. Today, the Forestry Commission manages Westonbirt for conservation, education and recreation. The Conservation aspect of the work involves looking after more than 18,000 numbered specimen trees and keeping detailed records of anything that happens to any one of them. The small Education Unit welcomes over 12,000 school children every year and caters to a wide range of topics. Approximately 250,000 people visit Westonbirt annually, of which half visit in October to see the autumn colors.

Even though Westonbirt is situated 400 feet (110m) above sea level, many mature *Quercus robur* provide shelter for other diverse plantings. We were shown the only specimen of *Q. petraea* on the site, while John White spoke about a tree of this species grafted from an old specimen in the Forest of Dean, which produced some stalked acorns (normally sessile in *Q. petraea*). He later discussed dating methods for old trees and we viewed an obviously very old tree which he estimated at 327 years old with a diameter at breast height of 171 cm (67 inches).

During lunch a meeting was held to discuss the creation of a European Chapter of the International Oak Society and James Harris agreed to chair a Steering Committee to organize such a chapter. In the afternoon the group toured the propagation facilities and saw many other splendid trees, including a magnificent *Q. canariensis*: I was asked to plant a tree in the oak collection, for which James Harris kindly presented a seedling *Q.* x *saulli* (*Q. alba* x *Q. montana*). Finally, it was time for the traditional plant swap, where some interesting seedlings began to appear. Apart from the few plants raised from seed from the 1994 Oak Conference in Illinois, USA, these included *Q. baloot*, an evergreen species from the western Himalayans, collected by member Shaun Haddock in Pakistan in 1995, which he offered to members as seed at the 1995 Oak Open Day, held at Sir Harold Hillier Gardens and Arboretum.

Next year's Oak Open Day in Europe will be hosted by Dick van Hoey Smith at Trompenburg Arboretum, Rotterdam, Netherlands on September 27 - 28, 1997. The date has been set to fit in conveniently before the Second International Oak Conference in California. European members will receive invitations from Trompenburg, but all International Oak Society members are welcome. If you live outside Europe and would like to attend the meeting, please contact Mr. van Hoey Smith directly at: Arboretum Trompenburg, Groene Wetering 46, 3062 PC Rotterdam, Netherlands.

Allen J. Coombes works as a botanist at Sir Harold Hillier Gardens and Arboretum in Hampshire England. He is also Vice President and European Representative for our Society.

THE SECOND CONFERENCE OF THE INTERNATIONAL OAK SOCIETY

at the Huntington Botanical Gardens San Marino, California, USA October 21 - 23, 1997

Make your plans to attend the Second International Oak Conference this year. It will be an exciting conference packed with places to visit, people to meet and things to learn. A brief summary of events includes:

- Field trips of interesting oak sites in California
- Welcome reception and dinner
- Excellent multi-national speakers
- Seed Exchange
- Business meeting for Society members

The Huntington Library and Botanical Gardens is one of the United States' greatest cultural and educational centers. As the former estate of California railroad magnate, Henry E. Huntington, the grounds possess a rare books library, three art galleries, and the Botanical Gardens. The gardens are an ever-changing exhibition of color and plants from around the world.

For those who attended the very successful First Conference of the International Oak Society in 1994, there was a lot to do in short period of time. With this in mind, the Conference committee has been working hard to schedule events, tours, conference sessions, field trips, and meetings with enough time for members and attendees to mingle and meet each other.

All Society members will receive registration information in early 1997. Early registration is encouraged. Non-members may be added to the mailing list by joining the Society or by contacting the California Oak Foundation (see addresses below). In the meantime there are a block of rooms reserved for this Conference and you may make hotel reservations by telephoning the Holiday Inn Pasadena at 1-800-457-7940.

Address for joining the
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P.O. Box 310
Pen Argyl, PA 18072-0310 USA
Tel: 610-588-1037
Fax: 610-599-0968

Address of the California Oak
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Tel: 510-763-0282
Fax: 510-208-4435
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The Editorial Committee and Editors reserve the right to edit all contributions for grammar, correct English translation, current nomenclature, generally accepted taxonomic concepts, scientific accuracy, appropriateness, length and clarity; but assume no responsibility to do so. If such review results in significant disputes of factual material, the author will be contracted, if possible, or the paper may be rejected. Every effort will be made to retain the original intent of the author.

