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THOUGHTS ON BREEDING FOR PATTERNED FLOWERS

Don Hollingsworth

In the following letter to Bill Seidl, I have laid out some of my present evaluation of probable genetic sources of the patterning of red pigments over white to yellow petal color – ground color – that we are seeing among the advanced generation hybrid peonies. Bill has plants of the hybrid Saunders 8969 (*P. officinalis* Rosea Plena x *P. corallina*) around which we got this discussion under way. Any comments, either in print or by correspondence will be appreciated.

Following up on our previous plan for me to send you some pollen selected for possibility of producing patterned flowers, I have surveyed my resources in the last few days. Looking at the plants that will flower and the record of their fertility in other crosses, I have come up with the following possibilities for this season. (The numeric designation is my accession number.)

1420 '**Silver Dawn**' F_3, Pehrson clone, hopefully the same as was used in producing some of his interesting things and Chris'. Large single flowers, petal color yellowish-ivory ground with lavender points (stigmas and filaments), small flares and margins colored. Moderate increase, big plant, big leaves. Plant from Chris.

1423 '**Silver Dawn**' F_4 and F_3, of seeds from Pehrson, presumably from 1420. Many flowers, medium size, petals yellow-white ground, soft pink filaments, red-purple stigmas, sharp pink wash, veins deepening to the border. Big, vigorous, good increaser.

1339 '**Sunny Boy**' (Laning's Best Yellow). Double yellow with red flares.

19 Quad F_2 Clone 1. From Silvia Saunders. Single, white ground with faint pink wash and red points. Macro-looking plant.

870 (35 '**May Music**' x 19 Quad F2). Single, coloring much like '**May Music**', wild; heavily veined and flared red-purple; fertile.

35 '**May Music**' (triploid). Occasionally seeds, so pollen fertility expected.

1740 '**Athena**' (triploid). Superb color, fertility not yet observed here, second year from acquisition. Lavender points and large flares of the same hue on a buffy-yellow ground.

The plant of *Paeonia daurica* which you sent in 1984 flowered last week. The coloring and pattern was very much like '**Athena**'. This is a revealing observation given my previous conjectures on the species sources of the flare pattern seen in the Quads Hybrids.

As I have written previously, the only ancestry connections I had been able to see heretofore was Officinalis, particularly 'Rosea Plena' (which fades to a flare pattern) as grandparent of some if not all of the Quads and parent of '**Little Dorrit**', also flared. '**Nancy**' also fades to a flare pattern (Officinalis Rubra Plena x Saunders 4710, a Mlo-Mac F_2). (On the Quads, I am aware that published statements attribute them to an '**Otto Froebel**' x Mlo-Mac pollinator; however, there is some confusion. The accession numbers Saunders cited when his first account of the Quads was published in the Bulletin are all shown in his summary, Big Notebooks, to be from the 'Rosea Plena' x Mlo-Mac pollinator.)

What makes the "Seidl Daurica" flower pattern seem significant is that Daurica has been considered to be the species of which Mloko is a botanical variety. While this departs from Stern's "family" groupings of peony species, it looks very credible to me as a breeder and concerned with fertility. Ledyard Stebbins, who studied peony biosystematics, using the Saunders collection and inter-species hybridizing records as well as USA herbarium sources, noted that crosses between Mloko and Daurica (then triternata) were entirely fertile and produced fertile progeny, as one would expect of matings between plants of the same species. Thus his conclusion that they are in the same species. (This is not meant to devalue Stern's work. He simply did not include breeding evidence in his concept of the peony species, while placing a high priority on explanation of their geographical proximity in the natural populations.)

I now have a basis to anticipate that the Mloko ancestry has played a contributing role in the appearance of flare patterned flowers among the advance generation hybrids.

There is something that asks explanation about the "Seidl Daurica". Stern says *P. daurica* has rose-red flowers. This one has an off-yellow ground with the lavender patterning. All else I have on Daurica is the photo illustration in “The Peronies”, which portrays an oddly formed flower, meaning what, I don't know. Perhaps "Seidl Daurica" is a descendant of some of the Saunders hybridizing. At any rate, the flower's expression of pattern is clear and definite and the plant is quite convincing of "Daurica" leaf, etc., and there is nothing about it to suggest Officinalis as a source of the patterning.

