American Camellia Society

The American Camellia Yearbook

BRADFORD KING ARTICLES

2007 – 2015

C. reticulata 'Frank Houser Variegated'

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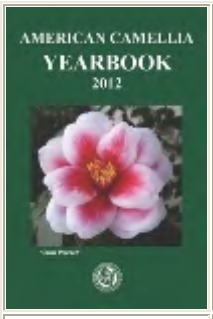	**American Camellia Yearbook 2012**	
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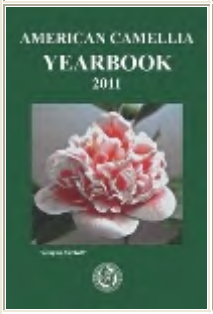	**American Camellia Yearbook 2011**	
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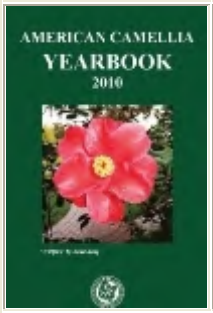	**American Camellia Yearbook 2010**	
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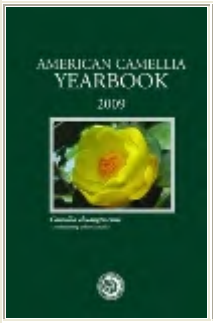	**American Camellia Yearbook 2009**	
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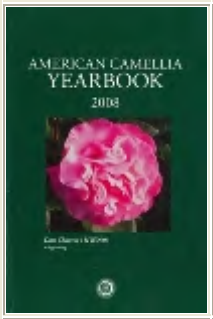	**American Camellia Yearbook 2008**	
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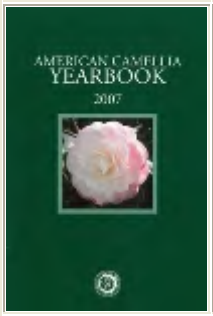	**American Camellia Yearbook 2007**	
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Return to TOC

Camellia Companion Plants

Article and Photos by Bradford King

Figure 1: Cluster of ‘Pooh’ Dahlias.

Most camellia lovers are, first and foremost, gardeners and will have a variety of plants and trees in their garden. This frequently includes beds of beautiful and prolific annual flowers that bring summer color to the home garden. Few gardeners will be without some spring blooming perennials. These may be peonies that have been reliably blooming since a grandparent first planted them, or a wonderful colorful hybrid Phlox, a new hybrid 'Coral Bell' ,or Hosta with fascinating foliage. This article will focus on plants that make good companions for camellias.

Family Relations

Botanically, azaleas and rhododendrons belong in the same genus, while camellias belong to a distinctively different family of plants. Since they share similar history and culture requirements, it allows us to link them as family relations. In addition, they make spectacular plants to accompany camellias. The beautiful flowers and lovely foliage are the qualities that endeared them to us today just as they did in Asia hundreds of years ago.

Azalea species have been cultivated in Japan for centuries. This flowering shrub has great versatility. It may be grown in a pot, espalier, specimen tree or hedge, but is at it best when planted in drifts. Optimally it is grown among high trees that provide light to penetrate with periods of shade from full sun. They may also be grown on the north or east side of the house or where shade is provided by a fence. They look particularly lovely in the foreground with mature camellias behind them in dappled sunlight provided by large trees. There are also azaleas that thrive in full sun along coastal areas. The Southern Indicas or Southern Indian azaleas do best in full sun like the *camellia sasanqua*, thus making for wonderful companions in the landscape.

Figure 2: Azalea 'Nuccio's Carnival'.

Figure 3: Azalea 'Arcadia'.

In general, azaleas are short spreading shrubs with small leaves and noted for the variety of beautiful colors. Breeders have introduced hundreds of hybrids that have extended the range of colors, flower size and where they can be grown. Nuccio's Nursery, for example, has introduced over one hundred hybrids. (See Figure 2.)

In addition to bringing camellias to America, the Nuccio's have imported Japanese azaleas. A major achievement was their introduction of Satsuki Azaleas to America. These beautiful late blooming (May-June) azaleas are treasured in Japan as they make wonderful bonsai. Nuccio's Nursery offers over two dozen of these cultivars. My favorite was introduced to celebrate the centennial of my home town Arcadia, California. (See Figure 3.)

It is only prudent to purchase azaleas that will do well in your climate. For example, the Southern Indian azaleas are not recommended north of Washington D.C., but the Gable hybrids do well in the Northeast. The Belgium Indians do well in Southern California and the lower Southeast.

Rhododendrons are valued for their stunning flower trusses and range of colorful blooms. There are more than 900 rhododendron species worldwide. In the U.S., they are native in the Northwest, Northeast and through Appalachia. In general, they tolerate cold climates better than camellias, but struggle in the hot dry Southern California climate where camellias and azaleas do exceptionally well. For example, they were a mainstay as flowering foundation plants when we lived in Massachusetts, but need a "perfect" garden spot to grow in Southern California. This means a bright but heavily shaded area of the garden. 'President Roosevelt' with its yellow variegated foliage

Figure 4a: Rhododendron 'President Roosevelt'.

Figure 4b: *Vireya* Rhododendron 'Cristal Rey'

Figure 4c: *Vireya* Rhododendron 'Princess Alexander'.

Figure 4d: Rhododendron 'George Bergen'.

and ruffled cherry red shading to white in the center is my only specimen. It blooms heavily in March as the camellia flowers are ending their season. (See Figure 4a - 4e.)

There are tropical species, such as *Vireya* often called Malaysian rhododendrons, that can grow in warmer climates. They can be grown in pots or as a summer flowering specimen plant. They perform best at mild temperatures above 45 degrees, but can't tolerate frost.

Shade Trees

Since most camellias require dappled sunlight, they are frequently planted under large trees. The three tiered landscaping with large trees, camellias and azaleas in the front is one proven landscape design. Evergreen trees are frequent choices. The many Live Oak tree cultivars are one of the best choices to accompany camellias. While providing the needed shade, the leaves are also good mulch for acid loving plants. California camellias are traditionally planted under California Live Oak (*Quercus agrifolia*) and in the South under Southern Live

Figure 4e: Rhododendrons.

Oak (*Quercus Virginian*).

These species retain leaves all year but shed old leaves. New research challenges this practice as the indigenous live oaks require less moisture than camellias. However, if camellias are planted outside the foliage and root circumference, they can remain good companions. Two Indian Laurel Fig (*Ficus microcarpa*) planted by the previous owner have shaded my camellias for many years. They are evergreen trees grown throughout Southern California and San Francisco that have a beautiful weeping free-form growth habit. They require severe pruning in the fall in order for the camellias to have adequate light. They fill in during the spring, providing shade in the summer.

Deciduous trees allow for shade during the warm summer and more sunlight in winter after their leaves are shed. Many trees, as long as their surface roots are not invasive, can be used to shade camellias. Since camellias are shallow rooted, such varieties should be avoided. Trees need to be suited to their sites. Large landscape trees should be planted where there is room for them to grow. This includes deciduous trees such *Ginkgo biloba* and the Tulip tree (*Liriodendron tulipifera*). These two varieties have very interesting attractive leaves. The ginkgo has unique fan shaped foliage and the tulip tree leaf is tulip shaped, as is its flowers. They both have lovely yellow leaves in the fall which look good on the tree and on the ground. They make good companions for camellias.

Midsized trees like the Birch (*Betula*) have graceful habits and small leaves. They make for good camellia companions as they, too, need moist soil with the added beauty of having attractive white bark. Whether in Asian or American public gardens, or one's home, the

Figure 5a: Tulip tree leaves and flower.

Figure 5b: Ginkgo in fall with yellow leaves.

Figure 5c: Birch in the fall with white bark.

Figure 6a: 'Firecracker' as a landscape Fuchsia.

small decorative red maples (*Acer rubrum*) make for wonderful companions. There are many cultivars to choose from, even though they will not provide shade to camellias. The red-toned lacy foliage of this small deciduous tree pairs well with camellias and azaleas. They are wonderful patio and rock garden cultivars. (See Figure 5a -5c.)

Shade Plants

There are many popular and desirable shade plants. Since they require shade, they can be grown with camellias. The biggest question for some of us is whether to give the space to plants other than a camellia. Most of us desire some variety in terms of flower time, texture and flower types.

Fuchsias are popular showy flowered plants. Hybrid Fuchsia bloom from early summer until first frost. They grow best in cool summer temperatures in modified sunlight and like moisture in the soil and atmosphere. In Southern California where it is hot and dry in the summer, they do well in morning sun or all day dappled sunlight. For example, my hybrid specimen

Figure 6b: *Abutilon* 'Nabob'.

Figure 6c: *Abutilon* 'Tiger Eye'.

'Firecracker' grows well in an eastern exposure under a small shade tree next to several *C. japonicas*. The small abundant flowers appear all yearlong except if stripped by high winds during the winter. They attract bees and hummingbirds, which is an added bonus. Fuchsias can be grown in hanging baskets on patios, green houses, pergolas, lath houses and even from camellias trees. They require more water and fertilizer to bloom when in a basket. If grown near camellias, be careful with liquid soluble fertilizers that run through the pot on to the camellias. To be on the safe side, granular and slow release pellets will give them what they need and avoid over fertilizing camellias. The many colored fuchsia provide summer flowers with blooms very different from the fall and winter flowering camellias, which make them very good companions for the garden. (See Figure 6a.)

Abutilon is an evergreen shrub that does well in full sun on the coast and partial shade inland. Its growth is rapid, coarse and ranging, requiring pinching branch tips to maintain a pleasing shape. The drooping bell shaped flowers of *A. hybridum* or "Chinese Bellflower" come in white, yellow, pink and red, blooming mainly in the spring. But the white and yellow bloom over a longer time. *A. megapotamicum* or "Chinese Lantern" may bloom May and until the fall. The red and yellow lanterns are interesting, attractive and especially fun to go with pumpkins and corn husks as an autumn decoration. I like abutilon as companions to camellias as they bloom in a different season with leaves and flowers distinctively different from camellias. They attract hummingbirds, too. There are very attractive new hybrids that will grow as tall as ten feet and bloom almost all year in Sunset Zones 8 and up such as 'Nabob', which is dark red and 'Tiger Eye', which is yellow with red veins. (See Figures 6b - 6c.)

Calla (*Zantedeschia*) form clumps with long rich green lance shaped leaves, sometimes spotted with white. They thrive when heavily watered. The common calla (*Z. aethiopica*) forms large clumps which

Figure 7a: *Clivia and camellias.*

Figure 7b: Yellow clivia.

produce pure white or creamy lily shaped flowers in spring and early summer on three foot stems. They are almost evergreen in frost free areas. They look good when artfully placed in and around camellia plants. New hybrid callas are short (two feet or less), and frequently have spotted foliage and lovely pastel colored flowers. They can be planted in front of camellias or in a pot that can be moved to a choice location when in bloom.

Clivia miniata are a tuberous rooted evergreen perennial that do best with no direct sun and regular watering. Most bloom in March and April on thick rigid stalks, traditionally in orange hues. The foliage is very wide and dark green. 'Flame' is an exceptional hot orange red and the Solomone hybrids have pale to rich yellow flowers. After flowering, red berries contin-

Figure 7c: Epiphyllum 'Clown'.

Figure 8a: Daylily 'Midnight Magic' and hummingbirds.

ue to decorate this small plant. They make an excellent evergreen border for camellias and other plants in frost free areas. They also do well in containers and can be grown indoors in cold climates. (See Figures 7a - 7b.)

Epiphyllum, the orchid cactus, has one of the most beautiful flowers borne on an ungainly plant. They are a tropical, not a desert cactus with most able to grow on trees a,s epiphytes. They are easy to grow indoors, in a lath house, in a pergola, or in the shade under trees. They will need protection from winter frost. They are easy to propagate by cuttings—three in a hanging pot will grow into a good sized plant in a few years. They look best in a hanging pot as the arching two-foot plant has long trailing smooth flat almost spineless stems. The glamorous flowers range from medium to large with colors in hues of white, cream, yellow, orange, pink, rose, lavender, and scarlet. Many cultivars have mixes of two or more colors. They generally will bloom from April to June. The hanging pots can be hung among camellias and fed low nitrogen fertilizers just like camellias. (See Figure 7c.)

Sun Plants

While the most widely grown camellias (*japonica*, *reticulata* and hybrids) need partial shade, there are a great many plants that thrive in full sun. The perfect perennials for sun are the thousands of daylily (*Hemerocallis*) cultivars that reliably bloom for years with minimal care. They grow as large clumps with sword like foliage. They also bloom in light shade, which makes them terrific as a transition between dappled sunlight to full sun in front of camellias. Like camellias, there are small, medium and tall culti-

Figure 8b: Yellow Daylilies.

vars in all the colors except blue. The three tiered landscape design of shade trees, camellias and daylilies works well with the daylilies blooming spring and summer. By choosing reblooming daylilies, it is possible to have flowers in the fall just as the camellia blooms begin to appear. Mass daylily plantings of one cultivar are an impressive landscape design. (See Figure 8a - 8b.)

Daffodils (*Amaryllidaceae*) are among the most valuable spring flowering bulbous plants. They naturalize and spread year after year, and are at their best in sweeping drifts. They have a fascinating variety of flower forms and colors. Traditional colors are yellow and white, but orange, red, apricot and cream add to the color range. They do well under deciduous trees, among ground covers, near water, patios, and borders and look especially good with flowering shrubs like camellias.

Dahlias (*Asteraceae*) are tuberous rooted perennials that thrive with regular watering and light afternoon shade in very hot areas. Dahlias have become very diversified, thanks to many years of hybridizing. They come in every color except blue. Bush and bedding dahlias grow from fifteen inches to six feet tall. The tall bush types can

Figure 9: Dahlias.

be used as a summer hedge, screens and fillers among shrubs. One use is as a companion to the fall blooming *C. sasanqua* cultivars, especially before they reach their full height and width. If you miss having large flowering yellow camellias, plant the very large "dinner plate" formal double yellow tall growing dahlias. (See Figure 1 and Figure 9.)

Conclusion

There are numerous sun loving plants that are popular in home gardens that people may not associate with growing camellias. Roses, phlox, peonies, coneflowers, coreopsis, salvia, yarrow and black-eyed-susan or their many hybrids come to mind. There are some tender perennials (impatiens and begonias) and biennials (pansies) that grow in shade. There are even more wonderful, easy to find and grow, annuals that love full sun and will bring bursts of bright colored flowers in the summer. The choices are almost limitless, with the most popular being the many hybrid marigolds, petunias, asters and zinnias that now come in various sizes and colors. These may not be camellia companion flowers, but are beautiful additions to the home garden.

Figure 2: Two stone sculptures at Erkson Garden and Stuart Haaga Gallery.

Garden Sculptures, Fountains and Bridges

By Bradford King

Gardens and parks are enhanced with decorative sculptures, fountains and bridges. These architectural structures add interest and diversity to the landscape. Public gardens and parks at times have large and impressive sculptures, fountains and bridges; a home garden usually will need smaller structures in order to keep everything to scale. Garden accessories are an added attraction to a camellia collection. When we travel in America or abroad we find many wonderful garden sculptures, fountains and bridges.

SCULPTURES

Statues are sculptures (a three dimensional visual art form) representing one or more people or animals, including abstract concepts or allegorical representations of animals and people.

Figure 3: Stone lions guard entrance to Chinese Garden at The Huntingdon.

Many statues are intended as public art and exhibited outdoors or in public buildings. Some statues gain fame in their own right such as the Statue of Liberty. Art museums usually exhibit sculptures in their galleries. The Norton Simon in Pasadena, California has a fine collection of small Degas figurines of race horses and ballerinas as well as bronze, lead and marble sculptures thoroughout the galleries. The front entrance garden has an impressive collection of large bronze Rodin sculptures along the entrance walkway which features his "The Burghers of Calais". Auguste Rodin was a

Figure 4: Dog statue with 'Minato-no-akebono' at the Huntington Steele Art Gallery.

Figure 1: Rodin's sculpture of the Burghers of Calais at The Norton Simon in Pasadena, California.

French sculptor considered the father of modern sculpture. The Norton Simon has an extensive Sculpture Garden beautifully landscaped around a pond reminiscent of Monet's Giverny. It is an amazingly peaceful spot considering it was constructed between Colorado Boulevard and the 210 freeway, both constantly busy with traffic. (Figure 1: Rodin's sculpture of the Burghers of Calais.)

Descanso Gardens in La Canada Flintridge, California means a peaceful place. It is known throughout the world for its camellia collection, especially for importing the first Chinese Yunnan *C. reticulata* in 1948 to the Western world. The newest addition to Descanso is the Sturt Haaga Art Gallery which opened in the restored Boddy garage in 2011. It hosts changing contemporary art exhibits and garden sculpture. The adjacent Erskine Garden has two stone sculptures

Figure 6: The Sampson Fountain in Saint Petersburg, Russia.

as part of a contemporary minimist concrete garden design. (Figure 2: The Erskine Garden and Sturt Haaga Gallery.)

The Huntington Library, Art Galleries and Botanical Garden in San Marino, California have numerous sculptures thoughout the art galleries and gardens. The entrance path to the Chinese Garden is guarded by two lion statues and a bust of William Shakespeare presides over the Shakespeare English garden. (Figure 3: Stone Lions at Chinese Garden.)

In the loggia of the Huntington Steele Art Gallery are two impressive dog statues among a cluster of pretty fragrant 'Minato-no-akebono' hybrid camellias. (Figure 4: Dog statue and 'Minato-no-akebono'.) The most impressive sculptures line the camellia collection in the north vista leading the eye to an impressive fountain.

FOUNTAINS

A fountain is a piece of architecture which pours water into a basin or jets water into the air and is used to supply drinking water or for a decorative effect which at times can be dramatic. Originally fountains were purely functional, connected to springs or aqueducts to provide water for drinking, bathing and washing for people living in villages,

towns or cities. It was not until the late 19th century that pumps were used to move the water. Before there were mechanical pumps, fountains were operated by gravity so the water source needed to be higher than the fountain.

Today the most popular fountain in America is at the Bellagio Hotel in Las Vegas, Nevada. These huge dramatic fountains are located on a manmade lake in front of the hotel. The fountains feature vast choreographed water performances set to lights and music. Their function is to entertain and attract the public to the Bellagio Hotel and are a noted part of "Sin City".

Many experts pick the Trevi Fountain as the most beautiful in the world. It is located in Rome, Italy as the sole feature of a city park. The 85-feet-tall and 65-feet-wide fountain has a sculpture of Neptune in the center and two tritons (the messenger of the sea in Greek mythology) on each side. One is trying to tame a fiery horse, symbolizing a rough sea, and the second is blowing a shell horn, symbolizing a quiet sea. There is a legend that says if you throw a coin into Trevi fountain you will return to Rome. (Figure 5: The Trevi Fountain.)

Both the fountain in Las Vegas and the Trevi Fountain are very well known and attract visitors from around the world but are not part of a garden setting.

Figure 5: The Trevi Fountain.

The famous Peterhof Palace in Saint Petersburg, Russia is a series of palaces and gardens laid out on the orders of Peter the Great in 1710. The most famous fountain is the Samson Fountain which was added in the 1730s. It depicts the moment when Samson tears open the jaws of a lion, representing Russia's victory over Sweden in the Great Northern War. The gardens are highly manicured and the beautiful dramatic gold fountains are the centerpiece of the palace gardens. (Figure 6: The Samson Fountain.)

CAMELLIA GARDEN FOUNTAINS

The beautiful camellia gardens seen in America have fountains that blend with the landscape. The Huntington Botanical Gardens in San Marino, California follow the European tradition in embellishing the gardens with temples, sculptures and two large elaborate fountains plus several smaller ones. The North Vista Camellia Garden is the length of two football fields lined with drifts of azaleas, hundreds of camellias and 22 Italian garden statues with a large stone Italian baroque fountain, complete with dolphin sculptures, as the focal point. The San Gabriel Mountains serve as the background. (Figure 7: The North Vista & Figure 8: Baroque fountain towards the Mansion.)

A row of mature *C. japonica* cultivars fills in between the 12-foot-tall seventeenth century limestone statues portraying allegorical and mythological subjects. The camellias include favorites like 'Fashionata', 'Owen Henry', 'Night Rider', 'Black Magic', 'Wildfire', 'Marchioness of Salisbury', and the antique variety 'Cup of Beauty', which came from China by the way of England. 'Fashionata' and one of the Italian statues make a great combination especially when the large pink flowers cover the 20-foot sturdy upright plant. (Figure 9: 'Fashionata' and statue.)

A lovely fountain and statue are surrounded by a nice full planting of *C. sasanqua* 'Showa Supreme' just east of the North Vista. Both would make a fine addition to a home garden. (Figure 10: A planting of 'Showa Supreme' and the fountain.)

The Japanese Garden in Descanso Gardens has a wonderful woodland design featuring *C. sasanqua* camellias, a tea house, pools of water filled with koi, a winding pathway and a sōzu water fountain. This style fountain consists of a segmented bamboo tube, pivoted on one side of its balance point. At rest, its heavier end is down against a rock. A trickle of water into the upper end of the tube accumulates and eventually moves the tube's center of gravity past the pivot, causing the tube to rotate and dump out the water. The heavier end then falls back against the rock, making a sharp sound, and the cycle repeats. This noise is intended to startle any herbivores such as deer which may be grazing on the plants in the garden. (Figure 11: Descanso Japanese fountain.)

The Huntington Japanese Garden also has a bamboo fountain

to the right of the traditional Japanese House, and it is placed where the family would wash their hands and feet before entering the house. When water is ladled from the fountain the movement creates a soft lovely musical tone. (Figure 12: The Huntington fountain.)

BRIDGES

A bridge is a structure built to span physical obstacles such as a body of water, valley, or road, for the purpose of providing passage over the obstacle. The first bridges were made by Mother Nature herself when a log fell across a stream. As people needed to regularly travel from one place to another they planned the first bridges. Most likely they cut down trees and used several of these logs lashed together with a simple support system of other logs or stones to bridge a stream. In an age of rapid transportation, bridges became very important.

Figure 7: (Left) The North vista at The Huntington Botanical Gardens in San Marino, California.

Figure 8: (Below) A baroque fountain at The Huntington.

Figure 9: The 'Fashionata' camellia with a statue at The Huntington.

They allow for roads and railroads to cross over otherwise impassable obstacles such as rivers, canyons and other roads. By the turn of the century there were three main types of bridges being used in the United States: the arch bridge, the draw bridge and the cantilever bridge. These three types of bridges reflect the needs and materials available to those who built them.

In America the most famous bridge is the Golden Gate Bridge in California, which spans 4,199 feet between San Francisco and Sausalito over the San Francisco Bay. The view of the bay and the bridge itself is awesome. The equivalent icon in England is the Tower Bridge in London. With the bridge and the castle next to it, it is among the most visited monuments in Europe. In Australia the Sydney Harbour Bridge has a beautiful view of the city, harbor and the Sydney Opera House. This wonderful skyline of the city is a symbol of Sydney and Australia. The bridge is nicknamed "The Coathanger" by the local residents because of its arch-based design. (Figure 13: "The Coathanger" bridge in Sydney, Australia.)

These three magnificent bridges make the top three tourist attractions in the world and are on

most people's bucket list; however, they definitely are not garden landscape structures.

CAMELLIA GARDEN BRIDGES

The Japanese garden bridges first appeared during the Heian period (794 -1185). These bridges were made from stone, wood and logs with earth on top covered with moss. They could be flat or arched. As part of a temple garden, they were sometimes painted red but more frequently they were left unpainted. (Figure 14: The Huntington stone bridge covered with plant material.)

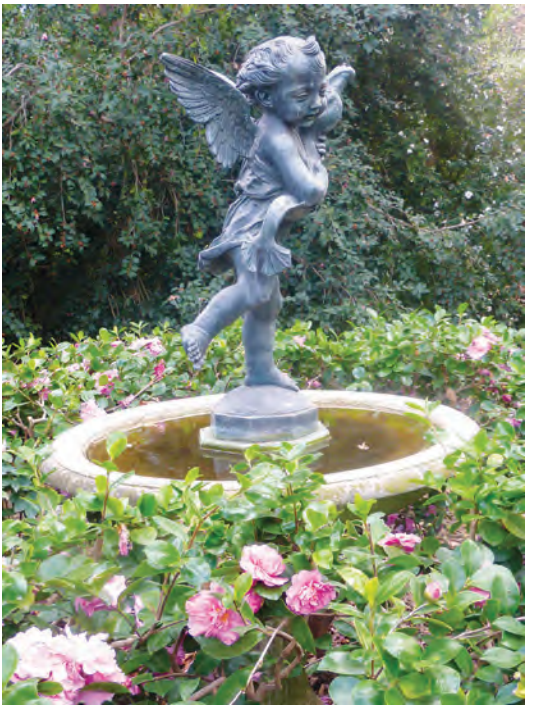

Figure 10: 'Showa Supreme' around a fountain at The Huntington.

In the Edo period (1603-1868) large walking gardens became popular. Streams and winding paths were constructed with a series of rustic stone or wood bridges so visitors could stroll through the scenic garden.

The Huntington Japanese Garden has 70 garden accessories including an arch bridge and a classical zig-zag bridge. The focal point is the pond with the decorative wooden arch walking bridge situated in a canyon setting. It is a moon bridge because its arch and reflection approximate the full moon. Numerous camellias are planted along the winding pathways. Some are manicured like the specimen 'Kanjiro'; there are drifts of sun loving *C. hiemalis* 'Showa-no-sakae' serving as an attractive ground cover for the hill side, as well as mature camellias leading to the extensive collection of camellias in the North Canyon. (Figure 15: The Japanese Garden and bridge; Figure 16: 'Showa-no-sakae' ground cover; & Figure 17: 'Kanjiro' blooming.)

The zig-zag bridge connects

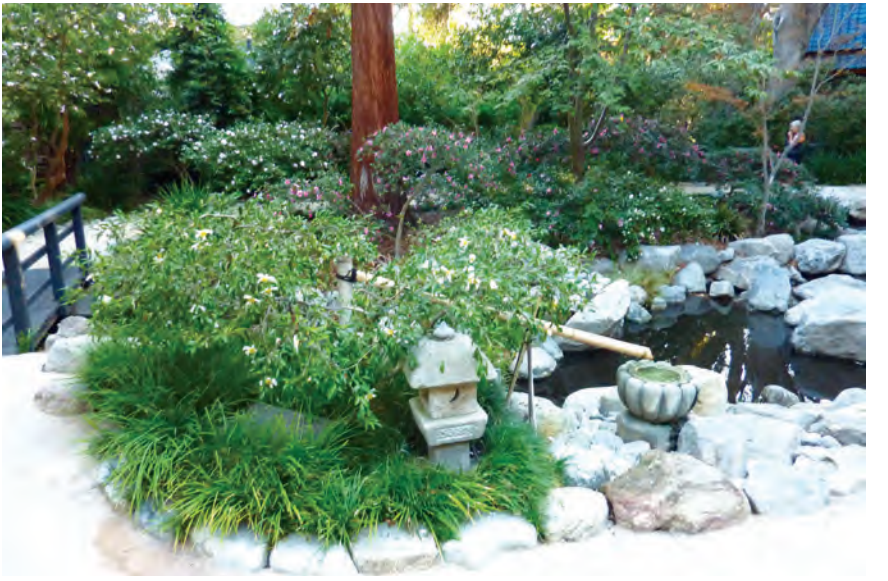

Figure 11: The Descanso Japanese fountain.

Figure 12: The fountain at the Japanese House in The Huntington.

Figure 13: The "Coat Hanger' bridge in Sydney, Australia.

Figure 14: The Huntington stone bridge covered in plants.

Figure 15: The Japanese Garden and Moon Bridge in The Huntington.

the central Japanese Garden with the Meditation Garden. It crosses a dry stream bed where pebbles and rocks evoke the presence of moving water. (Figure 18: The zig-zag bridge.)

The Descanso Japanese Garden features a tea house and koi filled interconnected pools with a wonderful collection of camellias sasanqua throughout. (Figure 19: Photo of the bridge, tea house and camellias.) Some of the popular varieties present are ‘Jean May’, ‘Hugh Evans’, ‘Yuletide’ and ‘Narumigata’.

Nearby are some of the earliest Japanese *C. japonica* imports to Star Nursery in the 1930s. When the owner of Star Nursery, Mr. Uyematsu, was interned at the beginning of World War II, Manchester Boddy purchased most of his camellias and now they are being preserved at Descanso for future generations to enjoy. Examples include 'Hanafuki', 'Oki-no-nami' and 'Soshi-arai (Light pink dots). Lovely camellias rarely seen except here in the Descanso camellia collection. (Figure 20: 'Hanafuki', 'Oki-no-nami' and 'Soshi-arai'.)

The Huntington Chinese Garden is named the Garden of Flowing Fragrance and is in-

Figure 16: 'Showa-no-sakae' ground cover in the Japanese Garden at The Huntington.

Figure 17: 'Kanjiro' blooming in The Japanese Garden.

Figure 18: The zig-zag Bridge at The Huntington.

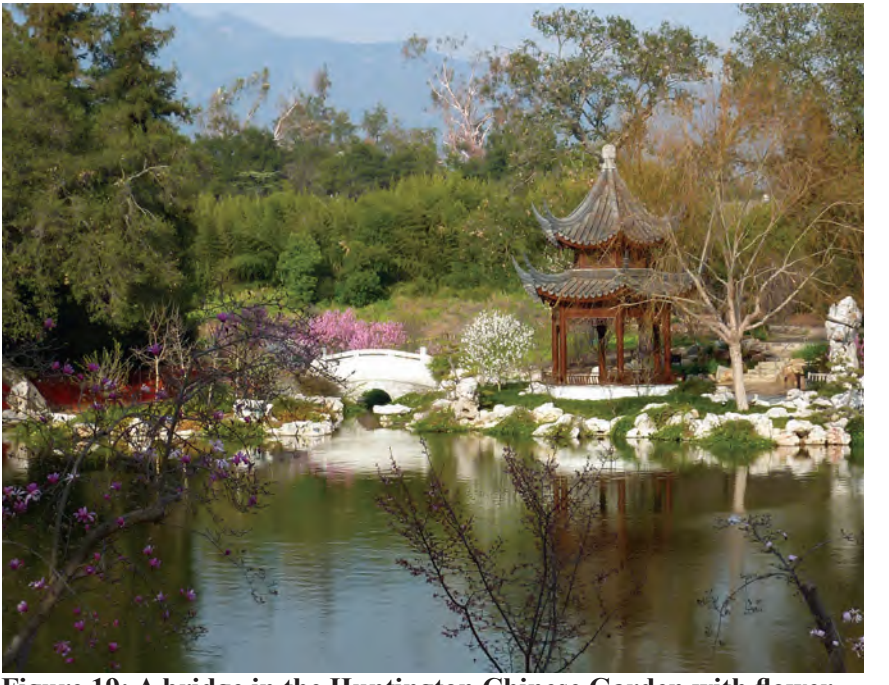

Figure 19: A bridge in the Huntington Chinese Garden with flowering fruit trees.

Figure 20.

'Hanafuki'.

'Oki-no-nami'.

'Soshi-arai'.

spired by Chinese tradition of scholarly pursuits. The design combines natural scenic beauty with literary expressiveness. The use of water, bridges and pathways are featured. The "Pond of Reflected Greenery" and "Lake of Reflected Fragrance" with pavilions connected by "the Bridge of Verdant Mist" and the impressive "Jade Ribbon Bridge" are key design components. The tea house is known as the "Hall of the Jade Camellia" honoring the camellia by linking it to jade which is a very highly valued gemstone in Chinese culture.

Weathered limestone rocks from China's Lake Tai line the water edges. Well composed scenes are seen by strolling along the pathways and bridges among rock formations, ponds, plants and pavilions. The 22 million dollar second phase was completed in spring 2014 with the "Clear and Transcendent Pavilion", "Lingering Clouds Peak" with a magnificent water fall and the "Waveless Boat". The "Bridge of the Joy of Fish" attaches to "Mandarin Ducks Island". The "Listening to Pines Bridge" get its name from the stand of pines growing nearby. (Figure 21: The "Bridge of the Joy of Fish"

Figure 21: The "Bridge of the Joy of Fish" with the "jade Ribbon Bridge" in the background at The Huntington.

in the foreground and the "Jade Ribbon Bridge" in the background.)

CONCLUSION

The home gardener can't compete with public gardens in exhibiting world class sculptures, fountains and bridges. However, garden sculptures, fountains and bridges can be found in local garden centers, nurseries and on the Internet. When artfully placed in the camellia garden, they can add style, form and beauty to the home garden. (Figure 22: A home fountain decorated with camellias)

Figure 22: A home fountain.

Return to TOC

Color and Borders in Camellia Flowers

by Bradford King

Camellia Japonica **'Kuro-tsubaki' is also known as 'Black Camellia' , 'Black Prince' and 'Purpurea'.**

***Camellia japonica* 'Betty's Beauty'.**

How do camellias get their colors? Why are some red, pink or white? We admire the beautiful colors of camellias in bloom, but what goes into the color production of these beautiful flowers? Flower color and fragrance attract pollinators. Since most camellias have no scent, color is the key to attracting pollinators. Camellia breeders came on the scene with goals of breeding new colors and flowers with colorful borders or selecting camellias plants with new and different color toned flowers that might not be able to reproduce on their own. For example, the gorgeous but sterile formal double camellia flowers cannot reproduce. New plants must be propagated by cuttings or grafts to keep this cultivar from being the one and only plant of its kind.

Color Making Process

The color of flowers is found in pigments that are produced in the hereditary genome of the camellia. Flower colors of red and pink come mainly from the pigments called anthocyanins, which are in the class of chemicals called flavonoids which gives plants their color. Carotenoids are responsible for the yellow and orange tones seen only in the yellow camellia spe-

***Camellia sasanqua* 'Old Glory'.**

cies. Chlorophyll is the most well-known pigment, providing the green seen in foliage. In brief, this means plants carry certain pigments in their genes that determine a flower's color.

The genes come in equal numbers from the cultivar's parents. The inheritance of color in flowers is a large field and varies in different species. Color can be dominant, recessive, or additive in nature, and in some plant species it can be a combination of these factors. Also, some plants can have genetic defects that affect color. In camellias, this is best illustrated by the abnormally long gene in 'Kuro-tsubaki' discovered by Dr. William Ackerman that accounts for the black red color flower.

Why Flowers Have Color

Flowers that are bright in color attract birds, bees and other insects in order to help the plants reproduce. The original camellias needed to reproduce with the help of the birds, insects and bees, so over thousands of years the flowers with bright colors that were most attractive to pollinators survived. The ca-

***Camellia sasanqua* 'Double Rainbow'.**

mellia flower's anthocyanins position the genetic groundwork for brightly colored blooms to increase the likelihood of its survival. Humans, through collecting native camellias or germinating seeds, selected those they found attractive to propagate, thereby extending the flower sizes, forms and range of colors. One of the many results of these human selections over hundreds of years is camellias with beautiful colorful borders.

Camellia Borders

Since genes for red colored flowers are dominant, there are red and pink blooms, but only a few white. This is most clearly seen in *C. reticulata* flowers where there are very few white cultivars and none with borders. Fortunately, there are colorful borders on a *C. sasanqua*, *C. japonica* and non-reticulata hybrids.

Camellia sasanqua

This species is native to Japan and originally had small white flowers borne on small trees or shrubs with fine texture and a uniform number of chromo-

***Camellia japonica* , 'Nuccio's Jewel'.**

somes. It is a diploid with 90 chromosomes (2n = 90). Hybrids have not been found in wild populations. However, *C. sasanqua* cultivars have been cultivated extensively for hundreds of years in Japan. Studies indicate these varieties have diverse numbers of chromosomes (2n =45-120). This has resulted in new cultivars with diverse color tones, forms, fragrance and plant texture. Many of these cultivated plants have intense floral anthocyanin pigmentation, some with bright beautiful colorful borders.

One of the popular older cultivars is 'Narumigata' which came from Japan in 1930 to Star Nursery, in Montebello, California. It has a medium to large single white cupped flower with a delicate pink edge. The petals have a nice crinkled texture. It is a pentaploid and was used by Howard Aster to cross with *C. reticulata* producing such hybrids as 'Flower Girl', 'Show Girl' and 'Dream Girl'.

Another cultivar from Japan is 'Navajo'. It was imported by Nuccio's Nursery and the original label was lost, so they renamed it. The large semi-double

***Camellia japonica* 'Grace Albritton'.**

***Camellia japonica* , 'Grace Albritton Flair'.**

white flower has a bright red border. 'Hana-jiman' ('Boastful Flower') has a large single to semi-double white flower with a pink edge that also originated in Japan. Toichi Domoto imported 'Yae-arae' ('Double Hailstorm') from Japan to his nursery in Haywood, California. It has a medium to large single white flower with a pink border. While 'Rainbow' has a single large white flower with a red border, 'Double Rainbow' has a beautiful semi-double white flower with a rose border. We know the white single flower with a blush pink edge as 'Apple Blossom,' the flower it closely resembles, but in Japan it is called 'Fukuzutsumi' ('Bundle of Fortune'). It is unclear if they are actually the same or different cultivars.

Nuccio's Nurseries has introduced two lovely *sasanqua* varieties with colored borders. 'Painted Desert' is a pale pink almost white flower with a deep rose red border around the large single flower. My personal favorite is 'Old Glory' because it looks like a flag blowing in a breeze with its wide open single to semi-double white flower with ruffled petals edged in dark pink.

Camellia japonica

This species is widely distributed and abundant in Southeast Asia, including China, Taiwan, Japan and Korea. For over two hundred years it has been cultivated in Japan and China for its

***Camellia japonica* 'Sawada's Dream'.**

***Camellia japonica* 'Baby Pearl'.**

edible oil and as an ornamental plant. Native populations generally have red and pink flowers, but rarely white, with 30 chromosomes (2n = 30) and occasionally 45 (2n = 45). Large numbers of camellias with genetic mutations that control flower color, form and growth habit have been discovered, especially in Japan where they have been preserved in gardens for years. These sports are the basis for thousands of cultivars that have been named.

Hybridization of *C. japonica* has continued to spread, with dozens of other countries introducing beautiful new cultivars. A few of these have wonderful white blooms with very colorful borders. One of the most beautiful types of camellia flowers is the formal double whites with shades of pink on the petal edges. These include 'Desire', 'Donnan's Dream', 'Jerry Donnan', 'Grace Albritton', 'Grace Albritton Flair', 'Kitty', 'Baby Pearl', 'Nuccio's Pearl', 'Pearl Maxwell' and 'Sawada's Dream'. There are a number of wonderful white peony flowers that shade pink on the petal edges such as 'Nuccio's Jewel'.

Also, there are other forms with lovely flowers that have color blends deepening as they reach the petal edges. 'Nuccio's Carousel' illustrates this with its medium to large tubular semi-double soft pink flower that shades to a deeper pink on its edge. 'Berenice Boddy' was introduced in 1946 by Jones and Descanso Gardens from plant

***Camellia japonica* , 'Berenice Boddy'.**

material imported from Japan by Star Nursery in 1930.

It is an iconic example of pink shading—light to dark. Dr. Clifford Parks used it extensively in his cold hardy breeding program and has observed its progeny inheriting, in many cases, the pink shading. He has postulated that a shading gene is responsible for this color phenomenon.

Are clear cut borders related or due to other genetic factors? This has not been determined. However, it would be hard to find a camellia enthusiast who doesn't grow one or more of these magnificent camellias.

When the Queen looked into the mirror and asked "who is the fairest one of all," expecting to hear her own name, she was shocked and angered when told "Snow White is the fairest one in the land." You may not agree, but can't be shocked and angered when the King's mirror says the camellia with the most beautiful colored border is 'Margaret Davis'. This cultivar has become a favorite throughout the camellia world. It received

***Camellia japonica* 'Margaret Davis'.**

the William Hertrich Award in 1969, the ACS Sewell Mutant Award in 1976, and the William E. Woodroof Hall of Fame Award in 1979.

This beautiful ruffled flower is creamy white with rose red dashes and petals edged in brilliant vermillion. It has a medium peony flower that blooms midseason on a bushy upright plant. This sport of 'Aspasia MacArthur' was found in 1961 in Margaret Davis' garden in Cammeray, Australia. Margaret Davis was the founding president of the Garden Clubs of Australia. The cultivar was named by her husband. This very beautiful camellia is an excellent addition to the garden.

Another very lovely sport was caught by Rudy Moore, a long term camellia curator of the Huntington Botanical Gardens in San Marino, California. 'Betty's Beauty' mutated from 'Betty Sheffield Supreme'. The medium semi-double to peony flower is white with a delicate soft rose red blurry border, more as if done by a water colorist than a draftsman's crisp sharp lines.

The Japanese Higo Society officially recognizes 120 Higo cultivars of which four have col-

***Camellia* Higo 'Ohkan'.**

ored borders. A first class Higo has five to seven petals, bright colors and a mass of stamens protruding from the center of the flower like the spokes of a wheel. They are all a type of *C. japonicas* with a flat single flower. The very best of the bordered Higo camellia is 'Ohkan' ('King's Crown') which has a white single flower with a very bright beautiful crimson border. It has sported twice with these mutations also having a red-toned border on a white flower.

Nonreticulata Hybrids

The first and best known of these hybrids were intentional crosses between *C. saluenensis* and *C. japonica,* and are known collectively as *williamsii* hybrids named after the first person, John Charles Williams, to germinate seeds from these crosses. *C. saluenensis* are native to the Yunnan and the southern Sichuan provinces of China. They typically have white to rose pink flowers with a uniform number of chromosomes (2n = 30). Surprisingly, there are only a few hybrids with a distinctive colored border and a few more with darker shading on the petal edges. 'High Fragrance' is

***C. williamsii* 'Spring Daze', an open rose form double form.**

***C. williamsii* 'Spring Daze', formal double form.**

most noted for its lovely scent, but is a good example of shading. The medium peony flower is pale pink shading darker as it reaches the petal edges. While a beautiful flower, it doesn't have a clearly defined border.

One hybrid with a wonderfully colored border is 'Spring Daze'. The small to medium rose form to formal double flower is white to blush pink and edged with a beautiful coral pink border. It was introduced by Kramer Brothers Nurseries, Rancho Cucamonga, California in 1989. This nursery was founded in New York and moved to California in 1929. They were known for their azaleas, camellias and gardenias. While this wonderful camellia nursery is no longer with us, many of the camellias they propagated and introduced are still grown and enjoyed today.

Kramer's *japonica* introductions include at least 20 cultivars and a dozen hybrids. One of the most popular is the show winning 'Spring Daze'. It is almost always an open rose form double thus looking like a loose peony flower when grown in Southern California but can be seen as a formal double in Northern California. In either form it has the strikingly beautiful coral pink

Camellia hybrid 'Showboat'.

***Camellia hiemalis* 'Shôwa-no-sakae' has Benten leaves with a pink semi-double flower.**

border which looks wider on the open form. In fact they don't look like the same flower.

Nuccio's Nurseries 2012 introduction 'Showboat' which has a large white formal double flower, occasionally with incurved petals, outlined in rose pink. This lovely new camellia shades to light pink making a subtle border. While it has a soft flower that may not travel well it, is capable of winning show points.

Borders On Leaves

When a camellia cultivar has foliage on which the leaf is darker in the center with a lighter border, these cultivars usually have "Benten" as part of the name. This follows the tradition begun in Japan to describe this type of foliage. This is the result of genetic mutations that may, in some cases also result in flower changes. Benten foliage is found in *C. sasanqua* and *C. japonica* cultivars but not *C. reticulata*. 'Shôwa-no-sakae' Benten is a good example of a plant with this type foliage. (Photo of 'Shôwa-no-sakae' Benten leaves with pink semi-double flower)

Conclusion

Colorful borders on a camellia flower add to its beauty whether a sasanqua, Higo, a white peony formed flower with a striking vermillion border or a beauti-

ful white formal double flower with a subtle pink border. The genetics involved are not well researched. It would seem that multiple genes are responsible for the color of camellia flowers. It is not known what produces a colored border on a white flower. We can see that the *C. sasanqua* flowers began as white with new cultivars cultivated with more color which means the new crosses carried genes for the red pigments.

When red and white pigments are introduced this gives us pink. How the red or pink pigments migrate to the petal border is unclear. However with 90 chromosomes (2n = 90), there are vast combinations and permutations that could be involved. The *C. japonica* flowers were originally red and pink so they already had genes that provided those pigments in their genome. Since red is usually dominant and white recessive, both parents would need to carry the white recessive gene to get a white flower. We know this occurs on a fairly regular basis. But how does the dominate red or pink tones remain only as a border? This is a mystery yet to be solved. In the meantime join me in enjoying some of the most beautiful flowers with their magnificent colored borders.

***Camellia sasanqua* 'Double Rainbow' in full bloom.**

Return to TOC

Breeding *Camellia azalea*

Article and photos by
Bradford King

Camellia azalea is the most exciting camellia species to be introduced in years because it blooms in hot summer weather and reblooms in the fall in Southern California and other areas of America when fall weather remains in the 70's and 80's. In its native China and at Longwood Gardens greenhouse in Pennsylvania it can bloom every month of the year with its peak blooming season summer through fall.

