

THE
AMERICAN
LILY
YEAR BOOK



The American Horticultural Society

1940

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GEORGE SLATE

EDITOR

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L. H. MacDaniels

Lilium testaceum

Foreword

This year 1940 finds the world in a confused turmoil the like of which no one of us has ever experienced. Few indeed are the places not directly under the shadow of war and few the people who are permitted to consider what is beautiful and lasting or to spend their efforts on what is constructive and valuable. Under these conditions it would seem that just now it is the special duty of those in the United States to foster those activities which are constructive and give attention to what is valuable and beautiful.

The work of the lily committee of the American Horticultural Society in publishing this second Lily Yearbook is certainly such a significant and worthwhile enterprise. We are all agreed that this great and varied genus of superb garden plants does not have the place it deserves in the gardens of America. Those who know the lilies more intimately are well aware of the handicaps which beset their culture. A keener appreciation of the difficulties which are involved has already been gained by many and this is always the first step toward real progress. During the past few years the combined research of the private, state, and federal institutions has done more to clarify the situation with regard to the more important lily diseases than that of any other decade. The breeding of new varieties and types has been carried on with increasing appreciation of the enormous possibilities that exist in originating new and more colorful forms and selecting superior clones of familiar species. Propagation has become better understood and more effective methods of raising seedlings devised. Although the commercial raising of lily bulbs is far from satisfactory, there are signs of real progress in the cooperation of nurserymen with the pathologists in an attempt to raise disease-free stock, and in the presence of some growers with a real understanding of the nature of the mosaic problem.

The growing of lilies can be said to be in a transitional stage. A better understanding of mosaic has made it plain that many of the cultural difficulties previously experienced and recorded in the older literature may be attributed to this disease. Thus we find that many lilies are of much easier culture than was supposed, provided mosaic is controlled. As this disease is better understood and more practical control measures devised, we can look forward to far greater success in raising lilies in the garden.

In one sense it seems unfortunate that so much attention is given to disease control in this lily yearbook. The ultimate goal of all lily growers is to have quantities of these plants growing in the garden for their beauty, and continual harping on mosaic and other troubles is likely to prove discouraging, particularly to the beginner. On the other hand, disease control is just now our most important problem—far more important than soil acidity, kind of fertilizer, type of shade, or other cultural matters. Our knowledge of mosaic is increasing by leaps and bounds and it is only by spreading this knowledge that a real measure of satisfaction is going to be attained by lily enthusiasts generally. It behooves those most interested in lilies to become familiar with this new information and spread it far and wide.

However, with all this talk of mosaic, bulb rots, clones and tetraploids, the lover of lilies must not lose sight of the ideal plant or group of plants in the ideal garden setting. We must all keep in mind that perfect clump of madonna lilies against a background of delphiniums, *L. martagon album*, in the cool shade among the ferns or stately plants of Brocade, then flowers dancing in the border along the edge of the woods. Such pictures are real achievements and it is toward this end that our efforts are directed.

L. H. MACDANIELS

The Annual Field Day of the A. H. S. Lily Committee 1939

The annual Field Day of the Lily Committee of the American Horticultural Society was held June 14 and 15, in the neighborhood of Washington, D. C. The program for the first day included the Lily Show of the Garden Club of Virginia at Fredericksburg, an account of which is given elsewhere in the Yearbook.

On the second day the group met at the U. S. Horticultural Field Station at Beltsville, Maryland, where an extensive program of research with lilies is being carried on under the direction of Dr. S. L. Emsweller. At 2 P. M. the visitors assembled at the station greenhouses where the research in progress was demonstrated.

Among the projects observed was the breeding under way with different clones of the Easter lily, *L. longiflorum*. The objectives of the project are to obtain disease-free varieties of this lily which are of superior size, style and substance and which are well adapted to the florist forcing trade. Many seedlings were on the benches, but few were in blossom. Superior types have been evolved, however, which are being tested in commercial greenhouses.

Of special interest was the work with lily mosaic carried on by Dr. Philip Brierley. Emphasis is being placed upon determining the different strains of mosaic in the commercial stocks of the Easter lily and the differing symptoms produced. Many of the benches were covered with plants of tobacco and *L. formosanum*, which had been inoculated with macerated tissues of lilies and other plants to determine the nature of their mosaic infection. In one of the head houses the technique of inoculating tobacco and *L. formosanum* plants with mosaic was demonstrated. *L. formosanum* is used to show the presence of tulip virus and tobacco plants are used to test for the cucumber mosaic type.

In the same headhouse a tetraploid *L. formosanum* attracted considerable attention. This plant, produced by treatment with colchicine, showed a larger flower and larger leaves than the normal plants, also the large stomates characteristic of tetraploids. Indications were that tetraploid lilies can be easily produced.

Extensive seed and scale propagation of lilies of many species were in evidence in some of the houses. A soil mixture, relatively rich in nutrients

and organic matter, which was devised by Mr. Houser, was observed to greatly increase the growth of seedlings as compared to soil mixtures ordinarily used and thus shorten the time required to produce flowering bulbs.

After touring the greenhouses the field plots containing propagation and breeding material were visited. Of special interest was an isolated planting of lilies of many kinds brought from the West Coast and including some of the hybrids made by the late Dr. Griffiths. Unfortunately many of these had become infected by mosaic and were being kept for breeding purposes only. The last stop was to observe isolation plots surrounded by woodland in which seedlings of many species of *Lilium* were growing. None of these were of flowering size but nearly all were growing vigorously in heavily fertilized soil. All appeared free from disease.

The journey through the demonstration fields ended at the picturesque cabin in the woods, on the side of the hill, overlooking a clear woodland stream. Here, cooling refreshments were served by Mrs. Emsweller and the wives of other members of the station staff, and the meeting was informally reviewed and discussed.

Many of the finer details of the work being so quietly conducted at the Station could not be thoroughly digested in the one short afternoon, but the cordial invitation of Dr. Emsweller and Dr. Brierley to those interested to return for closer study at any time and the appreciative acceptance on the part of the visitors, gave evidence of the great interest that was aroused by the visit to the Station.



L. H. MacDaniels

Lilium speciosum, one of the easier lilies flowering in September.

Princeps—Sulphureum—Sulphurgale Hybrids

E. F. PALMER

A personal interest in the breeding of this group of lilies dates back to about 1926 when the late Professor J. W. Crow "staked" me to the odd bulb of Princeps. This was supplemented by the purchase of some selfed seeds of princeps and of sulphurgale parentage, and by the gift of three *Lilium sulphureum* (*myriophyllum* var. *superbum*) bulbs from a Mr. Jamieson of Hamilton, Canada, who had secured them direct from a Japanese firm in Tokyo.

In the intervening years, from this general parentage, there have been several generations of seedlings including crosses of selected hybrids and back crosses with one or other of the original species, *regale*, *Sargentiae* and *sulphureum*. Also *centifolium* has been used sparingly, and attempts have been made, usually successful insofar as production of viable seed is concerned but otherwise without visible result, to incorporate other species such as *Henryi*, *Willmottiae*, *Humboldtii*, *tigrinum*, *speciosum*, and *cernuum*.

Some thousands of seedlings of the Princeps-Sulphurgale-sulphureum general type have now bloomed, many for the first time in 1938 and 1939, and your Editor has suggested that it would be of interest to other lily breeders to know the materials used, the methods, objectives, and the results to date.

Basically there were two main objectives, first the desire to produce *regale* and Princeps types with the bulbil forming habit (at least one of the original purposes of the *Sargentiae-regale* cross by Miss Isabella Preston which resulted in Princeps), and second, the hope of producing Princeps types of later season and equal hardiness. Both objectives seem to be freely represented in the material now blooming, and in fact have been represented in earlier populations. The real difficulty arises, and this might well be underlined, in building up virus-free stock of the selected clones. Many otherwise promising seedlings have eventually succumbed but fortunately are not entirely lost, as they have been used in further hybridizing, their desired characters being carried into later generations.

Other objectives, which in some cases may become the main stream rather than the tributary, have arisen as the work has progressed. These include particularly color, bloom type or form, size, vigor, and growth habit including bloom placement.

Perhaps the best way to discuss this general Princeps-sulphureum-Sulphurgale line of breeding is to deal, point by point, with the success or failure of the various objectives. Some of the material, including all the older generations, has been grown in my own garden here at Vineland, Ontario. Much of the 1936 breeding (seed saved that year) is being grown at the Ontario Agricultural College, Guelph, under the care of Mr. James Taylor of the Department of Horticulture there. In this analysis occasional reference will be made to the "Vineland" and "Guelph" stocks.

BULBIL FORMATION. Although Princeps itself has a bulbil former (*Sargentiae*) as one of its parents, selfed progeny of Princeps even to the

third and fourth generation, has never given me a bulbil forming seedling. Various progenies run into many hundreds of bulbs each, so that there has been ample opportunity for bulbil formation to show up. Other workers I understand have had similar results with *Princeps*.

Nevertheless I have obtained many bulbil forming seedlings from other parentages, more particularly where the bulbil forming varieties *sulphureum* and *Sargentiae*, or bulbil forming seedlings derived from them, have been used as *pollen* rather than *seed* parents. Herein I believe lies, in part at least, the answer to the problem. For some (to me) unexplained genetic reason bulbil formation seems to have been associated with the pollen or male parent rather than the seed or female parent in the material with which I have worked. This might explain *Princeps*' failure as a bulbil former, its parentage being as we know, *Sargentiae* as the female or seed parent and *regale* as the pollen or male parent. Now I do not know for certain that the reciprocal cross *regale* \times *Sargentiae*, would have produced a percentage of bulbil forming seedlings, but I do know that *Princeps*, and non-bulbil forming seedlings of *Princeps*, when crossed with *Sargentiae*, *sulphureum*, or other bulbil forming seedlings as the pollen parent, have produced a considerable percentage of bulbil formers in their progenies.

At least one exception to this personal idea of bulbil formation inheritance is the hybrid \times *L. aurelianense* Debras, a *Sargentiae* \times *Henryi* seedling, *Sargentiae* being the seed parent. \times *L. aurelianense* is described in the book "Lilies," by Woodcock and Coutts as *occasionally* producing *tiny* bulbils in the leaf axils. (The italics are mine.) This is a later description than that first given by the originator which appeared in the R.H.S. Lily Year Book, 1932, page 16.

To digress for a moment, the suspected manner of inheritance of the character for bulbil formation in my own material would also suggest that the original \times *L. Princeps* which was a bulbil former and which appeared as a chance seedling in the nursery of Messrs. R. & J. Farquhar, was a *regale* \times *Sargentiae* hybrid rather than the reciprocal cross *Sargentiae* \times *regale*. It is significant that E. H. Wilson in his "Lilies of Eastern Asia" states (pages 38-39) that the seedlings he named *Princeps* were grown from seed of *regale*. However, there does not seem to be unanimity of opinion on this point, other authorities expressing doubt as to which species was the actual seed parent. Nevertheless Wilson's account is based on personal observation and is so detailed and precise as to command respect.

My own experience with this group of lilies, here recorded in part, leads me to believe that *regale* was in fact the seed parent. If this thesis be true then one might easily argue that Miss Preston's \times *L. Princeps*, a non-bulbil former from the reciprocal cross is not properly called \times *L. Princeps*. In essence, my argument is that since the respective hybrid families are definitely dissimilar outwardly in at least one respect, bulbil formation, they must therefore be genetically different. Thus the *Sargentiae* \times *regale* cross constitutes a different parentage to *regale* \times *Sargentiae*.

Perhaps this is something for the botanists and geneticists to argue over. Also I must cheerfully admit that this contention as to nomenclature is contrary to the "Vienna Rules" which, as Miss Preston points out in correspondence, are the International Standard of Nomenclature. These rules state,



L. H. MacDaniels

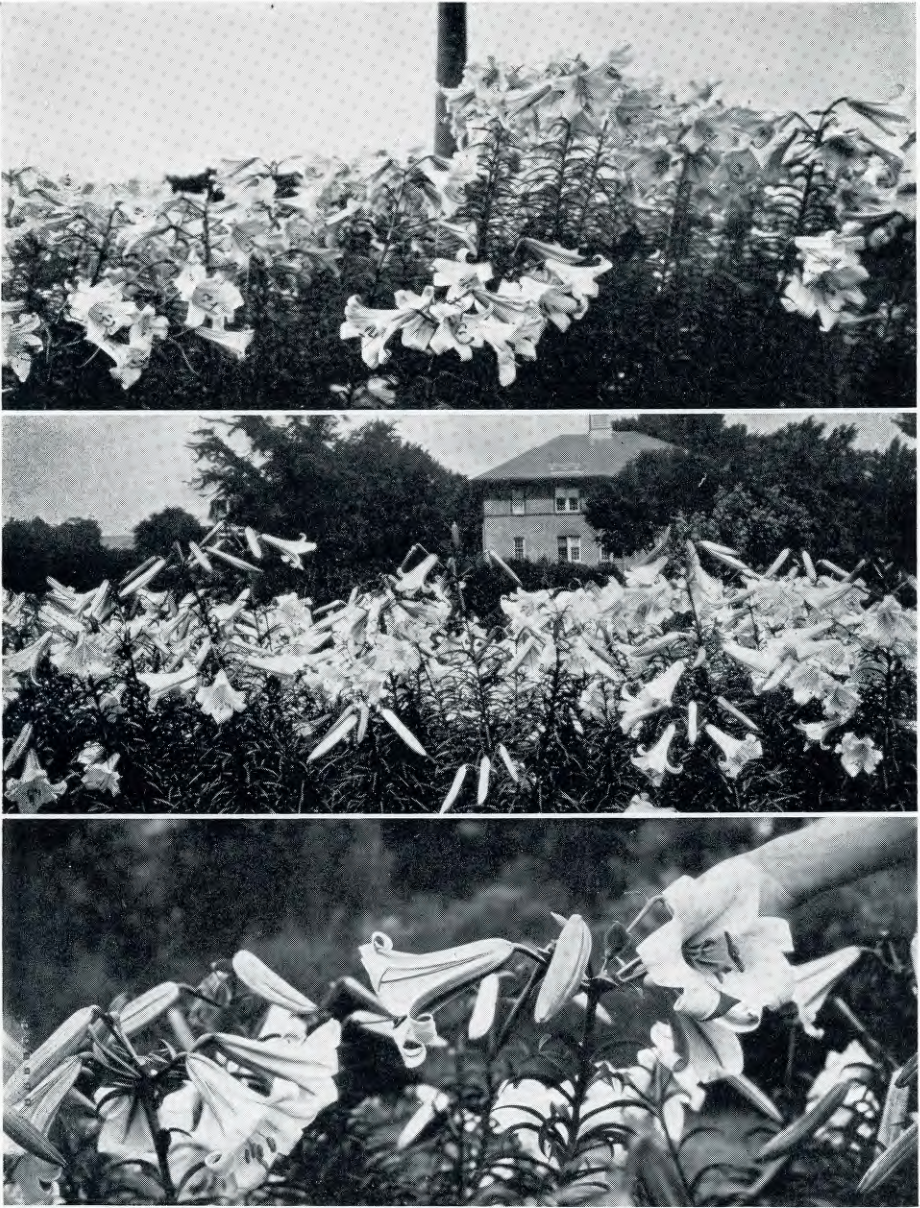
Princeps hybrids, Ithaca, 1938.

"All plants raised by crossing the same two species of plants receive the same specific name, variations between the seedlings being indicated, where necessary, by varietal names" I should not take issue with such authority but I hope it isn't unfair comment to suggest that if, *in rare instances* the plants themselves refuse to abide by the rules, then in such instances so much the worse for the rules. The basic soundness of the rules remains unimpaired.

Specifically in my own material a cross of non-bulbil forming seedling No. 531 (*Princeps* selfed) \times *Sargentiae* gave approximately 50 per cent bulbil formers in the resultant seedlings. Parenthetically it should be noted that generally the bulbils in this and other similar cases were smaller than normal for *Sargentiae* itself or *sulphureum*. The same seedling, No. 531, crossed with a non-bulbil forming *Sulphurgale* seedling gave no bulbil forming progeny.

In the above and similar crosses results were fairly clear cut and fortunately adequate notes were made. Yet there is some indication, and it is perhaps worth noting, that in *some* crosses of selected *Princeps* seedlings and where both the immediate parents are non-bulbil formers, a few of the seedlings may be bulbil formers. The suggestion is that some non-bulbil seedlings, which trace back to bulbil parents may carry a hidden factor for bulbil formation, the character showing up in the next generation. I believe there are examples of this in my garden, seedling 655 \times 280 being a case in point, yet there is an element of doubt due to inadequate observation and notes.

SEASON OF BLOOMING. Some extension of season was obtained simply by growing seedlings of *Princeps* itself, some of them being a week or more later



L. H. MacDaniels

Top, *Princeps-sulphurgale*, both clones with mosaic, left less tolerant than right. Center, *Sulphureum-regale* hybrids, Palmer's, Guelph, 1939. Lower, Palmer's hybrids, *Brozenii* type, Guelph, 1939.

than *Princeps*, and quite worth while in other ways. The real extension of season came from the use of Sulphurgale seedlings and *sulphureum*, and more particularly by crossing amongst themselves selected seedlings tracing back to *Princeps*, *sulphureum* and *Sargentiae* parentage. Examples are:

1. Seedling Group No. 3614. From sdlg. 320113 ((*Sargentiae* × (*sulphureum* × *Princeps* sdlg.)) × sdlg. 320128—(a sister seedling and therefore of the same parentage as 320113).

2. Seedling Group No. 3611. From sdlg. 655 (*Princeps* selfed) × sdlg. 32022 (*Princeps* sdlg. × *Sargentiae*).

3. Seedling Group No. 3613. From sdlg. 30011 (hybrid of two *Princeps* sdls.) × *sulphureum*.

4. Seedling Group No. 3727. From sdlg. 32045 (*Sargentiae* × Sulphurgale) × sdlg. 32055 (*Princeps* sdlg. 531 × Sulphurgale).

The above isn't intended to confuse but rather to indicate the method of breeding—thorough mixing up genetically of the three species proper, *regale*, *sulphureum* and *Sargentiae* and again using as parents of course the most promising seedlings, with the hope of securing in the hybrid population a fairly wide range of material in season, type, color and other characters.

In season, many of the seedlings blooming at Guelph in 1939 were well over a month later than *regale*. The blooming date there for *regale* is approximately July 12th, for *Princeps* July 20th. Certain parentages or family groups in the seedlings in question were in bloom in a general way with *Princeps* (individual seedlings varying of course), while other parentages did not show the first seedling in bloom until two weeks later, with the last being four weeks after *Princeps*. There has been a similar seasonal spread in the Vineland material.

