

## Flower morphology of *Dendrobium Sonia* mutants

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### Abstract

*Dendrobium Sonia* is a commercial hybrid which is popular as cut flower and potted plant in Malaysia. Variability in flower is important for new variety to generate more demands and choices in selection. Mutation induction is a tool in creating variability for new flower color and shape. *In vitro* cultures of protocorm-like bodies (PLBs) were exposed to gamma ray at dose 35Gy. Phenotypic characteristics of the flower were observed at fully bloomed flower with emphasis on shape and color. Approximately 2000 regenerated irradiated plants were observed and after subsequent flowering, 100 plants were finally selected for further evaluation. Most of the color and shape changes are expressed in different combinations of petal, sepal and lip of the flower. In this work, 11 stable mutants were found different at flower phenotype as compared to control. Amongst these, four mutant varieties with commercial potential has been named as *Dendrobium* 'SoniaKeenaOval', *Dendrobium* 'SoniaKeenaRadiant', *Dendrobium* 'SoniaKeenaHiengDing' and *Dendrobium* 'Sonia KeenaAhmadSobri'. In this paper, variations in flower morphology and flower color were discussed, giving emphasis on variations in flower petal shape.

### Abstrak

*Dendrobium Sonia* adalah merupakan hibrid komersial yang popular sebagai bunga keratan atau pokok pasuan di Malaysia. Kepelbagaian bunga untuk varieti baru adalah amat penting untuk menambah lebih permintaan dan pilihan. Mutasi aruhan adalah merupakan satu kaedah untuk mewujudkan kepelbagaian variasi bunga dengan warna dan bentuk yang baru. Kultur *in vitro* jasad seperti protokorm telah didedahkan kepada sinaran gama pada dos 35Gy. Pemerhatian dilakukan ke atas ciri fenotip bunga yang telah kembang penuh dengan penekanan dilakukan keatas bentuk dan warna. Pemerhatian dilakukan ke atas lebih kurang 2000 pokok yang telah tersinar dan mengeluarkan bunga. Akhirnya, kira-kira 100 pokok dipilih untuk penilaian seterusnya. Kebanyakan perubahan bentuk dan warna bunga diperhatikan pada petal, sepal dan bibir bunga. Dalam penyelidikan ini, 11 mutan yang stabil ditemui menunjukkan perbezaan berbanding kawalan. Empat daripada mutan ini mempunyai nilai komersial telah dinamakan *Dendrobium* 'SoniaKeenaOval', *Dendrobium* 'SoniaKeenaRadiant', *Dendrobium* 'SoniaKeenaHiengDing' and *Dendrobium* 'Sonia KeenaAhmadSobri'. Dalam kertas kerja ini, variasi morfologi dan warna bunga dibincangkan dengan penekanan diberikan ke atas variasi bentuk petal bunga.

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**Keywords/Kata kunci:** *Dendrobium*, induced mutation, breeding, flower morphology

### INTRODUCTION

*Dendrobium* genus accounts for 70-80 % of tropical orchid plant and flower trade. The main attraction of *Dendrobium* hybrid relative to other potted orchids is their floriferous flower sprays, wide range of colors, sizes and shapes, year-round availability and long flowering life of several weeks to months (Kuehnle, 2006). According to National Agriculture Policy (1992-2010), orchid is consider as priority group of crops with good potential to meet the growing demand and generate higher income for producers. Normally, new orchid hybrids were developed by hybridization or cross-pollination which sometimes are limited by availability of desired genotype and sexual compatibility of genetic resources. Based on this information, a project was initiated to produce more variations and a commercial hybrid *Dendrobium Sonia* which is popular as cut flower and potted plant in Malaysia was chosen. Induced mutation with gamma ray was used as an alternative to generate new sources of genetic variations in creating new varieties. The combined application of mutation and *in vitro* technology has resulted in changes of *Dendrobium* flowers (Sakinah & Mohd Nazir, 2000; 2002). The attempt of this paper is to discuss the morphology of all the stable mutants which have good characteristics as cut flower or potted plant.



