

PERSIMMONS FOR LOUISIANA'S CHILDREN – YOUNG AND OLD

I. UNDERSTANDING THE AMERICAN PERSIMMON, *Diospyros virginiana* L.

Compiled by Quintin Lee Holdeman
September, 1998

This article is the first part of a compilation of information gathered on the persimmon. Part I is concerned primarily with the American persimmon, *D. virginiana*. Part II deals with the Oriental persimmon, *D. kaki*. This article is a revised and updated version of a (unpublished) compilation on the subject prepared in 1992. The information has been gathered from the published literature, from personal communication with researchers, authors and hobbyists, and from personal experience. Brackets [] enclose words added to quotations, background comments, and the personal opinions of the author.

COMMON NAME. Persimmon, American persimmon, common persimmon, native persimmon, Virginia persimmon, wild persimmon, winter persimmon, date plum, winter plum, possum apple, possum tree, possum wood, Jove's fruit; and in French: Plaquemine (nf, persimmon), plaqueminier (nm, persimmon tree.)

The fruit name "persimmon" is an approximation of a native American word in the Powhatan dialect (Algonquin of Virginia) which may have meant "dried fruit."

SCIENTIFIC NAME. *Diospyros virginiana* L.* (henceforth designated as *D. virginiana*) (from Greek dios – divine, pyros – wheat, virginiana – from Virginia). One of approximately 175 (mostly tropical) species of the plant genus *Diospyros* belonging to the ebony family, Ebonaceae.

There are 4 species of *Diospyros* growing in the temperate regions of the continental United States: two native – *D. virginiana* L. and *D. texana* Scheele, and two introduced from eastern Asia – *D. kaki* L.f. and *D. lotus* L. Being distinct species, they do not pollinate each other.

GEOGRAPHY. *D. virginiana* is native to the eastern United States, ranging from Connecticut to southern Florida, westward to east Texas and southeastern Kansas.

SUB-GROUPINGS. Naturally occurring in the wild, man has designated three botanical varieties based on appearance, two genetically-isolated races based on chromosome count within the plant cell, and he has selected and cloned individual trees of exceptional quality.

Botanical varieties. Names have been proposed to designate three naturally occurring types:

D. virginiana var. *mosieri* (Small) Sarg. – a dwarf variety occurring in the Lake Okeechobee region, southern Florida;

D. virginiana var. *platycarpa* Sarg. – a big fruited variety (1-1/2 to 2-1/8th inches in diameter) scattered in Oklahoma, extending into Arkansas, Kansas, and Missouri.

D. virginiana var. *pubescens* (Pursh) Dipple – a fuzzy variety; branches and leaves densely pubescent (fine hairs); AR, FL, IL, IN, & VA.

Not all scientists accept this "splitting." Some "lump" the botanical varieties together as normal range of variation within the species – simply *D. virginiana*. [But if you mention *platycarpa*, everyone will know you are talking about the big one.]

Chromosome count: There are two sexually-isolated races based on chromosome counts of 60 and 90. The 60-

* In scientific names the second part of the binomial is the specific epithet, the first part being the genus to which the species belongs. The name or letter following the binomial identifies the scientist who first published a description of the plant in Latin. Once mentioned in an article, the genus designation is reduced to one letter, e.g., *D. virginiana* – as long as it does not create confusion. In textbooks the binomial is printed in italics; on a typewriter it is underscored. The scientific name is universal. It does not change with language or local dialects or with geographic regions as do common names.

chromosome race is centered in the southern Appalachian Mountains and adjacent regions, while the 90-chromosome race occupies a great portion of the total *D. virginiana* range north and west of the southern Appalachians.

Surveys have found only the 90-chromosome race north of the Ohio River and west of the Mississippi River. The 90-chromosome race extends into the Tennessee Valley and southward where it competes with the 60-chromosome race. Although cross pollination by bees does not produce seed, in some instances each race can be stimulated to produce parthenocarpic (seedless) fruit when pollinated by the other (McDaniel 1982)*.

In theory, the *basic* chromosome number within the normal cell is 15 ($x = 15$), – 15 different chains of genetic material. Thus the 60-chromosome race is a tetraploid (4x) and the 90 chromosome race is a hexaploid (6x) (Westwood 1978)**.

Cultivars: A cultivated variety (abbreviated cv.) is a horticultural clone consisting of many individual plants (in this case trees), reproduced asexually by cuttings, grafting, etc., starting with one original seedling. Each individual of the cloned cultivar is termed a ramet, and is reproduced (without seed) from a branch or root of the original seedling.

The first selection of American persimmon occurred about 1880 from a tree on a farm near Alton, Illinois. Its full technical name is *Diospyros virginiana* cv. 'Early Golden.' The list of cultivars is slowly increasing and now probably exceeds 100. Most of them are from either selected wild trees, or from first or second generation seedlings. A few are commercially available. Others are exchanged between acquaintances. Some have been discarded, some unintentionally lost.

ECOLOGY: Trees of *D. virginiana* are found in old fields, fence rows, along the edge of wooded areas, and in open deciduous forests. They thrive on almost any type of soil, hills to bottom lands – except on soils that are waterlogged, but bottomland trees in winter dormancy have withstood a month or more of continuous flooding.

In some areas, persimmon is a weed in cleared pastureland – sprouting from seed, or from root fragments that are chopped up by cultivators in late February, March, and early April.

The winter chill requirement, i.e., the amount of cold during the winter dormant season, is unknown; yet it is known that chilling requirements may differ between cultivars. 'Miller' requires more chilling for good spring opening of buds than 'Early Golden' and 'Early Golden' considerably more than 'Ruby'. "The chilling requirement even of the northern strains apparently is not as great as that of average apple varieties" (Chandler 1957 p 409).

Persimmons are native within the USDA Plant Hardiness Zones 6 thru 9***.

SEXUALITY: The American persimmon is classified as *typically* dioecious – functional male flowers are separate from functional female flowers, the sexes occurring on separate male trees and female trees, with fruit set only on female trees. Trees of both sexes are needed for fruit and seed production, but there are exceptions.

Nature is never consistent. Occasionally a monoecious condition occurs, a female tree may have a few male flowers or a branch with male flowers (e.g., cv. 'Early Golden') and thus these trees set seeded fruit even when isolated. Occasionally male trees may have female flowers and/or an infrequent perfect (bisexual) flower and even bear fruit (e.g., cv. 'Szukis'). However, such conditions are rare in the wild.

Successful pollination by native bees may occur even if male trees are several hundred yards away. Some authors have listed both insect and wind pollination*.

* In zoology the 60- & 90-chromosome races might be called "sibling species," – sexually isolated look-alikes; but not in botany.

** For the uninitiated an explanation of the terms tetraploid and hexaploid will be attempted near the end of this article.

*** USDA Plant Hardiness Zone map (revised 1990). USDA ARS Misc. Publication 1475.

* It is written (Fletcher, 1915) that the "very light and powdery" pollen of American persimmon "can also be carried great distances by wind." [The effectiveness of wind in the pollination of an urn-shaped flower is questioned – Q.L.]

Some female trees will set seedless fruit in the absence of pollination. Seedless fruit are smaller than seeded fruit on the same tree.

