PÆONIA

AN INTERNATIONAL NEWSLETTER FOR PEONY HYBRIDIZERS

Volume 28, No. 1 **Winter 1998**

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Subscription Rates:

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

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MORE ON HP1-61 AS A SEED PARENT IN THE INTERSECTIONAL CROSS

by Don Smith

In the last three years, I have twice reported on my experience using *HP1-61* as a pod parent in the intersectional cross (Pæonia, Vol. 25, No. 2, p. 1 and Vol. 25, No. 3, p. 3). These reports pointed out the erratic behavior of this lactiflora variety when used as a pod parent in the intersectional cross. I now feel that I have enough experience with this variety to give a more complete report on the usefulness of this variety as a seed parent. It is now clear that *HP1-61* is indeed an exceptional parent of intersectional hybrids, possibly as good or better than the more famous *Martha Washington*. If you have worked with this plant and have not had success with it, do not give up on the variety. I am certain that it will eventually produce hybrid seeds and plants for you, as it has for me.

However, the erratic seed production described in my earlier reports was again repeated for me in 1996 and 1997. Several crosses in 1996 produced no seeds at all, whereas similar crosses in 1997 produced a dozen good intersectional seeds. The 97 seeds came from just two crosses using pollen from Reath's beautiful new hybrid tree peony, *Alice in Wonderland*. This variety has proved to be quite fertile used as a pollen parent in intersectional crosses. In addition to *HP1-61*, it has also produced seeds on two other lactiflora varieties, *Martha Washington* and *Alice Roberts*.

What I like most about *HP1-61* is that the intersectional seeds produced by this variety germinate better than any others that I have encountered. In addition, the plants produced from these seeds have proved to be exceptionally healthy and they have survived better than those from other pod parents. This can easily be seen from the three tables below. These tables compare my results using *HP1-61* with those using *M. Washington*.

Comparison of Intersectional pod parents

HP1-61	92-94	95	96	97	Total	Seeds/cross or (Plants/cross)	% of ruptured seeds	Germ. Rate %
Crosses/seeds	3/0	6/22	5/0	3/12	17/34	2.0		
Germ. Seeds	0	16	0	10	26	-	-	76
Ruptd. Seeds	0	2	0	0	2	-	6	-
Initial Plants	0	15	0	10	25	(1.5)		
Surviving Plts	0	13	0	?	23	(1.4)		

Survival Rate 13/16 = 81%

M. Wash.	92-94	95	96	97	Total	Seeds/cross or (Plants/cross)	% of ruptured seeds	Germ. Rate %
Crosses/seeds	49/171	35/138	20/76	33/60	137/445	3.2	-	-
Germ. Seeds	63/171	87/138	26/76	10/52	186/437	-	-	43
Ruptd. Seeds	45	51	31	30	157/445	-	35	-
Initial Plants	55	83	20	10	168	(1.2)		
Surviving Plts	35	58	12	?	105	(1.0)		

Survival Rate 105/158 = 66%

Parent	No. of crosses	No. of seeds	Seeds/cross (92-97)	Germ. Rate %	% of ruptured seeds	No. of Plants (92-96)	Plants/cross (92-96)
M. Wash.	137	445	3.2	186/437 = 43%	35	105	1.0
HP1-61	17	34	2.0	26/34 = 76%	6	23	1.4

LACTIFLORA X SUFFRUTICOSA AND THE REVERSE

By Don Smith

It has been more than 30 years, since the late Louis Smirnow reported on the remarkable discovery of several new intersectional hybrids from the first successful cross between a herbaceous lactiflora variety and a Japanese tree peony (APS Bull. No, 184, Mar.-Apr. 1967 and also reprinted in "The Best of 75 Years", APS, 1979, p. 52). Unfortunately, little or no progress has been made on the cross during the intervening years.

Apparently, there were, at least, five separate hybrids from the cross lactiflora x suffruticosa (white herbaceous x pink Japanese tree peony) made by Tochi Itõ in 1949. Smirnow reported having two of these varieties in his garden on Long Island. These were called Pink Heaven and Pink Purity. Pink Heaven was described as having 12" full double flowers of bright pink with deeper pink towards the center. Both plants were said to be 36" tall with strong stems. Two other varieties, Pink Overture and Pink Symphony, were pictured in a Smirnow catalog that was distributed around that time. These plants also appeared to have large double pink flowers as well. A fifth plant, Pink Harmony, was mentioned in another APS Bull. article (The Best of 75 Years, p. 57) and was also listed in the catalog. The controversy over the existence of these hybrids was discussed in a recent newsletter article (Vol. 26, No. 4, p. 2).

