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FLORAL PRODUCTION AND TRENDS IN FOUR SYMPODIAL ORCHIDS AS INFLUENCED BY 6-BENZYLAMINOPURINE

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RINGKASAN

Empat jenis orkid simpodial disembur dengan 6-Benzilaminopurina (BA) pada kadar 200, 400, dan 800 ppm. Keputusan dibandingkan dengan kawalan yang hanya menggunakan larutan kalium hidroksida. Penyemburan dijalankan dalam tiga pusingan selama 48 minggu. Bagi penyemburan 200 ppm BA, *Dendrobium* Mary Mak menghasilkan 8.8 tangkai bunga sepasu berbanding dengan hanya 4.3 bagi kawalan. Dengan kadar BA yang sama, *D.* Madam Uraiwan menghasilkan 10.4 tangkai bunga sepasu berbanding dengan 6.8 bagi kawalan. Kedua-dua jenis orkid menunjukkan tindakbalas yang nyata. Bagi *D.* Jaquelyn Concert x Jester dan *Oncidium* Gower Ramsey, penyemburan BA tidak menunjukkan kesan yang nyata. *Dendrobium* Mary Mak dan *D.* Madam Uraiwan mengeluarkan bunga yang terbanyak selepas 10 minggu disembur. Pokok kawalan (terutamanya *D.* Mary Mak) memperlihatkan edaran pengeluaran tangkai bunga yang meliputi beberapa minggu. Walau bagaimanapun, kemuncak ini lebih rendah daripada kemuncak pokok yang disembur dengan BA. Kemuncak pengeluarannya juga meliputi jangka masa yang lebih lama dan muncul beberapa minggu kemudian daripada pokok yang disembur dengan BA.

INTRODUCTION

One of the criteria used in orchid breeding and selection is the ability of the plant to flower freely all year round. An orchid with this ability will flower continuously, regardless of slight changes in the environment. The demand for orchids as cut flower, however, is seasonal. Local demand for cut flowers is high during the cultural festivities and school holidays. European demand is high in winter when there are fewer temperate flowers and low in summer when temperate flowers are abundant. Thus, prices for orchids are lower in summer than in winter (WONG, 1985). It is therefore an advantage if the flowering of orchids can be regulated, so that production is high during the Malaysian festive periods and European winter.

Various techniques have been studied to regulate flowering. These included plant decapitation, stem incision, and the use of growth regulators. In plants that were decapitated, flowering began in 7–14 days, resulting in characteristic flushes (GOH, and SEETOH, 1973: GOH, 1975). With stem incision, the plants took 18 days or longer to start flowering (GOH, 1975). Among the growth regulators tested, 6-Benzylaminopurine (BA), a cytokinin, appeared promising as an effective flower inducing hormone. *Dendrobium* Louisae Dark treated with BA began flowering 9–10 days after the first day of treatment (GOH, 1979), whereas *Aranthera* James Storie first flowered within 14 days (KOAY and CHUA, 1981). BA was also found promising on *Aranda* Deborah (GOH, 1977). There is no information on the effect of BA on the time the plant takes to respond from spraying to flower bloom, but even greater variation might be expected.

An experiment was carried out at MARDI station, Serdang, to find out whether BA can induce flowering in immature plants and whether BA can regulate flowering in mature plants. The goal was to find ways to control flower production to meet the peak demands. The effect of BA on bud initiation was discussed in ZAHARAH, SAHARAN and NURAINI (1986).

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This paper reports on the influence of BA on flowering patterns in the orchid hybrids during a continuous period of 48 weeks, with three BA application cycles, and its residual effects for a further 16 weeks.

MATERIALS AND METHODS

The experiment used for sympodial orchid hybrids: *Dendrobium* Mary Mak, *D.* Madam Uraiwan, *D.* Jaquelyn Concert x Jester, and *Oncidium* Gower Ramsey. Two hibrids (*D.* Mary Mak and *D.* Madam Uraiwan) were already flowering while the other two hybrids were immature at the start of experiment. However, all buds and inflorescences were removed before the first spraying treatment. A Randomized Complete Block Design was used, with four potted plants as one experimental unit, replicated three times. Three levels of BA at 200, 400, and 800 ppm and a control, which only used potassium hydroxide solution, were tested. The two factors of hybrids and BA were combined factorially.