COLOR. Of course there is no violent change here and will not likely be unless and until an entirely different group of lilies as the *Umbellatums* or *Willmottiae* for example can be successfully crossed with the group under discussion. Nevertheless there are definite departures from the normal white of *regale* made possible by *sulphureum*, and by the reddish petal-back color which is occasionally so pronounced in *regale* itself and which gives a definitely pinkish cast to the bloom. Then too, one group of seedlings, family No. 3617 (Sdlg. 320141 × 655) has many individuals almost as white, inside and out, as the Madonna lily.

In the Guelph and Vineland groups there are certain parentages which are striking in their sulphury color. The cross 32022 × 320123 and 320145 × 32021 are particularly noticeable and in them there is promise of definitely worth while sulphur seedlings, varying in season too. In fact the question of season cuts right across that of color so that there is no reason why eventually there should not be sulphur, white, and pink tinted varieties throughout a continuous season of six weeks or more. Pronouncedly pink tinted seedlings have come in particular from the use of seedling No. 320113, derived from the three species *Sargentiae*, *sulphureum* and *regale*.

BLOOM TYPE. Personally I am rather intrigued by the wide open type which occasionally appears in large groups of seedlings, the Vineland and Guelph populations being no exception. In Seedling No. 30011, a hybrid of two *princeps* seedlings, the individual blooms are strongly suggestive of a pure white *auratum*. Seedling No. 36211 selected in 1939 at Guelph, from the

parentage 32025 \times 655 and blooming for the first time, is even wider open, and suggests the eventual possibility of forms not unlike *speciosum*. These are at least a welcome addition to the more orthodox trumpet-like forms. Sdlg. 32025 is from a Princeps seedling \times *Sargentiae*, and 655 is an open pollinated seedling of Princeps.

BLOOM AND PLANT SIZE. I would not deify size but it has its place. In the seedlings in question, the influence of *sulphureum* is very evident with the result that there are many with blooms definitely larger than Princeps or its direct derivatives. In the same way plant size has been influenced, and while the Guelph seedlings are too young to show their full height, older Vineland seedlings have grown to well over six feet in comparison with five feet for Princeps under the same conditions.

There are also equally interesting semi-dwarf forms of two and one half to three feet, and while not as spectacular as the giants yet they may be quite as useful garden subjects.

BLOOM PLACEMENT. The cart-wheel effect so often seen in *regale* should, I believe, be regarded as a defect, with the ideal in the direction of bloom placement such as in *Davidii* or *tigrinum*—a long flower head. In any event these Princeps-*sulphureum* seedlings offer plenty of encouragement in this direction, there being many with relatively long flower heads and carrying 20-25 well placed blooms. Still further desirable modification should be possible either with this material or by other breeders elsewhere.

I should like to end on a note of warning. Or rather I feel I must end on a note of warning, much as I dislike to do so. It has to do with virus. *Sargentiae* and *sulphureum* have been useful parent species in securing the various characters outlined in this paper but they are also both bad actors when it comes to susceptibility to virus. In breeding therefore they must be used with full appreciation of this weakness and with the determination to seek resistant seedlings. The third parent species, *regale*, should in my opinion always be represented in this line of breeding as it appears to be definitely more resistant to virus than the other two species.

What Can be Done About Lily Mosaic?

PHILIP BRIERLEY¹

In the Lily Yearbook for 1939 MacDaniels discussed the nature of the mosaic disease of lilies, described some of the mosaic symptoms, and outlined generally accepted control measures. The present article is an attempt to define the problem in greater detail, to weigh more recently discovered information, and to consider what lines of procedure are likely to lead to satisfactory control of mosaic in garden lilies.

Guterman proved that lily mosaic is a virus disease, and showed that the melon aphid, *Aphis gossypii*, spreads it in nature. When his final report appeared in 1930, lily mosaic seemed a relatively simple disease which should yield readily to control by removal of diseased plants. No host plants were known except lilies and one species of the closely allied *Fritillaria* the disease was not seed borne; and when lilies had mosaic they showed it. But, strangely, control by roguing of mosaic plants has not been very effective, even in the hands of competent experimenters.

NEW EVIDENCE AND NEW VIEWS ON LILY MOSAIC

In 1937 Price isolated a cucumber virus from mosaic Easter lilies, and McWhorter, working independently, showed that healthy-appearing lilies of certain species often carried a virus allied to those which cause breaking in tulips. The writer then showed that the viruses described by Price and McWhorter are distinct, and that both are commonly present in severely diseased Easter lilies which have brown dead flecks in their leaves. In Easter lilies tulip virus is more common than cucumber virus. Both viruses were found to occur in garden lilies from a number of localities in the United States and Canada in a recent series of index tests. Both the cucumber virus and the tulip virus thus associated in lily mosaic are found to be differentiated into strains, or sub-types, with similar properties but capable of inducing varied symptoms in lilies. Symptoms of mosaic in garden lilies may thus vary with the species or variety of lily, and with the strains and viruses involved. No longer do we attempt to interpret all expressions of mosaic as the effects of a single virus peculiar to lilies. We must consider whether we are dealing with a tulip virus, a cucumber virus, or both, and what the sources of infection may be for such a virus in our locality.

THE PREVALENCE OF MOSAICS IN GARDEN LILIES

A simple index test developed in the study of Easter lily diseases distinguishes viruses of the cucumber group from those of the tulip group. During the past summer this test was applied to samples of garden lilies from many localities. The results are summarized in Table 1.

¹Associate Pathologist, Division of Fruit and Vegetable Crops and Diseases, U. S. Horticultural Station, Beltsville, Md.



Figure 1.—Strong mottle (left) and necrotic fleck (right) symptoms in the Creole variety of Easter lily. Natural infection in each. The mottle carries only tulip virus and has little effect on salability of the plant; the fleck carries both tulip and cucumber viruses and is commonly not salable.

TABLE 1.—Results of indexing garden lilies for the presence of cucumber virus (C) and tulip virus (T) by inoculation into Turkish tobacco and *Lilium formosanum* seedlings. Figures indicate number of plants indexed when more than one. C+T indicates both types of virus found. H indicates plants apparently virus free.

SPECIES OR VARIETY	SOURCE LOCALITY											
	Yonkers, N. Y.	White Plains, N. Y.	Charlotte, Vt.	Ottawa, Canada	Ithaca, N. Y.	Geneva, N. Y.	Beltsville, Md.	Thurmont, Md.	Aspen, Md.	Bellingham, Wash.	Bellevue, Wash.	Corvallis, Oreg.
<i>amabile luteum</i>		T				H						
<i>auratum</i> and vars. ¹	T		2T		2C+T 1C	T	H		H	H	T	
Backhouse hybrids			10H									
<i>Brownii</i>					C							
<i>canadense</i> (incl. vars.)				H	1C+T 1C	T						
<i>candidum</i>		C+T	C+T T	T	2T 10H	T		T				
<i>cernuum</i>						T						
<i>chalconicum</i>						T						
<i>croceum</i>			C		C+T							
<i>Davidi</i> (incl. <i>Willmottiae</i>)					H		H			H		
<i>Daymottiae</i>		T										
<i>dauricum luteum</i>										T		
<i>Elegans</i> (and seedlings)						2T	3T					
<i>formosanum</i>	T						T				T	
George C. Creelman	T	C+T		T			T			T		

It appears from the samples tested (Table 1) that tulip virus is more common in garden lilies than cucumber virus, since the former was detected in 31 species or varieties from 13 localities and the latter in 18 sorts of lilies from 9 localities. Either virus may occur alone, or frequently the two occur together in diseased lilies. Some "crook neck" *Lilium auratum* plants, and some *L. superbum* plants with similar symptoms, were found to be infected with both tulip and cucumber viruses. Such plants are, of course, very badly injured. However, both viruses were recovered from some individuals of *L. regale*, *L. Sargentiae*, *L. tigrinum*, and *L. umbellatum*, which showed less damaging effects, although they were usually somewhat dwarfed.

Most bulb-propagated species and hybrids were found infected with tulip virus. However, *Lilium tigrinum* was still apparently virus-free in some isolated gardens, and *L. candidum* was found healthy where recently grown from seed. Most significant in this connection is the finding that *L. Hansoni* and its hybrids Marhan and the Backhouse group were apparently virus-free throughout our samples, although some were grown close to mosaic lilies. Evidently *L. Hansoni*, which is always propagated vegetatively since it rarely or never seeds, has some sort of resistance or some capacity to escape mosaic.

THE WILD HOST HAZARD

Since Price placed lily mosaic in the cucumber mosaic group there has been a marked tendency to look to wild plants as sources of mosaic infection. It is true that cucumber viruses occurring in lily are closely allied to the celery strain of cucumber mosaic for which a very wide host range has been determined by Wellman. It is probably true as inferred that the same host range also applies to the cucumber strains occurring in lily. Nevertheless it should be emphasized that this is an *experimental* host range, i.e., a list of plants to which this virus has been transmitted under experimental conditions. It is by no means reasonable to assume that all the plants so listed commonly carry lily mosaic and are awaiting the day when a lily shall be planted near them. Indeed, attempts to recover lily mosaic from susceptible weeds in the vicinity of mosaic lilies have not been successful, as far as the writer is aware. It is reasonable to suppose that lily strains of cucumber mosaic may be transmitted from lilies to certain weeds and thence back to lilies, but present evidence suggests that this is not a common occurrence.

Comparatively little is known of the host range of the tulip viruses, but these clearly have a much more restricted range than cucumber mosaic. But strangely enough the tulip viruses are more widely distributed and more common in lilies than the cucumber viruses which have an extended host range. In the writer's experience thus far it has always been possible to account for the appearance of lily mosaic on the basis of spread from other lilies. In fact, we shall have to grow much healthier lilies than we now commonly grow before we can develop enough circumstantial evidence to convict the neighboring milkweeds. In the meantime much of the thought devoted to the wild host hazard might profitably be devoted to the latent virus hazard discussed below.

THE LATENT VIRUS HAZARD

The control of lily mosaic is particularly difficult because of the tendency of some infected plants to remain symptomless. McWhorter first pointed out

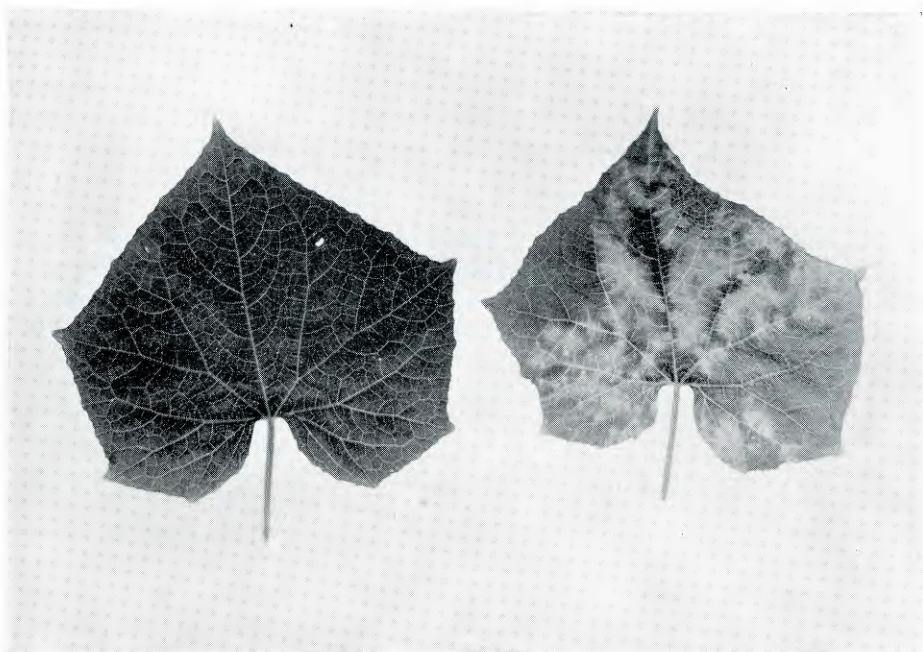


Figure 2.—Effect on cucumber of cucumber virus from flecked Easter lily. Healthy leaf at the left. Experimentally produced.

that some apparently normal individuals of *Lilium candidum*, *L. longiflorum*, and *L. tigrinum* carried a virus capable of producing breaking in tulips. He called this "a latent virus of lily," because it is usually concealed, producing no recognizable symptoms. This virus of the tulip group seems to be practically universal in stocks of the Madonna and Easter lilies, except those recently grown from seed. The tiger lily is still apparently free from it in some isolated gardens. Other lilies grown from bulbs rather than seeds, such as the Nankeen lily, *L. elegans*, *L. umbellatum*, various named hybrids long grown in collections, and even the easily seeded *L. regale*, often carry this virus without showing well-defined symptoms.

Lily strains of cucumber mosaic likewise may be present in symptomless *Lilium longiflorum*, *L. speciosum*, *L. formosanum*, and probably other species.

The fact that either cucumber or tulip viruses may occur in lilies without expression of symptoms practically destroys hope that removal of visibly diseased plants will be effective in eliminating lily mosaic. There is no longer a sound basis for reliance on roguing as a major control measure.

TWO POSSIBLE SOLUTIONS OF THE MOSAIC PROBLEM

It is probably too early to lay down rules for the control of lily mosaic, but a discussion of the advantages and disadvantages of two lines of endeavor will not be out of place here. If we want virus-free lilies we can grow them from seed, and take rigid precautions from the time of emergence onward to

avoid exposing them to sources of infection. If we want garden lilies with a minimum of expense and effort we can "live with mosaic" as Slate puts it, choosing varieties which resist, escape, or endure mosaic. Both lines of procedure may be said to be under exploratory trial at present, and one or both will probably displace roguing as the accepted procedure in time.

SEEDLINGS ISOLATED FROM DISEASED LILIES

Encouraging results have thus far attended our efforts to maintain Easter lily seedlings virus-free. Such seedlings transplanted from the greenhouse to the open field have remained virus-free at Charleston, S. C., for 2 years, and at Los Angeles, Calif., for 1 year. Index tests of large numbers of plants chosen at random from these plantings have shown no evidence of mosaic. At each of these stations the seedlings were grown at a considerable distance from other lilies, but no attempt was made to avoid vegetable crops or possible weed carriers. However, at Beltsville, Md., a first attempt to grow garden lilies virus-free in a supposed isolation plot has failed. Here seed and healthy seedlings set in the same plot from which diseased lilies had been removed in the previous season showed some tulip mosaic by midseason. Among other possible sources of mosaic, that of volunteer plants from scales or bulblets surviving from the previous year seems most reasonable. Evidently it is more difficult to effect a clean-up of an old site than to make a fresh start in a new plot.

In attempting to produce virus-free lilies the seedlings from emergence onward should be well separated from diseased lilies or varieties which are possible virus carriers. This calls for a plot for seedlings well removed from the parent collection. It is not known what distance may be safe, but a matter of miles rather than yards is to be preferred. Once the program fails, we must revert to roguing with the dark prospects explained above. A generous separation distance should be practical as well as sound, since lilies are still comparatively scarce in this country. In planting virus-free lilies in gardens it will probably be wise to start with a test planting of *Lilium formosanum*. If this species remains free from mosaic through a full growing season, the presumption is that virus sources have been successfully removed. Although *L. formosanum* may carry cucumber mosaic without showing symptoms in cool weather, it is the best test species known.

Are virus-free lilies worth all this trouble? A collection must be virus-free if it is to include acceptable *Lilium formosanum* and probably *L. auratum* and other species. The extent of such a list, which is almost wholly unknown at present, will determine the ultimate demand for healthy lilies. Perhaps such a program is too idealistic to be practical. But it has thus far had no fair trial, and we feel that it deserves one.

RESISTANT AND TOLERANT VARIETIES

If there are lilies which cannot be infected with lily mosaics (immune), or which can be infected only with difficulty (resistant), or which tend to escape because unattractive to insect vectors (klendusic) [Rankin], these sorts should rise in popularity. There is a reason to believe that *Lilium Hansonii* and its hybrids fall into one of these categories and, if we may rely on two or three samples, *L. pardalinum robustum* and *L. Davidi* may have similar qualities. Many lilies are readily subject to mosaics but not badly damaged when infected



Figure 3.—Effect on Clara Butt tulip of tulip virus from strongly mottled Easter lily. Healthy plant at the left. Experimentally produced.



Figure 4.—Green Island mottling in *Lilium formosanum*. Healthy leaves at the right. This type of mottling is a common effect of "latent" tulip virus. Experimentally produced.

(tolerant). Most of the species mentioned in the section on "the latent virus hazard" fall into this class. Tolerant lilies are much less desirable than resistant sorts, since the former commonly carry a latent virus and thus represent a hazard to any healthy lily not resistant or tolerant. Probably many mosaic-tolerant varieties are in some degree inferior when affected with mosaic, but not injured enough to call for removal. Tolerance is thus a doubtful asset at best.

The program of selecting resistant and tolerant lilies from their performance in a general collection is more complex than it appears at first glance. Individuals that show no mosaic symptoms after exposure to natural spread may be immune, resistant, klendusic, tolerant, or merely chance escapes. Furthermore they may react in one way to one virus and in another way to the other virus. Selections from one locality may fail in another place if a different virus is encountered. It would be helpful if claims of mosaic resistance in lilies could be made more specific, e. g., *Lilium Hansonii*: apparently resistant or klendusic to tulip virus; *L. tigrinum*: tolerant of tulip virus, etc.

The value of resistant and tolerant varieties as a solution of the mosaic problem in lilies will depend on how many such varieties can be assembled that are capable of living together with mosaics; and also on how many garden favorites must be left out of such a collection.

Methods of Raising Garden Lilies from Seed

HOWARD A. HOUSER¹.

Disease free garden lilies can be produced in quantity by growing them from seed either under glass or out of doors. This article describes methods used during the past 2 years at the United States Horticultural Station, Beltsville, Maryland, near Washington, D. C. Here efforts are being made to produce flowering size bulbs in the shortest possible time in order to speed up the breeding program and to have an ample supply of stock available for other research purposes.

