HortScience 43(2):532–534. 2008.

‘Sisters on Spring Outing’ (*Paeonia suffruticosa* ‘Zi Mei You Chun’) (Paeoniaceae): A Unique Chinese Tree Peony Cultivar Possessing Side Flowers and Bicolored Floral Discs

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Additional index words. Paeonia suffruticosa, side flower, bicolored floral disc, evolution, Paeoniaceae

Abstract. **Large natural genetic diversifications have occurred among Chinese tree peony cultivars under the natural and artificial selections on the flower for ornamental and medicinal uses in the past over 1500 years in China. *Paeonia suffruticosa* ‘Zi Mei You Chun’ X.Q. Zhao & J.P. Zhao & X.Z. Zhao & X.C. Zhao & Q.X. Gao & Z.Q. Zhao & J.X. Zhao & Z.L. Suo (Paeoniaceae) is a unique cultivar possessing side flowers and bicolored floral disc belonging to the Central Plains tree peony cultivar group of China. This natural mutant is not only an outstanding ornamental, but also a valuable material for scientific research on evolution of tree peony cultivars, metabolic pathways of pigments in the floral disc, origin of floral disc in Paeoniaceae, and other issues in plant evolutionary and developmental genetics.**

Tree peonies are deciduous shrubs belonging to genus *Paeonia* L., section *Moutan* DC., family Paeoniaceae Rudolphi. They are important ornamental and resource plants, having been cultivated in China for more than 1500 years; currently there are ≈1500 cultivars. Tree peony is one of the famous traditional flowers in China and is also well-known in the world. Tree peony flower is regarded as possessing graceful bearing of the king of flowers attributable to its elegance, various flower forms, the poised and dignified carriage, and great charm, which imply riches, honor, and good luck. They or their decorative patterns can be seen in the public parks, gardens of the imperial palaces, on folk arts, crafts, pottery, porcelain, and carvings. Tree peony is praised or cited in poems, songs, legends, and mythology. There are close relationships between tree peony and Chinese culture. Chinese flower farmers have developed consummate skills in cultivation and breeding of tree peony cultivars in the past more than 1500 years.

Because it is well-known worldwide, Heze city (Shandong Province) is one of the important production and commercial centers of tree peonies in China. To promote utilization of Chinese tree peony cultivar resources, gardening of cities and towns as well as sustainable development of the tree peony industry, as part of the work of a project for conducting an assessment of germplasm resources of Chinese tree peony cultivars, we report an outstanding Chinese tree peony cultivar with unique characteristics of possessing side flowers and bicolored floral discs.

Received for publication 20 Jan. 2006. Accepted for publication 23 Oct. 2007.
This research was supported by the National Natural Science Foundation of China (grant 30470177) and by a Knowledge Innovation Project from the Chinese Academy of Sciences (kscx2-sw-108) and by a grant of National Basic Condition Platform for Scientific and Technological researches (2005DKA21003) from the Chinese Ministry of Science and Technology.
This study is also a part of work of a joint-operated program with the People’s Government of Mudan District, Heze city, Shandong Province, China.
We acknowledge Li-hua Li, Di-jie Zhao, Di-zhan Zhao, Xin-yong Zhao, Di-chao Zhao, Di-xuan Zhao, and the leaders of Caozhou Tree Peony Garden for their meaningful support.
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Origin

The cultivation technician group of Caozhou Tree Peony Garden (formerly called Zhaolou Tree Peony Garden) has carried out breeding and selections for new tree peony cultivars every year since the Garden was founded in 1956. In Sept. 1976, they sowed 18 kg mixed natural seeds collected from plants of ‘Fen Dan’ (*P. suffruticosa* ‘Fen Dan’), ‘Jin Pao Hong’ (*P. suffruticosa* ‘Jin Pao Hong’), and ‘Hu Lan’ (*P. suffruticosa* ‘Hu Lan’) (the latter two cultivars were introduced from Jianshi city, Hubei Province, China), which were growing near each other in the Garden. The seedlings were transplanted in Sept. 1978, and 39,010 seedlings were obtained. When the seedlings began to bloom in Spring 1981, 317 outstanding individual plants were selected by Apr. 1982, and propagations by division were conducted and transplanted to build a line of ramets for each outstanding individual plant for further observation in detail in Sept. 1982. From Apr. 1985 to Apr. 1986, further selection was conducted on the lines of the 317 outstanding individual plants and top 86 ones were selected as new cultivars in which ‘Zi Mei You Chun’ is one of them. During 1981 to 1986, the technicians (Xiao-qing Zhao, Jian-peng Zhao, Xiao-zhi Zhao, Xiao-chong Zhao, Qin-xi Gao, Zhong-qing Zhao, and Jian-xiu Zhao) were attracted by a plant producing side (lateral) flowers (or the second floral flush). Then, propagations by division were conducted to build a line of ramets for further observation in detail. As a result of the beautiful view of the nearly joint blossom of the terminal and side flowers (see Fig. 1) making people easily connect mentally with the scenery of some sisters on an outing in spring in accordance with the traditional Chinese quality suggestive of poetry or paintings, the cultivar name ‘Sisters on Spring Outing’ (‘Zi Mei You Chun’ in Chinese pronunciation or Chinese pinyin) was finally given to it in 1988 to 1989 after a discussion over several years among the technicians. Its female parent may be one of the three cultivars mentioned, because the seeds from the individual plants of ‘Fen Dan’, ‘Jin Pao Hong’, and ‘Hu Lan’ were mixed and put into one bag and sown together for seedlings from which ‘Zi Mei You Chun’ was found and selected. Its male parent is unknown.

