PAEONIA

Volume 10, No. 4 December, 1979

REQUIRED READING –
1. "The Peonies" by John C. Wister, $3.50 from American Peony Society. 250 Interlachen Rd., Hopkins, MN 55343
2. The Bulletins of the American Peony Society.

The PAEONIA is authorized by Miss Silvia Saunders.

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TABLE OF CONTENTS

PEONY SEED GERMINATION

One of the most important challenges in hybridizing peonies is the germination of the seeds and carrying the seedlings on to maturity. Since a minimum of four years is necessary, it is often a problem to keep the crosses properly labeled.

The seeds are gathered when fully matured and are then dried for one or two weeks. In the past we have encountered fungous infections of seeds that are planted before fully matured. The infection first appears on the seed surface and from there penetrates the seed coat and enters the endosperm, then quickly destroys the entire seed.

The matured seeds are planted in flower pots containing good garden loam soil. The seeds are covered with at least one half inch of soil. Since the soil is not sterilized it is moistened with a water solution containing one tablespoon of Chlordane 50 powder (an insecticide) and one tablespoon of Captan (a fungicide) in one gallon of water. The insecticide is used to prevent the development of angle worms in the soil, the fungicide to prevent fungous infections of the seed. A recent article appearing in the American Nurseryman mentioned that Captan interferes with the germination of some seeds. Since this is the first year I've used Captan, I'm not sure of its effect upon the germination of peony seeds.

We use 5½ inch plastic azalea pots which are about the right size to accommodate up to 50 seeds. Each pot is labeled with a plastic label containing the cross number, the parentage of the cross, and the number of seeds. The cross number is placed on the outside of the pot. A notebook is used to record the above information for each cross.

After the seeds are planted and labeled, the pots are placed in a plastic bags, sealed, then held in the furnace room for about three months. The temperature averages between 60 - 70° F. During this period the seeds develop the hypocotyl (primary root) and later the secondary roots grow and permeate the soil mass within the pots. Towards the end of the three month period roots will appear in the drainage holes of the pots. The progress can be further noted by carefully removing the soil mass from the pots and the roots can be seen on the surface of the soil.

At the end of the three month period each plastic bag is opened and about four ounces of clean water is added to the soil. The bags are resealed and the pots are then placed in a frost free cellar where the temperatures are near 0° F. It requires about three months of cool temperatures to break the epicotyl dormancy.

(Cont. on Page 8)

COLCHICINE

Maybe it was eight or nine years ago that Lois and I visited the gardens of Father Fiala. The report of that visit was given so long ago that you'll not remember. The timing was anything but good since he (Father Fiala) had shortly prior to this time bought a 200+ acre farm and was in the process of moving his plant material to this new farm. The peonies were growing and a few were blooming, but this was not his year for a grand display. Surely, if someone was to evaluate the situation now, the report would be different with glowing enthusiasm describing the glorious new peonies he developed.

But this is the point I wish to make. Father Fiala talked about and showed some of his hybridizing work and new developments in the lilac line. Working with colchicine treated lilac seeds and seedlings, strange things developed. Some of his more interesting products were grafted on large established lilac bushes - thus speeding up the process of aging so as to get them to blossom sooner. I was really impressed with his approach to hybridizing.

*Tetraploid, hexaploid, and octoploid plants differ from the standard diploids in ways such as: heavier foliage and flower, greater or lesser fertility and stamina, and possibly could provide new color breaks. The story he me told of the success that a certain lady (maybe a student of Fiala's) had in doubling the chromosomes of the lilac was that she developed, (from the diploid) tetraploids and octoploids, and was now working on one step higher. This she found when dealing with octoploids, the fertility became highly reduced, so that viable seeds could not be obtained easily, if at all. Possibly octoploid is as far as she can go. What interested me greatly was that the plants seemed stunted, and of extra heavy substance. The flowers are small with thick petals. Could we apply this practice or technique on peonies?

*Diploid = 10 chromosomes in each, cell and is fertile.
Triploid = 15 chromosomes in each cell and is usually infertile.
Tetraploid = 20 chromosomes per cell and is usually fertile.
Hexaploid = 30 chromosomes and is expected, to be fertile.
Octoploid = 40 chromosomes and is expected to be somewhat fertile.
Above that anything can happen.

