



***Juglans nigra* – Black Walnut**
Jardin Botanique – Montreal, Quebec

THE JUGLANDACEAE – WALNUTS AND HICKORIES

By Susan McDougall

Daddy's work was physically demanding. He was a builder of houses – “spec” houses, as they were known – meaning he bought land, acquired a bank loan, and built houses one at a time, selling them to repay the loan and provide his family with a modest living. After selling one or sometimes before a sale, he would move on to the next project. It was an uncertain life, for then as now, quality homes had to compete with mass production. And, to keep costs down, Daddy performed nearly all the work himself.

Occasionally I would visit the construction site, but the most meaningful memories are of daddy arriving home, parking the car out front (no garage or truck in the early years), and coming into a warm house in winter and a shaded one in summer. He worked the year round in the Pacific Northwest - winter rains and summer heat were no deterrent.



Old nutcracker used by my Dad

After greetings and dinner, I would return to my room and daddy would head for his rocking chair in the corner of the living room, happy to read the newspaper or a book. But as I played or studied, occasionally I would hear another sound besides the occasional slow breathing of a tired man nodding off, or the turning of the newspaper pages. It was a cracking/crunching and comforting, reassuring sound. Daddy was eating walnuts, fresh from the shell.

The walnut shells did not give up the kernel within easily, but they could be broken open along a suture line with the simplest of tools. A metal nutcracker, held in the hand, no electricity required, was all it took; the meaty nut could be removed with a small pick. The one he used was straight-sided, hinged at the end. The shells were deposited in a bowl (mostly), and the nuts consumed. Other than vanilla ice cream, walnuts were his favorite dessert.

Harvesting on the farm

It was a 25-acre farm, located near the fruit-growing heart of the Pacific Northwest, and, as with the surrounding orchard property, included irrigation rights. Most of the land – 20 acres or so – was planted in corn rather than apples and was leased to a local farmer. The rest was given over to a home, sheds and other buildings not uncommon on small farms, open land, and a large vegetable patch. The soil was rich, the produce prolific, to the point of giving much of it away, and those who traveled there from the western part of the state looked upon such luxuriating plants with envy. Heat made size, and it was hot in the Yakima Valley in the summer.

The farm had been purchased by the owner's father in the first quarter of the twentieth century and had passed to the family as part of the estate. The new residents were my inlaws, recently returned to the Yakima Valley after a position in a Spokane church. They were retired now, and content to take a lesser

role in the local Presbyterian congregation and devote themselves to the old farm. Memories of the time with family at the old farm eased their transition, and the local community suited them well.

The house bordered on a road, separated by a line of trees, perhaps planted a century or more before. Several of these old trees were walnuts of the plantation type — probably grafted “English” walnuts, although more Mediterranean in origin — and they produced with abandon in the heat of the eastern Washington summer. They were big broad trees, with stout dark trunks, thick for several feet above the ground before separating into great arching branches. In September their great weight of walnuts began to fall.

One autumn we happened to visit when the walnuts were ripe, and never given to wasting a potential harvest — something I have come to admire in later times — my mother-in-law indicated that some help with gathering the nuts would be appreciated. We could keep it simple by picking up the walnuts on the ground, and so we headed out, a few feet from the house, buckets in hand, ready to gather the brown-husked nuts. At least, that is what I expected. Given my experience at home, I was knowledgeable of the fact that walnuts were produced in a hard shell, not as individual small pieces, mechanically placed into a plastic bag and sealed for selling.



**New walnuts on a Black Walnut tree (*Juglans nigra*)
MORTON ARBORETUM, CHICAGO, IL**

But when I looked at the littered ground, a surprise awaited. The walnuts were enclosed in a soft limey-green covering, not a tough, brown shell, and that green ball was blackened in places. It looked more like this:

As it turns out, my walnut knowledge wasn't as sophisticated as I had thought. There was another covering, making this a three-layered affair!