Plants were maintained under 60% shade on raised benches and watered twice daily. Foliar fertilizer was applied weekly. BA was dissolved in 2 ml potassium hydroxide solution (1M) and made up to 1 litre with distilled water. Treatment plants were sprayed using hand sprayers (50 ml capacity). A polyethylene shield surrounded the plants to prevent drift of spray mist from contaminating other treatments. The plants were sprayed in three cycles, first on 12 February 1985 and at 16-week intervals thereafter. In each cycle, the plants were sprayed for 5 days consecutively.

Each inflorescence was tagged, and the dates it reached 50% and 100% bloom were recorded. Fully bloomed inflorescences were counted on a weekly basis from first date of spraying. Effects of BA on floral production were studied in each cycle for a total of 48 weeks. At the end of the third cycle, residual effects of BA were studied for a further 16 weeks.

RESULTS AND DISCUSSION

Only records of 100% bloom were used because the 50% bloom was more difficult to determine in the field.

Response to BA in developed inflorescences for 48-week period

During the first 48 weeks, 406 fully developed inflorescences were recorded from *D.* Madam Uraiwan, 391 from *D.* Mary Mak, 93 from *D.* Jaquelyn Concert x Jester, and 31 from *O.* Gower Ramsey.

The main effect of BA on developed inflorescences averaged over all four hybrids was highly significant at probability less than 0.001 *(Table 1)*. Plants treated at all three levels of BA produced inflorescences compared with control.

Table 1. Analysis of variance for number of developed inflorescences for 48-week period

Source of variation	DF	MS	F-value	Significance levels
Replication	2	25	–	N.S.
Hybrid	3	3 202	77.03	***
BA	3	377	11.42	**
Hybrid x BA	9	98	2.97	*
Error	30	33		
Total	47			

Differences in response at different levels of BA were not clear cut. Averaged across all four hybrids, results at the 800 ppm level were significantly higher than at 400 ppm but not significantly higher than at 200 ppm *(Table 2)*. The increase in developed inflorescences from the application of BA over the control ranged from 48% to 108%.

Significant differences were recorded in only two of the hybrids, *D.* Madam Uraiwan and *D.* Mary Mak *(Plate 1). The two immature hybrids, D.* Jaquelyn Concert x Jester and *O.* Gower Ramsey, produced relatively few inflorescences and no signifi-

Table 2. Mean number of inflorescences per pot for 4 hybrids at 3 levels of BA for 48-week period

BA levels (ppm)	Mary Mak	Madam Uraiwan	Jaquelyn Concert x Jester	Gower Ramsey	Mean over all hybrids
Control	4.3c	6.8b	0.8a	0.3a	3.0
200	8.0b	10.4a	1.5a	0.9a	5.4
400	7.8b	6.8b	2.7a	0.6a	4.5
800	11.6a*	9.9a	2.8a	0.8a	6.3

*Means followed by a common letter in the same column are not significantly different at P = 0.05 by DMRT. SE of mean over all hybrids = 0.42.

Plate 1. BA treated plant of D. Mary Mak (left) produced more inflorescences a few weeks earlier than the control plant (right).

cant differences in results between levels of BA application or between treated plants and the control.

Residual effects of BA in developed inflorescences of 16 subsequent weeks

During the following 16 weeks (after the 48th week), 74 more inflorescences were recorded from *D.* Madam Uraiwan, 53 from *O.* Gower Ramsey, 37 from *D.* Mary Mak, and 15 from *D.* Jaquelyn Concert x Jester.