Roy Pehrson used other chemicals in trying to produce tetraploid lactiflora. His attempts were unsuccessful. All treated plants died with the exception of a small piece of '**Petite Rene**', but let him tell his story; Who Can Tell Me?, December, 1973, of Paeonia.

WHO CAN TELL ME?

I have a small start of a plant of the lactiflora '**Petite Rene**' which I have thought to be a tetraploid. This came about when, several years ago, I sprayed the foliage of a few clumps with naphthaleneacetamide and a few others with acenaphthene. In both cases these hormone type materials had been dissolved in dimethyl-sulfoxide.
Now I have a problem. Thinking about this plant, I have got to wondering if it is really a complete tetraploid or just a sectoral chimera. It would take quite a while to prove it out by breeding experiments. I don't really understand the mechanism involved very well. If someone knows of a book which treats on the subject of chimeras pretty well, I should like to obtain a copy for myself.

I have another question in this connection too. Sometimes in digging clump of peonies I may find one which has one or more buds not up in the crown of the plant, but well down below, seemingly right on one of the big storage roots. Are these adventitious buds? Are they derived from outer tissues of the plant? If so, should such a bud develop on a sectoral chimera would a stem arising from it then be completely tetraploid? I would very much like to know or to read some opinions.

- Roy Pehrson

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This is my rationale: If Roy Pehrson could destroy his big, well established lactiflora plants by spraying with acenapthene in a solvent, these substances must have been translocated (transported) from the leaves and stems to the roots!!, and they collected there: Then, if one would, use colchicine dissolved in dimethyl-sulfoxids as a spray applied to the leaves and stems of the peony plant, we could expect it to collect in the roots by the process of translocation. Hopefully, after one or two years buds and adventitious buds would be produced which would have higher ploidy (raised from triploid to hexaploid or from tetraploid to octoploid, etc.)

With proper timing and proper amounts of this spray material we might even succeed in the desired results through seed production. If this could be the cause of unreduced gametes in both ovum and pollen grains, interesting polyploid plants might be forthcoming.

Two clones that are of great interest to me are '**White Innocence**' and '**Garden Peace**'. Alas, these are highly infertile triploids and though I have ten big plants of 'White Innocence' and twelve giant plants of '**Garden Peace**', I get no seeds (NOT ANY). If a colchicine treatment would raise these triploids to the hexaploid level, seeds might be produced, and might be fertile. Whether success comes from the roots or from the seed production, either or both results would be greatly appreciated.

This same spray treatment I plan to use on a row of tetraploid '**Serenade**' F_2 plants, hoping for OCTOPLOIDS! And since this row of tets is a fantastic seed producer, it is a logical candidate for experimentation.

Is there anyone in our PAEONIA reading group that would hazard an educated guess as to the amounts and the timing of sprays to be used in this experiment? Dr. Reath, Don Hollingsworth, L.J. Dewey, Bill Seidl, and Father Fiala, would you offer an opinion on this matter?

- Chris

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CORRECTIONS from Don Hollingsworth

'**Laddie**' x '**Moonrise**' cross reported in the September, 1979 PAEONIA was wrongly claimed to be of '**Laddie**' as pod parent. '**Laddie**' was the pollen parent and '**Moonrise**' the pod, I had successfully used stored pollen of '**Moonrise**' in other crosses, but my recollections on this one were faulty. When I dug them this autumn, there it was on the stake clearly, '**Moonrise**' x '**Laddie**' (the name to the right of the x is the pollen parent in my records, as is conventional). A review of the pollination log verified the stake data.

Also, I reported in the American Peony Society Bulletin about my good luck using '**Age of Gold**' pollen in getting seeds and germination from the Itoh cross. The seedlings are hybrid, but the leaves do not seem valid for Itohs. Looks as though I had contaminated the pollen with something from the Little Reds group or Peregrina.

- Don

THE QUEST FOR ORANGE PEONY FLOWERS

Dear Chris:

You raise the question of how one might proceed in attempt to get orange color affect in peony flowers, using the yellows of the early hybrids group as a starting point.

What might come of merging the genes for yellow and red (or pink), which you ask, is an obvious starting point. I have a little experience with this, using '**Moonrise**' only, as the yellow flowered parent. The results are not all negative, but have given no great promise for getting smooth orange color in the first generation. Some patience and time will likely be required. (So what's new!)