The carrying out of such a program necessitates that a few facts be kept constantly in mind. For instance, the lily seedlings must be grown where they will be isolated from all other lilies except those known to be virus free. It is not safe to plant seed in a plot where diseased lilies have been grown before for fear that "left overs" may come up. Those grown under glass during the summer must also be kept away from sources of infection. A good, deep, medium soil which drains well and contains an abundance of organic matter is considered ideal soil for most lilies. They, like many other garden plants, respond to a fertile soil. Well-rotted manure properly used is one of the best sources of fertility available. It may be either worked into the soil or used as a winter or summer mulch. When manure is incorporated with the soil it is advisable to apply it 6 months or a year before planting the bulbs. Cover crops turned under several months in advance are always beneficial in supplying fertility and organic matter. Bone meal is also recommended as a safe source of fertility. Summer and winter mulching of lilies is essential. Winter mulching prevents the alternate freezing and thawing of the ground which is especially harmful to shallow planted lilies, particularly seedlings. Since newly planted lilies are less hardy than well established plants, they should be especially well mulched the first winter. The amount of mulch required will depend on where the lilies are grown, 2 to 4 inches being sufficient for the vicinity of Washington, D. C., but more will be needed for colder climates. Marsh hay or straw makes an excellent mulch, although strawy manure, coarse leaves, corn stalks, or even evergreen boughs may be used to good advantage. The winter mulch should be applied after the ground is frozen and removed in the spring just before the plants start coming through the ground. Summer mulching is much superior to cultivation as a method of soil management in the lily bed. When cultivation is necessary to eliminate weeds it should be very shallow. Deep cultivation can do much damage to the roots of young seedlings and to species of lilies that produce stem roots which are near the surface of the soil. A good mulch during the growing season will conserve moisture, keep the soil cooler, prevent the soil from packing and baking, and keep down weeds to a certain extent. There are a number of materials that are satisfactory for summer mulching; leaf mold, peat moss, muck, chopped straw, and strawy cow manure well rotted and pulverized are all efficacious. The summer mulch should not be applied until danger of frost is over. It has

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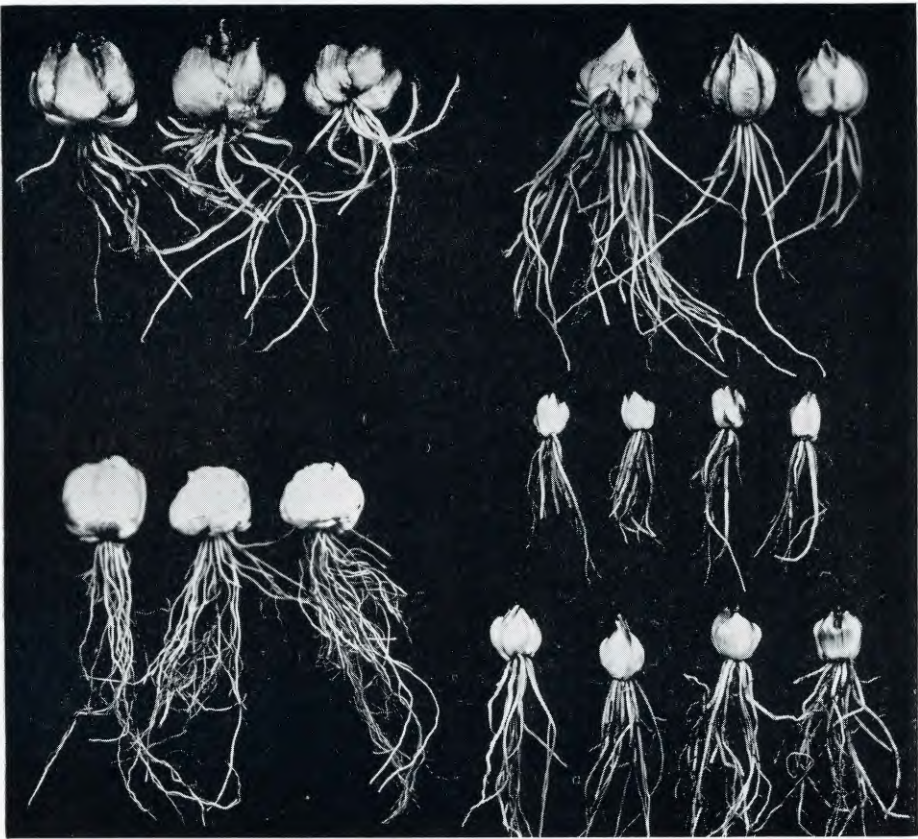


Figure 1.—*Lilium Sargentiae* bulbs the second year from seed. Seed planted in greenhouse December, 1937, transplanted to field May, 1937. All three bulbs produced flowers this past summer. Bulbs are 8 to 10 inches in circumference (upper left).

Figure 2.—*Lilium George C. Creelman* \times *leucanthum* bulbs the second year from seed. Grown same as Figure 1. Bulbs are 7.2 to 8.5 inches in circumference (upper right).

Figure 3.—*Lilium tigrinum* \times *Maximowiczii* bulbs the second year from seed. Grown the same as Figures 1 and 2. All three bulbs flowered this past summer. Each bulb 7.5 inches in circumference (lower left).

Figure 4.—Upper: *Lilium regale* \times *leucanthum* 1 year from seed. Planted in open field December, 1938. Bulbs harvested and photographed October 15, 1939. All bulbs 3.2 inches in circumference. Lower: *Lilium regale* \times *leucanthum* 1 year from seed. Planted in greenhouse November, 1938. Seed was spaced 1 inch apart in flats and grown in greenhouse throughout the year. Bulbs range from 4 to 5.2 inches in size (lower right).

been found that lilies forced by too early mulching are more seriously injured by late spring frosts, and injured leaves are more susceptible to development of the mold *Botrytis*. The watering of lilies during the growing season is essential, especially during hot, dry weather. Frequent light waterings are of little value. Enough water should be applied at one time to soak the soil thoroughly to a depth of 6 inches or more.

METHODS OF GROWING SEEDLINGS

Due to the fact that many lilies receive a beneficial impetus from an initial greenhouse push, the following two methods which are similar were employed by the Department of Agriculture 2 years ago.

Raising Seedlings in Greenhouse, Later Transplanting to Field

The seeds were sown in flats in December, 1937. When the seedlings had produced their second leaves the majority were transplanted 2 inches apart in flats and the remainder moved to 3-inch pots. After the danger of frost was over in the spring all the seedlings were transplanted into Dutch beds in the open field, where they remained until November, 1938. The intention was to leave the bulbs undisturbed for a period of 2 years. However, due to improper drainage conditions of the soil it was considered best to transplant them to a location where they would have better drainage. Bone meal was thoroughly mixed with the soil before planting the bulbs, the beds were mulched soon afterwards with several inches of wheat straw, and this was removed in the early spring. About May 15, 1939, well-rotted cow manure containing considerable straw, previously dried and put through a soil shredder, was applied as a summer mulch. It was put on about one-half inch deep. Due to the fact that the soil was rather sandy and not well suited for good lily culture, the sort of mulch used in this particular case undoubtedly served its purpose well. The planting required no attention during the growing season except keeping weeds down and giving an occasional watering. The plants were not affected with *Botrytis* and they made a continuous growth up to the time they were harvested on October 15, 1939. Due to plot management it was necessary to move the bulbs at this time, but in the writer's opinion it would have been better to leave the bulbs in place 2 years. When garden lilies have been planted the proper depth and spaced the proper distance apart in soil suitable for their culture there is no advantage in taking them up every year. It will, of course, be necessary for the commercial grower to lift his lily bulbs every second year. When it is necessary to lift lily bulbs, care should be taken not to allow the bulbs or roots to dry. They should be planted immediately in their new location or, if put in storage, immediately covered with slightly moist soil, peat, or some similar material.

Raising Seedling Lilies Entirely in Greenhouse

A number of ordinary flats, 15 by 22½ inches by 3½ inches deep, were used in this method. The soil used had been composted and contained one-third cow manure. It was put through a soil shredder and sieved through a one-half inch mesh screen. Since the texture of the compost was too heavy for growing seedlings, muck was added to lighten it and one-half cup of bone meal per flat was also added. The flats were then filled and sterilized for 4



Figure 5.—A flat of *Lilium regale* \times *leucanthum* growing in greenhouse. Seed planted December, 1938, photographed July 15, 1939.

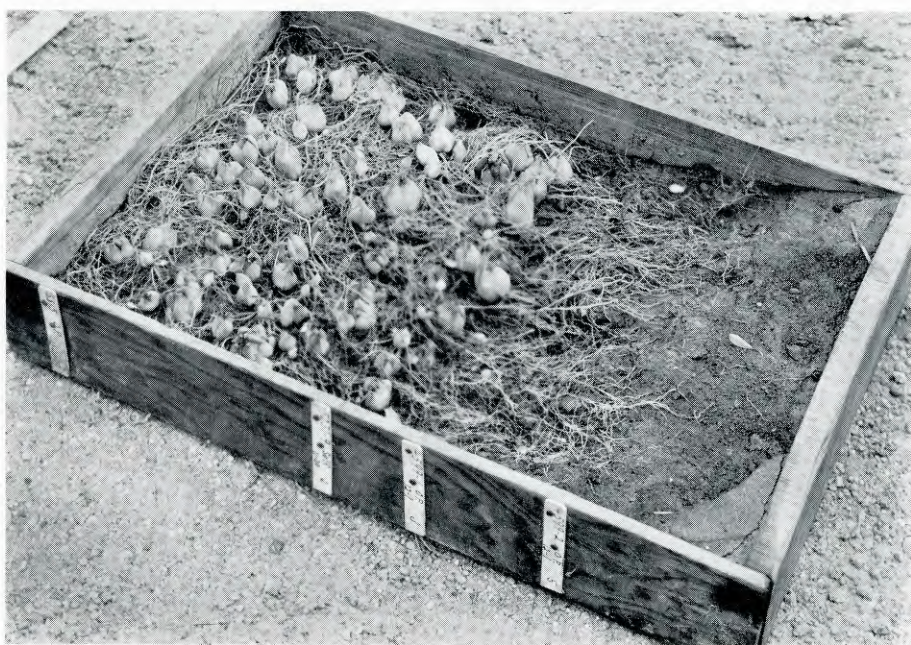


Figure 6.—Showing lilies in flat 10 months from seed sowing (grown in greenhouse).

hours with steam under 10 pounds pressure. When the flats had cooled the soil was leveled and firmed for planting. A spotting board containing 294 pegs spaced 1 inch apart was used in placing the seeds at a uniform distance. The seeds were sown the latter part of November. Before sowing they were all placed on a piece of frosted glass, under which was an electric light bulb. This made it possible to select those seeds containing embryos and one of these seeds was dropped into each of the 294 indentations made by the spotting board. They were covered one-fourth inch deep with a soil composed of equal parts of composted soil, muck, and sand. Some damping off occurred, and this year a mixture of one-half sand and one-half muck will be used with the hope that a dry surface may be more easily maintained, thus lowering such losses. After sowing, the flats were put out in the open because greenhouse space was not available at the time. A light mulch of straw was put over the flats to prevent heavy rains from washing the soil. The flats were brought into the greenhouse January 10, where they received the customary greenhouse care until October 20, when the bulbs were harvested. During winter and spring the night temperature was about 55° F. and the day temperature from 5 to 10 degrees higher. Summer temperatures ran much higher. The bulbs produced by this method made a remarkable growth and were of fine quality, and many of them measured from 3½ to 5 inches in circumference. This experiment indicates that soils containing manure are probably not detrimental to the health of lilies. It also indicates that garden lilies may endure a great deal of hot weather when given sufficient moisture. Just recently 255 of the largest of these 1-year-old bulbs were transplanted into smaller but deeper flats, again containing the same type of soil as before. The bulbs were placed 4 inches apart and they will remain in the greenhouse during the coming year. Many are expected to bloom next summer, which will be about 18 to 20 months from seed.

Raising Seedling Lilies in the Open Field

Where climatic and soil conditions are favorable, the vast majority of lilies can be grown successfully from seed on an entirely out-of-door basis. This method is particularly applicable to the Puget Sound region because there the rains are usually gentle and there is moisture constantly at the surface of the ground in most of the soils from September to June. Regions subject to heavy drying winds, beating rains, and droughty periods are not so favorable for this method, unless precautions are taken to overcome these obstacles. While the region of Washington, D. C., may not have as ideal climatic conditions as that of Puget Sound for this method of handling lily seed, nevertheless splendid results were obtained here at Beltsville this past year.

Seed was planted December 2, 1938, on a sandy type of soil surrounded by tall trees with no underbrush. This seemed to be an ideal location since the trees served as a protection against drying winds and gave some shade during hot weather. The absence of underbrush was also an advantage in allowing good air circulation over the planting, thereby reducing *Botrytis* development during cool, wet weather. The soil was well prepared by the use of a rotary type of garden tractor. Bone meal was used at the rate of 1500 pounds per acre. The seed was planted 1 inch deep in Dutch beds with rows 8 inches apart. About 150 seeds were sown to a 3-foot row across the bed.



*Figure 7.—
Showing bot-
tom side of
hand marker
for making
rows in Dutch
beds in which
lily seeds are
planted.*



Figure 8.—Planting lily bulbs in Dutch beds at the United States Horticultural Station, Beltsville, Maryland.

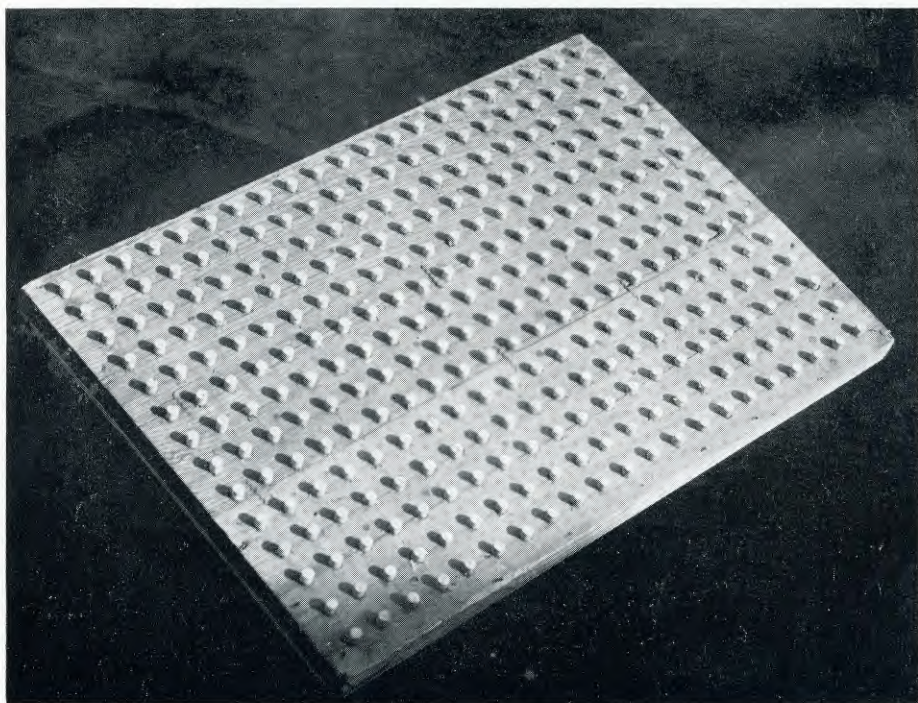


Figure 9.—A spotting board for spacing lily seeds 1 inch apart in flats.

They were covered with equal parts of sand and muck. The planted beds were then covered with a light mulch of oat straw. The mulch in this case was not used solely as a protection against cold weather, but also as a protection against heavy rains. The planting required no further attention until the mulch was removed in the early spring just before the seedlings came through the ground. The young seedlings received the same attention during the growing season as the 2-year-old plants growing nearby and previously mentioned in this article. They also, like the 2-year-old seedlings, were dug October 15. While these year-old seedlings did not make as rapid a growth as those grown under glass, the method is practical and is one of the most economical means of producing seedling garden lilies.

Since many lily growers are now virus-conscious and are striving to produce healthy stocks, it is indeed fortunate that most lilies are abundant seed producers and that the seed is viable and grows readily. Reproduction by means of seed is especially applicable in lily culture for the reason that the grower is usually dealing with natural species that reproduce fairly true to type. Seedlings of the horticultural varieties are, of course, likely to reproduce any variation within the species or, if of hybrid origin, even a much wider variation. In building up stocks absolutely true to type the grower's procedure will, of course, be to make selections and propagate vegetatively thereafter.

Living With Lily Mosaic

GEORGE L. SLATE AND E. P. IMLE

Lily mosaic is by far the most serious disease of lilies and the chief limiting factor in their culture. It is undoubtedly present in commercial stocks and in garden plantings of lilies throughout the world. Gardeners rather generally are not aware of the presence of the disease in their lilies and make little effort to eliminate it or reduce its ravages. A few commercial growers are making determined efforts to produce virus free bulbs and these should be encouraged to continue and expand their plantings of healthy lilies.

Lily mosaic has been the subject of considerable research during the past 10 or 12 years and much information concerning its nature and control have been accumulated. The virus which causes the disease is found in all parts of the lily plant except the seeds. Transmission from plant to plant during the growing season is effected by aphids, the melon aphid being the chief vector. Infected plants never recover and serve as a reservoir of infection as long as they live. Control measures based on these facts have been devised and under certain conditions are satisfactory.

These control measures include:

1. The detection and destruction of diseased lilies, thus preventing the spread of the virus to remaining healthy plants.
2. The planting of bulbs of known freedom from the virus and isolating them from diseased lilies. Collected wild bulbs and bulbs raised from seed under isolation from mosaic are now considered virus-free. The raising of seedling bulbs and isolating them from all other lilies has much in its favor and all cultivators of the genus are urged to follow this practice whenever circumstances will permit. Many, however, want quick results and do not care to take the time and trouble to raise lilies from seed. Isolation, too, is often difficult to secure. These persons will not have lilies unless they can purchase and plant bulbs from which a display may be expected the first season. Moreover, if their interest in lilies is to be sustained the plants must settle down in the garden and continue to display their beauty.

The indiscriminate purchase and mixing of many kinds of lilies in the garden is certain to result in heavy losses from lily mosaic. The detection and removal of diseased plants is attended with certain difficulties which will, to a large extent, nullify the benefits to be expected from a roguing program. Several species and hybrids are known to be infected with the lily mosaic virus without exhibiting external symptoms that will permit diagnosis of the disease. Even an expert is unable to say definitely whether certain lilies are infected or not. These symptomless carriers or "typhoid Marys" cannot be detected except with a special technique not suited to garden purposes and they will remain in the planting as sources of infection for other lilies.

It would seem from the foregoing that the raising of lilies is rather a discouraging experience not to be entered into by the average person. There is, however, another angle to the situation which has not received much attention.