The flower is a medium bright red single with five to nine petals that looks like an azalea flower. The flowers are borne singly or in clusters at the tip of new growth. In fact new growth may occur all year which is why this plant can bloom under optimal conditions every month of the year.

Buds become red and elongated as they mature such that they look like lipstick ready to be applied. (Figure 1: Photo of *C. azalea* bud.) The center of the flowers has a cluster of yellow anthers. The red flower with yellow anthers is very attractive—clear and bright. The leaves are a long narrow oblong with a very smooth surface that has a very thin light green edge with a raised mid vein.

The total package of leaves, buds and flowers make this a worthwhile landscape plant that grows bushy and slowly to a maximum of ten feet. The hot days of fall can induce blooming. In fact 100 degrees or more seems to their liking as long as the soil remains moist. (Figure 2: Cluster of flowers that bloomed in November.) When there are several days with day time temperatures in the 60s blooming ceases but is triggered by mid-70s and 80s. They will survive temperatures as low as 23 degrees.

Figure 1: Photo of *C. azalea* bud.

In general it appears best to grow them like japonicas—dappled sunlight, partial shade or under 50 percent shade cloth. In China they grow in a warm moist climate in full sun. *C. azalea* is notorious for its poor growth on its own roots—cuttings usually don't take and those that do grow slowly and weakly. However, cleft grafts are generally very successful and grow well.

Figure 2: Cluster of flowers that bloomed in November.

C. azalea as a pollen parent

Camellia azalea is a wonderful plant to use in breeding as the reblooming and summer flowering characteristics can be inherited in first generation hybrids. *Camellia azalea* is frequently called *C. changii* in scientific circles. It is placed in Section Camellia with 50 camellia species along with *japonica*, *reticulata*, and *saluenensis* out of the total 280 camellia species. It is fertile as a pollen parent and as a seed parent. In the hot dry summer and fall in Southern California it has been much more fertile as a pollen parent. Therefore my hybridizing program has focused on making controlled crosses with *C. azalea* pollen on a number of *C. japonica* cultivars.

Some good seed setting cultivars like 'Magnoliaeflora' and 'Wildfire' have rarely set seeds when pollinated by *C. azalea*. On the other hand 'Tama-no-ura' and 'Tama Peacock' have produced dozens of hybrid seedlings with leaves showing similarities with *C. azalea* foliage indicating a successful cross was made. A 'Tama Peacock' x *C. azalea* seedling with new bronze foliage in November would seem to indicate potential for reblooming plus inheriting the bronze color foliage typical of 'Tama Peacock.' (See Figure 3.) In addition 'Tama Americana,' 'Tama Beauty' and 'Betty Foy Sanders' have also produced *C. azalea* hybrid seedlings.

I germinate seeds in a germinating container a third full of moist peat moss. When they have two or more leaves, I place them in a one gallon pot filled with equal potting soil, sand and small pine bark which is covered with a one gallon plastic bag supported with two bent coat hangers. The high moisture of the germinating container and covered pot works very well with these seedlings.

Figure 3: A 'Tama Peacock' x *C. azalea* seedling with new bronze foliage in November.

Figure 4: New *C. azalea* seedlings.

The major challenge is keeping them alive after removing the plastic cover that has maintained a high level of humidity. The last five years I have lost many healthy seedlings in the hot dry climate here in Southern California. This year the covers were removed in the third week of October when temperatures finally dipped into the low 80s, and a cloud cover lasted several days with rain predicted that never materialized. (Figure 4: New *C. azalea* seedlings.) These seedlings are misted daily for a couple of weeks and then left to thrive, struggle or die.

In short these seedlings are high maintenance compared to a typical japonica seedling. One strategy I have used is to graft a seedling on to root stock. The photo shows a 2014 fall seedling that was grafted in February 2015. (Figure 5: Grafted *C. azalea* seedling.) When the graft takes, it produces a stronger seedling.

In conclusion, breeding *Camellia azalea* (See Figure 6.) has a few challenges not the least requiring patience waiting for seedlings to bloom. To date I have not had that pleasure. While I look forward to that time, I know the flowers may be unremarkable and that there is no guarantee that even if it is a pretty flower that it will inherit the summer or the reblooming trait being sought.

Figure 5: Grafted *C. azalea* seedling.

Figure 6: *Camellia azalea.*

King studied three conditions for germination: (1) Seeds in a germinating container (upper left); (2) Seeds in a mini greenhouse (upper right); and (3) Seeds in a 1-gallon plastic pot (bottom).

Camellia Germination Studies

By Bradford King

The easiest and most popular method for germinating camellias from seed is to place them in a garden pot very lightly covered in the potting mix. Typically, a loose "soil" mix high in humus is used, such as peat moss or oak leaf mold, pine bark, sand or perlite, garden soil, or potting soil. The pots may be left outdoors in a protected spot at least here in Southern California or placed in a greenhouse if available. This method has been used by Nuccio's Nurseries for 75 years with great success. The method I was taught by Sergio Bracci, a premier grower in Southern California for over 25 years who usually won the most points in camellia shows, was to use a germinating container with moist peat moss. Thirty years later I began to wonder whether one method is superior to the other.

In addition, for the last six years my breeding program featured using *C. azalea* pollen on *japonica* seed parents. Hundreds of seeds placed in germinating plants sprouted and were transferred into "mini greenhouses" (a 1-gallon pot with a plastic bag supported by two coat hangers). During the fall the plastic bags were removed. Some failed at this point. Many grew but tended to be "wimpy" and much slower and less robust than typical *C. japonica* seedlings. I have concluded most have inherited *C. azalea*'s trait of being hard to grow on its own roots.

The best seedlings to date are the result of approach grafting. Specifically, a first year seedling was transplanted adjacent to rootstock and grafted on to it leaving both with intact roots. These grafts support my conclusion that *C. azalea* hybrid seedlings are difficult to grow on their own roots.

In addition, the transfer from the "mini greenhouse" to drier natural outdoor conditions produced losses of healthy seedlings. This led me to ask if it is worth the effort to geminate seeds in one container, transfer them to the mini greenhouse, then mist frequently once the plastic bags were removed? Therefore, three methods of germinating camellia seeds were studied.

METHOD

Thirty-six seeds were pulled from a batch of 58 seeds harvested on August 1, 2014 from 'Tama Peacock x *C. azalea*. Twelve seeds were randomly placed in each of the three germinating conditions as follows:

1. Twelve seeds were placed in a germinating container one third filled with moist peat moss.
2. Twelve seeds were placed in a 1-gallon plastic pot filled with a camellia mix (equal parts peat moss, pine bark, sand and potting soil) and covered with a clear plastic bag, which was supported by two coat hangers, thus making a "mini greenhouse".
3. Twelve seeds were placed in a 1-gallon plastic pot filled with the same camellia mix as the mini greenhouse.

The three containers were placed together under a north facing pergola among other seedlings and young camellias that received water from an automatic water system augmented by hand watering as needed. While the germinating container and mini greenhouse did not actually require water as no moisture is lost, placing them next to each other served to control for other unwanted variables.

Condition 1: Seedlings in a germinating container.

RESULTS

After four months (August 1, 2014 to December 1, 2014) the first observation results were as follows. The germinating container had 4 seedlings with two leaves; the 'mini greenhouse" had 2 seedlings with two leaves and two sprouted stems, and the pot had 4 seedlings with two leaves and two sprouted stems.

After eight months (August 1, 2014 to April 1, 2015) the second observation results were as follows. The germinating container had 12 seedlings with at least two leaves for a 100 percent success rate; the mini greenhouse had 11 seedlings and 1 just sprouting, and the pot had 7 seedlings, 1 sprout and 4 seeds yet to sprout.

DISCUSSION

The first observation shows that 'Tama Peacock' x *C. azalea* seedlings will begin to successfully germinate in four months in all three conditions during the warm summer and fall outdoors in Southern California. Equal results were obtained for the germinating container and pot culture.

The mini green house at this point in time had half as many germinated seedlings.

The second observation found that the condition #3 (pot with planting mix) had a lower germinating success rate after eight months than conditions 1 and 2. Condition #3 will continue to be observed to see if the remaining seeds germinate as spring

Condition 2: Seedlings in a mini greenhouse.

temperatures rise and longer amounts of daylight occur.

STUDY NUMBER TWO

Twenty-one seeds were pulled from a batch of 37 seeds harvested on October 2, 2014 from 'Tama-no-ura' x *C. azalea*. Seven seeds were randomly placed in each of the three germinating conditions as detailed in Study One. The three containers were placed in the same areas as those in the previous study.

Results

The observation on April 21, 2015 (six months after planting) were as follows: The germinating container had seven seedlings with two or more leaves; the mini greenhouse had 4 seedlings, 1 seed sprouted and 1 failed (dried out stem), one seed with no growth and one seed missing; the pot had 5 seedlings and 2 seeds missing.

The observation done on June 20, 2015 (nine months and 18 days after planting) were as follows: The germinating container still had 7 seedlings with two or more leaves; the mini green house had 4 seedlings, plus 1

Condition 3: Seedlings in a 1-gallon plastic pot.

seed with a root but no foliage, and the pot had 5 seedlings and 2 missing seedlings.

DISCUSSION

The germinating container had a 100 percent success rate and no lost seeds as it is totally enclosed. The pot lost 2 seeds somehow with the remaining 5 seeds all germinated. The mini green house had essentially the same results as the pot.

CONCLUSIONS

1. Camellia seeds will germinate in all three conditions.

2. The germinating container has a 100 percent success rate in both studies as it provides high humidity and total protection from wind, rain, pests when placed in partial shade.

3. The mini greenhouse was almost as successful in germinating seedlings as the germinating container and has the advantage of not requiring the seedlings to be planted in a pot after germinating, thus saving time and loss of seedlings in transplanting. It will require that seedlings be acclimated to less humidity when the plastic bag is removed. It is best to cut a hole in the bag and mist once or twice a day for a week, then remove the bag and continue to mist the seedlings

'Tama Peacock' x *C. azalea* seed graft shows off new leaves in November.

daily for one to weeks, depending on heat and humidity.

4. Pots are less successful in germinating but require no additional care of the seedlings as they have been growing in "normal" outdoor conditions.

5. The use of germinating containers is worth the extra effort for hard to grow hybrids like *C. japonica* cultivars x *C. azalea* but generally will not be necessary for *C. japonica, C. reticulata* and their hybrids.

Return to TOC

Cover Story

Figure 13: 'Kuro-tsubaki'.

The camellia in sports, politics, art and literature

Article & Photos By Bradford King

Which state's official flower is the camellia? What state capital is nicknamed the Camellia City? Where was the Camellia Bowl post season NCAA college football game held? Which hole is named Camellia at Augusta National Golf Club? The answers to these questions as well as references to the camellia in literature, music and fashion will be revealed.

STATE FLOWER

In 1959 *Camellia japonica* was chosen to be the state flower of Alabama. Scholars believe the word Alabama comes from the American Native Choctaw *alba* which means plants and *amo* meaning to trim/cut or to gather. When put together they may mean "clearers of land," referring to clearing the land for cultivation or "herb gatherers" for collecting medicinal plants.

The unofficial state nickname is the Yellowhammer after the state

bird, the Northern Flicker. In the east the Flicker has yellow under the wings while in the west it has red. Both have striking plumage, a long incurved beak, and are 12.5 inches in length with a wing span of 20 inches. The Flickers are the only woodpeckers frequently found on the ground where they eat ants.

Alabama is more commonly known as the "Heart of Dixie". The state tree is the Longleaf Pine. The capital of Alabama is Montgomery. The largest city by population is Birmingham. The oldest city is Mobile, founded by French colonists. Mobile was a haven for camellia breeders like Kosaku Sawada, who owned Overlook Nursery, and Dr. Walter Homeyer. (Figure 1: 'Sawada's Dream'.)

STATE CAPITAL NICKNAME

The capital of California is Sacramento and it is nicknamed the Camellia City. Sacramento became a city through the efforts of the Swiss immigrant John Sutter, Sr., his son John Sutter, Jr., and James W. Marshall. Sacramento grew quickly thanks to the protection of Sutter's Fort, which was established by John Sutter in 1839. During the California Gold Rush, Sacramento was a major distribution point, a commercial and agricultural center, and a terminus for wagon trains, stagecoaches, riverboats, the Telegraph, the Pony Express, and the First Transcontinental Railroad.

Camellias made their debut in Sacramento during the Gold Rush when John Stevens brought the first seeds from Boston in 1852. Sacramento became known as the Camellia City in 1908 following a production of a play entitled "The Camellia City" by a theatrical group called The Camellians. By the 1920s the official title of Sacramento was "Camellia City of the World".

The Native Sons and Daughters

Figure 1: 'Sawada's Dream'.

Figure 2: 'Dahlohnega'.

Figure 3: *C. sasanqua* 'Jean May' in full bloom.

of the Golden West dedicated Capitol Park's Camellia Grove to the memory of their pioneer ancestors in 1953. The Camellia Bowl was the name of a post season football playoff game under the auspices of the NCCA. Sixteen football games were hosted by Sacramento between 1961 and 1980. (Figure 2: 'Dahlohnega', bred by Dr. Homeyer, representing the Gold Rush.)

SPORTS

Augusta National Golf Club is located in Augusta, Georgia and is one of the most famous golf clubs in the world. It was founded by Bobby Jones and Clifford Roberts on the site of a former plant nursery. Each hole on the course is named after the tree or shrub with which it has become associated. "Camellia" is the par-four 495-yard tenth hole considered the toughest hole because the tee shot requires a hard hook to gain extra distance. Drives that go too far right will leave a long second shot; if they go too far left, trees are a problem. The camellias serve as the background for the green.

The course was designed by Jones and Alistair Mackenzie and opened for play in January 1933. Since 1934, it has played host to the annual Masters Tournament, one of the four major championships in professional golf. It is the only major played each year at the same course.

It was the Number One ranked course in *Golf Digest*'s 2009 list

Figure 4: *C. japonica* 'Wendy' bush. *Photo by Randolph Maphis*

of America's 100 greatest courses and is currently the Number Ten ranked course on *Golfweek Magazine*'s 2011 list of best classic courses in the United States. (Figure 3: *C. sasanqua* 'Jean May') and Figure 4: *C. japonica* 'Wendy' in bloom.)

THEATER

Alexandre Dumas (July 1824 – November 1895) was a French writer and dramatist, best known for *The Lady of the Camellias,* a novel first published in 1848. It was later adapted for the stage and premiered at the Théâtre du Vaudeville in Paris, France on February 2, 1852. The play was an instant success. Giuseppe Verdi immediately set about putting the story to music. His work became the 1853 opera *La Traviata*. In the English-speaking world, *The Lady of the Camellias* became known as *Camille* and 16 versions have been performed at Broadway theatres alone.

The title character is Marguerite Gautier, who is based on Marie Duplessis, the real-life lover of author Dumas. The theme of *The Lady of the Camellias* is a love story between Marguerite Gautier, a courtesan, a woman "kept" by various lovers including a young provincial bourgeois, Armand Duval. She is named the "Lady of the Camellias" because when she wears a white camellia she is available to her lover and a red one when her medical condition (tuberculosis) precludes making love. (Figure 5:

Figure 5: 'Mathotiana'.

Figure 6: 'Alba Plena'.

'Mathotiana', a lovely European red camellia that could have been worn by Marguerite to indicate she was not available; and Figure 6: 'Alba Plena', a white camellia to indicate she was available.)

Armand falls in love with Marguerite and ultimately becomes her lover, convincing her to turn her back on her life as a courtesan and live with him in the countryside. This idyllic existence is broken by Armand's father, who, concerned by the scandal created by the illicit relationship and fearful that it will destroy his daughter's chances of marriage, convinces Marguerite to leave Armand, who believes, up until Marguerite's death, that she has left him for another man. Marguerite's death is described as an unending agony, during which Marguerite, abandoned by everyone, is left regretting what might have been. (Figure 7: 'Royal Intrigue'.)

Figure 7: 'Royal Intrigue'.

POEM

Rabindranath Tagore (1861-1941) wrote a lyrical poem entitled "Camellia". The author was a Bengali and the first non-European to win the Nobel Prize in Literature in 1913. While not well known outside literary circles, his poetry was viewed as spiritual and magical. Tagore introduced new prose, verse forms and the use of colloquial language into Bengali literature, thereby freeing it from traditional models based on classical Sanskrit. He was highly influential in introducing the best of Indian culture to the West. He is generally regarded by literary experts as an outstand-

ing creative artist of modern South Asia. (Figure 8: The magical bloom 'Yours Truly'.)

LITERATURE

To Kill a Mockingbird is a novel set in a small fictitious Alabama town written by Harper Lee and published in 1960. It was immediately successful, winning the Pulitzer Prize, and has become a classic of modern American literature. The plot and characters are loosely based on the author's observations of her family and neighbors, as well as on an event that occurred near her hometown in 1936, when she was 10 years old.

The novel is renowned for its warmth and humor, despite dealing with the serious issues of rape and racial inequality. The narrator's father, Atticus Finch, has served as a moral hero for many readers and as a model of integrity for lawyers.

In the book Jem destroys Mrs. Dubose's camellia bushes out of anger due to insensitive comments she had made about his family.

Figure 8: 'Yours Truly'.

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Later on in the book, Jem is given a camellia bud by the dying Mrs. Dubose.

Jem represents the idea of bravery in the novel. When the story begins, Jem's idea of bravery is simply touching the side of the Radley house. As the story progresses, Jem learns about bravery from Atticus facing a mad dog, from Mrs. Dubose's fight with addiction, and from Scout's confrontation with the mob at the jail. He grows from a boy who drags his sister along as a co-conspirator to a young gentleman who protects Scout and tries to help her understand the implications of the events around her.

FASHION

Gabrielle Chanel, nicknamed Coco, was a fashion designer. Coco Chanel catered to women's taste for elegance in dress, with blouses and suits, trousers and dresses, and jewelry of simple design that replaced the opulent, over-designed, and constrictive clothes and accessories of 19th-century fashion. The House of Chanel is known for the "little black dress" and the perfume No. 5 de Chanel. Chanel's use of jersey fabric produced garments that were comfortable and affordable. Chanel revolutionized high fashion (haute couture) and everyday fashion by replacing structured silhouettes based upon the corset and the bodice.

The camellia had an established association with Alexandre Dumas's literary work, *La Dame aux*

Figure 9: 'White Perfection'.

Camélias. Its heroine and her story had resonated for Chanel since her youth. The flower itself had become identified with the courtesan who would wear a camellia to advertise her availability. Later when Coco Chanel was given a camellia by her polo playing lover she fell in love with the camellia. She started pinning silk versions to her lapels and her hair, and the blossoms found a home on the carved Chinese wooden folding screen coated in black-and-gold-lacquer in her apartment.

The camellia came to be identified with The House of Chanel, making its first appearance as a decorative element on a white-trimmed black suit in 1933. The camellia appealed to Chanel's taste of provocation due to its reference as the forbidden flower. Like Dumas' courtesan, without perfumes or thorns, the camellia seduces by its simplicity. Coco Chanel adored the pure white camellia for its form and perfectly ordered petals. The white camellias become her emblem, and the brand's signature, as they evoke the true spirit of Chanel. (Figure 9: 'White Perfection'.)

CINEMA

Akira Kurosawa is regarded as one of the most important and influential film makers in the history of cinema. Kurosawa directed 30 films in a career spanning 57 years. He entered the Japanese film industry in 1936 and made his debut as a director in 1943, during World War II, with the popular action film *Judo Saga*. After the war, the critically acclaimed *Drunken Angel* (1948), in which Kurosawa cast then-unknown actor Toshiro Mifune in a starring role, cemented the director's reputation as one of the most important young film makers in Japan. The two men would go on to collaborate on another 15 films. In 1990, he accepted the Academy Award for Lifetime Achievement.

In his 1962 black and white samurai film *Tsubaki Sanjuro* nine young samurai believe that the lord chamberlain, Mutsuta, is corrupt after he tore up their petition against organized crime. One of them tells the superintendent of this, and he agrees to intervene. As the nine meet secretly at a shrine and discuss their problem, Ronin, played by Mifune, emerges from another room where he had been resting. Ronin had overheard their plans, and suggests that the superintendent is in fact the real corrupt official. While at first the samurai are insulted by his claims, they

Figure 10: 'Standing Ovation'.

soon find themselves surrounded by the superintendent's men, proving that he was correct.

Ronin fights off the men; however, after realizing that Mutsuta and his family must now be in danger, he decides to help the samurai bring down the corrupt officials. Indeed, when the samurai go to Mutsuta's house, they find that he has been abducted and his wife and daughter are imprisoned in the house. Following Sanjuro's suggestion, a servant from the house gets the guards drunk, allowing the samurai to free the women. The group hides in a house next door to the superintendent's compound, which contains a large number of camellia trees.

Mutsuta's wife asks Ronin's name; looking out the window at the *tsubaki* (camellia) trees, which he can see over the fence separating the two properties, he invents the name *Tsubaki Sanjūrō*, meaning "thirty-year-old camellias". The lady chastises Sanjuro for using his sword too frequently and insists that he refrain from unnecessary killing, noting that the best swordsmen keep their weapons in their sheaths. (Figure 10: 'Standing Ovation'.)

WOMEN'S RIGHTS

White camellias became a symbol of New Zealand women's right to vote. In 1893 New Zealand became the first nation to have voting rights for women. The white camellia is featured on the front of the country's ten dollar note next

Figure 11: 'Victory White'.

to Kate Sheppard, who lobbied for women's suffrage in New Zealand, and between them is a map of New Zealand. The endangered blue duck (Whio) is on the back. The note has a light blue background with ferns. (Figure 11: 'Victory White'.)

ROCK BAND

Tsubaki is a Japanese rock band composed of three members. The band's name originated from the flower in the city of Matsuyama. The name was changed from Camellia to its current name Tsubaki in October 2002. The band was formed in 2000 by front man Isshiki Noriyasu when he went to Tokyo to study. Bassist Ogawa Hironaga joined next in March 2001, followed by Okamoto Naoko on drums, with its current lineup finalized in May 2002. On December 11, 2010, the band announced on its website that guitarist-vocalist Isshiki Noriyasu had been diagnosed with a brain abnormality and would undergo surgery. All Tsubaki activities were cancelled and the band would be on hiatus until further notice.

SHRINE

Tsubaki Grand Shrine of America is the first Shinto shrine built in the mainland United States. It was erected in 1987 in Stockton, California and moved to its current location in Granite Falls, Washington in 2001 on a pristine 25-acre site near Seattle. It is the North American branch of Tsubaki O Kami Yashiro, one of the oldest and most prestigious shrines in Japan with a history of over 2000 years. Originating in reverence for nature, Shinto is the practice of the philosophy of proceeding in harmony with and gratitude to Divine Nature.

Figure 12: 'Silver Tower'.

PEOPLE

Camilla is the feminine form of Camillus used in reference to young female ceremonial attendants in Ancient Rome. It is a name suitable for girls. However it is not currently a popular name for baby girls in America. A recent survey asked people to imagine a person with the name Camellia. The general response was a beautiful person, or as one respondent said, "a tall and flawless beauty". (Figure 12:'Silver Tower'.)

The Japanese name Tsubaki may be written with the character for camellia. This would be considered a very new name yet to earn popularity. For example, it is the first name of Tsubaki Nekoi, previously known as Mick Nekoi, who changed her name because she was tired of people telling her that she had the same name as Mick Jagger. She is a member of an all Japanese female magna creating group named Clamp. Magna is the brand name of an acrylic resin paint which is very different from modern acrylic paint, as it is composed of pigments ground in an acrylic resin brought into emulsion through the use of solvents.

Clamp's magna is distinguished by its diverse visual styles. Clamp's art changes frequently; however, most of their works have characters with highly detailed hair, heavily stylized eyes and human figures, and elaborate clothing. In addition, sweeping curved lines are common in their drawings.

Tsubaki can also be a Japanese surname. The best known is the 33-year-old Japanese actor Takayuki Tsubaki, who may be remembered for his role as Kazuma Kenzaki in *Kamen Rider Blade,* a Japanese superhero television series that aired in Japan 2004. Figure 13: 'Kuro-tsubaki', aka "the Black Camellia".)

CONCLUSION

A camellia flower at its best is a flawless beauty. This is why Gabrielle "Coco" Chanel used the camellia as the icon for her fashion house. When discussing fashion and its link to the camellia flower she said:

"The seeming simplicity of a masterpiece is sure proof of its grace."

Return to TOC

Cold Storage of Cut Camellias: A Brief Study

By Bradford King

There are two reasons a camellia grower would wish to refrigerate flowers. First is to hold blooms for a camellia show and second is to maintain flowers for home decorating.

What is the best method of cold storage of cut camellias? Typically the method I was taught by experienced camellia show winners was to place the camellias in small cups filled with water and a flower preservative used by florists. The flowers are supported by cotton filler and stored in covered boxes that are placed in a refrigerator at a temperature suitable for food preservation (37 degrees plus or minus 2 degrees). If one is fortunate enough to have a florist refrigerator there is no need for covered boxes.

Other camellia show exhibitors have touted the following method. Place wet cotton soaked in water and a flower preservative solution on the bottom of the box and place dry cotton on top to support the cut flowers so the petals are not in the liquid. This study investigated these two methods of preserving a fresh camellia flower.

METHOD

On February 29 (Leap Year) BOX ONE (Cotton filler, medium cups filled with a solution of water crystal solution with blooms) and BOX TWO (Cotton very damp/wet with water crystal solution and dry cotton filler on top with flowers on top) had matched pairs of randomly assigned flowers of the following cultivars placed in each box: 'Frank Houser', 'Grand Prix', 'Adolphe Audusson Variegated', 'Curtain Call', 'Wildfire' and 'White Bouquet'. The identical boxes with lids that fasten tightly were stored in a refrigerator at a temperature of 38 degrees F.

RESULTS:

The boxes were opened and observed after seven days on March 7, 2012.

Box One:

'Wildfire' and 'Grand Prix' were off the calix with no visible spots. 'White Bouquet' and 'Adolphe Audusson Variegated'

Figure 1: Flower blight.

had numerous brown spots. 'Curtain Call' and 'Frank Houser' looked fresh but each had one small brown spot. 'Glen 40 Variegated' looked fresh and clean with no visible spots.

Figure 2: Camellia blight.

Box Two:

None of the flowers were off the calix. 'Wildfire', 'Grand Prix', 'White Bouquet' and 'Adolphe Audusson Variegated' had various numbers of brown spots. 'Curtain Call' had three spots and 'Frank Houser' had two brown spots. The only fresh unblemished flower was 'Glen 40 Variegated'.

DISCUSSION

Storing refrigerated cut camellia flowers for seven days using the methods described above was unsuccessful in maintaining blemish free flowers for the cultivars used in this study with the exception of 'Glen 40 Variegated'.

This leads to two conclusions. First, there were no appreciable differences in the two methods

of cold storage of cut camellia flowers. Second, the flowers of the cultivar 'Glen 40 Variegated' are good candidates for refrigeration. They maintained a fresh unblemished bloom for seven days.

Figure 3: Natural aging on petal edge and dark brown camellia blight in center.

While no flowers were sent for laboratory examination, there appeared to be normal aging and flower blight (*botrytis cinerea*) as the spots and blotches were tan or brown with a golden tint and randomly distributed like freckles and not camellia petal blight (*ciborina camellia*) which is dark brown mushy spreading from the center outward. (Figure 1: Flower blight.) (Figure 2: Camellia blight.) (Figure 3: Natural aging tan color on petal edge and dark brown camellia blight in the center.)

CONCLUSION

There are some camellia cultivars that only look their best when cut the night before or the day of a camellia show. However the vast majority can be maintained several days in a cool shady spot in the garden or in a refrigerator. This provides the grower an opportunity to maintain and show beautiful flowers. The challenge is how to keep a fresh unblemished flower for longer periods of time.

This study used seven days.

There are some camellias capable of lasting a week or more under cold storage. In this study it was 'Glen 40 Variegated', but experienced camellia show people are familiar with other good candidates. In this study fully opened flowers were used. A good strategy is to pick and cold store a bloom before it is fully opened. I have begun to place newly cut camellia flowers' stems in a grape the approximate size of a marble and then store them. This method reduces the humidity in the closed box that contributes to producing flower blight and will nourish the new cut bloom with sugary moisture.

Many of us have observed that some flowers actually improve when refrigerated. Careful observation and experimentation may reap great rewards for the dedicated grower.

Good Luck!

Return to TOC

Why Camellias Don't Need Pumps

Sequoia redwoods can reach over 300 feet.

Did you ever sit under a tree and look up at its foliage and wonder how the nutrient rich ground water moves up to the leaves at the very top? We know it travels upward through the xylem. The leaves take in carbon dioxide and expel oxygen and water vapor through stomata (pores).

But how does all this water move upward as if unaffected by gravity? Do camellias and even very tall trees have pumps?

Two Irish plant physiologists in 1895 believed that water is pulled through the plant by the creation of negative water pressure as water is lost through transpiration (moisture lost through the leaves). It turns out they were on the right track, but it would never account for water movement in tall trees. Water has the interesting property of cohesion where water molecules are held together by an oxygen atom which has a negative pole and two positive poles in the hydrogen atoms. When water molecules are bound together in very small tubes found in the xylem their opposite poles attract forming hydrogen bonds. These slender columns of water are very stable.

In summary, the transpiration as hypothesized by the Irish scientist produces the pull and the cohesion of water molecules allows the column of water to reach the top of even the tallest Redwoods (Sequoia *sempervirens*), which grow as tall as 379 feet. The leaves enrich the sap with sugars made through photosynthesis sending the nourishment through phloem tubes to the plant's tissue. **- By Bradford King**

Return to TOC

Those French ...

Figure 1: 'Clown' Epie.

Have a Name for Everything

By Bradford King

Perhaps you look back fondly to family trips together in the car. I remember saying to my parents, "Are we there yet?", and 20 years later hearing one of my kids asking the same annoying question. How did you all stay sane before iPads and video games? We played 20 questions, spotting different license plates and other games. When audio tapes became available we listened to stories and comedy routines. Comedians Bob Newhart and Steve Martin appealed to our family. Our oldest son even after 25 years, when in a party mood, can recite all Steve Martin's comedy routine, "Those French have a word for everything". I changed "word" to name" in this article title because hybridizers and nurseries that market azaleas, camellias, roses, daylilies, perennials and annuals, like the

Figure 2: 'Clown' Camellia. *Photo by Randolph Maphis*

French, have names for everything. But it is amazing how few have names that are identical. I went on a mission to find flowers that were given the same name as a camellia.

EPIPHYLLUM

These shade loving cactus were originally found in the rain and cloud forests of Central and South America. The exotic blooms thrilled early botanists but didn't become popular with the public because they bloomed late evening into the night, didn't last long, and had only white flowers. When hybridizers mixed species of the Epiphyllum (Epies) with a variety of other cactus plants, new shapes, flower colors and daytime blooms were obtained. Epies are epiphytes (plants that take water and nutriments from the environment) and use their roots to anchor them to a host plant. Today they are typically grown as terrestrial plants in a pot. I hang them from large trees or pergolas used to shade the camellias. There are about 8,000 hybrids to choose — from miniature (1 to 3 inches) to extra-large (12 to 15 inches) with a wide range of beautiful colors. They have culture requirements generally compatible with camellias — shade, moisture, fertilizer and soil. They are different in three

major ways. They bloom after the camellias in the spring, have ungainly unattractive plants and are very easy to propagate by cuttings. The gorgeous blooms are why they are grown. Many are fragrant.

One of my favorite Epies is **'Clown'**, which blooms large with white inner petals tipped with purple red tips. The *Camellia japonica* **'Clown'** has a medium peony flower with red, rose red, dark red and white fine stripes. While the flower shapes and colors are dissimilar the multi colors in the flower have the mixed colors associated with a circus clown. (Figure 1: 'Clown' Epie and Figure 2: 'Clown' Camellia.)

DAYLILIES

There are at least 60,000 Daylily (*Hemerocallis*) hybrids which is double the number of camellias cultivars. The beautiful daylily hybrids have a wide range of colors and beautiful markings. Many are remondant (reblooms in the same year). They grow 1 to 4 feet tall and wide with long slender green leaves that arch gracefully. The Daylily is low maintenance, excellent for landscaping, boarders, or containers. They have moderate water requirements and thrive in sun to partial shade. They are not fussy about soil requirements doing well in most garden soils. They are at their best in rich, well-drained soil. They require minimal fertilizing but appreciate low nitrogen fertilizers once or twice a year after they bloom. Since most of us have cottonseed meal to use on the camellias, it is an excellent choice for daylilies. Daylilies originated in Japan, Siberia, Korea, China and Eurasia and are now grown throughout the states.

Thousands of cultivar names are unique to Daylily hybrids with only a few sharing their name with a camellia. I found only three: 'Midnight Magic', 'Tinker Bell', and 'Disneyland'. I'm sure there must be more. The one well known to camellia people is '**Midnight Magic'** named for its brilliant dark red. This 1985 Nuccio's introduction has a medium full peony flower with center petaloids that have white markings. Daylily growers are equally familiar with their '**Midnight Magic'.** It was introduced in 1979. The flower is described as 5 1/2 inches, black red with a green throat. The plant is evergreen with flowers borne on 28-inch scapes in early midseason. It may also rebloom in late summer or early fall. The beautiful dark red flower clearly is the rea-

Figure 3: ***'Midnight Magic' Camellia and Figure 4: 'Midnight Magic' Daylily.***

son they share the name. (Figure 3: 'Midnight Magic' Camellia and Figure 4: 'Midnight Magic' Daylily.)

While I was unable to track down the Daylilies 'Disneyland' and 'Peter Pan', the camellias are still seen in public gardens. Nuccio's Nurseries introduced the japonica **'Disneyland'** in 1960. The flower is a very large semidouble, peony to anemone flower rose pink with white moiré central petaloids. Walt Disney gave the Nuccios permission to name this camellia. It was publically introduced at The American Camellia Society convention and camellia show held at Disneyland Hotel in Anaheim, California in February 1961. (Figure 5: 'Disneyland' as a semidouble and Figure 6: 'Disneyland' as a loose peony flower.)

Peter Pan is a mischievous boy who can fly and who never ages. Peter Pan spends his never-ending childhood adventuring on the small island of Neverland as the leader of his gang, the Lost Boys. The japonica **'Peter Pan'** has a medium semidouble to full peony flower with a creamy base that shades to blush pink, becoming darker pink at the edges with an overall orchid pink tone. (Figure 7: 'Peter Pan' Camellia.)

ROSES

Camellias and roses both originate in Asia; camellias have their origins in the southeastern temperate areas and the rose in cooler regions of central and western Asia. Both have been cultivated for thousands of years appreciated for their beautiful flowers. The first roses were small, single flowers that bloomed once

Figure 5: 'Disneyland' as semidouble blossom.

Figure 6: 'Disneyland' as a peony.

Figure 7: 'Peter Pan'.

a year in a limited color range. The same is true with the first *C. japonica* and *C. sasanqua* flowers. Roses and camellias have come a long way from the simple early flowers. Modern roses are the Hybrid Tea, Floribundas, Grandflora and David Austin Hybrids/English Roses. The most common camellias grown today are *japonica, reticulata, sasanqua* and non-reticulata hybrids.

I was able to find seven *camellia japonicas* that share the same name as a rose: 'Black Magic', 'Bob Hope', 'Granada', 'Grand Prix' 'Prima Ballerina', 'Tiffany', and 'Wildfire'. All can be found in public gardens and are grown by specialty camellia or rose nurseries, except the roses 'Black Magic' and Grand Prix'. The camellias bearing those names are well known cultivars introduced by Nuccio's Nurseries. The former has a medium black red semidouble flower with waxy textured petals and the latter has a very large bright red semidouble bloom. (Figure 8: 'Black Magic' Camellia & Figure 9: 'Grand Prix' Camellia.)

Bob Hope, the famous comedian, is most well-known for his trips entertaining American troops. These performances began during World War II and later to the wars in Korea, Vietnam and the Middle East. These shows, many televised to the American public, became his

Figure 8: ***'Black Magic' and Figure 9: 'Grand Prix' Camellias.***

signature shows as they brought laughter during the most difficult times when America was at war. Bob was also known during the 1940s and 1950s for his work in radio, film and television where he acted, sang, and danced, but is most remembered as a comedian.

The **'Bob Hope'** camellia is a favorite like its namesake. It has a deep brilliant black red flower with purple-black markings on its buds and irregular petals. It was introduced by Nuccio's Nurseries, Altadena, California in 1972. It first bloomed in 1969 from a 9-year-old seedling. It has a large to very large flower that blooms from mid to late season. The plant growth is upright, dense, and medium in rate. The foliage is dark green, making this japonica a great landscape plant. Joe and Julius Nuccio, the founders of Nuccio's Nurseries, named this flower 'Bob Hope' upon the recommendation of Ralph Peer, a past president of the American Camellia Society and friend of Bob and Dolores Hope. It is unclear if Bob ever visited Nuccio's but it is known that Dolores did.

The **'Bob Hope'** rose is a bright red hybrid tea introduced in 1959. The hybrid tea is an informal horticultural group of roses that characteristically are well formed with large, high centered bud centers supported by long, straight upright stems, making them popular as cut flowers. They are the most popular roses grown today due to their color and form. (Figure 10: 'Bob Hope' Camellia & Figure 11: 'Bob Hope' Rose.)

Granada, a popular name in the flower world, is the name of a large city in southern Spain founded in the 8th century and also of a city in Nicaragua located on the northwestern shore

Figure 10: 'Bob Hope' Camellia.

Figure 11: 'Bob Hope' Tea Rose.

Figure 12: Ralph S. Peer.

of Lake Nicaragua. There is a **Granada** variety of a camellia, daylily, onion, English pea, watermelon, tulip, hosta and a rose. The camellia **'Granada'**, introduced by Ralph Peer in 1968, is a large to very large, vivid red semidouble to peony. It grows vigorously and upright. The **'Granada'** rose has scarlet and nasturtium yellow petals. This hybrid tea rose is a 1964 All American Rose Selection (AARS). The AARS is a nonprofit organization of growers and introducers dedicated to the introduction and promotion of exceptional roses. (Figure 12: Ralph Peer, Figure 13: 'Granada' Camellia, & Figure 14: 'Granada' Rose .)

Camellias can also win awards as outstanding cultivars. One example is **'Tiffany'**, a flower as lovely as any jewel one can see in the famous Tiffany stores. It has a gorgeous ruffled loose peony to anemone flower that reaches over 5 inches in size. The flower is an orchid pink that shades to deeper pink at the petal edges. It blooms mid to late season on a vigorous upright plant. It was introduced to the camellia world in 1962 by Dr. J.C. Urabec of La Canada, California. It was grown from seed provided

Figure 13: 'Granada' Camellia.

Figure 14: 'Granada' Tea Rose.

by Ralph Peer. This cultivar has received many awards: the Margarete Hertrich Award, 1964; the John Illges Award, 1966; the William E. Woodroof, Camellia Hall of Fame Award, 1978; and the National Camellia Hall of Fame Award, 1978.

The rose **'Tiffany'** is a hybrid tea that grows 4 feet tall. The flowers are a lovely orchid pink just like the camellia that shares the name. It, too, is an award winning bloom. It was a 1955 AARS selection. (Figure 15: 'Tiffany' Camellia & Figure 16: 'Tiffany' Rose.)

Prima Ballerina is a title given to the most notable of female ballet dancers, and one of the most famous to be given this honor was Anna Pavolva. She was the first prima ballerina to travel around the world and is most remembered for creating the role of The Dying Swan. The *Camellia japonica* **'Prima Ballerina'** has a medium to large light pink flower that tones deeper on the wavy petal edges. It blooms mid to late season on a semi-dwarf compact upright plant and is a good choice for a spot under a window as this su-

Figure 15: 'Tiffany' Camellia.

Figure 16: 'Tiffany' Tea Rose.

Figure 17: 'Prima Ballerina Variegated' with hummingbird.

perb shrub stays neat, compact and small.

The rose **'Prima Ballerina'** is a cherry rose pink hybrid tea. The blooms start as long pointed buds that open to a medium to large very fragrant flower. It was introduced in 1957 and is still popular today. The one I see in the Huntington Rose Garden

Figure 18: 'Prima Ballerina' Rose.

Figure 19: 'Prima Ballerina' Camellia.

is struggling, causing the rose curator to make several grafts in order not to lose this cultivar. In the past most hybrid tea roses were propagated as grafts on vigorous root stock. This is a labor intensive method of propagating the thousands of roses needed for American gardens. The modern rose introductions

are now selected to include vigorous growth as well as beautiful fragrant flowers so they can be propagated by cuttings, a more economical way to bring cultivars to the public.

(Figure 17: 'Prima Ballerina Variegated' Camellia with hummingbird feeder, Figure 18: 'Prima Ballerina' Rose & Figure 19: 'Prima Ballerina' Camellia.)

The famous **Rose Parade** is held on New Year's Day in Pasadena, California. Flower covered floats, marching bands, and equestrians are watched in person by hundreds of thousands of spectators along the five mile parade route and are seen by millions more on television worldwide in more than 200 international territories and countries. The Rose Bowl college football game was added in 1902 to help fund the cost of the parade.

The camellia '**Rose Parade'** is a medium deep rose pink formal double. It is a 1969 nonreticulata hybrid introduced by Nuccio's. The '**Rose Parade'** rose is a pink toned floribunda. Floribunda roses are noted for producing many flowers in clusters on a vigorous bushy plant thus providing a mass of color in the garden. (Figure 20: 'Rose Parade' Camellia & Figure 21: 'Rose Parade' Rose.)

The name **Silverado** is a form

Figure 20: 'Rose Parade' Camellia.

Figure 21: 'Rose Parade' Rose.

of Spanglish (a blend of Spanish and English) indicating a place where silver is found. Silverado is a California Historical Landmark community founded in 1887 in Silverado Canyon in the Santa Anna Mountains in Orange County, California where silver was mined during the 19th century. The **'Silverado'** camellia is generally grown for its frosty, light gray small leaves. This *saluenensis* hybrid flower is a white medium single with a

Figure 22: 'Silverado' Camellia.

Figure 23: 'Silverado' Rose.

faint rose border. The rose **'Silverado**' is one of the finest lavender roses with a silvery lavender bloom edged with a touch of pink. The camellia foliage of silver gray and the rose flowers blend of silver lavender are the characteristic that gives the plant its name. (Figure 22: 'Silverado' Camellia & Figure 23: 'Silverado' Rose.)

Wildfire season begins in spring and continues throughout the summer and is especially dangerous in dry conditions and heavy winds. It can destroy acres of forest, homes and human life. Armies of dedicated firefighters assemble to fight major fires. The camellia **'Wildfire'** is a medium semidouble bright red with a cluster of yellow stamens. I can enjoy its blooms beginning in December and peaking midseason, yet continuing to April. It is a special camellia to me as the resident hummingbirds rest in its branches, occasionally sipping nectar from flowers, with the dominant male chasing others from the window feeder all winter. I sit at the computer writing camellia stories and answering e-mails, enjoying the flowers, hummingbirds and other birds seeking insects in this camellia. Perhaps you, too, have a special camellia that gives you great joy. The Rose **'Wildfire'** is a bicolor red and orange, capturing the two major colors of flames seen leaping and flashing during a fire storm. (Figure 24: 'Wildfire' Camellia & Figure 25: 'Wildfire' Rose.)

There is also a *reticulata* camellia that shares the same name with rose cultivars. The *C. reticulata* '**Flower Girl'**, developed by Howard Asper in 1965, has a large to very large semidouble to peony pink flower. The rose '**Flower Girl'** has pink buds that open to a pale pink flower that bleaches to almost white in the sun. It is a small shrub type

Figure 24: 'Wildfire' Camellia.

Figure 25: 'Wildfire' Rose.

rose used as a border or in the foreground in the garden. The only similarity between these two cultivars is the pink colored flower. A mature 'Flower Girl' camellia is a small tree while the rose is a small shrub. The camellia flower is at least 5 inches while the rose is less than 3 inches. (Figure 26: 'Flower Girl' Camellia & 'Flower Girl' Rose.)

AZALEAS

The flowering azalea shrub has contributed as much as any other flowering shrub to gardens in America. The range of color and varieties when properly planned can give the garden blooms from October through June in Southern California. Azaleas can be grown in pots, mass displays, specimens, trees, espalier and hedges. However, they are most impressive in drifts. They do best with some shade. Trees that provide dappled sunlight are great choices. Where there are no trees they will do well on the east or north side of build-

Figure 26: 'Flower Girl' Camellia.

Figure 27: 'Flower Girl' Rose.

Figure 28: Satsuki Azalea Bonsai.

ings or a fence, and in coastal areas many will thrive in full sun. However, the Southern Indicas are best suited for planting in the full sun. They are azaleas that are famous in southern gardens. In addition there are cold hardy azaleas (Gable) for northern gardens.