In theory the male/female ratio-of seedlings is 50-50. [A few old country boys have stated: "That ain't necessarily so!"] Individual trees may have a strong tendency to produce root suckers. These suckers may emerge 10 to 20 feet from the original tree. Thus one might encounter a cluster of non-bearing trees, all males – which in reality are branches of one original seedling.

DESCRIPTION: Sometimes a large shrub, commonly a tree. *D. virginiana* trees are broad-leaved and deciduous (i.e., bare limbs during winter), small to medium size, 25 to 50 feet tall with a trunk diameter of 10 to 12 inches, and have conical to rounded tops, often with pendulous branches. The canopy tends to be open due to *self pruning* of shaded twigs and small branches during the winter months.

Bark is gray to black; pattern variable, ranging from irregular squarish blocks to wavy vertical furrows and horizontal cracks.

Wood is yellow. Heartwood is 60-70 years old before it begins to turn black.

Roots are black giving the illusion of being dead. Black bark surrounds a porous yellow wood. [One can blow air through a dried root six inches long and 3/8th inches in diameter.] Seedlings produce a tap root that has a tendency to be devoid of lateral roots.

Stems of young growth are smooth to fuzzy and *lack terminal buds*. Leaf arrangement is alternate, alternating in placement on two sides of the twigs.

Leaves are 2 to 6 inches long and 1 to 3 inches wide, oblong to simple egg-shaped, with acute points and smooth edges. They are dark green and smooth to fuzzy above, paler green and smooth to fuzzy below. In humid climates leaves are blotched with black markings or spots either on one side only (upper or lower) or on both surfaces due to disease-producing fungi**.

In autumn leaves change to yellow, sometimes varying to reddish, or even red. In the Coastal South the change from summer to autumn to winter does not allow for a good fall color display.

The flower is a 4-lobed greenish-white, urn-shaped corolla (petals united) set in a 4-lobed green calyx (sepals united) – a cup-in-saucer arrangement, functioning as either a male flower or a female flower, or on rare occasions as a perfect flower, i.e., both male and female parts present and functioning. Perfect flowers are found occasionally on male trees that set fruit.

Flowers form on new spring shoots that grow from buds developed during the previous summer. [Without new growth each year there will be no flowers and fruit the following year.] Flowers are attached at the base of a leaf petiole by short stalks. The female flower is borne singly and is conspicuous due to the robust points on the strong calyx. Male flowers, with their much reduced calyx with clasping lobes (skullcap), are attached by a single branching stem (cyme) usually holding 3 (but sometimes 2 to 6) flowers. The male flowers on the cyme bloom in sequence then fall – with the "skullcap" calyx still attached when found on the ground.

In the female flower the corolla is dropped, while the calyx persists and is attached to the fruit until ripe – usually falling with the ripe fruit. The single robust stem remains attached to the stem thus enabling the recognition of female trees throughout the winter.

On the male tree the 3-pronged, dried-up flower stalk persists at the base of the leaf petiole as late as September enabling identification of male trees among other fruitless trees.

** Black leaf spot on seedlings of American persimmon has been prevented by using fungicides (Davis, 1994).

The American persimmon flowers later than the Oriental persimmon. The fruit is a berry which is flattened, globose, or



Figure I-1. American persimmon (54% natural size).

The sex of a wild tree can be determined at a glance at flowering time.

- Left – Female branch with single bud at base of leaf. Flower buds are robust and have prominent calyx lobes.
- Right – Male branch with clusters of flower buds, 2 to 6 but usually 3, at base of leaf. The calyx is much reduced compared to female. Flowers in a cluster bloom and fall in sequence. When the blossom falls to the ground the skullcap-type calyx remains attached to the corolla.

elongate. Its size is usually 3/4 to 1-1/2 inches in diameter, though occasionally up to 2-1/8 inches as in *D. virginiana* var. *platycarpa*. The fruit has 3 to 8 large flattened, dark-brown, hard seeds; it is rarely seedless*. The surface color varies from yellow to orange to deep red, sometimes with a touch of bluish or gray. Locally in Louisiana, the fruit skin may be touched with dark blotches and with areas of black stippling**.

The pulp, when ripe, is mushy to date-like dry, yellow to orange, with or without dark specks or streaks, bland to very sweet and often with a unique flavor.

Before the fruit is ripe, it is astringent. Astringency is attributed to tannic acid***. Frost, as sometimes believed, is not a requirement for ripening, or for losing astringency (Fletcher 1915 p 2).

Some American persimmons never lose their astringency (Reich 1991 p 32). Fruit of individual trees may be uniform in astringency, or vary on the same tree from astringent to non-astringent (Vines 1960 p 837), yet others may be sweet but have an astringent aftertaste originating from near either the seed or the skin.

Ripening periods of American persimmon cultivars have been reported as early as August, and on some trees, fruit may ripen late and hang on through February. Local wild trees in West Feliciana Parish, Louisiana, vary in their time of ripening and in length of the ripening period, the earliest ripening about mid-September while the latest trees start ripening

* Some cultivars can set fruit parthenocarpically (seedless fruit), if there is no local source of pollen. The cultivar 'Knowles' never sets seed, even if 60- and 90-chromosome male trees are present.

** The fly-speck fungus, *Schizothryium pomi*, colonizes the surface wax on many plants including the leaves of banana. Symptoms are clusters of tiny, black, evenly-spaced dots.

*** Tannins include a loosely defined group of phenolic compounds that have the ability to bind protein molecules together. *Astringency* is a property of the fruit; *pucker* is the symptom that is seen on the face. Thus, eating astringent fruit will cause the mouth to pucker. But, in local dialect, "Green persimmons are puckery." "American persimmons aren't as easily unpuckered as Oriental varieties" (McGee, 1990 p 145).

in late November. Two Northern cultivars, 'Killen' and 'Garretson,' start and finish ripening in August (16 miles south of latitude 31° N). Fruit is reported to be persistent, hanging on after ripening. The local tendency is to drop off when ripe, most with their calyx attached, but a few separating at the time of falling.

Fruit picked when mature, i.e., coloring but still firm, is reported to soften and lose astringency. Tree-ripened fruit is the best. "None of the treatments that remove astringency from *D. kaki* while still firm have been effective in removing astringency from firm fruits of *D. virginiana*" (Chandler 1957 p 410).

Alternate bearing, i.e., heavy crop one year, and a light crop the next has been observed on one tree in Leon County, Texas (Allen). [More observations are needed to validate such a tendency in American persimmons.]

Champion trees of *D. virginiana* are recorded in American Forests (Spring 1998, page 39). The information (repeated below) for each champion is: (1.) circumference of trunk in inches (") at 4-1/4 feet (breast high), (2.) height in feet ('), (3.) spread of canopy in feet, (4.) geographic location, (5.) year of last measurement, and (6.) name of nominator(s).

