BREEDING NEW CAMELLIAS

by Tom J. Savige

One of the most engrossing aspects of horticulture for the amateur is raising new plants from seed. Each seedling is an individual and, although many botanical species of plants breed so true to type that individual seedling differences are almost non discernible, most horticultural plant material, having arisen from selected, isolated variants over many years centuries in some cases and perhaps modified by earlier infusions of other species, has a considerable bank of different genetic factors which can give rise to an extremely wide range of variable characteristics in their seedlings.

The garden camellias are an outstanding example of plants which are extremely variable when grown from seed. From the few dozen Chinese plants brought to Europe and America in the early 1800s, were developed some thousands of named cultivars by the early camellia enthusiasts, such as John Alnutt who raised 'Alnutt Superba' in 18 17, and William Ross who produced 'Rossii' in 1815 in England, or Michael Floy who released 'Floyii'in New York about 1809. These were followed by such well known camellia breeders as Wilder and Hovey of America, Chandler and Low of England, Mathot of Belgium, Lemaire of France and Franchetti of Italy.

Such men as these introduced a flood of cultivars of their raising during the last century. At the same time a large number of camellias of Japanese origin were introduced to America and Europe, as well as a number of new camellia species coming mostly from China.

With this enormous background of material, the modern camellia breeder has introduced a large group of new cultivars, which have, to a large extent, superseded the old cultivars. A very recent development has stemmed from the realisation that many of the various camellia species are not only excellent garden material in themselves, but will cross fertilise with other species and, in particular, with the more elaborate flowering garden forms, of C. japonica, C. reticulata and C. sasanqua. From these hybridisations are now coming camellias with new combinations of colour, form and habit.

It may be thought that, in the tens of thousands of new camellia seedlings that have been raised, about every possible combination of desirable characteristics has been obtained and that there is no place for new varieties amongst the many hundreds now available. This is far from true as, not only is the camellia one of the most variable of plants, but the various combinations of interspecific hybridisation have hardly been touched, let alone the endless possibilities of multibrid combinations which increase with every new hybrid produced, so that there yet remains an enormous field to be worked.

R. Len Bray- Bred by Tom Savige- N.S.W.- 1980

R. Simpatica - Bred by Tom Savige- N.S.W.- 1980

In this article terms are used on which it may be desirable to be specific, as some of them are rather loosely used in general literature. The word 'hybrid' is here limited to define individuals obtained by crossing outside one species. Hence crosses between members of two different species would produce 'interspecific hybrids' and between individuals of two genera, 'intergenetic hybrids'. Intercrossing between hybrids or backcrossing a hybrid with a member of one of its composite species, all would produce hybrids. However a new plant obtained by crossing two members of the same species, such as a cross between the two C. japonica cultivars, 'Moshio' and 'Hagoromo', would be a 'cross', not a hybrid.

Furthermore, present botanical and horticultural convention limits the use of the word 'variety' to the natural occurring variants of a species as found in the wild. The seedlings that are raised under cultivation are properly called 'cultivars'. The term 'clone' is used to refer to a bud individual, that is a plant stemming vergetatively from a plant bud by grafting, layering, in arching, budding or striking. Plants of a particular clone are usually identical and changes can only occur through bud mutations which can form a variant clone, known as a 'sport'.

While it is always of interest to plant a few of the seeds that occur naturally on our camellia plants; and many of our present most famous cultivars are the result of chance set seed; the results of controlled crossings will create greater interest and be much more rewarding. It will also be found that the percentage of good results will be increased. With chance seed it has been averaged that only one in a thousand will be worthwhile growing on, while with controlled interspecific crosses, particularly where the field has been hardly touched, a large percentage of resultant plants can be worthwhile cultivars. An example of this is the three famous Asper 'Girls' selected from 11 seedlings obtained from the difficult reticulata sasanqua cross. Further breeding with this material alone raises the interesting possibilities of Autumn flowering reticulatas with sasanqua floriferousness and resistance to root rot.

The plant breeder should select a particular goal at which to aim and to concentrate in one area of plant development, particularly with camellias, which generally take 4 to 5 years from seed to the first flower, although this process can be hurried up if one can afford a climate control glasshouse with light and high nutrient levels.