In the spring of 1996, I made a number of crosses using several Japanese tree peony pollens on the herbaceous lactiflora variety, Martha Washington. As in previous years, none of these crosses were successful and no seeds were obtained. In addition, I also made this cross in reverse for the first time by using lactiflora pollen (Martha Washington) on several Japanese tree peonies varieties. Based on my experience with other reciprocal intersectional crosses (Pæonia, Vol. 25, No. 1, p. 1), I had a strong hunch that these crosses might prove to be more productive than their opposite direction counterparts.

In the fall, I was surprised to find that <u>all</u> of these crosses had been successful and had yielded at least some seed. One cross in particular, Stolen Heaven x M. Washington, gave a large number of seeds that appeared to be good. Unfortunately, however, there were too many (19) seeds --- far too many for these to be real hybrid seeds. Certainly, contamination had occurred. Although my procedures for contamination protection are usually meticulous, I honestly could not remember how well I had protected these particular crosses. Undoubtedly, this was the source of the problem.

On the other hand, this high seed production was consistent with my past experience using Martha Washington pollen on various F_2 lutea hybrids (see Pæonia, Vol. 25, No. 1, p. 1, Vol. 26, No. 1, p. 1 and Vol. 26, No. 4, p. 1). In addition, on most of the plants used for seed parents, these were the only stems with seeds; no other seeds were set. This seemed to indicate that these plants were infertile to their own pollen which is a common occurrence with peonies. If this was the case, then the possibility of contamination would, of course, be greatly reduced. This knowledge kept some hope alive that, at least, a few true hybrids might still be found among this batch of seeds.

The seeds from two of the three pod parents (Shin-tenchi and Gessekai) proved to be no good, but those from Stolen Heaven were different. Although generally smaller than other tree peony seeds, they were round and plump and seemed quite firm. More importantly, however, they sank to the bottom when placed in a cup of water. These seeds were started in damp sphagnum moss on 9/23/96 and eventually 9 of these 19 seeds (47%) germinated. Here again, this germination rate seemed much too high for true hybrid seeds, thus confirming my earlier preliminary conclusion that these seeds must have resulted from a contaminated cross.

But then something positive happened with these seeds. About half of these germinated seeds stalled. After initially growing a short, thin root, further growth became extremely slow and in some cases simply stopped. This peculiar behavior was consistent with that exhibited by other reciprocal cross intersectional seeds from (lutea) hybrid tree peony pod parents (see Vol. 25, No. 1, p. 3). So, once again, I thought maybe there was still some hope for success with these seeds.

By the end of January, 4 of these 9 seeds had grown normal-looking roots. Each of these seeds were transferred to the refrigerator when the roots had reached a length of approximately 1 inch (25 mm) for the required dormancy period. The remaining five seeds grew short skinny

roots and then stalled. These were held at room temperature for several more weeks and eventually were also transferred to the refrigerator. The roots of this second group were all less than ~3/4" long and two were shorter than 1/2".

In the spring, only 5 of these seeds had developed normally and produced plumules. These were handled like all other seeds and planted in separate 4" plastic pots (as described in Vol. 25, No. 4, p. 2-3). Two of the remaining four seeds failed completely and the other two have thus far failed to produce plumules although the now inch long roots appear to be in good condition.

The first seedling to emerge from this group had the standard 3 leaves with a leaf pattern that closely resembled that which is characteristic of pure suffruticosa seedlings (see article by John Simkins in the APS Bulletin, No. 213, Mar. 75, p. 48). This seedling emerged on 3/23/97 about one week after planting. More than a week later, the leaves remained almost completely pink with just a little light green color starting to show at the very tips of the leaves. At three weeks, the leaves still showed almost no green color -- more like a cream color with a slight green overlay. The stem grew normally and quickly reached a height of ~ 2.5 inches, but the leaves never turned green (as if they lacked a normal amount of chlorophyll). Not surprisingly, this seedling died after only 4-5 weeks of growth.