<u>1.</u>	<u>2.</u>	<u>3.</u>	<u>4.</u>	<u>5.</u>	<u>6.</u>
81"	131'	40'	Big Oak SP, MO	1970	John Wyle & Gene Brunk
136"	66'	85'	Dardanelle, AR	1987	Shelby Haywar
97"	110'	54'	Belmont Lodge, Wayside, MS	1989	David K. Lee
91"	121'	42'	Truckahoe WMA, Screven City, GA	1991	Jim Ozier
95"	130'	40'	Congaree Swamp NM, SC	1995	R.H.Jones & Gretel Arnold
85"	132'	37'	Congaree Swamp NM, SC	1995	R.H.Jones & Maria Richter
The champion tree of <i>D. texana</i> , Texas Persimmon, is:					
68"	26'	32'	Uvalde City, TX	1965	William Graves

NOTE: The Texas persimmon, *Diospyros texana* Scheele (Mexican persimmon, black persimmon, chapote, chapote prieto) is a separate species readily distinguished from the American persimmon by its small leaves, smooth bark, and dark-fleshed, purplish-black fruit. [It resembles a yaupon holly.] Its range is northern Mexico (states of Nuevo Leon, Coahuila, and Tamaulipas) extending northward into central Texas and eastward to just short of Houston, Texas. It is best adapted to well-drained limestone soils (Vines, 1960 p 839), but does not thrive as well in soils that are good for azaleas. It is highly drought resistant. [In the 1930s seedlings bore fruit in Crowley, Louisiana.]

USE: Leaves, fruit, wood, and seedlings have been used for various purposes.

Leaves have been used fresh or dried to make a tea rich in vitamin C. They are also browsed by deer.

Fruit has been used as fresh fruit and to produce jam, pudding, and (along with cornmeal or other ingredients) to brew persimmon beer. Fruit with seed is eaten by farm animals (cattle, horses, pigs) and by wildlife, including turkey and other birds, deer, fox, possum, skunk, squirrel, and raccoon, which distribute the seed through fecal droppings.

Wood, called North American ebony, is fine grained and harder than oak. It has been used for utensils, weaving shuttles, golf club heads, shoe lasts, billiard cues, brushes, veneer, and parkay flooring. It is still used by hobbyist for knife handles, and by tree cutters to make wedges*. The heartwood turns dark after the tree is 60 to 70 years old.

Seedlings are used as rootstock for propagating Oriental and American cultivars in the eastern United States, for Oriental cultivars in Australia (Plumridge 1976) and has been used in Israel** (Kitagawa & Glucina 1984). Since the 90-chromosome race tends to produce a more vigorous seedling than the 60-chromosome race, it is preferred as understock (McDaniel).

Warning to hunters. It is reported that hogging down many persimmons on an empty stomach can result in the formation

* Wood wedges made from American ebony and used by wood cutters are harder and last longer than wedges made from other woods. They are superior to plastic wedges. They are lighter in weight and safer to use with chainsaws than iron wedges. Persimmon wood from the hills lasts longer than from the lowlands. The wedge is cut out and then either put up to season for 6 months or kiln dried (C. Metz, p.c.). Logs that are left out in the weather quickly deteriorate.

** A slow decline of Oriental persimmon has been observed in Israel when the rootstock is American persimmon (Cohen, et al. 1991). [The descriptive term, slow decline, covers gradual loss of vigor and productivity of plant as opposed to quick decline or sudden collapse observed in the kaki sudden death syndrome. - Page I-11.]

of a bezoar in the human stomach* (McGee 1990, Reich 1991). Removal by surgery may be required (Claypool 1989).

NAMED CULTIVARS. A few nurseries handle some of the more popular cultivars of *D. virginiana* – mostly northern nurseries, which handle northern cultivars**.

Reich (1991) “was struck by a lack of consensus of fruiting quality and ripening dates. The American persimmon seems to be an inconsistent fruit, varying from region to region and year to year.” T. O. Warren of Hattiesburg, Mississippi tested six Northern cultivars and kept only ‘Garretson.’ At latitude 40° N. the cultivar ‘Garretson’ ripens before ‘Early Golden’ which is followed by ‘Killen’ (McDaniel 1990, in G&G). Just below latitude 31° N. the cultivar ‘Killen’ ripens about 7 days before ‘Garretson’ – the order of ripening is reversed***.

[In the plant world one cultivar may be adaptable to a wide range of ecological variation while another may have quality production limited to its immediate area of origin. The performance and quality of the product, which includes flavor and aroma, is influenced by soil, general climate, year-to-year weather variations, cultivar, and rootstock. In addition humans are quite variable in their ability to detect thresholds of the different flavors.]

Cultivar names that have been noted in the literature are catalogued on page I-17.

INTERSPECIFIC HYBRIDS. “The two species [*D. kaki* and *D. virginiana*] are cross-incompatible, hybrid seed development being arrested in an early age” (P. M. Smith 1976 p307). In the wild the 60- and 90-chromosome races of *D. virginiana* do not pollinate each other, nor do they pollinate nearby *D. kaki* trees, even though each of the three can serve as rootstock for the others.

Ripe pollen from the male, and receptive pistils on the female must be available at the same time. *D. virginiana* flowers after *D. kaki* has finished. By utilizing potted American persimmon trees, early flowering has been induced in the greenhouse.(Griffith & Griffith 1984 p 16). Pollen can be used immediately, or stored dry under refrigeration for a short while.

J. C. McDaniel’s “attempts at hybridizing *D. virginiana* and *D. kaki* and Eugene Griffith’s attempts with reciprocal cross-pollination, yielded a few apomicts [i.e., asexually produced seedlings], showing characteristics only of the seed parent” (Griffith & Griffith p 118). Could it be a question of numbers before a true hybrid is produced****? The use of advanced techniques, e.g., embryo culture, is beyond the reach of the backyard hobbyist.

To date the many attempts at interspecific hybridization of *virginiana* and *kaki* have failed – with the possibility of one or

* As defined: a bezoar, or bezoar stone, is a hard indigestible mass composed of plant or animal matter, or mineral, or a combination of two or more, formed in the stomach, especially of some ruminants. They can obstruct the passage of food. Phytobezoars can be caused by common foods such as celery, coconut, and oranges.

** The seedless American persimmon cultivar ‘Gehron,’ originally from Beauregard Parish, Louisiana, is available at Louisiana Nursery, 5853 Highway 182, Opelousas, LA 70570. In DeRidder, Louisiana, Gehron has been reported to retain astringency for some time after it becomes soft (Ray Hauser, p.c.).

*** Are *D. virginiana* cultivars subject to photoperiodism? Photoperiodism involves the relative length of the period of light to the period of darkness experienced in the 24-hour day by responsive plants and animals. Seasonal changes in the length of daylight (progressively becoming shorter in the autumn and longer in the spring) may trigger any of several phenomena in plants, including autumn coloration, leaf-fall, and the beginning of winter dormancy. By moving cvs. ‘Killen’ and ‘Garretson’ nine degrees latitude southwest their fruit ripening order was switched. Or, was it due to the influence of genetic variation in the seedling rootstocks?

**** In 1951 as an exercise, Quintin Lee used controlled breeding in crossing common tobacco, *Nicotina tabacum* L., using pollen from a wild *Nicotina* species of a different chromosome number (nothing original). Pods capable of producing many seeds were practically empty. The few seeds produced were collected and planted. One hundred seedlings were planted in the field. Later growth revealed 98 apparently regular tobacco plants and 2 obvious hybrids. This proved the cross was possible, but the probability was 1 in 50 at this point. What is the possible explanation of the 98? Possibly apomixis (defined as any form of vegetative reproduction in higher plants, but in the narrower sense to mean the production of seed without fertilization occurring). There are some species of plants that can clone themselves through seed, either frequently as in *Citrus* species, or rarely as in *Camelia japonica* cv. ‘Methodiana,’ a triploid. – Q.L.

two exceptions. Two hybrids have been claimed, one in the United States and one in Russia: *Diospyros* cv. 'Kawakami' originated near Dennison, TX. It is "thought to be a hybrid of *D. virginiana* x *D. kaki*." (Note: The female parent is always named first:) Some investigators consider it to be a large fruited American persimmon (McDaniel 1974 p 60).

