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Dear Mr. Laning

Many, many thanks for the Paeonia news you sent me. After studying them I think I should write another letter.

Your attempts to breed dwarf peonies interests me very much. At the Klose's nursery I saw 'LITTLE DORRIT' by Saunders and was thrilled by the thought these dwarfs do not need to be staked a.s.o. After reading your article in June 92 about Dwarfism I had the feeling to ask you whether I already sent you seeds of P. off. 'Mollis' or not? Therefore I'm sending you some.

I especially want to draw your attention to P. off. 'Mollis'. It is dwarf, slightly stoloniferous and it is the earliest of all! I already told my excitement about this plant to Mrs. Kessenich and she printed my letter in the March Bulletin 92, to my surprise. As you are such a specialist I studied more of my literature available. Stern tells that P. mollis is sterile, so my plant really seems to be a special form of P. officinalis (20 chromosomes). The next peony that blooms in our garden is P. tenuifolia (10 chr.) followed by P. mlokosewitschii (10) and P. wittmanniana (20). So the seeds I'm sending you probably are a self-crossing or maybe a crossing between P, off. 'Mollis' with P. wittmanniana, but I do not very much believe in this idea, because P. off. 'Mollis' was nearly finished when P. wittmanniana started in May 6, 92.

Here are some questions I do not know:

In peonies breeding - is there a method to convert the chromosomes with colchicine like the lilies or daylilies breeders do? So you could cross P. off. 'Mollis' with your very interesting tenuifolia x mlokosewitchi cross?

How can one store pollen of peonies? I suppose cool (refrigerator) and dry (with such a salt that dries out)?

My husband I wish you a Merry Christmas and a Happy New Year.

Irmtraud Rieck

REPLY TO MRS. RIECK'S LETTER

The answering of your questions will be of interest to many PAEONIA readers since general information is always desired.

The use of colchicine to induce polyploidy in peonies has been done successfully by Dr. David Reath of Vulcan, Michigan. The article written by him can be found on pages 153 and 154 of the book "The Best of 75 Years" compiled and edited by our Greta Kessenich.

My recollection of the further development of David' s tetraploids of the lactiflora varieties is infused with my opinions so are to be considered as opinions and not facts.

Dr. David's tetraploid lactiflora clones seemed to lack fertility and have not been distributed to fellow hybridizers. Or, if they did develop seed, the results have not been published (to my knowledge).

The clones did flower and pollen from them was given to one or more hybridizers and their development or the results have not been published. Quite likely, Dr. David Reath or his son, Scott, can bring us up to date on this undertaking. Surely enough time has elapsed that more developments are expected — How about it, David or Scott!

With the passing of time and the further developing of the advanced generation fertile tetraploid hybrids, the need for tetraploid lactiflora peonies is diminishing. The tetraploid hybrids with double, semi-double, anemone, and single flower forms are available in reasonable quantities as replacements for the diploid lactiflora varieties, however, just because a clone or a variety, or even a species, is tetraploid doesn't ensure fertility.

I suppose your interest in the changing of ploidy from diploid to tetraploid by using colchicine is mainly in hoping my tenuifolia x mlokosewitschii can be changed into a useful tetraploid! Surprise! — the plants of this cross are actually F_4's from the original cross and appear to be tetraploids or at least amphidiploids brought about by unreduced gametes. Maybe this is getting to be too technical so just think of these plants as tetraploids and forget about the process, but the fertile plants are the result.

Maybe we, you and I, can work on dwarfs. You may or may not be interested in hybridizing but you needn't get too involved. I'd like to send you a plant of tenuifolia x mlokosewitschii, an F_4 (one of 16 clones of this cross). This plant has yellow flowers and fertile pollen. Also it is very early blooming, probably as early as your P. off. mollis. If you make this cross and send me half of the seeds you get, I'll be delighted.