Thus, I feel we have good reason to expect to be able to generate patterned flowers at least partly upon looking at what is in the ancestry of the plants we work with.

Bill, one other question, or simply a report. The plant you sent to me as 'Russi Major' (Lemoine, P. russi x P. wittmanniana) looks very Mloko (or Daurica) and the flower is yellow with lavender pink at the petal bases. Just on curiosity, I intend to use the Daurica pollen on this flower and see what happens.

- Don Hollingsworth

ARTICLE BY: Bill Seidl May 31, 1985

As I begin to write this (May 26), Rock's variety is finishing up and '**Age of Gold**' is beginning to bloom. This is a good two weeks ahead of the normal season. Rainfall is also abnormal -- meaning too dry -- but the peonies are not suffering too much from it except some of those planted last fall. Some needed help breaking through the baked crust of clay soil over the eyes.

The season started on the best possible note -- when I uncovered two grafting beds (16 plants in each bed) and found many grafts had taken and were growing into the mulch. In fact, they should have been uncovered earlier (I waited until April 23) as a few broke off in removing the mulch but they eventually recovered by producing some lateral growth. Scott Reath had made 20 grafts for me; 17 grew. The 3 that failed were all of '**Shintenchi**'. So that's 85% successful. Pretty impressive, especially considering that all the failures were of the same variety so one cannot blame the technique. 12/12 of '**Anna Marie**' grew. Some (four) were made with 'Parafilm M' tape; they all grew except one '**Shintenchi**'. Scott had more trouble using the Parafilm M tape, not being used to it, but it seemed to not affect the outcome. I tried 12 grafts, all with Parafilm M tape, and 8 grew. Three of my failures were with '**Chinese Dragon**'. 2/2 of '**Anna Marie**' grew. I'm well pleased with these first attempts with growing grafts.

The grafts were planted the next day after being grafted (August 22). I watered in the roots -- below the graft union and without getting water on the union -- and then firmed in the rest of the soil without watering, leaving about an inch of soil over the tip bud. I then covered with black plastic sheeting. After 2 weeks when the weather forecast called for our first cool night, I bought some bales of marsh hay and, removing the black plastic, covered each bed with 3-4" of marsh hay and covered that with a large sheet of clear plastic and weighted that down. I did peek under one corner of the mulch in early April to look for new growth but wouldn't you know that was the corner where 'Shintenchi' was planted.

My introduction '**Anna Marie**' has about 22 flower buds, this after removing most of the end growth for scions last August. (This agrees with David's observation expressed in a Bulletin article that, with 2 months left in the growing season, the remaining stems still have time to "fatten up" the remaining axial buds.) Last year it had only one flower and before that 6 blossoms (the first year it bloomed). This past winter I had a chicken wire enclosure around the plant and that was filled with marsh hay. Perhaps that made a difference as we did have 21¡ãF below one night in January with a strong wind. Some other unprotected plants (lutea hybrid) will bloom OK, some were hit hard and will not. I did want to have '**Anna Marie**' blooms for hybridizing as one seed from '**Anna Marie**' x '**Chinese Dragon**' has produced a strong-growing first-year plant.

On Thursday-Friday, May 16 & 17, I visited Chris's garden in Kalamazoo and then stopped off at Roger's garden in Ft. Atkinson. 300 miles going and 400 returning. Some of the things I remember best at Chris's home garden (approx. 2 acres but not all in peonies) were *officinalis decora alba*, *P. coriacea*, '**Eclipse**' and *P. daurica* (quite different in foliage from the one I grow, from Pehrson) -- all of these had distinctive attractive foliage, but don't flood Chris with requests for divisions as they were all single plants or clumps with a few