Diospyros cv. 'Rosseyanka' originated in the Crimea, Russia. In 1993, J. Lehman reported hearing of, and seeing pictures with written descriptions of a cultivar growing at a station near Yalta that was produced by A. K. Pasenkov. It is said to be a *D. kaki* x *D. virginiana* hybrid. Its fruit was described as round, flattened, approximately 33 mm long and 48 mm in diameter (approximately 1 inch by 2 inches), weighing 47 to 60 grams, yellow orange, astringent, flesh with jam-like texture, seeds oval, flat and light brown – although some fruit may be seedless. Scion-wood from the Crimea arrived in Indiana in August 1992. It has cleared post-entry quarantine*.

TRANSPLANTING. Container-grown trees can be transplanted anytime, provided there is a water supply in case of drought. Bare-rooted trees are less convenient but produce sturdier trees.

Bare-rooted trees are transplanted anytime during the dormant season, but preferably early to allow root growth before top growth starts. If roots have been severely cut back then the top needs to be pruned to provide balance of top to bottom. Roots must be protected against drying. Back-fill the planting hole with the same soil that was removed and water well to settle the soil around roots.

Persimmon roots regenerate slowly. If needed, baby the plant with timely watering throughout the first season. Water thoroughly once a week during dry spells.

American seedlings produce a well-developed taproot system which is deficient in lateral roots. Transplanting seedlings except small ones is risky. To encourage a more transplantable root system nurseries cut seedling roots 2 feet or less below the ground level.

To remove a 4-year-old taprooted seedling, a hole is dug to the side, the taproot is cut in-place, and then the seedling is transplanted the next season. Root suckers from mother trees lack taproots. Seeds planted in-place, then grafted later, will have an excellent taproot system and greater resistance to dry weather.

Young seedlings growing in flats or which have been recently transplanted need shading, plus watering frequently during periods of dry weather.

[Needed is data regarding seedling survival when transplanting back to the wild.]

PROPAGATION. In nature, persimmon propagation is both widespread by seeds distributed by animals that feed on the fruit, and locally by suckers from the roots – technically, branches of the original tree.

Sexual reproduction, or seed propagation, involves genetic reshuffling, thus altering the characteristics found in the mother tree. Fruit quality and other characteristics vary from tree to tree. Theoretically, half of the progeny will be non-bearing males.

Persimmon seeds can lose their viability through extreme heat, cold, and drying (McDaniel 1973). Seed removed from ripe fruit can either be planted immediately outside, or washed free from pulp and dried only enough to be rubbed free of trash, stored in moist (not drippy wet) media (e.g., sand, peat, or vermiculite), placed in a labeled polyethylene bag which is closed then stored in a refrigerator (35° to 45°, not the freezing unit) for about a 3 month cold treatment to overcome dormancy. The stored seed may be planted outside as early as 2 weeks before the last anticipated frost.

Asexual reproduction preserves fruit quality and/or the ornamental value of the original tree by cloning – e.g., grafting scion-wood from desired trees onto seedling rootstock; using root sprouts or cuttings.

Although many asexual propagation techniques can be adapted to persimmon, most professionals use whip-and-tongue

* The U. S. Post-entry Quarantine agreement requires that all imported fruit trees (which includes scion-wood) be grown in quarantine in "isolation" and be inspected for 2 growing seasons before being recommended for release. 'Rosseyanka' was released after the 1994 growing season. Scion-wood is now available in many places in the United States. [CAUTION. Khaki sudden death, page I-11, can be transported in infected scionwood.]

grafting, cleft grafting, chip budding, and to a lesser degree, shield budding (T-budding). These low maintenance methods offer the fastest and most economical way to transfer a selected wild tree into cultivation.

Grafting is the joining together of parts of different plants in a way that unites them so that they grow as one plant. The wood used for the upper part is called the scion, while the lower part is called the rootstock, understock, or stock. The objective is to take advantage of desired qualities found in either the scion source, rootstock, or both. Grafting is used when easier techniques, i.e., seed, layering, cuttings, have not given the desired objectives.

Technically, grafting includes budding (bud grafting). In common communications the term “grafting” is used when scions consist of segments of limbs with one or more buds. When a sliver of the branch with a single bud is used as the scion, the common term is “budding.” Both are generic terms. A descriptive word is added to designate the method used, i.e., cleft grafting, chip budding.

Technical descriptions and illustrations of the various grafting techniques are provided elsewhere – in the many books on plant propagation. Trial and error enables one to adapt these procedures to persimmon, and to choose the method that gives one the greatest success.

With all methods in use, important factors include: quality and protection of selected scion-wood and stock, seasonal timing of the different techniques available, mechanical skill and speed in carpentry, and protection of grafts from overheating or drying.

For bench grafting bare-rooted understock during the dormant season (late winter) and for late summer budding, the grafting-wood is chosen as needed. For spring grafting and budding it is collected in the dormant season and stored under refrigeration until needed.

With persimmon, success depends on experience, technique, timing, plus knowing a few tricks (W. Sherman, p.c.). Quality scion-wood is a must. The wood in the scion provides the food needed to generate a callus on the scion. Strong wood exposed to the sun is chosen and branches that were shaded when in leaf are avoided.

When dormant scion-wood is collected for storage the cut ends are waxed to prevent drying, 3 sticks are wrapped in a slightly moistened paper towel (not wet), sealed in polyethylene bags with air squeezed out, labeled, and refrigerated until needed.

Timing for spring grafting of American persimmon seedlings is when the bud breaks and the leaves begin to expand. This critical time can vary as much as 3 weeks between different lots of seeds, or between the first and the last seedling in a mixed lot from the forest nursery.

To protect the scion from drying either a milk-colored or a clear plastic bag is placed over the scion and tied below the graft union. A clear bag is covered with either a brown paper bag or a cloche made from a white milk jug to give protection from the sun. A hazard is the family dogs – pulling off the bags and milk-jug cloches, chewing aluminum labels and sometimes the scions. Some breeds will retrieve anything touched by human hands. Pepper hot sauce gives only limited protection.

Cuttings produce cloned trees on their own roots. A cutting is a detached portion of a living plant that yields a new plant (a rooted branch or ramet). Some success with American persimmon has been obtained with second and third year old wood and with root cuttings. (Root cuttings from grafted trees reproduce the rootstock.)

Root cuttings 6 to 8 inches long and 1/3rd inch in diameter can be used (Vines 1960 p 836), preferably from a foot or more beyond the drip line (Bir 1992 p 41). Roots and root cuttings must be protected from drying and from later invasion by rot fungi. Root ends should be sealed with wax within less than ½ hour, or recut before sealing. (The roots are porous and one can blow air through a dried 6-inch root cutting.) To identify top and bottom of the cutting a cross cut may be made at the end closest to the tree, and a slanting cut on the distal end.

Root cuttings are taken in late winter to early spring, prepared, tied in bundles, packed in damp sand, bark, sawdust, or peatmoss and refrigerated (40° F.) for 40 days before being planted with the top end one-half inch below the surface. [May luck be with you.]