Azaleas are generally disease free plants, but they are susceptible to azalea petal blight caused by the *Ovulinia azaleae* fungus. The disease develops during periods of moist weather at flowering time, but can be controlled by picking off any diseased flowers from the previous year's blooms and removing leaf litter beneath the infected plants. A fungicide applied just before new buds open works well. The best time to spray is when the green buds begin to show their flower color. For continuing protection, spray again every 7–10 days throughout the blooming season. Unfortunately petal blight and flower

Figure 29: 'Arcadia' Camellia.

Figure 30: 'Arcadia' Azalea.

blight in camellias is not controlled by applications of fungicides.

There are at least a half dozen camellia and azaleas that have the same name.

Arcadia is an affluent community in Los Angeles County, California, United States, and located approximately 13 miles northeast of downtown Los Angeles in the San Gabriel Valley at the base of the San Gabriel Mountains. It is the site of the Santa Anita Park race track and home to the Los Angeles County Arboretum and Botanic Garden. The city has a population of about 60,000 and is named after Arcadia, Greece.

The camellia hybridizer Meyer Piet and his wife Bev raised their family in Arcadia. Meyer and Lee Gaeta bred and grew camellias in their back yard. They registered 16 *C. reticulata hybrids,* 12 *C. japonica*, and nine *non reticulata hybrids.* They named most of these cultivars for family and friends. One notable exception is **'Arcadia'** named for his home town. The flower is a very large semidouble to loose salmon pink *reticulata*.

Nuccio's Nurseries named a rose pink bordered medium single blossom, with a pale center, Satsuki hybrid azalea **'Arcadia'** in honor of the city's 2003 centennial. Satsuki azaleas originated in Japan where they have been enjoyed for several centuries due to their adaptability to bonsai culture. (Figure 28: Satsuki Azalea Bonsai.) They have dense growth habits that bloom late season (May-June). Satsuki means May, hence the name. They are evergreen spreading making them great in pots but also as landscape plants that extend the blooming season. Nuccio's Nurseries may be best known by readers of this publi-

cation for camellias; however, they also are famous for breeding azaleas. They are responsible for importing and popularizing the Japanese Satsuki azalea. They have introduced 25 Satsuki hybrids and over 100 azalea cultivars. (Figure 29: 'Arcadia' Camellia & Figure 30: 'Arcadia' Azalea.)

The Grimm Brothers story of Little Red Riding Hood is a favorite children's story we remember being read to us and years later reading to our own kids and grandchildren. It begins, "Once upon a time there was a dear little girl who was loved by everyone who looked at her, but most of all by her grandmother, and there was nothing that she would not have given to the child. Once she gave her a little riding hood of red velvet, which suited her so well that she would never wear anything else; so she was always called 'Little Red Riding Hood'." There is a special relationship between grandparents and grandchildren that is cherished by both. Those who grow *C. japonica* '**Little Red Ridinghood'** cherish this 1965 McCaskill introduction. The miniature to small formal double to peony red flower was awarded the John Tyler Miniature Award in 2012. The Kurume azalea hybrid **'Nuccio's Little Red Riding Hood'** has a very small brilliant orange red bloom. The Kurume azalea, with small flowers that bloom profusely on a dense compact plant, has been a garden favorite for over a century in Japan.

The Nuccios have introduced 20 Kurume hybrids, 80 Carnival hybrids (large blossoms with a long flowering season on vigorous sun tolerant plants), 28 Belgium hybrids, five Nuccio's Dragon Azaleas (cluster blooming spider chrysanthemum like flowers), and 28 miscellaneous azaleas noted for growing well in Southern California's hot dry climate.

Nuccio's Nurseries has introduced two other Kurume azaleas that share names with camellias: '**Nuccio's Jewel Box'**, which has a rose pink hose in hose bloom, and '**Apple Blossom'**, a white single with pink tipped petal edges. The camellia *saluenensis* hybrid named **'Jewel Box'** has a small single white flower with a soft rose red border. This plant is a dwarf that grows in a tight rounded manner. The *C. sasanqua* **'Apple Blossom'** has a single white flower with blush pink petal edges. (Figure 31: 'Jewel Box' Camellia & Figure 32: 'Jewel Box' Dwarf & Figure 33: 'Apple Blossom' Camellia.)

Pink Lace is a lovely soft

Figure 31: 'Jewel Box' Camellia.

Figure 32: 'Jewel Box' Dwarf.

feminine material used in hundreds of dresses, gowns and other women's clothing. The *C. japonica* '**Nuccio's Pink Lace'** has a large, light pink anemone flower introduced in 1987. The azalea **'Pink Lace'** is a sport of 'Duc de Rohan', which has a light pink with nice red spots in its throat with some white petal edges.

When browsing the Internet, I found Martha Stewart Weddings which highlighted a beautiful "White Wedding Bouquets Collection". There is nothing purer than a bouquet of white flowers. It is no wonder a bride might choose a white bouquet or that there are flowers named '**White Bouquet'.** In the camellia world we have a medium to large semidouble flower that blooms readily midseason. The azalea also has large semidouble flower. (Figure 34: 'White Bouquet' Camellia & Figure 35: 'White Bouquet' Azalea.)

Figure 33: 'Apple Blossom' Camellia.

CONCLUSION

Popular names for babies are very different today than they were in the past 80 years.

If you were born in the 1930s, the odds favor Robert, James, John, William, Richard and Charles for males and Mary, Barbara, Patricia, Betty, Shirley and Carol for girls. In the '40s the order of popularity changed and new names came into play. For boys Richard and David move up, and for the girls, Linda and Sandra. In the '60s the boy's

Figure 34: 'White Bouquet' Camellia.

Figure 35: 'White Bouquet' Azalea.

names are similar to those in the past with only Michael added, but the girls list added Lisa, Karen, Kimberly and Susan. Mary is always high for girls until very recently. Today the most popular names are very different than past generations. This year the boys are Liam, Ethan, Noah, Mason, Jacob and Jack, with the girls listed as Emma, Olivia, Sophie, Ava, Isabella and Mea.

Did camellia names change with the passage of time? Many older European camellias use title and personal names — Baron, Duchess, King, Queen which were never popular in America. There are many camellias named for family and friends. However, this practice is less used in the naming of other flowering plants. Nurseries most typically name flowering plants with colorful picturesque names to help identify and market the plants to the public.

Return to TOC

Seasonal changes and mutations in camellia flowers and leaves

Figure 1: Red Liquidambar.

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Figure 2: Yellow Ginko.

By Bradford King

When fall comes to New England, the deciduous trees turn beautiful shades of red, orange and yellow. There are many other parts of America where autumn foliage can also be en-

joyed. California has less dramatic seasonal changes than most other areas of the country so I count on the red leaves of the Liquidambar and the fan shaped yellow leaves on the Ginkgo *biloba* trees to enjoy fall foliage. (Figure 1 & 2: Red Liquidambar and Yellow Ginkgo.)

Deciduous tree leaves turn red, orange or yellow in the fall because the parent tree doesn't produce enough chlorophyll to keep them green. This condition causes pigments called anthocyanins to change the color of the leaves from green to the fall foliage colors.

Most leaves are green because they contain chlorophyll, a green pigment that when exposed to sunlight produces energy for plants.

RED LEAVES

Why then do some plants have red foliage? Why in particular do some camellias have new growth that has red hues? One theory supported by research is that red tone leaves help the plant survive insect damage. Harvard biologist Marco Archetti showed that aphids are less likely to survive from fall to spring in apple trees with red leaves than those with green leaves. Archetti believes the color red may signal danger to insects, thus causing avoidance.

According to *Ask Nature*, two hypotheses may work together to explain red pigmentation in leaves. First, insects that prey on leaves are visually adapted to the color green and red leaves may serve as camouflage for plants. Second, these same insects are normally green in color and thus are more apt to become prey themselves on a red leaf.

We know that some camellias produce new red-toned foliage in the spring. This includes among others *C. japonica* 'Tama Peacock', *nonreticulata* hybrid 'Night Rider' and *Camellia assimilis*. As the leaves mature they become green like most camellias. It may be that these spring red-toned leaves are less attractive to insect pests like aphids, helping them survive and develop into healthy mature green leaves.

However, questions remain. If anthocyanins fulfill important physiological or ecological function for certain plants including a few camellias, why aren't more plants producing red foliage? And for that matter why don't the leaves on camellias remain red all the time? Perhaps the plant requires the green chlorophyll leaves because they produce more food than red ones. Consequently it is desirable to have new red foliage to ward off insect-like aphids that prefer tender new spring foliage which then turn green to produce more

Figure 3: 'Tama Peacock' (Typical). - *Photo by Bradford King*

food for the plant all year long.

Until the scientists figure this out, I enjoy the bronze red of the new foliage on 'Tama Peacock' and the bright red of *Camellia assimilis*. (Figure 3: 'Tama Peacock' & Figure 4: *C. assimilis*.)

We know from Dr. William Ackerman's investigation that 'Kuro Tsubaki', the parent of a number of dark red camellia flowers including 'Night Rider', has one long chromosome responsible for the dark red flower, stem and roots. Is it also a factor in producing new red foliage? (Figure 5: 'Night Rider' leaves and roots.) Dr. Ackerman wrote, "The long chromosome in 'Kuro-tsubaki' apparently originated from unequal reciprocal translocation between a chromosome pair, resulting in one chromosome with a duplication of chromosomal material and one with a deficiency". (*Beyond the Camellia Belt,* page 171)

'Red Leaf Bella' is a sport of 'Nuccio's Bella Rossa' that the Chinese have propagated. It is

Figure 4: *C. assimilis* (Leaves only). - *Photo by Bradford King*

Figure 4: *C. assimilis* (Foliage and flower). - *Photo by Gene Phillips*

available in nurseries in China because of its beautiful flower and dark red new foliage. At this time it is not available outside China but Nuccio's Nurseries have several plants in propagation for future release. Mutations, or sports, are attributed to "jumping genes".

These "jumping genes", or transposable elements (TEs) were first identified by geneticist Barbara McClintock more than 50 years ago, a discovery that earned her a Nobel prize

Figure 5: 'Night Rider' red leaves. - *Photo by Bradford King*

Figure 5: 'Night Rider' red roots. - *Photo by Bradford King*

in 1983. Other biologists were initially skeptical of her discovery. However, over the years, it became apparent that not only do TEs "jump," but they are also found in almost all organisms. Typically they occur in large numbers. For example, researchers have discovered TEs make up approximately 50% of the human genome and up to 90% of the maize genome. Corn (maize) has been extensively investigated due to its agricultural importance.

Indian corn is famous for its beautiful patterns of red and yellow stripes and spots, making it an excellent visible example of mutations caused by "jumping genes". (Figure 6: Indian corn.)

What is a TE? It is a DNA sequence that can change its relative position by self-transposing within the genome of a single cell.

Transposition can create phe-

Figure 6: Indian Corn has "jumping genes". - *Photo by Bradford King*

notypically significant mutations and alter the cell's genome size. Transposable elements are only one of several types of mobile genetic elements. They are assigned to one of two classes according to their mechanism of transposition, which can be described as either "copy and paste" (for class I TEs) or "cut and paste" (for class II TEs).

Class I (retro transposons) copy themselves in two stages, first from DNA to RNA by transcription, then from RNA back to DNA by reverse transcription. The DNA copy is then inserted into the genome in a new position. Reverse transcription is catalyzed by a reverse transcriptase, which is often coded by the TE itself. Retro transposons behave very similarly to retroviruses, such as HIV.

During the 1940s and 1950s, McClintock discovered transposition and used it to show how genes are responsible for turning physical characteristics on or off.

What do all these jumping genes do, besides jump? Much of what a transposon does depends on where it lands. McClintock discovered that transposons are segments of DNA that can move around to different positions in the genome of a single cell. In the process, they may cause mutations like we see in 'Red Leaf Bella'. (Figure 7: 'Red Leaf Bella')

Figure 7: 'Red Leaf Bella'.
- Photo by Bradford King

VARIEGATED FOLIAGE

There are also other camellia mutations that appear in the plants foliage. A number are very interesting and attractive. A lovely example is the 'Showa-no-sakae benten', a foliage sport of *C. sasanqua* 'Showa-no-sakae' seen here growing in the Chinese Garden at The Huntington Botanical Gardens in San Marino, California. The name means Glory of the Showa era. The word *benten* is used in Japan to indicate a variety on which the leaf is darker in the center and bordered by a lighter margin. (Figure 8: 'Showa-no-sakae benten' & 'Showa-no-sakae'.)

Benten is the Japanese Goddess of Beauty. According to mythology, *Benten* was said to have descended to earth where she met and married a dragon in order to stop him from eating young children. We assume that

Figure 8: 'Showa-no-sakae benten'. - *Photo by Bradford King*

***Heimalis* 'Showa-no-sakae'.** - *Photo by Bradford King*

the foliage the Japanese refer to as *benten* is due to the beauty of the light colored border around the dark center of the leaf.

Camellia japonica sub species *rusticana* 'Taiyo' (The Sun) has rich green foliage with an irregular yellow pattern in the center of the leaf. The flower is a medium single coral rose that looks good against the variegated foliage. It originated in Japan and is seen occasionally in American gardens. It also makes an attractive bonsai camellia. (Figure 9: 'Taiyo' bush in bloom & 'Taiyo' bonsai.)

Figure 9: 'Taiyo' bonsai. - *Photo by Bradford King*

CAMELLIA FLOWERS THAT JUMP

Most camellias produce fairly consistent flower colors year after year even when provided minimal care. They may not be show quality blooms but the

Figure 9: 'Taiyo' bush in bloom. - *Photo by Bradford King*

Figure 10: 'Tama Americana' (Rose red).

'Tama Americana' (Typical).

'Tama Americana' (Almost white).

flower colors don't jump from one color to another. However, a few cultivars have flowers that jump around. The Tama family comes to mind. For example 'Tama-no-ura' tends late in the blooming season to lose its distinctive white border. The flowers on 'Tama Americana' jump from almost all rose red to almost exclusively white with just a splash of red in the center. It is most frequently a medium semidouble rose red bloom with a wide white border. (Figure 10: 'Tama Americana' blossoms in various colors all from the same bush.)

Why do these flower colors jump around? We know what makes the white border on 'Tama-no-ura', thanks to Tateishi, Ozaki, and Okubo from Kyushu University, Fukuoka, Japan. They "demonstrated that the white picotee part lacked an accumulation of anthocyanins, and it was caused by the gene suppression of chalcone synthase." (*International Camellia Journal* 2010, page 114) Basically chalcone synthase are enzymes associated with organic compounds found in plants as a natural defense mechanism. Anthocyanins are water soluble compartments of pigments that may appear red, purple, or blue according to pH. Therefore when the red flower pigment compartments on the petal margins of 'Tama-no-ura' are suppressed, it produces a white border. Does this mean that the amount of gene suppression is variable hereby producing different amounts of white on the flowers? Is the change in gene

Figure 11: 'Tama Peacock' (At its best). - *Photos by Bradford King*

'Tama Peacock' (Maroonish).

'Tama Peacock' (More white).

'Tama Peacock' (Reddish).

suppression influenced by environmental factors? Does it mean that the genes jump around -- individual cells are turned off to produce the white border on 'Tama-no-ura'? We can observe that this is not a flower mutation as the next camellia season the same branches produced lovely picotee flowers. 'Tama Peacock' also shows a color range especially mid-to-late season. (Figure 11: 'Tama Peacock'.)

CONCLUSION

We end with the iconic mind twisting multiple questions found on many scholastic and licensing exams.

Are the color differences on 'Tama Americana' and 'Tama Peacock' flowers?

A. Mini mutations due to jumping genes.

B. Caused by environmental variables.

C. Both A and B.

D. None of the above.

We don't have definitive studies to know the correct answer. Personally I suspect C -- that there are environmental factors interacting and triggering genetic changes at the cellular level.

Return to TOC

Colorful camellias make beautiful gardens

Article & Photos by Bradford King

The key reason the camellia world is such a beautiful place is the range of colors in the flowers. We are surrounded by colors in our homes, gardens, forests, markets, stores, movies, and television. How do we learn to differentiate among colors? How can we describe a color to another person? How do we identify the many hues in camellia blooms?

How do children learn colors?

Parents show children an object saying, "This block is red, this apple is red, and this fire engine is red." Children learn to associate objects and colors until the malleable brain intuitively gets the principle. By the time a child gets to nursery school he or she has learned and understands color, emotions and meanings like, "Roses are red, Violets are blue, Sugar is sweet and so are you."

We continue to refine our color perception as we grow and learn throughout life. We shop for clothing, decorate our homes and identify flowers based on a number of criteria with color one of the major factors. In camellia show judging, size, color, form and condition are each worth 25 percent. We can usually agree to general color hue — white, yellow, orange, pink, red, blue and black. But can we agree on different color tones? For example red camellias are described in the *Camellia Nomenclature* and nursery catalogues as follows: bright red, brilliant red, dark red, very dark red, burgundy red, rose red, flame red, salmon red, maroon, purplish red, and even turkey red. What is the difference between a pale pink and soft pink flower, or light yellow and a creamy yellow bloom? Color names may mean different things to different people. Some names have little meaning to the majority of people, for example, langite green or spinel pink. What can we do to bring clarity to this issue?

Flower color identification

The Royal Horticultural Society Colour Chart (RHS) is a

RHS color chart fan.

standard reference for plant color identification. The RHS chart can be used for identification of flower colors.

The chart has been specially developed to match nature's own colors. The colors are arranged in four fans and each color patch has a central porthole which can be laid over the object being matched. The fans come with full instructions in six languages. A color is defined by three attributes: **Hue**, the dimension which decides what color it is — red, green or blue; **Brightness**, the total amount of light reflected by each color that is a position from light to dark on a scale; and **Saturation**, the purity, brilliance or intensity. This means that any other color mixed with another color reduces the saturation.

It is recommended that the chart be used by examining colors indoors in the same lighting by placing the flower under the hole in the color patch so that it can be matched. Always use the same background; match two or three average blooms just fully open and never match colors if the eye is fatigued.

Investigation of camellia flower colors

In this color investigation the

Camellia Nomenclature 2009 color descriptions were used. Three newly opened natural flowers of each cultivar were observed using the RHC color chart to determine its color number. The results are as follows:

'Red Hots' (brilliant red) received a C. Azalea rating of 45 B.

'Grand Slam' (brilliant dark red) received a RHS rating of 47B.

'Kramer's Supreme' (turkey red) received a RHS rating of 45D when dark red and light red, 54B.

'Maroon and Gold' (maroon) received a RHS chart rating of 46A.

Royal Velvet' (dark velvet red) received a RHS chart rating of 46A.

'Wildfire' (orange red) received a RHS chart rating of 45B.

Camellia azalea (bright red) received a RHS chart rating of 43A and 44A.

'Frank Houser' (red) received a RHS chart rating of 58B.

'Koshi-no-yos'oi' (clear pink) received a RHS chart rating of 56B.

'Egao' (pink) received a RHS chart rating of 55C.

Discussion

I began this investigation with optimism. The promise of using the RHS chart to describe colors objectively was appealing. However, I found that it was actually very difficult to match flowers with the color charts. Further when three raters were used, they frequently differed in their ratings. In scientific studies the general practice is to take ratings and then do a correlations study to determine reliability (consistency) among judges. The reliability coefficients are expected to be very high, 90 to 98 percent agreement.

Finally, color chart ratings of numbers and letters held little meaning to most camellia people.

Therefore, using descriptive color continuums anchored by the use of specific camellia cultivars would be much more usefully to camellia hobbyists.

The Red Continuum would be as follows:

1. Black Red: 'Kuro-tsubaki', 'Night Rider', 'Black Magic' .
2. Very Dark Red: 'Royal Velvet', 'Maroon and Gold', 'Cherries Jubilee'.
3. Dark Red: 'Grand Slam', 'Midnight'.
4. Red: 'Red Hots', 'Wildfire', 'Glen 40', 'Grand Prix', and 'Kramer's Supreme' - red form.

Pictorial RED Camellia Continuum

Dark

‘Kuro-tsubaki’

‘Royal Velvet’

‘Grand Slam’

Light

‘Red Hots’

C. azalea

Pictorial PINK Camellia Continuum

Dark

‘Katie’

‘Pink Perfection’

‘Tiffany’

Light

‘Nuccio’s Pink Lace’

‘Kewpie Doll’

‘Grace Caple’

Pictorial YELLOW Camellia Continuum

Dark

C. nitidissima

'Kagirohi'

'Lemon Glow'

Light

C. tunghinensis

'Honeymoon'

'Buttermint'

Pictorial CORAL PINK Camellia Continuum

Dark

'Curtain Call'

'Coral Delight'

'Coral Bouquet'

Light

'Island Sunset'

'Cupcake'

Pictorial LAVENDER Camellia Continuum

Dark

'Princess Lavender'

'William's Lavender'

'Little Lavender'

Light

'Lavender Swirl'

'Star Above Star'

Pictorial WHITE Camellia Continuum

Dark **Light**

'Junior Prom'

'Elegans Champagne'

'Silver Triumph'

5. Light Red: *C. azalea,* 'Kramer's Supreme' - light form.

The Pink Camellia Continuum would be as follows:

1. Dark Pink: 'Katie', 'Valley Knudsen', 'Valentine Day'.

2. Pink: 'Pink Perfection', 'Hishi-karito', 'Debbie', 'John Hunt'.

3. Light Pink: 'Tiffany', 'Debutante', 'LASCA Beauty' and 'Queen Bee'.

4. Blush Pink: 'Nuccio's Pink

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Lace'.

The Yellow Camellia Continuum would be as follows:

1. Golden yellow: *C. nitidissima*, *C. chuangtsuoensis*.
2. Yellow: 'Kagirohi'.
3. Light yellow: 'Lemon Glow', 'Senritsu-ko', 'Ki-no senritsu', 'Alice du Ponte'.
4. Pale yellow: *C. tunghinensis*, 'Solstice',' Dahlonega', 'Kicho'.
5. Creamy: 'Honeymoon', 'Golden Glow', 'Buttermint'.

The Coral Pink Camellia Continuum would be as follows:

1. Deep Coral Pink: 'Curtain Call'.
2. Dark Coral: 'Coral Delight'.
3. Coral: 'Coral Bouquet'.
4. Light Coral: 'Island Sunset' (shades to darker coral).
5. Very Light Coral: 'Cupcake' (shades to white).

The Lavender Camellia Continuum would be as follows:

1. Purple: 'Princess Lavender'.
2. Dark Lavender: 'William's Lavender'.
3. Lavender: 'Little Lavender'.
4. Light lavender: 'Lavender Swirl'.
5. Very Light Lavender: 'Star Above Star' (shades from lavender to white).

The White Camellia Continuum would be as follows:

1. Blush: 'Junior Prom', 'Commander Mulroy', 'Twilight'.
2: Creamy: 'Elegans Champagne', 'Buttermint Creamy to pale yellow, French Vanilla.
3. White: 'Silver Triumph', 'White Bouquet', 'Melisa Ann', and 'Man Size'.

Conclusion

Flower identification, especially of older cultivars and those not widely known, is a challenge even for the well informed. Color of the blooms is only one way used to make a positive identification. A color is a combination of hue, brightness and saturation. Flower color is complicated by weather, soil, and culture among other variables. In addition, flower size, form, shape of petals and petaloids when present are also keys in identification. The plants growth habit and foliage color, size, and shape are needed to make an accurate identification of camellia cultivars.

Return to TOC

Figure 5: An intimate family home tea service.

How Tea Changed

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Photo by Bradford King

the World

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By Bradford King

Tea *(Camellia sinensis*) changed the world in many ways over the centuries. Worldwide it is second to water as the drink of choice. The history of tea is long and complex, spreading across multiple cultures and thousands of years. Although many stories are told about the beginnings of tea being used as a beverage, no one is sure of its origins. One popular legend is that Shennong, Emperor of China, was drinking a bowl of just boiled water when a few leaves from a tea tree blew into the bowl which changed its color. The emperor took a sip and enjoyed the flavor. Another version is that the emperor was testing on himself the medical properties of various herbs, some of them poisonous, finding tea worked as an antidote.

SANITATION

The key element is that tea is brewed in boiling water. The boiling of water for tea sanitized the water thereby greatly reducing illness and death. One of the major causes of disease and death was contaminated water. Early generations bathed, washed clothing and were unaware of the need to separate human elimination from their source of drinking water. Even in industrial nations clean drinking water was not always avail-

Figure 1: Tea master symbolically cleans tea utensils with silk cloth. - *Photo by Bradford King*

able. In Europe the French drank wine, Germans drank beer, and the British drank ale, instead of water, which was all too frequently contaminated.

Consequently when tea was introduced, especially to the British Isles, productive work was greatly improved. The brewed tea was disease free, contained caffeine and antioxidants, improving health and energy.

SERENITY

Tea began in China and spread to Japan where it became connected to Zen Buddhism. Monks who spent hours in meditation found that the stimulants in tea kept them awake and alert as they meditated. Elaborate tea rituals evolved over time. In the tea service a sweet is first served to guests to balance the bitter taste of the tea. The tea utensils are purified symbolically with a silk cloth. (Figure 1: The symbolic purification of tea utensils.) Invited guests also symbolically cleaned themselves at a water fountain before entering the tea house. The pace is slow to help bring a relaxing, pleasant, and respectful tone to the ceremony. A tea house is frequently located in a beautifully landscaped garden. (Figure 2: Descanso Garden Tea House setting.) A parchment scroll with the word for the day is hung near a vase containing

Figure 2: Setting for the Descanso Garden Tea House. - *Photo by Bradford King*

a single flower. These rituals bring simple beauty, peace, and serenity to participants. Four examples of tea service are illustrated in the following pictures. The first is a Westernized tea service bench (Figure 3), the second is a more traditional tea service with a beautiful wall decoration (Figure 4), the third picture is an intimate family tea service (Figure 5 on the front page of this article), and the fourth is a tea service in the Huntington Gardens Tea House (Figure 6).

SUPPLY

China exported tea in the 1760's demanding silver in return. Opium from India was traded for tea. For three centuries after the arrival of the Europeans, China maintained a tight control over trade with Europeans. In the 1830's conflict broke out between China and the British over the trade of opium, which was causing severe problems in Chinese society. When the Chinese authorities began seizing and destroying chests of opium, the English declared war. The British, with their superior technology, attacked and defeated China. In the aftermath, the Chinese were forced to open several ports to English merchants and allow the ports to be governed by British consuls

Figure 3: A Westernized tea service bench. - *Photo by Bradford King*

Figure 4: A more traditional tea service with a beautiful wall decoration. - *Photo by Bradford King*

Figure 6: Tea service in the Huntington Gardens Tea House. - *Photo by Bradford King*

who were not subject to Chinese law. Hong Kong became a colony of the British Empire until 1997. This opened up trade of many goods including the supply of tea to European markets.

DEMAND

The demand for tea was so great that tea plantations moved worldwide. India is the largest producer of tea but retains 80% for their own people. Although 80 countries today grow tea, Kenya and Sri Lanka (Ceylon) are the largest exporters. Tea sales in the U.S. are expected to grow to nearly $8 billion by 2014 from its current $6.5 billion. Specialty tea sales were resistant to the slow economy and are a significant part of the increase in tea sales.

It is expected that tea consumption will continue to increase as health-conscious consumers choose tea for its medicinal benefit. It is predicted that the trend to specialty tea is following the trend set in the expansion of coffee sales. Starbucks and other coffee houses are adding specialty teas to their menus to attract new customers and to keep growing.

TEA'S ROLE IN AMERICAN INDEPENDENCE

At the beginning of the 18th century, tea arrived in Northern America, quickly becoming a desirable drink. Around that time, the British Empire decided to place taxes on the tea supply to the colonies of North America who were under their power. This decision greatly angered the American settlers who decided to boycott the taxed products in protest. Whenever the British ships arrived at the harbors laden with tea, the settlers would start demonstrations which forced the ships to leave without unloading their wares. The most famous occurrence in this regard was the "Boston Tea Party", during which a group of settlers boarded one of the ships anchored in the Boston harbor and started throwing hundreds of crates of tea from its deck into the sea. England retaliated by sending military forces to the harbor and shutting it down. This event marked the beginning of the American War of Independence.

MARKETING OF TEA

The invention of tea bags greatly helped to significantly increase the consumption of tea in America. A New York tea merchant by the name of Thomas Sullivan is credited with inventing tea bags in 1908. Sullivan, a New York tea importer, inadvertently invented tea bags when he sent tea samples to clients in small silk bags. His customers mistakenly steeped the

Figure 7: A cluster of Habersham Tea blossoms. - *Photo by Gene Phillips*

bags whole. Sullivan did not realize this until his customers started to complain that the orders they received were no longer in the silk sample bags. Silk was too expensive for bagging; therefore, he invented tea bags made of gauze. Most tea sold in the United States is in bags, although there is a growing demand for both the loose leaf teas and for the ready-to-drink iced tea. Many people believed that the first iced tea was served in the 1904 Saint Louis World's Fair. The Indian exhibit was trying to sell hot tea to visitors during the summer heat with low sales until the hot tea was cooled and served. This version may be an urban legend. Regardless of how iced tea came into being, it makes up about 85% of all tea consumed in America. Today it is very popular as an alternative to carbonated soft drinks. Iced tea is ubiquitous in restaurants, convenience stores, vending machines, and grocery stores. It may be freshly made on premises and is available in bottles and cans. It is also popular sweetened, unsweetened or with a variety of fruit flavors. Traditionally a slice of lemon was served with tea and today a mixture of lemonade and iced tea, an Arnold Palmer favorite. There are many alcohol drinks also made with tea. One of the most popular is Long Island iced tea.

CAMELLIA SINENSIS

Camellia sinensis is more than just an agricultural plant used to make tea. It is an attractive plant in its own right with lovely small blooms and interesting foliage. While most tea flowers are white, *C. sinensis* 'rosea' has pretty pink blooms. (Figure 7: White tea flowers and Figure 8: 'Rosea' tea blossoms.) The diversity of tea leaves is amazing. Examine the photo and read the tea leaves for yourself. (Figure 9.)

CONCLUSION

Tea has impacted and changed the world in many ways as an agricultural crop that has benefitted the health and wellness of people around the world, initially because brewing tea sanitized the beverage. In addition tea contains the mild stimu-

Figure 8: The *C. sinensis* 'rosea' tea plant has pink blooms. - *Photo by Gene Phillips*

lant we know as caffeine which helped Buddhist priests while meditating, as well as millions of people worldwide stay awake and alert, whether farming, tending to children, or working in an office or industrial plant. Green and black teas have as many or more antioxidants than in fruits and veggies. Studies of humans and animals show that the antioxidants in black and green teas are highly beneficial to our health, according to 82-year-old John Weisburger, PhD, senior researcher at the Institute for Cancer Prevention in Valhalla, NY, who has published over 500 articles in his career. Traditional Japanese tea ceremonies or a cup of tea enjoyed at home or work is both relaxing and energizing.

Figure 9: Read the tea leaves. - *Photo by Gene Phillips*

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LEFT: ProGibb 'Richard Nixon' RIGHT: GA3

A Comparison of ProGibb and GA3

Article & Photos by Bradford King

Gibberellic acid (gibb) is used to get camellia flowers to bloom earlier and larger than they do naturally. Traditionally GA3 is the type of gibb used by camellia growers. Larry Barlow has detailed how it is purchased and administered in the 2012 American Camellia Yearbook article *How to Prepare Gibberellic Acid.* He compared five different amounts of gibb solutions including two control groups. In brief this study found that the 2% solution of GA3 helped flowers bloom on average eight days sooner than the 1% solution. While both 1% and 2% solutions worked, he recommends the 2% solution.

Method

This study compared 2% GA3 and 2% ProGibb to determine if there is any advantage in using one product over the other. The ProGibb is a trade mark product of Valent BioSciences Corporation and is labeled as 40%WSG in sample packets of 2.5 grams net weight. It is mixed as follows: 5 grams 40% ProGibb (2 packets) to 100 milliliter solvent to get a 2% solution. The 100 milliliter solvent solution is made by mixing 50 milliliter water with 50 milliliter ethanol alcohol. The Pro Gibb powder will usually dissolve within a few minutes when stirred into the solvent. If needed to totally dissolve the powder in the liquid, place the container in a microwave on high for eight seconds. ***Do not boil or over heat.***

Two similar buds on each of

the following *C. japonica* cultivars were selected: 'Adolphe Audusson Var.', 'Bev Piet's Smile'. 'Glen 40', 'Glen 40 Var.', 'Grand Prix', 'Koshi-no-yoso'oi', 'Richard Nixon', 'Ragland Supreme', 'Shiro Chan' and 'Wildfire'. The ProGibb was administered on November 12 to one of the buds on each cultivar and the GA3 on November 14, 2012 to the second bud. The adjacent leaf was marked with the date and type of gibb (GA3 or P).

Hypothesis

Since the two formulas are both 2% solutions of gibberellic acid, no differences in amount of days to bloom are expected. Slight differences in size, color or form can be expected. No major differences in size, color or form are predicted. In short no differences are hypothesized between flowers gibbed with ProGibb or GA3.

RESULTS

The gibberellic acid was administered to 24 buds. The ProGibb flowers averaged 66 days to bloom and the GA3 averaged 65 days. The range for the ProGibb was 25 to 87 days and the GA3 range was 24 to 106 days. There were some differences in size and quality of blooms which is expected due to natural climate and chance events. In conclusion, there were no significant differences in blooming time between the two products when they are administered in a 2% solution.

DISCUSSION

In the previously cited article by Barlow the 2% solution averaged 59.15 days when administered on October 5 and 25, 2011. In this study the gibb was administered on November 12 and 14, 2012 resulting in blooms in 65 days for GA3 and 66 days for ProGibb on different cultivars than were used in the Barlow study. The five to six day difference is not a significant time difference, most likely due to one or more of the following variables: climate, time of administration, and different cultivars' reaction to gibb. Specifically in the Barlow study gibb was administered by a number of growers located in different areas of the country, while in this study all flowers were gibbed in Arcadia, California.

The use of ProGibb or GA3 in a 2% solution will give the grower essentially the same results. In other words no difference was found between these two products. Both of these studies support the commonly held belief that gibb works between 30 and 90 days, averaging 60 days plus or minus a week due to climate, cultivars gibbed, buds selected and other chance variables. Those of us who gibb continue to enjoy earlier, larger, and more impressive blooms to decorate the home and enter in camellia shows.

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Figure 13: Mature *Camellia sasanquas*, an impressive sight, face this Chinese Garden wall in The Huntington Botanical Gardens.

Forgotten, But Not Lost

Article & Photos By Bradford King

Camellia sasanquas are frequently overlooked even by camellia people, yet they are wonderful evergreen landscape plants that tolerate full sunlight and will bloom in partial shade. Generally they are the first camellias to bloom, peaking in the fall but continuing to bloom through early winter. They have a profusion of flowers and lovely small green foliage which makes them attractive all year long. They are usually fragrant and some are heavily scented. While some people don't like the musky, heavy earthy scents, others appreciate the fragrance that at times may resemble a freshly opened packet of tea. Most flowers are small to medium, usually single or semidouble. Flower colors range from white though pink tones to red with attractive golden stamens and ruffled petals. (Figure 1: 'Crimson King'.)

Figure 1: 'Crimson King'.

Some of the most beautiful have white flowers with pink or red toned petal edges. (Figure 2: 'Taishuhai'.)

They are versatile low maintenance plants that grow faster than other camellia species. Their informal and relaxed manner fits the current American life style including little or no pruning. They may, of course, be groomed in order to keep pathways open or to make room for other uses. They make an excellent *espalier* or hedge that will need to be pruned after they bloom so that there is time for buds to set for the following season**.** (Figure 3: A hedge of 'Kanjiro' at The Huntington.) Low growing cultivars can be used in mass plantings as a ground cover. *Sasanquas* also can be grown in pots, making an excellent addition to a patio or a small yard.

The flowers usually are self-

Figure 2: 'Taishuhai'.

Figure 3: A well maintained hedge of 'Kanjiro' in bloom at The Huntington Botanical Gardens.

grooming, shattering on the ground, making a beautiful carpet of petals that can be left where they fall as they don't get petal blight. (Figure 4: 'Dawn'.)

HISTORY

Sasanqua camellias are native to the coastal forests of the southern Japanese archipelago. All have a small white flower borne on a small tree or shrub. (Figure 5: White *sasanqua*.) They are very popular in Japan where they have been cultivated for hundreds of years.

At the beginning of the Edo period, cultivars of *Camellia sasanqua* began appearing; the first record of the cultivars of this plant was made by Ihei Ito (1695–1733). The leaves were used to brew tea and the seeds produced edible oil which was widely used in Japan. Later the plants were used for garden landscaping. There are 400-year-old ancient trees growing in temple gardens in Kyoto, Japan. They were introduced into England in 1811, but they never gained the popularity they achieved in Australia, New Zealand and America. They also are grown in gardens and used as landscape plants in China and Europe.

More recently hybridizers developed many new cultivars.

Figure 4: A lovely carpet of petals from 'Dawn'.

Figure 5: A single white native *sasanqua*.

Figure 6: 'Brilliancy'.

For example, Bob Cherry established Paradise Nursery near Sidney, Australia in 1972 and introduced 28 *sasanquas*. Each cultivar's name begins with Paradise, e.g. 'Paradise Audrey' is named for his mother.

Camellia sasanqua came to the United States when Japanese American nurserymen imported them to California and to several Southern states in the 1930's. One early importer was Star Nursery owned and operated by Mr. F.M. Uyematsu of Los Angeles, California. K. Sawada from Alabama imported 'Brilliancy' in 1933 to his Outlook Nursery. (Figure 6: 'Brilliancy'.) More nurseries established connections with Japan and began importing cultivars. Nuccio's Nurseries in Altadena, California began growing Camellias in 1935. They have introduced 25 sasanqua hybrids. The *Camellia Nomenclature* has listed over 350 *C. sasanqua* cultivars as of 2013 and this doesn't include the other "Sun Camellias"-- *C. hiemalis* and *C. vernalis.*

The *sasanqua* cultivars from Japan are seen infrequently in home gardens but also are seen in large public gardens. These old treasures are part of the camellia collections in Descanso Gardens in La Canada, California and The Huntington Botanical Gardens in San Marino, California, one of the many reasons they have been designated by the International Camellia Society as "Camellia Gardens of Excellence".

DESCANSO GARDENS

Descanso Gardens Japanese Garden is beautifully landscaped with full grown *Camellia sasan-*

Figure 7: The walkway to the Japanese Teahouse at Descanso, with several 'Jean May' trees in bloom.

qua trees. (Figure 7: Teahouse walkway with 'Jean May' trees in bloom.) An early fall morning walk is very peaceful. (Figure 8: Descanso Gardens.) This is a sample of Japanese cultivars that can be seen during a short walk.

'Nodami-ushiro' (Backward Glance) has a rose pink medium to large single flower. When one passes by its beauty it is such it deserves a backward glance. It was imported by Toichi Domoto to his Northern California Nursery in 1934. (Figure 9: 'Nodami-ushiro'.)

'Hinode-no-umi' (Ocean Sunrise) has a medium single deep crimson flower with an interesting flat form. It was imported from Japan by Nuccio's Nursery in 1954. (Figure 10: 'Hinode-no-umi'.)

'Choji Guruma' (Wheel of Anemone) has a miniature anemone light pink flower with deeper pink petal edges and petaloids. It originated in Japan in 1896 and is one of the very few anemone formed *sasanquas*. (Figure 11: 'Choji Guruma'.)

'Shinonome' (Eastern Cloud) has a single flesh pink medium to large flower that originated in Japan in 1889. There are six *sasanquas* with this name listed in

Figure 8: Descanso Gardens is a peaceful place.

ABOVE:
Figure 10: 'Hinode-no-umi'.

BELOW:
Figure 11:
'Choji Guruma'.

Figure 9: 'Nodami-ushiro' tree in full bloom.

the *International Camellia Register.* This one was described by Hertrich in his 1959 book *Camellias in the Huntington* Vol. III p 333 where it can also be found.

A single white flowering *sasanqua* coupled with a Japanese water fountain making a soft tinkle sound is an attractive feature found in Descanso Gardens. (Figure 12: Japanese water

Figure 12: Japanese water fountain in The Huntington Botanical Gardens.

fountain in The Huntington.)

William Hertrich spent 30 years developing the Camellia collection at The Huntington. The majority of the *C. sasanqua* selections are planted on the east hillside of the North Canyon that runs parallel to the Chinese Garden merging with the Japanese Garden. (Figure 13: Chinese Garden wall with *sasanqua* trees.) It is impressive to see dozens of mature *sasanquas* trees in bloom. Specimens also can be seen among the camellia species and in the Japanese Garden. A few of the more than 100 cultivars that can be seen in bloom are:

• 'Mine-no-yuki' (Snow on the ridge), also known as 'White Doves', which has an abundance of small white loose peony flowers. (Figure 14: 'Mine-no-yuki'.) 'Mine-no-yuki', a mature *sasanqua* that has been well cared for, is impressive to see all year long with its fine textured foliage and is fantastic when in bloom.

• 'Colleen' a single pink flower originated by McCaskill Gardens, Pasadena, California in 1953. (Figure 15: 'Colleen'.)

• 'Cleopatra's Blush', a small blush pink flower which is a

Figure 14:
ABOVE: 'Mine-no-yuki' tree in full bloom.

RIGHT: A single 'Mine-no-yuki' blossom.

Figure 15:
BELOW: 'Colleen'.

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Figure 16: 'Cleopatra's Blush'.

Figure 17: 'Momozono'.

sport of 'Cleopatra', was caught and propagated by McCaskill Gardens in 1956. (Figure 16: 'Cleopatra's Blush.')

• 'Momozono' (Peach Garden) has a shell pink semidouble flower that was introduced in Japan in 1937 by Haykoneya Nurseries. (Figure 17: 'Momozono'.)

• 'Sparkling Burgundy', a small to medium peony flower in a ruby rose color overlaid with a lavender sheen. (Figure 18: 'Sparkling Burgundy'.)

• 'Fuji-no-mine' (Peak of Mt. Fuji), a pure white flower like the snow on Mt. Fuji. It has a medium rose form double bloom that originated in Japan. (Figure 19: 'Fuji-no-mine'.)

• 'Papaver' (Pink Poppy), a small cup-shaped soft rose pink flower. It was originated by K. Sawada's Overlook Nurseries

Figure 18: 'Sparkling Burgundy'.

Figure 19: 'Fuji-no-mine'.

Figure 20: 'Papaver'.

in Alabama. (Figure 20: 'Papaver'.)

NEW SASANQUA HYBRIDS

One of the most popular landscape *sasanqua* cultivars is Nuccio's Nurseries 'Yuletide'. It has a bright red flower with golden stamens. It blooms later than most *C. sasanquas,* usually during the holiday season. (Figure 22: 'Yuletide'.)

One of the newer Nuccio's introductions is 'Old Glory'. The flower has a medium white single with a deep rose pink border with wavy petals. (Figure 23: 'Old Glory'.)

The most recent introduction comes to us from Monrovia Nursery and Growers. Brad Crawford, a Monrovia craftsman, found a small single pink sport with seven petals among hundreds of 'Yuletide' plants in Azusa, California. It was first known as 'Pink Yuletide'. Monrovia Growers registered it in 2013 in the *Camellia Nomenclature* as *C. sasanqua* 'MonDel' and sells it under the trade mark 'Pink-A-Poo'. "Mon" stands for Monrovia and "Del" for Brad Crawford's daughter. The flower is a beautiful fragrant single that looks larger than its 2.5 inches as it has seven to eight wide petals. (Figure 24: 'MonDel'.)

CONCLUSION

The older *Camellia sasanquas,* many imported from Japan, are frequently forgotten, but thanks to the large collections in public gardens like Descanso and The Huntington they are not lost. As one walks near *sasanquas* your

Figure 21:
ABOVE: 'Yuletide' in full bloom in the landscape.

RIGHT: A cluster of 'Yuletide' blossoms.

eyes view the many beautiful flowers and your nose picks up their lovely scent. On a sunny day bees are busy pollinating the flowers, helping to ensure there will be camellia pods and seeds.

If you wish to learn more about these beautiful evergreen floriferous sun loving camellias, you can purchase a 50-page booklet, "Sun Camellia", from the Southern California Camellia Society. Contact the Society at socalcamellias@gmail.com.

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Figure 22:
ABOVE:
'Old Glory' in full bloom.

LEFT:
Single 'Old Glory' blossom.

Figure 23:
RIGHT:
The new pink 'Yuletide' registered as 'MonDel', also known as 'Pink-A-Poo'.

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Cover Story

Figure 1: 'Red Leaf Bella Variegated'.

- Photo Courtesy of Gao Jiyin

Camellia Popularity Throughout the World

Article & Photos By:
Bradford King

There are wide differences in camellia popularity in the various areas where camellias are grown. This can be seen by looking at the big winning cultivars at camellia shows in America, Australia, and New Zealand. This also can be observed when visiting private and public gardens throughout the camellia world, especially those designated by the International Camellia Society as "Camellia Gardens of Excellence". A tour of the major camellia growing countries and camellia regions in America chronicling past achievements leading to current successes will be highlighted in this article.