having only 1 or 2 stems. He also had a nice light yellow or cream flowered seedling out of an herbaceous hybrid x suffruticosa -- blooming for the first time. There was also a second but I can't recall a mental image of it. (I returned with some Kamata Fuji pollen to use on Rock's back home here, and also some A199 ('**Golden Era**') pollen to try on '**Archangel**' and other herbaceous hybrids starting to open here.) About 8-9 miles away Chris has another acre-size field densely planted with all kinds of peonies. I recall some strongly upright and husky plants from '**Sable**' x Super D, all dark red of course and just ready to open. Chris's season was also 2 weeks, or more, advanced over the normal. I put a tag on two T. P. seedlings as a reminder to Chris for scions in August; both were single but with interesting centers. In one, the sheath covering the carpels was the same dark color as the flares; in the second a medium purple sheath contrasted with deep pink stigmas. Most T.P.'s were past their peak so I missed quite a few sights. Within a few blocks of home, Chris has a large new acreage being readied for planting later this year. Forgot to mention a bunch of *P. delavayi* plants just finishing bloom. One plant had rusty-orange flowers, probably a hybrid between delavayi and lutea. Chris showed me many T.P. seedlings in flats but does not recommend that method. There were many non-magnolia plants around, azaleas and "Rhodies", a dawn redwood, a dogwood (cornus kousa), and a large double-trunked magnolia 'Merrill'. I thought I had a large specimen but this one was half again as large or more. All in all it was a very nice trip and I thank Chris and Lois for their hospitality. Too bad Chicago is between us -- even taking the tri-state tollway didn't make it easy to get around Chicago as a long section of it was under reconstruction. On the return trip I took the Skyway and came through the Loop and found it not all that bad.

At Roger Anderson's the new Ito seedlings were still early in their bloom period; one was white with short dark flares. Another was a peach-pink blend and another a sort of tan-yellow with darker flecks and streaks ... not all that impressive for clarity of color and disappointing to Roger. But at least they appeared to be complete and normal flowers on healthy attractively-foliaged plants. As with other peony crosses, not every new seedling will be a world-beater and even two excellent parents will yield some unimpressive seedlings. We also visited Carroll Spangler's garden and I was again impressed by the strong upright stems of the double "Martha Washington"; it was not yet blooming. He also had a large clump of "The Lavenders" strain, many buds and a few opening. I took some opening flowers for pollen. At home I looked at a sample under the microscope and found some -- but very few -- normal looking grains. I made several controlled crosses with it nevertheless.

May 28: Looked at the first flower opening on '**Golden Era**' today and noticed one complete petal and part of a second having a clear lavender-pink color, darker flares, so it can produce lavender progeny, as proven by the lavender seedling that first bloomed last year for Roger, from '**Martha W.**' x '**Golden Era**'.

May 30: Some half-dozen new lutea hybrid seedlings have opened, mostly blends of yellow, peach and rose. I rather prefer clear colors but a friend visiting in the garden was very excited about the subtle colorings, which goes to prove that old saying about one man's junk being another's treasure. Called Roger last night and was pleased to hear his later blooming Ito's were much more exciting and in a variety of colors. (The lutea hybrids mentioned earlier are mostly A198 x '**Chinese Dragon**' and reverse.)

(Continued on page 8)

PEONY BREEDERS ROBIN SV Flight #3, Position #9; In 2-28- 86, Out 3-4-86
L. J. Dewey, 2617 Wyndham Drive, Richmond, Virginia 23235

March 4, 1986

Dear Robin Members,

Since my tree peony crosses for Spring 1985 were close to a disaster (I harvested 2 firm seeds from 42 seed heads representing 30 separate crosses), I have decided to report on my Itoh program which was more successful. As the Japanese tree peonies were opening around the middle of April 1985, we had a heat wave with temperatures in the 90's. The flowers opened and faded so fast the reproductive organs were damaged and I was unable to make any crosses on these varieties or even collect pollen for later use. The 2 firm seeds I harvested involved crosses with lutea hybrids (Kinko x A199 and #10-79 (P. delavayi) x A199). Fortunately, temperatures settled back to normal as the later things (lutea hybrids, TP species and herbaceous varieties) were ready to bloom. As a result I was able to make a number of successful Itoh crosses which I will discuss later.

Identification of Breeding Stock - So that you will have a better idea of the parents involved in my breeding efforts some of them are described below.

