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GEORGE L. SLATE
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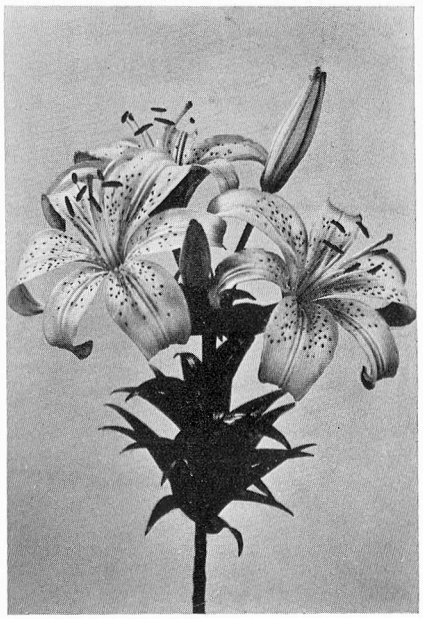
One of the lightest colored of the yellow-orange sideways flowering group of L. umbellatum—tigrinum hybrids.



L. Enchantment. The first clone to be named of the L. umbellatum—tigrinum-elegans group. The semi-upright flowers are very large (7″ to 9″) and of a most brilliant Nasturtium red. Placement and habit, excellent. This clone bears axillary stems bulbils generously.

L. Candidum

This season we dug the first large crop of one-year scale bulblets of our new seedling strain of the Madonna lily. These scales were taken in June 1946 and planted directly in shallow furrows in the open field. This planting amounted to four-fifths of an acre. In July of 1947 these were dug and the bulbs graded into two sizes. The larger size consisted of three to five inch bulbs and the smaller was mostly two to three inch bulbs. These bulbs were immediately planted out into the field and extended over approximately three acres. From previous smaller plantings, handled in a similar manner, we know that the larger grade of the one year old bulblets will flower and be of saleable size the second year and the smaller grade will be ready for sale the third year. This is an excellent indication of the vigor of this strain, since from test plantings of the older types of *L. candidum*, we have never been able to obtain a large proportion of flowering bulbs from scales the second year.

The selected clones, which at present number about twenty, have increased to such a size that we are now well able to compare them as to rapidity of propagation, bulb type and resistance to botrytis. Selection for these factors is difficult when the clones consist of only a few bulbs. When the clones have once grown to a population of several hundred bulbs of all sizes, differences become increasingly pronounced and the more vigorous, faster growing

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Bottle-fed Lily Hybrids

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EVERY summer, in many parts of the world, the lily hybridisers are at work dabbing pollen from one plant on to the stigma of another—one can almost hear the process in action. Most of this band of pleasure-seekers gamble on fairly safe chances and only make crosses which are likely to produce seed, but every now and then some lone individual is tempted to risk an outrageous combination. This urge often leads to disillusionment when failures follow year after year but then, Black Beauty is remembered and the gambling spirit revives. It is worthwhile sitting down quietly to figure out how the fruit machine works, to see if it might be possible to find a system which will stop the works at the right time and enable us to pull off a jackpot.

What happens when the machine gives us some return? In a normal fertile cross the pollen germinates to produce pollen tubes which travel down to the ovary. When it reaches an ovule each tube releases two nuclei, one of which fertilizes the egg cell to produce a new embryo plant and the other joins with special cells to give rise to the endosperm. The latter plays a very important part in the subsequent development of the embryo. It acts as an intermediary whereby the new hybrid embryo obtains its nourishment from the parent plant, and it survives in the seed as a food supply to wean the seedling until it is capable of fending for itself.

Many things can go wrong in this chain of processes. The pollen tube may not grow and fertilization may not take place (Asher, 1970). Even successful fertilization alone is not enough to ensure that viable seeds will be produced, and evidence points to the frequent break-down of the endosperm and thus the starvation and premature death of the new hybrid embryo. The late Dr. Emsweller (Emsweller *et al.*, 1962) showed that seeds of *Lilium speciosum* crossed with *L. auratum* may often appear to be normal but when they are sown the endosperm produces a poison which kills the embryo plant in its charge. If the embryo is isolated from this poisoned food supply and fed on artificial food it can be induced to develop into a healthy and vigorous hybrid plant.

Observations at our Institute here in Scotland suggested that fertilized embryos of some crosses can fail even before this stage is reached. In these circumstances the fault in the procedure apparently is due some-

times to a failure of the endosperm to develop normally so that the young hybrid embryos only grow to a small size and eventually die from starvation. The way in which this failure may occur was suggested by Brock (1954) and has been described recently by Brandram & Dowrick (1970). A situation like this occurred when we crossed *L. lankongense* with *L. davidi* at the Scottish Horticultural Research Institute. The cross produced capsules which began to swell in an encouraging manner but which stopped growing before they reached full size (Figure 1), and contained seed which was small and chaff-like. However, a close examination of this seed showed that it did in fact contain very small embryos, but endosperm was absent. Some of these undernourished hybrid embryos were subsequently grown on a nutrient medium and gave rise to strong plants of a hybrid which had been hitherto unobtainable (Figure 2).

To prevent the infection of the small 'bottle fed' embryos by pathogens which might kill them, the operation was done under completely sterile conditions. Capsules from hybrid combinations were selected just before they began to break open; at this stage the contents were entirely sterile and the only necessary precaution to prevent infection was to dip them in industrial alcohol and then remove the contents under a

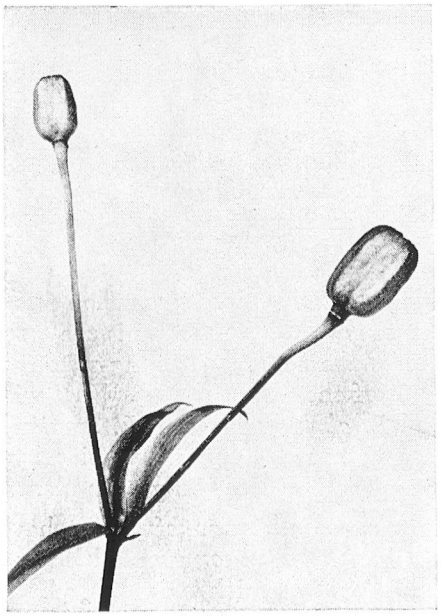

FIGURE 1. Small capsule from *L. lankongense* X *L. davidi and* normal sized capsule from *L. lankongense* sib cross.

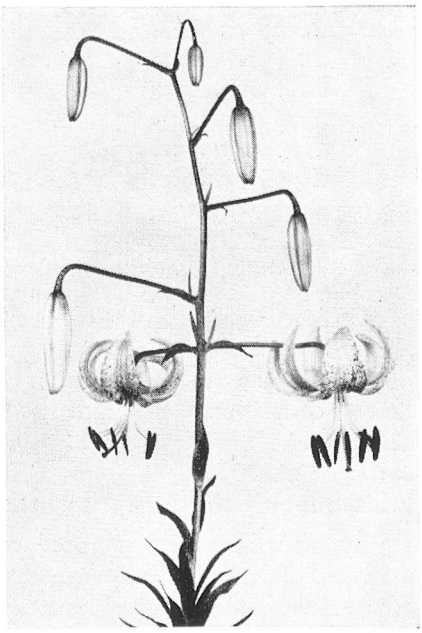

FIGURE 2. *Lilium lankongense* X *L. davidi.*

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'Stargazer', the original diploid cultivar (right, 2n=24) and the colchicine induced tetraploid version (left, 2n=48). (see page 14)