J. Trop. Agric. and Fd. Sc. 32(1)(2004): 1–8

Selection of miniature *Dendrobium* orchids as potential potted plants

(Pemilihan orkid *Dendrobium* jenis kerdil sebagai pokok berpasu yang berpotensi)

A.A. Fadelah*

Key words: *Dendrobium*, miniature, potted orchid, breeding

Abstract

In Malaysia, there is a lack of potted orchid hybrids for commercial planting. Therefore, through the breeding programme in MARDI, several potential potted miniature *Dendrobium* hybrids have been developed. After about 5–6 years of research, *Dendrobium* Doctor Sharif (F176.94), *Dendrobium* Tuanku Fauziah (F78.94), F167.94 and F53.93 were identified as promising potted miniature orchid hybrids. Basically, miniatures are orchid plants that grow no taller than 20 cm, excluding the flower stalk.

The result of the research has improved plant growth habit and flower traits of potted orchids as required by consumers. Most of the parents used in the cross combination, such as *Dendrobium biggibum*, *Dendrobium* Chao Praya Gem and *Dendrobium* Chao Praya Gem 'alba' are miniature orchids. The other parent hybrids are however, of normal size, such as *Dendrobium* Peewee, *Dendrobium* Spellbound Compactum and *Dendrobium* Nila Inangda. These cross combinations resulted in the development of progenies, with desirable characters of potted orchid plants make ideal houseplants. These potential potted orchid hybrids will be further tissue cultured, so as to ensure the supply of quality planting materials for the industry's needs.

Introduction

Potted orchid production throughout the world continues to expand with the increasing popularity of orchids in Europe, United States and Asia. Production of potted orchids with improved plant performance, and improved propagation techniques and practices, have also made them more readily available throughout the world.

Most of the orchid growers are aware that potted orchid is a profitable crop. According to a survey conducted by the U.S. Department of Agriculture, the wholesale value of potted, blooming orchids grown commercially was US$100 million in the year 2000 (Anon. 2002). This has attracted many commercial growers. Another factor that has led to the emergence of potted orchids as a category in the world's largest consumer market is the segmentation of the supply chain, adding value by improving product quality, lowering cost and expanding the market for potted orchid (Britt 2000).

The most popular potted orchids that are currently sold in largest quantities are the *Phalaenopsis* and *Dendrobium* orchids (Wang 2000). In 1999, Europe demonstrated an increase in orchid popularity when potted *Phalaenopsis* orchids became the third

*Horticulture Research Centre, MARDI Headquarters, Serdang, P.O. Box 12301, 50774 Kuala Lumpur, Malaysia
Author's full name: Fadelah Abdul Aziz
E-mail: dela@mardi.my

potted plant sold through Dutch auctions, after *Ficus benjamina* L. and African violets (*Saintpaulia* Wendl).

The number of potted *Phalaenopsis* sold through the auction at Aalsmeer steadily increased from 50 000 plants (1993) to 150 000 plants (1994) (Griesbach 2000). In Japan, despite the protracted recession, orchid sales have increased. Orchids in the United States have emerged as a popular and new plant category.

Besides *Phalaenopsis*, potted blooming *Dendrobium* orchids are a rapidly growing multi-million dollar activity. In the University of Hawaii, 15 *Dendrobium* cultivars for potted plant production have been generated from a breeding system known as genome breeding (Leonhardt 2000). In the United States, orchid plants are now sold through grocery stores, chain discount stores and home improvement centres (Britt 2000).

The improvement and acceptance of orchid propagation techniques have led to an increase in supply of quality orchid plants, and are directly responsible for the increase in potted orchid culture. They have demonstrated that potted orchid is a viable economic crop. European orchid growers have been carefully and systematically educated on the profitability of growing potted orchids. In the United States, growers found that it was more profitable to turn their greenhouses to potted orchid production as an alternative to foliage houseplants and cut flower crops (Anon. 2002).