No problem. All we had to do was remove the outer layer, easy enough with a knife, and beneath we would find the expected wrinkled, brown nut shell. Those could be packed in bags and cracked open for the sweet kernel at a later time. The harvest

would soon be done. So now in possession of new information, a bit of city-girl embarrassment, and cautious enthusiasm, I picked up the greenish mass, inserted the knife, and prepared to reveal the product of the tree's efforts. The only problem was that one more surprise awaited.

The outer shell was soft enough; in fact, it was too soft, and not thoroughly green to the core. Rather inside the (as it turns out) luscious mass was a creature partaking of its own harvest — a slimy (I think), dark, inch-long, yucky worm. Not appreciating the intrusion, it wiggled indignantly at the stabbing of the knife, sending me back on my heels, removing the offending piece.

Another lesson from nature — a mixture of flora and fauna — and we went ahead, less enthusiastically in the presence of an unexpected life form but determined to wrest the walnut and have it for ourselves. We did, technology winning, and soon there were walnuts in abundance for use in eating and baking throughout the winter. But I have never quite forgotten that surprise, and I cannot look at a new walnut fruit without thinking of the walnut worm.

THE JUGLANDACEAE FAMILY



Hind's Walnut (*Juglans hindsii*) – a California walnut

ANDERSON MARSH SHP, CA

The Walnut Family (the Juglandaceae) includes not only walnuts but hickories and pecans as well, both of them widely planted for harvest, and both with native representatives in North America. There are six species of walnut (*Juglans*) on the continent, two of them native to California. Worldwide, twenty species are recognized, at the present time. All of them bear edible nuts, but it is the Persian Walnut (*Juglans regia*) — also commonly known as the English Walnut, although it is not native to the island — is the most planted tree worldwide. Often grafted, English Walnut is the mainstay of walnut orchards in the major walnut-producing countries of the world. Its original range extended from the mountains of Central Asia, east as far as India and Pakistan, and west to eastern Turkey. The species was introduced as long ago as the fourth century B.C. to other parts of Europe, the Mediterranean. The trees hybridized rather freely with

local species, and in some regions it is difficult to determine if the species' presence in a particular location is natural or the result of a long history of planting by human hands. English Walnut was brought by Europeans to North America in the 17th century, where cultivation quickly followed introduction. Today the greatest production of commercial walnuts, nearly all of *J. regia* heritage, is measured in the millions of tons, with China the greatest producer, and the United States second.

California is the heart of walnut growing in the United States, a fact that seems appropriate, given that the California Hind's Walnut (*J. hindsii*), a rare tree in the wild, with possibly only one natural stand remaining, plays an important role in walnut production. Historically utilized as a rootstock for the English Walnut, today the California Hind's Walnut continues to provide that function for the introduced species.



***Juglans regia* (English or Persian Walnut) – buds and new leaves**

ARNOLD ARBORETUM, BOSTON, MA

walnut production. There are hundreds of *Phytophthora* species, and they are pathogens for a wide range of plant families. The Walnut Family is one of them.

Unfortunately, grafting can introduce a different problem with the Hind's Walnut as rootstock, and other sources are used, including the English Walnut itself. Nevertheless, commercial trees in California are grafted, typically onto Hind's Walnut or its cultivar. As might be expected, there are various methods used for producing rootstock and for grafting as well. Outwardly appearing simple – rows and rows of trees producing tons of tasty nuts - the creation an orchard is the result of years of experimentation, failure, and success. Walnut growing is both a complicated and a big business.

How is it possible for an endangered species to be utilized as a rootstock? For one, it is often the hybrid 'Paradox' that is cultivated, and it is often done so by a "tissue culture" approach. Rootstock far removed from the native tree is a vital part of the walnut-growing trade. And the reason for going to all the trouble of grafting a Persian Walnut onto another tree is the increased hardiness and resistance of the combination. To provide a defense against *Phytophthora*, a group of destructive molds perhaps best known as the cause of the Irish potato famine of the mid nineteenth century, is another reason for the grafting approach to

Discovering and naming a walnut – who was Hinds?

