

**Table S1.** Basic information of the materials involved in this study

Code	Name	Origin or parents' information*	Experiments conducted (filled by ●)			
			Flow cytometric analysis	Karyotype analysis	GISH	FISH
M01	<i>P. delavayi</i> var. <i>lutea</i>	Wild species collected from Yunnan, China	●	●	●	
M02	<i>P. delavayi</i>	Wild species collected from Yunnan, China	●	●		
M03	<i>P. rockii</i>	Wild species collected from Gansu, China	●	●		
M04	<i>P. ostii</i>	Wild species collected from Anhui, China	●	●		
M05	<i>P. × lemoinei</i> 'High Noon'	<i>P. delavayi</i> var. <i>lutea</i> × <i>P. suffruticosa</i> cv.	●	●	●	
M06	<i>P. suffruticosa</i> 'Luo Yang Hong'	Traditional cultivar collected from Henan,	●	●	●	●
P01	<i>P. veitchii</i>	Wild species collected from Sichuan, China	●	●		
P02	<i>P. lactiflora</i> 'Bai Shao'	Common cultivar collected from Anhui, China	●	●	●	
P03	<i>P. lactiflora</i> "Yang Fei Chu Yu"	Traditional cultivar collected from Shandong,	●	●	●	
P04	<i>P. sp.</i> 'Red Charm'	<i>P. officinalis</i> 'Rubra Plena' × <i>P. lactiflora</i> cv.	●	●		
P05	<i>P. mairei</i>	Wild species collected from Xinjiang, China	●	●		
P06	<i>P. officinalis</i>	Wild species collected from the Netherlands	●	●	●	
It01	Going Bananas	Unknown × Unknown		●		
It02	Bartzella	White <i>lactiflora</i> double × Reath hybrid (tree peony)		●		
It03	Viking Full Moon	<i>P. lactiflora</i> × Yellow <i>lutea</i> hybrid		●	●	
It04	Garden Treasure	<i>P. lactiflora</i> , cultivar × <i>P. Lutea</i> Hybrid Alice		●	●	●
It05	Prairie Charm	Miss America × <i>P. Lutea</i> Hybrid Alice Harding		●		
It06	Morning Lilac	Martha W. seeding × Golden Era. ( <i>Lutea</i> hybrid)		●		
It07	Cora Louise	<i>P. lactiflora</i> , white double × Reath hybrid (tree peony)		●		
It08	Julia Rose	Unknown × Unknown		●	●	●
It09	Court Jester	<i>P. lactiflora</i> 'Martha W.' × D-256 Tria seedling		●	●	
It10	Lemon Dream	<i>P. lactiflora</i> 'Martha W.' × Golden Era. ( <i>Lutea</i> hybrid)		●		
It11	Sequestered Sunshine	Miss American × D-74		●		
It12	Yellow Crown	<i>P. lactiflora</i> 'Kakoden' × <i>P. Lutea</i> Hybrid Alice		●		
It13	Ballerena de Saval	Unknown × Unknown		●		
It14	Sugar Plum Fairy	Unknown × Unknown		●		

It15	Lollipop	Anderson's seedling × D-79	•
It16	Magical Mystery Tour	Martha W. seedling × Golden Era. ( <i>Lutea</i> hybrid)	•
It17	Scarlet Heaven	Martha W. seedling × Thunderbolt	•
It18	Dark Eyes	<i>P. lactiflora</i> 'Mikado' × <i>P. delavayi</i>	•
/	<i>P. suffruticosa</i> 'Chojuraku'	Japanese cultivar collected from Henan, China	•
/	<i>P. suffruticosa</i> 'Nong Yuan Jin'	<i>P. delavayi</i> var. <i>lutea</i> × <i>P. suffruticosa</i> 'Chojuraku'	•
/	Pepper cv. Zunla-1	Fresh leave obtained from Dr. Hailong Yu in CAAS	•

\*The parents' information of Itoh hybrids is obtained from the online data of American Peony Society (<https://www.americanpeonysociety.org>) as maternal parent × paternal parent.