PÆONIA

AN INTERNATIONAL NEWSLETTER FOR PEONY HYBRIDIZERS

Volume 28, No. 3 **Summer 1998**

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Subscription Rates:

U.S.	Outside U.S.
5 yrs. -- $25.	$35.
10 yrs. -- $45.	$65.

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HÉLÈNE MARTIN AS A BREEDER PLANT

by Don Smith

The new hybrid tree peony, *Hélène Martin* (P. potanini x Gessekai) bloomed for the first time in my garden on 5/17/98 along with the bulk of the Japanese tree peonies (all of which were 2-3 weeks ahead of normal). There was just a single flower which was very large (~9") but nodding. The flower opened a very pale yellow, but quickly faded to a near white with a very light yellow central-petal streak. The plant was of average height, which was taller than I had expected. The foliage is finely cut and quite attractive. The single flower had many stamens that yielded an adequate amount of pollen.

It had been reported that H. Martin pollen was fertile when used on other tree peonies and I was anxious to test the fertility of this pollen for myself. Thus, H. Martin pollen was used on several seed-fertile lutea hybrids, such as A-198. As of this writing (approximately 7 weeks after pollination), it would appear that two of these crosses have been successful and at least a couple of seeds now appears certain. Hybrids with this parentage will undoubtedly continue to be dominated by the strong lutea yellow color, but could be fairly fertile and just might give rise to a few true orange shades in subsequent generations. But don't hold your breath (see page 3, this issue).

However, as you are all aware, my main interest in breeding peonies continues to be the intersectional cross. And so, I simply could not resist the opportunity to test this pollen on a few herbaceous peonies as well. Consequently, H. Martin pollen was also used on several herbaceous lactiflora varieties including the super-seeder, *Martha Washington*. As of mid-July it is clear that a number of these crosses (with *M. Washington*) will produce seed. If hybrid plants can be produced from these seeds, they would be unique and could also prove to be very interesting. Such hybrids would not contain the strong lutea yellow that has so dominated the bulk of the lutea and intersectional hybrids produce so far. However, since these would be first generation (F1) hybrids, they will in all likelihood be very sterile triploids. I believe that the yellow color will be masked in the first generation by the dominant lactiflora pigments and thus there will be no yellows (and therefore also no oranges) among these F1 hybrids. Yellows (and oranges) might segregate-out in subsequent generations, but with the high degree of infertility that is characteristic of this group, it will undoubtedly take a very long time for us to get there. If this is the road to orange peonies, it is no doubt a very long road indeed.

However, there is more to life than visions of beautiful orange peonies, at least, there is for me. If we can live with the real possibility that this cross may never yield orange or even yellow hybrids, then we can start to think about what such a cross might more likely produce. I believe that the possibilities are still quite exciting and should definitely be fully explored. See related article on page 3 of this issue for more details.

A summary of the crosses made using *H. Martin* and the results obtained are given in Table 1. Overall, thirteen crosses were made. Five of these crosses will give seed. We will have to wait to see whether any of these seeds will be "good".

Table 1. Summary of crosses made during 1998 with *Hélène Martin* as one parent.

Seed parent	X	Pollen parent	No. of crosses	Successful crosses	Pods with seeds
M. Wash.	x	H. Martin	6	3	5
Lactiflora	x	H. Martin	2	0	0
A-198	x	H. Martin	3	1	1
Exotic Era	x	H. Martin	1	1	1
H. Martin	x	M. Wash.	1	0	0

IN QUEST OF ORANGE

by Harold Entsminger

Hélène Martin bloomed this June, '98. The flower was light apricot, 7" in diameter, on a plant scarcely 8" tall. Hélène has deep red-purple flares on it's petals and has a moderate-lemon fragrance. It had a small amount of pollen. I opened the petals and taped the stigmas, but was fearful, as always, when I saw a big bumble bee fly into the blossom, then quickly back out. Had there been pollen, the bee would have stayed, I thought. I had several seeders in bloom, *Tessera*, *Ariadne, Nike* and others for both pollen and seed. So the pollenating began. Tessera x Hélène Martin, Ariadne x Hélène Martin, Nike x Hélène Martin, L'Aurore x Hélène Martin, Conquest x Hélène Martin, and Gauguin x Hélène Martin. Then there was Hélène Martin x Nike, Hélène Martin x Mons. Antoine Riviere and Hélène Martin x Gauguin. Nine different crosses in all. Now I wait and hope for seeds.