Crossed with '**Good Cheer**' (Paeonia officinalis alba plena x "Perry Lobata") I have two, both pale but with some orangey effect. These might be called salmon colored, perhaps on the order of '**Little Dorrit**', although I've not had it in bloom in the same year so as to make a fair comparison. The flower form of these two is very ragged. Certainly '**Moonrise**' and '**Good Cheer**' didn't bring out the best in one another on form.

'**Moonrise**' crossed to '**Sophie**' ('**Kelway's Glorious**' x "Perry Lobata"), '**Sophie**' as pod parent, one of several seedlings has been recorded as "soft pink, orange filaments." Nothing else unusual has been noted on these.

'**Cytherea**', '**Red Red Rose**' and '**Cardinal's Robe**', also of the "Perry Lobata" triploid hybrids, the cross has been worked both ways. With '**Cytherea**' as pollen parent (no seeds from '**Cytherea**' have germinated), a '**Moonrise**' seedling has a handsome flower of milky soft pink. With the other two matings there are seedlings from crossing both ways. All of these are red, to the best of my recollection. A cursory survey of notes reveals nothing else. These reds range from bright and clear to some with a muted undertone, which I speculate may indicate that a dose of the '**Moonrise**' yellow pigment is present.

Crossed by the pollen of '**Paula Fay**', '**Moonrise**' gave seeds which have grown into sturdy plants. These look much like the pod parent except that there is a range of flower forms and the colors range from milky pinks through pale yellow and creamy white. As most readers will already know, '**Paula Fay**' and '**Moonrise**' are both seedlings of 'Perry Lobata' triploid hybrids.

One other cross, involving "Perry Lobata" influence on only one side is '**Legion of Honor**' x '**Moonrise**'. '**Legion of Honor**' is of P. lactiflora x P. officinalis and has an unusual hue of red and its color effect, for the group, is quite high or light, though not so "hot" as that of '**Good Cheer**'. Two of these seedlings which have flowered show the same dulled red effect mentioned above. Another, which flowered first in 1979, is lighter, perhaps will be pink, but no promise of "hot" coloring.

The above account reflects not more than a dozen plants which have flowered. Hence they cannot be considered, to be a representative range of what one might get in breeding in this lineage. However, it does lead me to speculate that the further we stay away from Lactiflora and Officinalis red genes, the better results towards orange we may get.

In the pursuit of orange, '**Good Cheer**'looks most promising right now and I note that its officinalis parent does not show evidence of red pigment (it is white).

However, the matings I have reported above reflect only one genetic source for yellow and only a limited array of red sources. It would be a mistake to limit future tries to matings of '**Moonrise**' and '**Good Cheer**' alone. There are lots of sources of yellow now available (comparatively speaking). Perhaps the yellow Quads or '**Silver Dawn**' F_3 will give a different array of blend effects even if crossed with the same reds mentioned above.

'**Little Dorrit**' may be equally as good as '**Good Cheer**' in these respects. Its officinalis parent is pink rather than red.

What about pink instead of red in crossing for orange? I can only speculate, and I do, for until we have more data to work on we're stuck with mostly speculation. In my view, one possibility is that pinks are due to the same pigments that will produce reds when the concentration and/or the modifiers are different. The concentration of red pigment may be greater due to greater degree of genetic redundancy (the replication of the effective genes), or, maybe the red is less or more obscured by the presence of other pigments.

Differences in red hues are probably due partly or mostly to minor differences in the chemical structure of the pigment. In complex chemicals, as these are, many isotopes may be possible. We are also told by Fred Cooper's peony flower pigment studies that there is more than one red pigment in peony flowers. Peonidin and cyanidin were found in certain herbaceous peonies while pelargonidin and peonidin were found in the suffruticosas. Very little is yet known about the interactions of even the various known pigments with one another or with other chemicals that may be present in the cell contents. Hence, instinct, insight, and the results of trial and error must play the predominant roles in guiding our choices of matings.

Another possibility for the difference between red and pink in the flowers is that different isotopes of reddish pigments are involved and perhaps these result in wanted colors only when they appear in specific combinations with modifying pigments. For example, there appears to be a prominent role by something which imparts the milky or ice cream tones present in some of the more appealing early hybrids. I see this in the '**Cytherea**', '**Sophie**' and '**Good Cheer**' hybrids mentioned above. Is this involved also in those reds which have a muted undertone? Another example of the curious range of expression of pinks is seen in lactiflora peonies. From some matings you can get a prevalence of washed out, fading grey-pinks. In other instances something different happens, and you can get a '**Walter Faxon**' pink. What happened? Was something dropped out in the segregation of the genes?