- Chris

585 Napa Road
Sonoma, CA 95476
Jan. 17, 1993

Dear Chris:

Since mid-November the high-low-thermometer has recorded nightly temperatures ranging from the 40's and 30's to some upper 20's. Most peonies are safely dormant. In contrast, one of the five lutea seedlings looks almost fully evergreen with a flower bud gone soggy from recent rains and the other four look dismal with new growth at the tips and older leaves hanging brown and soft. (After trimming they don't look much improved.) There are eleven ludlowii seedlings, all but one looking equally miserable. That exception looks as dormant as do the suffruticosas. Mr. Seidl sent lutea and ludlowii seed in 1989 and I've come to appreciate the information gained by watching the growth of the lutea species compared to the hybrid offspring. It's no longer surprising that '**Boreas**' and '**Icarus**' threaten to die each winter when sudden frost cuts down their new growth. '**High Noon**' grows beautifully in the summer and then tries to bloom again in the fall and winter until it finally gives up and spends December and January looking terrible. '**Golden Era**' is the most lusty grower of the lot and appears as dormant as the suffruticosa's.

Since most of my peony energy goes toward hybridizing for Itohs, the response of the lutea hybrid parents here is particularly important. I wish someone would suggest methods of promoting dormancy among the lutea, ludlowii, and lutea hybrid plants. Christopher Lloyd in his Well Tempered Garden says of delavayi (with which I've had no experience) "...delavayi has the additional drawback of not shedding its old foliage in autumn.... It hangs on in an unsightly manner..." In contrast, writing of ludlowii, he says, "...it has a great pull over P. delavayi in shedding its leaves cleanly, in autumn, very often all at once in a matter of one blustery day." So much for the English garden view.

Come hybridizing time I use the two-part plastic Easter eggs (more traditionally used in children's Easter baskets) to hold pollen. These are then easily carried and stored in regular egg cartons.

There was one strange circumstance which perhaps someone may care to think about. Pollen from a fall blossom in '91 was saved for spring pollination of two protected '**Martha W.**' blossoms. Huge pods ensued and at harvest revealed 39 soft seed and one which appeared firm. All failed but I hope to repeat the experiment in 1993.

Best wishes for the New Year.

Sincerely,

Irene Tolomeo

Can and would you ship me a '**Sunny Boy**' this fall. I'd like to try for a few patterned flowers. (If you feel something else would be more appropriate I'll appreciate your views.) A stamped envelope is enclosed for your response, price, etc. Thanks.

Dear Irene:

Maybe you can glean some information from the following article and do a little experimenting on your own. California has what we call a Mediterranean climate which isn't too bad for our herbaceous peonies which have the "near east" climate origin, but all tree peonies have their origin in China. That indicates warm summers and cold winters. This article may be of interest to peony lovers in our southern states too.

I can't supply '**Sunny Boy**', but '**Sunny Girl**' and other double flowered yellow fertile clones will be available at $50 per division; singles at $25.

As our late Roy Pehrson would say with regard to experimenting, "try everything".

- Chris

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PROBING THE PRIVATE LIFE OF FRUIT TREES

(American Horticultural Society) Volume XX No. 1 January, 1978

One of the big problems with growing fruit in some areas is that fruit buds may be seriously damaged by warm spring temperatures followed by freezing weather. Another problem is that in some areas the chill requirement of the best varieties cannot be met. A research group at Utah State University is trying to find out whether it is possible to do something about those problems.

It seems safe to assume, says Dr. Schuyler Seeley, professor of fruit crops, leader of the research group, that the average tree simply responds each year to a series of interactions between its internal and external environments.

If we could determine the hows and whys of when fruit trees start and stop growing, we might be able eventually to program a tree's time of bloom by artificially manipulating chemicals that occur naturally in the trees.

In effect, we might be able to supply the trees with a hormone-based anesthetic in early spring and withdraw it when frost dangers moderate.

Right now, the research group is concentrating on one particular piece of the puzzle: Why do fruit trees require a certain amount of chilling before they can respond productively to warming spring temperatures?

Thanks to prior research, he says, we are starting with some "knowns". For example, a healthy tree, left to its own devices, has to accumulate a certain number of chill units before it can begin to grow each spring (1 chill unit equals 1 hour of 43 degrees temperature; a longer time is required above and below 43 degrees; 2 hours at either 50 or 35 degrees for 1 chill unit).

