

CHAPTER 4

Effects of NAA on Delaying Fruit Drop in the Cross Pollination Between *Dendrobium* Cultivars and Fragrant Species

In summer time, there were many external factors affecting immature fruit drop such as high temperature and low humidity (Chuecheen, 2003). A success in producing intersaectional cross pollination was depended relationship between the sections. Intersectional pollination of *Latourea* with *Spatulata* and *Phalaenanthe* produced 28.9% and 28.4% fruit set, respectively. Crosses between the *Formosae* section and both of *Spatulata* and *Phalaenanthe* yielded the successful from 13.0% and 33.3%, respectively. While the percentages of successful crosses obtained crossing of *Dendrobium* with *Spatulata* and *Phalaenanthe* were 6.2% and 9.1%, respectively (Kamemoto *et al.*, 1999). Some reports showed that NAA could induce embryo-sac formation and cause seed capsule to show sign of parthenocarpy (Zimmerman and Hitchcock, 1939), induced parthenocarpic fruit set (Gregory *et al.*, 1967) and induced fruit development faster than those initiated by pollination (Bouriguet, 1954). Pollination, emasculation and applications of NAA to the stigma and through the pedicel brought about increases in the diameter of *Cymbidium* ovaries, the swelling was due to increases in cell size rather than number (Arditti and Flick, 1976). In this study was used *Den. Jaquelyn Thomas* which a hybrid derived from sections *Phalaenanthe* and *Spatulata* as fruit parent and used *Formosae*, *Dendrobium* and *Stachyobium* species as pollen parents. Since intersectional cross pollination between *Dendrobium* cultivar and fragrant species were done, and possibility in obtain seed pod of these crosses were quite low. Thus, NAA at different concentration was applied and tested whether it could prevent external factors and could delayed fruit drop of intersectional crosses of *Dendrobium* as well as effect of auxin on fruit setting and seed viability.

Materials and methods

Den. Jaquelyn Thomas, mericlinal plants, was used as female parent and *Den. scabrilingue*, *Den. anosmum*, *Den. parishii* and *Den. peguanum* (Figure 3) were used as pollen parents. Pollination was done in early morning using three flowers, second to fifth flower from the bottom of their inflorescences. Three levels of NAA, 0, 25 and 50 mg/l, were applied on the ovaries with 3 replications and three flowers per replication. Each concentration of NAA was applied twice, the first time was on the pollination day and the second time was fifteen days after pollination. Number of fruit drop was recorded weekly, fruit size at every ten days after pollination and seed viability at fruit ripen and nearly to disperse. Completely Randomized Design (CRD) was used in this experiment. The comparison of means was compared using Least Significant Difference (LSD) at $P < 0.05$.



Figure 3 *Dendrobium* cultivar and fragrant species used to test the effect of NAA.

- (A) *Den. Jaquelyn Thomas* as female plant, (B) *Den. scabrilingue*, (C) *Den. anosmum*, (D) *Den. parishii* and (E) *Den. peguanum* as pollen plants.

Results

Den. Jaquelyn Thomas was employed as female parent when crossed with the other four species, *Den. scabrilingue*, *Den. anosmum*, *Den. parishii* and *Den. peguanum*. In this study, pollination was done for several times. Firstly, it was done in summer when none of the pollinated flowers yielded seed pod that might be caused by hot temperature. So, the second attempt was done in winter, which should have been the most suitable time for pollination, but the result was similar to those in summer. So, high temperature was not the main factor to forbid successfulness of the fruit setting in this study. In the following year, in stead of using 3 flowers per inflorescence, over 5 flowers were employed in the pollination. Unfortunately, none of the flowers gave any seed pod, although NAA application was done in order to delay fruit drop. The pollinated flowers without NAA dropped within 5-6 days after pollination. The flowers with NAA application were significantly lasted longer than those without NAA for about 3-4 days (Table 5, 6, 7 and 8).

Table 5 Effects of NAA on delaying fruit drop in the cross between *Dendrobium Jaquelyn Thomas* and *Dendrobium scabrilingue*.

NAA (mg/l)	Number of flowers	Number of fruit drop	Days from pollination to fruit drop ^{1/}
0	9	9	5.50 b
25	9	9	8.20 a
50	9	9	8.00 a

^{1/}Means followed by different letters were significantly different at P<0.05 by DMRT.

LSD = 1.948

Table 6 Effects of NAA on delaying fruit drop in the cross between *Dendrobium* Jaquelyn Thomas and *Dendrobium anosmum*.

NAA (mg/l)	Number of flowers	Number of fruit drop	Days from pollination to fruit drop ^{1/}
0	9	9	5.25 b
25	9	9	8.00 a
50	9	9	8.25 a

^{1/}Means followed by different letters were significantly different at P<0.05 by DMRT.

LSD = 1.591

Table 7 Effects of NAA on delaying fruit drop in the cross between *Dendrobium* Jaquelyn Thomas and *Dendrobium parishii*.

NAA (mg/l)	Number of flowers	Number of fruit drop	Days from pollination to fruit drop ^{1/}
0	9	9	5.75 b
25	9	9	8.00 a
50	9	9	8.00 a

^{1/}Means followed by different letters were significantly different at P<0.05 by DMRT.

LSD = 1.125

Table 8 Effects of NAA on delaying fruit drop in the cross between *Dendrobium* Jaquelyn Thomas and *Dendrobium peguanum*.

NAA (mg/l)	Number of flowers	Number of fruit drop	Days from pollination to fruit drop ^{1/}
0	9	9	5.50 b
25	9	9	8.50 a
50	9	9	8.25 a

^{1/}Means followed by different letters were significantly different at P<0.05 by DMRT.

LSD = 1.452

Discussion

Since pollination in this study had been done for three times without any success that might have been due to the internal factor that caused unsuccessfulness. *Den. Jaquelyn Thomas* which was used as the female parent was a hybrid derived from *Den. phalaenopsis* and *Den. gouldii*, both parents belong to section *Phalaenantha* and *Spatulata*, respectively whereas *Den. scabrilingue*, *Den. anosmum*, *Den. parishii*, *Den. peguanum* which were used as pollen donors belonging to section *Formosae*, *Dendrobium* and *Stachyobium*. Kamemoto *et al.* (1999) described the distance or compatibility among *Dendrobium* that the close relationship of the section could enhance the successfulness in making cross, and explained that difference of karyotype of chromosome might cause failure of making crosses. Although chromosome number of *Den. Jaquelyn Thomas* is $2n = 38$ which is the same as *Den. scabrilingue*, *Den. anosmum*, *Den. parishii* and *Den. peguanum*, their size and morphology might have been different. Usually, orchid has post-pollination phenomena and in *Dendrobium*, there was a report on this that fertilization occurred within 60-75 days after pollination. Thus, in this experiment, the flowers dropped within 5-9 days that means the fertilization may have not occurred yet. Even though NAA was applied, it could not prevent flower dropping. Therefore, there was no seed for further evaluation in this experiment.

Hence the external factor has been assumed not to inhibit pollination and fruit setting in this study, incompatibility of the female and male parents may be the main factor causing the unsuccessfulness.

Conclusion

In this study, applying NAA at 25 mg/l could prolong flower drop for 3-4 days of crosses using *Den. Jaquelyn Thomas* as female parent and *Den. scabrilingue*, *Den. anosmum*, *Den. parishii* and *Den. peguanum* as pollen donors.