PAEONIA

Volume 5, No. 2 June, 1974

REQUIRED READING –

1. "The Peonies" by John C. Wister, $3.50 from American Peony Society.

2. The Bulletins of the American Peony Society.

The PAEONIA is authorized by Miss Silvia Saunders.

Our leader and teacher in hybridizing is Roy Pehrson.

Editors are Chris and Lois Laning, 553 West F Avenue, Kalamazoo, Michigan, 49007.

TABLE OF CONTENTS

EXPLANATION OF PHOTOGRAPH ('Garden Treasure')

Don Hollingsworth

The enclosed print shows an "Ito Hybrid" seedling produced by Don Hollingsworth from pollinations made in 1969. His serial number identification and description follow:

Hollingsworth 205 (seedling). Hybrid, Paeonia lactiflora x (P. lutea x P. suffruticosa). Semi-double, yellow, medium height. Seed parent: unknown blush bomb double Chinese peony. Pollen Parent : Alice Harding Lutea Hybrid. Guard petals: 10-12 broad petals, exceptional substance, color near chartreuse RHS 2C. Inner petals: 15-18, like the guards except narrower, the petal series ending abruptly at the stamens, transitional forms almost absent. Stamens: long, relatively few in number, filaments and anthers light yellow, pollen absent in the first and second year flowers. Disc: prominent, forming sheath as in tree peonies, white. Carpels: large and prominent, 5-6 in number, normal, green ovary covered with white hairs, style arm and stigma not transformed and pink in color. Foliage: Shows influence of both, parents, but more like that of pollen parent Alice Herding, having notches in leaflet margins, leaflet-and wedge shaped and having no red pigment evident. The leaf segments are, however, thicker, broader, darker green and having higher luster. Stem: 21 inches on young plant, arching, but strong, displays the flower well beyond the foliage. Stem form similar to tree peony, but appears to be less woody, develops strong buds in leaf axials above ground although flowering has so far come from low buds having soil cover over winter.

QUESTION FROM H. ROGERS, SR.

(20 Vernon Terrace, East Orange, N.J. 07018)

"If you hear of any books on x-ray for purposes for mutation, or any book that gives any information on mutation, please let me know."

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Reply by Roy Pehrson

Dear Mr. Rogers:

Chris sent me your inquiry concerning induced mutations, asking that I reply. Right off I say this - emphatically - FORGET IT! .

The chances that you would be able to do something useful are so very slight that you are sure to be disappointed. Most of my arguments will be based on information found in R.W. Allard's, PRINCIPLES OF PLANT BREEDING (John Wiley & Sons).

Only about one mutation in a hundred, whether naturally occurring or induced, is a useful one. Most mutations involve traits which are recessives. Almost all the mutations induced differ not at all from traits already established and well recognized in the gene bank of stocks already available to the breeder.

Consider what might happen. Let's say that you treat 100 seeds and have the great good fortune of inducing just one single mutation in each of these — a highly improbable situation. Grow these out, and there MIGHT possibly be just one useful mutation among them. Since most mutations are recessive it would NOT be visible in the plant in which it occurs. You would then have to self-pollinate each of the 100 plants and raise any F-2 generation. Only then would you find revealed all the mutations you obtained; among them the (possibly) useful one. Now what if this mutation were to be a new one to the "doubleness" condition? Would you recognize it as such? And what good would it be? Existing stocks already contain the doubleness trait and we are using it. No matter that the mutation to this trait may have happened by natural means many years past, no doubt a number of times. All this would have taken no less than ten years of your life. Believe me when I say that I am not much given to negative thinking; nevertheless I am convinced that you should abandon the idea completely. The possibilities in conventional breeding procedures are vastly better!

Now, who sells seeds? Well, Louis Smirnow lists tree peony seeds at six dollars per hundred, but I know of no one else. I give away my surplus hybrid seeds to anyone who will grow them. Just let me know and tell me how much garden room you have for them!