Also, once a mature tree's chilling requirement is satisfied, it will grow best at temperatures between 40 and 80 degrees. In fact, temperatures that consistently exceed 80 degrees will stop growth. And, after a tree has produced its fruit, stripping it of all its leaves simultaneously strips it of its chilling requirement (The Javanese, with their mild climate, put this phenomenon to practical use. They harvest Rome Beauty apples in April, strip the trees of their leaves in May, and harvest again in October.).

The Utah State University researchers are experimenting with peach trees to find out whether the observed effects of leaf removal are correlated with variations in the trees' supply of growth-promoting and growth-inhibiting hormones. If so, the next step will be to separate the hormones from all the other chemicals in the leaves. Once that technically exacting task is accomplished, the hormones would be tested on seedling trees to pin down precisely how they operate.

Achieving the ultimate goal of controlling the dormancy (chilling) requirements of fruit trees would mean better fruit production in areas that are currently marginal because of either too much or not enough natural chilling potential.

EDITOR'S COMMENT ON PRECEDING ARTICLE (Probing the Private Life of Fruit Trees)

I'm wondering: — Since lutea hybrid tree peonies and suffruticosas form flowering buds in early summer, would the process of stripping them of their leaves in July or August cause them to bloom again in the fall (rebloom)? Also, some Itohs form flower buds during the summer time but freeze out during winter. Could these be forced into fall bloom by stripping them of their leaves in summer?

Maybe the article can give some direction for experimenting. Don't forget, gibberellic acid spray is an interesting tool — and it could possibly come into play in this experiment. Triacontanol or even alfalfa pellets conceivably could come into play right here.

- Chris

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GENERAL INFORMATION

When trying to germinate species peony seed it has been found that there often is very little stamina initially. The frail radicals and plumules die before sprouts show above ground. Last year while trying to discover why '**Picotee**' seeds (a hybrid clone) failed to grow even when planted in half soil and half vermiculite, the mixture was removed down to the seed, and plumules were leafing out beneath the one inch layer of soil.

Now seeds are planted on top of the ground (in pots) and covered only with vermiculite. The covering can be poured off any time inspection is desired.

Special treatment for a very treasured plant that is doing poorly:

- Dig soil from one side of the plant exposing outer parts of the roots on that side.
- Fill in the hole with leaves, straw, grass clippings, etc., or add old mulch.
- Water regularly with green water (green water is made of vegetation such as weeds, grass clippings, which have decomposed or fermented in a barrel of water. Add a cupful of lime to this mixture occasionally.)
- This green manure will add bulk, keeping the whole process level with the ground. Later, mound soil over this area.
- If this treatment proves successful, two years hence repeat the procedure on the other side.

It is altogether possible that the plant is intent on committing suicide in which case grant its desire.

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Species seed need coddling: Having tried a hundred different ways, success is still less than assured. "An Intensive Care Unit" along with close supervision is needed. I have found that often one inch of soil over the potted seeds acts as an impenetrable barrier. Occasionally when this inch cover is removed, seedlings can be seen developing — even leafing out. But they can't get through the one inch dirt. Now they are planted on top of the potting mixture and covered with one inch of vermiculite — which is always kept moist. This vermiculite covering can be poured off occasionally for inspection purposes — and then replaced.

Along with all this "monkey business," a location where the germinating seedlings will not freeze is required. They need the cold rest period but not sub-freezing temperatures. If it weren't for the winter pleasure I get out of all this, it just wouldn't be worth the trouble.

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Yellow flowers for Show: The petals of yellow flowered peonies readily turn brown where they touch the bag used to protect them. To keep them in good condition they must be kept from touching the bag or container. This is true of the Advanced Generation Hybrids —not of lutea tree peony blooms nor of the yellow Itohs. '**Sunny Girl**' and '**Sunny Boy**' and their yellow friends are not a finished product as yet.