The search for suitable persimmon roots in a mixed stand is very difficult. Also, an encounter with the roots of dormant poison ivy will punish those who are allergic.



Figure I-2

Spontaneous sprouting of a root fragment of American persimmon. Fragment of a root from a tree dug in January 1996. Sprout observed summer of 1996. Root had been on soil surface covered with a deep layer of leaf mold. (60% natural size.)

PESTS AND PROBLEMS. With the exception of nursery stock, it is hard to justify the cost of application of pesticides on American persimmon. In the wild, except for 2 or 3 conspicuous problems, the pests of *D. virginiana* go largely unnoticed. Overlooked problems become more noticeable in the nursery, the yard, or along nearby fence rows. Catalogued pests associated with the American persimmon in the eastern United States include about 60 fungi, a bacterium, a mistletoe, 24 insects, an eriophyid mite, and white-tailed deer.

When something becomes obviously wrong, homeowners and hobbyists have 2 questions, “What causes the problem?” and “What can I do about it?” There are few commercial pesticides that can be lawfully used on persimmon in Louisiana. “All chemicals sold as pesticides in Louisiana must be registered with the Environmental Protection Agency and labeled for use in the state by the Louisiana Department of Agriculture and Forestry” (Bob Sylvestre 8/11/96). Pesticides registered by Louisiana, as of October, 1997, for use on persimmon are: fungicides – none; insecticides – the BT (bacterial) formulations, Biobit, Javelin, and Crymax; miticide – Omite; herbicides – Devrinol, Round-up, Goal, and Touchdown*. (Florida has a longer list.)

DISEASES. **Persimmon wilt** is caused by the fungus, *Cephalosporium diospyri*, which invades the wood, entering through wounds in the bark and through root grafts. It kills American persimmon trees and Oriental persimmon trees on American rootstock. Wilt became established on native persimmon in the Tennessee Valley prior to 1936, where it destroyed most native stands. By 1942 wilt had been confirmed in TN, NC, SC, GA, FL, AL, MS, and TX.

The fungus is native to the Orient and probably was introduced in the United States on Oriental nursery stock shipped directly to the eastern states prior to the enactment of U. S. Plant Quarantine laws. A series of studies on Asian species, *D. kaki* and *D. lotus*, revealed high levels of disease resistance to this fungus, but the fungus can grow in the tissues of both asiatic species (Crandal & Baker 1950).

* Administrative Law requires the presentation of data that will justify the registration of a product for a specific crop. The pesticide must be effective, cause minimum danger to both the consumer and the environment. When voter power shifted from rural to urban the philosophy of supporting agriculture shifted from “use general funds money to support a basic industry” to “let the industry support its own research,” – the industry being the growers and the agricultural chemicals manufacturers.

California with its Mediterranean climate, i.e., dry summers, has satisfied its needs in the production of Oriental persimmon. Eastern problems, with rainy summers, are different from theirs. The eastern persimmon industry, combining both American and Oriental persimmons, neither provides enough crop income nor offers enough potential for pesticide sales to justify the cost of registration. Meanwhile, contact your local Agricultural Extension service and ask for control recommendations that can be used on persimmon – especially on non-bearing trees, which includes seedlings and nursery stock. Individual states vary in their pesticide registrations.

It has been demonstrated that infections can be caused by air-borne fungous spores landing on *wounds that penetrate* the bark. The wilt fungus has been isolated from wounds made by beetles, the shot-hole borer, *Xylobiopsis basilaria*, and the twig girdler, *Oncindres cingulatus*, but not from the beetle itself (Crandal & Baker 1950).

Infected trees *should* be cut and burned to prevent build-up of the fungus and the wood borers.

Leaf spots occur as dark blotches on the leaf surface and as dead streaks on the leaf veins – either on the upper or lower surface, or both. Leaf diseases start during the summer and become more plentiful as fall approaches. The different spots are caused by one or more species of fungi. Florida lists eight different fungi (Alfieri, et al. 1994).

Locally, the most important leaf spot fungi are *Colletotrichm* sp. (anthracnose) and *Cercospora* sp. (cercospora leafspot). Spots interfere with the *manufacture* of food. The death of a portion of the veins blocks the movement of food from the leaf. Highly susceptible seedlings are severely stunted, which keeps them shaded by uncontrolled grasses and other plants. Diseased seedlings may not reach pencil size the first year. (One might expect trouble with softwood cuttings under mist.)

Research on control must involve testing and timing of both surface and systemic (internal) fungicides on nursery stock – with follow-up studies on the influence of the systemic fungicides on budding and grafting strikes (takes).

Two **virus-like diseases** of the Oriental persimmon associated with the use of *D. virginiana* rootstock under *D. kaki* cultivate, are *kaki sudden death* in the eastern United States and a *slow decline* in Israel.

Kaki sudden death (Reighard & Payne, 1991), a virus-induced disease (Scott & Payne, 1988), first recognized in experiment station plantings in Georgia and South Carolina, is now known in Mississippi.

Symptoms on kaki include blackening of leaf veins, leaf drop, and dieback of twigs and branches to the trunk and then to the graft union. Symptoms appear in the cool weather of spring starting approximately 2 to 3 weeks after twig elongation begins, progressing rapidly for 2 to 3 weeks during the flowering period, stopping abruptly with onset of warm weather, and beginning again the following spring. Dieback stops at the graft union. Kaki scions placed on the resprouted rootstock grow briefly in the spring then collapse. Symptoms on the resprouted stock, if any, have not been noted. Nor has there been information on symptoms produced when virus-infected scions are placed on either *D. kaki* or *D. lotus* rootstock.

Written and verbal information indicates that the disease agent is a nepo-virus. It could be introduced on scions of *D. khaki* and *D. virginiana*. Once introduced the disease continues to spread in the orchard or nursery. *D. virginiana* is a symptomless carrier.

Slow decline and poor growth of kaki cultivars in Israel has been observed when seedlings of *D. virginiana* are used as rootstock (Cohen, et al. 1991), but not when *D. kaki* was the rootstock*. No pathogen was mentioned. Symptoms differ from those of kaki sudden death.

INSECTS AND OTHERS.

Persimmon root borer is the larval form of a clear-winged moth, *Sannia uroceriforms*, a close relative of the peach tree borer. Eggs are laid on the bark. Newly-hatched larvae bore through the bark, then tunnel through the wood, penetrating as far as 1-1/2 feet down the root. A loss of 50% of young nursery stock has been experienced.

A research approach would be to test the chemicals, and their timing, as used for the peach tree borer. A second project

* Infected scionwood or nursery stock on *kaki* rootstock from Israel could pass the required post-entry quarantine inspections and would be released for further propagation, since the usual procedure is to only use visual symptoms produced during the required two growing seasons. Would Israeli slow decline be detected within the 2 year quarantine if scions were placed on *D. virginiana* stock? – Q.L.H.

would be to observe the influence of the imported fire-ant.

Fall webworms, the larval stage of the moth, *Hypantria cunea*, live in colonies protected by a silk web while they feed on a limb of new and old leaves; then extend the web to enclose nearby limbs. Unless there is a severe infestation the damage is more conspicuous than serious. Removing a limb to remove the web does more harm than good.