CHINA

There are 280 camellia species worldwide with 80 percent of them indigenous to China. The diversity of China's camellia species is very impressive with numerous wild populations still present. In addition some species have been cultivated and grown commercially for thousands of years. The most important are *Camellia sinensis* and *Camellia oleifera* grown by the thousands for the production of tea and edible oil respectively. All the original *C. reticulata* are native to China. The first shipments from

China to the western world came to Descanso Gardens in California and Ralph Peer in North Hollywood, California, in 1948. There are now 800 new reticulata cultivars in the Western World. In China the breeding of new cultivars is a recent development, with about 80 cultivars available in China but not yet distributed here in America. Camellia nurseries are thriving with new varieties highly valued. Most nurseries carry the red leaf sport of 'Nuccio's Bella Rossa'. (Figure 1: 'Red Leaf Bella Variegated') These sports are not yet available in the States. The most important development in China is the propagation of the summer repeat blooming *C. azalea*. The more than twenty hybrids using *C. azalea* as one of the parents that bloom in the summer is a major breakthrough in hybridizing. These plants are not now available in the United States. In China there are thousands of *C. azalea* plants that have been propagated for distribution, so it is becoming a popular landscape camellia for its long blooming season with a peak flowering period from June to December. In

Figure 2: 'C. azalea'.

fact, in Foshan, they are planted along the city streets by the maintenance department. The market for large *C. azalea* plants and trees is robust. The nurseries buy large root stock, graft several *C. azalea* scions on and in three or more years can sell them to landscapers. (Figure 2: *C. azalea.)*

The newest development from China is the discovery of *C. chuangtsoensis,* a bright yellow camellia with a single to semi-double flower that can bloom all year and has its major blooming season from July to September. This species should be available in American in five to ten years. It has great potential for hybridizing new yellow hybrids, extending the blooming season, and producing both cold hardy and ever blooming camellias.

The Chinese have already successfully crossed hundreds of *C. azalea* and *C. chuangtsoensis*. Will these hybrids produce repeat blooming camellias? Only time will tell.

JAPAN

There has been a steady flow of wonderful camellias from Japan to America beginning in the 1800's and continuing to the present. One of the earliest and most successful camellia importers was Mr. F. M. Uyematsu, the owner and founder of Star Nurseries. He imported thousands of camellias from his native Japan to Los Angeles, California, his adopted home in America. He sold thousands of 'Pink Perfection', one of the most popular camellias for landscaping that we continue to see in home gardens and camellia shows because it has a small, perfectly formed, formal double pink flower. This cultivar has been grown since 1875 in California and has been widely distributed. Many of the Star Nurseries camellias are still growing in Descanso Garden because Manchester Boddy purchased thousands before F.M. Uyematsu was interned during World War II. One old favorite is 'Bernice Boddy,' one of the parents of a number of the cold hardy camellias Dr. Clifford Parks developed in his "April Series". It has a pretty, medium semidouble, light pink flower with deeper pink petals. (Figure 3: 'Bernice Boddy'.) Toichi Domoto was another Japanese-American who imported camellias from Japan.

Figure 3: 'Bernice Boddy'.


Figure 4: 'Flame', left, 'Flame Variegated', right.

In 1917 he received a deep red, medium to large semidouble flower which he fittingly named 'Flame'. 'Flame variegated' has white splashes on the red petals which makes the bloom resemble smoke and fire. This cultivar is no longer seen in camellia shows, but it is still one of the best red japonica camellias. It can be seen in older gardens, for example, Descanso Gardens and The Huntington Botanical Garden. (Figure 4: 'Flame' and 'Flame Variegated'.)

Joe and Julius Nuccio, the founding fathers of Nuccio's Nurseries, visited Japan looking for camellias to bring back to America. The most famous japonica camellia of these importations is 'Tama-no-ura'. It was discovered in a remote area of Japan and came to the United States in 1978. The Nuccios propagated and distributed it widely. The flower is a perky small bright red bloom with a genetic white border. It grows vigorously, flowers freely, and sets seeds readily, making it a great landscape plant that is a favorite with camellia breeders. (Figure 5: 'Tama-no-ura'.) It is the seed parent of nine picoted bordered cultivars introduced by Nuccio's Nurseries. The most popular of these are 'Tama Americana', 'Tama Beauty',' Tama Electra', 'Merry Christmas', and 'Tama Peacock', a small maroon toned red flower with a white border. (Figure 6: 'Tama Peacock').

There are two dozen 'Tama-no-ura' hybrids that have been bred and introduced in Japan -- none of which have made it to the American scene. In addi-

Figure 5: A trio of'Tama-no-ura' blossoms.

tion, second generation Tama cultivars have also been bred. For example, John Wang from Northern California developed 'Dragon Fireball' ('Longuo-zhu) using 'Merry Christmas' as the seed parent. It was the front cover of the 2011 Camellia Yearbook. (Figure 7: 'Dragon Fireball'.) In addition, Walter Creighton successfully collected seed from 'Tama Glitters', a semidouble to loose peony, to produce 'Alice Creighton', a formal double rose pink flower. It is a real beauty.

Did you ever wonder what genetic mechanism makes this white border? Tateishi, Ozaki, and Okubo from Kyushu University, Fukuoka, Japan, researched the white border in 'Tama-no-ura'. They "demonstrated that the white picotee part lacked an accumulation of anthocyanins, and it was caused by the gene suppression of *chalcone synthase*." (*International Camellia Journal* 2010, page 114) Basically *chalcone synthase* are enzymes associated with organic compounds found in plants as a natural defense mechanism, for example, in the production of pigment. Anthocyanins are water soluble compartments of pigments that may appear red,

Figure 6: 'Tama Peacock'.

Figure 7: Another look at 'Dragon Fireball'.

- Photo Courtesy of John Chang

purple or blue according to pH. Therefore when the red flower pigment compartments on the petal margins of 'Tama-no-ura' are suppressed, a white border is produced. Genetic white borders and markings are found in a number of flowers. In a classic study with petunias, researchers introduced a chimerical petunia CHS gene, with the unexpected result of blocking in anthocyanin biosynthesis, which resulted in totally white flowers or flowers with white marks forty percent of the time. While we can't see this internal genetic process with the naked eye, it is good to know that scientists are interested in investigating camellia plants and flowers.

The most recent Japanese camellias to be distributed by Nuccio's are *japonica* 'Fukutsuzumi', 'Koshi-no-yoso'oi' and 'Princess Masako'. 'Fukutsuzumi' has a striking, small, very dark red flower with white mottling the petals. New foliage is a lovely amber maroon while the variegated leaves are a rich pumpkin tone. 'Koshi-no-yoso'oi' has an elegant, small to medium clear pink formal double flower. 'Princess Masako' is an outstanding cultivar with


Figure 8

Figure 8:'Fukutsuzumi'.

Figure 9: 'Koshi-no- yoso'oi'.

Figure 10: 'Princess Masako'.


Figure 9

a medium rose form to semi-double white flower with red stripes and fluted petals which may at times have a fine red edge. The Japanese describe the bloom as semidouble lotus form as it does resemble a beautiful lotus flower. (Figure 8: 'Fukutsuzumi'; Figure 9: 'Koshi-no-yoso'oi'; Figure 10: 'Princess Masako'.)


Figure 10

Kazuo Yoshikawa of Osaka, Japan has successfully pursued the development of yellow camellias. He used camellia species *saluenensis, reticulata, japonica and sasanqua* crosses with *C. nitidissima variety nitidissima* in numerous combinations. In the United States four of his yellow

camellias are available through Nuccio's. They are 'Ki-no-moto #92', a light yellow medium single, 'Ki-no-moto #93', a light yellow semidouble; 'Kogane-nishiki', a pale yellow with slender stripes of red inherited from its parent 'Betty Foy Sanders' and 'Kogane-yuri' (Golden Lily), a creamy white single that blooms profusely up and down its slender stems. While "*kogane*" means gold in Japanese, these cultivars are more like heavy cream or pale yellow in color. (Figure 11: 'Kogane-nishiki' and Figure 12:'Kinomoto # 95'.)

Tadao Yamaguchi of Ishikawa, Japan, is a pioneer hybridizer of yellow camellias. In 1989 he introduced 'Shoko' which means "First Yellow". This light yellow, small single flower was followed by three other pale yellow hybrids: 'Kicho', a small tubular single, 'Kiho', a small to medium single tubular with wavy petals, and 'Ki-no-gozen', a cup-shaped, small to medium single bloom. Two of his best yellow hybrids -- 'Ki-no-senritsu' and 'Senritsu-ko' -- were introduced in America by Nuccio's Nurseries in 2007. 'Ki-no-senritsu' (Yellow Melody) has a lovely peony to loose peony formed flower that thrives in deep shade where it grows moderately fast, but is a shy bloomer. 'Senritsu-ko' has a beautiful small to medium, formal to rose form flower which has light yellow petals with peach pink edges. It grows moderately fast in an upright open growth pattern. It sets multiple buds and flowers in mid season. (Figure 13: 'Senritsu-ko'.)

Figure 11: 'Kogane-nishiki'.

Figure 12: 'Kinomoto # 95'.

Two cultivars that continue to be popular show flowers that came from Japan to the U.S. many years ago are 'Hishi-karito', with its small semidouble

soft pink flower with a fountain of white petaloids in the center, and 'Haru-no-utena', with a medium white or pink toned tubular single flower with pink and red stripes on the petals that stand up, making it a very perky flower. (Figure 14: 'Haru-no-utena' and Figure 15: 'Hishi-karito'.)

One very important style of *C. japonica* that has its roots in Japan is the "Higo" camellia. This class of camellias originated in the Province of Higo now called Kumamoto. Generally they have a single irregular, almost triangle-shaped flowers with thick, round, broad petals and a center full of stamens formed like the spokes of a wheel. The flower may be irregular and flat, but a quality Higo bloom has a perfectly round central mass of upright stamens. They have a range of beautiful bright colored flowers, with some bearing white markings indicative of viral variegation which usually is not uniform. The lack of uniform white markings is not seen as a problem in Japan as the focus is on the stamens and the five, round, broad, bright colored petals. There are approximately 120 different Higo cultivars in Japan with a few dozen grown in America. (Figure 16: Higo 'Mikuni-no-homare'.)

The Japanese archipelago is

Figure 13: 'Senritsu-ko'.

Figure 14: 'Haru-no-utena'.

Figure 15: 'Hishikarito'.

home to *camellia sasanqua* where it has been grown for many years. The native species always has white flowers and small foliage making a shrub or small tree. The cultivated forms now have a wide range of colors which make it a very popular landscape camellia in Japan, China, Australia, New Zealand, Europe, and America.

Many new beautiful camellias are being hybridized in Japan. But which ones will make it to America? Recently I was fortunate to see a flowering *japonica* 'Mahoroba' plant. It has a beautiful, delicate pink, formal double flower with white edges on its petals. It was developed in Saitama, Japan, in 2007 by Sosinn Hirai. This one seems like a winner to me but only time will tell. (Figure 17: 'Mahoroba'.)

Another example is 'Etsu-botan'. It is a 2005 Japanese hybrid of *C. amplexicaulis* and 'Tama Americana' from Kurum Hukuoka, Japan, bred by Satie Hisatomu. The bud resembles *C. amplexicaulis* except it is pink. The bud is pretty and takes a long time to open just like *C. amplexicaulis*. The medium, lovely, pink flower is beautiful. It is interesting that the genetic white border of 'Tama Americana' and the very thin line of white that edges the petals of *C. amplexicaulis* are missing, but there is some shading to lighter pink on the petal edges with some central light pink to white petaloids. The petals are thicker than most japonica flowers but not as thick and waxy as *C. amplexicau*lis. It is a heavy flower with petals numbering around 30. The foliage, however, clearly shows the cross is valid. The leaves are larger than a japonica, but smaller than *C. amplexicaulis,* yet similar in texture and shape to *C. amplexicaulis*. It may be that 'Etsu-botan' is the first hybrid from *C. amplexicaulis* to flower in America. (Figure 18: 'Etsu-botan'.)

Figure 16: 'Higo 'Mikuni-no-homare'.

VIETNAM

We know that 20 percent of the camellia species grow in Vietnam, many in isolated mountain-

Figure 17: 'Mahoroba'.

ous regions where new species have recently been discovered, including a number with yellow blooms. The dozen wild camellias that grow in the Tamdao National Park were studied by Le Nguyet Ha Ninh of Hanoi University of Science. Dr. George

Figure 18: 'Etsu-botan'.

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Orel from the Royal Botanic Gardens in Sidney, Australia, has also reported on the "Rare Camellia Species Garden" created in Southern Vietnam to house endangered and newly found *camellias.* This is very important because the human population is expanding rapidly with danger of loss of land to feed and house people where wild camellias grow. This loss of habitat can eliminate native camellias.

A number of camellias species, for example, *C amplexicaulis,* are sold in local markets as cut flowers and potted plants in Vietnam. This species is of North Vietnamese origin, but so far no wild populations have been located. It has been propagated for hundreds of years, e.g. around Buddhist temples. Apparently there are different clones of this species with different sized leaves and color of flowers (pink, red, to purplish red). Nuccio's Nurseries propagates two forms. Type A has large leaves up to nine inches with pinkish red bud, with a deep pink, small to medium semidouble flower with a fine white edge. Type T has a slightly smaller flower and smaller foliage up to five inches, with a very red bud that opens to a red flower with a fine white edge. *C. amplexicaulis* is a rather rangy, ungainly growing camellia that when small may require staking. The plant has large textured leaves. It has potential when crossed with japonica cultivars to produce attractive new cultivars with foliage larger than most japonica leaves on a plant that grows more like a japonica. (Figure 19: 'Tama Peacock' x *C. amplexicaulis* plant and Figure 20: *C. amplexicaulis* flower.)

There is also research and development in growing tea using a variety of *C. sinensis* var. *sinensis* and C. *sinensis* var. *assamica.* However, we know very little about any new camellia cultivars being bred in Vietnam. In America we do see *C. flava* in public gardens and it is grown for hybridizing. *C. flava* is used for breeding new yellow cultivars; for example, both Gene Phillips and Dr. Clifford Parks have worked with this species.

KOREA

Camellias are indigenous to Southeast Asia, which includes Taiwan, Indonesia, and Korea. The major importance of Korea is the native cold hardy camellias. The Morris Arboretum at the University of Pennsylvania in Philadelphia has participated in five plant collecting trips between 1979 and 1991 to South Korea. Barry Yinger instigated visiting and collecting camel-

Figure 19: 'Tama Peacock x C' *amplexicaulis* plant.

Figure 20: *C. amplexicaulis* flower.

lia japonica on Taecong and Sochong Islands in 1981. After more than twenty years of growing the seeds collected from the 1984 Korean *Camellia japonica* collection there are three commercially available cultivars in America. They are 'Korean Fire' introduced by Barry Yinger through Hines Nursery, and 'Longwood Valentine' and 'Longwood Centennial' introduced by Longwood Gardens. There are four plants they plan to introduce: 'Balustrade', a single scarlet red, 'Meadowbrook', a rosy red; 'Bloomfield', a scarlet red with excellent foliage; and 'Morris Mercury', a red flower.

CAMBODIA, THAILAND, AND LAOS

These Southeastern Asian countries must have camellia populations but little has been published or reported. We do know, for example, that *C. amplexicaulis* has been seen in Cambodia, China, and Vietnam. We can assume that other species cross national borders. These countries also may have unknown camellia species especially in remote areas. Deforestation, especially in Cambodia, is one of the highest in the world and it can destroy native camellia populations.

GREAT BRITAIN

The first live camellias came to England in 1792 and were grown in heated greenhouses until 1814 when it was discovered that camellia japonica could survive the cold winters. The initial ca-

Figure 21: 'Donation'.

mellias were 'Alba Plena' and 'Variegata'. In 1821 the first *C. reticulata*, 'Captain Rawes', was brought to England. *C. japonica* plants were the only camellias widely distributed in England and other European countries. All of this changed with the hybridizing between *C. saluenensis* and *C. japonica* resulting in the "Williamsii hybrids" now grouped in *The Camellia Nomenclature* as nonreticulata hybrids. Hybridizing with *C. saluenensis* has continued in England, Australia, New Zealand, and America, resulting in hundreds of new cultivars. Some of the English "Williamsaii hybrids" have become popular in America, and a good example and one of the most widely distributed of these hybrids is 'Donation'. Col. Stephenson Clarke of Sussex, England, introduced it in 1941. The name probably came from the fact Clarke received plant material from John Charles Williams, the pioneer English propagator of hybrid camellias. The donated seeds from Williams may have inspired the name. (Figure 21: 'Donation'.)

There are also a number of wonderful *C. japonica* cultivars that originated in England. Perhaps the most famous is 'Elegans' introduced in 1831 by Chandler. It is known for its beautiful, large anemone formed rose pink flower and that it has mutated frequently. In fact, Chandler caught one of the first of its sports called 'Elegans Miniata' which has a light lavender pink almost white flower. The "Elegans Family" has some of the best large and very large

Figure 22: ‘Elena Nobili’ tree - This cultivar was imported from Italy to the United States.

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anemone camellias.

Camellias are highly valued in Great Britain as landscape plants and sold in local nurseries. One we are familiar with is the Trehane Nursery. This Dorset based nursery has been run by the Trehane family for more than 60 years. It is now managed by David Trehane, a third generation camellia grower, who is also the new International Camellia Society webmaster. Trehane Nursery was founded by David's grandfather in 1957 specializing in camellias. Jennifer Trehane, David's mother, is a well know camellia lecturer, editor of the ***International Camellia Journal*** and author of ***Camellias: The Gardeners Encyclopedia.*** There are now three International Camellia Society Gardens of Excellence in Great Britain.

EUROPE

English, Dutch, and Portuguese traders brought camellias to Europe in the seventeen and eighteenth centuries. The first written records are from London, England. But others claim that the first importation were to Portugal where very old camellias can be found. There are many camellias grown in a number of European countries. This includes the Channel Islands, Portugal, The Azores, Maderia, Spain, Italy, France, Belgium, Switzerland, Norway, Germany, and Croatia. Hybridization of camellias also has occurred, especially in Italy. A number of European cultivars were imported by wealthy families and public gardens to America as early as the 1800's. The Drayton family, the owners of Magnolia Gardens in South Carolina, for example, imported 'Gigantea' and 'Marchioness of Salisbury' in the mid 1800's. 'Elena Nobili' was imported from Italy to the United States. This flame red medium rose form double was introduced in 1881. (Figure 22: 'Elena Nobili' tree, Figure 23: 'Elena Nobili' flower, Figure 24: 'Gigantea', and Figure 25: 'Marchioness of Salisbury'.)

Two old favorites, 'Prince Eugene Napoleon' ('Pope Pius IX') and 'Donckelarii', were imported to America from Belgium. While there have been new cultivars originating in Europe none have recently been seen in American camellia shows. (Figure 26: 'Pope Pius IX'.)

There are still many European camellia societies and growers who are active in the International Camellia Society. One major interest is in identifying and preserving older camellia trees and heritage camellias.

Figure 23: Close up view of 'Elena Nobili'.

There are International Camellia Society Gardens of Excellence in Italy, Switzerland, and Germany.

The 2014 International Camellia Congress will be held in Pontevedra, Spain. There will be tours to visit both Portuguese and Spanish camellia gardens. This will be a great opportunity to see antique camellias and cultivars not seen in America.

SOUTH AFRICA

Many of us may be unfamiliar with South Africa as a country where camellias can be grown. However, there is an Interna-

Figure 24: 'Gigantea'.

Figure 25: 'Marchioness of Salisbury'.

Figure 26: 'Pope Pius IX'.

tional Camellia Society Garden of Excellence as part of the famous Vergelen Estate in Somerset West. This estate was founded in 1700 and is noted for its fine wines and 19 botanical gardens. The camellia garden has more than 1,000 plants and 550 cultivars. There are two parts to the camellia garden. The Barlow plantings consist of classic, pre-1940s *C. japonica* cultivars, most of which are now large, mature shrubs up to sixteen feet tall. The Jan van Bergen Collection was established in 1995 when retired camellia nurseryman van Bergen donated several plants of each of the cultivars he had imported into South Africa, as well as new selections that he himself had bred. To my knowledge no camellias bred in South Africa have been distributed in the United States.

CANADA

In general, camellias are grown indoors in Canada. However, the few milder climate areas like Vancouver, British Columbia have camellias growing outside. The University Botanical Garden has a 20 acre garden which includes the David C. Lam Asian garden where the camellias are located. The Van Dusen Botanical Botanic Garden covers 55 aces and has a camellia collection planted near the Korean Pavilion of *C. japonica* and some Williamsii hybrids. Both camellia collections are open to the public and are well worth a visit.

AUSTRALIA

The Macarthur family of Camden Park, New South Wales, was a major early importer of camellias. They propagated and distributed camellias to other growers thereby helping to distribute camellias in Australia. Professor E. G. Waterhouse helped found the Australian and New Zealand Research society in 1952 and became the first President of the International Camellia Society in 1962. He also bred a number of new cultivars. In fact, he introduced one of the first formal double non-reticulata hybrids which bears his name. The light pink flower is very pretty. It is a very beautiful variegated form and is popular today. (Figure 27: 'E.G. Waterhouse Variegated'.)

Thomas James Savige is best known in the camellia world for the prodigious work he did in compiling the three volumes of ***The International Camellia Register*** with its descriptions of 32,000 cultivars and 267 species of camellias. He is also known for breeding small clus-

Figure 27: 'E.G. Waterhouse Variegated'.

ter flowering hybrid camellias. Each new cultivar name began with "Wirlinga"; for example, 'Wirlinga Belle' was his first introduction in 1973. "Wirlinga" is an aboriginal word meaning "meeting of the trees". Unfortunately few of these cultivars can be found in the United States.

One of the very best Australian japonicas is 'Margaret Davis'. It is the beautiful sport of another the well know Australian cultivar 'Aspasia MacArthur'. 'Margaret Davis' is a creamy white peony form flower with dashes of rose red with petals edged in bright vermillion. It is a medium flower that blooms in mid season on a bushy upright plant. It was introduced in 1961 by Mr. Davis who named it for his wife. Margaret was the founding President of the Garden Clubs of Australia and wrote gardening books until age 90. This camellia has been distributed throughout the camellia world and is a popular and successful show winner here in the United States. For example, the Australian Camellia Research Society Trophy has been awarded to 'Margaret Davis' fifteen times in the last twenty- seven years as the best bloom of Australian origin at the ACS annual meeting show.

One well known Australian hybridizer is Bob Cherry who founded the Paradise Garden and Nursery. He bred and introduced numerous *C. sasanqua* cultivars usually with the first name Paradise, e.g. 'Paradise Belinda'. They are sun tolerant camellias that make wonderful landscape plants. Kurt Boesen of Dancraft Nurseries has originated and re-


Figure 28: 'Phyllis Hunt', left, 'John Hunt', right.

cently registered two dozen *C. sasanqua* cultivars in Australia. They are known as "Dan's Collection" as Dan appears as part of each cultivars name. Unfortunately we see very few of the Paradise or Dan's camellias in America.

Two fantastic reticulata hybrids originated in Australia were bred by John Hunt in 1988. He named his very large pink semidouble to loose peony flower with veined petals 'John Hunt'. It grows vigorously open and upright. The blooms can easily reach or exceed seven inches and when the petals stand up it looks huge. It is a frequent winner as the "Best Australian Raised Reticulata" at the Australian National shows and is also a winner in American camellia shows. The other flower he introduced has a deep pink on the petal edges shading to lighter pink with a white center. This peony flower he named 'Phyllis Hunt'. It grows slowly in an open spreading manner and may be a shy bloomer when young. It has a beautiful flower with 30 or more petals in tones of pink and white. (Figure 28: 'John Hunt' and 'Phyllis Hunt'.)

The 1998 Quarantined Act protects Australia against introduced pests and diseases including plant pathogens like flower blight (*Ciborinia camellia*e). Australia is one of a few countries free from flower blight. This law prohibits camellia flowers and foliage from being imported into Australia. Camellia seed is allowed for 65 camellia species. Therefore scions and bare rooted new cultivars from other countries no longer can enter, thus no new *C. japonica; C. reticulata* or non-reticulata

hybrids can be imported. In addition, this means the loss of a cultivar in Australia may have serious consequences. There has been a progressive reduction of specialist camellia nurseries and a reduction of the number of camellias offered in nurseries. This has particularly negatively affected *C. reticulata* as many have had difficulty surviving recent droughts and water restrictions. The *C. sasanqua* have not been significantly impacted. In responses to these challenges the E. G. Waterhouse National Camellia Gardens at Caringbah in Sidney has provided a fund for a project aptly named the "Camellia Ark". The goal is to propagate and conserve representative samples of vulnerable cultivars for the benefit of Australian horticulture.

NEW ZEALAND

The *Williamsii* cultivars were widely bred and propagated but it was not until 1962 that Les Jury of New Zealand introduced a major color break with his cultivar 'Anticipation'. The large peony deep rose flower and its variegated form are widely distributed. (Figure 29: 'Anticipation'.) He also bred 'Debbie,' a lovely pink medium formal

Figure 29: 'Anticipation'.

double; 'Jury's Yellow', a white flower with yellow petaloids ; 'Mona Jury', an apricot pink large peony; and 'Les Jury', a red medium to large peony to formal double -- all camellia flowers seen in America. (Figure 30: 'Debbie' and 'Mona Jury'.)

James Finley from Whangarei, New Zealand, is known worldwide for his scented camellias. He began breeding them in 1970 and has introduced over 35 fragrant cultivars. He used *C. lutchuensis* because of its beautiful perfume and crossed it with *C. japonica* 'Tiffany' to get 'Scentuous'. He was one of the first breeders to break through the sterile barrier of F1 hybrids that had thwarted fragrant camellia development. His most popular fragrant hybrid is 'High Fragrance'. The medium peony

flower is an attractive pale ivory pink that shades to a deeper pink at the petal edges, and emits a lovely sweet aroma that usually wins in the fragrant class at camellia shows. The plant grows vigorously and is open in growth habit. (Figure 31: 'High Fragrance'.)

Os Blumhardt bred a number of black red camellias using *japonica* 'Kuro-tsubaki' (the Black Camellia), introducing 'Black Opal', Ruby Bells', and the most popular in America, 'Night Rider'. The attractive plant has small leaves that when new are a deep maroon and the semidouble flower is small and very dark black red. (Figure 32: 'Night Rider' and 'Kuro-tsubaki' flower and bud.)

Recently Derek Beard reported in the *New Zealand Camellia Bulletin* the results of an informal survey of the favorite New Zealand raised camellias. Not sur-

Figure 30:

'Debbie', right,

'Mona Jury', below.

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Figure 31: 'High Fragrance'.

prisingly the most popular was the hybrid 'Nicky Crisp'. Many camellia growers, including myself, rate 'Nicky Crisp' one of the best non-reticulata hybrids. It is a *C. pitardii hybrid* x *C. japonica* with an open, fresh and clean looking medium to large light orchid pink flower with 16 petals with deep notched edges, creamy filaments and golden anthers. It has show quality flowers with many identical blooms that make for beautiful trays of like blooms. The plant grows slowly and compactly, yet will bloom when small. It was introduced by Mrs. A. Bettie Durrant of New Zealand in 1980. When I first saw this flower I was impressed with how clean and crisp it was and thought that must be why it got its name. Not so. It was named for the originator's grandson. (Figure 32: 'Nicky Crisp'). Other camellias with multiple votes but rarely seen in the States were 'Takanini', 'Henry's Surprise', 'Peggy Burton', and 'C. W. Swann'. Four others with multiple votes we see more frequently in America are Reticulata 'Margaret Helford', a very large deep red; 'Dream Boat', a large pink flower with a

Figure 31: 'Night Rider'

Figure 32: 'Nicky Crisp'.

lavender hue; 'High Fragrance' and 'Mona Jury', which are both described above.

AMERICA

There are some camellias that have gained popularity throughout the camellia world with others successful only in their home country. In America there are also differences between growing regions. This is in part due to the different regional climates and growing conditions, but also are due to the camellias carried in local nurseries. In addition, what the camellias people like best is highly subjective. It is human nature to have aesthetic opinions and to make judgments. In the final stages of voting for the best of class at camellia shows this becomes apparent. For example, at the American Camellia Society's annual camellia show in Norfolk in March 2012 the choice for best very large camellia came down to 'Moonlight Bay' and 'Elegans Champagne'. Both were perfect in form, color, size, and condition. How do you vote? One could argue for 'Moonlight Bay' because it maintained its form due to its fresh condition with more pink than one frequently sees. Others could argue for 'Elegans Champagne' because it was a more complicated flower form with a blemish free white color and a few central yellow petaloids forming like champagne bubbles. We voted based on our aesthetic principles and subjective biases. I heard one experienced judge comment after the voting, "I just don't like that form", referring to 'Elegans Champagne'; whereas I voted the other way (for 'Elegans Champagne') because of its wonderful anemone form. Who was right? Both flowers were 100 percent so there was no right and wrong; at the very end, it was a popularity contest.

In the 2011 "Judges have Spoken!" the best show blooms in the very large japonica class were 'Lauren Tudor' with 84 points; 'Edna Bass Variegated' with 45; 'Paul Haskee' with 45; 'Moonlight Bay' with 42; and 'Show Time' with 33. In the nine camellia shows held in Southern California we didn't even have

Figure 33: 'Paul Haskee'.

Figure 34: 'Edna Bass Variegated'.

entries of these top three winners. The dominant camellia nursery in California is 'Nuccio's. The Nursery introduced and distributed 'Moonlight Bay' and 'Show Time' locally and across the country via a thriving mail order business. The Nuccios don't grow the other three, thus they are rarely seen in Southern California.

The Bennett's Creek Nursery in Virginia propagates 45 different camellia cultivars that are distributed to landscapers and retail nurseries in the Southeast. If I lived in the area I would purchase 'Paul Haskee', 'Edna Bass Variegated', 'April Remembered', and 'Les Marbury'. The first two would make one competitive at local camellia shows, and I would choose 'April Remembered' because I love two toned colored flowers like 'Nuccio's Carousel', which doesn't seem as popular in the South as it is in California. I grow no cold hardy camellias here in Southern California because I don't need to, but in colder areas of the country Dr. Clifford Parks' 'April Remembered' cold hardy camellia seems like a great choice. It is a beautiful cross between 'Bernice Boddy' and 'Dr. Tinsley'. I generally don't like the "tiered" formal double flowers like 'Les Marbury', preferring the spiral formal doubles like 'Sawada's Dream' and 'Nuncio's Pearl'. However, seeing 'Les Marbury' with its small pink and white flower with red markings changed my mind. If I lived in the Atlantic region, I would add 'Les Marbury Red' and 'Les Marbury' to my collec-

Figure 35: 'April Remembered'.

Figure 36: 'Les Marbury'.

tion. They are also cold hardy to zone 7, another bonus. (Figure 33: 'Paul Haskee', Figure 34: 'Edna Bass Variegated', Figure 35: 'April Remembered' and Figure 36: 'Les Marbury'.)

A number of Americans have been active in hybridizing camellias with some mentioned in this article. However, the most significant American achievement in camellia breeding is the development of cold hardy camellias. Dr. Clifford Parks' April series has been discussed above. In addition, the contributions of Longwood Gardens' cold hardy breeding program have been noted. However, for more than fifty years Dr. William Ackerman has investigated and developed a cold hardy camellia breeding program. The twenty-two cultivars in his Winter Series used *C. oleifera* and his fall blooming Ashton series of eight are only some of his cold hardy introductions. This seminal work is all included in his classic book ***Beyond the Camellia Belt: Breeding, Propagating and Growing Cold Hardy Camellias.***

The two American hybridizers who have contributed the most in developing fragrant camellias are Dr. Ackerman and Dr. Parks. Their most popular scented camellias were bred using the sweet scented very small white flower of *C. lutchuensis*. Dr. Ackerman's most popular are 'Fragrant Pink' and 'Ack-Scent Spice'. The best known and widely grown of Dr. Parks fragrant camellias is 'Spring Mist'. (Figure 37: 'Spring Mist'.)

The breeding of show quality camellias has been pursued by

Figure 37: 'Spring Mist'.

numerous American hybridizers This goal continues as part of the camellia hobby with dozens of new registrations made to the American Camellia Society every year that are included in the ***American Camellia Yearbook*** the year of their registration and the Southern California Camellia Society publication of ***The Camellia Nomenclature.*** Many are grown only by family and friends while others are propagated by Nurseries in the hope they will catch on with the gardening public. One that is popular in the South but not seen often in California is 'Lauren Tudor'. It is a wonderful introduction by Hulyn Smith with its very large pink flower with small red markings that is a big show winner in the south. Gene Phillips sent me a scion to graft a few years ago, it took, but it didn't survive. Sharing scions and air layered plants is another way camellias get distributed. But do I have the space for it, can I get it to take, thrive and bloom? Will it be like 'Sea Foam', very popular in the South but not a good bloomer in Southern California? If it does bloom will local judges vote for it? What to do? The easy path is to go to Nuccio's and purchase the newest introduction or a winner not yet owned , plant it in the one place left in the garden—end of story. Isn't this tale with some local variations what others do in their area of the country?

There are many other highly desirable and admired camellias grown in the Southeastern states that we hardly ever see in Southern California. A great example is 'Chile Mitchell', which has a large light orchid pink rose form to formal double flower. It was introduced in 1992 by Hulyn Smith, the late prolific hybridizer from Georgia. This non-reticulata hybrid is the top winning camellia show flower winner in the Southeastern states, but one that has not been seen at the camellia shows in Southern California. It out scored the more widely grown camellias like

Figure 38: 'Tiny Princess'.

'Buttons 'n Bows' and 'Spring Daze" that win in both the South and California.

'Tiny Princess' may not catch one's eye in a show cup because it gets swallowed up due to its miniature size, but it looks terrific on the plant. The white flower with delicate pink shading has loose petals and petaloids that stand up like a miniature Princess. It is another flower not seen in California but seen in the South. It was bred by the noted hybridizer Kosaku Sawada who made his home in Alabama. He introduced numerous camellias through Outlook Nursery with 'Sawada's Dream' his most popular throughout the U.S.A. (Figure 38: 'Tiny Princess'.)

Dr. Walter Homeyer from Macon, Georgia, introduced 'Frank Houser' in 1989. It is the most popular reticulata along with its variegated form in America that also wins in Australia and New Zealand, especially its variegated form. They are the biggest winners in camellia shows throughout all the United States in the last fifteen years. While his 1973 reticulata 'Betty Ridley' wins show points in the Southeast, it is not seen in Southern California.

We also don't see 'Kikutoji', a small deep red flower blotched

white, in Southern California. It has been available in Japan since 1895 and has won 74 points in recent camellia shows in the South. 'Punkin' has a rose pink flower with outer petals that shade lighter in the center of this small formal double hybrid with incurved petals. It was introduced in 1966 in Northern California by Novak, yet this cultivar is rarely seen in Southern California. It wins many show points in the Atlantic region camellia shows but not in Southern California. Why is this?

WHY CAMELLIAS BECOME POPULAR

In general, popularity is highly influenced by familiarity. Unless a new song, band, actor, movie, cereal, drink, or camellia is publicized, it will never gain a following. Millions of dollars for advertisement and public appearances do this for thousands of products and entertainers. Every year the TV show "American Idol" creates new stars. The winners and even the losers are interviewed on other TV programs and discussed in magazines like "People". There is limited publicity for plants. In addition, even major commercial nurseries catalogues tout seeds, annual flowers, perennials, and trees, but many have no camellias listed. Traditionally camellia cultivars gain popularity in the camellia world at camellia shows, society meetings, and nurseries. More recently, web sites and digital photography have helped increase interest. Books and magazines certainly help once people become interested in camellias.

There are at least three factors that are involved in camellia popularity. First and foremost, the cultivar must reliably produce beautiful flowers that are distinct from other camellias. Second, it should be an attractive and relatively easy plant to grow. Third, it must be available in sufficient numbers, which usually means it is propagated by a nursery. Flower size is not a key to popularity, but clear bright colors and distinguishing markings seem to help. Popular flower show winners tend to have more complicated forms with very few outside the species class having single flowers.

Why are some camellia cultivars popular in one country or region of America? One factor is the location where a camellia is introduced. If introduced in the United States, it is most likely to be first distributed locally. Many cultivars are distributed to fam-

Figure 39: 'Showboat'.

Figure 39: 'Showboat' with incurved petals.

ily and friends, never gaining more wide spread interest. Some camellias bred and propagated by nurseries in the South, never are seen in California. This is even more likely if the cultivar was bred in Australia or New Zealand. However, choice cultivars do become desired internationally. For example 'Nicky Crisp', a hybrid seedling from New Zealand, and 'John Hunt' from Australia are admired worldwide. In addition there are numerous southern bred camellias that are popular in California—'Glen 40' from Alabama, 'Frank Houser' from Georgia, 'Miss Charleston Variegated' from South Carolina, and 'Lady Laura' from Florida, just to note a few. Some camellia favorites lose popularity over time. For example, before 'Frank Houser' became a big show winner, 'Emma Gaeta Variegated' frequently won the reticulata class. Today it is seen less and less at shows, probably due in part to the fact the plant is rangy and sparse in the garden. It was bred by Piet and Gaeta from Arcadia, California.

In closing I wonder in the future what new cultivars will gain popularity as landscape plants and take home the top honors in camellia shows. I hope it is yours or mine. If I was a betting man, I'd put my money on a Nuccio's Nurseries introduction. Perhaps their newest introduction 'Show Boat', a large, white rose form double non-reticulata hybrid, with pink incurved petals, will be the next winner. The plant grows upright and is somewhat open in growth habit. It blooms from early to late season. What do you think? (Figure 39: 'Show Boat'.)

Return to TOC

Indian corn is an excellent example of mutations caused by 'jumping genes'.

JUMPING GENES

By Bradford King

There are many wonderful camellia mutations seen in gardens and camellia shows. Dr. Bill Bennett's article on Camellia Family Trees discusses a number of them. This led me to wonder how and why these flower mutations occur.

"Jumping genes" or transposable elements (TEs) were first identified by geneticist Barbara McClintock more than fifty years ago and earned her a Nobel prize in 1983. Other biologists were initially skeptical of her discovery. However, over the years it became apparent that not only do TEs "jump," but

they are also found in almost all organisms. Typically they occur in large numbers. For example, researchers have discovered TEs make up approximately 50% of the human genome and up to 90% of the maize genome. Corn (maize) has been extensively investigated due to its agricultural importance.

Indian corn is famous for its beautiful patterns of red and yellow stripes and spots, making it an excellent visible example of mutations caused by "jumping genes".

What is a TE? It is a DNA sequence that can change its relative position by self-transposing within the genome of a single cell.

Transposition can create phenotypically significant mutations and alter the cell's genome size.

Transposable elements are only one of several types of mobile genetic elements. They are assigned to one of two classes according to their mechanism of transposition, which can be described as either "copy and paste" (for class I TEs) or "cut and paste" (for class II TEs).

Class I (retrotransposons) copy themselves in two stages, first from DNA to RNA by transcription, then from RNA back to DNA by reverse transcription. The DNA copy is then inserted into the genome in a new position. Reverse transcription is catalyzed by a reverse transcriptase, which is often coded by the TE itself. Retrotransposons behave very similarly to retroviruses, such as HIV.

During the 1940s and 1950s, McClintock discovered transposition and used it to show how genes are responsible for turning physical characteristics on or off.

What do all these jumping genes do, besides jump? Much of what a transposon does depends on where it lands. McClintock discovered that transposons are segments of DNA that can move around to different positions in the genome of a single cell. In the process, they may cause mutations.

In conclusion, the beautiful camellia flower sports discussed by Dr. Bennett are the result of the jumping genes that produced cell mutations discovered by Dr. McClintock.

Flower sports are the result of jumping genes that produce cell mutations.

BRADFORD KING • 2012

Return to TOC

Figure 1: 'Toichi Domoto' as a formal double.

Camellias with Multiple Flower Forms

By Bradford King

There are many camellia japonica cultivars that are listed in the ***Camellia Nomenclature*** as having two or more flower forms. There are also a few *C. reticulata* and non-reticulata hybrids but no popular sun camellias that show multiple flower forms. Camellia species are typically one form. This tells us that it is through breeding different species and cultivars that produce multiple flower forms. Why does this happen? Is it due to genetic mutations, culture, climate, or all of the above?

JAPONICA CULTIVARS

There are dozens of japonica hybrid cultivars with two or more flower forms. They have the same range of colored flowers and growth habits as other cultivars. One of the most interesting combinations is one that shows rose form double and formal double flowers. Good examples include 'Toichi Domoto', '

Tom Knudsen', 'Glen 40' and 'Glen 40 Variegated'. When the rose form is in its initial stage it can be undistinguishable from a formal double, but as the bloom matures it opens, showing its stamens. It is to be noted that 'Glen 40 Variegated' informs us that viral variegation is not a factor in producing multiple forms. My observations of this season's flowers on 'Glen 40' and 'Glen 40 variegated' were that "all" began as formal double blooms with many opening up to show their stamens. This took from days to a week or more. This is what is typically meant by rose form double. At least some seemed to maintain the formal double form. I say "seem" because some that dropped off or were picked remained formal double, but would they have opened up if they remained on the plant? It was also not easy to track if and when they opened. All that said, I believe a few remained as formal double flowers. (Figure 1: 'Toichi Domoto' as a formal double; Figure 2: 'Tom Knudsen', a rose form open.)

'Ace of Hearts.' has a red medium to large semidouble to rose form double that can thrive in more sun than most other C. japonica. While 'Candy Apple' has a dark red flower with a semi-

Figure 2: 'Tom Knudsen'

Figure 3: 'Ace of Hearts'

Figure 4: 'Grand Marshall Variegated'

double to peony form. ‘Grand Slam’ semidouble to anemone; ‘Grand Marshall’ anemone to peony; ‘Rudolph’ full peony to anemone; and ‘Gigantea’ can be semidouble, anemone, or peony. And these are just some of the red colored multiple formed japonicas. (Figure 3: ‘Ace of Hearts’ as a semidouble; Figure 4: ‘Grand Marshall Variegated’ as anemone.)

‘Elaine’s Betty’ has highly ruffled petals on a light coral pink flower. It is a sport of ‘Betty Sheffield Coral’ and in this case inherited the same forms as its parent—semi double to loose peony. In other words, this is a color mutation with no change in flower size or form. ‘Tama Glitters’ inherited its red flower and white border from its seed parent ‘Tama-no-ura’. But did it get its medium, to large semi-double, to loose peony form from the unknown pollen parent, or did two recessive genes occur in the parents? (Figure 5: ‘Elaine’s Betty’.)

There are also white toned blooms with multiple forms. ‘Junior Prom’ has a large white flower with a faint blush tint. It is usually rose form but occasionally an irregular loose peony. ‘Ragland Supreme’ has a medium white formal double to rose form double flower. I see

Figure 5: ‘Elaine’s Betty’

Figure 6: ‘Junior Prom’

both forms of these flowers on the same plant in the same season sometimes at the same time. This is true for many of the multiple formed cultivars but not all of them. Why does this happen? If it’s the same plant at the same time, it’s not simply culture or climate. (Figure 6: ‘Junior Prom’.)

NON-RETICULATA HYBRIDS

‘Spring Daze’ is a rose form double in Southern California, but can be a formal double in

Northern California. This would seem to indicate that the differences in climate, soil, or other environmental conditions are factors in this flowers forms. In either case it is a beautiful, small, white tinted blush pink flower edged with coral pink. The significant differences in form lend itself to sending both to the head table for voting. Which form is most appealing to you? This is what I have observed. All of my 'Spring Daze' flowers when they bloomed were in a loose peony form whether mid or late season. None had a bud center. This led me to look at two mature 'Spring Daze' plants in Descanso Gardens in mid April 2012. There were a total of 53 flowers on these two bushes. All the flowers were open, loose peony type. Unopened buds were present but no formal double or bud centered blooms were present. These observations tend to lead me to say 'Spring Daze' is a loose peony formed flower, not a typical rose form double, as was observed in 'Glen 40'. However, in camellia shows I see what looks like formal double flowers from Bakersfield and Sacramento, California. Do some of these flowers when left on the bush over time open and show their stamens as we expect from a rose form double? 'Spring Daze' is a very popular and beautiful *C. saluenensis* hybrid which was introduced in 1989 by Kramer Brothers Nursery. This nursery was begun by Otto and August Kramer in 1896 on Long Island, New York, and moved to Rancho Cucamonga, California, in 1929. Ben Mackall married Marie, August Kramer's daughter, in 1937. After August's death, Ben and Marie managed the nursery until it closed in 1986. While this nursery is no longer with us, its camellia introductions live among us. Kramer Brothers introduced twenty japonica cultivars and at least eight non-reticulata hybrids. Ben Mackall was responsible for introducing the wonderful cultivar 'Spring Daze'. (Figure 7: 'Spring Daze' as a formal double; Figure 8: 'Spring Daze' as an open rose form.)