- Roy

IDENTIFYING THE ITO CROSS

Roy Pehrson

It's very pleasing to me to read from time to time of yet another hybridizer having succeeded with the Ito cross. It is clear from these accounts that these people are quite sure of their identification of at least some of their seedlings. This is understandable, since these hybrids are almost always very different in appearance from the "accidental" lactifloras which are so likely to be present with them.

These people are still uncertain that they have identified ALL of their seedlings correctly. I had these same doubts too — at first. By the summer of 1973 I had looked at four successive crops of emerging seedlings and had learned to recognize the hybrid plants with practically 100% accuracy. Those who have already found some hybrids will soon be able to do this too, but those who have not been successful will still keep puzzling over their plants. I think it might now be helpful to these latter if I were to describe the "marks of identity" which I use in the first year of growth.

Mark No. 1 - Leaf outline: Often very distinct and convincing. If not completely so, look for other confirming marks. I won't try to describe this leaf shape but it should be noticed when first seen.

Mark No. 2 - Pink in stem — leaf petioles: I think this is most easily recognized from about the time the baby leaf starts to expand until it has become quite green. It is a different, softer pink than the "red" coloring in the lactis. It is much like the color in the stems of mloko. A fairly good sense of color discrimination is required to recognize this and cannot be used alone in establishing identify. It supports identification by the other marks. It seems to be present in all the hybrids.

Mark No. 3 - Pink in leaf: A sort of halo or perhaps a suffusion. Still present until the leaf has attained its full size - along with the green. Disappears as the leaf matures. Does not appear in every seedling, but when it does it affords positive identification.

Mark No. 4 - Lighter, less glossy green: When the leaf has attained full size but has not become fully mature and “hardened", it will be a lighter shade of green and duller than the lactis. Quite noticeable. As the summer wears on it may darken enough to be indistinguishable from the color of the lactis. Excellent supportive evidence.

Mark No. 5 - Tiny red spots: I think that all of the lactifloras have at least a little bit of red in the leaf petiole at the point where it joins the main stem. In baby seedlings this appears as only a tiny spot, much smaller than a pinhead. Itos seem never to have this spot. Use this only to reinforce other evidence.

Mark No. 6 - Different root system: Can't be used at the beginning, but will surely separate the sheep from the goats when transplanting.

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COLOR DROP-OUT AND PLANT CHARACTERISTICS DROP-OUT

Chris Laning

I.
Tenuifolia

(See picture of it in "THE PEONIES", page 24.)

P. tenuifolia characteristics, that is, flower color and leaf pattern, surely must be recessive; so recessive in fact that its fern-like appearance is lost at the very first cross! No hybrid (with P. tenui as one parent) will have foliage as fine as tenuifolia. Crosses with mloko, woodwardii, lactiflora, officinalis, etc., give foliage of intermediate appearance, never true tenuifolia foliage. And what about any clone of tenuifolia cross in the next generation — do we find any seedlings with this extra fine foliage? Not Just the opposite is true, so in the F^2s, tenuifolia loses out even more. And in the third generation (F^3) there is no evidence of tenuifolia foliage at all.

II.
'Nosegay' – (Mlokosewitschi x Tenuifolia) F^2

Mlokosewitschi x tenuifolia F^1s get their flower colors from the tenuifolia side of the family. The foliage of this cross is midway between the two parents. But in the F^2s (as in **'Nosegay'**). the appearance of foliage and the color of the flower give evidence of tenuifolia drop-out.

With each succeeding generation the mloko appearance becomes greater at the expense of the tenuifolia parent. All the little two year plants, and I have 23 of them, from self-pollinated seeds of **'Nosegay'** have broad, rounded leaves that look very much like their Great-grandmother mloko. And I wouldn't be surprised if the flowers on all these seedlings turn out to be either pale yellow or dirty white. Where did the tenuifolia influence go?

III.
'**Daystar**' – (Tenuifolia x Mlokosewitschi) F^3

A. Tenuifolia x mloko F^1s give tenuifolia-like color and foliage - intermediate.
B. Tenuifolia x mloko F^2s give flowers that have lost much of their tenuifolia color, and quite a lot of the tenuifolia appearance. '**Gwenda**' is an example of this.
C. Tenuifolia x mloko F^3 - '**Daystar**' - which is a very early flowering hybrid has broad oval leaves, quite mloko-like and flowers which are clear, very pale yellow and single. Stems are reddish. David Reath says this plant is a fertile tetraploid. Where is the tenuifolia?