In breeding, the first generation crosses are only a start and, even though some worthwhile cultivars may result, it is the second and third generation plants that will show the results of a breeding program. For example if the Asper 'Girls' are taken as the first generation in endeavouring to breed Autumn flowering reticulatas, a second generation population could be obtained from back crossing them to the earliest flowering reticulatas. This population should then be selected for early bloomers with reticulata flower forms and the best of these intercrossed. This should bring in from both sides the early blooming characteristics as well as the large flowers of the reticulatas. From the resultant third generation population it should be possible to select plants with the huge, showy, reticulata blooms flowering as early as April.

Other fields open to further development include better early flowering japonicas, camellias more resistant to heat and drought, yellow camellias, scented camellias, camellias which display their blooms to better advantage, floriferous, landscaping qualities, smaller shrub like camellias with good flowers and many others.

INTERSPECIFIC CROSSING

With reference to interspecific crossing this has only recently been developed to any great extent due both to the small selection of species which were previously available and to the generally held opinion that different species would not cross. However, during the last 15 years it has been found that most species will hybridise to some extent, under suitable conditions. In this regard there is a wide range of interspecific fertility; some species, such as C. saluenensis, crossing readily with a wide range of other species, and others, such as C. sasanqua, which will cross only with a limited number of other species and with a low rate of success.

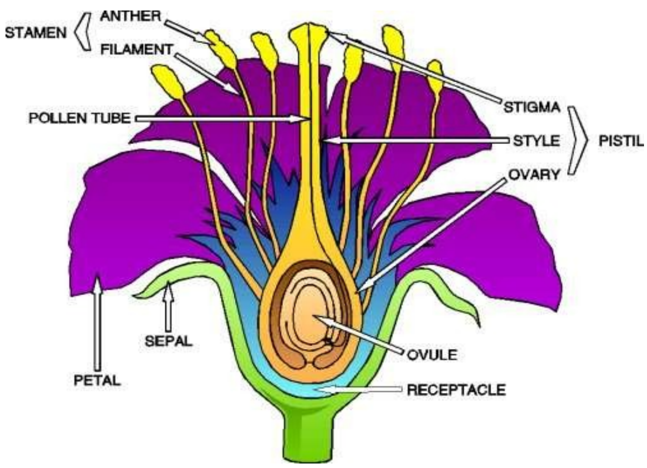
There yet remains a great deal to learn in this field, as there are still a considerable number of camellia species which have not yet been available for breeding and work done with most of the available ones is limited. However it is obvious that the difficulty factor in some crosses is considerable and seems to increase the further apart species are genetically. Successful intergeneric crosses are rare but the fact of their successful accomplishment should lead to further efforts in this area.

FLOWER STRUCTURE AND FERTILISATION

In selecting suitable plants for breeding, once the type and characteristics required are decided on, particular cultivars in this range should be selected as seed parents. These must have a normal pistil, the most fertile generally being in the single and semi double flower class. However plenty of informal double blooms also have a fertile gynoeceum. Amongst these is the old cultivar 'Anemoniflora' which has a complete cushion centre of petaloids without a single anther and in the middle is a perfectly normal pistil. This variety was much used by the early camellia breeders as they knew that it could not self fertilise; in fact most of the old Camden Park varieties have this camellia as a parent.

The particular value of each parent can only be evaluated after its first batch of seedlings flower, when certain parents will be found to throw seedlings with a much higher percentage of good blooms than others. Such plants can be considered as good breeder material and regularly used as such. Pollen can be obtained from most classes of blooms, even formals, at some time or another.

Controlled cross fertilising camellia blooms is quite simple, the main requirement being time and attention to detail. The flowers are large enough so that their various parts can be clearly seen and easily manipulated. To successfully fertilise a bloom it is necessary to place ripe pollen from one flower onto the receptive stigma of another flower at a suitable time, at the same time preventing accidental pollination from other sources. It is the attention to the various requirements of 'ripe pollen', 'receptive stigma', 'suitable time' and the prevention of accidental pollination that take the time and require the care and attention.