The different species of lilies vary greatly in their ability to escape mosaic infection, and also in their tolerance of the virus after becoming infected. During the past season mosaic spread through the stocks of certain species in the writers' garden with unusual rapidity. In certain cases the entire stock of several species became infected within a few weeks. Other lilies escaped entirely, or only a few plants became infected. The experience was a sad one, but the lessons learned may be useful.

The experience from the 1939 season at Geneva and elsewhere combined with previous experience and observation, and coupled with what is known of the history of various species and hybrids of lilies, has tempted the writers to suggest a program for living with mosaic. Under this program the cultivator of lilies will pay little attention to lily mosaic but will devote his efforts to growing those lilies which rarely become infected with mosaic. With these lilies may also be grown the types which are infected with mosaic but which will continue to perform fairly satisfactorily in spite of the presence of the virus. Under this scheme a fairly respectable collection of lilies may be assembled. A few fine lilies will have to be avoided, as they would soon become diseased and die, or be of no further ornamental value.

The lists of lilies which are suggested here are not to be considered final, as conditions vary in different regions and in different seasons. They are, however, in most cases based on considerable observation and in the absence of such lists at the present time they are offered as a guide to those who may wish to grow lilies without having to give much thought to the control of lily mosaic. Further experience may indicate that some infected more readily than we now believe and may reveal that some which are apparently virus-free are in reality highly tolerant carriers.

The reader should realize also that a new and complicating factor must be considered when one attempts to classify lilies in groups as is done here. United States Department of Agriculture pathologists have recently demonstrated the presence of more than one virus strain in the mosaic disease complex. This may account for the variable behavior of the same species of lily in different localities. Most of the recommendations made here are based upon observations made by the authors in several localities.

In reading the discussion which follows it should be kept in mind that lily mosaic has undoubtedly been present in lilies for many years and that the older lilies have been grown in nurseries and gardens with abundant opportunity for infection for the greater part of the time they have been under cultivation. Their present freedom from mosaic is all the more striking when one realizes that an entire stock of such susceptible species as *L. auratum*, *L. formosanum*, *L. tigrinum* and *L. Sargentiae* may become infected in a single growing season.

LILIES WHICH NEARLY ALWAYS ESCAPE MOSAIC INFECTION

L. Martagon and its varieties, of which *L. Martagon* var. *album* and *L. Martagon* var. *Cattaniae* are the best known, are rarely, if ever, infected with mosaic. Equally free is *L. Hansonii*, the entire stock of which is probably a single clone that has been in cultivation for about seventy years. A lily that can be grown in close association with virus diseases for that period of time and still remain healthy certainly possesses a high degree of whatever it takes to make a plant resistant to infection with the virus.

*L. H. MacDaniels**Lilium Hansonii*

The mating of *L. Hansonii* with *L. Martagon* and its varieties has produced a series of hybrids of great merit as garden plants and as virus-free as their parents. The Backhouse hybrids, raised before 1900 by Mrs. R. O. Backhouse of England are the best known varieties of this group. Brocade, Mrs. R. O. Backhouse and Sutton Court are excellent sorts but Sceptre and Golden Orb have also been introduced. Dalhansonii and Marhan are less well-known. Some others are Ellen Willmott, G. F. Wilson and E. J. Elwes. Recently, Guinea Gold, Mary Swaythling and St. Nicholas have been brought to notice. The foregoing lilies are mostly rather expensive, but are usually not hard to grow. Also, many of these increase rapidly by bulb splitting. A loamy soil, well supplied with organic matter, and light to moderate shade will best suit them.

This group is one of great promise for the hybridizer and should be worked extensively to produce additional mosaic-free varieties. The known hybrids have by no means exhausted the possibilities of this group.

L. pardalinum and its variety *giganteum* are both nearly always virus-free, and being fine lilies should be grown more extensively. Both are reliable and satisfactory lilies in eastern gardens.

LILIES WHICH USUALLY ESCAPE MOSAIC INFECTION

The lilies in this group usually escape mosaic infection, although an occasional infected plant will be found. Generally speaking, gardeners need not be greatly concerned about mosaic in the lilies in this group.

L. Brownii, a very beautiful trumpet lily was introduced about 1835 and the entire stock in cultivation is thought to have been descended from a single original bulb by vegetative propagation. That healthy bulbs are still obtainable indicates much greater than average resistance to infection. *L. Henryi* becomes infected rather slowly and the diseased stocks sometimes seen are probably the result of vegetative propagation of infected bulbs rather than rapid spread of the virus from diseased to healthy plants. The western *L. Roezlii* also belongs in this group.

L. Davidi and its variety *Wilmottiae* should give the gardener very little trouble from the virus standpoint. *L. Davidi* var. *Wilmottiae* has transmitted some of its mosaic resistance to a series of hybrids of recent development. These lilies are so recent that the writers are much less certain of their ground in including them in this group of varieties usually escaping infection. They have undoubtedly had abundant opportunity to become infected, yet are for the most part apparently healthy. Whether some are highly tolerant, the writers cannot say, but it would appear at present that they may be welcomed to the garden with open arms with no great concern as to their health. In this group may be placed *Scottiae*, *Lillian Cummings*, *Phyllis Cox*, *Brenda Watts* and *Edna Kean*. These are all first rate hybrids of great garden merit and of easiest culture.

LILIES WHICH REMAIN MODERATELY FREE FROM MOSAIC

The writers have experienced some difficulty in separating the lilies in this group from the preceding group. Certainly they have encountered more mosaic in some of these species. It is likely, however, that most of them will remain relatively free from mosaic except when grown in close association with large numbers of virus infected lilies. Lily mosaic will spread much more rapidly in closely planted nursery beds than between scattered colonies separated from each other by trees, shrubbery and buildings as in a large garden or on an estate.

L. regale, *L. pumilum* and *L. amabile*, all fine lilies, are easily raised from seed and become infected occasionally, but the rate of spread from plant to plant is usually rather slow and several years' bloom may be obtained before the stock is ready for discard. *L. speciosum* would also appear to belong here as well as in the group of tolerant lilies. Two beds of seedlings of *L. monadelphum* apparently escaped infection when several other species did not. *L. carnolicum* and *L. pomponium* are placed here tentatively on very limited evidence as is also *L. bulbiferum* var. *croceum*. Grace Marshall, Lyla McCann and Maxwill are assigned to this group until more extensive testing indicates a different classification.

LILIES TOLERANT OF MOSAIC

These lilies are rather generally infected with mosaic, in fact, it is doubtful whether virus-free bulbs are available of some of them. The masking of

mosaic symptoms makes it difficult or impossible to eliminate all diseased plants by rogueing. In spite of their virus content they usually make a fair to good display in the garden. Virus-free plants would probably be somewhat more vigorous, have larger and brighter colored flowers and persist longer in the garden. The grower of virus-free lilies should avoid this group or isolate them from his healthy stocks.

L. candidum and *L. testaceum* are two of the handsomest of all lilies and perform very well in a clay loam. They are less happy in a sandy soil. Some clones of *L. candidum* are much more tolerant of mosaic than others and these tolerant clones will persist indefinitely in the garden apparently uninjured by the virus. The ability of *L. testaceum* to persist, even though infected, is attested by its hundred years in gardens where mosaic has undoubtedly been rampant for most of that time. *L. elegans*, *L. umbellatum* and their host of varieties are highly tolerant and will persist indefinitely in good condition with mosaic. Certain strains or combinations of strains of the virus cause severe symptoms on *L. tigrinum* especially during the season they first become infected. Early loss of foliage and rapid degeneration of the bulbs may also result. However, *L. tigrinum* is included here because the usual reaction of this lily to mosaic infection is to exhibit considerable tolerance. Clumps are known which have performed beautifully for many years, although diseased.

In the trumpet lily group *L. Sargentiae* and its hybrids, among which are Creelman and Pride of Charlotte, are very tolerant. The lilies known as Crow's Hybrids are equally tolerant and impossible to rogue satisfactorily. They vary somewhat in their expression of symptoms and perform very well even when infected. *L. myriophyllum* var. *superbum* (*sulphureum*) is only moderately tolerant, but with good cultural conditions a fair display may be expected.

L. speciosum belongs in this group. The junior author has seen a planting of more than 100,000 bulbs of the variety *rubrum* on Long Island which were certainly more than 60 per cent diseased, yet they were thriving and producing commercial crops of cut flowers. The beautiful white variety, *album*, produces well under greenhouse conditions, but the writers have yet to see a mosaic-free plant of it.

L. bulbifrum and *L. dauricum* are as tolerant as *L. elegans*. *L. dauricum venustum* Batemanniae, a very beautiful lily, of which no healthy plants are known, flowers well the first year after planting, but soon dwindles away. Its beauty and mid-summer blooming period justify the frequent renewals of stock. Another unusual flower is the brilliant red *L. chalcidonicum* which is somewhat lacking in vigor, but worth trying, especially in the heavier soil types.

LILIES VERY SUSCEPTIBLE TO MOSAIC

This group includes those lilies which become infected with mosaic very rapidly and soon die or are so weak as to be of little use for ornamental purposes. It is largely a waste of effort to attempt their culture in any planting in which lilies of the preceding group are growing. To have these lilies only seedlings or collected wild bulbs should be attempted and they should be isolated from all other lilies. During the past season at Geneva stocks

of these species became almost completely infected with mosaic and the plants were severely injured. The list includes *L. auratum*, *L. callosum*, *L. canadense*, *L. cernuum*, *L. concolor*, *L. dauricum* Wallacei, *L. formosanum* and its dwarf form, Price's variety, *L. japonicum*, *L. Leichtlinii* var. *Maximowiczii*, *L. michiganense*, *L. rubellum* and *L. superbum*. Tolerant types in which mosaic spread rapidly this year are *L. elegans*, *L. myriophyllum* var. *superbum*, *L. Sargentiae* and *L. tigrinum*.

The Culture of the Pacific Coast Lilies

ALBERT M. VOLLMER

In writing this article on the culture of the Pacific Coast lilies, one may consider these lilies in groups.

One such group would be *L. maritimum* and *L. occidentale*. Both occur along the coast under similar conditions, *L. occidentale* beginning about 100 miles farther North from where *L. maritimum* ends. Both like a cool damp atmosphere, as in their native habitat, they receive abundant rainfall in Winter, and a great deal of fog in Summer, which condensing on the surrounding vegetation drops down and keeps the ground moist. In warmer climates, they should receive shade.

L. nevadense, *L. Parryi* and *L. parvum* would constitute another group. These lilies are found in the high mountains, up to 11,000 feet, along streams, below springs on raised hummocks in bogs, and in moist meadows. In Winter, the bulbs are encased in frozen soil, but with the advent of Spring, the bulbs are moist.

L. pardalinum and *L. Roesli* are found in similar situations as the preceding group, but at lower levels.

All the above group of lilies have bulbs that are rhizomatous. The soil in which they grow contains an abundant amount of humus and is well drained.

The *Humboldtii* group (*L. Humboldtii* type, *Bloomerianum* and *magnificum* or *occelatum*) either can stand or prefer a lot of sun, and hence should be planted in full sun. In the wild they often experience temperatures up to 100 degrees.

The *Washingtonianum* group (*L. Washingtonianum* type, *minor* and *purpureum*) prefer a cooler situation than the preceding group and more shade. In nature they are found growing among shrubs, the stems in shade and their tops in full sun.

L. Kelloggii and *L. rubescens* are found growing on the ridges of the Coast Range Mountains under similar conditions to the preceding group.

L. columbianum is found growing along the coast often associated with *L. occidentale* and under similar conditions.

L. Bolanderi is found in a red iron soil, growing in very thin pine forests or on open tablelands.

These lilies have bulbs that are made up of large closely overlapping scales. The soil in which they grow is not as rich in humus as that in which the

rhizomatous lilies are found, but is well drained. They receive almost no rain in Summer, except a rare thunder shower, and are dependent upon Winter rains for their moisture.

In a period of over ten years, more than a hundred bulbs of each variety has been planted, and with the exception of *L. pardalinum*, it has been the exception rather than the rule to establish these lilies. The usual story is that after planting, the following Summer a good flowering stalk appears, which has been the lilies' last effort. This has also been the case with *L. maritimum*, which in older days, was native here in the city of San Francisco. This is probably due to the fact that the bulbs have failed to make new roots. I have often lifted a bulb and found that no new roots have been produced. Hence, to succeed with these lilies, is necessary to induce new root formation. This past year, a new method was tried, which seems to be successful. The bulbs were potted up, and the pots plunged into the ground, and shaded. The soil was kept barely moist until the rains began. By this method, new roots have been produced in almost every instance. This year, in addition, hormone powder was dusted on the base of the bulbs, and without exception, new roots have been produced.

As for soil, a mixture was made up as follows: For the rhizomatous bulbed lilies, one part leaf mould, one part peat, one part heavy loam, and one part top gravel. This gives an open porous soil. For the other lilies, a mixture of equal parts of heavy loam and top gravel. The bulbs are left in their pots until the flowering stalks make their appearance, then planted in their permanent place in the garden.

Planting all lilies in pots has a number of advantages. The bulbs may be examined from time to time to see if new roots have been produced. If any bulb is diseased it can be destroyed immediately very easily. If new roots fail to appear, then the bulb may be left in the pot, and when the season's growth has finished, the bulb may be scaled, and a new start made from scales.

Why Starve Lilies?

J. C. FOSTER¹ *Taylor*

Ever since lilies have been grown in gardens it has been recognized, and often at considerable cost, that good drainage is by far the most important consideration in getting them to grow. In the past all else has been made subordinate and provided that a soil was well drained no other provisions were deemed necessary, except perhaps the providing of a cool "root run." Lilies planted under such conditions grew and flowered, giving more or less satisfaction according to the standard set by the grower. To my mind, however, there is a nice distinction between cultivating plants and merely leaving them to grow. Many gardeners have not been content to leave lilies to grow at will but have tried by various means to make them give of their best. Of these means fertilizing has been by far the most widely discussed and no phase of lily growing has given rise to more controversy. Although so much has been written about this subject it is still controversial, and since the editor asked for a few ideas with a practical slant I offer this for the consideration of those who would make yet another try.

For many years it was held that lilies did not require a rich soil and that they grew better and lived longer in any well drained soil which was comparatively poor. The late Dr. E. H. Wilson² fostered this opinion in the following words: "Since lilies inhabit the waste places of the Northern Hemisphere it is obvious that they are unaccustomed to rich food. For this reason even stable manure should not be used in their culture and artificial fertilizers are absolutely inimical."

Many others have advised consistently against the application of manure to soil which was to grow lilies on the ground that it either introduced organisms which would attack the bulbs, or that it would make the bulbs fat and soft and easy prey to harmful organisms already in the soil.

These, then, were the opinions of only a decade ago, but Woodcock and Coutts³ in "Lilies, Their Culture and Management," published in 1935, have this to say, "Well rotted manure, both horse and cow, is one of the finest foods provided that it not only never touches the bulbs, but is at least six inches below them, and is well incorporated with the soil, so that the roots do not reach it until they are strong enough to take full advantage of it whilst not so tender as to be hurt by it." G. L. Slate⁴ in "Lilies for American Gardens," published 1939, writes, "Well rotted manure is possibly the most valuable type of organic matter that can be added. It should be well rotted, however, as fresh manure is injurious if it comes in contact with bulbs."

This change in thought acknowledges the necessity for providing a good supply of plant food for plants which are of a perennial nature; in fact it conforms to the general custom in the initial preparation of soil for herbaceous

¹Department of Horticulture, Ontario Agricultural College, Guelph, Canada.

²E. H. Wilson, "Lilies of Eastern Asia," p. 5.

³"Lilies, Their Culture and Management," p. 25.

⁴"Lilies for American Gardens," p. 56.

perennials. But the real problem comes when the plants have been established for some time and have begun to exhaust this initial supply of plant food. It may be observed often that established clumps of lilies decrease gradually in height and vigor, and although virus disease is generally the main cause of this weakening, it is often due to nutritional defects. It is then patent that something has to be done to replace what has been removed from the soil in order to restore vigor, but without lifting the bulbs and starting all over again.

When we consider fertilizing lilies we must naturally do so in relation to their manner of growth. Many lilies produce adventitious roots on the bases of the stems just above the bulbs. These roots, since they are on the stems, are of annual duration only, but it is my contention that their proper functioning is of great value in the production of a vigorous flowering stem. Careful observation of plants prevented from forming this adventitious root system supports this point of view, for they seldom have the vigor which we normally expect from this class of lily. It is also known that when the stems are severed from the bulbs they will continue to live for the remainder of the season supported entirely by the stem roots.^{5,6}

In view of this would it not be feasible to concentrate on fertilizing the soil in the feeding area of these stem roots? It should then be good practice to fork a light dressing of well decayed farmyard manure, or a complete fertilizer, into the top few inches of soil where it would be readily utilized. Such a scheme would be invaluable on light soils for although the drainage conditions meet the requirements of lilies the supply of plant food, nitrogen particularly, is soon exhausted. At the same time this practice should reassure those who may still have qualms about the possibility of bulbs or basal roots coming into contact with manure, whether incorporated in the ordinary manner or placed some distance below them.

It must be borne in mind that although one can expect considerable increase in the height and vigor of the stems during the first year there would be an increased elaboration of food materials for storage in the bulb which would result in a greater number of blooms in the years following.

The idea of feeding lilies through the stem roots is by no means new. Generations of old country gardeners have practiced it in the cultivation of lilies in pots. Professor Palmer has been trying it in his gardens at Vine-land. Mr. Slate⁷ recognized it when he advocated the removal of the surface soil and its replacement with fresh material. It introduces the idea of cultivation to many who bemoan the loss of vigor in the fine clumps of lilies they planted and merely left to grow.

I believe the answer to the question at the head of this article is, "Don't do it, feed them through the stem roots."

⁵Coutts, R.H.S. Lily Year Book, 1932, p. 107

⁶Wallace, R.H.S. Lily Year Book, 1932, p. 107

⁷"Lilies for American Gardens," p. 78.

Lilies in an Ithaca Garden

DONALD SIMMONDS

Photographs accompanying this article picture a much admired *Lilium auratum* var. *platyphyllum* growing in the writer's garden at Ithaca, New York. Such specimens need not be rare if raised in disease-free surroundings. Serving as an illustration of the use of modern knowledge, this lily similarly refutes much of the misinformation widely disseminated by older literature on the genus. Its history and that of other species in our garden may therefore prove of interest.