With research on improved breeding programmes and on sophisticated tissue culture techniques, quality plants are consistently supplied to growers. Research has improved orchid plant size, shape, colour, shelf life and their growth habit, thus satisfying consumer appeal (Wong et al. 1996).

Breeding for the mass market is very different from breeding for the hobbyist or cut flower markets. For the hobbyist or cut flower markets, the main emphasis is on the flower traits (shape, size, texture, colour and shelf life, etc.), while in the mass market, vegetative characteristics are of equal importance to the flower traits (Fadelah 1996). In the potted orchid industry, constant flowering of orchid plants is important. The application of cytokinin to mature *Dendrobium* pseudobulbs was reported to trigger inflorescence production (Wang 2000).

The future development of potted orchids is likely to centre on increased production, improved and standardized plant size and quality, penetration into new geographic markets and extension into related care products, such as in soap, candles, perfumes and other aromatherapy products.

The potted orchid industry is currently growing throughout the world, and orders can be made through the Internet quite easily. It is now a trend to purchase flowering potted miniature orchid hybrids as unique gifts for various occasions. These potted orchids are also suitable as tabletop centrepieces and for window or counter displays. Currently, there is also potential in the market to utilize miniature orchid flowers as pressed or dried flowers. Gold or silver-plating of miniature orchid flowers has also some potential. These gold or silver-plated orchid flowers can be transformed into beautiful accessories, such as earrings, pendant, rings or bracelets.

In view of the demand for new potted orchid hybrids, research on breeding for these potted plants was conducted at MARDI, concentrating on the orchid genus *Dendrobium*. The breeding objectives for potted plants mainly emphasized miniaturization, using several dwarf orchid species/hybrids as one of the parents in the crosses. The criteria of selecting a potential potted plant from the breeding population are based on progenies that are free flowering, and with attractive shape and flower colour. Another objective was to select progenies with small but many flowers. On the other hand, selection of

potted orchids can also be based on progenies with big but few flowers.

Materials and methods

Selection of species and hybrids as parents for hybridization

The parents used in the breeding of miniature *Dendrobium* were:

Cross F176.94: *Den. biggibum* and *Den.* Chao Praya Gem.
Dendrobium biggibum, an Australian species, has been responsible for the release of many beautiful hybrids. This species produces short and weak flower stalk with only a few light purplish flowers. The texture of the flowers is thin and not firm. *Dendrobium* Chao Praya Gem is a popular commercial miniature hybrid from Thailand. The flower texture is thick and firm. Flower stalk is longer and bears more flowers as compared to *Den. biggibum.* The flower is white with purple colour at the interior part of the lip.

Cross F78.94: *Den.* Peewee and *Den.* Chao Praya Gem.
Dendrobium Peewee is a Thailand hybrid that is free flowering, with long flower stalks bearing many small purplish flowers. *Dendrobium* Chao Praya Gem is a popular commercial miniature hybrid from Thailand.

Cross F167.94: *Den.* Spellbound Compactum and *Den.* Chao Praya Gem 'alba'.
Dendrobium Spellbound Compactum is a normal sized Australian *Dendrobium* hybrid that is free flowering, with many small creamy white flowers, which have a light purplish lip. The petals curl upwards. *Dendrobium* Chao Praya Gem 'alba' is a Thailand hybrid, bearing small white flowers. This hybrid is not as free flowering as *Den.* Spellbound Compactum.

Cross F53.93: *Den.* Nila Inangda and *Den.* Chao Praya Gem.
Dendrobium Nila Inangda was registered and released by MARDI, in honour of the wife of the former Agriculture Minister, Tan Sri Sanusi Junid. This hybrid was derived from a cross between *Dendrobium* Jacquelyn Concert and *Dendrobium* Brown Derby. This hybrid is free flowering, producing dark purplish flowers.
Dendrobium Chao Praya Gem is a popular commercial miniature hybrid from Thailand.

The fourth cross was conducted in 1993, whereas the first, second and third crosses were conducted in 1994. Basically, the breeding procedures are as indicated in *Figure 1*.