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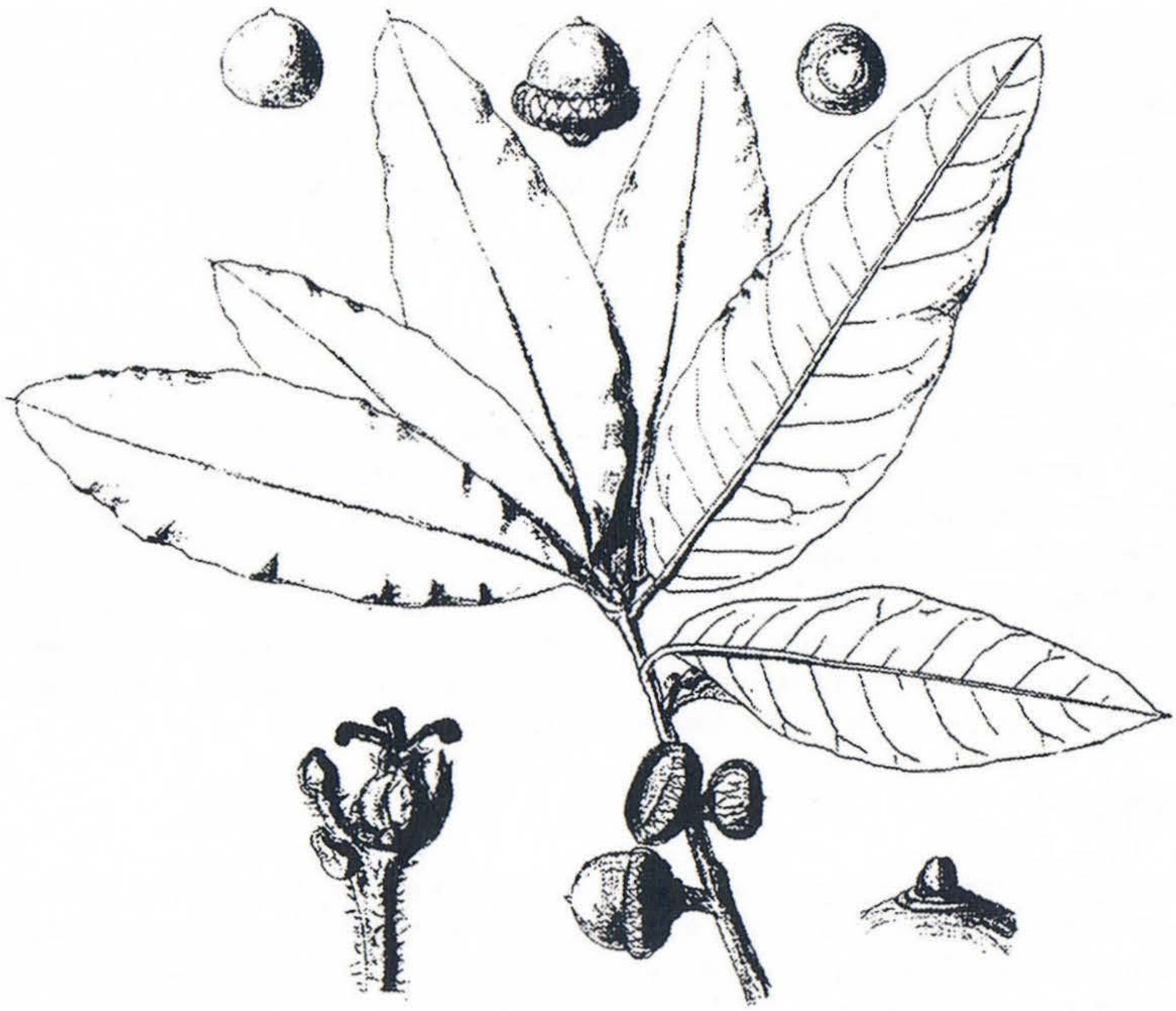

Quercus imbricaria by Camus

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