1. HP 1-61 = unknown lactiflora variety with full double pale blush flower which fades to white on aging.
2. A 199 = a David Reath advanced generation lutea hybrid now named 'Golden Era'
3. D-324 = a Nassos Daphnis advanced generation lutea hybrid, light to medium yellow single.
4. #23 Carr East #2 = unknown lactiflora variety with full double white flower from Don Hollingsworth.
5. Kinko = 'Alice Harding' TP, my plant imported from Japan.
6. #68-77 = 'Moonrise' x 'Archangel' seedling; seed from P. C. Laning; flower: ivory single.
7. #10-79 = P. delavayi seedling grown from Far North Gardens seed, dark maroon single.

Maiden Bloom on #171-79, an Itoh Hybrid - Spring 1985 brought me some excitement when my first Itoh hybrid to flower opened its maiden bloom on April 27. The cross (HP 1-61 x A199) was made in the spring of 1978 and the seedling is my #171-79. In my seedling numbering system the last two digits indicate the year in which the seedling epicotyl first appeared above the soil line - in other words the year from which the plant's age is determined. Therefore, this seedling was 6 years old before it had its first flower. The seedling forms a compact, vigorous plant with the typical, attractive Itoh hybrid foliage. For its first flowering season, the plant sent up two flowering stalks each with an apical flower bud and one side flower bud arising in the second axil below the main bud.

Flower description:

Color: bright yellow similar to '**Golden Isles**' and I think darker than '**Yellow Crown**', '**Yellow Dream**' or '**Yellow Heaven**'.

Size: medium, about 5 inches.

Form: open, semidouble with about 3 rows of petals.

Filaments: yellow the entire length.

Anthers: yellow; no pollen detected.

Stigmas: yellow.

Carpels: light green.

Sheath: partial; peach colored.
Flares: red.
Fragrance: sweet with hint of lemon; reminiscent of P. lutea.

The 4 flowers on the plant were pollinated with pollen from A199 (2 flowers), '**Minnie Shaylor**' and #68-77. No seeds were produced.

The semiwoody stems of this seedling are usually killed to the ground in our Richmond winters but an occasional aerial bud will survive and produce a shoot the following spring. This seedling was divided in November 1985 so it may not bloom in 1986.

Crosses on Itoh Hybrids - I have pollinated '**Yellow Crown**', '**Yellow Dream**' and '**Yellow Heaven**' for 6 years but none of the plants has ever produced a single seed. Pollens I have used include advanced generation lutea hybrids (A199, A201, D324), lutea hybrids ('**Roman Gold**', '**Golden Isles**', Kinko), TP species (P. lutea) and one herbaceous variety ('**Minnie Shaylor**'). The flowers appear to be extremely sterile on all three of these varieties. In addition to no seed set, I have never detected any pollen on the anthers of these Itoh varieties. Apparently the chromosomes are too diverse for pairing during meiosis and fertile gametes are rarely if ever formed.

Incidentally, the semiwoody stems on these 3 Itohs quite often survive the Richmond winters and the aerial buds send out new growth in the spring. However, the shoots and flowers arising from these buds are usually inferior in vigor and quality to those originating from buds near the soil level.

Germination of 1984 Crop of Seeds from Itoh Cross, HP 1-61 x A199 - In my Flight #2 letter, I described my unusual, for me, harvest of 37 seeds from 6 seed heads from this HP 1-61 x A199 cross in 1984. At that time 29 of the seeds had produced roots and were being held in the refrigerator. I thought there might be some interest in the progress of the germination of this seed batch. Incidentally, as the seedlings develop plumules in the refrigerator, I pot them in peat pots using a mix of 2 parts soil, 1 part perlite and 1 part sphagnum moss. The potted seedlings are labelled and held in plastic trays in a shady spot for observation. A summary of the germination results to date are given below.