It really doesn't make much difference how many throw away colors we get from the crosses. What counts is that occasional gain which is obtained. What seems indicated is to make a lot of different matings, keep track of the results and repeat in quantity those which seem to inspire further work. Failure to do the repeat work may be the biggest mistake.

- Don Hollingsworth

REPORT FROM NORTH DAKOTA

The past year was very good to us weather wise. We had no real drought or excessive rainfalls no excessive heat or cold and no windstorms.

The peony bloom was very good on most every variety but not many exceptionally fine blooms such as we had the year before.

The peony seed planted last year gave us a rather poor germination as many crosses failed to show above ground at all. I believe that the seed rows were allowed to become too dry soon after planting as we had a rather dry August and September in 1978. I expect to see a lot of these seedlings coming up this spring.

New this year were three near-yellow plants with large double bloom of a type and color that I thought were a better yellow than any that we have grown before. Also two rose type pure white that seemed very good for first bloom. These were all dug, divided and replanted for further evaluation and observance.

One section of seedlings were from 105 seeds of '**Laddie**' x '**Early Scout**' pollen. Twenty-three plants were grown from these seeds. None of them had ever bloomed yet as my seed rows are 18 inches apart and the seedlings in the rows on either side were very tall and leafy plants while the '**Laddie**' x '**Early Scout**' planted were quite dwarf, thus they were in deep shade all summer long the last few years. These seedlings were very interesting and carried the four species — Tenuifolia x Lobata and Lactiflora x Wittmanniana and about one-third of them showed the grey-green foliage to some degree of wittmanniana although '**Early Scout**' does not have any resemblance to wittmanniana (ED: probably because wittmanniana is not at all involved in '**Early Scout**' parentage!). They were all dug and replanted where they would have plenty of room and sun to develop properly.

'**Goldilocks**' again had large very full flowers without well developed carpels and so the only seed we got from it was from the lateral or side bloom. Next spring I intend to let some of these plants grow all stems to full height and then cut them clear down to the crown, hoping that another crop of stems will come on from the undeveloped buds and have good carpels like the variety used to have in its first few years it bloomed. It was a very good seed producer at that stage.

The variety that I first used for seed production for double rods, 5903, was for a number of years a good seed, setter and, totally free of pollen but had good carpels. When bagged before opening and kept that way, it was always completely seedless. Later on it started to produce pollen on anther like lumps on the edges of some of its petalodes and would self pollinate if bagged before opening and the bags left on, so peony plants do change.

The '**Claire de Lune**' seedlings that I found a year ago which I call "Clare de Lune 2", and dug and divided into two fair sized divisions and replanted, had only one bloom this year which was pollinated with a mixture of '**Alice Harding**' tree peony and '**Oriental Gold**' — both of them notoriously poor pollens and it produced 9 seeds. The tree peony bloom had been out a couple of days so there was plenty of chance that other pollen was introduced into the flower.

- Ben Gilbertson,
Kindred, North Dakota
58051

MAKE YOUR OWN SPECIES!

Pure lines can be developed, by in-breeding.

Self-fertilized plants produce seeds (the F_2 generation) that are the beginning of development of a pure line. When these seeds develop into plants that produce seed, if self-fertilized, will give F_3 seeds. Repeat this process and you will come up with F_4, then F_5, and so on

With each succeeding generation the group of inbred seedlings becomes more uniform (homozygous).

So, naturally, they become less mixed up. Hybrids are heterozygous. With each succeeding generation of in-breeding, the seedlings lose 50% of their differences.

Let's try an example. Assuming that all seeds in this program are fertile and no strange (stray) pollen contaminates our test, results are as follows:

Test case: Hybrid = Lactiflora x Macro,
'**Serenade**' F_1 cross - is 100% hybrid.
'**Serenade**' F_2 is 50% homozygous and 50% heterozygous; the next generation, if self fertilized again, gives F_3 plants – 75% homozygous and 25% heterozygous; F_4's = 87½ % homozygous, 12½ % heterozygous. F_5's - 93-3/4 homozygous, and 6¼ % heterozygous.