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Red - Red - Red: The list of bright red hybrids with single flowers is getting to be fairly long. '**America**', '**Burma Midnight**', '**Dad**', and '**Burma Ruby**' are dandy plants - do we need more? Our Mrs. Greta Kessenich says there is one that yet needs to be introduced. To me it is quite similar to the above group but she says it's better. The parentage is Roy Pehrson's '**Sable**' x Super "D". Two clones of this cross were given to me many years ago, now listed as #113 and #114. Both are fertile but I gather more seed from #114 and this makes it very valuable for hybridizing. Paeonians, what shall be its name? Pehrson's Pride? or Red MaMa?, or what?

- Chris

TREE PEONY PROPAGATION BY ROOTED CUTTINGS

As recorded by the late C. Graham Jones and included in the book American Peony Society Seventy Five Years, compiled and edited by Greta M. Kessenich.

This review of the process of developing new suffruticosa plants by means of cuttings is to inspire the hybridizers and other peony enthusiasts to experiment with the process and, if possible, develop it further!

1. Take cuttings of the current season's growth immediately after flowering. The cuttings selected should be taken with a small amount of old wood at its base. Inter-node cuttings should also be tried.

2. Cuttings should be 5 and 6 inches in length.

3. Remove lower leaves, reduce the area of upper leaves by cutting off about one-half of each leaf.

4. If cutting has a terminal flower bud, remove it.

5. Sharp sand, sand and vermiculite, sand and Perlite, sand and peat moss, etc., are mixtures that should be tried to find the best medium for the rooting process.

6. Dip cuttings in a rooting agent such as "Rootone".

7. Pot up in 4 inch pots, taking care to not scrape off the rooting powder.

8. Place potted cuttings in a closed frame to ensure high humidity.

9. Note that peony cuttings are not only node but also inter-node rooters.

10. For winter protection place pots in a cold frame.

11. Keep us informed as to your success, or lack of success. Both Paeonia and the American Peony Society will be interested in your results!

p.s. Read C. Graham Jones' article as found on pages 158 and 159 in the book "The Best of 75 Years". If you don't have the book, buy it since it is full of valuable information!

Suggestions for Seedling Production from Rare Peony Seeds

Don Hollingsworth
November 1992

The current lively demand for plants of Paeonia species which are rare in commerce has led to increasing interest in species seeds, also difficult to obtain. Of course, acquiring seeds satisfies only when seedling production is successful.

"Indoor" germination practices, the basis upon which much of the presently known details of peony seed germination have been worked out, may be a poor choice for trying seedling production from rare, unknown seeds. Most of us who have been studying seed germination see a great many failures, even when working with the better understood domestic varieties.

Natural species exist only because they are able to reproduce in nature, unaided by humans. Recognition that this may mean the species seeds are rather narrowly and precisely programmed is a good place to start. It is therefore suggested that, when trying to germinate seeds for which nursery procedures have not been worked out, the prudent choice is to plant them out of doors under the influence of the natural cycle of the seasons. This is not to say that we should forget what we have learned through "indoors" germination activities, for this knowledge may lead to useful insights for outdoors handling.

In light of the foregoing and what I have already seen of variation in germination requirements among peony seeds, my current seed packet label would read as follows:

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"Paeonia species: Seeds may produce plants in one or two years, delays believed due to factors in embryo and/or endosperm. These blocks may be overcome by (in sequence) 1-4 months, or more, in warm moist environment, followed by rooting upon onset of colder soil temperatures of 55-70 degrees, after which one to several months of chilling at around 40 degrees should reduce bud dormancy and allow leaf production in early spring. Significant variations are seen between species and different seed lots within the above ranges.

"Plant dormant seeds of peony outdoors late winter to mid-spring, in a prepared bed or at a lightly shaded, protected site with good air circulation where the plants are to grow. Provide a fertile, well aerated, well drained growing medium which will remain moist. A later planting time, in summer or early autumn may be associated with second spring emergence. Exception: Seeds of *P. californica*, native to dry places at lower elevations, may complete germination in less than a month, plant in late autumn.