In Southern California there were thirty-five camellia and azalea specialty nurseries from 1930 to the mid 1980's. Today the only survivor is Nuccio's Nurseries. They have introduced 130 japonica cultivars, including variegated forms, 24 sasanqua cultivars, 12 reticulata, 29 nonreticulata hybrids, and five species seedlings for a total of 200 cultivars. Most of these are still listed in the nursery catalogue, but I found 30 more no longer listed, and most of these

Figure 7: 'Spring Daze' as formal double; Figure 8: As open rose form
Which form of 'Spring Daze' looks best to you?

were from the 1950's. They introduced 'Buttermint', a *C. kissii* hybrid, in 1977. This miniature, very creamy white to pale flower has a formal double to rose form double that occasional puts out a peony form flower. It blooms very profusely. (Figure 9: 'Buttermint'.)

There is a dearth of large non-reticulata hybrids. However, 'Grace Caple' has a wonderful large semidouble to peony form with a faint blush pink flower that fades to white. It is a *C. pitardii* hybrid introduced in 1974 by Mrs. Bettie Durrant of New Zealand. The peony flower form has better chance of winning in a camellia show, but the semidouble form is easier to use in breeding. This cultivar is a good choice for a hybridizer seeking large non-reticulata hybrids with complicated flower forms. Would it make a difference in a new seedling's form if one used the semidouble or the peony flower? As far as I know, this has not been researched. I assume they have the same genetic make-up unless these forms are minor genetic mutations that have a change in DNA that can be inherited. (Figure 10: 'Grace Caple'.)

Figure 9: 'Buttermint'

Figure 10: 'Grace Caple'

Figure 11: 'Senritus-ko' as rose form double.

Figure 12: 'Senritus-ko' as formal rose form double.

'Senritsu-ko' has a beautiful light yellow hue, small to medium flower, with lovely peach pink on the petal edges. It usually is a rose form double but is more impressive when formal double. It was bred by Tadao Yamaguchi of Ishikawa, Japan. My observations are that almost all of the blooms on my plant rapidly open. However, Nuccio's Nurseries, fifteen miles from me, located east and at a higher altitude, does get rose form and formal double flowers. Is it that they have far more of these plants, or the higher altitude, or colder mountain nights, or some other variables that account for the formal double flowers? (Figure 11: 'Senritsu-ko' as an open double; and Figure 12: 'Senritus-ko' as a formal rose form double.)

RETICULATA HYBRIDS

It is generally believed that reticulata camellias are a hybrid with other species, largely *C. pitardii*. The original reticulata imported to America in 1948 by Ralph Peer and Descanso Gardens were inter-bred with other species resulting in numerous new reticulata hybrids and a few have multiple flower forms. Four examples are 'Bill Woodroof', 'Dr. Clifford Parks', 'Frank Houser' and 'Valley Knudsen'.

Figure 13: 'Bill Woodroof'

'Bill Woodroof' has a very large scarlet flower occasionally with lighter tones with a semi-double to loose peony form. It is named for the founder of the ***Camellia Nomenclature***; he was also its editor from 1947 through 1990. Nuccio's Nurseries honored him in 1989 by naming this camellia for him. This was a perfect choice as he was noted for proclaiming a winning show camellia flower needs to be big and red. (Figure 13: 'Bill Woodroof'.)

'Dr. Clifford Parks' has a very large, rich red flower which can be semidouble, anemone, loose peony to full peony. A number of growers, including myself, have observed different flower forms on the same plant at the same time. It is named for one of the most successful camellia breeders in America. Dr. Clifford Parks began to make controlled crosses between reticulata cultivars and a variety of other camellia species when he was at the Los Angles State and County Arboretum in Arcadia, California. He introduced ten reticulata hybrid cultivars. He also has bred a number of non-reticulata hybrids over the years and is a pioneer hybridizer of cold hardy camellias which he developed when he moved to North Carolina. He introduced seven cold hardy cultivars which are known

Figure 14: 'Dr. Clifford Parks' as loose peony form.

Figure 15: 'Dr. Clifford Parks' as peony form.

Figure 16: 'Dr. Clifford Parks' as semidouble form.

as the April series for their spring blooming season. In addition he has introduced two fall blooming cold hardy cultivars. If this wasn't enough, Cliff has a long standing interest in collecting and preserving camellia species. He is a co-author of ***Collected Species of the Genus Camellia: An Illustrated Outline*** with Gao Jiyin and Du Yuequiang. (Figures 14, 15, and 16: Three forms of Dr. Clifford Parks'.)

The most popular reticulata cultivar in America today is 'Frank Houser'. The very large, rose red semidouble to peony form wins more points at camellia shows than any other cultivar. The only one close is its variegated form which also gets more points than any other, because the red and white flower is beautiful. Many camellia enthusiasts have several of these plants which makes it an excellent choice to observe flower forms. Do multiple flower forms occur on a specific plant -- both forms at the same time or does one plant just have semidouble flowers and others the peony forms? When I count petals on 'Frank Houser', the best looking range from 20 to 24 petals with flat ones numbering 11 to 15. Both petal counts are typical of a semidouble form. A few blooms look like a loose peony flower, but the petal count remains the same—numbering in the low twenties. This raises a key question: Do we define a camellia form by its visual appearance or petal count? When camellia friends or flower show judges discuss this and describe a particular 'Frank Houser' as loose peony, it is understandable. However, one definition of a loose or full peony is that it must have at least 30 petals. Do reticulata flowers like 'Frank Houser' ever have that many petals? My observations of hundreds of these flowers at shows and counting petals of fifty flowers from five different plants is that the wonderful 'Frank Houser' and its variegated form are actually semidouble, with many having upright petals sometimes called " rabbit ears". The Chinese call this semidouble type "Butterfly Wings", which is an apt description. (Figure 17: A photo of 'Frank Houser' that looks like a peony formed flower, yet has less than 30 petals; Figure 18: a photo of 'Frank Houser' that looks like a traditional semidouble bloom. Figure 19: 'Frank Houser Variegated.)

However, there are peony formed reticulata flowers that reach 30 petals or more. Three examples are: 'Ruta Hagmann', 'Larry Piet', and 'Mandalay

Figure 17: 'Frank Houser', which appears to be a peony form.

Figure 18: 'Frank Houser', which appears to be a traditional semi-double bloom.

Figure 19: 'Frank Houser variegated'.

Queen'. When I counted several 'Ruta Hagmann' flower petals, they ranged from 31 to 58 and they also looked like a peony. (Figure 20: 'Ruta Hagmann'.) The 'Larry Piet' in the picture had 53 petals. The 'Mandalay Queen' pictured had 31 and looks like a peony flower.

'Valley Knudsen' has a stunning colored deep orchid pink flower which we see in Southern California in its semidouble form, but it is reported to also bloom as a loose peony flower. Do we know if this loose peony actually has a petal count of 30 or more? 'Valley Knudsen' is a *C. saluenensis* seedling x *C. reticulata* 'Buddha' that has received the following awards: Aubrey Harris Hybrid Award, 1971; Frank L. Stormont Reticulata Award, 1972; and the William E. Woodroof Camellia Hall of Fame award, 1981. It was introduced by Howard Asper in 1958. Mr. Aster was Curator of Descanso Gardens and later became Superintendent at Huntington Botanical Gardens. Asper was a prolific breeder who introduced sixteen reticulata hybrids. (Figure 21: 'Valley Knudsen'.)

The very large and beautiful pink 'John Hunt' bred in Australia also is reported to have semidouble, loose peony, and rose form double formed flowers. I have not seen it as a rose form double. The flowers on my plant visually appear to be a loose peony. However, when petals are counted they don't reach the 30 mark. My observations lead me to conclude that 'John Hunt' is a semidouble with butterfly wings which makes it seem like a loose peony flower. The large size with petals undulating like the wings of a butterfly is truly spectacular. What have you observed? Did the petals count reach 30 or more? (Figure 22:

Figure 20: 'Ruta Hagmann'

Figure 21: 'Valley Knudsen'

Figure 22: 'John Hunt'

'John Hunt'.)

ARE CAMELLIAS AN EXCEPTION?

Horticulturists and botanists generally believe that when a plant's flower has a different form it is a key characteristic in classifying it as a different cultivar. This makes sense if the flower form is consistently different when propagated on separate plants. However, when different forms occur on the same plant, which we frequently observe with certain camellias, this doesn't necessarily make a new cultivar. There would need to be other differences in the plant's characteristics, including increased petal count, flower color, growth habits, changes in foliage, etc. Camellia flowers have both male (stamens and pollen) and female (pistil and ovary) parts, although the formal double form is usually sterile. There are some flowering plants with male and female flowers. A good example is the tuberous begonia. (Figure 23: Yellow tuberous begonia.)

NATURE OR NURTURE

It is known that many plants, including camellias, have a shift in leaf size and color, as well as flower size and color tones, as a result of altitude, climate, soil, fertilizers, minerals (for example, the presence of iron makes a richer red hue in camellias), and adding gibberellic acid will increase flower size. However, it is not clear which, if any, environmental factors cause multiple camellia flower forms. Since only some camellias throw different formed flowers, a cultivar that does so must have this genetic potential. This is its nature. In E-mail communication Gene Phillips says, "Camellias are known for their many mutants and unstable genetic nature. My theory is that there are many micro sports or fluctuations that are not as noticeable as the more defined sports. I think these account for the many various "Strains" of camellia varieties." Professor Verne Grant in his book ***Genetics Of Flowering Plants*** wrote on page 96, "In their morphological and physiological effects, gene mutations form a spectrum from minor mutations to macromutations". Consequently it may be

Figure 23: A yellow tuberous begonia - The single male flowers have stamens while the female flowers are double.

that different flower forms on a particular camellia cultivar may represent a genetic flower mutation. However, this does not rule out the impact of environmental causes of flower forms. For example, many growers have noticed that some normally formal double producing cultivars will throw late season blooms that are semidouble to loose peony. Tom Nuccio has observed this on 'Nuccio's Bella Rosa'. Gene Phillips has noted it in 'Pink Pagoda' and thinks temperature changes usually account for it. I can find pollen late season on the full peony flowers of 'Margaret Davis' when it is a loose peony flower. I also attribute this to late season increases in temperatures.

What can we make of a cultivar that generally throws a form in one growing area and a different form in another area? I think environmental factors must play a role. What are they? No definitive studies have been conducted using camellias. The main factors that come to mind are temperature, altitude, and soil conditions.

Bob Ehrhart, a Northern California camellia grower and past ACS President, reports, "I have

gibbed up to 4,000 buds a year and have not noticed any changes in the forms. As far as 'Dr. Clifford Parks', there seems to be two different forms of this bloom, and sometimes there is even a third less attractive form."

It is clear that gibberellic acid, a normal occurring growth hormone, influences blooming period and size of the flower, occasionally creating mishapen ones. It also is clear that it is not the cause of multiple camellia flower forms.

When I asked Dr. Clifford Parks about this, he said, "In short, the effect of mutations in plants and animals can have no, slight, or up to major effects on any organism. Mutations that cause major changes, particularly in morphology are often expressed variably. Many camellia cultivars vary from rose form double to formal. A different climate might favor one form. Doubleness in other plants shows the same variation. There are at least two major genes for doubleness in *C. japonica*. The basic double gene increases petal number but maintains floral symmetry. The paeoniform gene causes the symmetry to break down thus the irregular peony flower. If you cross a plant heterozygous for basic double times one carrying paeoniform, all of the flower forms occur in the progeny. I think there are other petal number modifier genes involved also. The gene that controls extra toes and fingers in man and other mammals shows the same kind of inheritance. The whole subject is somewhat involved. Molecular geneticists are using flower doubleness mutants in the study of flower development".

LET'S INVESTIGATE

A simple study would be to observe several cultivars and accurately label a flower's specific location and form. For example, observing a 'Grand Slam' for two or three years to see if the same form consistently occurs on the same branch or branches. If so this would offer support for the hypothesis of a minor genetic mutation. If propagating that stem also produced the same form, this would be added proof. On the other hand, if reliable observations determine low or no correlation between forms and location, this would lend support to the supposition that unknown environmental factors are interacting with a cultivar's genetic potential to produce multiple forms.

Return to TOC

'Fukurin-Ikkyu' - Japan to U.S.A. through Star Nursery 1930

Mr. Uyematsu A Great Importer

By Bradford King

Most camellia people are unfamiliar with Mr. F.M. Uyematsu, the most important camellia importer of his generation. He came from his native Japan as a twenty-three-year-old in 1904. He and a friend began importing plants in 1908 from Japan to Figueroa Nursery in Los Angeles. Mr. Uyematsu was very enterprising. He began peddling camellias and other plants about Los Angles with a horse and buggy. In 1912 he moved to a five acre lot in Montebello, California, and established a wholesale business named "Star Nursery". He continued his entrepreneurial ways to the

point of operating four nurseries and a wholesale flower market, and by experimenting with hybridizing willows, wisterias, and peaches, and by breeding tropical fish. Over the years Star Nursery imported hundreds of thousands of camellias. He paid 3 cents for camellias in Japan, 5 cents to import them to the United States, and sold them for 25 cents in cart loads of up to 60,000. Commercially he stuck to varieties requested by retail nurserymen --'Pink Perfection' and 'Eureka'. On the side he privately collected other camellias. In those days camellias were not important commercially in Japan. In fact, since the feudal days the Japanese dislike flowers that drop off the bush in one piece, preferring petals to blanket the ground.

In 1915 the United States announced an embargo of Japanese imports to begin the next year. Therefore, Mr. Uyematsu imported a number of camellias prior to the deadline. He didn't order them by name, just that they be "good varieties". Many were labeled simply "Red', "Pink", and "White". As a consequence he had sufficient plants in stock that he sold 450 unnamed camellias in 1917 to Joshua E. Youtz of Pasadena from his Montebello nursery. As many as 300 were 'Frau Minna Sedel', which we know as 'Pink Perfection'. Mr. Ellsworth Youtz, son of Joshua Youtz, reported they also received seeds to germinate. Mr. Uyematsu claimed he never sold them seeds. Regardless, a number of camellias were introduced commercially from this source. A good example is 'Youtz White Daikagura', which we know as 'Joshua E. Youtz', which has a large white peony to formal double flower. In the Camellia Nomenclature it is listed as from Japan 1915 – Star.

In 1930 Mr. Uyematsu visited Dr. B. Miyazawa of the Tokyo Horticultural School who had his students breed camellias. Mr. Uyematsu secured some seeds of these interbred camellias, and he also obtained a large quantity of seeds from a nurseryman in Saitama Province who was producing new cultivars. Upon returning to America he planted 25,000 of these seeds. The first flowers appeared in 1935 – all singles, but two years later the first doubles began to bloom. In addition he imported 113 choice camellia cultivars in 1930. There were a total of 500 plants from one of a kind to a baker's dozen. These were planted in the Sierra Madre branch of Star Nursery

'Bernice Boddy'

and grown in a lath house. A list of these camellias appears in the 1950 Camellia Yearbook pages 39 - 41. The first blooms were unimpressive, thus of little interest, and were therefore neglected. Mr. Uyematsu estimated about half died and most of the survivors' labels were weather-worn and unreadable.

After Pearl Harbor and the United States entered World War II, Mr. Uyematsu was faced with internment along with other Japanese Americans which meant the loss of his property and business. He had 60 or so new seedlings worthy of propagation and about 250 of the 1930 imports. On February 22, 1942, he was visited by Manchester Boddy, a Los Angeles newspaper publisher, and Charles S. Jones, president of the Richfield Oil Company, both avid camellia collectors who wished to buy camellias for their estates in the Los Angeles area of California. It is reported that as many as 300,000 camellias were sold to them. Mr. Boddy got most of the named camellias from the 1930 importation; Mr. Jones got a number of the unnamed seedlings, some of them in bloom. Mr. Uyematsu had named only one of his seedlings -- 'My Darling'. Jones gave numbers

to his new collection of seedlings, some of which were later obtained by Boddy's Descanso Nursery (now Descanso Gardens). The result is that many of these Star Nursery cultivars were never identified or named. Some were named and distributed by Descanso with Jones' numbers. For example, number S101 is 'Bernice Boddy'; S103 is 'Pride of Descanso'; S194 is 'Mrs. Howard Asper'; and S218 is 'Lauren Bacall'. While 'Gibson Girl' was never numbered by Mr. Jones, it was released by Descanso in 1947.

In 1941 Mr. Henry Davis of Glendale visited Star Nursery and was given a seedling by Mr. Uyematsu. Mr. Davis gave the seedling to Mr. and Mrs. T. B. Nichols. The Nicholses could never discover the name for their lovely, pink, semidouble camellia; thus, when propagated by others it was named 'Edith Nichols'.

Mr. Uyematsu through Star Nursery was a major importer, propagator, and distributor of camellias in America. He was a successful and enterprising businessman whose camellia legacy can be found in genes of old and new camellias. This is illustrated by the camellia 'Bernice Body' whose genetic background is Japanese. The plant was propagated and introduced by Descanso and Jones from plant material purchased from Star Nursery. It has been used in many breeding programs, including a number of cold hardy camellias bred by Dr. Clifford Parks in his April series. Nuccio's Nurseries grew hundreds of 'Bernice Body' seedlings, introducing 'Bernice Beauty' and' Bernice Perfection' in 1965. In American camellia history we have individuals, commercial nurseries, and public gardens that have made significant contributions to the camellia world. One of the least known and yet most important was Mr. Uyematsu.

'He paid 3 cents for camellias in Japan, 5 cents to import them to the United States, and sold them for 25 cents in cart loads of up to 60,000.'

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Return to TOC

The Wonderful Hybrid Camellias

By Bradford King

There are two hundred and eighty species that comprise the genus *camellia.* The big three are *japonica, reticulata and sasanqua*. The breeding of camellia cultivars within a species has a very long history in Asia, Europe and the English-speaking camellia world. The intentional breeding between camellia species is a more recent development. This is the story of camellia hybrids excluding reticulata hybrids.

The Williamsii hybrids

The first species when bred with C. *japonica* that produced wonderful new camellias was C. *saluenensis*. These are known as *Williamsaii hybrids* named after John Charles Williams of Caerhays Castle in Cornwell, England. He was a major sponsor of George Forrest's plant collecting trips to Yunnan China. Forrest made seven trips between 1905 and 1932 collecting thousands of plants and seeds. He gave seeds of *Camellia saluenensis* to Williams who shared them with Col. Stephenson Clarke. They found the plants grew well, flowered freely, set seed and survived the cool winter weather in Great Britain. They began to make controlled crosses to augment the open crosses. It was after Williams's death in 1939 when they began introducing new hybrids. The first was named 'J.C. Williams' in 1940 to honor him. Col. Clarke introduced 'Donation' one of the best known and widely distributed hybrids. It has an orchid pink flower with darker pink veins. The name may have been selected to indicate that the original seeds were a donation from Williams to Clarke.

Today we have hundreds of C. *japonica* and C. *saluenensis* crosses which are listed in camellia nursery catalogues and The Camellia Nomenclature under the category of nonreticulata hybrids. In general these small leafed hybrids produce a profusion of small to medium flowers, tend to set buds when young, and tolerate cooler tem-

peratures. Flower forms may be single, semidouble, loose peony, peony, formal double, but rarely anemone. Most have flowers in shades of pink from blush to very deep pink. A few flowers have a bluish pink color, others lavender pink tones, and some lovely shades of coral pink. There are also a limited number of hybrid flowers that are rose red, bright red, and dark red.

A few of the choice single cultivars are 'Demure', 'Tulip Time', 'Holland Orchid' and the original *saluenensis hybrid* 'J.C. Williams, which has a small to medium orchid pink flower. David Feathers spent forty years as a camellia lecture writer and prolific hybridizer. Two of his most beautiful pink hybrids are 'Demure' and 'Tulip Time' which are propagated by Nuccio's Nurseries. 'Demure' has a lovely small single pale pink flower with deeper pink on the petal edges. 'Tulip Time' has a light pink medium flower shaped like a tulip. The plant grows vigorously and blooms profusely. (Photos of 'Demure and 'Tulip Time')

'Holland Orchid' has a medium tubular single with an orchid pink flower introduced in 1961 by John Holland of Upland California. These single blooming camellias are rarely seen at camellia shows but have earned a place in the home garden landscape.

'Demure'

'Tulip Time'

The semidouble hybrids do well in the garden with some of them making beautiful show camellia entries. 'Angel Wings' is a good example of a medium semidouble, white shaded, orchid pink flower. The narrow, upright petals inspired the name. An example of bluish pink medium semidouble bloom is 'Blue Bird'. 'Waltz Time' and 'Julie' have beautiful lavender

pink flowers, whose variegated blooms are even more striking, making them popular exhibition flowers as well as wonderful garden plants. Coral pink semi-double flowers are illustrated by 'Coral Bouquet', 'Coral Delight', 'Kramer's Fluted Coral, and 'Island Sunset'. One of the best hybrids is the beautiful cultivar 'Spring Daze'. It has a small to medium, rose form to formal double, blush pink with coral pink petal edges flower. There are many orchid pink hybrids; some of the most popular are 'Taylor's Perfection', 'Pink Dahlia' and 'Donation'. There are some very beautiful formal

'Buttons N Bows'

'Coral Delight Variegated'

'Joe Nuccio'

'Island Sunset'

'June Variegated'

'Taylor's Perfection'

double pink hybrids. One of the first to gain popularity was 'E.G. Waterhouse', bred and named by Professor Waterhouse of Australia in 1954. One of the best formal double is 'Buttons N Bows'. The small flower has a mass of fluttered pink petals that shade to a deeper pink on the edges. In addition, there are several formal doubles that have interesting incurved petals, for example, 'Dreamboat', 'Water Lily' and 'Joe Nuccio'.

New *Williamsii* cultivars were widely bred and propagated but it was not until 1962 that Les Jury of New Zealand introduced a major color break with his cultivar 'Anticipation'. The large peony, deep rose flower and its variegated form are widely distributed. One of the most popular with show quality flowers is 'Freedom Bell'. The bright red, small to medium, semidouble bell shaped flower was introduced by Nuccio's Nurseries in 1965. Os Blumhardt from New Zealand bred a number of black red camellias using japonica 'Kuro tsubaki' (the Black Camellia), including 'Black Opal', Ruby Bells', and the best of all, 'Night Rider'. The attractive plant has small leaves that are a deep maroon when new, and the semidouble flower is small and a very dark, black red.

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'Anticipation Variegated'

'Freedom Bell'

'Night Rider'

The Pitardii Hybrids

These hybrids are nonreticulata hybrids with *C. Pitardii* parentage. While I try my best not to impulsively buy cultivars in bloom when visiting Nuccio's Nurseries, I was encouraged by my wife, Lynn, to buy a camel-

lia with profuse, formal double, bright pink flowers, stunningly beautiful and aptly named 'Adorable'. It is an Australian *Pitardii* seedling introduced in 1979 by Edgar Sebire. The plant is compact and upright that reliably blooms profusely in the garden. However, the flowers don't travel well to camellia shows, generally falling apart.

If lavender toned flowers appeal to you, 'Contemplation' with its medium, semidouble, lavender pink flower with occasional petaloids would be a good choice. It is not, however, a show flower camellia. On the other hand, the large semidouble to loose peony, 'Grace Caple', with a blush pink flower that shades to white, has potential to show well. It blooms mid to late season and is one of the few large nonreticulata flowers. This open pollinated seedling was introduced by Mrs. T. Durrant in 1974. This means she knew the seed pod developed on a *C. Pitardii* plant but not the pollen source. Most likely the pollen came from a japonica flower in her garden. Many camellia growers, including myself, rate 'Nicky Crisp' the best *Pitardii hybrid* with its fresh, clean looking, medium to large, light orchid pink flower. It has show quality flowers with many identical blooms that make for beautiful trays of like blooms. The plant grows slowly and compactly, yet will bloom when small. It was introduced by Mrs. Durrant of New Zealand in 1980 and was named for her grandson. This is a must camellia for one's collection. Since it grows slowly, room can be found to plant it in the garden, but if not,

'Grace Caple'

'Nicky Crisp'

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'Fragrant Pink'

it makes an excellent container camellia and can be grown as a bonsai.

The Lutchuensis hybrids

Fragrance is rare in japonica cultivars, and when present, is very thin, with some of us never able to detect it. Fragrance is lacking in reticulatas and present in some sasanqua, with some people finding the musky scent unpleasant. The breakthrough in breeding fragrant camellias came when C. *lutchuensis* was brought to America from Okinawa in the early 1960's. It is a naturally perfumed ca-

'Scented Gem'

mellia. A profusion of small, single, white flowers are born on graceful weeping branches that are highly fragrant. It is in the parentage of the best modern fragrant camellia hybrids. The first of these interspecific crosses using *C. lutchuensis* as pollen parent were female sterile and produced very little viable pollen. However, Dr. William Ackerman began to report breakthroughs in breeding lovely scented hybrids. He developed 'Fragrant Pink' by crossing C. *rusticana* 'Yoshida' with C. *lutchuensis* in 1968. It has a miniature peony flower. In 1978 he developed 'Ackscent' (C. *japonica* 'Kramer's Supreme' x 'Fragrant Pink Improved' a rusticana x C. *lutchuensis*) which has a medium peony flower with a spicy fragrance. This was followed by 'Acksent Spice', a deep rose red medium bloom with a lemon spicy fragrance

'Spring Mist'

and a spicy cinnamon scented flower, aptly named 'Cinnamon Cindy'. It has white shading to pink peony flowers.

In Northern California, Toichi Domoto, a pioneer camellia breeder, introduced a lovely fragrant camellia named 'Scented Gem'. The flower is a cute miniature fuchsia pink. The plant grows upright and has nice, lacy, light green foliage. It inherited its sweet fragrance from *C. lutchuensis* and its anemone form, guard petals, and white

petaloids from 'Tinsie'. It is one of the rare anemone formed hybrids.

The delightful fragrance of 'Spring Mist' is a *lutchuensis* hybrid developed by Parks and Longley. This plant, which grows vigorously in an upright open manner, has a lovely, small, semidouble, blush pink flower which shades to white. It is a profuse midseason bloomer.

'Sweet Emily Kate' was introduced in Australia by Ray Gannett in 1987. It has become widely distributed because the lovely, medium peony, light pink flower, shading to pale pink in the center. is lovely to look at and has a pleasant fresh scent.

James Finley from Whangarei, New Zealand, is known worldwide for his scented camellias. He began breeding them in 1970 and has introduced over 35 fragrant cultivars. He used C. *lutchuensis* because of its beautiful perfume and crossed it with *C. japonica* 'Tiffany' to get 'Scentuous'. He was one of the first breeders to break through the sterile barrier of F1 hybrids that had thwarted fragrant camellia development. His most popular fragrant hybrid is 'High Fragrance', a japonica 'Mrs. Bertha A. Harms' x hybrid 'Scentious' seedling. The medium peony flower is an attractive pale ivory pink that shades to a deeper pink at the petal edges and emits a lovely sweet aroma that usually wins in the fragrant class at camellia shows. The plant grows vigorously and is open in growth habit.

'Sweet Emily Kate'

'High Fragrance'

In general these fragrant camellias do not win points in the non reticulata class at camellia shows. Therefore, some shows will have a class for fragrant

'Senritsu-Ko'

'Ki-No-Senritsu' (Yellow Melody)

camellias where a three person judging team selects the most fragrant camellia with good flower qualities to go directly to the award table. As a camellia head judge it is important to select a judging team free from smokers, people wearing perfume, and judges who acknowledge difficulty distinguishing scents. This usually means a team with one or more women who generally have the "best noses". While fragrant camellias may not be exhibition camellias, they make excellent landscape camellias with masses of lovely perfumed flowers. We would be a lot poorer without these wonderful hybrids that stimulate sight and smell.

The Nitidissima hybrids

While there are more than forty yellow camellia species growing in China and Vietnam, the best known of these species is *C. nitidissima variety nitidissima* formerly *C. chrysantha* but generally just know as *C. 'nitidissima'*. It has been used to develop new yellow camellias because the small cup shaped flower is a lovely deep shade of golden yellow. However the progress in developing yellow hybrids has been very slow with most controlled crosses failing especially with japonica parents. Today we have a dozen or so lovely creamy and light yellow cultivars almost all of them have *C. nitidissima* in their lineage.

Mr. Tadao Yamaguchi of Ishikawa, Japan, is a pioneer hybridizer of yellow camellias. He introduced 'Shoko'in 1989, which means "First Yellow". This light yellow. small single was followed by three other pale yellow hybrids. 'Kicko', a small tubular single; 'Kiho', a small to medium, single tubular with wavy petals, and 'Ki No Gozan', a cup shaped, small to medium, single tubular flower.

In 2007 two of the best yellow hybrids were introduced by Nuccio's Nurseries. They are also the work of Yumaguchi, who back crossed 'Kiko' on *C. nitidissima* to get these light yellow hybrids. 'Ki-No-Senritsu' (Yellow Melody) has a lovely peony to loose peony formed flower that thrives in deep shade where it grows moderately fast but is a shy bloomer. 'Senritsu-Ko' has a beautiful small to medium, formal to rose form, flower, which has light yellow petals with peach pink edges. It grows moderately fast in an upright open growth pattern. It sets multiple buds and flowers easily in midseason. In Southern California it has many more rose form flowers than formal doubles. It, too, prefers more shade than a typical japonica.

Mr. Kazuo Yoshikawa of Osaka, Japan, used camellia species *saluenensis*, *reticulata, japonica* and *sasanqua* crosses with *C. 'nitidissima* variety *nitidissima*' in numerous combinations. Most have some *reticulata* in their genetic makeup. Yosikawa's best nonreticulata hybrid is 'Kogane Nishiki'. It has a pale yellow background with slender stripes of red inherited from its parent 'Betty Foy Sanders'. It has a small, single, trumpet shaped flower that blooms on a vigorous upright plant. While "kogane" means gold in Japanese, this cultivar is a lovely pale yellow with distinctive red markings.

'Kogane Nishiki'

'Golden Glow'

'Honeymoon'

Nuccio's Nurseries used a cultivar with *Pitardii* and *japonica* 'Guilio Nuccio' to cross with *C. nitidissima* in their quest for yellow camellias. These crosses produced 'Honeymoon', a

medium to large, semidouble, very creamy white flower with yellow on the base of the petals; 'Golden Glow', a medium semi double with a creamy white that deepens to a light yellow on the flower base, the petals have a light pink tone on the edges; and 'Lemon Twist', a medium semidouble, pale yellow flower with deeper yellow tones in the center.

The deepest yellow camellia to date is called 'Kagirobi'. It is a formal double obtained from crossing 'Silver Chalice' x C. *nitidissima.* However, it is not readily available commercially. It grows vigorously but is a reluctant bloomer.

'Kaigirobi'

'Buttermint'

'Bunny Ears'

Other hybrids

Hybridizers have used a number of other camellia species in their breeding programs. Some examples of the most widely distributed are discussed below. A miniature, formal double to rose form double, creamy white to light yellow *C. kissii* hybrid that has gained some popularity is 'Buttermint'. It blooms profusely on an upright growing plant that blooms early to late season.

C. roseflora has a small, single, pink flower that blooms profusely and has produced several nice hybrids that have their fans. 'Baby Bear', has a single, miniature, pink flower that grows on a dwarf, compact upright plant and 'Bunny Ears', has a miniature to small, pink, semidouble flower with rabbit eared petals.

C. granthamiania has white flowers, very large leathery serrated oblong pointed foliage with brown scaly flower buds. Examples of its hybrids are 'China

Lady', which has a very large, irregular semidouble, rich orchid flower; 'Moonrise', which has a very large, semidouble, white to blush pink flower with pale yellow at the base of the petals; and 'Shanghai Lady', which has a very large, irregular light orchid flower.

The small, single, white flowering *Camellia cuspidata* produced 'Moonstruck', which has nice red buds opening to a single, medium, blush flower with pink tones in its center and on its petal edges. 'Spring Festival' has a miniature rose form double that puts out masses of pink to light pink flowers blooming mid-to-late season New growth is an attractive reddish brown. This cultivar is very sun tolerant.

'Sweet Jane' is a *C. transokoensus* hybrid with a miniature peony flower with a pale pink center that shades deeper pink on the outer petals. 'Yume' is a cross between *C. Hiemalis* 'Shishi Gashira and *C. yuhsienensis* that has a very showy single pink flower genetically blotched with white. It is a profuse bloomer, making it an excellent landscape camellia.

'Moonstruck'

'Yume'

Future Hybrids

What will hybridizers think of next? Dr. Clifford Parks is experimenting with *C. flava,* a yellow species to see if richer yellow camellias can be bred. Professor Gao's group in China has bred twenty summer blooming camellias using *C. azalea.* Longwood Gardens in Pennsylvania is also using *C. azalea* to produce cold hardy, long blooming camellias. Gao and Longwood gardens are seeking to breed hybrids that will bloom repeatedly in the same season. Currently there are no hybrids being commercially propagated from *C. azalea.* There are many camellia species whose potential has not been fully tapped beside *C. flava* and *C. azalea.* Which ones will produce camellia breakthroughs?

Return to TOC

WHAT IS A CAMELLIA SPECIES?

By Bradford King

While it is 150 years since the publication of Darwin's "On the Origin of Species", there are a number of unresolved questions among botanists about taxonomy of camellia species. Increasing your understanding of species, hybrids, and the classification system will help you to understand the diversity of camellias. This will improve your enjoyment of this beautiful flowering evergreen plant.

CLASSIFICATION AND TAXONOMONY

Early naturalists wanted to organize and categorize all plants and animals. The goal was to systematically describe distinct groups separated from each other by a set of definable characteristics such that individuals in each group are distinguishable from those in any other group. In addition, each individual species in a group needs to be described by characteristics that make them different from all other species. The next step was to name each group and write up a diagnostic description of the shared characteristics that define the group.

Linnaeus published his classic text "Systematic Naturae" in 1735. He established a binomial nomenclature which continues to be used today. This gives an organism two names--a genus and species-- for example, Camellia (genus) *japonica* (species). He named the genus after Georg Joseph Kamel. Kamel was a Jesuit missionary in the Philippines who was also a pharmacist and amateur botanist. Kamel's extensive writings on the plants in the Philippines impressed Linnaeus so he used the Latinized version of Kamel -- "Camillus" -- for the genus.

This classification system is arranged hierarchically in order to indicate relatedness. This means that like species are grouped into genera with like genera into families. The camellia is a member of the Theaceae or tea family, tribe Gordonieae and eight other genera as follows: *Franklinia, Gordonia, Laplacea, Pyrenaria, Schima, Stewartia, Tutcheria, and Yunnanea.*

The three most important authorities on Camellia taxonomy are Sealy, Chang and Ming. They each developed a taxonomy system. Sealy described the genus and placed the species into

morphologically similar groups known as sections. He developed 12 sections, 82 species, and 24 doubtful species. Chang with more plant material to study revised the system three times. He added several sections, ending up with 22, plus 4 subgenera, and named new species totaling up to 280. Later Ming reduced the number of species by combining and eliminating. He closely follows Sealy compiling 14 sections, 2 subgenera, and119 species.

SPECIES OF THE GENUS CAMELLIA

The species of the genus are arranged into sections according to visual and morphological similarity. The material presented here is based on *Collected Species of the Genus Camellia: An Illustrated Outline* by J. Gao, *C. R. P*arks, and Y. Du. They discuss nineteen sections of which the nine most relevant to the American camellia grower are discussed here with examples of camellia species that can be found in specialized camellia nurseries like those listed in this Yearbook.

Section *Archecamellia:* This section contains only two species after it was reduced by Chang. He moved *C. petelotii* to section *Chrysantha* because it has a yellow flower. Camellia *amplexicaulis* is the most important species in this section.

Figure 1: *C. amplexicaulis*
-- Photo by Bradford King

Chief characteristics: The flowers are borne signally and in multiples at the tips of the branches and in leaf axils on clearly visible pedicles (bud stems). The leaves are large, oblong, and finely serrated. This plant can form a large tree. The perules (combined bracts and sepals) are persistent. Bracts are the outermost section of the flower and sepals are the individual outer parts of the flower which protect and hold the flower. This totality is what camellia growers call the calyx. These species ovaries have 3 to 5 locular (small compartments which contain ovule or seeds). Figure 1: *amplexicaulis*.

Section *Camellia:* This is the largest section with 60 species and subspecies. Most have

Figure 2: *C. azalea*, or 'Changii Ye' *-- Photo by Bradford King*

ornamental value. The following are the most important to camellia breeders and growers. *C. azalea, C. chekiangoleosa, C. edithae, C. hongkongensis, C. japonica var. japonica, C. japonica variegated rusticana, C. pitardii var. Pitardii, C. pitardii var. Yunnanica, C. reticulata, and C. saluenensis,*

Key characteristics: red flowers two or more inches in diameter, undifferentiated bracts and sepals and basal fusion of the flower parts. Figure 2: *C. azalea* (aka *C. Changii* Ye) and Figure 3: *C. pitardii variety Pitardi*

Figure 3: *C. pitardii variety Pitardi*
-- Photo by Bradford King

Section Chrysantha: This section contains the 40 yellow camellia species that have been collected and reported in the

Figure 4: *C. nitidissima* -- *Photo by Bradford King*

scientific literature. Those available in the United States are *C. chrysanthoides, C. flava, C. nitidissima, and C. tunghinensis.*

Key characteristics: yellow flowers with distinct bracts and sepals that are persistent. The styles are free and not fused at the base. Figure 4: *C. nitidissima.*

Section *Eriandria:* There are fourteen species in this section, all of which are native to China with the following commercially available: *C. assimilis, C. cordifolia, and C. salicifolia.* Figure 5.

Key characteristics: small flowers, long soft hairs on the shoots, and leaf bracts. The filaments are fused into a column and the ovary has dense hair or wooly appearance when viewed under a microscope or magnifying glass.

Figure 5: *C. assimilis* **-** *Photo by Gene Phillips*

Figure 6: *C. oleifera* *--Photo by Bradford King*

Figure 7: *C. grijhsii* *--Photo by Bradford King*

Section *Oleiflera:* In 1981 Professor Chang established this section by separating five species from Sealy's Section Paracamel-

lia. Three are well known in the United States -- *C. oleifera, C. sasanqua and C. vietnamensis.*

Key characteristics: Flowers are slightly fragrant, white, and bloom in autumn to early winter. The styles and anthers are long. The seeds have high oil content. Figure 6: *C. oleifera.*

Section *Paracamellia*: These species are cultivated in China for edible oil. The following four examples from this section are available from camellia nurseries in the USA: *C. grijsii, C. kissi, C. miyagii, and C. yuhsienensis.*

Key characteristics: The profuse flowers are small, white, and fragrant. The perules drop early. The leaves are small. The pollen bearing part of the flower is short and the ovary has fine plant hair.

Nuccio's Nurseries bloom hundreds of grijshii seedlings. Most of the seedlings are almost identical to the seed parent, however, *C. grijhsii* 'grijsii select' has a slightly larger white flower that is fragrant. The foliage is slightly larger and darker. Figure 7: *C. grijshii.*

Section Protocamellia: This section was set up by Professor Chang in 1996 with five species. The two found in the camellia trade are *C. granthamiana* and *C. yunnanensis.*

Figure 8: *C. granthamiana*
-- American Camellia Society

Figure 9: *C. irrawadiensis*
-- Photo by Bradford King

Figure 10: *C. sinensis*, the tea plant.
-- Photo by Bradford King

Key characteristics: The white flowers are borne at the tip of the plant stems. The flower has 10 to 14 petals. There are 12 to 16 persistent perules. The stamens and styles are free—not

Figure 11: ***C. rosaeflora*** *-- Photo by Bradford King*

fused together at the base. The ovary has five locules. The seed pods are large with a thick wall. Figure 8: *Granthamiana.*

Section *Thea*: The leaves of camellias in this section are used to make tea. The species available for purchase through camellia nurseries are *C. irrawadiensis, C. ptilophylla, and C. sinensis var. sinensis* (the classic tea plant).

Key characteristics: The flowers are small, white, and borne in the leaf axils. The pedicles (flower stems) are long and thick. Figure 9: *C. irrawadiensis* and Figure 10: *c. sinensis var. sinensis*

Section *Theopsis:* The camellias in this section are valuable for breeding and make good garden and landscape plants. The following species can be found in camellia nurseries and ordered by mail from Nuccio's Nurseries or The Camellia Forest*: C. costei, C. cuspidata, C. euryoides, C. forrestii, C. fraterna, C. handelii, C. longicarpa, C, lutchuensis, C. minutiflora, C. nokoensis, C. rosaeflora, C. transnokoensis, C. trichoclada, and C. tsaii.*

Key characteristics: These species typically have small leaves and bloom profusely with fragrant small flowers. They will develop into a nice tree with good thick branching. Figure 11: *C. rosaeflora.*

HYBRID SPECIES

There are camellia species that appear in the Camellia Nomenclature, books, and articles that are part of camellia lore. But are they truly species? What is a *hiemalis, vernalis, rusticana*, or a *wabisuke*?

***Hiemalis* origins** are unknown, but there is evidence that it is not a separate species. Most camellia researchers (Sealy, Ming, and

Figure 12: *'Showa-no-sake'*
-- Photo by Bradford King

Figure 13: 'Egao'
-- Photo by Bradford King

Parks) consider it a form of *C. sasanqua,* but Chang and Bartholomew state it is a separate species. Sealy used the name first to define a group of C. *sasanqua* cultivars that exhibited significant characteristics inherited from *C. japonica*. A typical *hiemalis* has small leaves and blooms in the fall. They generally are more similar to a *sasanqua* than *japonica*. The wild *sasanqua* are almost always white with other colors developing in the past from chance crosses with *C. japonica.* Frequently they are grouped under the descriptive title "Sun Camellias". It can be argued that they could be more accurately classified under a heading such as "Camellia sasanqua complex". Good examples are 'Dazzler', 'Kanjiro', 'Shishigashira' and 'Showa -no-sake'. They make excellent landscape camellias. Figure 12: 'Showa no sake'.

Figure 14: 'Kasuga-yama'
-- Photo by Bradford King

Figure 15: 'Campfire'
-- Photo by Bradford King

Camellia x vernalis is a hybrid species morphologically intermediate between *C. japonica* and *C. sasanqua*. Japanese research indicates that *C. vernalis* originated about 400 years ago based on the age of the oldest

Figure: 16: 'Shooting Star'-- *Photo by Bradford King*

tree on Hiraldo Island where *C. vernalis* began. Japanese books published in 1630 described *vernalis* camellias. The seed parent was *C. sasanqua*. The rationale is that camellia chloroplast is entirely maternally inherited with *C. sasanqua* chloroplast found in *C. x ver*nalis. This species blooms from fall to early winter with flowers that are larger than the typical *sasanqua* on plants that thrive in more sun than the typical japonica. They make excellent landscape camellias with many cultivars readily available. Popular examples include 'Egao', 'Shibori-egao' (variegated 'Egao') and 'Star above Star'. Figure 13: 'Egao'.

Rusticana is a *japonica* subspecies that are adapted to very high snow fall in Japan. They are frequently called "snow camellias". They thrive in humid climates and may be difficult to grow in dry areas. They are usually bushy and compact in growth habit with many small flowers. 'Botanyuki', 'Hime shira yuki', 'Kasaga Yama', 'Shiro karako' and 'Yuki komachi' are examples of this japonica subspecies. There are a few dozen cultivars available at camellia nurseries throughout the country as well as several seedlings – 'Campfire' and 'Shooting Star' that can be added to a garden collection. Figure 14: 'Kasuga-Yama'; Figure 15: 'Campfire'; and Figure 16: 'Shooting Star'.

Wabisuke **is** a *japonica* sub-

Figure: 17: 'Fukurin wabisuke'
-- Photo by Joe Tunner

Figure: 18: 'Hina wabisuke'
-- Photo by Joe Tunner

species of unknown origin whose flowers are small, single, usually tubular with reduced stamens—very few pollen sacks. The plants are small to medium leafed and shrubby making a simple but attractive garden camellia with their single blooms which look good in flower arrangements. A few cultivars are commercially available such as 'Fukurin wabisuke,' 'Hina wabisuke', and 'Taro kaja' ('Judith'). Figure 17: 'Fukurin wabisuke' and Figure 18: 'Hina wabisuke' credit for these photos go to Joe Tunner

CONCLUSION

Since the beginning of time, Mother Nature has contributed to the development of camellia species and interspecific crosses with the fittest ones surviving to pass along their genetic material. New camellia species continue to be discovered in the isolated regions of China and Vietnam. Camellia hybridizers have been crossing camellia species for hundreds of years in order to develop new cultivars with interesting and beautiful flowers. This, too, continues.

The Camellia Nomenclature combines *Reticulata* and hybrid camellias with *C. reticulata* parentage together. Hybrids with other than reticulata parentage are combined in another category. Many of these hybrids are *saluenensis x japonica,* which are also known as *Williamsii hybrids*. As camellia breeders make more interspecies crosses besides *saluenensis* this general non reticulata category becomes more and more diversified. The addition of more camellia species in the breeding pool enhances and advances camellia diversity which drives the development of new, interesting, and beautiful camellia cultivars.