## MATERIALS AND METHOD

Protocorm-like bodies (PLBs) of matured self-pollinated seeds from *Dendrobium* Sonia were exposed to gamma ray at dose 35Gy using Gamma Cell (GC4000A) at Malaysian Nuclear Agency. After irradiation, it was transferred immediately onto fresh half-strength Murashige and Skoog medium ( $\frac{1}{2}$  MS) (1962) and multiplied by sub-culturing onto fresh medium every three weeks. After four subcultures, the complete plantlets with roots were acclimatized and grown to maturity in the greenhouse with 30% shade. After the first flowering of each plant, the spray was harvested when it was at 70% blooming stage. Data on the morphology of the flowers were taken and mutants were grouped based on flower form (shape of petals, sepals and lip) and color. Color grading was based on color chart by the Royal Horticultural Society (RHS) Color Chart.

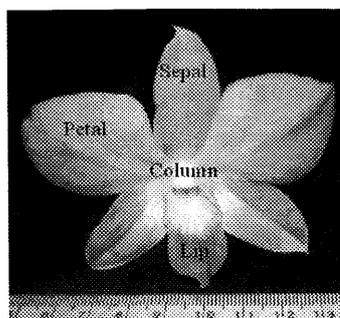


Figure 1. The morphology of a *Dendrobium* flower.

## RESULTS AND DISCUSSION

Approximately 2000 regenerated irradiated plants were observed and after subsequent flowering, 100 plants were finally selected for further evaluation. These mutants were selected and evaluated based on the morphological traits with the purpose to select the potential population for cut flower or potted plant. During screening process, plants with flower morphology which is different from the mother plant (control or non-irradiated) were grouped based on flower formation (shape of petals, sepals and lip). Finally, the mutants were group according to shape of petals as shown in Table 1.

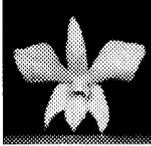
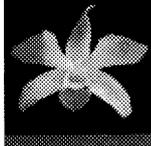
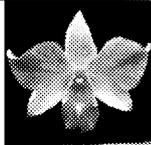
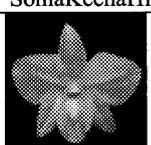
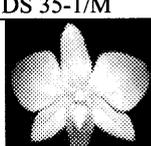
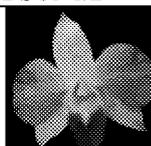
Generally, the shapes of petals can be categorized into six groups described as narrow petals, narrow and elongated petals, narrow and broad petals, broad and undulated petals, broad and rounded petals or broad, rounded undulated petals. The first group which has flower with narrow petals same as *Dendrobium* Sonia (Control) consists of mutant DS 35-White A and *Dendrobium* 'SoniaKeenaAhmadSobri'. Both flowers are close to the control and the significant difference is only related to the color.

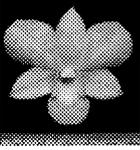
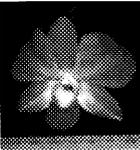
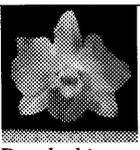
Mutant *Dendrobium* 'Sonia KeenaRadiant' is the only mutant in the second group which has narrow and elongated petals. It was observed that this mutant is the largest flower size mutant among the others with special fragrance. The third group of mutants has broad undulated petals also contains only one mutant which is *Dendrobium* 'SoniaKeenaHiengDing'. This mutant has flower that is unique because it has purple red column but unfortunately the growth of this mutant is slow.

The fourth group has narrow and broad petals contains mutant DS 35-1/M, DS 35-1/B and DS 35-Lace. These three mutants have nice flower arrangement of spray and recommended as potted plant. The fifth group of mutant has broad and rounded petals. This group contains mutant DS 35-N and DS 35-1/S. The last group of mutants which are *Dendrobium* 'SoniaKeenaOval' and DS 35-1/J have flower with broad and rounded undulated petals. Flower with broad and rounded petals tend to be much smaller compare to the control.

Growing problem related to fertilizer is an obstacle in this work. The applications of fertilizer are necessary in maintenance the plants at the optimum growth stage as normally mutant plants are difficult to grow and not completely in shape. During the growing stage, no hormone was applied to ensure the performance of the plants remain growth under nature.