There were so many exciting blossoms all in one year. *Hélène Martin* kept it's round cup or bowl-shape for the entire 2 week period that it stayed in bloom. It faded to light yellow, then white with mid-petal yellow stripes just prior to dropping it's petals.

Tessera blooms well here, and reliable year to year. It's color is elusive, varying greatly from year to year. Dependent, I think, on soil and weather conditions, hot or cold. This year it bloomed a semi-double, nearly double, yellow with deep purple flares and some fragrance. Had I just purchased it, I would have written the nursery and said, "I know what *Tessera* is, and this is definitely not it." *Tessera* usually blooms a single, with an almost metallic new-copper-penny color without fragrance. I moved it this early spring (1998) to my new garden. Another year it bloomed after an exceptionally cold winter, -50° F and sustained -30° F for two weeks, a vertically alternating striped color of pink, yellow and red. It is, however, the only tree peony I know of with orange stigmas, 4-6, which is a constant or has been so far.

I had hoped for a bud set on Saunder's F2A, but was disappointed after having moved it to it's new garden. I would have tried Coral Charm on *Hélène Martin*, but ran out of carpels. So like the hybridizer who drank eight Cokes and burped

Seven-up, I hope one of these crosses will produce something orange, very orange!

The Trollioides from Reath are up and growing nicely. So, when they are old enough to flower they may produce orange with some deep, bright red tree peony. Time will tell! For now, I am really excited about *Hélène Martin*! If I get an orange from her, I may name it Bee-dazzled, in honor of that bee who flew-off and left Hélène's pollen for me.

THE POTENTIAL FOR ORANGE FROM P. POTANINII AND ITS HYBRIDS

by Don Smith

I hate to rain on the parade of those peony hybridizers who are so optimistic about the prospects of producing orange peonies by using P. potaninii or its hybrid progeny. However, I think the prospects are not particularly good for producing orange with this line of breeding.

The yellow in P. potanini trollioides, while not as intense or as opaque as that of P. lutea, is nonetheless, a fine clear color. It can be matched closely with Mimosa Yellow 602 from the Wilson Horticultural Chart. This yellow belongs to a class of pigments known as chalcones, which are related to the anthocyanidins (reds) and flavones (pale yellow) found in herbaceous peonies. In theory this yellow color will mix with the red pigments found in other peonies to make orange. However, based solely on the experimental evidence that we have so far, I suspect that this is unlikely to occur especially in first generation hybrids.

I admit that these preliminary conclusions are based on very limited information, but here's how my thinking on this goes. As far as I know, P. potaninii has only produced two known (named) hybrids. These are the tree peony hybrid, *Hélène Martin* (P. potaninii x Gessekai) and the Anderson intersectional hybrid, *Unique* (Lactiflora var. Martha Washington x P. potaninii). Each of these hybrids was produced using yellow forms of P. potaninii (var. Trollioides or Tall yellow). However, neither of these hybrids is yellow. *Unique* is a deep, dark unusual pink and *Hélène Martin* is a very pale yellow which quickly fades to near white. So where did the yellow go? It appears that the chalcone pigments from P. potanini are overpowered by the flavones and anthocyanidins from P. suffruticosa and P. lactiflora respectively. In other words, the yellow pigment in P. potanini is recessive and acts more like the yellow in P. mlokosewitschii and P. wittmanniana (to which it is related) than the yellow in P. lutea.