Control: When webs are spotted within reach they can be stripped by hand or with the aid of a rake, then placed in a black plastic bag to be left in the sun. An old method was to singe the webs and worms using a kerosene-soaked rag held in an improvised enclosing wire basket attached to the top of a pole. Some people merely left them alone.

Hickory twig girdler, *Oncideres cingulata*, a member of the long-horned beetles, induces winter pruning of limbs of several forest tree species. Small persimmon branches 2 to 4 feet long and 1/4 inch or more in diameter are found on the ground under trees in mid to late winter. As many as 13 fallen branches were picked up under a tree 20 ft. tall. The effect on yield was not noticeable the following season.

In late summer to early fall, high in the tree, the female lays eggs under the bark of a small limb then retreats trunkward to carve a V-shaped groove around the limb thus leaving a wood attachment of one-third the diameter of the branch. This allows the outward flow of water and dissolved nutrients while preventing the return of the carbohydrates via the inner bark. Winter winds break off affected limbs, which fall to the forest floor**. The larva continues to feed inside the detached limb. In early summer the larva pupates and emerges later as an adult beetle. On emergence the young adult does maturation-feeding on bark of twigs before mating.

Where persimmon wilt is present the maturation-feeding wounds on twigs plus the girdling wounds expose live wood to spores of the persimmon wilt fungus.

Powderpost beetle *Xylobiopsis basilaris* of the horned powder-post-beetle family, normally inhabits dying or dead trees but will attack healthy trees when populations are heavy and favored host material is scarce (Crandall & Baker 1950 P 317). The adult beetles usually restrict their attack to freeze injury, and stressed, dying or dead persimmon trees and branches. The defense reaction of healthy trees is to flood-out, or gum-up, the tunnels made by egg laying adults and the hatching larvae. In the summer these unsuccessful attacks are seen as blobs of gum on the bark surface.

In Maryland dead adult beetles of *Xyloborinus saxeseni* (Ratzeburgh), a near relative of *Xyleborus*, were found in some of the gum blobs (Santamour & Batzli 1990).

Leaf-eating beetles feed on the tender foliage during the spring and summer growth flushes.

June bugs, *Phyllophaga* spp., also called May beetles, attack wild persimmon in April in Louisiana. They devour leaf blade, leaf veins, and frequently eat tender bark on the twigs. The adult beetles are night feeders, not appearing until after dark, and sometimes not until late at night. Several species feed on persimmon in addition to nearby oaks and other hardwood forest species.

Leaf beetle. The clay-colored leaf beetle, *Anomea laticlavata*, colored either tan or black or black-and-tan and resembling a miniature June bug, start feeding on the edges of new leaves in May and continue into the summer consuming up to 50% of the individual leaf. Occasionally, a chewed out area extends from the edge toward the central vein forming a signature pattern that resembles a tube sock (i.e., a sock woven without a heel) that has been worn. Adult beetles may be seen feeding in the cool of the day. When disturbed they either fly away or fold their legs and drop.

Persimmon psylla nymphs, *Thioza diospyri* cause the edges of young leaves to roll upward or downward resulting in a permanent crinkled leaf distortion and shortening of the stem internode below the damaged leaf. Starting in May and continuing throughout the summer as new growth appears, tiny clear-wing, black-body, gnat-like adults appear on the just-expanding leaves and lay their eggs along the leaf edge. The sucking of the nymphs stimulate the leaf edge to roll,

** Fallen branches, due to girdler activity, were collected January 4, 1997 under a 55-foot forest tree. On a few the bark showed green when scratched. Scion sticks were made, kept dormant under refrigeration until spring, then both chip budded and whip-and-tongue grafted onto a bearing Oriental persimmon tree. Three buds failed but 2 of 5 grafts were successful. – Q.L.H.

thus producing a protective cover for a colony of white wax covered, pink-bodied sucking juveniles.

One research approach would be to test insecticides (formulated with a wetting agent) that have proven effective against aphids. [*These are not mealybugs.*]

Eriophyid mite, *Aceria theospyri* attacks a spot on young expanding leaves stimulating the formation of a small bead-gall which protrudes (wart-like) on the upper surface and is open below. Heavy infestations result in rolled, distorted, mildly chlorotic leaves and stunted twig growth. Galls are sparse in early spring but continue to increase in abundance as new growth forms during the season. The mite is a minor problem on bearing trees.

The four-legged mite (resembling a microscopic squid) overwinters under bud scales. They crawl to the new growth. Outward spread is by drifting on the winds toward a chance encounter.

Research should be directed toward using a contact miticide to protect new growth, and the testing of systemics to eradicate infestations on nursery stock. The latter study should be followed up to see if the systemic would influence the takes when the stock is budded or grafted. Use of grafting-size rootstock for *D. kaki* presents no problem since *kaki* is immune. (The introduction of the mite on infested scionwood is a possibility.)

Browsing animals, which include cattle, *Bos taurus*, and especially the the white-tail deer, *Odocoileus virginiana*, can severely prune seedlings and young trees in orchards, open meadows and cow pastures. In one pasture in West Feliciana Parish, Louisiana, there was no increase in height of four-foot-tall trees during five years of observation. Trees protected by briar patches grew normally.

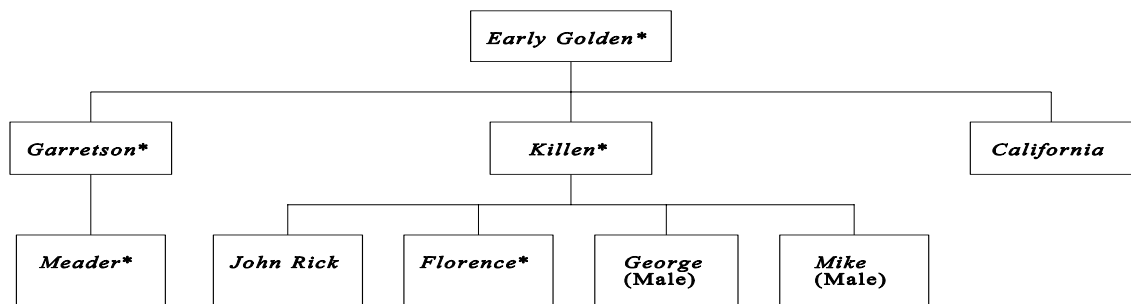
EARLY GOLDEN FAMILY OF CULTIVARS

McDaniel (1982) wrote that 'Early Golden' has a flowering characteristic that has been observed on it and some close kin. It is predominantly pistillate (female) flowered, but – as 'Early Golden' trees attain more maturity there are sporadic branchlets which bear some staminate (male) flowers. Pollen from these flowers can fertilize female flowers on the same tree and induce seed production.

This monoecious condition has been observed on older trees of 'Early Golden,' 'Garretson,' 'Killen,' 'Florence,' and 'Meader,' but not on 'John Rick' and 'California.'

Branches on monoecious females bearing only male flowers have been grafted and renamed (e.g., 'Early Golden' – 'Illini'; 'Killen' – 'Pogo') but they did not hold true. They reverted back producing the original.

The *Early Golden* family (J. C. McDaniel, 1974)



* Male flowers have been observed on older female trees.

DIOECIOUS, MONOECIOUS, AND INHERITANCE OF SEX. In the wild *D. virginiana* is typically dioecious producing only female functioning flowers on one tree and male functioning flowers on another tree. Monoecious is when the sexes are in different flowers but on the same tree.