Table 1: Selected mutants of *Dendrobium* Sonia derived from *in vitro* mutagenesis after gamma radiation.

| Petal shape                 | Mutant  | Description   |
|-----------------------------|---|---|
| Narrow petals.              | <br><i>Dendrobium</i> Sonia<br>(Control)         | Red purple (71A) petals, sepals and lip. White tinge on the petals sepals. Long and narrow lip with curled at the edges.  |
|                             | <br>DS 35-White A                                | Pure white petals, sepals and lip with pointed lip.   |
|                             | <br><i>Dendrobium</i><br>'SoniaKeenaAhmadSobri'  | Purple (74B) petals, sepals and lip. Clear vein on the petals and sepals. The lip is narrow and long.   |
| Narrow and elongated petals | <br><i>Dendrobium</i><br>'Sonia KeenaRadiant'   | Purple (78C) petals color which is paler around the edges and more intense towards the centre region of the petal. Smudge of purple (78C) on sepals and purple (78B) long and broad lip. It has slight fragrance. |
| Broad and undulate petals   | <br><i>Dendrobium</i><br>'SoniaKeenaHiengDing' | Purple (78A) with clear veins on it. Smudge of purple (78B) on sepals. Purple (78A) long and broad lip with curled at the edges. It has red purple column with yellow throat in the centre.                       |
| Narrow and broad petals.    | <br>DS 35-1/M                                  | Purple (78C) petals, sepals and lip. Veinous petals and sepals. Long and broad lip with curled at the edges.  |
|                             | <br>DS 35-1/B                                  | Petals are white at the centre but gradually becomes purple (78B) towards the edges. Smudge of purple (78D) on sepals. Purple (78B) narrow and curled backward lip.   |
|                             | <br>DS 35-Lace                                 | Red purple (74C) petals with smudge of red purple (74B) at the edges. Sepals are almost white with little smudge of purple (78D). Purple-violet (80A) narrow and long lip.  |

|                                   |  |  |
|-----------------------------------|--|--|
| Broad and rounded petals          | <br>DS 35-N                               | Smudge of purple (76B) petals and sepals. Purple (76A) short and rounded lip with curled at the edges.   |
|                                   | <br>DS 35-1/S                             | Red purple (74B) petals, sepals and lip. The lip short and rounded.  |
| Broad and rounded undulate petals | <br><i>Dendrobium</i><br>'SoniaKeenaOval' | Purple (78B) petals and lip. Smudge of purple (78B) with green tip sepals. Short and broad purple (78A) lip with curled at the edges.  |
|                                   | <br>DS 35-1/J                             | Purple-violet (80C) petals. Petals are white at the centre but gradually becomes purple towards the edges. Smudge of purple on sepals. Purple-violet (80A) lip, short and curled at the edges. |

\*Color description-according to RHS color chart

From these population of mutants, 4 mutant varieties with commercial potential namely *Dendrobium* 'SoniaKeenaOval', *Dendrobium* 'SoniaKeenaRadiant', *Dendrobium* 'SoniaKeenaHiengDing' and *Dendrobium* 'SoniaKeenaAhmadSobri' will be further mass propagated through tissue culture by Hexagon Green Biotech Sdn Bhd. In future, pre-commercialization of mutant orchids for cut-flower industry will be done at Hexagon Green Nursery, Bukit Changgang, Banting, Selangor.

#### CONCLUSION

By grouping the petals shape of mutant flower morphology, it has facilitated the selection because numerous shape and color variations in petals, sepals and lips of flower were observed on mutant plants. The possibilities of inducing changes in only one character make induced mutation a potential tool for further improvement of orchid varieties.

#### ACKNOWLEDGEMENT

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#### REFERENCE

- Kuehnle, A.R. (2006). Chapter 20: Orchids, *Dendrobium*. In: N.O Anderson (ed.), Flower Breeding and Genetics, Springer, pp. 539-560.
- Murashige, T & Skoog, F. (1962). A Revised Medium for Rapid Growth and Bioassays with Tobacco Tissue Cultures. *Physiol. Plant* 15: 473-497.
- Sheehan, T. & Sheehan, M. (1994). *An Illustrated Survey of Orchid Genera*. Australia: Cambridge University Press.
- Sakinah, A & Mohd Nazir, B. (2000). Induced Mutation of *Dendrobium* Orchid. *Proceed of Research and Development MINT 2000 seminar*, MINT Bangi, 17-18 Oct. 2000.
- Sakinah, A. and Mohd Nazir, B. (2002). Increasing Characteristic Variation in *Dendrobium* Orchid Through Acute Irradiation. *Proceeding: The 17<sup>th</sup> World Orchid Conference*, Shah Alam, Malaysia, 26 April-2 May 2002.