A study of the most simple type of camellia bloom is best to illustrate its various parts, as in this type of bloom all the sexual parts are fully developed, Firstly and most obviously there are the large, fleshy outer petals with a centre group or column of stamens. The stamens consist of filaments crowned with the anthers on top and forming a united base with the petals below. The anthers can be pale to deep yellow or golden when fresh, often becoming brownish when old. In the case of many hybrids they turn dark brown to almost black when past maturity. They are usually heart shaped and consist of two sacs or lobes from which the pollen is released when they rupture on maturity. Anthers generally mature in camellia blooms before the stigma is receptive, sometimes even before the petals are open. This is probably a mechanism to reduce the possibility of self fertilisation.

In the midst of the stamens will be found the pistil, which consists of an ovary at the bottom, then a slender column called a style, the upper tip of which is split into three to five arms, depending on species and cultivar. On the tip of each of these arms will be found a stigma. A section through the ovary will show that it is divided by membranous partitions into three to five little chambers known as locules or carpets, corresponding in number to the arms on the style.

In each of these chambers are from one to three ovules which are the elements that when fertilised, will develop into seeds.

When the stigma is mature it becomes receptive to pollen by exuding a slightly sticky, moist film over its surface. This enables it to capture any pollen with which it comes into contact. In nature, this contact is usually made by wind or insects. It can also be done artificially by hand.

Under suitable conditions of temperature and humidity this moist film causes pollen grains to germinate and develop long thread like processes known as pollen tubes, which penetrate completely down the style into the ovary, until they reach and enter the ovule. The extending tip of the pollen tube carries the male nucleus and when this joins with the nucleus of the ovule (the female egg) the embryo plant is formed. This is fertilisation, which not only causes the development of the ovule into seed but stimulates the growth of the complete ovary to form the fruit. The fruit of the camellia is the familiar woody capsule which can be rounded, pear shaped, green, striped or russet, depending on species and the particular cultivar.

When mature the capsule splits, permitting the release of the dark brown seeds. As soon as it is noticed that the seed capsules start to split they should be gathered and opened by hand or otherwise the seed may be lost on the ground.

Hand pollination is very simple. Firstly the flowers from which the pollen will be taken are selected and covered with a small bag held by a rubber band. The female flowers are prepared by removing all anthers, usually known as emasculation, and best done with a small pair of scissors or tweezers, and then bagging in the same manner. Small polyethylene or waxed paper bags are generally best as the condition of the flowers can be observed through them. This bagging is to prevent accidental pollination from an undesired source.

As soon as it is considered that the stigma of a selected bloom is receptive, the bag is removed and the desired pollen placed on the stigma. This can be done by detaching a complete stamen from the pollen donor bloom and brushing its anther across the stigma. In the case of stored or loose pollen, a match end or toothpick can be used as a spatula for transferring the pollen to the stigma. A new spatula should be used for each variety of pollen. If there is doubt about the receptiveness of the stigma, an anther can be left lodged in the arms of the style or it can be re pollinated the next day. An ordinary reading glass is quite helpful to establish if pollen grains are adhering to the stigma, usually denoting receptivity. Usually when receptive the moisture on the stigma makes it glisten. After pollination the bag should be replaced until there is evidence of success, shown by the swelling ovary. The date and information on each cross made should be written on a plastic or metal tag and secured to the flower twig by fine wire. When the seed has matured it should be collected and planted as soon as the capsule shows signs of splitting. The tag can then be used to identify the particular seed.

Pollen can be stored for considerable periods of time and still retain its viability. Pollen from reticulatas blooming in the spring has been stored and used successfully on sasanquas next autumn. For storage, pollen collected from each cultivar should be placed in a separate standard gelatin capsule such as is used by chemists for powdered medicines. A code number is then inscribed on the side to identify the pollen donor and the capsules placed in a sealed jar on a layer of cotton wool over a dehydrating agent such as silica gel on anhydrous calcium chloride. The sealed jar is then held in the crisper compartment of the refrigerator until required.

CONDITIONS FOR POLLEN 'TAKE'

Weather has a considerable effect on the percentage of successful 'takes' obtained in cross fertilisation. Dampness from rain or watering by sprinklers will render pollen ineffective by causing pre germination or diluting the sticky film on the stigmas. Low temperatures severely inhibit pollen germination. Too high temperatures with low humidity will keep the pollen too dry to germinate. High humidity often favours the development of a mould on the pollen which destroys it.