Starting with 'Early Golden,' trees have been found and propagated that are primarily female, which upon aging begin

either sporadically or consistently to produce male flowers – thus enabling seed production through self pollination. Also, male trees have been found that either occasionally or sometimes frequently bear fruit. This monoecious trait continues to be passed along to a percentage of the trees in succeeding generations.

Open pollinated 'Early Golden,' i.e. open to wild-type pollen carried by bees, has been observed to produce male seedlings and female seedlings. However, when 'Early Golden' was self pollinated (*Early Golden* x *Early Golden*), or pollinated by another monoecious *female* (*Early Golden* x *Garretson*), *all seedlings were female*. And, "If you use 'Mike' as a pollinator you can expect half of the female trees to put on an occasional male flower" (Claypool). Also, "in crosses where pollen from EGF [Early Golden Family] male flowers produced on female trees was applied to normal, non-EGF females, F1 seedlings have been females." [F1, read as "F one," means the first filial generation, – the seedlings of the original cross.]

BACKGROUND INFORMATION – MITOSIS, MEIOSIS, AND POLYPLOIDY. The basic unit of living organisms is the cell. The living cell has a nucleus enclosed in a nuclear membrane which is floating in a jelly-like substance, the cytoplasm. In turn, the cytoplasm is wrapped in a cellular membrane, the delimitative plastic wall. In order for an organism to grow its cells must divide. But, before dividing the cell must duplicate the mass of genetic material enclosed in its nucleus – half of which came from the male parent, and half from the female parent. The half, received from either parent, is symbolized as "n" (lower case n). Thus, the ln (one n) from the male and the ln from the female equals 2n, or the total genetic mass in the nucleus.

In a process called MITOSIS, the nuclear membrane breaks down and the nuclear material forms into chromosomes, which are linear strings of genes (the genetic code). There are matching sets of chromosomes – one set received from the female parent, the other set from the male parent.

In growth, the chromosomes of the 2n cells form-up on a plain in the center. Each chromosome duplicates itself. Then as two 2n-groups the chromosomes pull away from each other; a wall forms to separate them, each of the two clusters changing back to a nucleus. Thus, two 2n daughter cells are formed. And so it continues in the growing tissues of the plant.

But in MEIOSIS, the process involved in formation of sex cells (gametes), there is a reduction division. When the 2n nucleus changes to chromosomes, there is no duplication (no cloning) of the genetic material. Instead, the chromosomes pair-up in the center, each with a matching partner, then the two dance away from each other to form 2 groups. One of the ln groups forms into the nucleus of the gamete. Following pollination, the uniting of the male and female gametes results in a 2n cell that eventually grows to become the next generation seedling. Meiosis facilitates a random reshuffling of the genetic materials thus enabling new combinations of characters.

A POLYPLOID, not uncommon in plants but extremely rare in animals, has 3 or more homologous sets of chromosomes in its nuclei. A gain in the mass of genetic material in a plant species' cell nuclei may, over the eons and involving ecological changes, enable an evolving line of plants to compete with other plants. The species' ancestral types either die out, or become locally displaced by the improved descendants.

Ancestors of today's plants had two basic sets of chromosomes, each chromosome within one set different from the others, but having a matching partner in the second set. The basic number in a set may have been 4, 5, 11, or 15 depending on the ancestral species. The basic set (or the genome) is symbolized by "x" (lower case x).

A hypothetical persimmon ancestor with two 15-chromosome genomes would have the formula $2n = 2x = 30$. Due to infrequent accidents in nature the basic genetic mass may be increased 2- or 3-fold. A doubling of the mass of genetic material in persimmon would give 4 duplicate chromosome sets (4 genomes) or $2n = 4x = 60$, a tetraploid.

Terms used in discussing the quantity of basic set are: haploid (1x), diploid (2x), triploid (3x), tetraploid (4x), pentaploid (5x), hexaploid (6x), and so on.

During meiosis in plants with even numbers of genomes, either 2x, 4x, or 6x, each chromosome will be able to find a matching partner. Plants with 2x, 4x, or 6x will function as a 2n plant – producing fruit with seed.

When chromosomes either duplicate themselves in mitosis, or pair-up with their homologous partners in meiosis, and then fail to separate, they change back into a nucleus with the double load. To repeat, the new nucleus of a body cell, or of the

gamete is double loaded.

Starting with the $2n = 2x$ body cell (i.e., 2 genomes) the result of nature's accident would be a genetic mass of $2n = 4x$ (4 genomes) in the nucleus. If descendant cells of the double-loaded cell ($4x$) gains dominance in the growing tissue of the limb, the limb would be tetraploid. If flowers on the $4x$ limb were pollinated ($2x$ male gamete unites with $2x$ female gamete) then seed production could initiate a colony of tetraploid trees to compete with their diploid ancestors.

Should the double-loaded gamete ($2x$) be successful in uniting with a $1x$ gamete to produce seed, the resulting seedling would be a triploid ($3x$) that produces no seed. Now for the rare miracle in nature. During mitosis the three genomes duplicate themselves but fail to pull apart, then the cluster of 6 genomes form into a single $6x$ nucleus, – and should it gain dominance, the hexaploid ($6x$) branch would produce seeded fruit.

And thus the background for understanding the miracle of polyploidy and for the genetic formula for *D. kaki* written as $2n = 6x = 90$ (a hexaploid) and for the American persimmon races as $2n = 4x = 60$ (a tetraploid) and $2n = 6x = 90$ (a hexaploid); or $2n = 4x$, $6x = 60$, 90 for *D. virginiana*. (P.M.Smith in Simmons 1976, p. 306-307).

CULTIVARS FOR THE GULF COASTAL-SOUTH? The challenge for Louisiana is to have formal or informal collections of cultivars that would provide quality ripe fruit continuously, starting mid-August and continuing into December, with fruit hanging on the late ripening selections into January.

The improvement of the Oriental persimmon by selection and reselection in Japan alone has been going on for at least 1,000 years, and for perhaps an additional 1,000 years in China before reaching Japan.

The road to improvement of the American persimmon started in 1880 with the finding and transferring to cultivation of 'Early Golden' in Illinois. The continuing search, now going into its second century, has not progressed far beyond additional finds in the wild plus propagation and selection of first and second generation seedlings. Controlled breeding work is now in progress.

Most of the cultivars now available are of the 90-chromosome group and are adapted to latitudes north of the Gulf South.

Southern cultivar search could start in Louisiana using the cooperation of local woodsmen and hunters to locate and mark trees with outstanding fruit (flavor, seed count, fruit size, length and dates of ripening season, *with emphasis on flavor*). The seedless cultivar 'Gehron' was found in Beauregard Parish, Louisiana.

Cultivar breeding could be either *controlled*, or *lazyman* style.

Controlled breeding involves bagging limbs of both female and male flowers to prevent contaminating pollen being introduced on foraging bees. Controlled breeding requires hand pollination, labeling, and careful record keeping. Protection of flowers continues for three days after hand pollination.

In controlled breeding, the use of pollen from male flowers found on older female trees of the Early Golden Family (EGF) of cultivars, e.g., 'Early Golden', 'Garretson', 'Killen', others, to pollinize local females *would result in 100% female seedlings*.