Readers who are interested in breeding for orange colored peonies should definitely read and re-read a number of old articles related to P. Mlokosewitschii and it's hybrids. The first is an article by Don Hollingsworth entitled "Breeding a strain of Pæonia Mlokosewitschii for Garden Use" (Vol. 8, No. 2, p. 6-8) 1977; and the second is an article entitled "Cream" by Chris Laning (same issue, p. 9). The third is by the late Roy Pehrson and is entitled " P. Mlokosewitschii" (Vol. 4, No. 1, p. 2). According to Pehrson, Saunders produced several distinct groups of fertile hybrids containing "mloko" blood (the mloko-macro hybrids and the mloko-tenui hybrids are two examples). "In these hybrids, the rather pale yellow of "mloko" is diluted or may not be evident at all". In the Hollingsworth article, Don conjectured on the mode of the inheritance of "mloko" yellow. Although these were not put forward as hard and fast "rules", I accept these as "rules", because they are clearly supported by decades upon decades of experimental data. These "rules" are summarize below:

1. Mloko yellow is dominated by other pigments in the F1 generation. This is true even in crosses with white-flowered species which can either dilute or mask the mloko yellow and cause primrose, off-white or cream colors. When genes that give red or purple pigments are present along with mloko yellow, they produce "pinks of varying depth, rosy ivory and other warm muted color tones".

2. The clear yellow color of mloko can be recovered in subsequent generations, but only by breeding-out the contaminating red or "white" pigment genes which dominate or dilute the yellow color.

3. Breeding-out the contaminating genes to restore the good yellow color probably requires, at least, two generations (F2 and F3).

I believe that these "rules" can be summarized by stating that: mloko yellow does not really mix with other pigments (including other flavones and anthocyanins) but is instead diluted or dominated by them. If these "rules" are valid or even approximately so, then good yellow colored hybrids can eventually be produced from this line of breeding (in advanced generations) but, orange shades can not.

Once again, it is important to point-out that these conclusions are fully supported by the available experimental results. The advanced generation hybrids with "good" yellow color from Laning, *Sunny Boy*, *Sunny Girl* etc., are clear evidence that support the former conclusion. The fact that we have yet to produce an orange (or anything even close to orange) from this line of breeding strongly supports the latter conclusion. The experimental data supporting these conclusions is summarized in Table 2 below.

Some have suggested the possibility that mloko yellow is inherited through the action of non-chromosomal genes (i. e., by maternal inheritance) and thus can only be transmitted when mloko is used as the seed parent (Vol. 7, No. 4, p. 7). This conclusion, however, cannot be supported by the experimental results. The existence of the pale yellow F1 hybrid, *Claire de Lune* (lactiflora x mlokosewitschii) by itself completely eliminates this possibility. The yellow color in this hybrid could only have come from the action of chromosomal genes contributed by the pollen parent.

Based on the evidence presented in Table 2, I am convinced that there will be no orange peonies produced from mloko or wittmanniana yellow. In addition, I do not believe that there is any evidence that would suggest that we will be any more successful by using P. peregrina (lobata) which also contains a yellow pigment. In fact, it has been reported that this yellow dye is the very same pigment that is found in mloko (Vol. 4, No. 1, p. 2). Furthermore, the "yellow" (flavone) in P. macrophylla is even weaker and more recessive than that present in mloko and wittmanniana.

So, where does that leave us relative to producing orange colors in the herbaceous group? The only hope I see is with *Oriental Gold* and its hybrid offspring, *Goldilocks*. However, there is a good chance that *Oriental Gold* is itself a hybrid derived from mloko breeding, in which case we are dead out of luck. Even if *Oriental Gold* is not from mloko breeding, it may still contain the very same yellow pigment (flavone) found in mloko. Nevertheless, there is still some chance that the yellow is not from mloko, but is from some unknown yellow species that contains a different yellow pigment. Personally, I am not particularly optimistic about our chances for orange here either, but certainly, this possibility should be pursued further.