Purchased in April 1935, the bulb was planted 12 inches deep in ordinary soil to which half a bushel of peat moss was added. Growth and bloom has been as follows:

1935.....	no growth above ground.
1936.....	25" in height, 3 blooms.
1937.....	48" in height, 5 blooms.
1938.....	65" in height, 9 blooms.
1939.....	70" in height, 14 blooms.

The blossoms vary from six to eight inches in diameter. Presumably, further growth may be expected if disease can be kept away. During these five summers, ten bulblets have been formed, detached, and transplanted in two different gardens. All have grown well except those which caught mosaic elsewhere; the oldest should bloom in 1940.

My wife and I became interested in lilies in an attempt to prolong the bulb season from late spring into summer. We tried a few bulbs of *L. candidum*, *regale*, *Washingtonianum*, *formosanum*, *Grayi*, *Brownii*, *speciosum*, *Hansonii*, *Henryi*, *auratum platyphyllum* and *superbum*. Only the last three remain. Efforts to discover why literature then available was so vague and contradictory, resulted in our meeting those working under the Lily Disease Fellowship at Cornell University. These men attributed most of our trouble to mosaic and they were kind enough in May 1937 to inspect what few lilies remained and rogue those showing symptoms of the disease.

Among these were six *L. candidum* which we regard as the original focus of infection and the source of its subsequent spread. It seems that they were rogued too late. Six feet from them grow a lusty *L. regale*, which showed no definite symptoms until 1939, when dwarfing and splitting of the bulb confirmed earlier suspicions of a quite indistinct mottling of the leaves.

Unfortunately, bulblets from it had been mixed, late in 1937, with healthy *regale* seedlings. The following May, mosaic was evident in this planting and in June, adjacent *L. elegans* showed symptoms and were likewise discarded. In May, 1939, a nearby clump of *L. canadense* and, beyond them, *L. Maximowiczii* revealed the infection despite the fact that the offending *regale* planting as well as some Indian Chief tulips had been moved to other locations in the autumn of 1938.

In 1939, *L. Henryi*, close to the new location of the *regale* bulblets, showed mosaic by July. The Indian Chief tulips proved also to be diseased and through failure to rogue at once had by June transmitted it to three surround-



L. H. MacDaniels

Lilium auratum in the garden of Donald Simmonds, Ithaca, N. Y.

ing groups, *L. callosum*, *L. auratum platyphyllum* (a new purchase), and another *L. regale*.

From the original *L. candidum* the infection was carried also to some President Taft tulips only three feet away. They "broke" markedly in 1938 and apparently transmitted it to Tulipa White Giant by 1939. No known susceptible plant was within fifteen feet and this trouble spot seems to have been eliminated.

The foregoing paragraphs fall short of proving a case, since the manner in which the disease spread is supposition. Nevertheless the evidence seems strong enough to warrant drawing certain conclusions. A reference to the chart will indicate this when it is remembered that out of dozens of healthy clumps only the few diseased lilies are shown.

I would conclude, first, that under conditions in our garden and perhaps in other gardens as far north, aphids seem normally to be restricted in their range to an observed twelve feet. At least the virus has been carried no farther in one season. In the New York and Philadelphia region, this would scarcely be true, since the aphid infestation seems much heavier. Second, tulips are dangerous carriers of the virus and under our observation, the symptoms are always distinct. I have not seen in a tulip a doubtful case—they showed it clearly or not at all. In lilies even the expert, at times, may be at a loss in a visual diagnosis.

Our mosaic troubles can be attributed to failure to rogue infected tulips promptly and to careless mixing of healthy and what should have been suspect small lily bulbs. Prior to this year it was not proved that the tulip virus was intercommunicable between lilies and tulips, though some of us had guessed the truth. While the results show to date a continuous spread of the disease, the recognition of these factors may aid more intelligent roguing henceforth. We shall particularly be on watch around the places where infections occurred in 1939. Superficially, the situation looks discouraging but that the disease has travelled no faster is distinctly hopeful.

The escape of our prize *L. auratum platyphyllum* until now may have been more good luck than good management but certain experienced lily growers insist that had mosaic been allowed to rampage unchecked its chance of survival for four years would have been very slim.

Like most amateurs, we are attempting too much. Our 3000 square footage is not adequate for the 46 species and varieties which we are trying to grow. They are so crowded that should an aphid year arrive the pests might carry the virus like wildfire through the entire plantation. We are heroic in our roguing but not, I am afraid, valorous enough to cast out the bulbs among which some symptoms may be expected next year. One precaution that we are trying is to insert between groups of lilies, tall perennials such as delphinium and phlox, in the hope that they will prove a barrier to the insect. In addition, some scores of *L. formosanum* are scattered throughout the garden to serve as a rapid signal of infection. *L. Maximowiczii* might also prove useful for this purpose. We try to destroy all milkweed in the neighborhood. Although many of our iris and narcissus show the typical streaking of mosaic, we do not at present suspect them of carrying a virus damaging to lilies.

Speaking of mosaic detection, it is very difficult to recognize all diseased plants by their appearance alone. *L. auratum*, *formosanum*, *canadense*, *su-*

perbum, and *Maximowiczii* are very easy to diagnose; *L. regale*, *pumilum*, *Davidi* are difficult. Whether the broad lush foliage of the former types shows symptoms more readily than species with thick wiry leaves or whether they are simply more attractive to aphids is hard to say—perhaps both. Certainly species vary in their resistance and their ability to mask it. From the virtual immunity of the *Hansoni-Martagon* group to the susceptible *auratum*, *formosanum* and *Maximowiczii*, there is almost every grade. One could grow only the immune and resistant types and tolerate disease in the expectation that damage would be light. On the other hand, one could try some of our most charming but most susceptible species realizing that while the virus might be more easily controlled through speedy recognition, infections would be fatal. In any case, tulips cannot be ignored in any roguing program since their fleshy foliage seems to be attractive to aphids and therefore conducive to rapid spread of mosaic.

As to other conditions, our soil is a silty, stony loam resting on a yellow gravel subsoil. In 1935, it tested pH8+ and contained considerable lime. Drainage is excellent but moisture retention is poor. Here in the valley, snow cover is seldom present and winter temperatures normally reach 10° below zero. Recent summers have been hot and the driest on record and many local wells have gone dry. So far ours has not and we are able to use some water for the garden. There are no other lily growers within a mile and farmland on three sides.

Late spring frosts are a frequent annoyance. In mid-May, 1938, with growth two weeks ahead of normal, the temperature reached 27°. *L. regale* was ruined and many bulbs split up. *L. Henryi*, *speciosum* and *longiflorum* were also damaged sufficiently to prevent flowering. Most of the others recovered. Frosts this year also caused a great deal of twilight scurrying to cover choice plants but little damage was done.

In spite of dry summers, mature bulbs have come through remarkably well. The current season's bloom was little affected. The chief difficulty lay among seedlings where, despite almost daily watering and protection of cheesecloth covered lath frames, the mortality was high.

The old time bogies have affected us little or not at all. We have no *L. candidum* since mosaic claimed the original stock and therefore have had little botrytis. We have picked off and burned what few leaves of *L. canadense* and *L. superbum* showed it and did not spray at all. A wet season might be a different story. Not yet identified is a leaf tip rot that looks like botrytis and travels from tip to base in segments until the stem is affected. This occurs chiefly in *L. Willmottiae* and has also been observed in many species at the Dominion Experimental Farm at Ottawa, Canada. The only method of checking it that we might suggest is early removal of affected leaves.

Bulb rot claimed four of eight plump *auratum* purchased in the autumn of 1938. Two others succumbed to mosaic. Two remain. Perfect drainage should help us here.

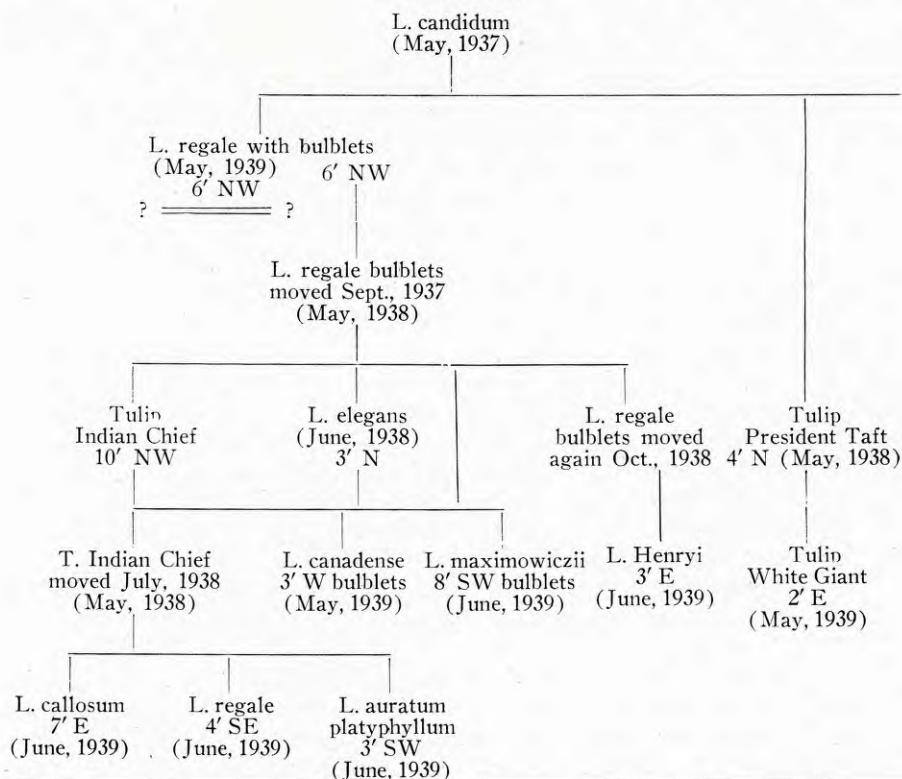
As for the sine qua non of the older books on lilies, “. . . this species requires acid soil and will not tolerate lime,” we have found it untrue. At first I worried about our alkaline soil and looked upon it as our chief problem. Such has not been the case. Except for a little chlorosis in *L. Hansoni*, *canadense* and *superbum*, which decreases each year and is much reduced if plenty

of compost is used, I see no lily troubles here that can possibly be attributed to too much lime.

The other "essential" in old books on lilies was a ground cover of plants. In three gardens I can see no difference in growth between groups of various species where ground cover is and is not grown. We use old buckwheat straw as a mulch partly to keep down weeds and partly to keep the topsoil cooler and moister. We prefer it to peat moss for mulch since it does not cake and shed rain after a period of dry weather. Peat moss is useful to mix with our soil for moisture retention but sifted compost under the bulbs has in several instances produced markedly vigorous growth and we are experimenting further.

Control, if not elimination of mosaic remains the greatest obstacle to success with lilies. It is the one problem that prevents this queen of the garden from becoming as populous as the rose, and the number of varieties as plentiful as the iris. Plant pathologists will add each year to our knowledge of how to combat it, commercial growers may be educated to supply clean stock, but the conquest of the disease in the garden lies in the hands of amateurs. Should mosaic attack our prize lily now, four years of pleasure in it would impel us to continue every effort to guard its young but promising offspring.

CHART INDICATING BY LINES PROBABLE ROUTES OF MOSAIC TRANSMITTAL,
1937 TO 1939



Location in regard to "parent" shown as 6' N = 6 feet north. All removals were at least 30 feet. Symptoms of disease appeared as per dates in parentheses.

The Flowering of Lilies in the Upper Middle South

VIOLET NILES WALKER

The following notes are based on the behavior of liliiums in the small Lily Test Garden of the Garden Club of Virginia. This garden is situated in Piedmont Virginia, about twenty miles from the Blue Ridge Mountains. The soil is heavy red clay, naturally highly alkaline. The hill on which the garden is located has an elevation of about six hundred feet, its general character extremely dry. The extreme fluctuation of temperatures over the past thirty years has been from 20° below zero to 92° in the shade. The winters vary from warm and open to periods of ice and snowbound conditions, though the latter have seemed to decrease somewhat in the past decade. Average frost penetration is from six to eight inches. The summers are almost semi-arid, with unfailing southerly winds.

PART I

Since the success of planned companionships in the flower garden depends on the accuracy of all data furnished, a real hardship is worked when, through lack of dependable information, any one or more members of a given plant group fail to run true to an expected schedule, either in cultural behavior or where the question of seasonal bloom is involved.

Yet such a handicap has long hampered the gardener of the Upper Middle South, particularly when dealing with the great plant families which form the nucleus for garden operations. It is not generally realized how little attention is paid to the differences which exist between this in-between region and the New England States—differences that are very real and often distressingly vital, since members of any given plant family vary greatly in habit under climatic influences, though the transition stage may be imperceptible at a first casual glance.

However, only a brief general survey is needed to show that the great bulk of standard cultural notes are based on the behavior of plants in localities where short summers and long winters, with deep and long frost penetration, are in direct contrast to summers that are double the length and intensity of those of New England, and winters that are short and almost unbelievably variable in fluctuations between light frosts and below-zero temperatures.

Among the questions involved under such conditions, that of dependable data for seasonal bloom in given localities has been the most carelessly handled, and the closest study of available popular horticultural publications offers little aid along this line to the mid-southern gardener, from the coast to the great western mountain system. The most that is contributed to this state of affairs is the infrequent casual statement that climatic differences can be estimated at an average rate of a week to ten days for every hundred miles of latitude.

That this should be true when dealing with the varied material which

goes to compose the general flower border is discouraging enough, but it is the more so when applied to the study of any one particular plant family, such as the rose, or delphinium, or iris, or any other well known group that may be selected as a basis for planning either a garden picture or a flower show. But when the subject involved happens to have suffered a general widespread neglect at the hands of the American gardening public, as has the scale-bulb lily, with only a minimum of understanding of any of its habits or likes and dislikes, any chance for dependability would seem to be well-nigh hopeless.

The happy revival of interest in lily culture in America, and the resultant forming of groups devoted to special study of lily habits have brought many questions into the open, heretofore overlooked, and prominent among them is the need for more particular and dependable knowledge of flowering periods in widely differing localities, not only of lilies but of the flowers that bloom with them.

The establishment of a small Lily Test Garden four years ago by the Garden Club of Virginia, with cooperating collections in each of the member clubs, and the development of the Annual Lily Shows of the Virginia organization have been the first efforts made by amateurs in the Mid-South towards a more intensive study of lily habits for their own section, and already the results of this study are becoming apparent. Important findings as to hardiness and general behavior have been developed, and most of all, as it concerns us at this moment, the records of blooming dates are eye-opening, as may be seen from the brief survey that follows.

It should be borne in mind that up to 1929, when "Garden Cinderellas" appeared, the only available reference authorities for particular details of lily culture in America, such as climatic or soil idiosyncrasies or dates of bloom, etc., were a few brief publications, including the catalogues offering lilies for sale, and the general division of these catalogues by months only, giving a wide fluctuation of thirty days, made this information of no value as a working basis in garden planning. The attitude found on all sides is well summed up in the following sentence occurring in the catalogue of one of our foremost dealers. He says discouragingly, even as recently as 1937, "While there is a multitude of true lilies in existence, only a small number have proven to be successful in the average American garden." Furthermore, the comparatively small number of lilies offered in the majority of catalogues, bear eloquent testimony to the very real handicap met with in the search for information when starting any enterprise with lilies south of Washington.

From catalogues we turn to Garden Cinderellas, which gave the most complete cultural suggestions then offered to American gardeners, and we find that the table of blooming seasons is frankly for New York State, since the records are taken so generally from personal experience in Mrs. Fox's Peekskill garden, and so again we come to an impasse.

The annual Lily Shows of the Garden Club of Virginia have been largely responsible for bringing this question more prominently into the open. Through the cooperation of Mrs. Fox at each of the three shows, definite standards for comparison for early blooming varieties have been established, and the displays that she has sent each year, of lilies blooming at Foxden at the time of the Show, have served to accentuate differences in flowering dates. Moreover, her displays have supplied at the Show the earlier varieties which

have been over in Virginia for many weeks, and have made it possible to show the lily parade from its earliest appearance to the middle of June.

Further valuable comparison was made possible in 1939 through the interest and courtesy of Mr. Kline, who sent by air mail a display of over one hundred stalks of thirty-three varieties blooming at that time in his Oregon gardens. Many of the lilies in this collection had bloomed from three weeks to a month earlier in the Virginia Test Garden, in its Piedmont home, and where represented in the Test Garden Collection at the show were cold storage flowers, and far from being in the perfection of bloom.

From the first week in May to the opening of the Lily Show, June 16th, thirty-four varieties had bloomed in the Test Garden, although only seventeen were actually displayed, since only a few of the earlier ones came through the amateurish cold storage successfully.

The calendar of blooming dates which follows is taken from 1939 notes. Though this season was generally early, following a mild and open winter, only the first lilies were abnormally earlier than the previous year, and by the latter part of May most of them were running true to past schedules, with possibly occasional slight variations of a day or two. The reference dates on the calendar are compiled chiefly from Garden Cinderellas and from "Beauty from Bulbs," the beautiful catalogue of John Scheepers, Inc., and the comparison speaks for itself.

It should be noted that in 1939 several lilies were not represented in the Test Garden display, due to late frosts that caught both May and early June varieties. Among these were *L. pyrenaicum*, *L. Dalhansonii*, and *L. cernuum*, ordinarily blooming in May; and *L. testaceum*, *L. candidum*, *L. Brownii*, and *L. longiflorum*, which appear before the middle of June.