IV.
General - color - drop-out.

1. '**Moonrise**' - lactiflora x lobata.
2. '**Horizon**' - lactiflora x officinalis - an F^2.
3. '**Sanctus**' - lactiflora x officinalis - an F^3.

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LETTER TO DON SMITH — from Roy Pehrson

Dear Don: April 3, 1974

I think I can say some things which will help a little to resolve some of your questions about the Ito cross. I seem to have mislaid or destroyed the letter, so I can't quote him exactly but Mr. Smirnow did write to say that "those other" seedlings from the Ito cross proved to be lactifloras when they bloomed.

I think I should elaborate somewhat on my previous position which you quoted in your letter to Chris.

> ALMOST ALL OF THE HYBRID PLANTS PROVIDE INDISPUTABLE EVIDENCE IN THEIR FOLIAGE FORM OF THEIR TREE PEONY DERIVATION.

Obviously they cannot at the same time look very much like lactiflora — or any other herbaceous sort. If any of them could be said to look intermediate in appearance, then one could not know the identify of either parent merely by looking at them.

If I now say "almost all", it is because I do have two plants which don't follow the usual pattern at all. It would be fair to call these two "intermediate" in appearance, I think. One of these, by last summer, had grown into a far bigger plant than any of the typical four year olds. There were stems 15" tall whereas none of the usual kind had made stems more than three or four inches. The lush foliage is very much lobed too but does not look like tree peony foliage. The stems are pithy — very completely herbaceous. The second one is somewhat smaller. There were only a few tree-peony lobes on the lowest leaves; not enough even to suggest a tree peony origin for it. It does not look at all like lactiflora either. Stems were ten or twelve inches tall.

I think that if any of my plants are to bloom this summer, only these two are likely to do so. I have a "sneaky" feeling that the flowers will not be of lutea or delavayi coloring. I base this hunch on yet another possibly unwarranted supposition — I have believed for some time that the Itos are either triploids or aneuploids of some other count. If so it is conceivable that these two odd ones could be diploids. Owing less then to their tree peony parent, they might show a greater lacti influence in their blooms as well as in plant form.

These two plants of intermediate appearance come from a total population of about 60 hybrids. This total number is large enough to justify the prediction that these atypical plants should appear in any other hybrid population in a not very different ratio. Accordingly, I should expect that no more than perhaps three of your truly hybrid plants would be of this type. Yet you say of your 41 plants that almost all are of intermediate appearance.

I can't explain this discrepancy, certainly not at a distance — sight unseen. I guess you can only keep up a close communion with your plants and listen carefully to what they tell you.

As for Father Fiala; well his report too was based on the first small plants he obtained. By now he certainly owes us a progress report which might be very enlightening. – Roy

Editor's Note: See Don Smith's article in the March, 1974, issue of PAEONIA.

LETTER TO CHRIS LANING — from Roy Pehrson

In your reply to Don Smith, you deplore the long period of years which must elapse from the time that a new, fine seedling is found and the time that sufficient divisions have been made to permit a limited distribution. Well, this is not exactly the substance of your complaint, but is a logical extension of it.

Without any doubt at all, the greatest impediment to a growing popularity of the peony is its very slow asexual propagation. This is reflected in the size of the membership in our Society as well. In this fast-paced age, people have come to expect instant success. If they learn of a new and finer plant they want to have it — right now. The necessity of waiting for maybe 20 years is simply not acceptable.

Let's consider the matter a little. Let us say that you find among your seedlings one of obviously outstanding merit; Then let us assume that this plant will increase naturally by doubling itself each year. Then at the end of the seventh year from the time the first stem bloomed you would have 64 plants. Much too slow!