Goldilocks (*Oriental Gold* x *Claire de Lune*) is currently available from Reath's Nursery and several other sources. *Oriental Gold*, which was long unavailable, has recently reappeared under the name *Golden Wheel* (see Vol. 27, No. 3, p. 6) and is now available from two U.S. sources (White Flower Farm in Litchfield, Conn. and Golden Port International in Duluth, GA). *Oriental Gold* is obviously pod fertile. *Goldilocks* has no stamens or pollen, but is reported to be seed fertile as well. Additional work with these two varieties is probably warranted and might be rewarded.

At this point, let's look closer at our chances for orange with P. potaninii. Unfortunately, there seem to be strong similarities in the way the yellow color in P. mloko and P. potaninii reacts when these two species are used in crosses with other species. These similarities can be seen by examining the crosses shown in Table 3 below. Although it would be extremely desirable to have a lot more data to work with here, one very important observation cannot be easily overlooked. When the yellow potaninii was crossed with a white suffruticosa, it did not produce the expected yellow offspring. This fact alone should be very troubling to the hybridist hoping to achieve orange colors from this line of breeding. This is the very same behavior that is exhibited by P. mlokosewitschii when used in similar herbaceous crosses. To me, this result strongly suggests that potaninii yellow is effectively "recessive" even to white. But white is the expression of a lack of pigment, so how can this be? White is supposed to be recessive to all other colors. Unfortunately, this issue cannot be understood in terms of simple dominance and recessiveness. To adequately understand this situation requires a much more detailed discussion of the genetics of flower color than can be presented here. In reality, flower color inheritance is fairly complex and in most cases involves six genes operating in a serial gene system with epistatic interactions. I will save this detailed discussion of flower color genetics for a separate article in a subsequent issue of the newsletter. For the purposes of the discussion here, it suffices to say that yellow was not dominated by white, but was instead merely diluted by the presence of a special type of color inhibitor gene called a bleaching gene. A yellow producing gene in the presence of a yellow inhibitor gene will give primrose, cream or off-white, but not good yellow.

Continuing along with the present discussion, if the yellow in P. potaninii is similar to the yellow in Mloko, then the same "rules" that govern the inheritance of mloko yellow may also generally apply to potaninii yellow as well. I believe that they do and I also believe that the experimental results obtained to this point (limited though they are) fully support this conclusion.

Table 2. Summary of experimental results obtained from F1 crosses involving P. mloko and P. wittmanniana.

Seed parent		Pollen parent		F1 hybrids	Seed parent flower color		Pollen parent flower color		Color of F1 hybrids
P. mloko	x	p. tenuifolia	=	Many hybrids	Mloko yellow	x	red	=	Reds and pinks only
P. tenuifolia	x	P. mloko	=	Many hybrids	Red	x	mloko yellow	=	Reds and pinks only
P. lactiflora	x	P. mloko	=	*Claire de Lune*	Pink	x	mloko yellow	=	Pale creamy-yellow
P. mloko	x	P. macrophylla	=	Many hybrids	Mloko yellow	x	white	=	Pale ivory-yellow
P. lactiflora	x	P. wittmanniana	=	Several hybrids	Various colors	x	pale ivory yellow	=	Creamy pinks and whites
P. wittmanniana	x	P. lactiflora	=	*Ballerina*	Pale ivory-yellow	x	white	=	Pale greenish yellow → cream white

Table 3. Summary of similarities between P. potaninii and P. mloko with regards to inheritance of yellow flower color.

Seed parent		Pollen parent		F1 hybrids	Seed parent flower color		Pollen parent flower color		Color of F1 hybrids
P. lactiflora	x	P. potaninii (y)	=	*Unique*	Pink	x	potanini yellow	=	Pink
P. tenuifolia	x	P. mloko	=	Many hybrids	Red	x	mloko yellow	=	Reds and pinks only
P. potaninii (y)	x	P. suffruticosa	=	*Hélène Martin*	Potaninii yellow	x	white	=	Pale ivory-yellow → white
P. mloko	x	P. macrophylla	=	Many hybrids	Mloko yellow	x	white	=	Pale ivory-yellow

Working from this assumption, we can speculate on the "rules" for the inheritance of yellow and orange color that would apply to P. potaninii trollioides. These are summarized below:

1. The good yellow color of P. potaninii (Trollioides) will be lost or at least strongly diluted in first generation crosses with virtually everything.