Return to TOC

Tea in America: Yesterday & Today

By Bradford King

Worldwide tea (*Camellia sinensis)* is second to water as the drink of choice. The history of tea is long and complex, spreading across multiple cultures and thousands of years. Although many stories are told about the beginnings of tea being used as a beverage, no one is sure of its origins. One popular legend is that Shennong, Emperor of China, was drinking a bowl of just boiled water when a few leaves from a tea tree blew into the bowl which changed its color. The emperor took a sip and enjoyed the flavor. Another version is that the emperor was testing on himself the medical properties of various herbs, some of them poisonous, finding tea worked as an antidote.

Tea In The West

Tea arrived in Europe via Dutch and Portuguese sailors at the beginning of the 17th century. They had trade relations with China and brought the tea to Britain and Holland, where it was sold at auctions and became very popular among the aristocracy and the wealthy. The beverage's initial high price prevented it from circulating among the western population at large. The tea trade was a significant factor in establishing connections between east and west. In China, tea leaves were used as a substitute for coins. In Europe, tea was used as a symbol of high status and as a stimulus for many technological developments, for instance, the development of fast sail boats such as the "Clipper", which shortened the time it took to sail from China to Europe and made it possible to provide shipments of fresh tea to the West.

Tea was imported in the 1660's to Britain with the marriage of King Charles II to Catherine of Braganza a Portuguese princess, who introduced the drinking of tea to the court.

British companies established for the importing tea, such as "The East India Trade Company". The royal family empowered them to operate in any way necessary to ensure the continuous supply of this popular drink. At the beginning of the 18th century, with the expansion of tea imports to the West and the consequent decrease in its price, tea became a common product enjoyed by all sectors of the population.

The Boston Tea Party

At the beginning of the 18th century, tea arrived in Northern America, quickly becoming a desirable drink. In New

Tea plant growing on a tea planatation.

York and Boston, London-style teahouses started developing, where the drink was sold to the general public. Around that time, the British Empire decided to place taxes on the tea supply to the colonies of North America who were under their power. This decision greatly angered the American settlers who decided to boycott the taxed products in protest. Whenever the British ships arrived at the harbors laden with tea, the settlers would start demonstrations which forced the ships to leave without unloading their wares. The most famous occurrence in this regard was named the "Boston Tea Party", during which a group of settlers boarded one of the ships anchored in the Boston harbor and started throwing hundreds of crates of tea from its deck into the sea. England retaliated by sending military forces to the harbor and shutting it down. This event marked the beginning of the American War of Independence.

Tea In The 20th Century

A significant rise in tea consumption resulted from the appearance of tea bags at the beginning of the 20th century. The inventor of tea bags, a New York tea merchant by the name

of Thomas Sullivan, is credited with inventing tea bags in 1908. Sullivan, a New York tea importer, inadvertently invented tea bags when he sent tea samples to clients in small silk bags to cut costs, and they mistakenly steeped the bags whole. The customers were interested in the silk bags instead of the tea. Sullivan did not realize this until they all started to complain that the orders they received were not in the bags the samples had been in. Silk was too expensive for bagging; therefore, he invented tea bags made of gauze. Most tea sold in the United States is in bags, although there is a growing demand for both the loose leaf teas and for the ready to drink iced tea.

How did ice tea make its way into the American food scene? Many people believed that the first iced tea was served in the 1904 Saint Louis World Fair. The Indian exhibit was trying to sell hot tea to visitors during the summer heat with no sales being rung up until the hot tea was cooled and served. This is one version of how iced tea was born. However, others think this story is an urban legend. Regardless, in the United States iced tea makes up about 85 percent of all tea consumed and is very popular as an alternative to carbonated soft drinks, especially in the hotter Southern states and Southern California. It is ubiquitous in restaurants, convenience stores, vending machines, and grocery stores. It may be freshly made on the premises or available in bottles and cans. It is also popular sweetened, unsweetened, or with a variety of fruit flavors. Traditionally a slice of lemon was served with tea and today a mixture of lemonade and iced tea is a favorite.

'There are many alcohol drinks also made with tea. For example, there is a web site dedicated to recipes of vodka and iced tea. A Long Island iced tea originally was a simple mix of tea, vodka and ice, but today there are dozens of combinations using many types of alcohol.'

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was a simple mix of tea, vodka and ice, but today there are dozens of combinations using many types of alcohol.

Tea Growing in The U.S.

Camellia sinensis can be grown in the warmer areas of the United States. Today the U.S. mainland has only two commercial tea farms. A relatively large mechanized plantation in Charleston, South Carolina, and a small farm where tea leaves are handpicked in Burlington, Washington. There is also a collective of about 40 small growers in Hawaii.

Georgia & South Carolina

Commercial tea cultivation in the United States has been attempted since 1744. The first recorded successful cultivation of the tea plant in the United States is recorded as growing on Skidaway Island near Savannah, Georgia, in 1772. Junius Smith succeeded in growing tea commercially in Greenville, South Carolina, from 1848 until his death in 1853. Dr. Alexis Forster oversaw the next short lived attempt in Georgetown, South Carolina, from 1874 until his death in 1879.

The U.S. Government planted an experimental farm outside Summerville, South Carolina. They ran the program from 1884 until 1888. They concluded that South Carolina's climate was too unstable to sustain the tea crop. In 1888 Dr. Charles Shepard established the Pinehurst Tea Plantation close to the government's farm. Dr. Shepard secured laborers for the fields by opening a school and making tea-picking part of its curriculum, essentially ensuring a force of child labor while providing them with an education they might not otherwise obtain. Pinehurst produced award winning teas until Dr. Shepard's death in 1915. The garden closed after Shepard's death and the Pinehurst Plantation lay unattended until 1963.

In 1963 The Lipton Tea Company paid to have the surviving tea plants at Pinehurst moved to a former potato farm on Wadmalaw Island. Lipton operated this experimental tea farm until it was sold in 1987 to Mack Fleming and Bill Hall, who converted the experimental farm into a working tea garden.

The Charleston Tea Plantation used a converted tobacco harvester to mechanically harvest the tea. The Charleston Tea Plantation sold tea, known as American Classic Tea, by mail order. American Classic Tea has been the official tea of the

White House since 1987. Losing money and nearly bankrupt, in 2003 the plantation was sold to Bigelow Tea Company at a court auction for $1.28 million. The garden reopened in January 2006 and gives free tours to the public.

Today The Charleston Tea Plantation is the largest commercial tea farm in the United States. On a recent visit to Charleston we observed hundreds of thousands of tea plants (*Camellia sinensis)* growing in full sun. The soil is loose and sandy. There are large amounts of natural moisture augmented by irrigation for an average of 52 inches of water a year. Only new leaves are used to make tea. New growth is harvested every 20 days from May to October. During the 20 days a mature tea plant grows from six to eight inches.

In the other sixteen countries where tea is grown it is usually handpicked. A worker on an Asian tea farm would be paid the equivalent of several dollars a week. It is clearly impossible for an American company to be a profitable business and pay minimum wage to have leaves handpicked. The Charleston Tea Plantation is profitable because they built a unique tea picking machine nicknamed the "Green Giant". It is able to clip new leaves from the top of the plants. One man operating the "Green Giant" can do a block of plants in a day. The farm has 20 blocks of mature plants and is thus able to harvest all the blocks every 20 days. This is an economical and profitable business plan. The tea tastes good, too.

This is how they make the tea. Green tea is produced from freshly harvested leaves which are steamed briefly to make them wilt. The green tea has a light color and has a mild grassy or earth flavor. Oolong tea is partially oxidized by steam and gently rolled, thereby bruising the leaves and drying them for 15 to18 minutes in a special drying machine, which releases a floral or fruity flavor to the tea.

Oolong tea is traditionally paired with Chinese food. To produce black tea, the leaves are steamed, firmly rolled to bruise them, and dried for 50 minutes in the drying machine until they are completely brown. This is the rich dark tea that is enjoyed by the majority of tea drinkers throughout the world.

If you prefer less caffeine (commercial decaffeination is done chemically), discard the first infusion after steeping the tea for a minute in hot water and

drink the second infusion. The hot water releases the caffeine without added chemicals.

Hawaii

Tea was introduced in Hawaii in 1887 and was commercially grown until 1892 on Kauai and the island of Hawaii in the Kona region. While it is not clear why the tea was eventually discontinued, historians believe higher wages compared to other prime tea growing areas in Asia and Africa was the biggest factor. In addition, the lower production costs of coffee which flourished in the Kona helped prevent tea from becoming a major agricultural product. In the 1960s Lipton and A&B formed a joint venture to investigate the possibility of growing tea commercially in Hawaii. They decided not to open farms on the big island and turned to Latin and South America to open large farms.

In 2000 horticulturist Francis Zee found a strain of *Camellia sinensis* that thrives in the tropical climate and volcanic soil of the island of Hawaii. A joint study of commercially growing tea in Hawaii was started by the University of Hawaii at Manoa and Hilo with the U.S. Department of Agriculture. With the

The 'Green Giant' Tea Harvester can clip a block of tea per day on the Charleston Tea Planation.

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Tea plants for the home garden

Habersham tea plant bloom.

Camellia sinensis can be grown outside in one's garden in areas that are warm without cold winter. Tea plants are tolerant of a variety of growing conditions from full sun to deep shade, but do best in light shade or a half day of sun. The tea leaves are harvested every ten to fourteen days during the growing season. A few large trees or a hedge may be needed to supply a family, especially if several are multiple "cuppers" a day.

While many tea drinkers can't distinguish tea made from different cultivars, they can appreciate the superiority of tea made from fresh leaves as compared to those stored for even a few months. Store bought tea is harvested, processed, packaged, and shipped to warehouse before making it to local stores where it may sit on the shelves for weeks or months. If you are interested in growing your own plants in order to get fresh tea leaves there are specialized camellia nurseries in the U.S. that offer *sinensis* seedlings for sale. In fact a number of nurseries offer several cultivars of *C. sinensis.* Growth habits, flower color, and foliage size vary among cultivars, especially the foliage as the leaves can be crinkled, small, or large.

Camellia Forest Nursery in Chapel Hill, North Carolina, owned and operated by Kai Mei and David Parks, offers a dozen *Camellia sinensis* cultivars to choose from. The catalogue has a green tea recipe and descriptions of the varieties, including cold hardiness zones to help in selecting ones to grow. They carry both small and large leaf cultivars from China, India and Korea. In addition, several cultivars have variegated yellow foliage, for example, 'Gold Splash', 'Golden Dragon', and 'O Kuntze'.

Camellia Shop, Savannah, Georgia, is operated by Debbie Odom and Gene Phillips, and they sell a wide range of tea and camellia products. They have introduced a number of *C. sinensis* seedlings. 'Madison Tea' has a miniature single light pink flower. The vigorous compact plant has a crinkled leaf. Their 'Old Savannah Tea' and 'Queen Bees Tea' plants have miniature, white, single flowers borne on vigorous upright spreading plants with a large leaf.

Nuccio's Nurseries in Altadena, California, offers three forms of *C. sinensis. C. sinensis* (89#3) is the one they sell to customers requesting simply tea plants or *Camellia sinensis*. The plant has an elongated flower stem with a small white flower; the foliage is reticulated soft green, and it is a medium upright growing plant. The second cultivar is an unusual form of *sinensis*. It has very dark moroonish green foliage, small pink blooms with a maroon tint, and even has maroon roots. Nuccio's named this early to mid-season, rounded, compact growing plant "Black *Sinensis'*. A more compact mounding plant suitable for gardens with limited space is *C. sinensis* 'Moundy'.

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decline of Hawaii's sugar industry tea cultivation was seen as a possible replacement crop.

The Hawaii Tea Society was formed in 2004 with about 40 members, many of who had started backyard tea farms, to promote tea grown in Hawaii. Almost all of the Hawaii-grown tea is harvested and produced by hand from farms located on the East side of the of big island of Hawaii at elevations from 900 to 4,000 feet. Michelle Rose is running the organic Cloud Tea Farm on Kauai.

Washington

Hand-picked green, oolong, and black teas are also available from Sakuma Market Stand in Burlington, Washington. This farm has approximately 5 acres of tea in production as of 2010. The Sakuma Brothers have been growing tea for over 10 years. They report that when the tea leaves are ready for harvest, they hand pinch off only two leaves from each leaf at the stem. The leaves are heated, rolled and dried. The brittle flakes of tea leafs are steeped in water and served.

Conclusion

Commercial tea growing in the United States has had a rocky history with the high cost of labor inhibiting its profitability when compared to the major tea growing countries. The few successful tea growing farms in the U.S. sell their tea by mail order on the Internet and their boutique stores. This is an important niche market as it appeals to tea drinkers who like the fresh tea flavors. There are, however, more and more people growing camellia sinensis in their home gardens so they can pick the choice new growth and brew their own tea. It is an extracurricular activity that combines gardening, science and culinary skills. It appeals to a wider range of people than camellia enthusiasts. It is an integral part of the organic food movement of the twenty first century which is in many ways a reawakening of the victory gardens of World War II and our American small family farming history.

What will be the future of tea growing in America? A public Tea Garden is planned as part of the Judge Arthur Solomon Camellia trail at the Bamboo farm and coastal gardens in Savannah, Georgia. This will provide a unique opportunity for gardeners to see how tea is grown and learn about the different processes by which tea is made.

Return to TOC

Cover Story

WILDFIRE

by Bradford King

Summer wildfires throughout the country destroy acres of prime forest, homes and even human life. When there are major fires, armies of dedicated firefighters from all over the country assemble to battle the blazes. Tactics are developed for the ground forces, backfires are set and flights of water-carrying airplanes bomb the fires. The power and the destruction with lost plants, buildings and human life is a time for sadness and

A 'Wildfire' tree

'Flame'

grief.

However, we humans also are fascinated by fire. We use the word to name cars -- Firebird, shrubs -- Firethorn/Pyracantha -- and camellias 'Flame' and 'Wildfire'. Is it the power, heat and beauty that make us use the name? Perhaps! I do know that both 'Flame' and 'Wildfire' have outstanding fire-red flowers with yellow stamens shooting out of the centers like yellow flames.

'Wildfire' is a bright, clear red, medium semi-double bloom with a cluster of upright golden yellow stamens in the center. However, this flower brings beauty and joy to the garden, unlike the destruction and fear generated by its namesake. This japonica cultivar was introduced in 1963 by Nuccio's Nurseries. It grows vigorously in an upright manner and blooms early to mid season. When mature it can be twenty feet tall like the one at The Huntington Botanical Gardens in Southern California which looks spectacular when in bloom with hundreds of flowers. 'Wildfire' can easily be pruned to stay six feet tall as a landscape plant around one's home or garden. The foliage is the attractive dark green we see on most japonica camellias.'Flame' is originally from Japan and was introduced to the United States in 1971 by Domoto. It has a medium to large semi-double flower that grows on a vigorous upright bushy plant.

Return to TOC

A beautiful Camellia azalea.

An emperical study of camellia azalea and camellia amplexicaulis germination

Article and pictures by Bradford King

Research Question

Which camellia species and cultivars require a period of cold storage in order to successfully germinate? Since *C. azalea* and *C. amplexicaulis* are rare new camellia species of great interest to camellia breeders, this is a controlled study of their germination requirements when used as pollen parents with three japonica cultivars --'Tama-no-ura', 'Tama Peacock' and 'Silver Waves'.

Seed Dormancy

In general it is believed that camellia species requirements range from none to many months of cold treatment for successful germination. The *japonica* cultivars have a low cold requirement ranging from zero to three months. Thousands of *japonica* seeds are germinated outside in California with no added cold treatment other than the natural winter cooling. Camellia species from the tropical and sub tropical areas of Asia may require little to no cold dormancy in order to germinate. *C. azalea* and *c. amplexicaulis* grow in sub tropical areas of Asia and may not require cold to germinate seeds. However, when they are crossed with *C. japonica* cultivars will they need a cold period to germinate?

In an observational study reported in the 2009 Camellia Yearbook, I found

that *japonica* cultivars 'Tama-no-ura' and 'Tama Peacock' when crossed with *C. azalea* pollen developed seedlings with no period of cold dormancy. The same cultivars when crossed with *C. amplexicaulis* pollen showed no observable seed germination during the three-month observation. Consequently it is hypothesized that the three *japonica* cultivars used in this study when crossed with pollen from *C. azalea* will germinate without a period of cold dormancy. When 'Tama Peacock' is crossed with pollen from *C. amplexicaulis* germination is expected to exceed three months.

Method

Seeds were harvested the day the pod opened naturally. The seeds used in this study were not part of the previously reported observational study. Pairs of seeds from each pod were randomly placed in two groups. Seeds in group one were soaked in warm water for seven hours and placed in a germinating container one-third full of moist peat moss and placed in a warm location in doors (no cold treatment). The night time temperatures average in the 70's and never went below 65 degrees. There was sunlight supplemented with artificial light for 12 to 15 hours per day.

Group Two (cold treatment) were placed in a sealed Zip Lock bag with a moist paper towel and placed in the refrigerator at 40 degrees Fahrenheit for 85 days then soaked for seven hours in warm water and placed in a germinating container one-third full of moist peat moss and placed in the same location as Group One.

Fourteen seeds of 'Tama-no-ura' x *C. azalea* were harvested in October

C. azalea seed pod.

2009 and randomly placed in the two groups -- seven seeds in cold treatment and seven seeds in no cold treatment . These seeds were typically smaller than most *japonica* seeds (half the size of a pea) and irregular in shape.

Two pods were harvested from 'Silver Waves' x *C. azalea.* One pod had two seeds and the other, four seeds. Random assignment of the seeds for each pod was made to the cold treatment group and the no cold group.

Nine seeds were collected from 'Tama Peacock' x *C. azalea* and randomly placed in the two treatments -- five were placed in cold treatment and four in the no cold condition.

Eight seeds from 'Tama Peacock' x *C. amplexicaulis* were harvested with four randomly assigned to each of the two treatments.

Results

The first seedling from the no cold treatment from 'Tama-no-ura' x *C. azalea* reached the top of the germination container in 37 days and was potted up. The six remaining seeds developed from 90 to 120 days into viable seedling with two or more leaves. The seven seeds receiving cold storage also germinated. They began

germinating four months (120 days) after the 85 days in cold storage.

Three seeds from 'Silver Waves' x C.*azalea* harvested on 10/18/09 were placed in cold storage for 85 days. Two of the three seeds germinated and developed fully formed seedlings ready for transplanting on 6/2/10. This is a germinating period of 170 to180 days. The no cold treatment of 'Silver Waves x *C. azalea* also began germinating in late May and June. One seedling of comparable size to the cold storage group was transplanted on 6/2/10, a second seed was germinating but had yet to develop fully formed leaves, and one seed had not yet germinated. This was a period of eight months from harvest.

The first seedling to germinate from the 'Tama Peacock' x *C azalea* no cold treatment group developed in 71 days. The five seeds harvested from 'Tama Peacock' x *C. azalea* received 85 days cold storage. They were placed in a germinating container which was placed with the no cold germinating containers. Two of the seeds sprouted in 70 days. The last seed produced a seedling in 200 days.

One seedling in the no cold treatment of 'Tama Peacock' x *C. amplexicaulis* developed in 75 days; the remaining seeds germinated in 120 to 231 days. The cold storage seeds germinated from 95 to 208 days.

Follow-up observation of seedlings from the cold and no cold treatments show some differences in number of leaves and height, but these differences were not due to the germination treatment conditions. Pairs of seedlings from each condition were planted in the same container, labeled, and observed in the fall 2010. (Figure 1)

Pairs of seedlings from cold and no cold treatments were planted in same container and observed.

Discussion

Previously it was reported in an observational study published in the 2009 Camellia Yearbook that *Camellia azalea* seedlings from japonica seed parents 'Tama-no-ura' and 'Tama Peacock' began germinating in 60 days from harvest without a cold dormancy period. The current study was designed to replicate these findings, using different seeds while controlling variables by random seed assignment and identical growing conditions. The three month observational study found no germination of seedlings produced on 'Tama-no-ura' and 'Tama Peacock' pollinated by *Camellia amplexicaulis* during the 90 day period of observation However, most of these seeds did germinate from 160 to 280 days. The seedlings were planted in the spring 2010.

The current study was designed to

determine length of germination and cold dormancy requirements for these interspecific crosses. In addition a third *japonica*, 'Silver Waves' x *C. azalea* was included to begin to determine germinating requirements for other japonica cultivar seed parent.

Camellia azalea crosses

This study found that 'Tama-no-ura' x *C. azalea* and 'Tama Peacock' x *C. azalea* seeds successfully germinated without a cold treatment. The seeds receiving cold storage also germinated. The seeds from 'Tama-no-ura' harvested in August germinated rapidly (37 to 120 days) in the late summer and fall heat in Southern California. The germinating containers were placed outside in a shady location during the daytime and inside at night in a warm window that received sunlight augmented by artificial light for 12 to 15 hours per day. Those receiving cold storage also germinated. The seeds with no cold treatment from 'Tama Peacock' germinated and produced the first seedling in 71 days. The cold-treated seeds also germinated and seedlings were developed in 70 to120 days.

While Silver Waves x *C. azalea* seeds germinated with no cold treatment those receiving cold treatment developed two seedlings sooner than the no cold treatment group. There were only three seeds in each group (the third seed did not germinate in either group). The germination period for this cross was 170 to 190 days.

Camellia amplexicaulis crosses

The one seedling to develop in 75 days from the 'Tama Peacock' x *C. amplexicaulis* cross had an observable break in the seed covering when placed in the germination container after harvest. This may have been accidental damage to the seed skin, early natural germination, or some other unknown anomaly. The remaining seeds germinated from 95 to 146 days regardless of whether they were in cold storage or not. Cold storage is not a necessary requirement for this cross but clearly not a hindrance to germination. It is recommended to germinate these hybrid crosses as soon as possible from harvest.

Conclusion

It can be concluded that when 'Tama-no-ura' and 'Tama Peacock' are used as seed parents for *camellia azalea* no cold treatment is required for successful seed germination. Seed germination in warm conditions is rapid (37 days) for 'Tama-no-ura' x *C. azalea.* The 'Tama Peacock' seedlings began to develop in 70 days, regardless of whether they received cold or no cold treatment. Since the cold storage seeds also successfully germinated, they may be stored if need be in a refrigerator (in a moist paper towel in a Zip Lock bag) for a number of months. It is still highly recommended to plant seeds in the spring or early summer of the season they were harvested to insure the seeds have not become dehydrated and to have optimal seed germination.

The range in time for seeds to germinate is an important natural survival strategy. If early germinating seeds fail to thrive, later ones may survive due to the change in the microclimate. In general the moist, warm and longer days of spring are optimal for seed germination and successful seedling development.

C. azalea, Tama-no-ura and seedling C.azalea x Tama-no-ura, showing foliage midway between the parents.

The *amplexicaulis* hybrids with 'Tama Peacock' do not require cold storage and generally require a period of germination of four months or longer. Many of the seedlings inherit the new reddish foliage of their parents -- *C. amplexicaulis* and 'Tama Peacock'. (Figure 2). When mature the leaves are green and mid sized (smaller than *amplexicaulis* and larger than 'Tama Peacock'), indicating a successful cross was made. (Figure 3)

The 'Silver Waves x *C. azalea* hybrids in cold storage developed slightly sooner and looked more robust initially than the no cold storage, lending mild support for the need for cold treatment. It is prudent to plan for cold storage when new crosses are made with parents whose cold dormancy is unknown. In California this can be done by placing germinating containers outside. In other areas of the camellia world it is necessary to incorporate the microclimate into the germinating plans. The most reliable method is cold store in the refrigerator which offers maximum control of variables.

It should be noted that *japonica* cultivars like 'Tama-no-ura' and 'Tama Peacock' tend to have early flowers, at least for me in Southern California, when Camellia *azalea* is also blooming which allows for fresh pollen to be used in control crosses. Fresh pollen is much more desirable than frozen pollen. It is unclear if *C. azalea* will cross with *C. reticulata.* This is due in part to the divergent flowering times of these species.

Camellia amplexicaulis blooms mid season in California so that fresh pollen is available to cross with *japonica* and *reticulata* cultivars. It is clear from my program as well as others that crosses can be made with some *japonica* cultivars. It has not been determined if crosses are compatible with any *reticul*ata cultivars. I have had seed pods but no viable seed to date. Initially, of the eight pods set on 'Frank Houser', all but one dried up. It is known that C. *amplexicaulis* does itself set seed. (Figure 4) However, the four crosses I made in 2010 using japonica 'Royal Velvet' pollen did not take. While this is too low a number to conclude a lack of compatibility, subsequent crosses will use pollen from other *japonica* cultivars. There is too little time and too few opportunities to repeat unsuccessful crosses.

Camellia amplexicaulis blooms mid season in California, providing fresh pollen for crosses.

Return to TOC

Fact or Fiction?

What we think we know

Article and pictures By Bradford King

There is much that camellia growers do that is tried and true based on years of experience. There are books, articles and camellia gurus who have educated us. However, there are some disparate ideas, practices, and questions that are unresolved. Some are quietly discussed and a few are hotly debated. Let's take a look at some of them. I posed a few questions to Dr. William Ackerman, Dr. Clifford Parks, Dr. Matthew Taylor, and expert hybridizer Mr. John Wang in order to determine fact from fiction.

Dr. Ackerman, retired research geneticist from the U.S. National Arboretum, has continued his research on cold hardy camellias in Ashton, Maryland. Dr. Parks, Professor Emeritus of Biology at the University of North Carolina at Chapel Hill, concentrates on the botany and horticulture of the genus Camellia. Dr. Taylor is research horticulturist at Longwood Gardens in Kennett Square, Pennsylvania.

QUESTION ONE:

When viable pollen is placed on the female stigma of an emasculated flower

Figure 1 (Below) : 'Tama-no-ura' with bags. White jewelry bags protect crosses from insect pollination and also collect seeds.

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Figure 2: Floating and sinking seeds.

how soon does it take to activate? The controversy is whether or not to bag the emasculated flower. Many hybridizers believe it is unnecessary, yet numerous books and articles clearly recommend that precautions are needed to prevent unwanted pollen from contaminating the cross.

Dr. Clifford Parks: "Bagging crosses is a complex issue. I don't do it in the greenhouse in the winter because there are few pollination vectors. I do bag out-of-door crosses. Flower blight kills the ovary when the flower is infected and bagging can help prevent infection. There are lots of other possible considerations that have not been resolved by experiment."

Mr. John Wang: "I usually let the last flower set for four days after pollination indoors before moving the plant outside. If you observe the pollen tube formation by introduction of fresh pollen on 8 percent sugar agar, you should see a long extended pollen tube that is amazingly well developed. I do not bag flowers due to the heavy covering of pollen on the stigma which is done indoors where there is no wind, fog or insects." (Sugar agar is a gelling agent derived from red algae made up of sugar galactose and used as a culture medium for micro biological studies.)

Dr. William Ackerman: "Most of my crosses through emasculation and hand pollination take place in the greenhouse, which is thoroughly screened against insects. So, I do not cover them at time of pollination. However, later any that show signs of a take, are covered with a fine netting bag to keep the seeds from scattering when mature." (Figure 1 - 'Tama-no-ura' with white bags.)

Dr. Matthew Taylor: "I'm not sure about cell division in pollen grains but it seems camellia pollen is viable for quite some time after shedding. I base this anecdotal information on storage life in the freezer, and that I never pollinate a cross more than once and don't seem to have much trouble with

fruit formation on compatible species. As for covering flowers, I think this is very important outside and on large floriferous plants. Inside we have minimal insects, not a lot of flowers, and we never cover emasculated flowers. Outside in our hardiness trials, I see enormous amounts of pollinators. I can't say I have ever seen one on an emasculated flower but that is because they are always covered. Additionally, some flowers produce so much pollen that it could drop from an above flower onto an emasculated flower. I always bag outside and I think a breeder puts himself at risk by skipping this step in an environment with a high capacity for pollen contamination."

Dr. Bradford King: "A web search of pollen cell division provided no information on camellia pollen growth rates. Examples of pollen growth in Chestnuts and Birches using time lapsed photographs from zero to 70 minutes every ten minutes showed significant pollen tube growth by 90 minutes. In addition the general web site information on pollen growth (www-saps.plantsci.cam.ac.uk/pollen/pollen2.htm) is as follows:

"When a pollen grain is released from an anther, it is partially dehydrated. If it lands on the surface of a stigma of the same flower or of a different flower of the same species, it rehydrates. The growth of pollen tubes is easily observed under medium power of a microscope, but the 'in vivo' growth is often much faster because of several factors that are known to enhance the growth. Some of these are calcium, boron, and sucrose: this last compound acts as a source of carbon as well as exerting an osmotic effect."

QUESTION TWO

What data is there for the "float test"? The float test involves placing seeds in a container of water for a few hours and those that sink are viable and those that float are not.

Dr. Matthew Taylor: "I am confident in this test for *C. azalea* hybrid seeds. If they float, the seed coat is removed and the inside embryo is typically underdeveloped and/or shriveled. Very rarely (<1 percent) do one of these seeds germinate normally in culture. If it sinks it is sown normally, and to date, 75 percent of the seeds that have been sown have germinated."

Dr. William Ackerman: "I do not utilize the float test. Any seeds that are extremely light become obvious at harvest. I save everything else. If I do not get 100 percent germination, it does

Figure 3 - Seeds from a *C. nitidissima* hybrid floating, tan, light weight, and soft to touch are not viable.

not bother me"

Dr. Clifford Parks: "I have not used flotation as an indication of seed viability in any species. When the embryo loses water, the seed will float. Slightly dried seeds will rehydrate and germinate. Floating seeds have lost water, and they may be alive or dead. This pattern was clear in the germination experiment I am doing. Slightly dried seeds tend to float, but germination is normal after planting I have found."

Dr. Bradford King: "Since I generally place all seeds in water for seven hours before germinating, I find most seeds sink immediately, a few float a few hours, then sink, and a few float the seven hours. (Figure 2) I plant all of these that are normal size for that cultivar. However, a number of the floaters are light tan, as opposed to dark brown or black of most normal seeds, are light weight compared to other seeds of identical cultivars, and are soft when pressed between forefinger and thumb. These seeds are not germinated as they are not viable. (Figure 3)

Some seeds are significantly smaller than others from the same cultivar and these will not germinate. They range from the size of grains of sand to half the size of the seeds from the same cultivar; I do not bother to germinate them as I have good numbers of seeds that are "normal' size."

QUESTION THREE:

How do you get seedlings to bloom in three years?

Mr. John Wang: "My seedlings are growing in a special greenhouse. In late February, they are ready for approach grafting. I only do a few cleft grafts. However, my friends in China like to make a cleft graft and plant the seedlings' root portion."

Dr. Bradford King: "Since John Wang discussed this in 2009, I have been using approach grafting and cleft grafting of seedlings to shorten the time to blooming but especially to produce more robust *C. azalea* hybrid seedlings. I am conducting a matched pair study of seedlings to determine if grafting improves *C. azalea* hybrid seedlings as they are notoriously slow growers that lack vigor like their parent *C. azalea.* In spring 2010, nine grafts were completed and planted in the same pot with a non grafted seedling matched for similar root and top growth. The grafts were examined in early fall. Six grafts failed to take, but all seedlings and under stock were growing well. The under stock was removed from the pot. Three grafts took. The one with the best callus was twice the size of its matched pair seedling with four leaves to three leaves. (Figure 4) The low grafting take is frustrating and most likely due to the grower's technique as the under stock was growing in all cases.

FACT OR FICTION:

It is a fact that camellias cross pollinated inside do not need to be bagged to avoid contamination. The picture is more complex when flowers are emasculated and pollinated outside. The safest solution is to bag the cross to avoid chance pollination before a pollen tube has grown. This particularly makes sense if difficult and unusual crosses are being made on a heavy flowering parent with many insect pollinators around, e.g. azalea pollen is limited in quantity thus warranting the precaution of bagging. In addition when petal blight is active a paper bag will limit infection and destruction of the ovary.

A net bag will inhibit insect pollinators but not stop the air borne spores of petal plight. However, the grower will be able to see if the cross has taken and may leave the net bag in place to collect seeds, thus insuring no seed loss. I have found the net bags easier to attach than a paper bag. I usually take it off and remove the petals that have fallen away from developing seed pod. A case can be made for not bagging a controlled cross as pollen has been placed on the stigma, making it a low probability that pollen from another source will get on the stigma and grow a pollen tube before the breeders' pollen grows its tube. Can this happen? Yes, the original pollen may not be viable or as fast growing. The key question is how long viable pollen takes to grow a pollen tube to the ovary. We do not have scientific data for camellias to definitively answer the question. Variables like camellia species, heat, humidity, the presence of sucrose, boron, calcium or other elements will affect growth rates. However, it would appear that under optimal conditions a pollen tube may grow within a few hours and certainly within a day or two.

This may be safe enough for many breeders while others will continue to bag for additional insurance.

The "float test" is a fact for *C. azalea* seeds and is worth doing for rare seeds if the breeder has the interest, knowledge and skills to aseptically germinate seeds that float.

In general when harvesting seeds, if they are noticeably light colored, lightweight, soft when pinched, they will not germinate. Seeds half or less than normal size for that cultivar are not worth planting. I do plant floaters of normal size, color, weight and firmness as they may be viable. Not all seeds will germinate at the same time and some will never do so which is to be expected. I agree with Dr. Ackerman, this doesn't bother me as usually there is a good supply of seeds to germinate.

It is important to provide adequate care for new seedlings. Greenhouses and other protection will enhance seedling maturity. Fertilization, warmth, and increased light will enhance growth. In addition, approach grafting and cleft grafting where the seedlings own roots also are planted are strategies that may bring a seedling to flower in two or three years rather than five to seven years.

It is fiction that no camellia species will grow in the full sun. It is fiction that camellias are heavy water consumers and thus out of favor for home landscaping. Yes, they require moisture, but mature camellias can survive droughts. Many camellias will grow with less water than is provided by Mother Nature.

It is a fact that we love camellias.

Figure 4 - A large and small plant is shown in this container.

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Figure 1: *Camellia x williamsii* 'Flirtation' is a hybrid between *C. japonica* 'Lady Vansittart' and *C. saluenensis* introduced in 1961 by Armstrong Nurseries of Ontario, California, USA.

What is hybrid vigor and why does it matter?

Article and pictures By Bradford King

We periodically read about hybrid vigor in magazines and books. It is used in camellia articles to describe new camellia hybrids. For more than 80 years, corn breeders and farmers have taken advantage of hybrid vigor to grow high-yielding crops. Yet this biological process remains a mystery.

The scientific name for "hybrid vigor" is heterosis. It is a term used in selective breeding of plants and animals. In other words it is out-breeding enhancement. It is the occurrence of a genetically superior offspring by gene mixing and is the tendency of many hybrids to grow faster, get larger, bear more flowers and fruit, or be more adaptable than their parents.

Selective breeding or artificial selection is the process of breeding plants and animals for a particular trait. In camellias this would include cold har-

Figure 2: The reticulata hybrid 'Howard Asper' is a cross between *Camellia reticulata* 'Cornelian' ('Damanao') and *C. japonica* 'Coronation'. It was introduced by Howard Asper in 1963.

dy, fragrance, repeat blooming, white borders, size and colors. Bred plants are known as varieties, cultigens or cultivars. Crossbred plants are called hybrids; for example when camellia breeders cross species *C. saluenensis* and *C. japonica* we call them non reticulata hybrids which differentiate them from hybrids with reticulata in their parentage. They are, however, both hybrids. (See Figure 1 and Figure 2.)

Plant breeding has been going on for thousands of years, and began with the domestication of wild plants into uniform and predictable agricultural cultivars. It is of major importance because application of heterosis is one of the most important contributions of genetics to scientific agriculture. It has been instrumental in providing hybrid corn, and vigorous, high-yielding hybrids in other plants and in livestock. In other words it has improved the quality and quantity of meat, chicken, vegetables and fruits we consume on a daily basis.

However, it is an erroneous assumption that all cross breeding is genetically superior. It is possible for hybrids to inherit traits from their parents that make them unable to survive. This is called "out-breeding depression". This is illustrated in a 2006 report of a bear with a patchy white and brown coat that was shot in the Canadian Arctic. DNA confirmed the animal was a polar-grizzly hybrid (a "pizzly' or "grolar bear"). Its mottled coat no longer trapped heat efficiently as that of a pure polar bear; it was a poor swimmer and didn't exhibit the crafty hunting skills, like jumping on a snow cave to pin a hiding seal -- all keys to survival in the arctic.

There are two, not mutually exclusive, hypotheses that have been developed to explain the mystery of hybrid

vigor. The dominance hypothesis attributes the superiority of hybrids to the suppression of undesirable recessive alleles from one parent by dominant alleles from the other. Alleles refer to one member of a pair of genes that occupy a specific position on a specific chromosome. The DNA coding determines distinct traits that can be passed from parents to offspring. Organisms have two alleles for each trait. When the alleles of a pair are heterozygous, one is dominant and the other is recessive. The dominant allele is expressed and the recessive is suppressed. The dominance hypothesis attributes the poor performance of inbred strains to the loss of genetic diversity.

The over dominance hypothesis states that some combinations of alleles obtained by crossing two inbred strains are especially advantageous if both genes are different for a trait. If both of the genes are the same, the organism is said to be homozygous for that trait. Zygosity refers to the similarity for an inherited characteristic or trait in an organism. This hypothesis is commonly invoked to explain the persistence of many alleles which are harmful in homozygotes; in normal circumstances such harmful alleles would be removed from a population through the process of natural selection. It attributes the poor performance of inbred strains to a high percentage of these harmful recessives.

A recent study at Iowa State looked at hybrid vigor using microarray technology. They were able to observe the activity of 14,000 genes simultaneously of hybrid corn and its inbred parents. They found that some genes are more active in the hybrid than in both of the parental inbred lines (overdominant), some genes are less active than both inbred lines (underdominant) and most genes -- 78 percent -- have activity levels in between the level of the inbreds. The results of this experiment provide support for multiple mechanistic explanations for hybrid vigor. It shows there are numerous molecular mechanisms at work and that hybrid vigor is a very complex phenomenon.

However, neither hybrid vigor nor its qualities can be predicted. It is established by testing of the F1 hybrids for each parental combination of characteristics. In addition hybrid vigor is reduced in further generations in which there is self pollination. This means F1 hybrids are more vigorous than the next generations.

It is clear that further research is needed to unravel the mysteries of hybrid vigor. In the meantime, reap the benefits of hybrid vigor and enjoy larger, more bountiful tomatoes from your garden, or smaller tomatoes from the super market that lack garden flavors but have a very long shelf life. Buy the white eggs produced by hybrid leghorn chickens bred to give consumers the white eggs they prefer to brown. But most of all, enjoy the hybrid camellias with larger, more floriferous complex blooms in many vibrant colors that thrive on beautiful disease-free evergreen plants.

'Plant breeding has been going on for thousands of years, and began with the domestication of wild plants into uniform and predictable agricultural cultivars.'

BRADFORD KING • 2010

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History 101:
How camellias won the West

Figure 1: 'Night Rider', a dark red camellia.

Article and pictures by Bradford King

Camellias are native to eastern Asia, including China, Japan, Korea, Taiwan, Vietnam, Thailand, Burma, and the islands adjacent to these countries. The Buddhist priests were known to travel widely carrying camellia seeds with them, thus distributing camellias throughout eastern Asia. *Camellia sinensis*, the tea plant, has been cultivated and used for tea for many centuries in China. The earliest accounts from 2737 B.C. discuss the cultivation of tea. Camellia species such as *oleifera* and *chekiangoleosa* have also been the source of cooking oil since the seventh century. In the 11th century, P. Chao, a Chinese botanist listed 72 cultivars of *C. reticulata* growing in China. These cultivars are known as the *Yunnan reticulata* and are most likely the result of cross pollination between *C. reticulata* and *C. pitardii.* The Chinese have been cultivating camellias as ornamental plants from the days of the T'ang dynasty which spanned the years 618 through 906.

A thousand years before Christ, the Japanese began growing tea plants and by the seventh century there are written accounts of camellias as a source of cooking oil in Japan. The word *japonica* means originating or related to Japan. In the 1400's the Shoguns were growing and propagating *Camellia japonica* to please their masters, including the emperor. In 1630 a Buddhist priest described ten cultivars of camellias growing in Japan. Today there are 400-year-old camellias growing in Japanese gardens.

Moving west to England and beyond

Camellias first came to the West, specifically England, in the early 1700's

Written records indicate that Lord Petre grew camellias in 1793. Tea became a very popular drink in Great Britain in this time but all the tea was imported from China. The English wanted to grow their own tea in order to improve their profits. The Chinese wished to keep the business and exported only *C. japonica* plants. However tea plants eventually were exported but they were not profitable to grow and harvest in the British Isles.

It is believed that the first named cultivars 'Alba Plena' and 'Variegata' were imported to Great Britain in 1792. The first *C. reticulata*, 'Captain Rawes', arrived in 1820 from Canton China. *C. sasanqua* was introduced to England in 1811. They have not gained much interest in Great Britain. On the other hand the introduction of the *Williamsii* hybrids dramatically increased the popularity of camellias in England. The *Williamsii hybrids* are crosses between *C. japonica* and *C. saluenensis*. John Charles Williams used seeds of *C. saluenensis* collected in China. The initial seedlings were introduced after his death in 1939. The first one was named 'J.C. Williams' in 1940. One of the most successful of these *japonica/saluenensis* hybrids is 'Donation', which continues to be a popular landscape camellia today with its lovely, medium semi-double, orchid pink flower. It was introduced by Col. Stephenson Clarke of Sussex England in 1941. These *Williamsii* camellias are the beginning of the hybridizing of camellias in the western world. They are the first examples of what we now call the non reticulata hybrids.

Camellias have made their way throughout many European countries. There are accounts of camellias in Portugal as early as the 16th century. The sea faring Portuguese traded with many Asian countries, and it is most likely that the first camellias came to Portugal from Japan. There are also camellias in the Channel Islands, the Azores, Madeira (The Flower Island), Spain, Italy, France, Belgium, and Germany.

Naming the camellia

In 1735 the Swedish botanist and taxonomist Carolus Linneaus named the camellia after Georg Joseph Kamel. Kamel was a Jesuit missionary in the Philippines and also a pharmacist and amateur botanist. His extensive writings on the plants in the Philippines impressed Linneaus so he used the Latinized version of his name: *Camillus*.

Linneaus originated the binomial system used today in which plants are named with two Latin names — one for the genus and one for the species. In his book Systema Naturae (1735) he described two plants previously known under their Japanese names which were provided in 1712 by Kaempfer. Linneaus called them *Camellia Tsubaki* Kp paying tribute to Kamel and Kaempfer (Kp).

Tsubaki is the Japanese word for camellia. In 1753 Linneaus published Species Plantarum where the term *Camellia japonica* was first used. Thunberg in 1784 was the first person to use the term *Camellia sasanqua*.

Australian growers promote camellias

Australia began importing camellias as early as 1826. John MacArthur received a shipment of camellias from England in February 1831. Camellias continued to gain popularity with nursery men who imported more varieties and began breeding new cultivars

Figure 2: 'Sawada's Dream' developed by K. Sawada, a Japanese American nursery man.

themselves. One major grower was E.G. Waterhouse. He promoted camellias and was instrumental in founding the Australian and New Zealand Camellia Research Society. He also became the first president of the International Camellia Society in 1962. He introduced the lovely, light pink, medium, formal double hybrid that bears his name. Bob Cherry has bred and introduced numerous *C. sasanqua* cultivars usually with the first name Paradise, e.g. 'Paradise Belinda'. They are sun tolerant camellias that make wonderful landscape plants.

New Zealand's North Island has optimal conditions for growing camellias. The first shipments came from England but also from France and Australia in the 1840's. Growing and breeding Camellias has continued to this day. Les Jury increased the color range of *Willliamsii* hybrids, introducing outstanding cultivars like 'Anticipation', 'Les Jury' and 'Jury's Yellow'. Dark red camellias 'Night Rider' (Figure 1) and 'Black Opal' were introduced by Os Blumhardt. Hybridizing for fragrance in camellias was a goal of the New Zealand breeder Jim Finlea who introduced 'Superscent' and 'High Fragrance'. He and Neville Haydon, also of New Zealand, are responsible for introducing many other new cultivars that have gained popularity in the camellia world.

'Alba Plena' first camellia in U.S.

The first camellia japonica to arrive in the United States was a single red, imported from England to Hoboken, New Jersey, by John Stevens. In 1800 he imported 'Alba Plena' from England. Stevens had nurseries in Manhattan and Harlem helping New York become the center for greenhouse grown camellias. Interest spread to the wealthy in Philadelphia, Baltimore, Washington, and Boston. Only those well off financially could afford the necessary greenhouse facilities to grow camellias in the Northeastern states. The Boston Conservatory displayed 1,000 plants the Christmas of 1838. The oldest continuous camellia show has been held in Boston every year since 1829.

