Achievements of *Phalaenopsis* orchid breeding in Taiwan

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Phalaenopsis is the most popular cultivated orchids in the world because of its infinite inflorescence with many beautiful and long-lasting flowers. There are 92 wild species and 34,112 hybrids of *Phalaenopsis* registered in the Royal Horticultural Society (RHS) in 2017, although only about 18 species are most used for breeding. Taiwan orchid breeders create and produce most commercial varieties for the market. The major species contributing to the large flowers are *P. amabilis* and *P. aphrodite*, accounting for more than 90% bloodline. *P. aphrodite* and *P. equestris* are only found in Taiwan which are very important species to breed new hybrids with multi-flowers. Up to 2017, *P. aphrodite* has produced 58 G1-generation hybrids (First generation progenies) and a total of 31,460 hybrids in 12 generations. *Phalaenopsis* Timothy Christopher (*Phalaenopsis* Cassandra x *P. aphrodite*) has an average of 35.0 flowers per spike with a 5.5-cm flower size, and produced 197 next-generation hybrids and a total of further 615 hybrids. *Phalaenopsis* Doris, containing 12.50% germ of *P. aphrodite*, is a very important breeding line for large flowers and has produced a total of 30,266 hybrids. The most famous hybrid, *Phalaenopsis* Sogo Yukidian 'V3' which contains 15.30% of *P. aphrodite* and 53.03% of *Phalaenopsis* Doris germ, respectively, almost represents the large-and-white flower in *Phalaenopsis* market. *P. equestris* has short spikes and many small flowers. There are 550 G1-generation hybrids and 21,805 hybrids derived from *P. equestris* in 13 generations. *Phalaenopsis* Cassandra (*P. equestris* x *P. stuartiana*) is an important G1-generation hybrid produces 222 next-generation hybrids and a total of further 3,305 hybrids. Among the 13 generations, the G2 to G10 generations produced the higher number of hybrids and had over 1,000 hybrids for each generation, especially each of G6 to G8 generations containing more than 3,000 hybrids. Recently, the breeding of short spikes with many-flowered cultivars has been gaining popularity, because these cultivars are plastic for table decorations and cost-save for the growth space and transport. Therefore, the use of progenies from *P. equestris* and *P. aphrodite* for breeding parents would be continued and lasted for a long time. Furthermore, harlequin flowers and big-lipped flowers are currently important *Phalaenopsis* cultivars in the world. The harlequin flowers are always shown as clown-spot pattern, and result in very complicated color patterns. The occurrence of harlequin flowers came from the finding of somaclonal mutants of *Phalaenopsis* Golden Peoker 'Brother'. The beginning of the big-lipped flowers was from the occurrence of *Phalaenopsis* World Class 'Big Foot'. The progenies of its G1 hybrids, *Phalaenopsis* Yu Pin Easter Island and *Phalaenopsis* Yu Pin Fireworks are the major breeding parents for big-lipped hybrids. In addition, the sizes and numbers of chromosomes in plant cells affect the crossing efficiency and are the bottleneck for a breeding program. We will present a chromosome doubling technique to develop the strategy of polyploidy breeding. Therefore, the breeding for *Phalaenopsis* has been extending to very wide diversity.