Description and Performance

Plant. Commonly, propagation by division had been conducted once every 3 years. When the modified clearcut treatments were conducted at the beginning of Sept. 2004, a short root collar (or root crown) 4 to 8 cm in height was usually reserved, buds at the root collar (root–stem transitional region) and underground eyes of the plants enlarged

Fig. 1. A plant and the attachment posture of side flowers of 'Zi Mei You Chun'.

to emerge as healthy and robust floral shoots (7–11 floral shoots each plant, ≈50 cm high), and bloomed normally in Spring 2005. The number of shoots produced each plant may depend on the age and size (storage of nutrients) of the root system. Plants were erect, 50 to 60 cm high, and tree crown range was 50 to 70 cm. Branches and leaves were comparatively dense.

Flower. Flowering time was 20 Apr. to 2 May 2005 and was about the same time in 2006. On a floral shoot, below the terminal flower, there are commonly one or two side flowers (occasionally three side flowers) emerged at the same time. Both of the terminal flowers and side flowers were upward. Each of the side flowers attached at the tip of a shorter pedicel, which protruded from the axil. The attachment posture of the side flowers (the pedicel is produced at the node) is regular and neat (see Fig. 1). This feature is extremely stable among individual plants and years. The side flower beneath the terminal flower often blooms 1 or 3 d later after the terminal flower opens or commonly becomes a red–purple [Royal Horticultural Society (RHS) 74B; Royal Horticultural Society, 1966], bursting, round flower bud, ≈2 to 3 cm in diameter when the terminal flower just opens. Each flower may last for ≈1week, depending on the air temperature or rain. The graceful posture [of the terminal flower blooming jointly with the side flower or with a display of the red–purple (RHS 74B), bursting side flower buds on a floral shoot] may last for 5 or 6 d. Most of the flowers were in single form with three-whorled petals; a flower in crown form was also observed in Apr. 2006. The terminal flower was ≈14 cm in diameter and 6.5 to 7.0 cm in height.

Petals were thin, broad, and large, as normal with a grained surface. In the flower in early blossom, the lower part of the petal, was suffused slightly with red–purple (RHS 74B), and the upper surface of the petal and the lower side of the petal were light red–purple (RHS 75C). The floral disc, 13 to 19 mm high, varied in color among flowers. Milk white floral discs (RHS 155B; three flowers), red–purple floral discs (RHS 74C;19 flowers), red–purple floral discs (RHS 64B; two flowers), purple floral discs (RHS 77B; three flowers), bicolored floral discs with various kind of transitional color pattern shift between white (RHS 155B) and red–purple (RHS 74C) or between white (RHS 155B) and purple (RHS 77B; at least over eight flowers) were observed in full blooming flowers among plants and/or within a plant, but colors or color patterns of the floral disc were identical between the terminal flower and the lateral flower within a floral shoot (see Fig. 2) according to an investigation done in Apr. 2006. The mentioned colors or color patterns of the floral disc were based on the observation of the fresh floral disc in flowers at the early blooming stage. In the flower in late blossom, floral discs usually became withered (dry at least at the upper edge) and lost their fresh images in color (did not measure the floral disc color), the lower part of the petal became lighter red–purple (RHS 74C), and the upper surface of the petal and the lower side of the petal became white (RHS 158C). The ovary surface was gray–green (RHS 139D) with vellus hairs. Pistils were normal, 15 to 24 mm tall. There were commonly five carpels. The stigma was 3 to 4 mm in height and red–purple (RHS 64C, 59B) or red (RHS 53B). The anther was yellow (RHS 9D) and the pollen was yellow (RHS 9A). The filament was red–purple (RHS 74C) at the lower approximately two-thirds and white (RHS 155B) at the upper approximately one-third. The flower bud (before bursting) was conicoacuminate in shape and suffused with red (RHS 54D).

