

George Keith Cowlshaw, the surname often rendered "Cowlsham" (which is also itself an English surname and perhaps a variety of "Cowlshaw"). was a member of the Botanical Society of South Africa (a group of amateur 'flower-lovers' associated with Kirstenbosch, founded in 1913) from 1926 to 1937. During this period, aside from his listing amongst the members (of which there were only a couple of hundred), his name only appeared in a single issue of the yearbook; volume 19 of 1934, in two places - the editorial, and at the head of the single article he contributed.

THE JOURNAL OF THE BOTANICAL SOCIETY OF SOUTH AFRICA 19: 5 (1934).

Mr. Keith Cowlsham (*sic.*) of Sydney, N.S.W., Australia, has for many years been carrying on breeding experiments with various South African bulbous plants, and has sent an article which he thinks may be of interest to members of the Botanical Society. Undoubtedly it will, and we print it with pleasure as an example of work of which there is an enormous amount to be done, and which is certain to yield results of the greatest interest and value from the horticultural point of view. The Gladiolus industry—founded entirely on South African species—has reached astonishing proportions as the result of hybridisation work. Hybrid Freesias—South African again—are developing rapidly. Innumerable Montbretias have been developed from South African ancestors. Valuable Watsonia hybrids have been produced in Australia from Cape species, Barberton Daisies, Ixias, Pelargoniums, and many more, swell the list of the South African plants which in their cultivated and hybridised varieties have brought beauty to gardens all over the world, and prosperity to those who grow them. How much of this development of South African flowers has been effected in South Africa? Practically none of it. It is incongruous to import Gladioli from Europe into South Africa, buying back with our money the floral wealth that once grew at our doors; but it is worse than incongruous to make no attempt to develop the great floral wealth that we still possess. At Kirstenbosch we have the "raw material" for this work—the native species: we also have ideal conditions for carrying it out. When shall we have a department of hybridisation attached to the Gardens?

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Experiments in the Cross Fertilization of certain species of the Amaryllidaceae.

By KEITH COWLISHAW.

FIRST of all I might say, as an introduction to these few notes, that I first started these experiments more than twelve years ago from a horticultural and not botanical point of view, and it was only as the results appeared that I became more and more attracted by the botanical aspect of them, that is to say the botanical relationship of various plants as shown by the possibility of their cross fertilisation. I am setting out here the species I experimented with and the results of the crosses. The experiments are as yet too incomplete to allow me to draw any inference from the results as to the relationship of plants, but I might say this, that some of the results have been surprising; some species considered of the very closest relation refuse to cross, others, placed by botanists in separate genera, produced fertile hybrids while others produced only mules.

In these few notes I will mention only the genera in which I have been successful in carrying on the cross for some three generations. The Amaryllidaceae are about the most wearying of plants to experiment with in this way, for seldom do they flower from seed under four years and in many cases take very much longer.

All seed is raised under glass, and set out in its growing quarters the following year. I obtain about 95 per cent. germination where the relationship is very close, but where it is very remote every seed that grows is carefully treasured.

My most successful experiments from the horticultural side has been with the Clivias. These experiments also afford an interesting demonstration of the effects of line and inbreeding.

I possessed two species when I commenced these experiments viz. *C. nobilis* (orange-red form) and *C. miniata* (an orange form). These were crossed both ways, and the resulting seedlings (of which there were some seventy-five) flowered in about five years. The seedlings from the original cross were of a vigorous type and in most cases more robust than their parents, and often produced flowers markedly larger than either of their parents. The colour varied little, as was to be expected, being without exception orange-red. I certainly thought I would obtain some variation as I understood there are various colour forms of both these plants found growing wild.

The flowers compared with those I possess now were decidedly ugly and with narrow perianth segments as in their parents, with pointed tips. From these I selected those with the widest segments

and the roundest ends, also the most vigorous and largest flowers and crossed them. The seedlings resulting from these secondary crosses I: were a very marked improvement on their parents. Not only were they even more vigorous than their parents, but they attained to a flowering state in about four years from the sowing of the seed thus clipping off a period of one year from the flowering time of their parents.

Some of these flowers, compared with their grandparents, were truly remarkable. From this batch of some three hundred plants I selected 25 sorts of exceptional merit horticulturally. In this batch had appeared the perfectly symmetrical flower with large broad overlapping perianth segments all of one size with nicely rounded tips and a reflexed habit. The range of colour had increased, but not to the extent I had hoped or even anticipated. No pale flowers appeared, though certainly one of a deep bright brick-red colour stood out as a marked acquisition. For the most part they were still orange-red with good deep yellow eyes, though in some the yellow is more or less replaced with pure white. A few were of a lighter shade of orange-red such as one might describe as orange-pink.

The best of these seedlings and to date the best I have raised had a head of flowers on it standing this year 30 inches high, perfectly globular and composed of 20 large flowers all open at once. The individual flowers were some five inches across, perfectly round and reflexed. It caused no little comment when exhibited at the R.H.S. show on the 6th inst.