Cumulative flowering records were kept during the residual 16-week period. The variance analysis showed that the average effect of BA was not significant, but there was a significant variety x BA interaction (significant at probability less than 0.01). When the means for each hybrid were compared, the means for each hybrid were compared, the differences between the BA treatments were significant only for *D.* Madam Uraiwan. Here, the control gave a significantly higher number of developed inflorescences than any of the BA levels *(Table 3).*

Table 3. Mean number of inflorescences per pot for 4 hybrids at 3 levels of BA for 16-week residual period

BA levels (ppm)	Mary Mak	Madam Uraiwan	Jaquelyn Concert x Jester	Gower Ramsey
Control	0.9a*	2.6a	0.5a	0.9a
200	1.1a	1.0b	0.4a	1.1a
400	0.6a	1.2b	0.3a	1.4a
800	0.5a	1.4b	0.1a	1.0a

*Mean followed by a common letter in the same column are not significantly different at P = 0.05 by DMRT.

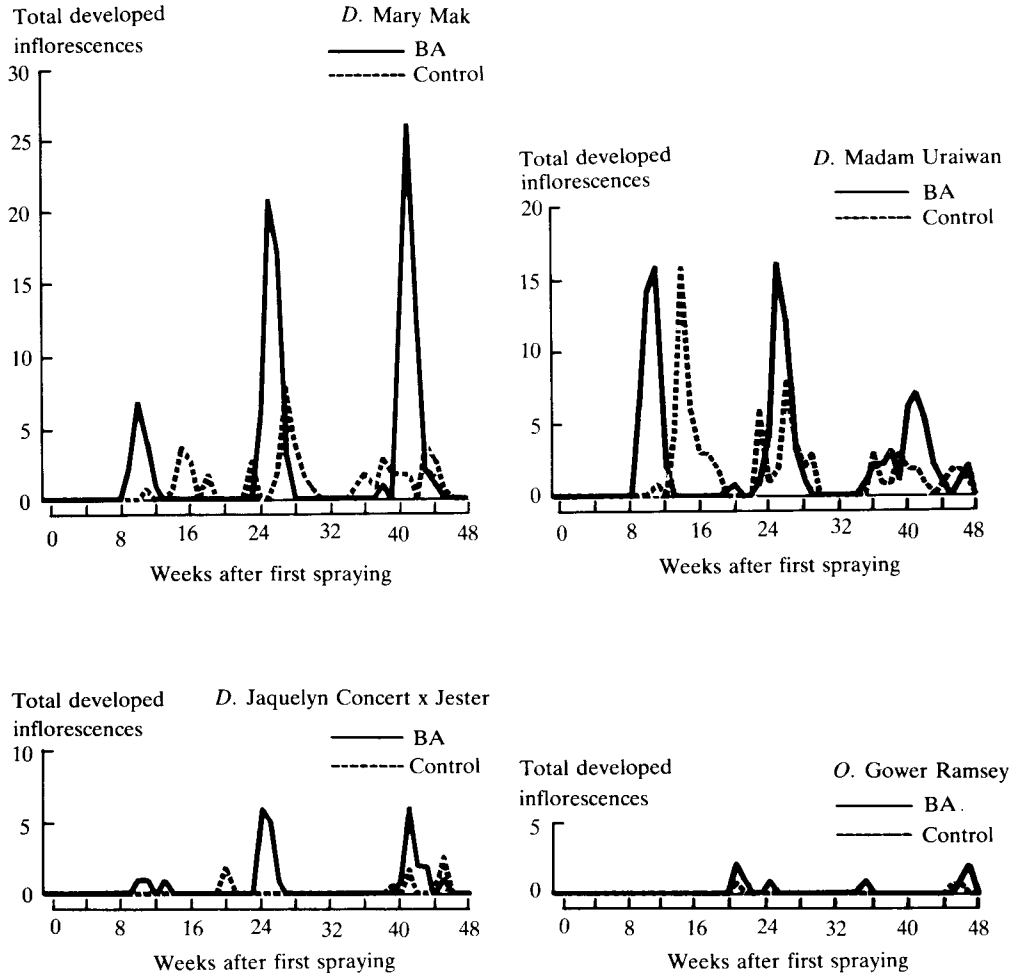

Figure 1. Total weekly production of developed inflorescences for control and BA-treated plants by hybrids

As the experiment progressed, all the plants appeared more and more exhausted and produced fewer and fewer pseudobulbs. It was however, more obvious in *D.* Madam Uraiwan. In this hybrid the application of BA which increased the number of developed inflorescences for 48 weeks had resulted in fewer inflorescences compared with control in the subsequent 16 weeks. This may suggest that BA applications exhaust the food reserves of this hybrid more than other hybrids.