Lazyman breeding covers either of two procedures, both of which can be used as wildlife plantings:

1. Scrounge surplus seed from owners of outstanding cultivars. Transplant the seedlings in groups, space 5 feet apart, protect from foraging deer and cattle during the early years. [This eliminates the chance of introducing a virus in scionwood from symptomless but infected trees.]
2. Open-pollinated 'Garretson' and 'Killen' seed, locally grown and in the absence of Northern males, can be used in hopes of combining August ripening and southern flavor. Seedlings are planted in protected groups. Seed are collected from selected first-generation trees and are planted anywhere for second generation observations. (By then you got it, or you are too old to care.)

Seedlings grafted onto bearing trees will fruit earlier than when grafted onto seedling stock, which in turn will fruit earlier

than either seedlings on their own roots or trees are cloned from root cuttings. The method used will be dictated by the number of seedlings, land, and labor. Own-root seedlings may require 5 to 15 years for growing, selecting, and complete testing. Grafts made on shaded limbs may be lost due to natural abortion of shaded limbs.

CULTIVAR NAMES that have been published, along with some of their synonym and misspellings, are compiled below.

A. Lincoln	Golden Gem	Miller
Baugh	Golden Supreme	Mitchellena
Beaird	Greek	(Lena, Mitche, Mitchell)
Beavers	Griffith	Mood Indigo
Blagg	Griffith II ²	Morris Burton
Bolten	Grayville	Nebraska
Boone	Hamilton	NC-10
Brown	Harris	Newbold
B.S.Bank	Hicks	Oliver
Buhrman	Ida	Penland
Burrier	Illini ⁶	(Pennland Seedless) ^{5,7}
California	John Rick	Pieper ⁵
Claypool's F-100 ²	John Talbott	Pogo
Coffing	Josephine	Rice
Colby	Juhl	Ruby (Little's Ruby)
Coles	Juicyfruit	Runkwitz
Country Club	Kansas	Shoto
Craggs (Creegs)	Kawakami	Siebrare
Crain	Killen ³	Silkyfine
Curry	King	Smeech
Delman (Delmas)	Kitch	South Fork
Early Bearing	Knowles (Owen,	Spencer (Dr. Spencer)
Early Golden ³	Owen's Seedless) ^{4,7}	Stout
Edris (Edrus)	Krutch	Sweet Lent
Ennis (Ennis Seedless) ⁴	Lady Maryland	Szukis ²
Evelyn ⁴	Lambert	Table Grove
Fannin	Leeper	Texas
Fehrmann ⁴	Link	Wabash
Festimoon (moon)	Liz ¹	Warren (Cemetery)
Florence ³	Luther	Waterloo
Ford	Machovina	William ¹
Gardner	Marion (Marion Market)	Woodward
Garretson ³	McMunn (McNinn)	Woody
Gehron ⁴	Meader (New Hampshire)	Woolbright
George ¹	Mike	Yates ⁴
Glenwood	Miles	
Glidewell (Glidwell)	Mildred Belle	

NOTES:

- 1 - male.
- 2 - predominantly male flowered, with occasional female flowers (monoecious).
- 3 - predominantly female flowered, producing male flowers occasionally or consistently (monoecious).
- 4 - seedless.
- 5 - seedless if not pollinated.
- 6 - a male-flowering branch of Early Golden was grafted and named, which then reverted back to Early Golden.
- 7 - member of the 60-chromosome group.

FURTHER READING:

- Capon, Brian, 1990. *Botany for Gardeners, an Introduction and Guide*. Timber Press (Portland, OR), 220 pp. pbk ISBN 0-88192-258-7.
- Claypool, James V., 1995. "Improving the American Persimmon." *Pomona* **28**(1), p. 76-78.
- Fletcher, W. P., 1915. "The Native Persimmon," *USDA Farmers' Bul.* **685**, 28 pp. (revised 1942).
- Griffith, Eugene & Griffith, Mary E., 1982. *Persimmons for Everyone*, North American Fruit Explorers, 145 pp, ISBN 0-9690165-2-2, (including chapters by J. C. McCaniel, p. 111- 125; & I. Kajiura, p. 126-134).
- Hartmann, E. T., Kester, D. E., & Davies, T. T. Jr., 1959. *Plant Propagation Principles and Practices*, 5th edition. Printice-Hall, Inc. (Englewood Cliffs, &T), 647 pp. ISBN 0-13-681016-0, (p. 550-551, 575, & Chapters 10 - 13) .
- McGee, Harold, 1990. *The Curious Cook*. Collier Books, McMillan Publ. Co. (New York), 339 pp, pbk ISBN 0-02-009801-4, (Chap. 9 - Persimmons Unpuckered, p. 134-156).
- Reich, Lee, 1991. *Uncommon Fruits Worthy of Attention*. Addison-Wesley Publ. Co. (Reading, MA), 273 pp, ISBN 0-201-52381-7, (p. 75-94).
- Rombough, Lon J., 1993. "Exploiting the genetics of native persimmon," *Fruit Gardener*, 7-9. Feb., 1993, Calif. Fruit Growers, Inc.

ACKNOWLEDGEMENTS. No one achieves anything completely alone. We must thank those individuals, both agricultural scientists and hobbyists of the past and present who have published their observations, experimental results and opinions. Thanks to those generous persons – scientists, nurserymen, hobbyists, and others – who answered questions when contacted, and to those who called attention to or supplied significant publications and/or shared personal experiences.

For person-to-person contacts this compiler expresses his gratitude to:

- California – Dr. Gary Bender, Dr. Conrad Kress, Tokuwō Kono, Dr. John Mercetich, Dr. Ron Summerby, and Dr. Tom Watson;
- Florida – Dr. Salvatore Alfieri, Jonathan Cowley, Nabih El-Gholl, Dr. Robert Esser, Dr. Susan E. Halbert, and Dr. Wayne Sherman;
- Indiana - Jerry Lehman;
- Louisiana – Dr. Lowell Black, Dr. Joan Chapin, Melvin Guidry, Garret McCutchan, Carl Metz, and Vicky Mosely;
- Maryland – Dr. Edward Baker;
- Mississippi – Jack and Gloria Reese, T. O. Warren;
- New Jersey – Harry Hartmann
- Texas – Patricia Allen, and Arthur Holdeman.

Compilers assemble information into an over-all story that serves as a review of the state of the art at a given point in time, which is 2 to 5 years before the publication of the summary. Teachers and compilers neither have the time, the money, nor the facilities for verifying all that is either printed or passed along by oral contact. Interpretation of the information gleaned from many sources is based on the reviewer's professional knowledge, professional naivety, and state-of-the-art. There will be mistakes in interpretation. This compiler reserves the right to be wrong. As a lady that played the piano in church once told him, "I'm not the best, but I am the best of those willing to do the job."

This is a public service compilation, presented in appreciation of 19 years of education in Louisiana's public schools. Permission to use the material to write one's own interpretations is granted. – Q.L.H.

Special thanks is due for donated dedicated help. This writer is indebted to:

- Dr. Luther Baxter, retired plant pathologist, Seneca, South Carolina for editing the first draft and for helpful suggestions; and
- Dr. Jonas Holdeman, Jr., Knoxville, Tennessee, for assistance in final document preparation. – Q. L.H. 990111 (slightly retouched 000620).