Best results will be obtained when pollination is done on a reasonably calm, sunny, warm day (65' to 75') of average humidity. This is the weather that best suits the bees and is no doubt why they sometimes seem to have more success than the human agency. It is also the reason that, in countries like England, it is almost impossible to pollinate outside a glasshouse. In the cooler Melbourne area, greater success will be obtained in the warmer weather at the end of the flowering season. However statistical tests have shown that the highest fertility is about the middle of the flowering season for each variety or cultivar.

HYBRIDS

Many hybrids will be found to be almost infertile due both to malformed pistils and to the lack of development of fertile pollen grains. Nevertheless, in many cases, these apparently totally infertile plants occasionally produce fertile pollen grains and it is often worthwhile to persevere with such difficult crosses as the results are often unusual and interesting. A proportion of such crosses produce seed with shrunken cotyledons and deformed embryos. If these are to grow, the technique of embryo culture has to be used and it can be considered a moot point that the extra problems associated with embryo culture are worthwhile, as usually the resultant plants are so lacking in vigor that their horticultural value is minimal. This in no way detracts from using embryo culture with normal embryos.

True hybridisation occurs only when an individual of one species successfully fertilises an individual from another species. In nature this is rare and usually will only occur between closely related species which may have recently (from a botanical sense) diverged on either side of some barrier which has isolated them for generations and meet again when such barrier is bridged, often by human agency establishing some members of one species within the area held by the other.

However the main barriers to natural hybridisation are usually due to differences in ploidity (chromosome number), different flowering times, different pollination mechanisms, varying adaptability to soil and climate, or inherent incompatibility. Many of these barriers can be overcome by the human agency.

Also amongst the camellia species it is not uncommon for members with different chromosome numbers to hybridise. In such a case the resultant hybrid will be infertile unless it loses its unpaired chromosomes by aneuploidity or becomes allaptoid by doubling its chromosomes during the cycle of cell division. Amongst fertile camellia hybrids both mechanisms have been in evidence. Under cultivation many highly sterile individuals persist for long periods of time, through methods of vegetative propagation, without ever producing seeds. The sterile C. reticulata cv, 'Captain Rawes', with its unusual haploid genetic structure, is a case in point, but even such a highly infertile cultivar as this occasionally produces some grains of fertile pollen as evidenced by a few hybrids existing which claim it as the pollen parent.

So in these 'way out' crosses one never knows, and the same attitude that causes thousands of hard headed Australians to buy lottery tickets can apply here. If you are not in it you can't win it.

A couple of Tom's finest mini-hybrids

H. Wirlinga Princess - 1997

H. Wirlinga Belle - 1973

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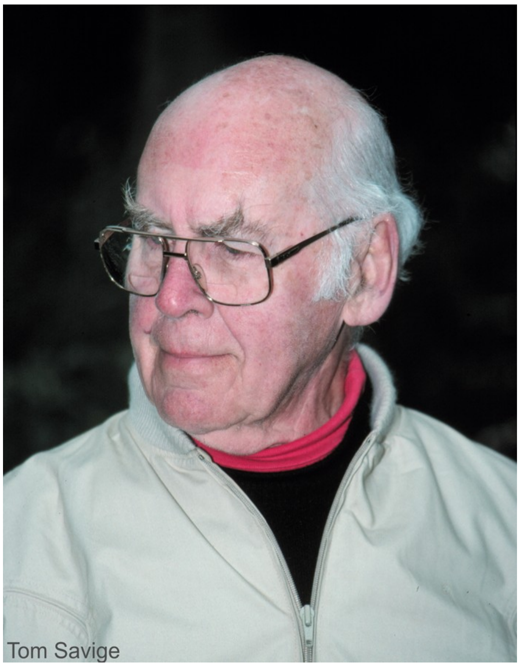
Footnote:

The late Tom Savige is regarded as one of our greatest 20th century camellia experts. Apart from his celebrated breeding prowess, he was also responsible for creating the exhaustive International Camellia Register, which was an enormous opus and undertaking. The I.C.R. is now being transferred to CD.ROM.



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