Summary of Germination Results on 1984 seed crop from the Itoh Cross, HP 1-61 x A199

	Number
Seeds at start of incubation (9-12-84)	37
Seeds discarded during incubation (hollow or "mushy")	3
Seeds rooted	33
Rooted seedlings discarded (went bad in refrig.)	2
Firm unrooted seeds remaining (2-17-86)	1
Rooted seedlings presently in refrig. (2-18-86)	3
Seedlings with plumules (potted spring and summer 1985)	28
Potted seedlings sprouted (epicotyl emerges above soil)	24

These results represent a 76% germination rate (28/37) and an 86% survival rate (24/28). This is one of my best germination efforts to date. The majority of these seedlings have the typical hybrid foliage. However, there are a few with lactiflora foliage Since these seeds came from protected crosses (flowers bagged), the obvious question arises as to how the

lacti seedlings originate. I am reasonably certain that this pod parent produces no pollen so could we be dealing with some kind of parthenogenesis here.

Chris Laning discussed some aspects of this problem some time ago, see PAEONIA Vol. pl'2, Dec. 1971. The Itoh hybrid seedlings from this cross are usually vigorous and some produced as many as three separate leaves during the course of their first summer.

Seed Production in Itoh Crosses, 1985 Crop - The seed production and number of successful Itoh crosses were even better for me in 1985 than they were for the 1984 season. The results of the 1985 seed harvest from the Itoh crosses are summarized in the table below.

Seed Production from 1985 Itoh Crosses

Cross	No. Flowers Pollinated	No. Seeds Harvested Hollow	Firm
'**Big Ben**' x A199	4	4	0
'**BuTe**' x A199 (1984 & 1985)	5	8	9
#23 Carr East #2 x A199	3	1	3
'**Charlie's White**' x A199	3	0	0
'**Gertrude Allen**' x A199	6	14	48
'**Gertrude Allen**' x '**Golden Isles**'	3	7	10
'**Gertrude Allen**' x '**Roman Gold**'	3	1	2
'**Gertrude Allen**' x '**Golden Hind**'	2	1	4
'**Gertrude Allen**' x Kinko	1	0	0
'**Raspberry Sundae**' x A199	3	8 / 4 *	6
HP 1-61 x A199 (1984 & 1985)	6	7	25
HP 1-61 x '**Golden Isles**'	3	0	3
HP 1-61 x '**Roman Gold**'	2	0	1
HP 1-61 x '**Golden Hind**'	2	0	9
HP 1-61 x D324 (1984)	1	0	0
HP 1-61 x Kinko	1	0	0
'**Westerner**' x A199	2	3	3

Table Notes: The year 1984 in parentheses following pollen parent indicate pollen was collected in spring 1984 and stored dry in the deep freeze for use in 1985. Pollen stored this way remains viable as shown by pollen germination tests in the laboratory and by seed production when the stored pollen is used in making crosses. Crosses without a year designation were made with pollen collected in 1985.

A total of 123 firm seeds were collected from these crosses. The seeds were placed in damp vermiculite for germination Oct. 20, 1985. As of this writing 27 seeds have produced roots and have been transferred to the refrigerator for plumule development. This was my most encouraging year for the Itoh cross and I have no explanation for the greatly increased seed production from this cross after so many meager years. Perhaps some of breeding stock is getting mature and is producing more fertile gametes or is it just weather?

A Possible Answer for Al Rogers - With regard to the treatment of peony seed with gibberellic acid, Lela V. Barton and Clyde Chandler (Contribs. Boyce Thompson Inst. 19, 201-214 (1957)) have reported that gibberellic acid applied to the hypocotyl of rooted TP seeds promotes the growth of dormant epicotyls replacing the need for low temperature pretreatment for the production of green shoots. I have not tried this chemical and am not aware of any more recent references to its use on peony seeds. It might be time to try some experiments.

A Question - Does anyone have a list of the Daphnis numbered seedlings which shows their pedigrees and preferably also gives a description of each seedling's flower and plant habit? I would very much like to have a copy of such a list.

I find the Breeders' Robin to be very informative as well as a pleasure to read. Steve, I, for one, want you to know how much I appreciate all the effort you must put into this endeavor so that things run smoothly.
I trust this finds everyone well and ready for a big 1986 pollinating season.

Best regards to all,
L. J. Dewey

P. S.
Steve Varner: Sorry I forgot to type on both sides but will try to mend my ways on the next flight. Incidentally, the Siberian iris plants you sent fall 1985 were beautiful divisions and arrived in great shape. Of course they have not started growth this spring (1986) so I cannot tell how they came through the winter. I am leaving my Flight 2 letter in the Robin for William Adee to see. You can remove it when the Rob gets to you and discard it or whatever since I have a copy of my own.