In 1837 a British botanist by the name of Richard Brinsley Hinds was traveling on a scientific expedition on the *HMS Sulphur*. This ship, with her various commanders (three in all) was directed to explore the west coast. The *Sulphur* came to the San Francisco harbor and explored up the Sacramento River where they observed many oaks and sycamores, and, on the ground the nuts of an unknown walnut. Seventy years later the famous California botanist Willis Jepson determined the distinctive nature of the walnut Hinds had observed and named it for the botanist, who would never know of the honor. Like all good explorers of the time, Hinds collected specimens, now located in the Kew Herbarium in England.

For a person who likes to see an orchard come alive with the blossoms of spring, the walnuts are a bit disappointing. The male and female catkins are green and somewhat showy, but the individual flowers lack petals and are greenish. Lacking are the bright white petals of an apple or the pinkish forms of an almond. Yet the walnut trees may cover acres and acres of ground, and with their thick trunks, dark bark, and stout branches, they are uniquely beautiful, with or without a showy blossom.

Eating the Walnuts

When I think of walnuts in food, chocolate chip cookies come to mind as that is where my mother was most likely to include the nuts. Marshmallow fudge, too, and maybe as a topping for a salad. Of course, the nuts were included in breads, cakes, pie toppings, and more uses. Inexpensive, they were easy to chop, especially when you could buy them already shelled, and an expected part of dessert offerings.

Many years later, I met David. Our first meeting was a blind date picnic at a favorite place, Longmire at Mount Rainier. I had brought cookies to share, but I had left out the walnuts; they had become too expensive for my budget. I do not recall David mentioning anything at all about the cookies, but rather eagerly accepting one and consuming it. He should have asked me. David has a walnut allergy, a serious one, and since that time I have taken on the self-appointed task of making certain David does not inadvertently eat a walnut. This is not altogether bad, as I have been the beneficiary of several sweet treats that had to be declined by my husband of 15 years.

So what is it in walnuts that causes a respiratory distress, experienced by David and others with his allergy? In David's case, his allergy was discovered when he was playing with shells in a backyard setting, probably throwing them at his brothers. Breathing problems ensued, and since that time walnuts and the related pecans as well have been taboo for David.

Peanut allergies have perhaps received the most attention in recent years, as reactions are severe, and an increasing number of people have been shown to exhibit an allergy. But nut allergies (peanuts are not a nut but rather a Pea Family member) are also common, and walnuts are considered part of the "big eight," responsible for 90 percent of allergies. You don't outgrow it, either. David will always have to be aware of the presence of walnuts in a food.

What happens is that the immune system of an allergenic individual reacts to a protein that the body mistakenly identifies as harmful. These proteins do not break down when heated and are slow to digest. Thus, whether raw or cooked, the nut is harmful.

For most people, however, walnuts are both enjoyable to eat and beneficial to health rather than harmful. The long history of cultivation and continuing expansion of orchards today are indicative of the continuous role walnut trees have played in the human diet.

***Carya* – the Hickories**

Evolving approximately 55 million years ago in North America, today eighteen species comprise the hickories (genus *Carya*), eleven of which are native to North America, all of them confined to the East and South. The trees are stout, upright, often with deeply grooved attractive bark, as shown in the



**The deeply grooved bark of *Carya tomentosa*
(Mockernut Hickory)**

**UNIVERSITY OF TENNESSEE ARBORETUM,
OAK RIDGE, TN**



***Carya illinoensis* (Pecan), widely grown for
the tasty nuts**

**UNIVERSITY OF KENTUCKY ARBORETUM,
LEXINGTON, KY**

photo of Mockernut Hickory (*Carya tomentosa*). The feather-like leaflets offer a lovely contrast to the trunk and branches, and sometimes display excellent autumn color. As with the walnuts, hickories are often planted as ornamentals. Several species thrive in sandy soils, while others are native to rich bottomlands, river terraces, and flood plains. Some, such as Shagbark Hickory (*Carya ovata*), aptly named and easily recognized by the exfoliating bark, grow in a variety of habitats, from dry slopes to limestone, to wet bottomlands.