But wait! What might happen if in the meantime the necessary experimental work had been done, and a workable technique perfected for propagating peonies from tissue cultures? Here is perhaps one possibility. When you have decided that your plant is deserving of fast propagation you will dig down alongside the plant and sever a root near its junction with the crown of the plant. You will uncover this root again a year or so later to find that a callus has formed on that cut end. This root is then carried to your workshop where you set the process in motion. (I suggest the possible use of callus tissue because it has been used in other genera, and many more flasks could be seeded with bits of the undifferentiated cells in a callus than could be had from the meristems of perhaps two or three precious buds! At the end of the same seven years, using this method you would have almost any number of thousands of four or five year plants instead of only about 64. Revolutionary!

Orchids, like peonies, propagate slowly by natural division. In spite of this it is now possible to obtain at very reasonable prices the very newest and finest products of the hybridizers art only a short time after their origination. The large orchid growers use the meristem method of propagation routinely. One catalogue which I saw about a year ago devotes a number of pages to listing these plants which they call "MERICLONES".

A couple of years ago, at our annual hybridizers session, I proposed that this method be seriously investigated. I am very inept at such oral presentations so I am sure the matter was forgotten immediately. Now that Dara Emery has given us such a competent account of the possibilities, I think it would be tragic if someone were not to seize the opportunity to investigate thoroughly. It MUST be done!

I have the feeling that much time might be saved by commissioning someone like. Dr. Murashige to do the initial spadework. Since germinating peony seeds requires a cold period in order to grow, it may be possible that a cold period would also have to be plugged into the meristem sequence at some point. This would be an added complication not required for other plants.
I started this letter on the 3rd of April. Writing these things is always a painful process and it is now April 7th. On the 3rd we had a mini-blizzard which left about 7 inches of heavy snow. Much of it is melted now, but it may still be about two weeks before any peony "noses" show themselves. Maybe the late springs we have here may be an advantage, because we seldom have damage to early emerging kinds from late frosts. This seems to be a real problem with some of you.
No, Chris, meristem culture cannot be used in the hybridizing effort in any way!

Yes, I'm convinced that there are (or were) two lacti x suffruticosa hybrids. More about this some other time if Smirnow does not himself explain the matter in the Bulletin in June.

You ask, "Please don't disparage this issue by your silence." There is nothing in what you wrote with which I have any real disagreement. You DO need to read up on the meristem method of propagation, since it is obvious from one of your questions that you don't understand what it is all about. The basic principle of the process is very simple. There is no reason why an ordinary hybridizer should "flounder" as you suggest, nor is a trained mind required.

The two basic pieces of equipment needed are simple in their most basic forms, and might be assembled by any clever "tinkerer". These consist of a sort of "Ferris wheel" driven by a small electric motor and a "transfer case" for manipulating the materials in a sterile environment. If they can be purchased ready to go they should not cost an awful lot. The special flasks, some small hand tools, and ingredients for preparing the nutrient substance would have to be purchased.

I can think of some problems which would have to be resolved in working out the technique:

1. From what source and at what time of year should the starter cells be obtained?
2. What formula for the nutrient medium? .
3. Is a cold period required? When In the cycle? How long?
4. When are the little plants removed from the flasks? Where and how planted?
5. At what stage in the cycle should bits of tissue be removed from one of the flasks in order to seed some new flasks and thereby keep the process going indefinitely?
6. What lighting requirements?

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Dear Mr. Laning, April 3, 1974

Thank you. The roots you sent arrived and are in the ground. Any roots you might send would be appreciated. Your gift increased my small planting of peonies by about 1/3, and the unexpected interest and generosity of the senior members at the Peony Society in this beginner, has increased my interest in the plant a hundred fold. Mr. Laning, I should like to send to you some tetraploid daylily seeds if you would like to have them. I've been working with them for a number of years and am beginning to get some nice things. Next fall I will be thinning out the seedlings and will have more seed than I will be able to plant. I should like to offer them to the subscribers of PAEONIA either as swaps for peony roots or to those people who would enjoy them as I do. If you think anybody might be interested, could you publish my offer in PAEONIA (as was suggested in the Dec. '71 issue). Thank you again for the roots.

- David Hochstein, 1114 East 48th St., Brooklyn, New York 11234

Ed. Note: PAEONIA READERS — Please correspond directly with Mr, Hochstein if you wish to take advantage of his offer.