Al Rogers: About the Smirnow Chinese tree peonies. My guess is that most of them are suffruticosa but I have not seen any of the yellows. My only survivor of the several I have ordered is Red Dynasty. It is suffruticosa and forms an attractive compact plant of medium height (3 to 4 feet). The flower is a medium red with a little bluish tint - not the real clear red I like. It is semidouble. I like the plant and flower form and can live with the color. It is a prolific bloomer, sets seed and has lots of pollen.

Bill Seidl: You are welcome to a division of HP 1-61. I will plan to send you one this fall (1986). What to trade?: Because of my limited space, I am sticking mostly to tree peonies so if you had a young graft of an interesting variety you could spare that would suit me fine. If not, no trade would be necessary. -L.J.

(From page 4)
'**Zephyrus**' has produced several blooms on a first-year plant and to get maximum amount of pollen from it I've put the day-old anthers in a salt-shaker with a pebble, and that in a dessicator except when in use. Shake the salt-shaker and the pebble knocks the pollen loose. Most seem to become available about the 3rd day and there is quite a lot. Under the microscope I've observed what appears to be many normal grains. (Pehrson always used a pebble in a 35 mm. film cannister.)

PEONY BREEDERS' ROBIN - Flight #4

May 1, 1986 -- Chris Laning

Much of the material in this Robin is timely for 1986 hybridizing projects so I hope you all can agree to allowing some of it to be included in the newsletter PAEONIA. If some articles are not to be reproduced, please state that in your writings!!
Hybridizing is bringing new and unexpected things at an ever increasing rate making our hobby so very interesting that one hates getting old!
Last week two nights of freezing -- down to 20°F -- damaged buds on the early varieties and burned some of the foliage. (Magnolias in full bloom ended the flowering season with brown petals that still disfigure the trees.) We must take cognizance of this serious shortcoming in our plans in hybridizing for earliness. It appears that flowers of yellow color are especially susceptible to frost damage though even lobata hybrids suffered somewhat.

About 250 seedlings of *P. delavayi* are developing in my plastic A-frame. Germination has been about 50%, while not exceptional, total amount of these black-red species seedlings are enough for a beginning on a new line. What is wanted is a plant that produces no pollen but produces seeds from pollen of other plants. How to identify such a plant I cannot yet tell -- maybe by lack of pollen or pollen that is shriveled and no good or ?? If such a plant is found, by isolating it and applying pollen of my choice, hybridizing will be much simplified. Just think, planting this product of a daydream among the selected group of named varieties of suffruticosa giving grand results with little hand labor. The T.P. plants that are grouped by themselves (away from other peony plants) are as follows: (1) '**Guardian of the Monastery**', (2) '**Companion of Serenity**', (3) '**Shintenchi**' and (4) '**Yaso No Mine**'.
Right now I am wondering if a method of deactivating pollen is a possible approach such as maybe manually opening a bloom and spraying the pollen with honey, making it too sticky to pollinate the flower or -- what ideas do you folks have?

The flowers in this plastic folder were taken by Roy Klehm some years ago at one of our National Peony Shows. It depicts a group of seedlings that he thought outstanding. The group of four (second from the left - top row) is Saunders '**Halcyon**' F2, a gift from Silvia. The plant itself is as good as any I have ever seen, about 30 inches tall and really compact. The flowers are not large and the side buds give small exquisite flowers not more than two inches across. Should be called Darling Halcyon, or something.

At the turn of the century the Berlin Botanical Garden received a plant of P. suffruticosa variety papaveracea. This one is what we call Rock's Variety. Mr. Langfeld sent me 24 seeds, eight of which produced seedlings -- the other seeds are still sound -- still in moist vermiculite and will probably remain dormant until fall. The enclosed picture shows a magnificent flower from the magnificent plant. I have read that this variety is not fertile on its own pollen; Dr. Reath, do you find this to be true? Also it has been stated that it is very hardy! -- and if true should be a good seed parent.