The most well-known hickory is probably the Pecan (*Carya illinoensis*), a tree with a rather restricted native range, occurring from East Texas to Missouri, but absent from the Southeast. Pecans have become naturalized however, and are often planted wherever conditions are beneficial for nut production. Both the native and a variety are grown in plantation settings, with Georgia, Texas, and New Mexico leading in production.

Together, Mexico and the United States produce approximately 93 percent of the world's supply of pecans. In Texas alone over 175,000 acres are given over to pecan plantations. As with other nuts and fruits, production can fluctuate; in 2017 pecan production overall was significantly lower than in previous years. Growers do not work in national isolation, as pecans are imported for shelling in the

United States and exported to China, where demand is high. As with so many crops, production has international ramifications with supply and demand subject to worldwide markets, disease problems - primarily scab which particularly flourishes in wet years - hurricanes, and other natural processes.

Pecan production is measured in the millions of pounds – the 2017 United States crop was approximately 300 million pounds.

Hickory wood, including the pecan, is also valuable, both for manufactured products and for burning. The bark may even be used for a somewhat bitter syrup. Several of the native species bear edible nuts, while others, including the aptly named Bitternut Hickory (*Carya cordiformis*), are considered useful only as animal food. What the animals may think of this human reject is unknown. Despite the name, Bitternut Hickory is closely related to the delectable Pecan.

Lovely Leaves

The leaves of walnuts and hickories are very similar. Both have “pinnate” leaves, meaning feather-like, composed of paired leaflets along a narrow stem, and making the trees quite distinctive; although other families have pinnate leaves, walnut family members are typically large trees with hefty branches and broad trunks. By contrast the leaflets appear quite delicate. The number of leaflets varies from as few as five to eleven. Autumn color varies from rather drab to golden hues.

As can be seen from the photos, hickory and walnut leaves resemble one another, and distinguishing one from the other is difficult. Walnut leaflets typically are uniform in length, while hickory leaflets vary from the largest near the tip or the middle of the leaf.



The leaflets of *Carya aquatica* (Water Hickory), a southern species of wet habitat
PAYNE CREEK HISTORIC PARK, FL



Juglans nigra (Black Walnut) leaves
PEAVEY ARBORETUM, CORVALLIS, OR



***Carya floridana* (Scrub hickory) nut in the split husk**
LAKE JUNE ROAD, FL

However, there is one difference more easily observed in the fruit-the husks of most hickory nuts split open, whereas they tend to stay tightly closed with walnuts.

Here is an example of a hickory nut revealing the tasty fruit within, although at first glance it is not particularly appealing, but rather resembles a miniature elongated tough ball. But somewhere along the line someone, perhaps by observing an animal stashing the nuts for winter food, discovered the taste, and hickories (and walnuts) have been a part of the human diet since that time.

The nuts are an excellent source of fat, and recent studies have indicated that they contain beneficial antioxidant compounds. It is also possible they improve brain function. Promotion of the nuts often includes such possible health benefits.

Evolution and Diversity of the Juglandaceae

Older than the maples but younger than the roses, the Juglandaceae family dates back approximately 70 million years (the late Cretaceous period when the dinosaurs were still around) and diversifying in the following 10-15 million years. Some genera disappeared, and others evolved into the modern genera around 30-25 million years ago. At this time North America was the center of the walnut family diversity, but today only two genera (*Juglans* and *Carya*) are found in the New World; both of them evolved more than 50 million years ago.

As time passed, the family expanded its range, so that by the Miocene (approximately 23 – 5 million years ago) walnuts and their relatives enjoyed a very wide distribution, including a few in the Americas that are now confined to Asia. But then came the Ice Ages, and with the pronounced cooling, and diversity in the family was reduced, with some exceptions. Most genera disappeared from Europe, including the walnuts.

