Cross pollination on randomly chosen commercial varieties of Phalaenopsis

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Abstract Phalaenopsis is one of the most popular orchid currently on the market of developed countries. Due to the high number of varieties being sold, hundreds of colors and chromatic combinations, Phalaenopsis became a first choice by the orchid enthusiasts. Cultivating new Phalaenopsis varieties takes a long time. Modern hybrids derive from two high quality paternal strains. Such cultures are designed to better the size and colouring of the flowers, as well as other characteristics, like longevity, inflorescence quality, disease resistance and cultivation ease.

Key words orchid, Phalaenopsis, seeds, capsules, flower

The sexual reproduction of flowering plants requires the transfer of pollen from the anther to the stigma. This must be followed by germination of the pollen (pollen-tube growth) and subsequently fertilization (union of gametes), which leads to zygote formation. Since both the pollen and eggs contain genetic material, the fusion of gametes during pollination brings about recombination of genes (1).

For a long period of time the orchid seed had remain unknown for the european botanists. The first paper that made reference to the existence of seed capsules was drafted by the german botanist G.E. Rumphius, between 1645 – 1670 (6), a work later published. Konrad Gesner was the one who released the first sketches in 1771 in the Botanic Opera, where illustrations of species of the genus Epipactis can also be found. (5).

It refers to the orchid fruits as pods, but this is a wrong term, because they are in fact capsules, each consisting of three carpels. The dried orchid fruits split and divide into valves, thus releasing the seeds. The valves then remain attached apically to the orchid (1).

Orchid seeds are very small, many of them being 0,2 – 0,75 mm wide, 0,3 – 5 mm long, having a dust like apperance. Their shape may vary, but they are generally integrated into 5 basic categories (3). Orchid seed embryo is much smaller in size and can measure from 30-100 μm to 150-300 μm and can weight 0,3-14 mg. It only occupies a small portion of the seed coat. Therefore the orchid seeds may consist of 70-90% air and can float in the atmosphere for a long period of time, aiding their dispersal over long distances (4).

The development period of a capsule, from pollen transfer to harvesting of mature capsules, can differ according to gender. In the case of Phalaenopsis genus, a capsule reaches maturity in 6 months, but for in vitro culture initiation, it is desired that seeds should be harvested 20 to 25 days earlier, when the pod is still green, to avoid a harsh treatment of seed sterilization (2). A single capsule can contain from a range of 500.000 up to 1.000.000 seeds.

Materials and Methods

To conduct this work 4 Phalaenopsis commercial hybrids were randomly chosen and used. Selected plants show different characteristics relevant to color and size of the flower, as well as the number of inflorescences and flowers on these (Table 1). Another plant selection criteria was decided by the strength of the mother plant, only those young and healthy being chosen due to their early flowering period, as orchids pollinia ripen a bit ahead of the stigma.

The polen specific to orchids is arranged in small unified piles, forming pollinia. Cross-pollination has be realised manually using tweezers to transport the polen from one plant to another.

From a total of 75 flowers attached to 8 plants only 18 flowers (24%) were pollinated. Due to the weight and energy consumed by the capsule to reach maturity, the number of flowers pollinated on a floral stem is reduced to 1-2 copies.

The pollinated plants were kept in a closed environment, providing them with the necessary conditions for growth and development: strong light, 60-80% air humidity, temperature of 15 – 17 °C, immersion in softened water once every 5-10 days.
The flower stems were anchored to a stately stake to support their weight throughout the experience.

**Results and Discussions**

The maturity period of a *Phalaenopsis* capsule ranged to 6 – 7 months. Within this period, data has been taken regarding the success of the pollination, capsule size, number of days to harvest (at which point the capsules open and release the seeds) and quantity of resulting seeds that were produced (Tabel 2).

In the first month after pollination 4 flowers (22.3%) fell prematurely. Seed capsules developed on 14 (77.7%) of the fecundated flowers (Fig. 1). In a few days the stigma increased in volume while the lobes on each side grew closer to the stigma.