After five generations of self-fertilizing this is what you have; out of 100 seeds, or rather seedlings, 94 plants will be pure bred and 6 plants still have hybrid characteristics. At the end of ten generations only one plant in a thousand will be heterozygous.

At what point shall we consider that a pure line has been developed? Five generations gives 94% pure line and that is good enough for me. Now, of what value is a pure line?

1. It can be used, in hybridizing with known results.
2. It is in effect, a new species.
3. Uniform plants with uniform results.

Thus, you see, in-breeding if continued for five or more generations, results in an end product of a race of very uniform plants.

I have '**Serenade**' and its F_2. These second generation seedlings (46 of them) are very uniform -- looking just like their parent. They have produced a heavy crop of seeds (so are F_3 seeds). If any of you Paeonians wants to continue this project you can get the seeds from me and start your own project next spring.

Roy Pehrson's '**Silver Dawn**' is an F_3. I have a plant of it from him. Also, I have a plant of '**Silver Dawn**' F_3 which came from Silvia Saunders in 1969. These two plants are closely related but have some differences — such as blooming time and fertility. Roy's is more fertile than mine. This process of de-hybridizing (or in-breeding) is being carried out with Roy's plant since mine produces so few seeds. Seedlings from Roy's '**Silver Dawn**' F_3 are too young to bloom so results are as yet unknown. If, when these plants bloom they set a heaver crop of seeds, I'd appreciate help from someone to develop this strain. Let me say that I have found no other plant which will give more character to its seedlings when using pollen of this on various hybrids. But that is another story.

Now, what are the rewards in carrying these projects to their conclusion?

1. All along the way an occasional spectacular plant will appear.
2. The flowers all are beautiful and are flower arrangers' delights
3. The seed pods are beautiful and prized by flower arrangers as dry materials.
4. Will provide material for hybridizing on a scientific basis — with known results before making specific crosses.

What are the shortcomings in undertaking a task of such magnitude?

1. When figuring three to five years in producing a generation of mature seedlings, the program is long and drawn out; probably twenty to twenty-five years is actually involved.
1. 2.Much garden space is used since a good population (many seedlings per generation) is desirable.
2. The work involved may become a burden and might get out of hand.
3. Public demand for any one type of plant or flower fluctuates.

The great thing about this whole deal is that we know where we're going, whether we get there or not is immaterial.

- Chris

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Peony Seed Germination, (continued from Page 1)

Near the end of this period the pots must be watched closely as seedlings of some crosses will start to grow. If left too long in the dark cellar the growth becomes too spindly.

Fluorescent lights have been installed in the cellar. As each cross starts to germinate above the ground the pots are placed under the light to prevent spindly growth of seedlings grown in the dark.

At the end of the three month cool period the germinating seeds are ready to be lined out. In early May the soil mass containing the germinating seeds is carefully removed from the pot, disturbing the soil as little as possible, and planted in outside beds as are used for grafts. Each cross is spaced one foot apart and labeled with durable labels on steel stakes. The rows are spaced two feet apart.

As the outside temperatures begin to rise in May the seedlings will start to grow. This is a critical period for the seedlings. Excessive sunshine may burn the newly developing leaves so shade is necessary. We use three wooden shingles placed on the east, south and west side of the seedlings. When the seedlings have grown for six to eight weeks the shingles are removed to permit a maximum amount of sunshine. The seedlings must be carefully watered during summer dry periods. Weeds must be controlled.

Not all seeds will germinate the first year; some will start during the second season.

The seedlings are permitted to grow for two or three years in these beds and are then lined out individually in nursery rows. The seedlings are spaced 12 to 24 inches apart in the rows. Precious crosses are given the wider spacing. The rows are spaced ten feet apart to permit tractor cultivation. Wood shavings as a mulch have been very beneficial. It provides winter protection and prevents the soil from packing too firmly over the young seedlings. The seedlings are able to grow more easily in the spring. The mulch is used for at least two years. A light application of Treflan (5%) greatly assists in the control of weeds in the nursery rows.

The above method is used for herbaceous as well as tree peony crosses. A couple advantages of germinating seeds in this manner are:
1. The newly developing roots are capable of absorbing nutrients from the soil.
2. Less transplanting shock in moving the whole soil mass from the pots to the transplant beds.

- David Reath, Vulcan, Michigan