After crossing, seedpods took about 2 months to develop and mature. Seeds from the ripe pods were then cultured and germinated in the laboratory. A standard Vacin and Went III medium was used for the culturing of orchid seeds (Nuraini and Shaib 1991). Plantlet sub-culture was conducted three times, at different stages of growth, so as to allow rapid root development in the culture bottles.

Mature plantlets with at least two to three young roots were transplanted into thumb-pots in the nursery. Subsequent transplanting into bigger pots was necessary, so as to allow space for further side shoots to develop. Evaluation and selection of potential progenies were conducted at the flowering stage, mainly based on desirable flower colour, size, shape, length of flower stalk and frequency of flowering. Flower morphology and shelf life morphological data were recorded as well.

Results and discussion

Dendrobium hybrid, F176.94

A promising miniature *Dendrobium* hybrid F176.94, was released as *Dendrobium* Doctor Sharif by MARDI in 1999, in honour of the former Director General of MARDI, Dato' Dr. Md. Sharif Ahmad. The International Registration Authority of Orchid Hybrids, England, accepted this

Year	Cross no.	Cross combinations
1994	F176.94	*Dendrobium biggibum* x *Dendrobium* Chao Praya Gem
1994	F78.94	*Dendrobium* Peewee x *Dendrobium* Chao Praya Gem
1994	F167.94	*Dendrobium* Spellbound Compactum x *Dendrobium* Chao Praya Gem 'alba'
1993	F53.93	*Dendrobium* Nila Inangda x *Dendrobium* Chao Praya Gem (2 months) ↓
1994		Seed culture (1 month) ↓
1994		Seed germination (6 months) ↓
1994		Production of plantlets (4 months) ↓
1995		Subculturing of plantlets (2 months) ↓
1995		Seedlings planted in greenhouse (within 30 months) ↓
1996–1997		Flowering stage (Evaluation & Selection) ↓
1998–1999		Selection of potential progenies ↓
1999–2002		Mass propagation (Tissue culture)

Figure 1. Breeding procedures for potted miniature ***Dendrobium***

hybrid for registration on 26 January 2000 (Fadelah 1999). This miniature hybrid is suitable as potted plant because of its small plant structure and attractive spray of many small flowers.

Through intensive care and improved method of cultivation, the growth of this miniature *Dendrobium* orchid can be enhanced to produce healthy pseudobulbs that can develop long flower stalks bearing many sturdy miniature flowers. It is free flowering with small but many attractive flowers. The average horizontal and vertical lengths of each flower are 5.4 cm and 4.6 cm, respectively *(Table 1)*. These miniature flowers are purple violet (RHSCC 81D) with a phalaenopsis-like shape *(Plate 1)*. The average length of the flower stalk is 34.9 cm, bearing 4–14 flowers per stalk. A single spray of flowers on the plant can last for or is still presentable about one month in an indoor environment. TROPBIO Research Sdn. Bhd. has taken up the mass propagation of *Dendrobium* Doctor Sharif for the commercial supply of its planting material.

Dendrobium hybrid, F78.94

The segregating population of this cross combination between *Den.* Peewee and *Den.* Chao Praya Gem, produced a variation in flower colour. This promising miniature *Den.* hybrid F78.94, was released as *Dendrobium* Tuanku Fauziah by MARDI in 2002, in honour of Her Royal Majesty, the 12th Raja Permaisuri Agong. The International Registration Authority of Orchid Hybrids, England, accepted this hybrid for registration on 17 September 2002 (Fadelah 2002).