After being accepted by the stigma, the pollen sprouts tubes, which grow down through the column over a period of several weeks and find their way to the ovules in the immature ovary. Once fecundated, the ovules develop into seeds. Within days of pollination, the ovary begins to swell in anticipation. The flower’s petals and sepals wither, however they remain attached to the base of the column, while the seeds pods develop further.

In the second month, 3 (16.6%) of the remaining fecundated flowers had stopped their development process and turned yellow. Few days later they fell off the floral stem, turning to yellow aswell. The remaining 11 fecundated flowers (61.1%) continued their development, increasing in length by an average of 3.45 cm and girth by an average of 1.58 cm (Fig. 2). The color of the capsules changed from raw green to dark green.

On the third month 2 more specimens (11.1%) of the remaining ones have turned yellow, however still attached to the stem for a long period of time. The stem stayed green. The 9 (50%) remaining capsules continued their growth reaching an average length of 5.2 cm and a girth of 3.10 cm.

In the forth and fifth month the 9 remaining specimens grew to the size of 8.27 cm long and 3.82 cm in girth. Halfway on the fifth month the capsules reached complete maturity, during which the green-seed culture can be attained by using the green capsules (Fig. 3). The capsule begins it’s ripening process in the sixth month, reducing it’s size. At the end of this period the three seams split open along the sides, allowing the dustlike seeds to shake out.

From the 9 resulting capsules, 1 remained intact, 2 capsules did not develop seeds and 6 capsules produced a total of 3 grams of seed (Fig. 4) later dried and stored in a room temperate environment, until they can be sterilized and used for further culture.

**Data recorded during the six months**

<table>
<thead>
<tr>
<th>Month</th>
<th>Capsules number</th>
<th>Success percentage</th>
<th>Average length</th>
<th>Average girth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>bad</td>
<td>good</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>14</td>
<td>77.7</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>11</td>
<td>61.1</td>
<td>3.45</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>9</td>
<td>50</td>
<td>5.20</td>
</tr>
<tr>
<td>4</td>
<td>-</td>
<td>9</td>
<td>50</td>
<td>8.27</td>
</tr>
<tr>
<td>5</td>
<td>-</td>
<td>9</td>
<td>50</td>
<td>8.27</td>
</tr>
<tr>
<td>6</td>
<td>3</td>
<td>6</td>
<td>33.3</td>
<td>-</td>
</tr>
</tbody>
</table>

**Tabel 1**

**Tabel 2**

**Description of Phalaenopsis hybrids used in cross-pollination**

<table>
<thead>
<tr>
<th>Plant label</th>
<th>Flower size</th>
<th>Flower color</th>
<th>Number of plants</th>
<th>Number of inflorescences</th>
<th>Number of flowers</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>medium</td>
<td>pink</td>
<td>2</td>
<td>3</td>
<td>21</td>
</tr>
<tr>
<td>B</td>
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<td>white</td>
<td>2</td>
<td>2</td>
<td>16</td>
</tr>
<tr>
<td>C</td>
<td>medium</td>
<td>pink</td>
<td>2</td>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>D</td>
<td>medium</td>
<td>purple</td>
<td>2</td>
<td>3</td>
<td>24</td>
</tr>
</tbody>
</table>
Fig. 1 Results concerning success percentage

Fig. 2 Results concerning the capsule size

Fig. 3 Seed capsule 5 months old

Fig. 4 Riped seed capsule and seeds
Conclusions

Cross-pollination is a good way of obtaining new *Phalaenopsis* hybrids that takes the characteristics of the two plants. A large number of plants can be attained in a short period of time by use of these seeds, that is why pollination is essential in the horticular industry and orchid trade.

The outcome of the experiment suggests that after 6 months only 6 capsules (42.8%) out of the total pollinated flowers managed to reach and go through the growth stages and eventually produce seeds.

Such an experiment is particularly helpful because it identifies commercial hybrids that can be used in pollination by obtaining new kinds that determine the compatibility among them. Using hybrids that are already adapted to our country’s environment is an accomplishment to the horticular industry. Although the period of growth and flowering of new hybrids stretches on about six years, introducing newer hybrids on the market is essential for the orchid trade.

References