From this series I had raised another batch, all of which were "selfed." Here I was astonished to find that whereas a plant would set seed with the utmost freedom pollen from another plant, even though it came from the same berry, (I have had as many as 10 from a single berry) I found that "selfed" they set seed badly, and when they did set it I never obtained seed from the berry to the extent of more than two.

Some of these latter seedlings have now flowered in their third year from the sowing of the seed. Those which have flowered are dwarf plants with slender stems and pendulous starry flowers all very much alike. They attain a height of not more than 15 inches and make attractive pot plants. These dwarf types appear fixed and have now flowered two years in succession. Is it possible that the species of *Clivias* as we know them are of hybrid origin, and these are a throw back to an older and now lost species?

Others of this batch which flowered at the fourth year while very vigorous in growth have reverted to the starry form of *C. nobilis*, and one can hardly tell them from the original plant from which they sprung. There are still others to flower (to the extent of some two hundred plants) and some of these are showing remarkable variation in foliage, for whereas neither of the original plants possessed foliage above 1½ inches wide some of the unflowered plants, which are already 4 ft. high possess foliage quite 5 inches across.

I find *Clivias* the easiest of plants to grow, and one might almost say the worse they are treated the better they respond. Mine are all growing in bush houses in pots, for I find that when their roots are potbound they always flower the best. You would be astonished at the small quantity of the soil necessary to support them, and the amount of dry conditions they will stand. They grow equally well in the garden, though if set out in full sunlight the flowers will not push up above the foliage and so their beauty is lost.

Seed takes a year to ripen and when ripe will remain on the plant another twelve months if so allowed. When ripe the berry containing the seed is as large as a walnut, and of a bright scarlet colour, and I might say equally attractive as the flowers. Germination after sowing is slow but sure and when once up the plants grow with fair rapidity. As to soil, any seems to grow them well. If grown in pots it is necessary to use a light compost and perfect drainage.

The next genera I experimented with were the *Amaryllis*, *Brunsvigias*, and *Crinums*. To start with, I possessed *A. belladonna* good pink variety, *Brunsvigia multiflora*, *B. m. rosea*, and *B. m. alba*; later on *B. Josephinae* and a hybrid raised by the late H. B. Bradley known as "Haythor" and reputed to be a cross between *A. belladonna* and *B. multiflora alba*. This I doubt for the the reasons you will see later. Of African *Crinums* I possessed and still possess only *C. capense* and *C. Moorei*.

I first of all crossed *A. belladonna* with each of the three varieties of *Brunsvigia multiflora* each way and obtained a good quantity of fertile seed, but in crossing "Haythor" I could obtain no seed from it though its pollen is very potent. I later on ascertained that Mr. Bradley himself found "Haythor" to be only partly fertile, and never obtained seed from it though he so tried for many years.

The resulting seedlings were very disappointing, mostly taking after *B. multiflora*, though a few took after *A. belladonna*. The colour variation was not great, and one would have great difficulty in finding more variation in this batch than in any other batch of *belladonna* or *multiflora* seedlings.

But I found this, that all the hybrid seedlings were fertile and set seed with the utmost freedom. Also that they were of very rapid increase.

I accordingly selfed these, as I could not see any advantage to be gained by crossing them, and the resulting seedlings which flowered some six years ago are very interesting indeed. Some have attained to a great size in flower stalk, size of flower and the number of flowers to a head. Also the colour variation of the flowers is very great. Some are of the deepest carmine-pink, others of a pure glistening white with a yellow eye, like Haythor, but without the wavy petals of that variety. In all the flowers I have selected as being worthy of propagation, the segments of the perianth are round, of equal size and slightly reflexed.

Some of the flowers are a delightful blending of pink and orange, the latter colour which is present in all the seedlings in the form of an eye, having in these examples run up to the very edge of the perianth segments; others are of some shade of pink inside, but on the outside of the flowers picked out and streaked and stained bronzy brown. Others are of small stature, attaining a height of not more than 15 inches with small flowers of a soft pink shade. This latter type, while strong growing and vigorous, is easily smothered by its stronger neighbours in the seed beds, and so needs isolating as soon as discovered.

Another very interesting type has appeared in these seedlings forming perhaps 5 per cent. of the whole. These possess no flower stalk at all, but have large pink flowers of excellent form carried on the end of long peduncles, and as the leaves appear with the flower, give the plant for all the world the appearance of a giant pink crocus. So far I have been unable to secure any seed from these plants as the ovary is situated well down amongst the base of the leaves and so apparently cannot swell but their pollen is fertile and some seedlings from this are now being grown on.