	TEST GARDEN	NEW YORK STATE
May		
9	<i>L. rubellum</i>	June, July
13	<i>L. carniolicum</i>	Not listed
12-30	<i>L. pumilum</i>	Early June flowering
12-30	Golden Gleam	Early June flowering
12	<i>L. Elegans</i>	June-July
14	<i>L. Elegans alutaceum</i>	Not listed
14-20	<i>L. Kelloggii</i>	May-June
20	<i>L. croceum chaixii</i>	Late June - early July
12	<i>L. japonicum</i>	Advised only for pot culture
22	<i>L. dauricum luteum</i>	No date given
22-29	<i>L. Washingtonianum purpureum</i>	June-July flowering
24-29	<i>L. occidentale</i>	Mrs. Fox finds no record of it
24	<i>L. dauricum</i> (the type)	July
24-31	<i>L. Umbellatum</i> Apricot	June flowering
24	<i>L. Martagon album</i>	June flowering
26	<i>L. Roezli</i> , yellow variety	June-July
24	<i>L. Elegans</i> seedlings (home grown)	
28	<i>L. Lillian Cummings</i>	June flowering
29	<i>L. Elegans</i> Alice Wilson	No date given
29	<i>L. Elegans</i> Peter Barr	June flowering
29	<i>L. concolor</i>	July

	TEST GARDEN	NEW YORK STATE
June		
1	<i>L. Duchartrei</i>	July
1	<i>L. Douglas Ingram</i>	Not given
2	<i>L. Parryi</i>	July flowering
3	<i>L. columbianum</i>	July, beginning of August
3	<i>L. Kulshan</i>	Not given
4	<i>L. Hansoni</i>	June flowering
6	<i>L. Shuksan</i>	Not given
6	<i>L. regale</i>	June - July flowering
7	<i>L. rubescens</i>	June - July flowering
7	<i>L. amabile</i>	No date given
10	<i>L. Roezlii</i> —yellow variety	June-July
15	<i>L. longiflorum</i>	May-June, greenhouse and pot culture
18	<i>L. Willmottiae</i>	July flowering
18	<i>L. pardalinum</i> Giganteum	No date given
18	<i>L. G. C. Creelman</i>	Two weeks later than regales
18	A home-grown regale hybrid	
18	<i>L. Maximowiczii</i> —Wada's variety	July to early August
20	<i>L. Davidi</i>	July
July		
1	<i>L. Elegans aureum</i>	No date given
1	<i>L. Princeps</i>	Late July flowering
1	<i>L. pardalinum</i> (the type)	End of June, first half July
2	<i>L. Batemanniae</i>	Early in August
2	<i>L. canadense</i>	End of June to end of July
5	<i>L. callosum</i>	Mrs. Fox says last of July
9	<i>L. superbum</i>	July flowering
11	<i>L. Henryi</i>	August-September
12	<i>L. carolinianum</i>	July-August
12	<i>L. tigrinum</i> and <i>tigrinum florepleno</i>	August-September
12	<i>L. Tigrimax</i>	August-September
19	<i>L. speciosum album</i>	August-September
29	<i>L. speciosum rubrum</i>	August-September flowering

The *speciosums* run over into early August, and the only other lilies blooming in the Test Garden in August are *L. formosanum*, which varies with its location in the garden, and *L. ochraceum*. The latter opened its first bloom August 15th, and its last September 16th, and the individual flowers showed great lasting substance.

Even such a casual survey of this one subject must be eye-opening and, where other cultural procedure is involved, it may easily be realized how many other problems of lily growing in the mid-South are widely different from any yet dealt with by authoritative information.

PART 2

In her comprehensive article "The Lilies at Foxden" in the 1939 Lily Year Book, Mrs. Fox says: "One of the most pleasurable phases of gardening

is the possibility of painting pictures with living plants. Such a picture is never static, and is never finished, for it changes as the bulbs, shrubs, and trees grow, flower, and fade," to which might be added "and as the locality changes."

Close study of this article affords sound general suggestions for companionships in the flower borders between herbaceous perennials, bulbs, shrubs, and lilies. These companionships, as far as they go, are generally adaptable to any north temperate climatic conditions, since, for the most part, the garden procession follows the same relative route up to a certain period.

But two important factors appear which together affect the garden display in the Middle South, varying the picture, and widening the scope of the display. One of these is the length of the southern summer; the other is the possibility of using garden material ordinarily classed as half hardy, or even tender, but which can be treated as hardy south of the Potomac.

The first of these, i.e., the length of the Southern summer, was long overlooked and only comparatively recently has it come to be recognized that the procession of bloom called mid-summer in the North has finished, from Virginia on south, by the middle of July. And there is a long gap of four to six weeks between this wave and the early autumn bloom, that must be filled in order to preserve the beauty of the garden. To fill this gap southern gardeners have had to search for, and experiment with, more or less new or little used plants, and this has led, among other things, to many important findings in regard to the half hardy material above mentioned.

The Lily Shows of the Garden Club of Virginia have emphasized this fact, and even in the short space of three years the records show an increasing amount of unusual material which, used with the general run of seasonable flowers, will contribute to vary the painting of the garden picture.

Since the painting of the picture is primarily an expression of personal liking, or taste, the notes that follow are only informative as to blooming periods, making no attempt, beyond suggestions, to handle the cultural or aesthetic problems of planting companionships,—for as Kipling says, "That is another story."

First of all, there are several familiar plants, which, like the prophet who is not without honor, etc., offer unsuspected value in flexibility; such as: *Salvia farinacea*, dwarf dahlias, Louisiana irises, *Verbena Aubletia*, etc.

Salvia farinacea, a native of Texas, and not reliably hardy in the North or in England, is a dependable perennial from Virginia south, having one of the longest seasons of bloom in the entire category of plants. It begins in mid-May and carries on vigorously until frost, and its beauty of form and color, together with its ease of culture (for it needs almost no attention), make it a most desirable neighbor for choosy plants such as the scale-bulb lilies, whose chief desire in life is to be let alone. With its long blooming period this salvia can serve as ground cover and companion for many varieties of lilies, from the low *Elegans* varieties, including *L. Elegans* Alice Wilson and *L. Elegans* Peter Barr, or *L. concolor*, or *L. longiflorum*, and many taller varieties in succession, such as *L. Lillian Cummings*, *L. Roezli*, *L. Maximowiczii* Wada's variety, *L. Davidii*, *L. Princeps*, with its parent *L. regale*, and the *speciosums*. One small *L. speciosum* bulb left from another group and planted four years ago beside a clump of *Salvia farinacea* has flourished and increased, and forms the nucleus for a varying group of August bloom.

Another fine salvia, little known in this country, though extensively used in parts of England, and which is probably a tender perennial north of Washington, is *Salvia uliginosa*, a native of Brazil. The flowers are what we think of as pure blue with no tinge of grey or purple, and the foliage a deep green. The plants grow four to five feet, and while with spreading root habit, are not dangerous. The bloom starts in early June, continuing till after early frosts. As a background for medium tall lilies, or for grouping with tall *formosanums*, this salvia is an admirable companion, grateful for the water the lily likes when coming into bloom, and yet able to stand considerable neglect. *L. tigrinum* has grown happily and effectively with it for many years.

The dwarf dahlias, single or double, are valuable and flexible subjects, not only for colors and plant forms, but because they need so little cultivating care, and because they start to bloom as early as the third week in May, continuing until hard frosts. In the garden at Woodberry Forest, after their form and color have definitely shown themselves, they are left undisturbed until their increase demands separation, which is about every three years. The Coltness hybrids and others are raised from seeds sown in March, put in a cold frame till they show the color and character of their bloom, then lifted, in full flower, and planted deep in their permanent place. Color schemes are then built around them. Since the Elegans group as well as *L. longiflorum* will flourish under the same growing conditions and exposure, the possibilities for interesting combinations in dwarf planting are many and varied.

Any lilies blooming after the third week in May can be grouped with *Verbena Aubletia* as a ground cover, and as any of its shades are pleasing, it offers quite a choice of color combinations. From Piedmont Virginia south, this verbenas is hardy enough to offer one solution of the ground cover problem.

Strange to say, two such widely differing subjects as the Louisiana iris and some lilies can be grown together. While the iris may not attain the fullness of their swamp-home beauty when grown with herbaceous perennials, they bloom reliably and well, increase rapidly from division and seeds, and accept the garden conditions under which dahlias, chrysanthemums, or any ordinary annuals and perennials flourish. Interesting color combinations should be possible for the experimenter, with the lovely copper or china blue tones of the iris, and any sun-loving lilies of varying height.

Jasminum floridum, one of the choicest summer blooming members of the jasmine family, is another semi-tender plant that should be much used in the Middle South with lilies. The small yellow, deliciously fragrant, star-like flowers are borne in long graceful sprays and bloom profusely for many weeks from the middle of May, and sparingly the rest of the summer. But even without the bloom, the general character of the shrub puts it in the front ranks of desirability. In size, not over three or four feet tall, but spreading gracefully over four to five feet, with deep green stems and small shining evergreen leaves, it is an ideal shrub around which to make groupings of June and July blooming lilies.

Among effective ground covers for dwarf lilies in the rock garden we have *Nierembergia hippomanica* and a most interesting variety of dwarf winter annuals, such as the beautiful blue *Collinsia verna*, *Silene pendula*, in a fine salmon pink, several of the California annuals, as *Collinsia grandiflora* and *Collinsia bicolor*, *Phacelia campanulata*, *Phacelia Parryi*, etc., all of which

bloom so rampantly as to make strong splashes of color from which *pumilum*, *cernuum*, and *concolor* rise as brilliant accents.

Where no color prejudice exists, a display of oriental richness can be had by using together *Delphinium chinense*, some of the dwarf late May lilies, and *Cuphea miniata*, one of the most gorgeous of all red flowers. The crinkled clear cherry-red flowers, with a touch of brilliant blue purple at the throat (a true fuchsia-like combination) are borne in greatest profusion on fifteen-inch bushy plants. Seedlings started in early March in cold frames begin blooming May 15th, and continue with no care till heavy frosts.

Although there are many questions, such as soil conditions, acidity, alkalinity, climatic differences, etc., that are yet to be solved, there is a host of material that will fit in dependably and effectively with the scale-bulb lilies, needing only an investigating and inquiring mind. And though the information available for lily culture for mid-southern gardeners is as yet in its infancy, the interest is growing rapidly, and each year sees a definite advance, not only in the planting of more varieties, but in an enquiring spirit as to the problems which confront the gardening world with this tantalizing but much-to-be-desired garden asset.



L. H. MacDaniels

Lilium Brownii, West Hill, 1937

Lilium x Princeps (Wilson)¹

ISABELLA PRESTON

Division of Horticulture, Central Experimental Farm, Ottawa, Ont.

The first plant to bear this name was a chance seedling which appeared in 1916 in the plantings of Messrs. R. and J. Farquhar at Roslindale, Mass. The late Mr. E. H. Wilson saw it and described it in his book "Lilies of Eastern Asia." This plant has been lost.

The object of this article is to tell the history of the lilies generally known as *L. × Princeps* in Canada, the best of which for general garden purposes is the variety "George C. Creelman" (Patterson).

The late J. W. Crow was Professor of Horticulture at the Ontario Agricultural College, Guelph, and I worked under his direction. He was interested in lilies, and a collection of several species was obtained and grown in a greenhouse. The first bulbs of *L. regale* flowered in 1914 and those of *L. Sargentiae* in 1916. They were bought from R. and J. Farquhar, Boston, Mass. The following is the history of the hybrid as far as is known.

1916. A cross between *L. Sargentiae* (female) and *L. regale* (male) was made. Three seed pods formed. Seeds were sown in the greenhouse.
1918. Young bulbs planted in cold frame. No record was kept of the number.
1919. The bulbs bloomed. (Probably this fall six small stem bulbs were given to Mr. H. L. Hutt, Georgetown, Ont.)
1920. The bulbs bloomed and were photographed. They were considered to be all alike or at least to show such slight differences as to be unimportant.
1921. Three or four original bulbs (probably from end of row) were taken by Mr. Crow and planted in the garden of Mrs. Stickney, Forbes Ave., Guelph, in the spring of this year.
1923. Mr. Crow took three bulbs from Mrs. Stickney's to Simcoe, where he then resided. These were kept under numbers 1, 2 and 3. Numbers 1 and 2 were later considered to be identical and not so good as number 3. This last was distributed by Mr. Crow first as *L. × Sargale* and then as *L. × Princeps*. Numbers 1 and 2 were sold in mixtures with seedlings of *L. × Princeps*. In August of this year, Prof. MacLennan of the Horticultural Department sent an application to the Canadian Horticultural Council to have the name "George C. Creelman" recorded as the name of the lilies growing at the College, the idea being they were all alike.
1924. Mr. Robt. Patterson obtained one bulb from Mr. Oliver Stickney in the fall of this year. In a letter dated September 23, 1939, he says "All the stock we have sent out as 'George C. Creelman' was grown from bulblets. We never used seed or scales." Prof. MacLennan gave Mr. Patterson permission to call his plant "George C. Creelman."

¹Contribution No. 544 from the Division of Horticulture, Central Experimental Farm, Ottawa, Ontario.



Isabella Preston

Lilium × *Princeps* var. *George C. Creelman* (*Patterson*) growing at Central Experimental Farm, Ottawa, Canada, 1934.

1923 or 1924. Mr. R. L. James, Mt. Pleasant, Ont., on leaving the Department where he had been foreman of the flower garden, was given one large bulb from the stock at the College. He told Prof. Crow that when he planted the bulbs from the cold frame to the flower border, there were eight large bulbs.

1927-28. It was brought to the attention of the Canadian Horticultural Council that the name George C. Creelman was not suitable for a group of lilies, so it was resolved "That the lily now registered with the Council as George C. Creelman should be recorded and registered as *Lilium* × *Princeps* George C. Creelman and that other seedlings of this hybrid which are sufficiently different from 'George C. Creelman' should be given other varietal names." The number of bulbs distributed by the College under this name is not known to the writer. The variety now known in commerce in the United States, Canada and Great Britain as "George C. Creelman" is the clone which Mr. Patterson has. This is not the same as those at the College.

1939. Several members of the Lily Committee visited the College in July and saw the three (?) groups of *L. × Princeps* growing there, and also the plantation at Mr. H. L. Hutt's at Georgetown. The clone he has is quite distinct from Mr. Patterson's and has proved a useful flower for the florists' trade. He has suggested the name "Crow's Triumph" for it.

Figure on page 49 shows a snapshot taken in Mr. Patterson's garden in 1929 of *L. × Princeps* var. George C. Creelman. The sturdy habit, long leaves and symmetrical head are easily seen. The outside of the buds is dark brown turning paler as the flowers expand. The inside of the bloom is white with a yellow throat. The anthers and stigma are brown. The leaves are long and drooping, and clothe the stem from base to flower stalk. Four to five feet is the average height of well grown plants. There are no bulbils in the axils of the leaves.

The Cultivation of Lilies

DR. L. HORSFORD ABEL

In the fall of 1917 I purchased three small bulbs of *Lilium regale* and planted them in a cold frame. These increased until I had fifty large bulbs, but none of the plants were ever taller than two and one-half feet.

In 1931 bulbs of Crow's Hybrids, Crow's Princes and Davmottiae, were added to the collection and planted in a rich mixture of garden soil, humus, bone meal, sheep manure and sand made up to a depth of fifteen inches. The bulbs were surrounded with sand when planted.

In spite of instructions in lily books not to plant lily bulbs near manure, these plants grew four feet high and bore three to five flowers. They improved each year until all but one was destroyed by virus disease. This plant still grows seven feet high each year and has shown me the desirability of fertilizing lilies.

Trenching is the best method of preparing a lily bed. My lily beds are thirty feet long by two and one-half feet wide and eighteen inches deep. In the bottom of this trench is placed five inches of two-year-old cow manure, above this five inches of a mixture of soil, shredded cow manure, humus, bone meal and sheep manure. The next eight inches is a mixture of soil, bone meal and humus. The bed when finished is raised four inches above the level of the ground. Into each bed goes three-quarters of a yard of cow manure, fifty pounds of coarse bone meal, three-quarters of a yard of humus, one hundred pounds of shredded cow manure and fifty pounds of sheep manure.

Lilies are successfully planted among perennials by digging holes eighteen inches deep and eighteen inches in diameter. The soil in the bottom is loosened. Ten inches of good garden soil mixed with three quarts of humus, one quart shredded cow manure, one pint of sheep manure and one cup of bone meal is placed in the hole. To the top eight inches of soil are added three quarts of humus, one cup of bone meal. The top of the bed is rounded up above the level of the ground. Lilies planted in this soil mixture will not need fertilizing for two years.

The soil in my garden is ideal for lilies, sandy with a layer of sand two feet below the top soil. A heavy soil should have sand added to improve the drainage.

The lily beds are prepared in August to allow time for the soil to settle. In a bed thirty by two and one-half feet I plant three rows of bulbs ten inches apart in the row. In the prepared spots among the perennials I plant three or four bulbs, depending on the size of the plant. The largest Regal and Princes bulbs are set five or six inches deep to the top of the bulb which is surrounded with sand. This depth is sufficient for the development of stem roots.

Lily growers do not agree as to the advisability of fertilizing lilies. I have successfully fertilized a colony of five bulbs of *L. Henryi* every fall for many years with ten quarts of shredded cow manure. This fall there were twenty-seven stems six feet tall.

The white lilies receive a 5-10-5 fertilizer, the first application consisting of a tablespoonful for each stem when they are three inches high; the second another tablespoonful about ten days later. The fertilizer is worked into the soil about six inches from the stem, being careful not to get any on the leaves.

If the soil is dry it is soaked with water after each application of fertilizer. Too much fertilizer should not be applied or trouble may result.

It is important that lilies have plenty of water during the growing season. The soil should not dry out at any time and in dry weather should be soaked with water every ten days until blooming time. The water is applied by letting it run slowly from the end of the hose for several hours at a time until the ground is thoroughly soaked without wetting the foliage.

It is important to spray lilies for aphid which are virus carriers and to prevent *Botrytis*. The first spray is applied when the shoots are four inches high and consists of Bordeaux and Black Leaf 40, or one of the rotenone preparations. After this the lilies are sprayed every week or ten days until the last of June, after which only the rotenone or Black Leaf 40 is used every ten days until September. From then until October I use Bordeaux and rotenone. The under side of the leaves as well as the upper surface should be sprayed. If July and August are wet months the Bordeaux spray must be used to prevent *Botrytis*. This extra spraying will be rewarded by keeping the foliage healthy until frost, thus developing a larger bulb for the following year. Spraying also reduces the aphid population and reduces the rate of spread of mosaic.

I have had good results from the use of a salt hay mulch applied to a depth of two inches after the ground freezes. It is removed in the spring just as the shoots are coming through the ground. Maple leaves are too wet and soggy for a mulch.

Lilies are best planted in new ground or where they have not previously been grown for five years.

Mosaic, a virus disease, is the worst enemy of lilies. In 1934, after a visit from Dr. Stout, I removed and destroyed seventy per cent of my lilies because of mosaic and started again raising my bulbs from seeds. Today I have several thousand bulbs. As soon as a plant with virus is discovered it is removed and destroyed. A plant with mosaic should be destroyed, regardless of how good it may appear.

Most of the *Elegans* and *Umbellatum* lilies in the trade today are infected with the lily mosaic virus. It is advisable to start with these lilies by raising them from seeds and thus have them virus free. *L. tigrinum* masks the symptoms of mosaic and should not be grown with other lilies. *L. Hansonii*, *L. Henryi* and the Backhouse hybrids are most resistant to mosaic.