Table 1. Characteristics of potted *Dendrobium* orchid hybrid/progenies

Morphological data (average)	F176.94 n = 20	F78.94 n = 6	F167.94 n = 20	F53.93 n = 10
Flower colour (RHSCC)	Purple violet (81D)	White (155D) + violet (87A)	White green (157A) + white (155B)	Red purple (72B)
Flower length (cm)	5.4 ± 0.1	4.5 ± 0.1	5.0 ± 0.1	5.3 ± 0.1
Flower width (cm)	4.6 ± 0.1	4.7 ± 0.1	4.5 ± 0.1	4.4 ± 0.1
Petal length (cm)	2.3 ± 0.1	3.5 ± 0.1	3.6 ± 0.1	2.6 ± 0.1
Petal width (cm)	2.5 ± 0.1	2.5 ± 0.1	1.2 ± 0.1	2.0 ± 0.1
Petal thickness (mm)	0.54 ± 0.01	0.57 ± 0.01	0.40 ± 0.01	0.49 ± 0.01
Dorsal sepal length (cm)	2.1 ± 0.1	3.5 ± 0.1	2.5 ± 0.1	2.4 ± 0.1
Dorsal sepal width (cm)	1.3 ± 0.1	1.0 ± 0.1	0.8 ± 0.1	1.0 ± 0.1
Dorsal sepal thickness (mm)	0.47 ± 0.01	0.53 ± 0.01	0.53 ± 0.01	0.50 ± 0.01
Lip length (cm)	2.2 ± 0.1	2.5 ± 0.1	2.8 ± 0.1	1.9 ± 0.1
Lip width (cm)	2.5 ± 0.1	2.4 ± 0.1	2.3 ± 0.1	2.2 ± 0.1
Lip colour (RHSCC)	Purple (78A) + red purple (71A)	Violet (82 A)	White green (157A) + purple vein	Red purple (72A)
Bract length (cm)	0.3 ± 0.1	0.3 ± 0.1	0.4 ± 0.1	0.3 ± 0.1
Bract width (cm)	0.2 ± 0.1	0.2 ± 0.1	0.2 ± 0.1	0.2 ± 0.1
Bract colour (RHSCC)	Greyed yellow (160C)	Yellow green (149D)	Greyed white (156D)	Greyed white (156D)
Length of spray/ inflorescence (cm)	34.9 ± 0.1	34.2 ± 0.1	30.0 ± 0.1	32.4 ± 0.1
Number of flowers/buds	4–14	8–15	5–15	5–15
Length of pedicel (cm)	3.0 ± 0.1	3.7 ± 0.1	2.7 ± 0.1	3.8 ± 0.1
Internodes length (cm)	1.3 ± 0.1	1.5 ± 0.1	1.8 ± 0.1	1.6 ± 0.1
Shelf life (days)	14–30	14–25	14–25	15–30

RHSCC = Royal Horticulture Society Colour Chart
n = Number of plant samples

a. *Dendrobium* Doctor Sharif, with phalaenopsis shaped miniature flowers
b. Miniature potted *Dendrobium* Doctor Sharif in decorative pots

Plate 1. Potted miniature ***Dendrobium*** *Doctor Sharif*

The first potential progeny that was selected, however, produced flowers with white petals and sepals (RHSCC 155D) and a violet interior lip (RHSCC 87A). Some of the progenies produced violet flowers (RHSCC 87B), with similar shape and flower size. The first selected progeny is free flowering, with many small flowers arranged alternately on the flower stalk, which has an average length of 34.2 cm. *(Plate 2)*. The average horizontal and vertical lengths of each flower are 4.5 cm and 4.7 cm, respectively. The flower stalk is bearing 8–15 flowers. This free-flowering hybrid is suitable as a potted plant because it produces attractive spray of flowers, arranged alternately on a long flower stalks. Other morphological data are shown in *Table 1*.

Due to the same parents, this second selected progeny from the cross will be named as a variety of the first selected progeny. The first selected new miniature F78.94 orchid progeny has been successfully propagated by tissue culture. However, MARDI Seed Unit will continue the commercial propagation of these newly selected potential hybrids in the near future.

Dendrobium hybrid, F167.94

The progenies are quite similar to the selected progeny of F78.94. The only differences are in the shape and colour of the petals and sepals. The selected progeny is also free flowering, which is a desirable characteristic of a potted plant. The petals are white green (RHSCC 157A) and the sepals are white (RHSCC 155B). Both petals and sepals are narrow and the frilly lips are attractive with purple veins that get darker in the interior part of the lip *(Plate 3)*.