DON HOLLINGSWORTH REPORTS

1. Progress report on heavy fertilization: I overdid some with potash the second application in early May. However, ..some flowers showed dramatically improved color, esp. tree peony, lobatas.

2. In Winter 1972-73, you published a list of my pollinations and seeds produced. Most of the "Ito" class crosses proved not genuine, and this should be reported, in order to update that information.

3. I have no conclusive evidence of successful pollen storage over winter. There is a considerable amount of research literature relevant to this, however.

4. Incompatibility in plant breeding refers to inability of certain pollen tubes to grow and function to the point of fertilization in certain tissues of incompatible species or varieties. There are self incompatibilities, inter-variety incompatibilities and inter-species incompatibilities. Incompatibility is often flexible, not operating in every instance. Perhaps it is one of these flexible incompatibility systems that is responsible for the erratic performance of "Ito" class cross pollinations, I have studied the literature on this and am excited about some of the findings. (See attached correspondence with Roy.)

5. Had flowers of the Windflowers for the first time. These provide an especially appealing variation in peony flower form; apparently the lacti-emodi cross is similar.

6. Adaptation to a particular environment is absolutely necessary if a given cultivar is to provide satisfaction (and therefore worthiness of introduction into the trade). The tree peonies currently available have largely been originated in very humid Japan or the Eastern United States. We need varieties proven for adaptation to the tougher environment of the Central U.S. For this reason it will be especially beneficial for someone in the Midwest to grow a large number of tree peony seedlings from seeds drawn from a large number of different parent plants, and grow them under relatively unprotected circumstances for several years, in order that plants with advantageous local adaptations will have every opportunity to show up.

7. Some of the different peonies I am growing have shown deficiencies in their adaptation to Kansas City area fluctuations in spring temperatures. The Saunders Triples and macro hybrid groups are very poorly adapted to hard freezing temperatures after shoots have made substantial growth. Japanese tree peonies are variable in their tolerance of similar conditions and Lutea Hybrids are late enough in development that they suffer little damage. On the other hand all of the hybrid groups containing lactiflora, lobata, peregrina, officinalis, and tenuifolia in combination or as species seem especially well adapted to the extreme fluctuations we have experienced in recent seasons.

8. Some peonies flower "easier" from small plants than do others, although any peonies have to be well established and in a satisfactory growing environment in order to produce their best possible quality of flower. This "easy" flowering character should be especially desirable in sustaining the interest of persons new to peony growing and is a characteristic worthy of attention by hybridists. Some that I have noted which are also appealing to me for hybridizing are the P. lactiflora '**Red Star**', the hybrids '**Moonrise**' F^2 and '**Good Cheer**'. Among tree peonies Tamafuyo qualifies but is extremely vulnerable to late freeze. The Lutea Hybrids '**Age of Gold**' and '**Alice Harding**' probably qualify.

9. Grafting tree peonies has not been very satisfactory for me so far. I continue to be on the lookout for clues to success. Right now I think my sanitation practices have been largely ineffective and that I have not carefully culled roots or scion material for the most vigorous (therefore better supplied with reserves of whatever materials are essential). Toichi Domoto says he feels temperature cycle and humidity may be of critical importance, that he gave up trying to compete with Japanese propagators (he grows and sell from seed-grown plants, however, not from imported grafts).

10. It is generally known that many hybrid peonies will initiate "eyes" on root pieces. The Saunders lobata (Perry) hybrids frequently do this as does a *P. peregrina* I have from Ben Gilbertson. I plant all of the root pieces found loose in the packing when receiving plant deliveries from other growers. From one such scrap came a nice surprise – a lovely semidouble red hybrid colored like '**Carina**' but with '**Red Red Rose**' form. Some root pieces lay over without growing for one season and put up a shoot the second spring.

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(Correspondence with Roy referred to in No. 4 - dated May 15, 1974, Kansas City, Mo.