According to the investigation done in Apr. 2006, eleven 2-year-old plants produced 90 shoots, including eight vegetative shoots and 82 floral shoots. Among the floral shoots, 41 floral shoots (45.56%) each produced two flowers (a terminal and a lateral flower), two floral shoots (2.22%) each produced three flowers (a terminal and two lateral flowers), and 33 floral shoots (36.67%) each produced one flower (actually below the terminal flower accompanied with a very tiny lateral flower bud, which was not able to open, probably caused by insufficient nutrient supply in the body of the 2-year-old plants). A shoot that may produce either a flower or two or three flowers in spring came from only one bud attached on a 2- or a 3-year-old branch, the root collar zone, or from an underground eye attached on the upper part of the root system.

Fig. 2. The color patterns of the floral disc surface between the terminal and side flowers are identical within a branch.

Another tree peony cultivar, 'High noon' (bred by Saunders in 1952) may also produce a second flush, but in alternate time (summer) compared with the flowering time of its terminal flower (Page, 2005), not as regular and neat as 'Zi Mei You Chun'.

Leaf. The biternately compound leaf (No. 3 or No. 4 from the base of the floral shoot) (Suo et al., 2005) consists of 11 leaflets commonly. On 16 June 2005, the full length of the biternately compound leaf in maturity was ≈36 cm in diameter of the base of the main petiole was ≈1.0 cm, the main petiole length was ≈12 cm, full length of the main compound leaf was ≈24 cm, full length of the lateral compound leaf was 15.2 to 18.4 cm, the terminal leaflet was 10.0 to 12.0 cm long and 8 to 9.3 cm wide, and the lateral leaflet 10.6 to 12.0 cm long and 5.8 to 6.9 cm wide. The leaf surface green (RHS 143C) with obviously sunken veins, and the lower side was gray–green (RHS 148C), with protruding veins but no hairs on it. The upper sulcus was red–purple (RHS 59A), and the lower side of the petioles was green (RHS 141D).

Branch and bud. Pedicels were green (RHS 145A) in spring. The outer scale of the bud was gray–purple (186B, C) suffused slightly with green (RHS 141C). Old bark was gray (201C, B). According to an investigation done on 8 Aug. 2005, buds attached at the tip of the short branches, which might be partially fused with the main branch at the lower part protruding from the axil. The fused part was ≈6 cm long. This kind of buds accounted for ≈60% of the total number of buds; normal axillary buds made up ≈40% of the total. The internode, ≈6 to 10 cm commonly, may be longer more or less in vigorous and larger plants.

Fruit. A fruit commonly consists of five follicles with no hairs on the yellow green surface (154D) and each follicle ≈56 mm long and ≈20 mm wide. Terminal flowers were strongly fertile. Mixed pollen from other cultivars were pollinated onto stigmas of more than 10 side flowers in Apr. 2006, and normal seed set was observed during investigation on 20 Aug. 2006, indicating that side flowers are fertile.

Use. Above-ground clearcut treatments were conducted at the beginning of September, once every 3 years, during the grafting season. After the treatment, underground eyes or buds attached at the root collar

usually initiate the reproductive phase by a shift from the vegetative phase causing rapid flower bud differentiation by genetic instinct until ≈10 Nov. (before the ground freezes). As a result, the floral shoots derived from the eyes and buds were able to produce flowers normally the next spring if nutrient storage in the root system is sufficient. The robust and erect pedicels, ≈50 cm tall, are good for cut flowers. The clearcut in fall did not influence the ornamental use, seed production, and grafting (taking cuttings and/or scions) in the subsequent year. This cultivar possesses expected target features (such as shorter period of seedling production, faster speed of propagation, and an abundance of flowers) in future breeding of tree peonies. The terminal and side flowers, which bloom successively in nature, elongated the flowering time of the population, especially under moderate weather conditions (i.e., air temperature, 22 to 25 °C; relative humidity, 60% to 80% during the flowering season). At small wind-bell stage (when the flower bud attached at the tip of the floral shoot comes up to ≈2 cm × 1 cm in early spring) (Li, 2005), if terminal flower bud is removed, the side flower may grow and reach the size and ornamental effectiveness of the terminal flower, and flowering time of the side flower might be postponed for ≈3 d under common weather conditions. It is a very vigorous cultivar, strongly resistant to clearcut and diseases. This cultivar (natural mutant) possessing side flowers and bicolored floral discs is unique to our knowledge in Paeoniaceae (Li, 2005; Page, 2005; Rogers, 1995; Wang, 1998). It is not only an outstanding ornamental, but also a valuable material for scientific research on evolution of tree peony cultivars, metabolic pathways of pigments in the floral disc, origin of floral disc in Paeoniaceae, and other issues in evolutionary and developmental genetics.

Availability. Scientists interested in some plants of this cultivar for research purposes should contact the leaders of Caozhou Tree Peony Garden, Heze city, Shandong Province, 274001 China.

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