The average horizontal and vertical lengths of each flower are 5.0 cm and 4.5 cm, respectively. The average length of the flower stalk is 30.0 cm with 5–15 flowers per stalk *(Table 1)*. Shelf life in an indoor environment can be extended up to a month with proper watering. This miniature hybrid is very vigorous and propagated planting materials by tissue culture are already available at seedling stages in the nursery.

Dendrobium hybrid, F53.93

The progeny resembles the miniature *Den.* Doctor Sharif. However, when observed carefully, both the plant and flower phenotypes differ to a certain extent. The pseudobulbs and the leaves are thinner as compared to *Den.* Doctor Sharif. The new selected progenies are free flowering and can produce many small red purple flowers (RHSCC 72B), with thinner petals and sepals, as compared to *Den.* Doctor Sharif *(Plate 4)*.

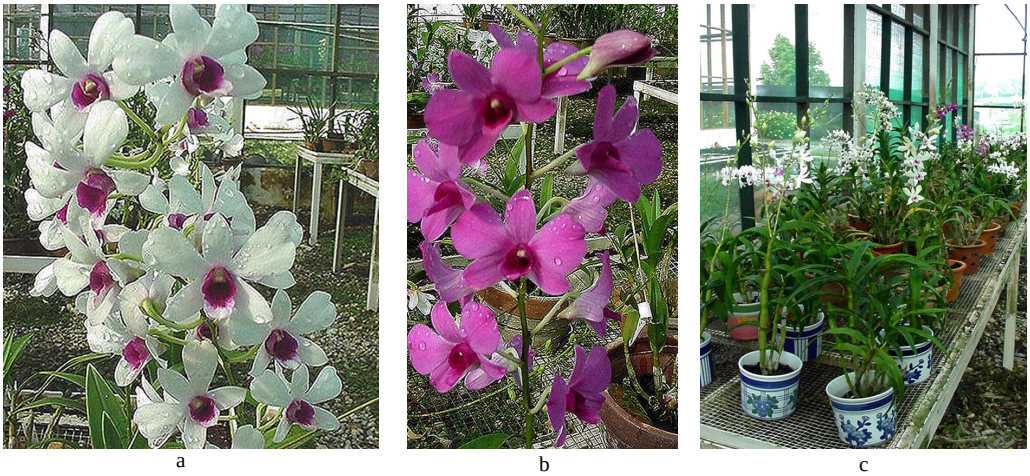
The average horizontal and vertical lengths of each flower are 5.3 cm and 4.4 cm, respectively. The average length of the flower stalk is 32.4 cm with 5–15 flowers per stalk. The shelf life of flowers on the plants is about one month *(Table 1)*. The selected progeny will be further propagated by tissue culture.

Conclusion

Selected potted orchid plants usually preferred are those with attractive flower shape, colour and with many small flowers or a few big flowers. Orchid plants that are generally small or medium in size make ideal potted plants. These fast-growing compact miniature plants normally clump easily, and often flower several times a year. Such a growth habit makes the miniature orchid plants more suitable for limited space such as in high-rise apartments and offices.

The breeding of potted orchid miniatures in MARDI, which focuses on *Dendrobium*, has successfully developed several new hybrids, such as F176.94 (*Den*. Doctor Sharif), F78.94 (*Den*. Tuanku Fauziah), F167.94 and F53.93. The availability of these new hybrids will help to solve the current problem of a lack of orchid hybrids for the growing industry.

In the evaluation and selection of breeding progenies, the main selection



a b c

a. First selected progeny of F78.94 with white flowers and violet interior lips
b. Second selected progeny of F78.94 with violet flowers
c. Potted orchid F78.94 in decorative pots

Plate 2. Potential F78.94 orchid hybrid population

*Plate 3. Another potential **Dendrobium** potted miniature hybrid (F167.94)*

*Plate 4. Potential **Dendrobium** potted miniature hybrid (F53.93)*

criteria were free flowering, many small flowers, attractive flower colour, and flower with good shape and firm texture. Long lasting flowers on the plants are also preferred for potted plants. Commercial mass propagation through tissue culture will ensure the supply of quality planting materials for the needs of the local industry.