Unraveling the history of the Walnut Family as colder temperatures began to prevail over a million years ago provides an ongoing challenge for botanical research, and it is fortunate that the family is well-represented in the fossil record. Pollen, leaves, wood, flowers, and fruits are all present, some of the material dating back 60 million years. At least one scientific paper indicates an expansion of walnut species' distribution occurred before the onset, but it is also possible that the number of species may have increased about this time, resulting in confusing data and uncertainties in the analyses.

What can be said about the climatic changes during the onset of the Ice Age? Temperatures declined dramatically, and the contraction of available range in the north by the cover of ice would be expected to at the very least place stress from reduced space and cooler weather. An increase in pathogens may

also have occurred during this time. One outcome that is known is that certain genera did disappear from the fossil record in North America, and today only two remain.

Yet the survival of the Walnut family would seem to indicate a tolerance for the cooler weather of the Pleistocene, and although North American Walnut family species are most common where summers are hot, several are adapted to the cold winters of the Northeast, and one grows in southeastern Canada as far east as New Brunswick (*Juglans cinerea* – the Butternut). Perhaps it is enough to have hot, humid summers with warm nights and the occasional thunderstorm. The winter cold can be tolerated, and in fact the Butternut can grow at an elevation of 1,500 meters.



The immature nuts of *Pterocarya fraxinifolia* (Caucasian Wingnut), from Southwest Asia.

UNIVERSITY OF IDAHO ARBORETUM

Worldwide, seven or eight genera are recognized in the Juglandaceae, several of them with only a few members. One that is no longer native to North America – the *Pterocarya*, also known as Wingnuts – includes six species, all of them native to Asia. Wingnuts are widely planted as ornamentals, and are interesting for the fruits, which quite unlike walnuts or hickories combine to form long “strings” that often persist into winter. The closely related *Cyclocarya* consists of only a single species, while another – *Rhoiptelea* – also is confined to one. It is not difficult to conjecture about more diversity in the past.

Today, East Asia is home to the most Juglandaceae genera, suggesting this region served as a refugium for the family during the Ice Age. For the most part, the Eurasian species are native to the Himalayas and China. Today only two genera from the family are absent from China, and several species are endemic. This alone suggests isolation from a retraction of range, but the record is incomplete, and the analysis of what transpired during the Ice Age a subject for research and speculation.

Food and Other Uses for Walnuts and Hickories

The walnut and hickory genera produce the largest nuts of the family, and other genera are not harvested, at least commercially. Not surprisingly, use of the walnut and hickory in recipes as well as for fresh eating is promoted by several organizations. An example is the “California Walnut Board” which promotes – California walnuts! Established in 1948, the Walnut Board represents over 4,800 growers. Clearly recognizing that raw walnut consumption isn’t sufficient to support the harvest of over 400,000 acres of walnut trees (most of them English Walnuts), the group offers recipes on its website, and these go so far beyond chocolate chip cookies with walnuts that one feels almost embarrassed at the simplicity of that old, if delicious, standard. Other than baked goods – breads, pies, cookies, and the like - there are such appealing titles as “walnut blue cheese butter,” “walnut crusted pesto salmon,” “lemony zucchini salad with walnuts,” and so on. Walnuts are paired with broccoli, ravioli, cheesecake, caramel corn – the list goes on and on. Walnuts even make their way into liqueurs in Italy. The possibilities indeed seem endless! It is even possible to tap the sap of walnut, producing a syrup similar to maple.

Recipes unlimited for walnuts and hickories, unless you are David, in which case one whiff is not good.

As it turns out, you can also poison fish with walnuts, although that recipe may not be so easy to find. Using various plants to poison fish is not unusual, and in North America, the Catawba, Cherokee, and Delaware used the green husks of *Juglans nigra* and *Carya illinoensis* (pecan) for this purpose.