The attached (Tabulation of Ito Class Hybrids) is, I believe, self-explanatory. The literature copied introduced to me for the first time information on various kinds of incompatibility. The results of temperature investigations in connection with pollen tube growth in generally incompatible crosses led me to see if I could find a temperature pattern in association with my crosses that resulted in Ito hybrids.

While it is certainly not conclusive, the evidence is consistent with the hypothesis that '**Alice Harding**' pollen performs "when temperatures at pollen tube growth are in the range of 80°F or above. The same holds for '**Banquet**'.

So far, all the lutea hybrid pollen I have for this year is '**Alice Harding**' and not much of that. The flowers are very double and few stamens. I am using it sparingly, waiting for higher temperatures. Monday, May 12, was 85° but I had to be away from the city so no pollinations were made. On Sunday, however, I pollinated a '**Miss America**' flower with '**Alice Harding**' and bagged it in a fairly large plastic bag, tied tightly around the stem, hoping to hold heat for longer and at higher levels than ambient temperature, at least during daylight hours. I was relieved to note that Monday evening after the 85° heat the flower in the bag seemed unhurt, though there was quite a lot of moisture condensed in the bag, suggesting that a lot of transpiration had been going on.

Today, a.m., May 15, I pollinated five heads and bagged them similarly to that described above. The forecast is for 70° and then colder tomorrow, so results from this would certainly be encouraging as to the effect of bagging. Right now all of the lactis that have been fertilized by '**Alice Harding**' for me (there are only 3) are coming into flower. There won't be many more days in which I can pollinate them, yet there is no reason to be confident of ambient temperatures. So, unless I can get it with the bags, there is no reason to expect to be able to replicate the temperature conditions associated with previous successes.

Even though there isn't a whole lot encouraging in this so far, the potential benefits of identifying an achievable key for unlocking the barrier(s) in this cross are so great it would seem foolhardy not to try. In addition to the temperature variable possibility, I am also interested in boron nutrition and intra-ovarian pollination leads which are revealed in articles I have sent to you. However, these do not lend to application of technique in the current season, so are a bit of "on the back burner".

- Don (Hollingsworth)

TABULATION OF ALL ITO CLASS HYBRID CROSSES THAT PRODUCED HYBRID SEEDLINGS, BY DATE AND PREVAILING AMBIENT TEMPERATURE

Date of Pollinations Month-Day-Year	Cross that Produced Hybrid Plants	Daily Temperatures (°F)								
		Previous Day			Same Day			Following day		
		Hi	Lo	Avg	Hi	Lo	Avg	Hi	Lo	Avg
May 30, 1969	Carr E #6 x '**Alice Harding**'. Several seedlings, two surviving.	88	63	--	86	67	--	86	64	--
May 21, 1972	'**Miss America**' x '**Alice Harding**' -2 seedlings.	88	57	73	89	62	76	90	65	78
May 21, 1973	'**Gertrude Allen**' x '**Alice Harding**' -1 seedling.	83	55	69	90	62	76	73	58	66
May 28, 1973	'**Alice Roberts**' x '**Banquet**' - 2 seedlings have emerged from crosses made on these days.	61	54	58	66	52	59	66	53	60
May 29, 1973		66	52	59	66	53	60	73	56	65
May 30, 1973		66	53	60	73	56	65	77	54	56

Question: Is there an incompatibility barrier which is subject to reduction, in response to "heat", that limits fertilization in the '**Alice Harding**' cross?

If one is to find a hypothesis in this, perhaps it will be found relative to an interaction between speed or completeness of growth of the tube of incompatible pollen and the presence (or absence) of competing, less incompatible pollen. It would depend on the following:

1. That there is an incompatibility barrier (s) present in the cross.

2. Heat reduces the incompatibility effect (which is the inhibition or reduction in rate of pollen tube growth).

3. At least some of the pollen grains supplied are able to develop normal pollen tubes in the nutrient environment afforded by the stigma, style and ovarian tissues when the incompatibility barriers are depressed or removed.

4. That competing pollens are prevented from reaching the stigma.

(Note: Temperature data was obtained from the Weather Service for Kansas City and at the Linda Hall Library here for Maryville, MO, where the 1969 pollinations were done.)