Acknowledgement

The author wishes to thank Ms Inthirani Ramasamy, Mr Yassin Tan and Mr Sapawi Chapril for their assistance in conducting this project successfully. This research project was funded by IRPA (Research Grant No: 01-03-03-0074).

References

Anon. (2002), Potted orchids prove profitable. http://www.agjournal.com/story.cfm?story_id=1431

Britt, J. (2000), The status of the commercial production of potted orchids around the world. http://primera.tamu.edu/orchids/britt.htm

Fadelah, A.A. (1996). Advancements in orchid breeding in MARDI. Paper presented at the 2nd Genetic Congress, 13–15 Nov. 1996,

Kuala Lumpur. Organiser: Genetic Society of Malaysia

—— (1999). Miniature *Dendrobium* hybrid, F176-94-1 for potted plants. Occasional paper No. 9/1999. Endorsed during the 99/1999 Scientific Council Meeting

—— (2002). Potential *Dendrobium* orchid hybrids as cut flower and potted plant. Presented during JKPK-PST, Bil 05/2002 and MARDI's Scientific Council Meeting, 21 Nov. 2002

Griesbach, R.J. (2000). Potted *Phalaenopsis* orchid production: History, present status and challenges for the future. http://primera.tamu.edu/orchids/griesbach.htm

Leonhardt, K.W. (2000). Potted, blooming *Dendrobium* orchids. http://primera.tamu.edu/orchids/leonhardt.htm

Nuraini, I. and Shaib, J.M. (1991). Kultur in vitro. In: *Penanaman Orkid*, chapter 8, (Zaharah, H. and Rozlaily, Z., ed.) p. 61–70. Serdang: MARDI

Wang, Y.T. (2000). Medium, nutrition and flower induction in potted blooming orchids. http://primera.tamu.edu/orchids/wang.htm

Wong, L.J., Nazir, M.B., Fadelah, A.A. and Lim, H.J. (1996). Induced mutation and orchid cut flower production in Malaysia. Presented at the Seminar on Mutation breeding in Horticultural crops for Regional nuclear cooperation in Asia, 13–10 Nov. 1996, Bangkok

Abstrak

Di Malaysia, terdapat kekurangan hibrid-hibrid orkid berpasu untuk ditanam secara komersial. Oleh itu, menerusi program pembiakbakaan di MARDI, beberapa hibrid *Dendrobium* jenis kerdil telah dihasilkan. Selepas 5–6 tahun penyelidikan, *Dendrobium* Doctor Sharif (F176.94), *Dendrobium* Tuanku Fauziah (F78.94), F167.94 dan F53.93 telah dikenal pasti berpotensi sebagai hibrid orkid berpasu. Secara umum, pokok orkid kerdil ialah pokok yang tumbuh tidak melebihi 20 cm tinggi dan tidak termasuk tangkai bunga.

Keputusan penyelidikan telah membaiki beberapa tabiat pertumbuhan pokok dan sifat bunga orkid berpasu yang diperlukan oleh pengguna. Hampir kesemua induk yang digunakan dalam kombinasi kacukan, seperti *Dendrobium biggibum*, *Dendrobium* Chao Praya Gem dan *Dendrobium* Chao Praya Gem 'alba' ialah orkid kerdil. Hibrid induk yang lain adalah bersaiz biasa seperti *Dendrobium* Peewee, *Dendrobium* Spellbound Compactum dan *Dendrobium* Nila Inangda. Kombinasi kacukan ini telah menghasilkan perkembangan progeni yang mempunyai ciri-ciri yang dikehendaki sebagai pokok orkid berpasu, yang sesuai dijadikan pokok hiasan di dalam rumah. Hibrid orkid berpasu yang berpotensi akan seterusnya dikultur tisu supaya mampu dibekalkan sebagai bahan tanaman yang berkualiti untuk keperluan industri.

Accepted for publication on 16 December 2003