The response to BA application depended on the hybrids. This differential response may be attributed to the state of maturity of the hybrids at the start of the experiment. Some undesirable side effects on flower quality (*e.g.* inflorescences not well dispersed and doubling of flower lip) were observed in *D.* Mary Mak and *D.* Madam Uraiwan at the higher levels of BA. Thus, the safer and economical level of BA for these two hybrids would be 200 ppm.

Trend in flower production

Total developed inflorescences in the control were compared with those in the BA treatment (average for each hybrid on a weekly basis *(Figure 1)*.

The treated plants of *D.* Mary Mak and *D.* Madam Uraiwan, which responded significantly to BA treatments, showed pronounced cyclic patterns in flower production. Distinct peaks occurred after each cycle of spraying.

For *D.* Mary Mak, the peak occurred exactly 10 weeks after the onset of each spraying cycle. The peak productions of 7, 21, and 26 inflorescences, (from 12 potted plants) in the successive cycles showed a generally increasing effect of BA. Possibly, an additional BA application would further increase the number of inflorescences without any harmful effects. In the control, production tended to spread over several weeks in a cyclic pattern and was lower (for cycles 1 and 2) than in the BA-treated plants. Any semblance of a peak was located at weeks 15 and 27. In cycle 3, no distinct peak production was discernible in the control.

Dendrobium Madam Uraiwan produced much the same cyclic pattern. The peak production occurred 10 weeks after each spraying, as in *D.* Mary Mak. The peaks for cycles 1 and 2 in the control occurred slightly later than those in the BA-treated plants, with no distinct peak at cycle 3. The effect of BA became smaller with each successive spray. After the second spray, the plants treated with BA were exhausted of food reserves with hardly any leaves or new shoots compared with control.

On *D.* Jaquelyn Concert x Jester, no peak production was discernible in either the control or the treated plants in cycle 1. However, BA-treated plants produced peaks at 9 and 10 weeks after each spraying cycle.

Dendrobium Jaquelyn Concert x Jester is not known to be a free flowering orchid and the small peaks for cycles 2 and 3 show the potential of BA application on this hybrid.

There was no clear pattern of response to BA in *O.* Gower Ramsey, partly because of the use of immature plants.

CONCLUSION

Regulation of flowering for some sympodial orchids can be achieved by successive application of BA. In *D.* Mary Mak and *D.* Madam Uraiwan, the application of 200 ppm BA gave significantly higher number of inflorescences over 48 weeks compared with control. There was no response to BA in *D.* Jaquelyn Concert x Jester and *O.* Gower Ramsey. Production cycles with distinct peaks in the first two hybrids suggest that production can be controlled to meet the peak demands by treating the plants 10 weeks before the blooms are needed.

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ABSTRACT

Four sympodial orchid hybrids were sprayed with three levels (200, 400, and 800 ppm) of 6-Benzylaminopurine (BA) in three cycles during 48 weeks. The results were compared with control plants which were treated only with potassium hydroxide solution. With 200 ppm BA, *Dendrobium* Mary Mak produced 8.8 inflorescences per pot, compared with 4.3 for control. With the same level of BA, *D.* Madam Uraiwan produced 10.4 inflorescences per pot, compared with 6.8 for control. Both responses were significant. *Dendrobium* Jaquelyn Concert x Jester and *Oncidium* Gower Ramsey did not respond significantly.

Dendrobium Mary Mak and *D.* Madam Uraiwan produced the most flower about 10 weeks after each apraying. The control plants (*D.* Mary Mak especially) produced flowers in a cyclic pattern. In each cycle, the flowers were spread over a few weeks, with peaks less distinct and smaller than the treated plants; the peaks also appeared a few weeks later than in the treated plants.

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