David Landreth founded the first seed company in Philadelphia in 1784. He also sold camellias. In 1818 he opened a branch of his company in Charleston, South Carolina, introducing camellias to the Southern states. In 1830 through 1860 thousands of camellias were sold to plantation owners for landscape purposes. Fruitland Nursery was established in Augusta, Georgia, in 1858. Camellias were sold until the property became the Augusta National Golf Club. As the cotton industry grew throughout the South so did the distribution of camellias. The Civil War interrupted the interest in camellias. However in the early 1900's

Figure 3: 'Shot Silk' - The reticulata thrives in Southern California and numerous crosses with *japonica* have been introduced.

camellias received new life when K. Sawada, a Japanese American nursery man moved to Mobile, Alabama, in 1910. He, along with other camellia growers and nurserymen, helped the camellia regain its popularity. He was an outstanding breeder of new camellias. One of his most treasured introductions is 'Sawada's Dream', a medium, formal double white with delicate pink outer petals. (Figure 2: 'Sawada's Dream') Magnolia Gardens in Charleston, South Carolina, has named more than 150 camellia cultivars throughout the years and continues to have one of the great Camellia collections with many cultivars.

ACS and Dave Strother

In 1939, the Camellia Society of America split from the azalea group and published the organization's first year book. In 1946 the Camellia Society of America reorganized and became the American Camellia Society and in 1968 placed its headquarters at Massee Lane Gardens in Fort Valley, Georgia.

David Strother donated the land and his collection of camellias, thus beginning the collection at Massee Lane Gardens. Over the years other camellia hobbyists have continued to donate camellias. For example, in 2009 Clifford Parks, Ph.D., contributed hundreds of camellia species to Massee Lane, making the gardens an important reservoir of diverse genetic plant material. This is in keeping with the American Camellia Society mission of promoting the genus Camellia through science and education.

Camellias moved West in 1850. James Warren moved from Boston to

Sacramento, establishing a seed store at 15 "J" Street and selling camellia plants and seeds from Boston to the public. Sacramento became known as the Camellia City in 1908, following a production by a theatrical group called The Camellians of a play entitled "The Camellia City". A grove of old camellias is still growing in the State Capital Park.

Toichi Domoto was one of the pioneers of the California camellia industry from Northern California who introduced a number of new cultivars and helped promote interest in camellias. David Feathers lived at number 1 Camellia Lane in Lafayette, California. He was known by his friends as Mr. Camellia due to his many introductions of new camellias and as editor of the classic (now out of print) book The Camellia Its History, Culture, Genetics and a Look into Its Future Development. More recently Dan Charvet in Fort Bragg has been propagating and breeding new cultivars at Heartwood Nursery. He has developed new landscape camellia hybrids, some of which are fragrant, that do well in the cooler regions of the West Coast.

The triple crown of camellias is located in Southern California, with The Huntington Library and Botanical Gardens, Descanso Gardens, and Nuccio's Nurseries. The Huntington camellia collection currently has 1,400 cultivars, 60 species covering 12 acres of the 120-acre gardens in San Marino. Descanso Gardens has more than 30,000 camellia plants growing in a native habitat under a canopy of Coastal Live Oaks in La Canada-Flintridge. Both gardens, as well as Massee Lane Gardens, were honored in 2001 as International Camellia Gardens of Excellence.

A major development in the camellia world occurred in 1948. Dr. Walter Lammerts learned that Professor T. Tsai, a botanist at Kumming Institute in China, had 20 cultivars of *C. reticulata* available to send to the United States. The 20 cultivars were shipped to San Francisco, but the quarantine and fumigation process left 15 alive for Descanso Gardens. Ralph Peer of Los Angeles also imported 20 plants with only three surviving. Some of the original shipments to Descanso were duplicates. However with additional shipments and cultivar sharing between Peer and Lammerts there resulted 14 new and different *C. reticulata* cultivars. (Figure 3: 'Shot Silk') The reticulata thrived in Southern California and numerous crosses with japonica were introduced. The Camellia Nomenclature published by the Southern California Camellia Society lists 826 *Camellia reticulata* and reticulata-hybrid hybrids. This attests to the growth and interest in propagating and growing the reticulata for its magnificent blooms.

The best known camellia breeders in California are the Nuccio's Nurseries of Altadena which has been in business since 1935. This Italian American family business was one of more than 30 Camellia nurseries growing and breeding camellias in the 1930's through the 1980's in Southern California. The Nuccios are the only nursery in Southern California dedicated to camellias and azaleas still in business. They have introduced 150 new camellia cultivars and counting. They propagate and sell more than 600 different camellias. They have introduced about 90 *C. japonica* cultivars with only seven bearing the Nuccio name. The newest is a landscape plant with a heavy bud set and a long blooming season. This large formal double flower is named 'Nuccio's Bella Rossa'. (Figure 4: 'Nuccio's Bella Rossa')

Figure 4: 'Nuccio's Bella Rossa' - Newest cultivar introduced by Nuccio's in California, a landscape plant with heavy bud set and long blooming season.

Cold hardy & fragrant camellias

The development of cold hardy camellias is the most significant development in hybridizing in the last forty years. Dr.Clifford Parks began a breeding program when he was at the Los Angeles Arboretum and Botanical Garden in the early 1960's which continues today in Chapel Hill, North Carolina. Dr. Parks introduced his noteworthy April series of nine cold hardy japonica hybrids. Dr. William Ackerman began his hybridization with camellias in Glenn Dale, Maryland, in 1959 and at the U.S. National Arboretum in 1974 with the objective of developing cold hardy landscape camellias. He worked hybridizing with *C. oleifera* to produce the "Winter" series of 22 cultivars and an Ashton series of eight cold hardy (up to zone 6) cultivars. These cold hardy hybrids have extended the range of where camellias can be successfully grown.

The other major hybridizing developments include introducing fragrance, cluster blooming, and especially yellow camellias. Pale yellow camellias are increasingly seen in gardens and at camellia shows. W.F. Homeyer of Macon, Georgia, had a chance white-to-yellow seedling bloom in 1963, which he introduced in 1982 as 'Witman Yellow'. He used it to produce 'Dahlohnega', a lovely, creamy to pale yellow, formal double. However, with the discovery of *C. nitidissima* most breeders have used this golden yellow species in their breeding programs. Tadao Yamaguchi of Ishikawa, Japan, is one of the pioneer hybridizers of yellow camellias. In 1989 he introduced 'Shoko' or "First Yellow". Subsequently he has released at least a half dozen more, including 'Senritsu Ko'. Kazuo Yoshikawa of Osaka, Japan, also has produced yellow camellia hybrids. In his program he has *saluenensis* hybrids, reticulata hybrids, sasanqua and japonica. The Nuccios have introduced 'Honeymoon', 'Golden Glow', and 'Buttermint'. Gene Philips of Savannah, Georgia, backcrossed 'Golden Glow' to *C. nitidissima* to get 'Alice B. DuPont'. Dr. Clifford Parks' breeding program has used the yellow species *C. flava* in his introduction of 'Solstice'.

In the future the use of new species discovered in Asia, like *C. amplexicaulis*, *C. azalea*, and *C. chuangtsoensis*, offer the hope for camellias that are more tolerant of extremes of heat and cold, bright golden yellow hybrids, as well as the exciting possibility of camellias that will repeatedly bloom in the same year.

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Challenges and Opportunities in Camellia Breeding

by Bradford King

The development of new *Camellia* hybrids is fascinating and challenging to camellia growers and hybridizers. The use of crosses among cultivars of the same *Camellia* species has resulted in the introduction of thousands of wonderful flowers and the generation of a substantial body of knowledge.

Camellia hybridizing between species has been successful when using *Camellia japonica* with *Camellia saluenensis, Camellia sasanqua* and *Camellia reticulata*. However there are many challenges to hybridizing camellias between other *Camellia* species. As the challenges are met, opportunities for the development of new yellow camellias, reblooming camellias, reblooming cold-hardy camellias, reblooming yellow camellias and blooms in new colors and complex flower forms present themselves. The major hybridizing challenges include compatibility, seed dormancy, seed germination and seedling propagation.

COMPATIBILITY

Which *Camellia* species are compatible? According to Chang's taxonomic system the Genus *Camellia* has about 280 species divided into 22 Sections. It is believed that species from the same Section are more likely to be compatible than those from other Sections. *Section Camellia* is the largest, having 60 species which include *C. changii* aka *C. azalea; C. japonica* var. *japonica, C. japonica* subspecies *rusticana, C. pitardii* var. *pitardii, C. pitardii* var. *yunnanica, C. reticulata* and *C. saluenensis.* We know that *C. japonica* and *C. reticulata* are compatible and have produced many new cultivars including the beautiful and popular 'Frank Houser', 'Dr. Clifford Parks' and 'Harold L. Paige'. *C. saluenensis* is compatible with *C. japonica* and has produced 'Donation', 'Anticipation' as well as hundreds of other wonderful blooms. *C. pitardii* var. *pitardii* is compatible with *C. japonica* as witnessed by 'Nicky Crisp', 'Jury's Pearl' and 'Jury's Moon Moth' to name a few. However, there are crosses between other Sections. For example, *C. lutchuensis* has been crossed with *C. japonica* to produce the fragrant cultivars 'Ack-Scent Spice', 'Scented Gem' and 'Scentuous'. *C. nitidissima* crosses well with *C. reticulata* but with little success in producing yellow camellias. When crossed with *C. japonica* there is weak compatibility but some hybridizers have managed some light yellow cultivars. This is all helpful knowledge.

Since the *Camellia* species *C. azalea* and *C. amplexicaulis* are very new to the western world, we lack experience and data about their compatibility with other species. It is a reasonable strategy to make crosses between *C. azalea*, a member of *Section Camellia*, with other species in this Section. *C. azalea* is a primitive diploid 2n=30 based on a

Karyological study in 2000 by Shaung et al; *C. japonica* is a diploid 2n=30 (Kondo 1977); and *C. pitardii* var. *pitardii* is also 2n=30 (Kondo 1977). This similarity in chromosome number is another indicator of their compatibility. The fact that *C. reticulata* and *C. pitardii* var. *yunnanica* are 2n=90 indicates less genetic compatibility but not necessarily incompatibility because *C. japonica* and *C. reticulata* are frequently crossed successfully. There are several reports documenting crosses between *C. japonica* and *C. azalea*. The next question is which japonica cultivars are compatible with *C. azalea*?

Currently we know that *C. azalea* is compatible with the following japonica cultivars: 'Maiden of Great Promise', 'Longwood Centennial', and 'Longwood Valentine'. All three are cold hardy and grown in a greenhouse at Longwood Gardens in Pennsylvania.

My personal experience indicates good compatibility between *C. azalea* and 'Tama Peacock' and 'Tama-no-ura'; weak compatibility with 'Betty Foy Sanders', 'Wildfire', 'Silver Waves' and 'Silver Triumph'; and low compatibility with 'Magnoliaeflora', 'San Dimas', 'White Bouquet', 'Kramer's Supreme' and 'Tama Americana'. There are no reports of successful crosses with *C. reticulata* and no known successes with *C. saluenensis* and sasanquas. My experience with such crosses indicates a low compatibility with 'Dazzler', 'Yuletide', 'Shishigashira', 'Narumigata', and 'Kanjiro', and weak compatibility with 'Egao'. You Muxian in China reports one seed pod developing when he used stored pollen from 'Kramer's Supreme' and three when using 'Tiffany'. He also had one seed pod when he made a cross with *C. nitidissima*.

There is evidence that *C. azalea* sets seed in its natural habitat. However it appears to be a problematic seed setter. Longwood Gardens reports that *C. azalea* frequently produces non-viable seeds due to pod formation in 2 to 2.5 months rather than the usual 6 to 9 months. Nuccio's Nurseries has not had seed pods to date. You Muxian of China reported seed pods in 100 days which is half the usual time for most camellias. The use of *C. azalea* as a seed parent needs further investigation.

The seed pods I have harvested with *C. azalea* as a pollen parent have been in the 6 to 9 month range as one would expect. I have not had seed set on *C. azalea*.

In summary there are great opportunities when using *C. azalea* as a seed parent but also a number of challenges. The first challenge is rapid pod development resulting in low viability of seeds and seedlings. Second: there are no other camellias in bloom during the peak summer period of flowering making it necessary to pre-store pollen that is both viable and compatible with *C. azalea*. Third: is *C. azalea* capable of self pollinating or are there other camellias for cross fertilization available in its natural habitat?

In order to use *C. azalea* as a seed parent, I would recommend pre-storing as large amounts of quality pollen as possible from japonica cultivars like 'Tiffany' and 'Tama Peacock'. Sparse pollen producers that have shown compatibility like 'Tama-no-ura', are to my

way of thinking, less desirable but further experience is needed before giving up on them. It is safe to conclude that *C. azalea* can be crossed with some japonica cultivars. The challenge is in finding the other cultivars that are compatible with *C. azalea*.

Sealy placed *C. amplexicaulis* in *Section Archecamellia* which has only three species, one of which is *C. petelotii,* a yellow; therefore Chang moved *C. petelotii* to *Section Chrysantha* with the other yellow *Camellia* species. This leaves hybridizers with no significant species within *Section Archecamellia* to cross with *C. amplexicaulis*. I have not seen reports on its chromosome number which is a worthwhile study. Therefore it is recommended to make crosses with good seed-setting cultivars. I found good compatibility with 'Tama Peacock' and 'Tama-no-ura' as seed parents but low compatibility with 'Magnoliaeflora'. In the latter case, pods begin to develop but remain very small, dry up and fall off. I had two pods form on reticulata 'Frank Houser' but when they opened each had one very small B.B.-sized seed. These were not viable. The one seed pod on 'LASCA Beauty' formed as expected but when opened contain several "seeds" the size of grains of sand. Seed pods didn't form on reticulata 'Curtain Call', 'Dr. Clifford Parks', or 'Mandalay Queen'. Tentatively it appears there is a compatibility with some japonica camellias and inconclusive data on compatibility with reticulata. There is clear evidence that *C. amplexicaulis* itself will set seed. However, there are no published reports in English on compatible pollen parents. I would expect that some japonica cultivars produce compatible pollen and that somewhere there is a reticulata cultivar with compatible pollen. I know Dan Charvet at Heartwood Nursery in northern California and Jude Nuccio of Nuccio's Nurseries in southern California are working on this challenge.

SEED DORMANCY

What if any dormancy is required for camellia seeds to germinate? We need to learn more about this in terms of each species to be used in hybridizing in order to know how to treat any resulting seeds. In general it is believed that *Camellia* species requirements range from none to at least three months of cold treatment for successful germination. The popular *C. japonica* has a low cold requirement. Thousands of japonica seeds are germinated outside in California with no added cold treatment other than the natural winter cooling. There are many *C. japonica* cultivars in both the warm and cold areas of Asia. Therefore even within a species there may be different cold requirements. The *C. japonica* variety *rusticana* sub species would most certainly require cold treatment to have survived in the cold and snow of the Japanese mountains.

The first step in understanding dormancy requirements is to learn where a specific species originates in their natural environment. The species originating in the northern regions of Asia would most certainly require a cold requirement to have survived, e.g. *C. oleifera*. Those species from the tropical and subtropical regions of Asia such as *C. nitidissima* are less likely to have seed dormancy requirements.

The three camellia species with the potential to rebloom are of particular interest to hybridizers. *C. azalea* is found in a warm humid habitat alongside a small stream between steep hills in China, southwest of Yang Chun city in the province of Guangdong. This province is subtropical and tropical with a humid monsoon climate of rain from April to September and typhoons May to November. The temperature is 46° to 63° Fahrenheit in January and 81° to 84° in July. It is a species that thrives in 90° and 100° degrees which lends indirect support to it not requiring cold dormancy. I have several seeds harvested July 31, 2009 from 'Tama-no-ura' x *C. azalea* that have developed tap roots (radicle) and two seedlings with two leaves as of October 4, 2009. The temperatures have been 80° to 100° during the day time with cooler night-time temperatures. This would seem to indicate neither a period of dormancy nor the need for cold treatment. However, further data is needed in order to make a firm conclusion.

C. amplexicaulis is found in northern Vietnam at Mount Tam Dao in Long Son Province — a vast high mountainous region affected by humid monsoons with an average annual temperature of 70° — and the contiguous areas of Hekou County, Yunnan Province in China which is a sub-tropical area. I am conducting a small study to see if this species requires cold treatment. My hypothesis is it has a low dormancy requirement. It has limited capacity to withstand cold and will tolerate a few degrees of frost. I have germinated seed of its progeny outside in Arcadia, California which has provided sufficient cold to germinate japonica and reticulata seeds.

Camellia chuangtsoensis is the newest repeat-blooming camellia species to be discovered. It was collected in a mountainous area of China near Guangzhou City, Guangdong Province. This is a humid sub tropical area with a mean annual temperature of 71°. The temperature in July is 81° to 84° and in January46° to 63°. The period without frost is more than 330 days. It seems that it is not cold hardy but can tolerate lower temperatures for a short period. It has a deep yellow small single to semi-double flower with 12 to 15 non-waxy petals and grows under broad-leaf plants and trees. While it has great potential for hybridizing it is not available outside China. In fact the Chinese are just beginning to propagate it. The location areas points to this species having low or no cold requirement for seed germination but further data is needed to form a more specific conclusion.

Dr. William Ackerman reports that when two species are crossed, the resulting progeny should be provided the cold treatment of the one with the longest dormancy requirement. This is sound advice. Therefore when sub-tropical camellia species are crossed with *C.japonica* some cold storage or germination outside in California and some areas of the southeast would be adequate. Cold treatment of ten to twelve weeks is recommended. The seeds are usually kept in a refrigerator in a plastic bag with moisture provided by moist sphagnum, tissue or paper towel. They should not be put in the freezer for stor-

age or allowed to completely dry out. They may be viable for long periods (several years) if not frozen or allowed to dry out. However, it is best to use seeds harvested in summer and fall by the following spring or early summer.

SEED GERMINATION

The basic challenge is providing the seeds the necessary moisture, warmth and aerated growing medium. Seeds in dormancy are protected by the skin coat until water penetrates it and there is sufficient heat and oxygenated soil for them to germinate. The length of time for seeds to germinate depends on the *Camellia* species and the growing conditions. For example *C. granthamiana* seed may take up to a year to germinate. The camellia grower will need to provide appropriate conditions for seeds to germinate. I soak seeds in warm water for 7 hours and then place them in plastic containers at least seven inches tall containing one third full of moist peat moss and covered with a screw top to make them air tight. They are placed outside in the shade in a northerly exposure. This provides adequate moisture and protection from sun, wind, children, pets and wildlife. There is evidence that increased light and warmth will speed up the process of germination. This can be accomplished in a heated greenhouse or a warm location in one's home. The seed has less than 2 percent of its weight as water and if allowed to dry out will no longer be viable. A viable seed is like a sponge in its ability to soak up large amounts of moisture. When there is sufficient food available to the embryo, its first root (the radicle) pushes into the soil in order to anchor the seedling and to take up more water and minerals. Next to develop is the embryonic shoot (plumule) which grows towards the light source. In this early stage, the seedling is totally dependent on the food supplies stored in the seed. It is only when the seedling's first leaves are lifted into the light that it is capable of becoming an independent plant. *Camellia* seedlings are vulnerable requiring appropriate care — moisture, shade, partial sunlight and protection from wind, children, pets and varmits. I have lost a number to skunks and opossum looking for worms and grubs. They tip over pots and remove the soil looking for food. They have no interest in the seedlings themselves. I place pots tightly together in an area protected by chicken wire.

PROPAGATION

The first priority is to propagate a large number of seedlings for distribution to camellia growers and hybridizers. This has been done in China with *C. azalea*. Gao Jiyin reports that there are thousands of these plants in China and 500 hybrids. This is good news as the *C. azalea* population in its native habitat, while now protected by the government, has seen its numbers decrease. In the United States it is still difficult to purchase this camellia. One of the biggest challenges is that this plant grows poorly on its own roots. As a consequence nurseries have not been able to developed adequate stock with cuttings. This challenge is worthy of further study. Is it the soil mix, water properties, other variables, or a combination of

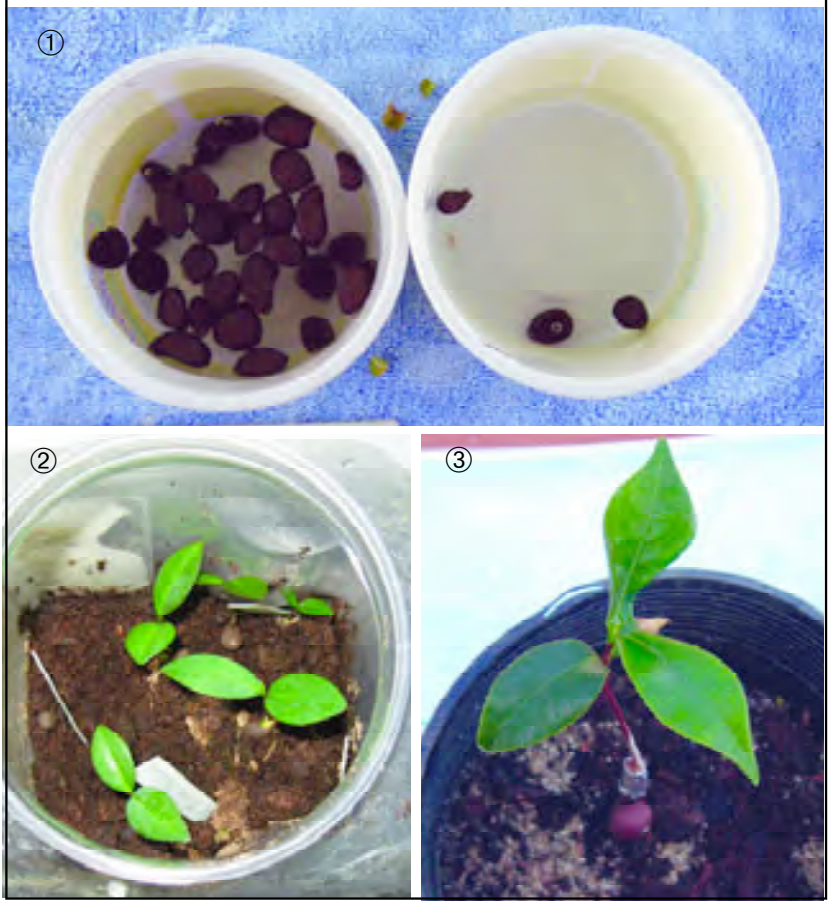
interactions that diminish success?

The good news is that grafting of *C. azalea* scions is much more successful. *C. japonica, C. sasanqua* and *C. oleifera* understock all has been used with success. Large rootstock produces the best results. I have seen pictures taken by You Muxian of *C. azalea* grafted on *C. oleifera* trees in China that are very impressive. I have three grafts. The one

Picture 1: Seeds are placed in a warm water soaking bath for 7 hours.

Picture 2: Seeds are then placed in a 7-inch tall container. When two true leaves are present on the new seedling, it is capable of making its own food.

Picture 3: A vigorous seedling.



with three scions grafted in the spring of 2008 on large root stock bloomed several times in late summer and early fall in 2008 and again in the summer of 2009. My two one-gallon grafts are showing new growth but no flowers to date. *C. azalea* is a slow grower. Gao recommends monthly fertilization; a practice I am now following.

Hybrid seedlings of *C. azalea* grow much slower than japonica seedlings. This is a challenge that needs to be investigated more thoroughly. In addition after 2 to 3 months they frequently look choleric. Applications of iron may not help. Longwood recently used chelated iron (Sprint) which resulted in improvement. Miracle-gro for camellias at half strength was not effective for me. This is also an area for further investigation.

I have harvested a number of seeds this season. Those that successfully sprout will be divided into two groups. One group will be grown on their own roots, fed monthly and carefully monitored. A second group will be approach grafted onto healthy under stock, fed monthly and monitored. Another option to consider is seed grafting with *C. azalea* and its progeny to see if more vigorous root systems can be developed which may increase the rate of growth. The challenge is to be able to propagate hybrid seedlings that are healthy and vigorous.

Camellia amplexicaulis has been cultivated and propagated for many years in Vietnam. In general it is less difficult to grow than *C. azalea*. It can be grown from cuttings or grafts. It can be a seed or pollen parent. It is grown in shade with moisture like most *C. japonica* cultivars. Likewise my hybrid seedlings, especially 'Tama Peacock' x *C. amplexicaulis*, are growing very much like japonica seedlings.

CONCLUSION

NASA has met many challenges in the space program in order to have the opportunity to visit the moon, build a space station, and explore the planets. The program is built on scientific investigation, dedication, human effort and sacrifice and has ongoing challenges and opportunities. In the camellia world we too need to experiment and investigate our frontiers — the new camellia species. There are tremendous opportunities to develop new camellia flower colors — better yellow blooms, repeat flowering camellias, and even cold-hardy repeat- blooming yellow camellias. All are possible by taking advantage of the genetic variability within the diverse *Camellia* species.

Return to TOC

Investigation of Germination in *Camellia azalea* and *Camellia amplexicaulis*

Article and Pictures by Bradford King

One of the challenges in breeding camellias is determining if a species and its hybrid cultivars require a period of cold dormancy. Solving this challenge with *C. azalea* and *C. amplexicaulis* opens up opportunities of developing repeat blooming camellias, summer flowering camellias and new cultivars. We know that camellia species range in cold dormancy from none to many months and that *C. japonica* has a weak cold dormancy requirement.

C. azalea grows in a warm moist sub tropical area of China (zone 10) and enjoys hot temperatures. It blooms in southern California during the summer and fall. Therefore, it can be assumed to have no cold dormancy requirement and when crossed with *C. japonica* cultivars would have, at most, a weak requirement. It is also possible that these crosses would inherit the capacity to germinate without a period of cold dormancy.

C. amplexicaulis blooms in southern California in the winter and appears to be from a less tropical area than *C. azalea*. Therefore it is hypothesized that it will have a weak cold dormancy requirement, especially hybrid seedling crosses with *C. japonica* cultivars.

Study Method

This is an observational study of controlled crosses between two *C. japonica* cultivars, 'Tama-no-ura' and 'Tama Peacock' as seed parents with *C. azalea* as the pollen parent, to see if the resulting hybrids require a period of cold dormancy before germinating. The crosses were done during December 2008 and January 2009. Crosses with *C. amplexicaulis* were done in February 2009.

Nylon bags were placed on seed pods in late June in order to protect pods and insure that no seeds would be lost. These were checked daily every morning from the end of July until all seeds were harvested. Pods were allowed to open on the plant naturally. When pods were partially opened, seeds were harvested, soaked in water for 7 hours, placed in a plastic container one third full of moist peat moss, labeled, dated and placed outside in a shady, protected area. Germination containers were checked regularly and observations of germination recorded in two week intervals from October 4 to November 9, 2009.

The weather in Southern California (Los Angeles County) remains warm throughout summer and fall. This year (2009) several weeks of daytime temperatures exceeded 90 degrees and there were no extended periods of cold temperature as of November 9, 2009.

Observation: October 4, 2009

Seeds harvested on 8/1/2009 from 'Tama-no-ura' x *C. azalea* developed tap roots (radicles) with two seedlings pre-

senting two fully-formed leaves. These seeds were developed in pods from controlled crosses made December 2008. The pods developed for seven months. The two seedlings with leaves were transplanted into one-gallon pots covered by a plastic bag supported by wire, labeled and placed in the same area as the germination containers. This is a shaded location with some midday sun and full shade in the late afternoon.

Observation: October 18 2009

1.'Tama-no-ura' x *C. azalea* seeds harvested on 8/1/2009 (the same germinating container as above):
• 1 seedling with 2 leaves
• 4 with embryonic shoots (plumules) but no fully formed leaves
• 5 seeds with radicle developing
• 2 with no observable germination.
A total of 12 seeds observed.
Note that two seedling were transplanted from this germinating container on 10/4/09 for a total observation of 14 from this harvest.

2. 'Tama Peacock' x *C. azalea* seeds harvested on 8/11/09:
• 1 embryonic shoot with radicle
• 1 radicle growing and
• 5 seeds with no germination observed.

3. 'Tama Peacock' x *C. azalea* 3 pods with a total of 14 seeds harvested on 8/15/09. At this point there were:
• 2 seedlings with 2 leaves, 1 radicle developed
• 2 seeds naturally cracked open
• 10 with no germination observed.

4. 'Tama Peacock' x *C. azalea:* 1 pod harvested 8/21/ 09 with 6 seeds.
• 1 seedling with leaves
• 1 leaf stem (plumule) but no fully formed leaves and
• 4 no observable germination.

The seeds harvested from the 'Tama Peacock' x *C. azalea* were from control led crosses done late December 2008 and early January2009.

Observation: October 28, 2009

1. 'Tama-no-ura x *C. azalea* harvested on 8/1/09 were observed for a third time which was 89 days from date of harvest. There were now 3 seedlings with two leaves, two seedlings with leaves developing and five seeds with tap roots and two seeds with no germination activity. Therefore a total of five seedlings developed during the observation period from August 1, 2009 harvest.

2. 'Tama-no-ura' x *C. amplexicaulis:* three seeds harvested on 8/1/09 had no germination activity.

3. 'Tama Peacock' x *C. amplexicaulis:* one seed harvested on 8/1/09 which had no observable germination activity.

4. One pod with one seed was harvested from 'Betty Foy Sanders' x *C. azalea* on 8/6/09 which had developed a radicle and plumule but leaves were not yet fully formed.

5. 'Tama Peacock' x *C. amplexicaulis:* three seeds harvested on 8/6/09 had no germination activity.

6. 'Tama Peacock' x *C. azalea* harvested on 8/6/09 had one seedling, 2 seed coats (testa) cracked open and no germinating action on the other 9 seeds.

7. 'Tama Peacock x *C. azalea* harvested on 8/11/09 (second observation) 1 seedling, 3 seeds with a radicle and 3 no observable germination activity.

8. 'Tama Peacock' x *C. azalea*: five seeds harvested 8/12/09 had no observ-

able germination but the peat moss smelled "swampy" and felt too wet. The peat was removed, container cleaned, replaced with new peat and seeds reinserted.

9. 'Tama Peacock' x *C.amplexicaulis*: three seeds harvested on 8/11/09 had no germinating activity.

10. 'Tama Peacock' x *C. amplexicaulis*: two seeds harvested 8/12/09 no germination activity observed.

11. 'Tama Peacock' x *C. amplexicaulis*: one seed harvested on 8/13 no germination activity observed.

12. 'Tama Peacock' x *C. amplexicaulis:* seven seed harvested. one had a cracked seed skin (testa) indicating the beginning of germination, an injury, or accidental cut of the seed coat.

13. 'Tama Peacock' x *C. azalea* harvested on 8/15/09 (second observation of 14 seeds) had two fully formed seedlings that were transplanted, 1 cracked seed cover indicating the beginning of germination and 11 seeds no observable germination activity.

14. 'Tama Peacock' x *C. amplexicaulis* 3 seeds harvested 8/21/09 had no observable germination activity.

Observation: November 9, 2009

1. 'Tama-no-ura' x *C. azalea* harvested on 8/1/09 (fourth observation) now had a total of 7 seedlings with two leaves, 7 radicles developed and 2 no observable seed germination.

2. 'Betty Foy Sanders' x *C. azalea* harvested on 8/6/09 had one leaf stem with immature leaves. There was no significant growth since the observation on 10/28/09.

3. 'Tama-no-ura' x *C. amplexicaulis* harvested on 8/1/09 had no germination activity.

4. 'Tama Peacock' x *C. amplexicaulis* harvested on the following dates 8/1, 8/11, 8/12/, 8/13, 8/14 and 8/21, a total of 20 seeds showed no observable germination activity.

5. The 'Tama Peacock' x *C azalea* observations reported on October 28, 2009 showed no further germination activity or significant growth.

Summary of Findings

1. There was good compatibility when *Camellia japonica* cultivars 'Tama-no-ura'

1. Tools used to protect pollinated camellias are shown with seeds of 'Tama-no-ura' x Camellia azalea.

(on next page) 2. Seeds from 'Tama Peacock' x C. azalea.

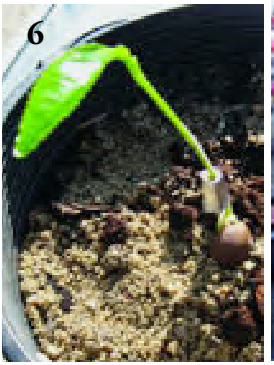
3. Dried out, non viable seeds from C. azalea x 'Tama Peacock', 'LASCA Beauty' and 'Tama-no-ura'.

4. Seeds of 'Tama Peacock' x C. azalea (left) and C. amplexicaulis (right) soaking.

5. Shady protected area.

6. Seed grafting of C. azalea hybrid.

7. 'Tama Peacock' x C. azlaea seeds.



and 'Tama Peacock' were used as seed parents and *C. azalea* as the pollen parent. There is a weak compatibility between 'Betty Foy Sanders' and *C. azalea*.

2. *Camellia amplexicaulis* crosses with *Camellia japonica* cultivars 'Tama-no-ura' and 'Tama Peacock': There is good compatibility between these japonica cultivars as seed parents when *C. amplexicaulis* is used as the pollen parent.

3. Seed pods develop in 6 - 9 months as many other japonica hybrid cultivars.

4. The pods contained from 1 - 7 seeds.

5. Seeds germinated in as little as 60 days without a period of cold dormancy for seedlings pollinated by *C. azalea*. However, seeds may continue to germinate for months.

6. *Camellia amplexicaulis* crosses with 'Tama-no-ura' and 'Tama Peacock' with harvest dates during August and September exhibited no germination activity during the period of observation. One seed did have a crack in the seed coat. This could be germination or an injury to the seed skin.

7. There was little additional germination or significant growth observed between October 28 and November 9. This may be due to cooler temperatures and less sunlight with the shorter days.

Previous research has documented that higher temperatures and longer exposure to light have both been important factors in germination and plant growth. Daytime temperatures were in the 70s and nighttime temperatures in the high 50s in November 2009.

Conclusion

It can be inferred that *Camellia azalea* is a species that has no cold dormancy requirement because resulting hybrid seedlings with *C. japonica* cultivars were observed germinating without a period of cold treatment. This observational study found that hybrid seedlings of 'Tama-no-ura' and 'Tama Peacock' as seed parents with *Camellia azalea* as the pollen parent began to germinate in 60 days from harvest providing there is sufficient moisture, length of daylight and heat (day-time temperatures from 70 to 100 degrees). Further studies are needed to determine which other japonica seed parents are compatible with *C. azalea* and if they require a mild dormancy requirement or are able to germinate in warm weather without dormancy.

Camellia amplexicaulis is compatible with *Camellia japonica* cultivars 'Tama-no-ura' and 'Tama Peacock'. The resulting hybrid seedlings did not germinate during the three month period of observation. Therefore, there are at least two possibilities: first, these crosses require a period of cold dormancy; second, the length of germination for *C. amplexicaulis* and resulting hybrids is longer than three months but need not be cold. Tentatively it appears that this species and its hybrid seedlings have a mild cold dormancy requirement much like *Camellia japonica*. Additional research is needed before firm conclusions can be made.

Further investigation of compatibility and dormancy among camellia species is warranted. Many camellia devotees are capable of carrying out these studies at home, thereby increasing the knowledge base of propagating *Camellia* Species. ◗

Return to TOC

Camellia Botany

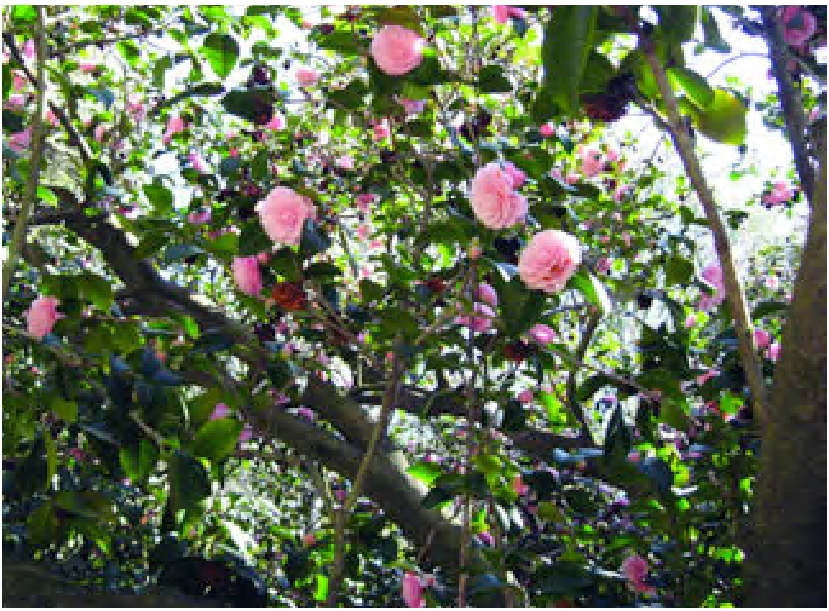
Camellia Life Cycle

Article and Pictures by Bradford King

Which comes first — the chicken or the egg? What is happening inside a camellia seed after it is planted? How does moisture travel from soil to the leaves? Why do camellias bloom? Are camellias trees or shrubs? What are some of the basic scientific underpinnings of the camellia life cycle? The answers to these questions determines camellia culture and adds pleasure to growing, propagating and breeding camellias.

In The Beginning

A camellia begins life as a single fertilized seed. A camellia has no predetermined size limit — if the plant is



This very large 'Pink Perfection' at Huntington Gardens in California is well over one hundred years old.

allowed to grow in an unrestricted volume of soil its root will not reach a predetermined size. Likewise if there is ample space the camellias branches will continue to grow. Its life span is indefinite. However its growth habit and height are under genetic control.

The oldest camellia I see regularly is a 'Pink Perfection' growing and blooming every year in the Huntington Gardens. Curator William Hertrich began working at the Huntington January 1, 1905 and reported it was fifteen or perhaps twenty years old at that time. It is now a bushy tree, 20 feet tall with a circumference of 30 feet. Every spring there are flushes of new growth. It continues to grow year after year and will do so as long as it has light, water, oxygen, minerals and space. In 2008 a mature California Live Oak that provided shade to this camellia blew down and sun damage resulted to much of the foliage. Flowers were sparse. The following year the 'Pink Perfection' had recovered from this environmental trauma. This tree may get a little taller but it will always be a small tree, never tall like the Live Oak that shaded it for over a hundred years. The fact that most camellias (japonica and reticulata) grow in moist, well-drained soil in partial shade, are inherited environmental needs controlled by the genes imbedded in the cells of the camellia seed.

There is a theory that camellias grew under the canopy of trees because this is where they could compete successfully. New research at Massee Lane Gardens will be conducted to determine if camellias (japonica and reticulata) can thrive in central Georgia in more sun than is commonly believed. Challenging horticultural assumptions, followed by empirical investigation, is a hallmark of science that can increase knowledge and influence gardening practices.

Seeds

Seeds may look dry and lifeless because they are in a dormant state, protected by the skin coat. When water penetrates the skin coat and sufficient heat and well-aerated soil are present, germination begins. When this happens there is a short period of intense activity. The seed leaves (cotyledons) are food storage structures. When pried apart the embryo, or miniature plant, waiting for birth is revealed. The root, or radicle, a short stem and a pair of leaves are all present. During germination the embryo grows into a seedling. The length of time seeds remain viable before germination varies with camellia species and conditions of storage.

First the radicle appears when sufficient food is available to the seed.

Low-temperature storage (not freezing) of camellia seeds is possible for months and even years. The seed has less than 2 percent of its weight as water but if dried out it will no longer be viable. A viable seed acts like a sponge in its ability to soak up large amounts of moisture. The water molecules fit into the spaces between cellulose, proteins and protoplasm in the dry cell. The seed swells as it fills with water and the skin splits which allows for absorption of more water by the embryo and cotyledons. In addition it is now exposed to oxygen which is needed to break down large food molecules of fat, starch and protein into easily transportable sugars and amino acid.

When there is sufficient food available to the embryo, its first root (the radicle) pushes into the soil in order to anchor the seedling and take up more water and minerals. Next to develop is the embryonic shoot (plumule) which grows towards the light source. In this early stage, the seedling is totally dependent on the food supplies stored in the seed. It is only when the seedling's first leaves are lifted into the light that it is capable of becoming an independent plant. This allows for photosynthesis which will produce all the food the camellia will need. This is the reason that when seeds are germinated in a container, they are not transplanted until there are two leaves present. Camellia seeds do not usually germinate in the cold winter months as a survival strategy waiting for the warmer temperatures of spring when conditions are more suitable for seedling survival. In addition some camellia seeds may require a cold period before germination. This is an area that requires more study.

In Southern California there is enough cold for this to occur naturally outside. It may be irritating to the gardener that all the camellia seeds do not germinate simultaneously but this is another survival strategy. If conditions are inhospitable for the first seedlings, they may be improved for those germinating later. While a seed is the stage in the camellias life cycle that is most resistant to environmental extremes, the seedling is the most vulnerable. Therefore an early germinating seedling may be killed by a frost but later ones will continue the survival process.

Seedlings

The seedling develops a tap root system (radicle) first which sends one or two rapidly growing sparse roots down in the soil to anchor the plant and capture water and minerals below the surface. Its primary growth is in length. This can be seen when a seedling is removed from a germinating container — the tap root may be twice as long as the stem supporting the leaves. Root hairs are extensions of the outer root cells and increase the roots' capacity to absorb moisture and nutrients in the soil. The root hairs are easily broken when a plant is dug and transferred to a new location. Container-grown plants are much less vulnerable to root damage during planting.

The camellia's shoot system (plumule) consists of the aerial stems, branches and leaves. The principle function of stems is to support the leaves. As the stem is formed it divides into short sections called nodes where the leaf and

'Americana' in the Huntington Gardens in California still shows its original trunk with multiple new trunks taking the decaying trunk's place.

buds develop. These alternate with clear sections called internodes. As the stem grows the internodes stretch resulting in spreading the leaves apart. Generally shoot systems are capable of producing unlimited numbers of branches but only small percentages grow at a given time. Many growth buds lie dormant until needed. This may be after disease, frost, wind, animal damage and even pruning. When only a tree stump is present there are buds hidden inside the bark that may provide new growth or new growth will shoot from the roots. For example the oldest camellia in California is 'Americana' It was moved to the Huntington Gardens where you can see the decaying original trunk and multiple newer trunks, now the size of a human legs and arms, that sprouted from the tree stump and roots.

Leaves are wonderfully designed to harvest light as the energy source for photosynthesis — the manufacturing of food for the plant. The typical camellia leaf is blade shaped with a mid rib and veins. It is attached by a leaf stalk or petiole. This allows the leaf to rotate the leaf blade to track the sunlight and contributes to spacing of the alternating leaves which also helps maximize exposure to the sunlight. It also helps protect the leaf from wind, heavy rain and hail. After a violent hail storm I visited Nuccio's Nurseries, where shade cloth was ripped and some supporting poles were bent from the weight of ice balls and slush. Camellia flowers were damaged but the plants and leaves were fine. This is adaptation at its best because

most leaves cannot repair themselves. When an insect severs a vein in the leaf, the ends may be sealed to prevent water loss but the hole itself will not be filled with new cells.

Trees

Is the camellia a tree or a shrub? Some say "tomato" some say "to-mato"! Woody perennials like camellias that produce a large number of branches are considered trees or shrubs. Trees have one or a small number of main trunks to support its branches and foliage. Shrubs are smaller plants with many woody stem that branch close to the ground. A small camellia less than fifteen years old may look like a shrub but when you see thirty and fifty year old camellias (japonica and reticulata) growing it is clear, at least to me, they are small trees.

The trunks and branches of the camellia provide a sturdy and vital transportation system. Xylem tissue transports water and minerals from the roots upward throughout the plant. Another tissue called phloem conducts food molecules between leaves and roots. When winter approaches the tree needs to reduce the amount of water and sugars (sap) in their tissue. Sugars are converted to starch and stored until needed in spring for producing new growth.

These functions are mediated by hormones which are controlled by the amount of day light and temperature. The first plant hormone to be discovered was the one that causes the plant to grow toward light. This physiological process is phototropism. The hormone controlling phototropism is an auxin whose principal function is to stimulate increases in cell length. Gibberellin is another important hormone which promotes the growth of stem internodes, controls seed germination and plays a role in flowering.

Flowers

While we grow camellias for their beautiful flowers, their biological function is reproduction. For plants to survive they must reproduce or they will die out. Most wild camellias have simple, brightly colored single or semi doubles flowers that attract pollinating insects and hummingbirds. The reproductive organs are easily accessed in simple flowers which makes reproduction relatively easy.