Coming back to the hybrid "Haythor" I very much doubt the reputed parentage of this plant. All my experience has gone to show that any form of *multiflora* x *belladonna* is fertile and produces good seed. But here we have a plant which for a period of some ten years has absolutely refused to seed with me, nor has the ovary ever shown any indication of swelling. From its pollen, it is true, I have raised a number of seedlings of very inferior type, all white with the orange eye as possessed by the pollen parent. Unlike most of the hybrids of *belladonna* x *multiflora* crossed either way, Haythor has ruffled petals which gives it a decorative appearance. All the seedlings from its pollen are weak in growth and also will not set seed though their pollen too will produce seed on another plant. I am rather inclined to think Mr. Bradley was mistaken in its parentage, and that it is a particularly good form of *B. Josephinae* x *B. multiflora alba*.

I have raised hybrids between *A. belladonna* and *B. Josephinae* and *B. Josephinae* x *B. multiflora* crossed both ways. So far I am convinced that the first cross is quite infertile, it will not seed nor will its pollen produce good seed so far as I can ascertain. I have certainly had seed swell and ripen from the use of this pollen but it has been few and never will germinate. From the latter cross I have had a number of seedlings, which also will not set seed, though I think I have succeeded in effecting a cross back to *B. multiflora*. For the most part these are starry, pinched flowers, of a cerise-pink shade, but as I have never tried a cross on *B. m. alba* I cannot say that a white hybrid would not be possible. These latter experiments cannot proceed further owing to my inability to effect further crosses.

I have raised two seedlings, crosses between *Crinum capense* and *Brunsvigia Josephinae* and of this cross the bulb is the most imposing feature being some twelve inches across. They show no signs of increase, the flowers are of a pinkish shade and admittedly ugly. They are quite infertile. I have been unable to effect a cross with this *Crinum* by *A. belladonna* or *B. multiflora*.

I have raised many seedlings between *Crinum capense* x *C. Moorei*. *C. capense* x *C. latifolium*. *C. Moorei* x *C. pedunculatum* (this is our giant native species,) and have a large series of other interesting crosses coming along. Some good seedlings resulted from the *C. capense* x *C. Moorei* cross, dark pinks, being particularly good. *C. capense* x *C. latifolium* gives typical *latifolium* leaves with its typical flowers, its freedom of flowering with the hardiness of *capense*, the colour variation is slight. My best hybrid of *Crinum* is from the cross *C. Moorei* x *C. pedunculatum*, it is quite sterile, and is the result of over three years' attempt to effect the cross. I was quite convinced that they were too far apart in relationship. But eventually I obtained one seed which grew and flowered in four years and has since then increased with the utmost rapidity. It is extremely vigorous as I have generally found all sterile forms to be, with growth after the style of a dwarf *pedunculatum*: the flowers are large, *Moorei*, type, of the pure glistening white of *pedunculatum*: they are carried on the end of long peduncles of the type of *pedunculatum*, and have opened on the 23rd of December each year, so we always have them for Christmas.

But with one cross I have had the strangest experience. For five years now I have been endeavouring to effect a cross between *C. pedunculatum* x *C. capense*. When using the latter as the seed parent every flower fertilised seems to take readily, the ovary swells rapidly and seems full of seed. Finally it attains to a size bigger than a clenched fist, turns yellow and one thinks here is a nice lot of seed. But opening it I find that it is one mass, that each seed has grown into the other, and the whole, which if they could be separated would comprise some sixty seeds or so, is quite useless. Occasionally there will be one in which the seeds do not cohere and can be separated, but though these do not rot as rapidly as do those which are all joined together, they will not germinate and so I have been unable to obtain a single seedling from this cross.

Crossed the other way I have obtained fertile seed but never had the seedlings existed more than two years being too weak in growth. All the coddling imaginable will not prolong their lives.

Crinums, *Amaryllis* and *Brunsvigias* grow well with us. As they make their principal growth during the Autumn and Winter months they are particularly at home here in Sydney where most of our 26-inch rainfall comes in the winter months. I find that they flourish in any sort of soil, and full sunlight or partial shade seems to suit them equally well. I have many of them growing at my weekend place 20 miles from here, where they are doing extremely well under the tall *Eucalyptus* trees (130 feet high).

I might mention that here the Cape Iridaceae do well also, the *Freesias* have spread all about beneath the tall gums, where the sunlight filters down to them through the leaves a hundred feet above them; on the flat in front towards the water's edge *Sparaxis*, *Ixias*, *Babianias* and the like are quite at home making a wonderful carpet of colour in the spring. Here they receive nothing but the natural rainfall, about 16 inches a year and all received between March and October with the exception of a thunder storm or so during the summer months.

I intend to make extensive planting as stock increases of other bulbs and hybrids.

I almost forgot to mention that an old road runs through the place disused these thirty years or more, and over its hard surface has spread *Anomatheca cruenta* which makes the old road a crimson sheet in September. It is so hard that the native plants have avoided it, but *Anomatheca* simply revels here and has spread little into the more fertile and lighter soil of the neighbouring bush.

Sydney, N.S.W.,

20th September. 1933.