SUMMARY

Lilies should be planted in new soil.

The soil for lilies should be prepared early, August, if possible.

The bulbs should be surrounded with sand when planting them.

The plants should not be permitted to dry out during the growing season.

It is not advisable to dig in the soil near the bulb until the shoot is up or it may easily be injured or broken off.

Spraying should begin early and be continued through the summer.

All plants infected with mosaic should be dug and destroyed.

During the growing season clean up and destroy dead leaves and stems.

All dead leaves and stems should be cleaned up and burned in the fall.

A mulch of marsh hay should be applied after the ground freezes. In the spring this mulch is removed as the shoots begin to come through the ground.

A Note on the Germination of *Lilium Candidum* Seed

LELA V. BARTON

Various growers have reported that seeds of *Lilium candidum* are erratic in their germination behavior. Apparently neither fall nor spring plantings can be fully relied upon to give satisfactory seedling stands.

A supply of fresh seeds of this species were received in this laboratory from George L. Slate in October, 1937. A series of preliminary tests were begun to determine whether there were special temperature requirements for germination. Seeds were mixed with moist granulated peat moss and placed in ovens at controlled temperatures. Constant temperatures of 59°, 68°, 77°, and 86° F., and daily alternating temperatures of 50° to 68° F., 50° to 86° F., 59° to 86° F., and 68° to 86° F. were used. In the case of daily alternation, the cultures were left at the lower temperature for sixteen hours and at the higher temperature for eight hours each day.

The results indicated a rather specific temperature requirement for germination. Seventy-four and 66 per cent germination were obtained at constant temperatures of 59° F. and 68° F. respectively. No seedlings appeared at constant temperatures of either 77° F. or 86° F. Some germination took place at the daily alternating temperatures: 48 per cent at 50° to 68° F., 48 per cent at 59° to 86° F., 10 per cent at 50° to 86° F., and 6 per cent at 68° to 86° F.

On November 16, 1937, duplicate lots of one hundred seeds each were planted in soil. Greenhouses at 70° F. and 55° F. as well as mulched and board-covered cold frames were used. In the greenhouse at 70° F., 60 per cent seedling production was obtained and 86 per cent of the seeds produced seedlings in the 55° F. greenhouse, within a month after planting. In the cold frames, however, only 5 per cent of the seeds germinated the following spring.

Further tests made on this same seed lot in January, March, April, May, July, August, and October, 1938, showed similar germination responses. Since the seeds were stored open in the laboratory, no special conditions were necessary to preserve their vitality for a year.

In short, the data indicate that the erratic behavior of *L. candidum* seeds is probably due entirely to their specific temperature requirement. Consequently, a fall planting in a greenhouse which was too warm or a spring planting when the temperature was too high would be equally ineffective in producing good seedling stands. Fall planting out-of-doors also seems undesirable in this region, since the seeds do not require low temperature pre-treatment for germination and many of them rot before spring.

Seeds of *L. candidum* may be sown with success any time within a year after harvest if a temperature not lower than 50° F. or higher than 68° F. is provided. Fifty-nine degrees F. appears to be optimum for their germination.

The Origin of *Lilium* x Maxwill

F. L. SKINNER

It is now widely known that there has been some controversy regarding *Lilium* Maxwill during the past year or two. As some observations I have recently been able to make in our test plots lead me to believe I have been mistaken regarding the identity of the seed parent of this hybrid I am taking the opportunity of telling the complete story of the Maxwill Lily.

Over twenty years ago I secured some lily bulbs under the name of *L. pseudo-tigrinum*. This lily did fairly well under our Manitoba conditions and when a number of years later I was successful in flowering *L. Willmottiae* I took the opportunity of crossing the lily I had under the name of *L. pseudo-tigrinum* with it in the hope of combining the stiff stem of the *L. pseudo-tigrinum* with the extremely graceful flowers of *L. Willmottiae*. In making this cross *L. pseudo-tigrinum* (as we shall call it) was used as the seed parent. As I already had experience in plant breeding work, the usual precautions of emasculating the flowers to be used as seed parents and protecting them with paper bags were taken and one pod developed and produced some fertile seeds. These seeds were ripened under glass and sown in a flat as soon as ripe in the late fall of 1928.

As the hybrid selection came even nearer my ideal than I had hoped for, I decided to name it and, finding from Wilson's "Lilies of Eastern Asia" that three lilies had borne the name of *L. pseudo-tigrinum*, I set to work to see if I could determine which of these I had used in my work.

I found on page 82 of Wilson's book that *L. Davidi* is described as follows, "Leaves numerous, densely crowded, . . . linear oblong, 8-12 cm. long, 3-4 mm. wide" and "This species is distinguished by its . . . prominently 1-nerved leaves . . . It is stem rooting and usually the culm rises erect from the bulb." Now my *L. pseudo-tigrinum* always has leaves over 4 mm. wide, the leaves are not crowded, and the stem usually wanders some distance underground before appearing, and as will be seen from the illustration resembles plate XI of Wilson's work much more closely than plate XIII.

Now turning to page 71 of "Lilies of Eastern Asia" under *L. Leichtlinii* is the statement, "Fruit not seen" and on page 72 under *L. leichtlinii Maximowiczii*, "The underground stem, dotted at intervals with small bulbs, wanders more or less horizontally for 6 to 18 inches before emerging from the ground." Nothing is said to denote the shape or size of the fruit, and I therefore came to the conclusion that with its wide and scattered leaves and underground stems the lily I was growing under the name of *L. pseudo-tigrinum* was really *L. Maximowiczii* and its hybrid was therefore named *L. x Maxwill*.

Since then I secured some seeds under the name of *L. venustum*, said to have been collected in Korea; from these seeds I have raised a rather varied lot of lilies growing from 3 to 7 feet high and flowering from late July until September. Some are quite smooth, some heavily covered with white tomentum but all with fruits 2 inches or more in length, cylindrical in shape, and not more than $\frac{1}{2}$ inch wide. In 1937 I succeeded in getting some hybrid seeds of this lily and some of the hybrids from this seed flowered and fruited during the past season, and while some of the fruits were typical of the seed

parent others were much shorter and wider, and like most lily fruits the seeds in which are not all fertile, rather distorted.

During the past season I have also fruited lilies that I received from two other sources under the name of *L. Maximowiczii*. These also have long narrow cylindrical fruits and other characteristics that show their relationship to the lilies I have grown under the name of *venustum*.

Lilium Davidi and *Willmottiae* with me have fruits that are distinctly lobed, always less than 2 inches long and more than $\frac{1}{2}$ inch wide. *L. "pseudo-tigrinum"* is quite sterile if left to itself and the few fruits I have secured are quite short and more or less lobed. In this they resemble my new hybrids of *L. Leichtlinii Maximowiczii* (*L. venustum*) than either the true *L. l. Maximowiczii* or *L. Davidii*.

Judging from the above therefore I now believe that the seed parent of *Lilium* \times Maxwill was either a very extreme form of *L. Davidi* or a hybrid between that species and some form of *L. Leichtlinii Maximowiczii*.

Glass Wool Mulch for Winter Protection of Seedling Lilies.

Seedling lily bulbs in the seed flat are shallow rooted and easily heaved out of the soil by alternate freezing and thawing. The trumpet lilies, *L. regale*, *L. formosanum*, *L. Sargentiae* and others are not fully hardy and need thorough mulching while young to ensure safe wintering.

For several years the writer relied on wheat straw, easily obtainable in central New York, for a winter mulch in the cold frame. Hay has also been used. These materials provide good insulation and are inexpensive, but have two serious faults. Many young plants of wheat and grass spring up in the seed flats and increase the labor of weeding. The most serious fault is the attraction they offer to mice which are attracted by the seeds in the mulch and may destroy many of the seedling bulbs.

As soon as the virtues of the Corning glass wool mulch had been set forth by Professor R. C. Allen of Cornell University, it was tried in the cold frame. The lilies wintered well under it, in fact, foliage that had not died down when the mulch was applied was still green in the spring. A lot of *L. candidum* seedlings which germinated in late fall and showed only the tip of the first true leaf wintered well under the glass wool mulch. It is doubtful whether such young plants would have wintered well under straw.

Another advantage of the glass wool mulch is that enough light is transmitted through it to prevent the foliage from bleaching if some of the seedling lilies come up before the mulch is removed in the spring. Some lilies start very early in the spring and more than one lot has been injured before the mulch was removed.

Perhaps the most important advantage of all is the fact that mice apparently avoid the glass wool, presumably because the tiny pieces of glass stick in their feet. To one who has witnessed the destruction of many flats of choice lily seedlings this material is a godsend.

GEORGE L. SLATE.

Hybrids of *L. Dauricum Wallacei* and *L. Dauricum Venustum Batemaniae*.

One of the objects of the writer's lily breeding project is the production of hybrids of *L. dauricum venustum Batemaniae* possessing the beautiful apricot color and late blooming habits of that lily, stocks of which are probably completely infected with mosaic. This variety was crossed with *Wallacei*, another variety of *L. dauricum*. *L. Wallacei* has erect, reddish orange flowers spotted with brown, is low growing, lacking vigor and not flowering very freely. Its hybrids, of which a population of about forty were flowered, were vigorous plants, the best of which were three feet or more in height with sturdy stems well clothed with foliage. The flowers of all were very uniform, closely resembling those of *Wallacei*, the seed parent. The plant shown on page 57 is considered an attractive and worthwhile lily by those who have seen it. It flowers in mid-July at Geneva, N. Y. Propagation is by scales and bulblets from the base of the stem.

This hybrid has been used successfully as a pollen parent on *L. tigrinum* and *Batemaniae*, but the seedlings have not reached blooming age. Seedlings from crosses with its sister hybrids are also being raised with the hope that among them will be some of *Batemaniae* type.

GEORGE L. SLATE.

The Culture of *Lilium Formosanum* and *L. Regale* in Virginia

Fresh seeds of *Lilium formosanum* from selected plants are sown in April or early May. These germinate in about two weeks and are grown through the first season undisturbed except for weeding. With the soil, a mellow sandy loam, is incorporated equal parts of leaf mold and rotten wood or decayed sawdust. The resulting mixture is thus two parts of soil, one part leaf mold and one part decayed wood. The rotten wood is important to make the soil more acid than it would otherwise be. Most lilies produce larger and healthier bulbs in acid than in neutral or limestone soil.

Seedlings from April-sown seeds frequently bloom in late September of the same season. In late October or early November, the bulbs, which by then are the diameter of a nickel, are lifted and buried in leaf mold in mouse-proof containers. They are fully hardy.

In late February or early March they are set in soil heavily dressed with leaf mold, rotten wood or sawdust. My lilies have never been troubled by disease or insects and have not needed spraying.

This method is satisfactory with most lilies except *L. regale* and a few others. *L. regale* is better if undisturbed.

No fertilizer is used, only leaf mold and rotten wood. Lime manure and commercial fertilizer mean trouble for the lily grower.

I have done some breeding and selecting with these lilies. Among my first plants of *L. formosanum* and *L. regale* which were of the usual type were



L. H. MacDaniels

Lilium dauricum Wallacei \times *L. dauricum* venustum Batemanniae,
Geneva, N. Y.

a few with flowers of heavier substance, larger size, ruffled petals and more exquisite texture. The more promising were crossed with each other and a seed crop produced. Some interesting results were obtained, but a second and third generation are needed to determine their extent.

Some of the resulting plants had strong stems seven feet high and able to withstand any summer storm. Many of these stems bore as many as eighteen immense trumpets. One plant of *L. regale* developed forty buds of which only twenty-five were allowed to open.

Theron J. Liskey.

Cheesecloth Houses for Lily Culture

It is explained more fully elsewhere in this Yearbook that the only bulbs which can be guaranteed to be mosaic-free are those which have been individually indexed and found healthy, or those which have been grown from seed in isolated plots. Individual indexing is a useful method for the plant pathologist but it is not practicable for the average gardener. Available stocks of seedling grown isolated bulbs are at the present time limited to a small number of bulbs of a very few species.

The presence of virus disease in practically all available stocks of lily bulbs presents a real problem to the lily grower who wishes to enlarge his collection of plants by bulb purchase. In order to maintain and increase interest in lily culture it probably is not advisable for gardeners to delay their endeavors until the time when adequate supplies of disease-free commercial stocks are available on the market. The question then arises as to how to foster interest in garden lilies until such time that the producer of disease-free bulbs gets started. One possible answer to this may be found in the article, *Living With Lily Mosaic*, elsewhere in this book.

Another partial solution may be found in the use of a cheesecloth cage for growing certain lilies. This provides a means whereby diseased and healthy lilies can be grown in close proximity since the insect carrier of the virus is excluded. Dr. K. D. O'Leary in 1934 first adapted this idea, already in use with asters, to lily culture at the Boyce Thompson Institute.

Such cages have proved especially useful for the plant pathologist and for lily breeders as well. Lily hybridizers who wish to keep diseased stock for seed or pollen production without endangering their healthy seedling stocks may find a solution to their problems in a cheesecloth cage.

Gardeners who grow only virus-free lilies in their gardens but who at the same time would like to have some of those bulb-propagated species of which no healthy stocks are readily available, such as *L. Sargentiae* or *L. dauricum* var. *Batemanniae*, may overcome their difficulties by keeping all the diseased plants under cheesecloth. If the grower is specializing only in the mosaic-tolerant group of lilies in his garden but would like to have a few of the mosaic-susceptible types such as *L. auratum*, *L. formosanum*, *L. cernuum* and others for cut flowers or for other purposes, he can do so by keeping the healthy but susceptible ones under cheesecloth.

A third use for the cheesecloth cage is as an isolation or quarantine station where purchased bulbs may be grown under observation for a season or

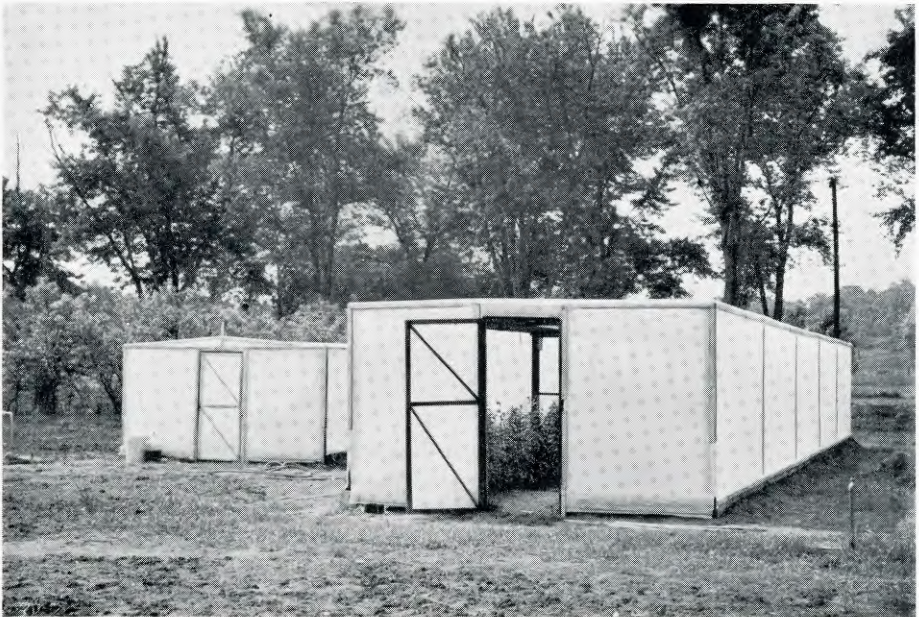


Figure 1, exterior view. Figure 2, interior view of cheesecloth lily houses.

two before being planted in the garden with the healthy bulbs. This use is greatly limited because all but a few species of lilies, such as *L. auratum* and *L. formosanum*, are apt to mask their disease symptoms under certain conditions and thus be difficult to rogue. This usage for a lily cage is not to be recommended except in the hands of the trained expert and even here it has its limitations.

The very small size of the insect vector, *Aphis gossypii* Glover, requires the use of a fine mesh cheesecloth. Aster cloth is far too coarse to exclude this insect. A 32 x 36 or 30 x 34 mesh cheesecloth has excluded winged forms of this aphid and has been used successfully for several years for lily cages such as are seen in Figure 1. The cloth should not be expected to last more than one season.

Size and type of frame construction can be varied widely to suit individual needs. Construction need not be as permanent nor as rigid as is shown in the interior view, Figure 2. Aster tent designs, available at most florist supply houses, can be adapted for use in building the lily cage but, because of the different nature of the insect involved, more attention must be paid to closing all seams, joints and small holes than is called for in aster tent construction.

The cloth must be applied to the frame before the aphid appear in the spring. This date will vary from season to season and from one locality to another. In the New York City area May 10th has been found to be sufficiently early.

It should be borne in mind that the cage method of insect control is by no means a cure-all. Too many gardeners are inclined to build the cage and consider their aphid and mosaic troubles at an end for the remainder of the season. They are quite likely to find themselves worse off than with no cage at all as a result of their neglect. Aphid occasionally find their way inside the lily cage either through an opened door, improperly closed seams or joints, or on the clothing of workmen. They may also be carried in by ants through tunnels under the baseboards. Once inside they may become more numerous than they do outside because their natural enemies are excluded and cannot hold them in check. Regular spraying with nicotine sulfate inside the cage is to be recommended.

Light intensity inside the cage may be reduced to 75% of what it is outside but no harmful results have been noted. Air movement is reduced by the cheesecloth and in periods of high humidity the *Botrytis* blight disease may be slightly worse inside the cage than outside. This fact makes it important that a regular bordeaux spray program be followed inside the cage as well as outside. Bordeaux spray, 4-2-50, can be combined with the nicotine sulfate, 1-300, and both given as one application. Since this weekly or bi-weekly spray schedule should be followed anyway, the cage adds little additional spraying expense. The gardener who is not prepared to take the necessary precautions with cage culture of lilies will do well not to attempt to grow lilies by this method. Those who recognize the limitations of the method and act accordingly will find it a very useful means of extending their adventures in lily growing.

E. P. IMLE.

Boyce Thompson Institute for Plant Research, Inc., and
Cornell University



L. H. MacDaniels

Yellow form of Lilium canadense.