The axillary or growth buds are located in an axil at the base of a leaf. The flower buds on camellias develop terminally or in axis down the stem. Initially the flower bud is not easy to distinguish from the growth bud but as it grows and swells it can be distinguished by its bulb like form that eventually shows colored sepals before opening as a flower. The bud has a flower stem or pedicel which is difficult to see in japonica and reticulata camellias but is clearly visible in *C. nitidissima* and *C. tunghinensis*. The stem

Pedicels are clearly visible in** C. tunghinensis **pictured on the right.

tip that contains the flower parts is called a receptacle which is made up of the calyx and sepals. These hold and protect the unopened bud. The petals are the beautiful show piece of a camellia flower. The flower's male reproductive structure is the stamen made up of its filament (stock) and tip which bears the anther. The pollen develops within the anther. The fine grains of yellow pollen contain two cells. The female part of the flower is the pistil. It has three sections — the top is the stigma, the sticky receptive surface where the pollen adheres, an elongated section or style which elevates the stigma into the center of the flower where it can be pollinated, and the base of the stem or ovary. The ovary, when fertilized, becomes the fruit containing the seeds.

How does fertilization take place? When an insect, hummingbird or human hybridizer places compatible pollen on a flower's stigma, one of the two pollen cells grows into a long pollen tube that penetrates the pistil's tissues as it searches for the microscopic opening in the ovule located in the ovary. The growth of the pollen tube is rapid, fed by food substances and hormones in the stigma and style. The second pollen cell divides to become two sperm that travel down the pollen tube entering the ovule. Each ovule must contain an egg ready for immediate fertilization. When one of the sperm unites with the egg, a zygote is formed. The second pollen cell combines with another cell in the ovule to produce temporary food storage tissue called endosperm. This is used to nourish the zygote that grows into a miniature plant or embryo within a

Camellia fruit varies in size according to the species. Fruit can be pea sized to over 3 inches across.

seed. The ovules grow and mature into seeds enclosed by the ovary which slowly enlarges to become the camellia fruit or seed pod.

Seed Pods

Camellia seed pods develop during the spring and summer and become obvious by late summer and fall. The seed pods are capsules with three chambers, or loculi, each carrying one or two seeds. Some camellia species will have more chambers, e.g. those in *Section Protocamellia* have five. Depending on the camellia species and cultivar, pods may be green, brown, bronze, red or striped and flecked. Many are smooth brown, hard, and woody with others have a rough scaling on the surface. Fruit sizes range based on the camellia species. Most sasanqua pods are small (the size of the nail on a pinkie finger) japonica cultivar pods are medium (the size of a thumbnail to that of a ping pong ball) while *C. yunnanensis* seed pods, hanging like purple red apples or Christmas ornaments, can be three inches in diameter.

Mice, rats, squirrels and some birds may eat camellia seeds. If harvesting is wanted, a plastic onion bag or nylon stocking may be used for protection and collection of seeds. When the camellia fruit is ripe the capsules gradually split along the wall lines of the seed chambers from tip down to the base where the valve remains attached. This may take a few days to a week or more. When the seeds are exposed they fall to the ground. The seeds may be separated from the parent plant in a natural setting by rolling down a slope, moved by animals, wind, water or some other chance occurrence. However, the most likely distributor of camellia seeds is man.

Camellia seed used for cooking oil have been collected in China and Japan for centuries helping to distribute them through Southeast Asia and beyond. Centuries ago Buddhist monks in China discovered the beautiful flowers of the original japonica and reticulata camellias growing near by. We know they propagated them and planted them to landscape the temples. We also know they collected camellia seeds and took them in their extensive travels. Tea is a beverage that is popular in Great Britain, Europe, Australia, New Zealand and the United States. Its popularity drew interest to other *Camellia* species which has helped them be widely distributed to the western world.

The Cycle is Completed

The camellia life cycle begins with a seed that grows into a camellia tree having the potential to produce the beautiful flowers we cherish. The flower is the reproductive structure of the camellia, which when fertilized produces fruit (seed pod). Within the camellia fruit are the camellia seeds that humans have been collecting and distributing for centuries to other people across country borders and cultural differences because of the shared appreciation of the useful and beautiful camellia.

Cover Story

Beauty, Performance and *FRAGRANCE!*

by Bradford King and Ann Walton, Co-Editors

In his article on page 19, Master Hybridizer Dan Charvet describes his intra specific crosses with *C. yunnanensis* with the goal of producing fragrant camellias.

In his 40 years of hybridizing camellias, Dan has developed very specific requirements that must be met before he considers any hybrid worth pursuing or to be successful.

So it comes as no surprise that when the hybridizer set out to produce a fragrant camellia it had to be not only fragrant, it had to be a solid performer in the landscape as well. Factor in the incredible beauty of these new hybrids shown in the photographs with his article, and Dan will have a camellia that all will admire and want.

Dan Charvet's HW0903

This fragrant camella includes four fragrant species and two C. reticulata in its bloodlines.

Many of the crosses Dan describes with *C. yunnanensis* have produced varying levels of fragrance in the resulting camellia hybrids. The reader can sense the excitement just below the surface of Dan's words as he writes about his fragrant hybrids. One you will read about is scheduled for production. We will be waiting to hear from this one!

What are the attributes a camellia must have to have value in Dan Charvet's eyes? First he demands that his camellia plants are what he terms as self grooming. That is, his plants must have the ability to shed their spent blooms, or be self grooming as he explains it.

Second is the plant's structure, not only for the months it is a foliage plant but during the blooming time as well. Dan explains that strong branching is important in camellias with the angle at the branching points being quite open. He adds that although this can be achieved to some extent by pruning, it is only successful when the plant has strong growth to begin with.

He also expects his camellias to be vigorous, enabling them to root deeply as soon as possible. This he feels is becoming increasingly important as water scarcity is more and more prevalent.

His interest in seeking fragrance in camellias ties in with his philosophy that new varieties need to be distinct from the older varieties. As a retail nursery man he knows the value of offering something different from the norm to his customers.

He observes that in a nursery one of the first things a customer does is to smell the flowers to find those that are fragrant. As a nursery man he sees the importance a customer puts on fragrance, then on the beautiful bloom and, finally, on the plant's ability to grow well in the landscape.

In this Yearbook Dan provides us with details of his extensive breeding program and photographs of the results at Heartwood Nursery in Fort Bragg, California.

Stepping into the future

Follow the hybridizer as he describes combining the fragrances of demure *Camellia* species such as *Camellia yunnanensis*, *Camellia fraterna* and *Camellia lutchuensis* with the more opulent *C. reticulata* and others in his breeding program.

Check the photographs on the pages of his article and wonder out loud if these beauties can really be fragrant? Camellias have always been the most beautiful of all flowers but lacking the fragrance of other blooms. And now Dan Charvet is opening the door for us to a whole new world of fantastic camellias.

New Camellia Hybrids

by Bradford King

Everblooming camellias are closer than ever

The development of new camellia hybrids begins with using *Camellia* species. The most exciting prospects are the recently discovered species growing in Asia. The two best examples are *Camellia azalea* first collected by Wei in 1984 and the rediscovery by Professor Gao Jiyin in China and the finding of *Camellia amplexicaulis* in Vietnam.

These species offer outstanding opportunities for new camellia hybrids. *C. amplexicaulis* has two important characteristics sought by hybridizers—potential to rebloom in the same season and ability to tolerate frost. *C. azalea* also is sought for hybridizing for its ability to repeat bloom in the same year and to thrive in hot weather.

Camellia amplexicaulis

The heavy waxy petals and small to medium cup-shaped bloom are purplish

Figure 1: C. amplexicaulis.

red with a very thin white edge. The leaves are large, finely serrated, and oblong to elliptic in shape. In the wild it is found in northern Vietnam and southern China. It has been cultivated as an ornamental plant in Vietnam for years. Dr. George Orel reporting on his 2007 trip to Viet Nam discussed two unusual seedlings in cultivation. One had flowers the color of port wine. The second was light pink and larger than average. He also reports that there is a white form of *C. amplexicaulis*. Orel and Marchant's preliminary studies in 2006 indicate that the white-flowering type may be a different species. Future DNA and molecular studies will be needed to sort this out.

Hybridizers in Japan have crossed *C. japonica* with *C. amplexicaulis* which has resulted in numerous seedlings, some of which have successfully bloomed. Shuko Kirno has published a paper which reports that hybrids with *C. amplexicaulis* have flowers similar in size and shape to *C. amplexicaulis*. In addition they tend to be resistant to cold. He did not indicate if they inherited the ability to grow asynchronously and therefore are able to rebloom. He recommends using japonicas as seed parents and *C. amplexicaulis* as pollen parents. However, we know that *C. amplexicaulis* is capable of being both a pollen and a seed parent.

In the United States a number of growers have grafts of *C. amplexicaulis.* For example, Nuccio's Nurseries has *C. amplexicaulis* that is blooming and setting seed. They have two types. One is a short-leaf form having a slightly redder bloom and lovely bright red buds which they call 'Terada' after the grower who sent them this one. The long-leaf form has a bloom that is slightly on the pink side of red. The bud is a darker, duller red as compared to the short leaf form. The long leaf form is called 'Atagawa'

Figure 2: Long leaf ('Atagawa') and short leaf ('Terada') forms of C. amplexicaulis. The picture on the right shows the bright red buds of the short leaf form.

(hot river) for the location it was collected in Vietnam. The Vietnamese may be using other names which would be the priority names once the English-speaking world is notified. However the size and form of the flower is visually identical in both forms. See figure 1.

C. amplexicaulis is a shy bloomer when young and seems to prefer more shade in the hot dry areas of Southern California than many *C. japonica*. It is a camellia that has some cold tolerance which is a highly desirable trait. Dan Charvet in Northern California has begun to use *C. amplexicaulis* in his hybridizing program where the climate is cooler than Southern California. He recently told me that he has germinated crosses between *C. yunnanensis* and *C. amplexicaulis*.

We are still learning the culture requirements and differences in *C. amplexicaulis* especially the blooming characteristics due to heat and humidity. I lost one in a pot under 50% shade cloth that got extra sunlight due to being located at the southwest side of the cover. Consequently I now have them planted in the ground in about 60% shade and kept moist. In summary *C. amplexicaulis* doesn't tolerate full sun. It requires shade and adequate moisture similar to many other camellias.

I have been able to cross *C. amplexicaulis* successfully with several *C. japonica* cultivars. My most successful crosses are with 'Tama Peacock' as the seed parent. They show a leaf that is mid way between the parents. (figure 3) These seedlings have not yet bloomed thus it unknown what flower characteristics may be inherited or if the new plant is capable of re-blooming. I like the notion of increasing the thin white edge line on the *C. amplexicaulis* reddish purple bloom with the red blooms of 'Tama-no-ura', 'Tama Peacock' and 'Tama

Figure 3: Seedling of 'Tama Peacock' x C. amplexicaulis shown with a C. amplexicaulis leaf and a 'Tama Peacock' leaf

Americana' with their genetic white border. An additional objective is to get a flower that opens up more than *C. amplexicaulis* and blooms more profusely like the "Tama" parents. The heavy fleshy petals of *C. amplexicaulis* make for a heavy flower that hangs its head from a long flower stem (pedicle). Therefore another objective would be to have flowers that "show their faces and look up at you".

The use of a variety of good seed setting *C. japonica* is strongly recommended. In my program I like to use 'Betty Foy Sanders', 'Magnoliaeflora', 'Nuccio's Carousel', and 'Wildfire'. The use of *C. sasanqua* seed parents has the potential to increase flower production and sun tolerance. While we know *C. amplexicaulis* crosses with *C. japonica* hybrids, I have seen no reports of crosses with *C. sasanqua, C. reticulata* or non reticulata hybrids. *C. flava* and *C. amplexicaulis* crosses have been reported in Japan. In summary there are many interesting avenues for camellia breeders to explore using different *Camellia* species and hybrids.

Camellia azalea

The bright red, small-to-medium flower of *C. azalea* has 5 to 7 petals and is found singularly or in clusters at the tip of the shoots. It has some resemblance to certain azaleas hence its common name. The scientific name is *Camellia changii* Ye(1985), aka *C. azalea* Wei (1986). The narrow long smooth leaves are oblong with a rounded tip. The mid vein is raised. The plant can grow into a ten-foot (3 meter) shrub. It thrives in hot (90° to 100°) temperatures.

Professor Gao Jiyin has reported a small population of 1118 *C. azalea* plants found on the Honghuatan River in southern China, a lowland, maritime tropical area. This is the only known wild population in existence. They flower 9 to 10 months of the year in this remote area. The climate is warm and moist without frost. Orel, Marchant and Curry did a molecular investigation of *C. azalea*. The study concludes that *C. azalea* is firmly within the genus *Camellia* indicating a high degree of nonspecific compatibility. They isolated 16 clones which may have different blooming times. These authors propose, based on their investigation that this morphological polymorphism is the result of an on-going process where two or more populations that could interbreed do not do so due to different flowering times or type of pollinators. They reason this is possibly occurring in *C. azalea*. Specifically the *C. azalea* blooming in January crossbred within their little group and theoretically not with the other *C. azalea* plants. If this occurs over a long period of time a new *Camellia* species is created. While this is an interesting explanation for how a new camellia species is created, it is a disturbing hypothesis for those of us hybridizing with *C. azalea*. The basic rationale for using *C. azalea* is based on the premise that individual shrubs repeat flower in the same year.

The observations in situ reported by Professor Gao of the wild population clearly indicate that this species blooms

every month of the year. Dr. James Harbage (*American Camellia Yearbook*, 2003 p. 10) wrote "*C. azalea* has bloomed in virtually every month of the year here (in the greenhouse) at Longwood Gardens, Pennsylvania." He explains that this ever-blooming ability is due to the fact that the plant can have shoots just beginning new growth flush, shoots in the middle of a growth flush, shoots completing their growth that are setting buds, and shoots with flowers. This asynchronus growth pattern is unusual for camellias. Typically a camellia has one, or in some cases, two growth flushes a year with the vegetative growth and flower buds developing about the same time. This asynchronus growth pattern is the trait sought by hybridizing with *C. azalea* in order to produce a re blooming camellia.

While Chinese hybridizers have a number of *C. japonica* and *C. azalea* seedlings, they have not reported that they are capable of re-blooming. Professor Gao (*International Camellia Journal* 2008) reported that many individuals and camellia nurseries are cultivating and propagating *C. azalea*. He estimates there are now more than 100,000 plants in China. In addition the local government has protected the natural occurring population of *C. azalea*. This assures that this *Camellia* species will not be lost to future generations. He also reported that there are several flower forms of *C. azalea*—a narrow petal form, a wide petal form, a larger flower form and a smaller flower form. In addition he noted that there are four flower mutations identified in propagating this plant. One is anemone formed called 'Azalea Pearl'. The second is named 'Azalea Camellia Variegated'. The third has shining petals that look like it is covered in wax so it was named 'Waxy Petal Azalea

Camellia azalea

Camellia'. The forth has curly and wrinkly petals and is called 'Curly Petal Azalea Camellia'.

A number of people in the United States have grafts of *C. azalea* and have reported successful flowering from June until January. It is interesting to note that Dr. Harbage told us at the ACS convention held at Longwood Gardens that at least 65° is needed for their plant to flower but 70° is better. He also reported that they have four *C. azalea* hybrids one of which bloomed three times in the green house. The leaves were more rounded with a small red azalea-like flower. This is the first report of a reblooming camellia hybrid to date. This is very exciting news which supports the goal of developing a "remontant" camellia. It took the rose hybridizers 40 years to develop "remontant" hybrid tea roses. Longwood Gardens has a different *C. azalea* clone from the more widespread *C. azalea* sometimes called the ACS clone. The Longwood clones have more pointed leaves with the ACS clone having more rounded leaves. These clones are most likely the two leaf forms reported by Professor Gao. The difference in these clones, in my opinion, doesn't support the proposition of a separate species but rather the bio diversity within the species. Professor Gao from China provided cuttings to the American Camellia Society Research Committee chaired by Hulyn Smith. Gene Phillips has been very successful in grafting *C.azalea* and has had flowers for several years. Mark Crawford, Loch Laurel Nursery in Valdosta, Georgia, has a flowering hybrid called 'Windy' as a result of his successful crosses. In a personal conversation he informed me that his flowering *C. azalea* died this year for no apparent reason. This underlines, what many have discovered, that *C. azalea* is not always easy to maintain. It has a mineral sensitivity or deficiency that resembles iron chlorosis but applications of iron are not effective. In addition, this plant is extremely difficult to grow on its own roots. These are areas for further investigation. However, *C. azalea* grafts are successful. I have one grafted in March 2007 that has yet to bloom, has had new growth but not continuous growth throughout the year. I believe this is due to its young age.

New color tones and leaf forms are also future possibilities with these species and there are many exciting opportunities to develop new Camellia hybrids with them.

In April 2008 I made two successful grafts. One had three scions placed on a large (5 gallon) 'Narumigata'. All three scions took, budded and bloomed in late October and early November 2008. They were well callused but had little new growth until after they bloomed and fall heat arrived (85 to 97°). At this point they shot five to seven inches of new growth with several new branches. I believe this is a result of having large understock and the high levels of heat. The two other grafts are in a cooler (north side under shade cloth). They

had new growth but no buds. *C. azalea* is capable of new growth under the right conditions any time of the year. It is clear from other reports as well as my experience that *C. azalea* likes hot weather (90° plus). It still needs shade and adequate moisture. I mist the new plants and seedlings most days mornings and evenings especially when hot and dry. Professor Gao reports in the 2008 *International Camellia Journal* that this species likes good soil or artificial media that are loose, acidic, moist, well drained and also that they like monthly fertilization.

Longwood Gardens has found that *C. azalea* is best grafted on *C. japonica*. My successful grafts were on 'Narumigata' and 'Kanjiro'. My recommendation is to use rootstock that is very well rooted and if possible large rootstock (5 gallon or larger). Professor Gao suggests that the best root stock are *C. sasanqua* and *C. japonica*. In conclusion *C. japonica, C. hiemalis* ('Kanjiro') or *C. sasanqua* ('Narumigata') rootstock can be used successfully and is much more successful than growing *C. azalea* on its own roots.

For three years I have used pollen sent from Longwood Gardens with very few seed pods developing. The use of one fresh flower with pollen resulted in several seed pods and four seedlings of 'Tama-no-ura' x *C. azalea*'. One seedling died out and the remaining three are alive with some new growth. It is not clear how robust these seedlings will be growing on their own roots. All are several years away from flowering. They do show leaf characteristics of *C. azalea*. Leaf characteristics are the first sign that a cross is successful. (Figure 4). The opportunity to make further progress is enhanced with having a flowering plant of *C. azalea*.

However there are still challenges to overcome. *C. azalea* blooms regularly outside in California in summer and fall when *C. japonica* camellia buds are not generally ready for hybridizing. Therefore the pollen needs to be harvested and stored in the refrigerator or freezer until buds are mature. I will con-

Figure 4: Leaf characteristics are the first sign that a cross is successful.

tinue to use 'Tama- no- ura', 'Tama Peacock', and 'Tama Americana' because they bloom early and are good seed setters. I have had less takes on 'Wildfire' and 'Silver Waves' so these will dropped from my seed parent list. I will also use other *C. japonica* solid seed setters like 'Betty Foy Sanders', 'Magnoliaeflora', 'Nuccio's Carousel', 'Silver Triumph' and 'White Bouquet'. *C. azalea* will also cross with non-reticulata hybrids such as 'Cupcake' and some *C. vernalis* e.g. 'Egao'. In addition, by gibbing in late October I had blooms ready for hybridizing in November on 'Tama Americana', 'Wildfire' and 'Silver Waves' thus being able to use fresh pollen from a later bloom of *C. azalea*.

My experience leads me to believe that the fresh pollen is much more successful than stored. In the future, I will be gibbing more buds to see if I can have fresh pollen at the same time as mature buds for hybridizing. The dry, warm, even hot weather in late summer and fall in southern California should be an asset in crosses with *C. azalea*. The hot humid weather in parts of the southeastern United States should also provide good growing conditions for this species.

However it may still be necessary to store pollen of *C. azalea* to use during peak camellia blooming season. Dr. Ackerman reports pollen is viable up to three months in the refrigerator and several years if frozen. The key is in harvesting, and keeping the pollen dry. The anthers are placed on a paper towel, dried and stored in a zip lock bag or gel capsule. I collect the moisture "cubes" from pill bottles and put one in a zip lock bag. Moisture is the biggest problem as it leads to fungus and nonviable pollen. I have found some frozen pollen dried out and no longer viable. It was unclear if the pollen was too dried out before being stored or if freezing dried it out or a combination of both. This is an area for further study.

Conclusion

Hybridizing is well underway in Japan and China with *Camellia azalea* and *C. amplexicaulis.* It has just begun in the United States as growers receive scions from China and Vietnam. The goal to produce vigorous repeat flowering camellias for the landscape is of particular interest. Longwood Garden's report of a 'remontant' *C. azalea* hybrid provides exciting support for this objective. *C. azalea* offers the most promise for a repeat blooming camellia that may also extend the range of camellias to climates that are hot and unfriendly to camellias. The use of *C. amplexicaulis* to get a cold-hardy reblooming flowering camellia would be a significant achievement especially if it were a good bloomer with larger, complex flowers on a vigorous plant.

How about YOU!

There are too few of us persistent, patient dreamers seeking to make a break through in hybridizing. We are looking for others to join the quest. How about you? *BDK*

Camellia Culture

New Horizons in Camellia Hybridizing

Bradford King

GENE PHILLIPS

Camellia azalea

Successful businesses, health and educational institutions spend time and effort developing a strategic plan. A *Camellia* hybridizing program also needs a strategic plan. A key initial step is to articulate a vision.

Vision

In 1978 Julius Nuccio of Nuccio's Nurseries in Altadena, California shared his vision for hybridizing. "It is every camellia grower's dream to develop a camellia with the foliage of *C. japonica*, the vigor and exposure range of *C. sasanqua*, the fragrance of *C. lutchuensis*, the flower style of a large *C. reticulata*, the mass bloom of *C. saluenensis* and, of course, yellow." His vision statement holds true today.

Programs

Most of the hybridizing in the past focused on developing better landscape plants or beautiful new show flowers. These programs have been very successful in developing blooms of many sizes, forms and colors. A camellia show is the best place to see the results of these efforts. These programs continue to be of major interest to camellia lovers. According to

Jude Nuccio of Nuccio's Nurseries, they plant 25,000 seedlings a year in the hopes of marketing two or three new varieties during the course of the next seven to 10 years. This high volume of chance seedlings has helped Nuccio's offer over 200 wonderful new camellias over the past 70 years. We expect hybridizers to continue to be interested in developing new show and landscape camellias.

Objectives

A hybridizing program begins with a specific objective or goal such as a fragrant or yellow camellia. The next step is to identify a seed parent. This is a camellia that is known to set seeds and has one or more characteristics that fit the hybridizing goal. The third step is access to camellia pollen which also has characteristics fitting the chief objectives.

Frontiers

The most important frontiers for *Camellia* hybridizing are for blooms that are cold hardy, yellow, fragrant, clustered, or rebloom. Each of these objectives will be discussed.

Cold-Hardy Camellias

The development of cold-hardy camellias is a significant hybridizing frontier. The pioneer work by Dr. Clifford Parks and Dr. William Ackerman in developing cold-hardy camellias is impressive. Dr. Parks concentrated on intraspecific crosses with *C. japonica*. He has developed cold-tolerant cultivars like 'April Blush', 'April Dawn', 'April Remembered', 'April Rose', 'April Snow' and 'April Tryst'. Dr. Ackerman focused his program on crosses with *C. oleifera* with fall- and spring-flowering cultivars. He developed fall bloomers such as 'Snow Flurry', 'Polar Ice', 'Winter's Beauty', 'Winter's Hope', 'Winter's Interlude' and 'Winter's Rose'. Ackerman's spring flowering variants include 'Fire n' Ice', 'Ice Follies', and 'Spring Frill'. In the 2005 *American Camellia Yearbook*, Dr. Ackerman reports he has a total of 51 named cold-hardy hybrids as a result of his 45 years of research.

We applaud Dr. Parks' and Dr. Ackerman's programs as they are extending the range of cold-hardy camellias in the northern climate.

Yellow Camellias

When *C. nitidissima* (formerly *C. chrysantha*) was discovered in China in the early 1980s it created lots of excitement and promise to camellia breeders in the quest for developing a large yellow bloom. Unfortunately, the next 30 years did not bring the hoped-for success. According to Dr. Ackerman, the yellow genes are recessive to all other color genes, even white. In addition, he reports that the interspecific crosses are very difficult with F1 yellow hybrids sterile. Gao, Parks and Du (2005, p.112) state, "It (*C. nitidissima*) has been widely used in breeding programs, but it is nearly incompatible with other *Camellia* species." In a recent personal

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C. nitidissima *buds*

communication Dr. Ackerman stated the importance of using *C. nitidissima* as a seed parent in order to get the deeper yellow colors.

Mr. Tadao Yamaguchi of Ishihawa, Japan is a pioneer in developing yellow camellias.

He has developed 'Shoko', 'Kicko', 'Kiho' and 'Ki-no-gozan'. Two of the *C. japonica* seed parents are unlisted in the 2006 Southern *California Camellia Nomenclature*. The other two are listed in the 1996 *Camellia Supplement*. They are both white flowered plants. 'Hatsu-arashi' or 'First Storm' is a 1935 small single from Japan and was the seed parent of 'Kicho'. 'Hakuko' is a medium peony-form flower. It served as the pollen parent with *C. nitidissima* as the seed parent for 'Kiho'. Mr. Yamaguchi used 'Kiho' and *nitidissima* in his back crossings to develop two of the most promising yellow camellias to date. 'Ki-no-senritsu' is a peony-to-loose-peony form with a small-to-medium soft yellow bloom. The plant grows fast, is upright and open in its growth pattern. 'Senritsu-Ko' is a beautiful light yellow with peach tones at the edges of the small-to-medium formal to rose-form double. It grows moderately fast and is upright in growth. These yellow varietals are available at Nuccio's Nurseries.

Mr. Kazuo Yoshikawa of Osaka, Japan has pursued many avenues in his goal to produce yellow camellias. He has used *C. saluenensis* hybrids, *C. reticulata* hybrids, *C. japonica* and *C. sasanqua*. Nuccio's Nurseries has four of his crosses: 'Ki-no-moto #92', 'Ki-no-moto #95', 'Kogane Nishiki', and 'Kogane-yuri'.

The frontier in developing a yellow camellia is to use one of the 38 yellow-flowered camellias besides *C. nitidissima*. My investigation into these yellow *Camellia* species leads me to recommend three potential candidates. My top pick is *C. flava*. According to Gao, Parks and Du, it hybridizes readily with *C. japonica*. It develops into a small shapely tree with small leaves. The yellow flower is less than two inches in size with a large number of petals. My second choice is *C. euphlebia.* Gao, Parks and Du (2005, p.95) state, "This species is fast-growing, tolerant of a wide range of growing conditions, and resistant to disease. It is an excellent garden and landscape plant for mild areas and may be useful in breeding programs." *C. tunghinensis* produces numerous single pale yellow blooms. The plant has medium glossy foliage and is moderately upright.

Fragrant Camellias

Most hybridizing programs seeking to produce fragrant camellias have used *C. lutchuensis*. In addition, *C. fraterna* and *C. tsaii* have also been used.

The last 40 years has brought some success, but further work is needed. Nuccio's Nursery 2005-2006 catalogue lists only 10 fragrant camellias. The best fragrant Nuccio's introduction is 'Scented Gem'. The flower is a miniature fuchsia-pink anemone-form with white petaloids.

One avenue hybridizers followed was to use cultivars with a slight scent such as 'Kramer's Supreme' paired with *C. lutchuensis* hybrids. The best example is 'Ack-Scent'. Dr. Ackerman introduced it in 1978. The bloom is a shell-pink full peony medium with a deep spicy fragrance.

The Japanese growers concentrated their efforts using scented Higo *Camellia japonica*.

A notable fragrant parent is 'Nioi-fubuki' ('Scented Snowstorm'). This

white flower has carmine-colored stripes in the typical Higo form and has 150 pale yellow stamens.

Jim Finlay of Whangarei, New Zealand may have had the most successful fragrant camellia program thus far. Three of his best are 'Superscent', 'Scentuous' and 'High Fragrance'. 'High Fragrance' is, in my opinion, the best fragrant show flower developed to date. It is a peony-form pale-pink shading to deeper pink at the edge and has a lovely scent. It is a seedling cross between hybrid 'Salab' with 'Scentuous' as the pollen parent. The seed parent was *C. japonica* 'Mrs. Bertha A. Harms', which is an ivory-white flower with a pink tone. It is a large semi-double with wavy, crepe petals.

The frontier in developing additional fragrant camellias is to broaden the horizon and use a wider range of fragrant *Camellia* species. Fragrance is present in *forrestii, fraterna, kissi, meyagaii, synoptica, tsaii,* and *yunnanensis*.

My top recommendation is *C. yuhshsienensis* because it is fragrant and flowers in clusters. Two potentialities in one! The very small white flower blooms

BRADFORD KING

'Tama Americana' is one of the stunning cultivars bred from 'Tama-no-ura'.

profusely in midseason on an upright plant. It is the pollen parent of 'Yume'. The seed parent used by Dr. Kaoru Hageya was 'Shishigashera'. 'Yume' is a small single pink flower with genetic white blotches. It makes a showy display mid-to-late season with its abundant blooms.

My second pick is *C. grijsii*. It is a very fragrant small white flower with potential to produce clusters. Hybridizing potential is excellent if the parental chromosome numbers can be identified. Researchers report *C. grijsii* is a diploid with sub varieties having different numbers of chromosomes, such as 30, 45, 75 and 90. Hybridizing results would be best if both parents have the same number of chromosomes. For example, *C. japonica* is a diploid with 30 chromosomes and should be hybridized with a *C. grijsii* with 30 chromosomes. Conversely, less success would be anticipated if the sub variety carries 45, 75 or 90 chromosomes.

Cluster-Flowering Hybrids

The fine-leafed miniature cluster flower hybrids have been popular with hybridizers since 1948 when J.C. Williams received an Award of Merit from the Royal Horticultural Society for 'Cornish Snow'. Hybridizers have found *C. rosaeflora* useful for developing pink flowers; *C. fraterna* for cluster flowers; *C. tsaii* for wavy leaves; and *C. japonica* 'Kuro-tsubaki' for its black-red color.

Seedling of C. Amplexicaulis*, which is one of the most promising species for creating reblooming camellias.*

Neville Haydon from New Zealand crossed *C. rosaeflora* with *C. tsaii* to get 'Baby Bear' and 'Baby Brother' to continue the process of developing new miniature hybrids. In 1999 Nuccio's Nursery introduced 'Bunny Ears'. This is also a *rosaeflora* hybrid miniature, pink semi double with rabbit ears. Thomas Savage of New South Wales also used *rosaeflora* to develop fine hybrids. Several of his best cluster styles are 'Wirlinga Princess', 'Wirlinga Bell' and 'Wirlinga Bride'.

In the 1990s Ray Garnet introduced two *C. transnokoensis* hybrids, 'Sweet Jane' and 'Transtaman' that have clusters of blooms.

On the horizon are camellias with abundant cluster flowers that excel in the landscape. An added value is to breed new cultivars that also have distinctive qualities, such as scent, yellow or apricot colors, unique foliage or that have a continuous blooming season.

There are several *Camellia* species that have potential for hybridizers that may result in crosses with a combination of desirable characteristics. Following Ray Garnett in using *C. transnokoenis* may lead to fragrant cluster flowers. It is a small abundant blooming white flower that often displays an attractive red spot on the petals. It also has scent. Crosses with larger flowers could make for excellent landscape varieties.

A hybridizer interested in developing yellow cluster flowers could explore *C. tunghinensis* as a parent. It produces single, small pale flowers in abundance.

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The mother plant 'Tama-no-ura' was pollinated using a C. azalea *flower bud.*

Those breeders seeking a very long or continuous flowering season could find *C. yunnanensis* a sound choice. It produces a small to medium white flower with some scent. It can set abundant buds. The foliage is small and finely textured. The seed pods are purple-red and hang like Christmas tree ornaments when fully mature. It requires less humidity than other species. Since it has not been used extensively in hybridizing, its full potential has yet to be discovered.

A hybridizer seeking to use a larger flower with a lovely red flower should consider *C. chekiangoleosa*. It sets seeds readily so it can be either a seed or pollen parent. While not a cluster type bloomer, it does have lots of flowers. In addition, it is reported to be resistant to common diseases and has cold tolerance. It grows into a small tree.

Japanese hybridizers have successfully crossed *C. chekiangoleosa*. with *C. japonica* to produce excellent red flowers. It has the same number of chromosomes as *C. japonica* (2n=30). In addition, hybridizers such as Dr. Parks, Gene Phillips and Tom Nuccio, speculate that color breaks are possible from this species. Therefore, this species is a very strong candidate for a hybridizing program.

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Reblooming Camellias

To my knowledge no one has reported developing a *Camellia* hybrid that has two or more blooming seasons. However, it is a real possibility. Gao, Parks and Du have identified a number of species that have very long, if not continuous, flowering seasons. The most promising species for this objective are *C. amplexicaulis*, *C. azalea* and the previously discussed *C. yunnanensis*.

C. amplexicaulis has a purplish red cupped flower with a very narrow white margin. It blooms mainly in the summer and autumn, but under optimal conditions can bloom at any time. The petals are thick and fleshy. The stamens are yellow and clustered, producing quantities of pollen. It has very large glossy dark green leaves. It sets seeds readily; therefore, it is an excellent candidate for hybridizing as either a seed or pollen parent.

The strongest candidate for producing four-season blooming hybrids is *C. azalea*. The flower is a single bright red. The leaves are a shiny green. *C. azalea* gets its name from its resemblance to the evergreen azalea plant's flowers and leaves. The plant is compact, upright and

dense in its growth pattern.

Gao (*American Camellia Yearbook* 2005, p.61) wrote, "I have visited the native place of *C. azalea* four times (May, August, October and January) and I could see the bright flowers of the species each time." Dr. James Harbage (2003 *American Camellia Yearbook*, p. 10) said "*Camellia azalea* has bloomed in virtually every month of the year here at Longwood Gardens (Pennsylvania)." He explains that the ever-blooming ability is due to the fact that the plant can have shoots just beginning a new growth flush, shoots in the middle of a growth flush, shoots completing their growth, that are setting buds and shoots with flowers. This asymmetrical growth pattern is unusual for camellias. As you know, the typical camellia has one growth flush (or perhaps two) a year with the vegetative growth and flower buds developing about the same time.

Dr. Harbage also reports in the same article that rooted cuttings of *C. azalea* were significantly less successful than grafts. The grafted plants grew normally in producing new foliage but at a slow rate. They had not had seeds set for them as of 2002. Therefore, they consulted with Professor Gao. He suggested that very warm temperatures may be required for successful fertilization.

On December 9, 2005 I received one *C. azalea* flower bud which had a small amount of pollen. I immediately made the following controlled crosses: five on 'Tama-no-ura', three on 'Egao', and one on 'Tama Peacock'. In early June, I had three seed pods growing well on 'Tama-no-ura' and one on 'Egao'. On June 17, two seed pods opened on 'Tama-no-ura'. Each had three seeds. Four seeds germinated resulting in four seedlings. One died the summer of 2007. Two of the seedlings have leaves that are smooth and rounded with a slightly raised mid vein that is similar to *C. azalea.* The remaining seedling also has rounded smooth leaves but is not as pronounced. The one seed from the 'Egao' pod was lost much to my chagrin. 'Egao' is a species *vernalis* which is most likely a *japonica* and *sasanqua* hybrid.

In December 2006, 58 controlled crosses were made using *C. azalea* pollen. Ten viable seed pods developed. The successful seed pods were on six different japonicas and one non-reticulata hybrid. All the crosses with *C. sasanqua* failed. No attempts were made to cross with *C. reticulata* because no mature flower bud has been available when *C. azalea* pollen was available. It is clear that *C. azalea* crosses with *C japonica* and non-reticulata hybrids. Further attempts to cross *C. azalea* with *C. sasanqua*, *C reticulata* and other camellia species is warranted.

While it is difficult to obtain *C. azalea* plants, Longwood Gardens has pollen available for distribution to *Camellia* hybridizers. The address is Longwood Gardens, PO Box 501, Kennett Square, PA 19348.

Conclusion

Camellia japonica has diversified into over 30,000 cultivars in many different forms and colors. The horizons of hybridizing are in tapping the genetic potential of the *Camellia* species to develop cold hardy, yellow, fragrant, cluster and reblooming camellias for the future. Camellia hybridizing is an interesting and challenging enterprise. Why not give it a try? We would enjoy hearing from you about your experience. The more the merrier.

Research

Studies of Camellia Seed Germination

Bradford King

Germinating container of seedlings soaked in "gib."

"What is the best way to germinate camellia seeds?" In August 2007 I began a series of studies to answer this question.

The first condition or control group was to plant 20 seeds in two one-gallon pots (ten seeds to a pot). The pots were placed in a shady spot in the yard where other pots I had planted previously were producing thriving seedlings.

The second condition was to place 20 seeds in a covered plastic container one-third full of moist peat moss. This was then placed in the same general area as the uncovered pots described in condition one.

In the third condition the 20 seeds were soaked in very warm, but not hot (to the touch), water for two hours; then placed in the germinating container in the same manner as in condition two.

The seeds used in these three groups were from identical varietals; e.g. each condition has five seeds from 'Tama-no-ura', two seeds from 'Tama America', two seeds from 'Rudolph', six seeds from 'Nuccio's Carousel', four seeds from 'Jackpot', and one each from 'Wildfire'

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Seedlings soaked in "gib." Notice that no leaves or hair roots have developed.

for a total of 20 seeds. This seed matching should control for different varietals' rate of germination.

The three conditions were evaluated on November 25, 2007. Condition One had only one seed showing any signs of germinating; Condition Two showed no activity; and Condition Three had two seeds displaying signs of growth.

They were examined in detail on April 19, 2008. The seeds in Condition One (the control group) were generally dormant or showing only preliminary signs of germinating (e.g. a cracked seed hull). No stems or leaves were present. When the seeds were pulled from the medium and examined, 10 (or 50%) had initial root growth present.

Condition Two showed five seeds with root development and the beginning of leaves. In Condition three, 15 seeds had germinated with 10 having two to three leaves. Four of these had leaves one-half to three-fourths full size. The roots were well-developed with some branching and many small white roots ("hair roots"). These were ready to be transplanted into pots.

I concluded that camellia seeds will germinate in all three conditions. However, it is very clear that the seeds soaked for two hours in very warm water and then germinated outside in a closed plastic container were significantly better rooted and leafed out than the seed raised under the other two conditions. The time from seed harvest to being ready for transplanting was eight months. The average daytime temperatures in the *Sunset Magazine* climate zone 21 where this germinating study was conducted ranged from the low 80s to mid 60s with nighttime temperatures typically 20º cooler.

Soaking seeds in gibberellic acid

A second study was conducted beginning September 3, 2007 in an attempt to answer the question, "Does soaking camellia seeds in gibberellic acid enhance germination? And, are the resulting seedlings healthy?" One gram of ACS gib (90% gibberellic

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Comparison between a gibbed seedling (left) and control group seedling (right).

acid and 10% other ingredients) was dissolved in four ounces of distilled water. No ammonia was added. Twelve seeds were soaked in this gibbed mix for two hours. The seeds were not rinsed off, but placed directly in a germinating container one-third filled with moist peat moss as described in conditions two and three in the previous study. A control group of 12 matched seeds was placed in a germinating container of moist peat moss

The seeds soaked in gib had sprouted when observed on November 25, 2007. Specifically, 11 seeds were very open, green and plump. Two had light green stems that reached to the top of the 8" container. The control group showed no such activity. Therefore, I concluded that gib, in fact, does significantly quicken the germinating process. When seeds were examined and removed from the germinating container on April 19, 2008 all the gibbed seeds had sprouted with six (50%) showing stems reaching the top of the germinating container. Three had two leaves. However, all were spindly, most lacked leaves and roots had no branching or "hair roots."

The control group continued to show minimal activity – three small, well-rooted seedlings with two very small leaves. When the gibbed seedlings were directly compared to condition three (seeds soaked in warm water for two hours) they looked spindly, sick and lacked adequate root development.

In conclusion, it can be stated that soaking in gibberellic acid hastens germination, but did not produce robust seedlings ready to be planted.

On September 15, 2007, a third study was begun to investigate if a longer soaking in gib would be beneficial to seed germination. Twenty-four seeds from 'Jackpot' (a non-reticulata hybrid) were soaked in the gib solution overnight (or 20 hours to be precise). A control group of 24 'Jackpot' seeds were placed in germinating container, covered and placed outside next to the gib container.

The gibbed seeds germinated quickly in three to four weeks' time and were open, plump, green, with roots and stems. By April 19 all 20 seeds had germinated with 12 showing very small leaves atop thin spindly, light green stems. In addition, one seedling had a "normal" width and colored stem, but lacked leaf development. When the roots were examined they were present, but short with few if any branches and no "hair roots."

Germinating container of seedlings raised outside.

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Seedlings germinated outside and not treated with "gib" (control group for gib study).

The 'Jackpot' control group showed no activity until March 2007. By April 19, eight seeds showed signs of germinating. Two had leaves and were ready to be transplanted. The stems were light brown, the leaves a normal color (medium-dark green) and looked healthy. Three seeds had the beginning of leaf formation and had long tap roots with branching and showing "hair roots."

It can be concluded that gibberellic acid does speed the opening of camellia seeds by penetrating the outer cover of the seed. However, the quality of the seedlings produced is poor, showing lack of adequate root systems and small leaves on a spindly stem.

The cost of the gib is not high, but the added expense doesn't justify itself when results do not produce robust seedlings. The speed at which they germinate is interesting to note, but it doesn't translate to a healthy, well-rooted seedling. My opinion, in brief, is that it is a dead-end for further investigation.

Using controlled heat and extended light to hasten germination

The final study was to place 12 seeds of 'Magnoliaeflora' in a covered germinating container one-third full of most peat moss. The container was placed indoors in a north facing "frosted" window. The room remains at 70º F (+/-2º) during the fall, winter and spring months due to the fact that it houses eight tropical fish tanks that are constantly heated. In addition to the filtered natural light, there are 16 hours a day of artificial light in the room.

On April 19 after five and a half months, six of the seeds have germinated with well-developed healthy leaves and roots. Three seeds have germinated with roots, stems and leaves just beginning. The remaining three seeds show no signs of germination.

This condition was begun a month later than the first study but had results better than all but one condition. That is, the outcomes were better than the control groups and both of the gibbed conditions. When compared to condition three (seeds soaked for two hours and placed outside in the germinating container) the results are very similar. The two conditions had different numbers of seeds 20 with 15 germinated and 12 with nine germinating. The seedlings germinated inside had more extensive root development while those grown outside had more leaves but appeared "younger" (soft, tender stems).

'Magnoliaeflora' seedling germinated inside, but not soaked in water.

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'Magnoliaeflora' seedling soaked in water for two hours and germinated inside.

In other words, the seeds grown inside germinated sooner in the warm/high light conditions.

What has been learned through these studies?

•Soaking camellia seeds in very warm water for two hours is an easy and helpful step in germinating camellia seeds.

•Warmer temperatures (70º F) shortened the time of seed germination.

• Moist peat moss is a sound germinating medium. Very little fungus or weeds were found.

•A closed container provides a constant level of moisture required for seed germination.

•A greenhouse or germinating container offers protection from extremes in weather (heavy rain and wind), as well as protection from pests (bugs and insects or squirrels and raccoons).

Conclusion

The germinating container acts like a mini-greenhouse. This container should be at least 7" tall, but preferably 12" or more in height to allow for seedling growth. I believe the seeds germinated indoors would have benefitted from a taller container. That is, the height and leaf development would have improved if the container was 12" or taller.

James Bonner (*Camellia Review* Vol 69 #2, 2008, page 20) reported that in his studies at California Institute of Technology that "the growth of the camellia, the production of leaves, and the elongation of stems are controlled by the length of day or daily exposure to light." He recommends supplying artificial light at night during the winter months. This may be incandescent lamps and be of "only low intensity." He states that 100 foot-candles intensity has been found to be adequate. He explains that camellia plant growth is mediated through gibberellic acid which increases in minute amounts as the length of day increases. This is artificially induced by using a night light. He hypothesizes later in the article (page 22) that "somewhere above 12 hours and perhaps as high as 16 hours" induces flower and bud protection.

To conclude, the best way to germinate camellia seeds is to soak them for two hours in very warm water, planting only the seeds that sink (floaters are most likely infertile) in a covered plastic container 12" tall or larger, one-third filled with moist coarse peat moss. The container may either be placed outside in a shady part of the garden or inside where it is 70-80º F and where it receives natural and artificial light lasting 12 to 16 hours a day. The latter condition is expected to produce better results. However, unless one has a greenhouse, only a few germinating containers can be accommodated by a hobbyist in one's home. In addition, seedlings germinated at high inside temperatures will require hardening off when transplanted outside in cooler weather.

Germinating camellia seeds and growing seedlings is an interesting and enjoyable way to develop new varietals and to obtain rootstock for grafting.

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