2. The good yellow color can be recovered in subsequent generations, but similar to mloko yellow, only by breeding-out the dominating red and/or "white" pigments. Since orange tones require the simultaneous presence (mixing) of both red and yellow pigments, this method can not result in any orange colors, tones or shades.

3. Therefore, orange colors will not be produced from the potaninii yellow pigment (chalcone) even in subsequent (advanced) generations.

But, what then are the prospects for *Hélène Martin*? As a breeding tool, I believe that *H. Martin* will act as if it were a white "lutea" hybrid. As such it will have little influence on the flower color of the resulting offspring. At most, it might add a creamy tone to the pinks and whites that are produced. Crossed with lactiflora, it should produce progeny with the full range of lactiflora colors without the dominating influence of the strong lutea yellow color. These (nearly "pure" lactiflora) colors would be new to the intersectional hybrid group and might be fairly similar to those achievable by crossing lactiflora and suffruticosa. Crossed to red or pink lactiflora, it should produce intersectional hybrids with "good" red and pink colors. In crosses with lutea hybrids, the dominant lutea (yellow) and suffruticosa colors will undoubtedly prevail.

I realize that this is not a very optimistic view of our chances for producing orange colored peonies and, therefore, I hope that these conclusions are completely wrong. Those with a more optimistic outlook are encouraged to write and express their views on this subject. However, I believe that the evidence in the herbaceous group is quite substantial and remarkably consistent. Several of the hybrid lines included in Table 2 have been carried-on into the F_4 and F_5 generations. I would be extremely surprised if orange shades were to suddenly appear in any of these lines after all this time. On the other hand, there is only minimal evidence for conjecturing that mloko and potaninii yellows behave in a similar manner. In the end, this preliminary conclusion may not hold up in the light of additional evidence. If Hélène Martin turns out to be as fertile as it now appears to be based on my initial trials (see this issue, p. 1-2), then we should know much more about the behavior of this yellow pigment in various crosses over the next 5-10 years.

In addition, there is one other ray of hope in the tree peony group. There does appear to be at least one orange among the tree peonies. This is the Chinese tree peony *Tao Hua Chun* (Peach Blossom Spring). It is described (in the Cricket Hill Garden Catalog #3) as a semi-double of an apricot color that lightens near the petal edge. Since it is a semi-double, it probably has both stigma and stamens and thus could be fertile both ways. This variety is available from Cricket Hill Garden, 670 Walnut Hill Rd. in Thomaston, Conn. 06787. I suspect that it is not a strong color, but is rather only a light shade of apricot. Nevertheless, it just might be the only true orange peony in existence. Those who are interested in breeding orange peonies should definitely check this one out.

In the final analysis however, I agree with Bill Seidl (Vol. 28, No. 2, p. 3) that our best chances for orange lie in working with the advanced generation lutea hybrids, where some success in this direction has already been achieved and where fertility is not a major barrier. Plants such as *Tessera*, *Ariadne*, *Nike* and *Brassy Lady* are a good place to start. However, I do not believe that the addition of potaninii (Trollioides) genes to the mix will significantly increase our chances for obtaining orange peonies from this line of breeding. In addition to the varieties mentioned above, I would also try light yellow varieties such as *Age of Gold*, *Silver Sails* and *Wings of the Morning* crossed to reds and pinks like *Banquet*, *Redon* and *Leda*.

As a final note, I should not forget to point-out an intersectional hybrid introduced by Roger Anderson a few years ago named *Kopper Kettle*. The flower is described as a tricolor of red, yellow and orange giving an overall copper color effect when viewed from a distance. From the photograph in his catalog, it appears to be at least as copper as *Tessera*. It would really be nice to know the parentage of this one. Certainly this plant is a clear signal that we should not ignore the intersectional cross in our quest for orange.