Experimenting With *Lilium Superbum*

VIOLET NILES WALKER

The statement is met with, not infrequently, that *Lilium superbum*, while a swamp lily, flourishes equally as well in ordinary garden conditions as in its native habitat, and it was on the strength of this that I first attempted to grow it in a spot that I had always thought was diametrically opposed to its needs and demands. So it was no surprise, after having grown a few for several years in my garden, among the general run of herbaceous perennials, annuals, and a number of varieties of lilies that go to make up a full flowering procession, to find, as I expected, that *Lilium superbum* was far from happy in its surroundings.

The plants were free from disease, but their development was most unsatisfactory. Though they made a dependable bloom each year, they never attained a height of more than 4 to 5 feet and the bloom was indifferent in quality and color. That they received from visitors who knew nothing of what they should be a degree of enthusiastic admiration did not in the least compensate for what I knew was their very poor behavior.

About four years ago, the gift from a friend of a number of fine healthy bulbs collected from the wild on her several thousand-acre estate in the Southern Appalachians made possible some experiments which I would not have attempted with purchased material, owing to the uncertainty of disease conditions from commercial sources.

It happens that my hillside garden, though small, is so constituted as to offer several distinct conditions of soil, exposure, and drainage. It faces due south, has portions in partial shade, and is located at the top of a ridge which falls steeply to the Rapidan River, about 400 feet below. There is not naturally an inch of level ground, so the fall of the hill must be taken care of by rather narrow terraces, built up with small rock retaining walls, varying from 18 inches to 2½ feet in height, and for ordinary purposes this provides excellent drainage. The sub-soil is a heavy, tight, sticky red clay which has to be drastically handled where special drainage is required. In many parts of the garden this has had the necessary under-treatment, but in other places the flower beds have been built up without digging out the sub-soil and supplying the needed rubble or cinders. So that the little garden really runs an unusual gamut, for its size, from good to bad.

In addition, about ten years ago, fired by the examples of a New York State gardening friend, I developed a tiny artificial bog which has been the greatest enjoyment and has provided a means for added experiments. This bog consists of an old iron kettle, 45 inches across and 45 inches deep, sunk to the level of the ground, and its outline well concealed by rocks and planting. In the bottom is placed about 8 inches of crushed stone, above this, 10 inches of heavy red clay, and from there to the top the kettle is filled with real bog muck, most of it brought from the upland bogs of the North Carolina Sandhills, and consisting of leaf mold, sand and sphagnum moss, highly acid in content. A 3-foot iron pipe goes to the bottom, and the bog is watered

through this, semi-occasionally. The only treatment given is an occasional top-dressing of sphagnum moss.

Now for the lilies. They were divided into groups of about eight bulbs each, and planted in different parts of the garden, under various conditions of sun, shade, and soil acidity or alkalinity. The only place I did not think to plant them was in the little artificial bog. All but one group were sunk in wire baskets ($\frac{5}{8}$ -inch hardware cloth) 10 inches deep, 12 inches across and 18 inches long.

For two years the results were carefully watched. The variations in behavior were very marked, between conditions of full sun, partial or deep shade, dry or moist locations, and in the acid or alkaline character of the soil.

Those in full sun, with no special underdrainage, and in the rich but heavy soil, full of lime, were stunted in growth and bloom, and suffered heavily from chlorosis. They evidently will not be long-lived, though most of them are still existing. As the conditions changed to lighter soil, full of humus, more moisture, some shade and sharp underdrainage, the plants improved in size, color and behavior, even with lack of acidity.

The second year all but one bulb of the group that were not planted in wire baskets were eaten by mice, which also demolished a group of *L. pardalinum* nearby but left some *L. Henryi* bulbs untouched. Late in the summer the *L. superbum* bulb was dug, and looking for some spot to place it without disturbing bulbs already growing in the wire baskets, on the spur of the moment it was placed in the little bog garden. This was already so thickly planted that it was hard to find a spot where the lily bulb could be set deep enough, but throwing rules to the winds, a shallow hole was scratched, the bulb laid on a small flat stone, just below the surface, and little more than covered with sand and moss.

The following summer two stalks appeared, one young and one mature. This latter grew to over six feet, with great stout stalk, rich deep green foliage and had eight flowers, rich in color and fine in texture. This past summer, both stalks appeared, one growing six, the other nine feet; both bloomed, one with six blooms, the other with fifteen, and with the same fine foliage and texture of bloom.

The other groups in the garden showed little change from the previous years, so will be moved to other locations for other trials.



L. H. MacDaniels

Shukshan Hybrid Lily, 1937.

The Third Annual Lily Show of the Garden Club of Virginia

The Third Annual Lily Show of the Garden Club of Virginia, held in Fredericksburg, Va., June 14th and 15th, 1939, bore eloquent testimony to the progress made by the Virginia clubs in their pioneer work with the study and development of lilies for the Upper Middle-South.

The Show was staged, as usual, with the cooperation of the American Horticultural Society, the Rappahannock Valley Garden Club of Fredericksburg and the Dolly Madison Garden Club, near Orange, Va.

Through the courtesy of Dr. Morgan L. Combs, President of Mary Washington College, one of the large dining halls in Seacobeck Hall was placed at the disposal of the Show Committee, and the fine architectural features of the room provided a setting of unusual dignity and beauty.

The schedule was divided into two sections: the first devoted to *Liliums*, the second to garden flowers. About 35 varieties of *Liliums* were shown by amateur growers in the lily classes. The specimen classes were divided ac-

cording to the three general forms of liliun—the upturned cup type, the trumpet, or Easter Lily type, and the martagon, or Turk's Cap, the two latter being the best filled, since the early varieties of the cup type had, for the most part, finished blooming before the date of the Show.

In the trumpet and martagon classes there was an interesting variety which included several of the West Coast lilies, well-grown, such as *Lilium Washingtonianum purpureum*, *L. Parryi*, *L. maritimum*, and the Bellingham hybrids, Shuksan, Kulshan and Douglas Ingram. *Lilium Grayi* and *canadense* represented the East Coast group; while the Asiatic and hybrid lilies were represented by *L. Davidii*, *L. Hansonii*, *L. amabile*, *L. cernuum*, *L. Willmotiae*, *L. japonicum*, *L. longiflorum*, *L. Brownii*, *L. regale*, *L. concolor*, *L. tenuifolium*, *L. Golden Gleam*, *L. Maximowiczii* Wada's variety, *L. E. J. Elwes* and *L. Sutton Court*. Of the European lilies only *L. candidum*, *L. testaceum* and the purple and white *L. Martagon* were present.

In the upturned cup classes there were several forms and colors of the Elegans and Umbellatum varieties.

In each section there were classes for arrangements of lilies, both alone and with other flowers under various conditions, such as color schemes, size of arrangements, similar containers, predomination of lilies, and so forth. This offered a wide scope for groupings and comparisons of varieties of lilies, as well as the employment of contemporaneous garden flowers, bringing out original and pleasing combinations of plant material.

Magnolia grandiflora was used many times, often with Regal lilies, and employing bold foliage accents, such as *Eleagnus* branches, *Funkia* leaves, *Prunus Pissardii*, bleeding heart leaves, *Artemisia* Silver King, and so forth.

Gorgeous oriental effects were produced in combinations of yellow and orange lilies, such as *L. Davidii*, *L. Hansonii*, or the various Umbellatum hybrids, with the different blues of delphiniums, ranging through the cool blue of *Delphinium belladonna* to the rich tones of the *chinense* varieties, and combined with Parker's Yellow yarrow, *Asclepias tuberosa*, *Thalictrums*, both bloom and foliage, *Clematis Jackmanni*, *Hemerocallis* of different hues, purple beech foliage, etc.

Regal lilies, *Clematis Jackmanni*, yellow *Thalictrum*, *Clematis recta*, Mermaid roses and *Gypsophila* Bristol Fairy, in a canary pottery urn, drew much attention.

A prize winner was an arrangement of bright blue delphiniums, orange Elegans lilies, yellow *Hemerocallis* and quilled zinnias.

One particularly outstanding exhibit was a large low copper dish with side handles, containing one apricot *Lilium Elegans*, one red *Lilium Elegans*, four yellow *Hemerocallis* and foliage of the purple plum.

The merit system was used in the judging and ribbons were awarded wherever deserved. In addition there were a number of prizes, among them the medal of the American Horticultural Society, the Eleanor Truax Harris Cup, the silver trophies given by the Garden Club of Virginia and Mrs. B. V. Devore, and several other silver trophies, together with a number of prizes devoted especially to furthering an interest in lily culture. Among these latter were lily bulbs, the Lily Year Book of the American Horticultural Society and a complete set of the Lily Year Books of the Royal Horticultural Society.

As at the previous Shows, educational exhibits and non-competitive dis-

plays added interest to the Show. Photographs illustrating sterilities in lilies were loaned by Dr. A. B. Stout from the New York Botanical Garden, and living plants showing the nature and progress of diseases were given through the Lily Committee of the A.H.S., by the cooperation of Dr. S. L. Emsweller, of the United States Horticultural Station at Beltsville, Maryland.

There were three non-competitive displays of lilies. From the Test Garden of the Garden Club of Virginia, at Woodberry Forest, Va., there were seventeen varieties, several of which had been held in cold storage, not over-successfully, but which were included as bearing testimony to their behavior in Virginia. The bulk of these were from young bulbs, some only the first year's bloom, and many of them home grown seedlings, so mature floescence was not looked for. This collection included *L. amabile*, *L. maritimum*, *L. Kelloggii*, *L. Roetzli* yellow variety, *L. columbianum*, *L. martagon album*, *L. Davidi*, *L. Willmottiae*, *L. Parryi*, *L. Lillian Cummings*, *L. Maximowiczii* Wada's variety, *L. pardalinum giganteum*, *L. Washingtonianum purpureum*, and the Bellingham hybrids Douglas Ingram, Kulshan and Shuksan.

The fine display of early blooming varieties sent by Mrs. Fox from her garden at Peekskill was awarded a special honorable mention. It represented the blooming season for that locality and was of added value as a standard of comparison with the Virginia lilies. In her collection were: *L. concolor racemosum*, *L. tenuifolium*, *L. Golden Gleam*, *L. Martagon album*, a collection of Skinner's Umbellatum seedlings, and her own Foxden Hybrid Umbellatum.

One of the high spots of the Show was the magnificent display sent air mail by Edgar L. Kline from his Oregon gardens. Over 100 stalks of 33 varieties of lilies in the fullness of development and beauty created a great sensation. Among these were: *L. tenuifolium*, *L. rubellum*, *L. Golden Gleam*, *L. Szovitsianum*, *L. maritimum*, *L. parvum*, *L. Kelloggii*, *L. columbianum Douglasii*, *L. Bolanderi*, *L. Washingtonianum purpureum*, *L. Martagon album*, *L. Martagon*, *L. japonicum*, *L. concolor*, *L. longiflorum Creole*, *L. cernuum*, *L. Dalhansonii*, *L. Ellen Wilmott*, *L. Umbellatum* hybrids Sappho, Orange King, Incomparable, Vermilion Brilliant and Orange Brilliant, *L. croceum*, *L. dauricum*, *L. Parryi*, *L. Mrs. R. O. Backhouse*, and *L. Elegans* hybrids Alice Wilson, *Atrorubrum* and *Horsmannii*. This display was given an award of merit, justly deserved, not only for the beauty and excellence of the collection, but for the perfect condition in which the flowers arrived.

VIOLET NILES WALKER.



J. de N. Henry

Lilium canadense in a hayfield.

Lilium Canadense

MARY G. HENRY

We have two extremely hardy easily grown lilies native to the middle Atlantic states; one is *Lilium canadense* and the other is *Lilium superbum*.

It is a very simple matter to raise both of them from seed and thus a large number of healthy bulbs are acquired at a minium of expense. These two magnificent lilies should form the basis for every collection of lilies in our part of the world. There are a number of distinct and fine varieties of both of them.

Lilium canadense is found in sunny meadows in both dry and moist soil but it grows to much taller dimensions in the naturally rich moist virgin soil that requires no fertilizer. In such ground it frequently reaches six feet in height. It is also often found growing among shrubbery and in thin woods and in these positions it sometimes grows eight feet tall. The beautiful pendulous bell-like flowers are usually a soft shade of yellow. Inside the blossoms towards the centre are many small dark spots. However, dark forms varying to red occur with considerable frequency.

Sometimes a few dark lilies dot a meadow of yellows and sometimes there are large drifts of them in the deeper shades. To my eyes the typical yellow *Lilium canadense* is handsomer than the red-flowered form.

A portion of last summer was spent by the writer in collecting varieties of this lily. It has a wide range in the Northeastern states, so that it was



J. de N. Henry

*This many petalled form of *Lilium canadense* is very pleasing.*



J. de N. Henry

*An unusual type of *Lilium canadense* in which the outer segments curve inward while the inner segments curve outward!*

necessary to cover a considerable territory between Pennsylvania and the Gaspé Peninsula in the Province of Quebec.

This does not mean that many bulbs were disturbed or taken from their native homes. On the contrary, a conscientious regard for the lilies was observed during the entire trip, befitting an ardent lover of our native flora. Of the many thousands seen and examined, less than twelve bulbs were taken. I found one especially unusual lily in which the three inner segments of the flower recurved while the three outer segments turned inwards. The waved appearance of the latter added much to the attractiveness of the flower. A many petalled lily does not sound pleasing but I think most people would admire the one pictured.

One of each type is enough, for if a lily is distinctively beautiful it is well worth while to propagate it vegetatively and thus in a few years' time a stock can be acquired.

It is a distressing fact that each one of the especially interesting forms of *Lilium canadense* found by the writer on this trip came from open meadows that judging by the stunted growth of the lilies had evidently been cut over for years. The result of this untoward treatment being that the plants were unable to rise above the grasses and bore mostly but one or two blooms per stalk. Many stalks were flowerless.

Alas, in one way and another so many, many of our beautiful native flowers are being destroyed. One wishes fervently that some of the devastation to our native vegetation committed by the C.C.C. boys might be curbed. The P.W.A. and in the south the prison gangs who work on the roadsides are also doing an irreparable harm.

More power to the garden clubs and the excellent work they do. Let us hope and pray that the day may be not too far distant when the floral beauties of our land may be known, appreciated and respected.

Gladwyne, Pa.

Lily Notes, 1939

F. L. SKINNER

This past season will stand out at Dropmore as one of the worst years for lilies we have had. Mild weather in late March gave promise of an early spring but this promise was not fulfilled and cool weather in early April still left enough frost in the ground so that it was difficult to dig shrubs until the last week of that month. The last week of April was unseasonably hot and temperatures of 97° F. in the shade at 12 inches above ground level were registered during that week. This had the effect of starting most plants into growth ahead of their usual time. By mid-May when we had a sharp frost lilies had made much more growth than usual at this time and by June 8th when we had another severe frost most lilies were from one to three feet high. The damage from this frost was very severe and many varieties were quite limp and watery looking after they had thawed out. In spite of this some varieties made a remarkable recovery and even flowered later on. *L. Willmottiae* unicolor was one of those that came back and flowered quite well, though many flowers were distorted and only a few hand-pollinated flowers set seed and the seed pods apparently contain only a few seeds each.

L. Hansonii and Martagon and their hybrids suffered severely and out of several thousand bulbs only a very few flowered while *tenuifolium* and *concolor* varieties were rather erratic, in a few spots flowering fairly well but mostly with distorted and poorly colored flowers.

The new *L. dauricum luteum* suffered less than most and this lily gives promise of being a decided acquisition in the yellow shades; both form and color are good.

The Dropmore hybrids of *L. philadelphicum* fared badly and very few normal heads could be found. By way of contrast both Maxwill and Scottiae escaped fairly well and we were able to get some quite good stems of both to send to "Flowers on Parade" at the New York World's Fair.

Though *L. Henryi* seemed to be rather badly frozen, it recovered and now, September 4th, is finer than I have ever seen it before.

L. Farreri, *distichum* and *tsingtauense* all flowered, through not so well as during 1938.

One of the disappointments of the past season was that few of our own new hybrids flowered and we will have to wait for another year before we can pass judgment on their merits.

Out of several hundred hybrids of *L. tenuifolium* that flowered in 1938 only two were really distinct in form and color and these were two of which the labels bearing their pedigrees had been lost. The balance were merely extremely vigorous specimens of *L. tenuifolium* growing to four or five feet high and bearing 25 to 30 flowers on a stem. The one illustrated flowered during late June (while I was away from home) and the color was yellow slightly shaded orange. It promises to be an attractive and interesting break and I hope to be able to see it at its best next year.

Lilium Cordifolium

HELEN M. FOX

After my three bulbs of the *Lilium cordifolium* had lived through two winters and flowered on our exposed hilltop, it was both pleasing and surprising to read in Woodcock and Coutts that: "it (*Lilium cordifolium*) is a delicate and difficult subject producing its leaves so early that it is liable to be much injured by frost; for this reason it is rather a subject for the cool greenhouse than the open, except in favored districts."

The old bulbs of this lily die back after flowering. Maybe if the coming Winters will not be too severe, when the new bulbs will have grown again the stalks may attain the five or six feet natural to them. The stalks of my lilies only grew eighteen inches high. They can hardly be called beautiful but are welcome because of the sense of triumph from growing something rare and because this lily belongs to the same group as the somewhat difficult *Lilium giganteum*.

When they are young the leaves are reddish and after they spread out they are heart shaped, pointed at the tip, and with entire and sinuate margins. They grow on the stem about four inches from the base and are crowded together but not in whorls. After this first crowding of leaves, the others, which are smaller, are scattered along the stem to the top. The largest leaf on my plants was eight inches long and two and a half inches across at the widest point.

The flowers came the end of July. They are born at the tip of the stalk. On my plants there were only two, but there are supposed to be from six to fifteen. They are trumpet shaped, but with the trumpets not very open, and measure three inches across at the mouth. The lilies are greenish white, and spotted with dark plum. Two thirds of the way down the spotting turns into a solid green blotch. The spotting is barely visible from the outside. The pistils are greenish white and so are the stamens. The flowers have an unpleasant scent.

I read that the bulbs should be planted in positions similar to the one given to the *L. giganteum*, so planted mine in semi-shade and since it was very dry, had been watering the ground under them every night. At first when the flowers opened, I thought the spotting was a splashing of mud from my watering. Perhaps because of the drought the buds remained unopened for an unconscionable long time.

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The American Horticultural Society invites not only personal memberships but affiliations with horticultural societies and clubs. To such it offers some special inducements in memberships. Memberships are by the calendar year.

The Annual Meeting of the Society is held in Washington, D. C., and members are invited to attend the special lectures that are given at that time. These are announced to the membership at the time of balloting.

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