In the past, some species were utilized to make dye for cloth, although apparently the use was confined to the home. The common name “butternut” of the widely spread *J. cinerea* may come from the yellow color of the dye.

Besides being a food source, walnuts are probably best known for the wood, which combines hardness with the quality of color, polishing possibilities, and durability. American Black Walnut (*Juglans nigra*) has historically been utilized for furniture and other products. Variability in color, particularly between sapwood and the desirable heartwood, the presence of knots, and other characteristics that may require extra care in woodworking do not seem to affect demand. Historical utilization of this highly disease resistance wood of course has a downside; American Black Walnut is much reduced from its former range, and the species typically grows with other hardwoods, meaning that it is not found in pure stands. In the past, Black Walnut trees that exceeded 120 feet in height were not uncommon at that time, and settlers used the trees for a variety of products, including fenceposts, gunstocks, firewood, and, of course, furniture.

Hickories are also known for their excellent wood. Among hardwoods used commercially, the combination of hardness, bending strength, stiffness, and shock resistance of hickory wood is considered greater than any other. They vary by species (although the wood is often sold simply as “hickory”), and it is interesting that Pecan, the most widely-planted species for its nuts, has the most undesirable wood of the group, while the tough, hard wood of another hickory with a tasty nut – Shagbark Hickory (*C. ovata*) is utilized for a variety of products. Shagbark sap can also be tapped for a smoky-tasting syrup. Hickory wood can be carved, but this artistic media is considered difficult because of the wood’s hardness.

Although disease resistant, today Juglandaceae species are subject to a variety of insect and fungal attacks, including at least one – the “thousand cankers disease” – that poses a threat to the American Black Walnut and possibly other hardwood trees. Walnuts and their relatives can also pose threats to other plants. This is known as “allelopathy” and involves a substance toxic to both wild and cultivated plants. If they are too close to the trunk of a walnut, life is probably going to be short.

A Beautiful Tree

Walnut and hickory trees are used in a variety of settings. At arboretums throughout the United States,



**Fresh husk of a nut with the remains of the flower on a *Juglans nigra* (Black walnut)
UNIVERSITY OF IDAHO ARBORETUM, MOSCOW, ID**

these magnificent trees are preserved in garden-like settings or as members of old forests. Black walnut, as shown here in a photo of the annual nut, will survive (and reproduce) in dry, cool places such as the University of Idaho Arboretum, where this photo was taken. But they attain their largest size east of the Rockies, where trees with broad, dark trunks, stout branches, and countless drooping feathery leaves thrive in their native home.

Old trees are sometimes encountered in historic farms, probably planted when the house was built, the barn added, and cultivation of the fields begun. With its rich history of providing food, shade, and a place to climb, such trees are priceless heirlooms, in an age when a tree is as likely to be taken down as left to grow throughout its long life. But the owner often knows its value, where

the simple presence of the tree is a link to the history of the land and the families that live there. Memories of children playing beneath the trees, gathering nuts (whether wormy or not!), and enjoying the rich kernels within, add to the personal attachment of what to the passing observer might appear as simply a big tree.

Sometimes a walnut tree grows far outside the boundaries of an old homestead where the kernel may have been deposited by an animal, or the vagaries of weather. One such deserted farm is in the Umtanum valley of eastern Washington, a place where sagebrush takes the form of a small tree, and pine trees hug the river banks and sheltered terraces. One walnut tree of unknown age stands out on a dry hillside above the valley floor. How it germinated and survived is a mystery, as this English Walnut grows far from its native home and well above the flatter land of the valley below where, at one time, a hopeful farmer planted two species of walnut. The old house and barn – for we can assume they were once there – are gone. A few fence posts remain and some broken, collapsed wire. Yet the trees continue to grow, reminders of dreams and opportunities, successes and failures. Today the land belongs to the public, and if you look carefully in a shaded spot near the stream, in autumn you may find the forgotten, fallen walnuts.



English Walnut on a dry hillside

UMTANUM CANYON, WASHINGTON