"In colder climates, provide additional protection, such as an insulated cold frame, to reduce the length of time the growing medium remains frozen, especially indicated for seeds of species native to climates where growing sites are cold but are not frozen most of the winter. The frame cover should admit light.

"First year seedlings of most species typically produce only one leaf, sometimes two. Survival to the second year depends upon growth and food stored in the root. Guard against untimely loss of leaves. Provide shade against intense sunlight to protect against sunburn. Provide good air circulation and/or other measures as may be indicated to control fungi."

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Species seeds in their natural habitat can be expected to complete germination and leaf production at the season most favorable for their survival. For peonies this is near the beginning of the growing season while soil is relatively quite cool. (In the case of *Paeonia californica*, noted above, the growing season may commence in early winter, e.g., right after Christmas at southern California sites.)

The coldframe recommendations above are directed especially toward some of the southern species of peony. My direct observations support the conclusion that at least two adaptations of note are present among such peony species. One is in *Paeonia peregrina* Miller, in which root germination tends to be delayed until the relatively colder autumn soil temperature of about 55 degrees is reached.

The second adaptation of note is based upon seeds of uncertain identity with which I failed at last, due to the very long chilling period (in the refrigerator) which was necessary before the plumules commenced extending. I planted them outdoors in late August when plumules were about a half inch long, but they still did not grow. This was after seven months in the refrigerator, at least twice as long as any other seed lot has required for a similar stage of development.

Both the late rooting and the longer period for dormancy reduction are adaptations which in nature would conceivably delay the time of leaf emergence, thereby abating the risk of late frost damage. Since it is understood that dormancy reduction is slowed or stopped at near freezing and lower temperatures and that some species may require an extra long time at the effective temperatures, the coldframe procedure is incorporated above.

Then there is the Vegis Hypothesis, which instructs concerning the expansion of temperature range at which buds may grow as dormancy is progressively released. It comes from research in the study of dormancy and may or may not be generalized to include peonies. Nevertheless it has implications for the analysis of what we see happening when indoor germinated seedlings of peony having extending plumules are removed from chilling environment and planted out during warm weather, yet fail to grow.

The Vegis Hypothesis holds that the release of dormancy is not just an on/off matter — the bud is not at one point unable to grow at all and at the next able to grow no matter what. Instead, the release of ability to grow is at first at a very narrow range and as the dormancy block is further reduced, then growth can take place at a progressively wider temperature range. Suppose with me that this applies to peony buds and that the first level of release is for growth at cool temperatures (keeping in mind that peonies in fact grow at very low temperatures in early spring).

Peony seeds started late for indoor germination (common when trying to get the current season crop going "first" year) will be rooting until well into autumn as contrasted to possible September rooting of seeds planted in spring, as suggested above. If by our handling, or in spite of it, these seedlings are not producing plumules in early spring, pretty soon there is nothing but quite warm soil out there in which to plant them. By the Vegis Hypothesis, we must have the dormancy block more fully released or they cannot grow. In the growing warmth of the season we then have to get the dormancy block completely wiped out or the seedlings will fail when planted out.

In 1992, I first planted peony seedlings from the refrigerator in late June and July. Only those with very long plumules succeeded (provided they weren't too far gone) . This wasn't a very satisfying experience! But, it seems to be consistent with application of the Vegis Hypothesis in trying to understand what is happening. I suppose some of the seedlings could have grown very early while it was cool, but later the warming season outran the rate of further dormancy reduction!

Needless to say, for my own breeding program I am leaning toward using whatever strategies can be identified to get seedlings ready to grow earlier in the season, whether first year or second, whether germinated indoors or outdoors. Ultimately, all of them must complete leaf production outdoors.

Breeder clones are being classified upon the speed with which their seedlings germinate. And, seed lots are being moved to rooting temperatures earlier. I may also develop a better cold frame to protect germinating seeds for outdoors germination, and maybe give up this indoor struggle by which we try to hurry germination by a year. Perhaps, there will also be the bonus of a different slice out of the gene pool among the resulting seedlings, some peonies the like of which we haven't seen before because the germinating seeds did not succeed.