A second seedling (RC-96-02) from this group was planted on 5/4/97 after approximately 150 days of cold storage. Although only a single plumule was visible upon planting, two stems of nearly equal height emerged from the single root and rapidly grew to ~2.5 inches in height. The leaves resembled other intersectional hybrids, but were slightly more pointed with somewhat fewer and deeper cuts. By chance, this plant was placed under lights next to two intersectional back-cross (IBC) seedlings from the cross (Miss America x "i" hybrid) which are presumed to be pure lactiflora (the result of a contaminated cross). Excluding obvious differences in height, it was very hard to tell these three seedlings apart. All three looked much more herbaceous than tree peony-like. In both color and leaf shape they were remarkably similar. However, the leaves of the suffruticosa x lactiflora seedling were a little more pointed and showed some of the leaf-cuts that are typical of tree peony and intersectional hybrid seedlings. Suddenly, it all became clear. This was indeed a true intersectional hybrid. There simply could be no doubt concerning the hybrid status of this plant. A seedling with more or less herbaceous-type foliage had clearly come from a Japanese tree peony seed parent.

This seedling remained very healthy until the end of October when it underwent normal fall die-back (after ~24 weeks of growth). At present this plant is beginning to grow again after being successfully "wintered-over" in a sealed plastic container in a refrigerator. This indoor method of "winter" storage was described in an article in the previous issue of the newsletter (Vol. 27, No. 4, p. 4) and has resulted in an average survival rate of better than 95%.

A third seedling from this group was planted on 5/25/97 and emerged above the soil about one week later. From the beginning, this seedling was peculiar in appearance and never achieved normal size or height. At full size, it was barely 1/2" tall with foliage that was only about an inch across. The shape of the leaves was more typical of suffruticosa seedlings and thus its true identity remains very much in doubt. Nevertheless, this seedling did survive for the entire growing season and is currently also in the refrigerator for winter storage. However, due to its small size and general lack of vigor, I would not be at all surprised if this plant failed to re-appear this spring.

To summarize the results to date, there are two surviving seedlings from a 1996 cross of suffruticosa x lactiflora. One of these seedling is a true reverse-cross intersectional hybrid seedling. From observations made thus far, this seedling appears to be more herbaceous-like than other intersectional hybrids (i.e., it is more herbaceous-like than tree peony-like). If this hybrid is a triploid, as appears to be the case for other intersectional hybrids, then it seems likely to have a 2:1 ratio of herbaceous to tree peony chromosomes. This is the reverse of the usual ratio in intersectional hybrids, and therefore should result in a unique set of characteristics. This situation is similar to that assumed to be the case for another reverse-cross intersectional seedling recently reported by Harold Entsminger (see *Pæonia*, Vol. 27, No. 2, p.1 and also Vol. 27, No. 2, p.3) from the cross (Tessera x Prairie Moon). This now brings the total surviving reciprocal intersectional seedlings to at least three.

As a group these new intersectional hybrids are completely unique in the peony world. However, since the parentage of these three seedlings are all quite different, each is also totally unique unto itself. It will be very fascinating to see what these remarkable plants turn out to be.

The hybrid status of a second surviving seedling from the same cross remains uncertain.

However, I now believe that this plant is also a true hybrid. In fact, based on all of the results to date, I believe that all of these seeds were produced from an uncontaminated reciprocal cross.

The leaf patterns of both stems of the above mentioned intersectional seedling (RC-96-02) are shown in figures 1 and 2. These images were obtained following the procedure described previously (Pæonia, Vol. 25, No. 2, p. 6), only this time the images are shown full size.

FIGURE 1. The first year leaf pattern of seedling RC-96-02, stem 1 from the cross (p. suffruticosa x p. lactiflora)

These leaf patterns can be compared to those for one of the (false) intersectional back-cross (IBC) seedlings (IBC-96-01) discussed above. Coincidentally, this seedling also had two stems as well. The two leaf patterns exhibited by this seedling are shown in figures 3 and 4. As mentioned earlier, I am reasonably certain that this is not a true intersectional back-cross seedling, but is instead a pure lactiflora seedling from a contaminated cross. However, it is difficult for me to be entirely certain about this point, since I do not believe that I have ever seen a genuine IBC seedling. For the purposes of the discussion here, I assume that the offspring of an intersectional hybrid back-crossed to lactiflora would exhibit significantly increased herbaceous characteristics compared with F_1 intersectional hybrids. As a result, it might be quite difficult to clearly distinguish true IBC seedlings from ordinary (pure) lactiflora seedlings, especially based only on a comparison of the first year leaves.

FIGURE 2. The first year leaf pattern of seedling RC-96-02, stem 2.

Due to this uncertainty, it is probably more useful to compare the leaf patterns shown in figures 1& 2 with other true intersectional seedlings. The first year leaves of two such seedlings are shown in figures 5 & 6. Figure 5 shows the pattern of a "normal" intersectional hybrid (lactiflora x lutea hybrid) whereas figure 6 shows the pattern exhibited by a rare reciprocal cross intersectional hybrid (lutea hybrid x lactiflora).

Intersectional hybrid seedlings are characterized by leaves and leaf segments that are reasonably broad and pointy with multiple leaf cuts that are primarily of a shallow nature. In most cases, intersectional hybrids can be easily distinguished from other seedlings based solely on these characteristic foliage features. All of these features (the broad foliage, pointed tips and multiple shallow leaf cuts) are inherited from the lutea hybrid parent on the tree peony side of the cross. First year intersectional hybrids average around 11-12 leaf cuts per seedling (total for 3 leaves) but some true hybrids exhibit as few as one or two. Most often, there is a mixture of shallow and deeper cuts with the shallower cuts

out-numbering the deeper ones by approximately 3 or 4 to 1. Pure lactiflora seedlings, on the other hand, are characterized by foliage that is less broad and more rounded (less pointy) with significantly fewer and deeper cuts. Many of the leaf cuts of lactiflora seedlings go nearly all the way to the stem, thus creating the appearance of two separate leaf segments.

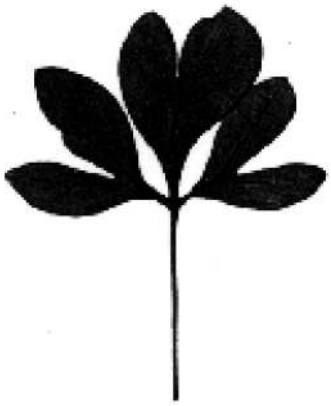

FIGURE 3. The first year leaf pattern of seedling IBC-96-01, stem 1.

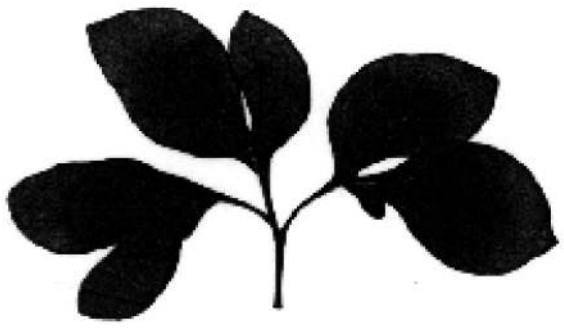

FIGURE 4. The first year leaf pattern of seedling IBC-96-01, stem 2.

Based only on the pattern shown in figure 2 (stem 2), it would be easy to mistakenly conclude that this seedling (RC-96-02) was a herbaceous (pure lactiflora) seedling. However, the shallow leaf cuts and more pointed leaf tips shown in figure 1 clearly reveal the true intersectional heritage of this seedling. This conclusion can be readily confirmed by comparing the leaf pattern in figure 1 with that displayed by the intersectional seedling shown in figure 5. The similarity of these patterns is apparent. Other conclusions concerning these seedlings are left to the reader.

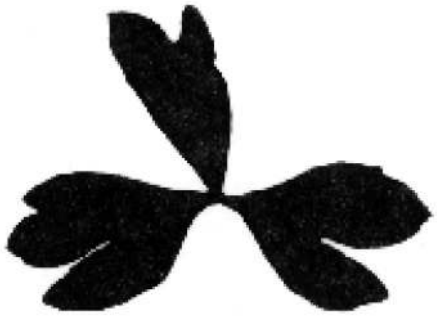

FIGURE 5. The first year leaf pattern of intersectional seedling IC-93-04 (lactiflora x lutea hybrid).

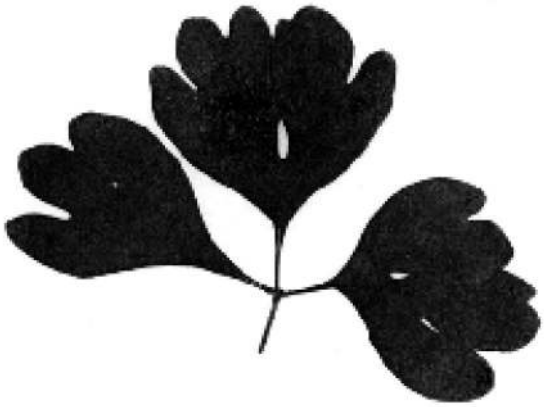

FIGURE 6. The first year leaf pattern of the reciprocal cross intersectional hybrid seedling RC-95-01 (lutea hyb. x lactiflora).