

STUDY ON TECHNIQUES TO IMPROVE THE SURVIVAL RATE AND GROWTH OF PHU THO'S 5-PETALED WHITE ORCHID *IN VITRO* IN THE ACCLIMATIZATION STAGE

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Received: 13 May 2022; Revised: 13 June 2022; Accepted: 06 July 2022

Abstract

Hardening *in vitro* orchid plantlets to adapt to the *ex vitro* environment is a decisive step to the final quality of the tissue culture products. The acclimatization of the Phu Tho's 5-petaled white plantlets was carried out in a greenhouse by controlling relative humidity and the light intensity. Research results have shown that, the leaving containers of Phu Tho's 5-petaled white plants for 7 days in the greenhouse, then opening the lid for 2 days, has helped the plantlets gradually acclimate to the natural environment to achieve the survival rate of 89.44%. Plantlets growing in a greenhouse in a condition that was shaded 50% and watered two times a day in the early morning and late afternoon got a survival rate of 92.22%, plant height of 4.35 cm, with an average of 12.05 roots, 6.77 leaves per plantlet, and leaf surface width of 1.85 cm. NPK fertilizers at the concentration 1.0 g/l were applied with the ratio of 30:10:10 periodically every 7 days after 1 month of planting. As the result, after 12 weeks, the plantlets have achieved the height of 8.55 cm, the trunk diameter of 1.11 cm, the number of leaves of 12.09, the number of roots 16.10, and the plantlets were sturdy and healthy.

Keywords: 5-petaled white, acclimatization, environment, *in vitro*, light intensity

1. Introduction

Dendrobium anosmum is an orchid species native to Phu Tho province that is very popular with orchid enthusiasts. A well-groomed plant can grow up to 2 meters long, with a large trunk and yellow to green leaves. The burning body has deep and clear white rays.

Flowers bloom in clusters on the body, the flower face has 5 white petals, the lips are heart-shaped with snow feathers on the lips, the eyes are purple, and the fragrance is faint. Plants are usually propagated by cutting and stem cuttings or by germinating directly on the parent stem. Currently, Phu

The white 5-petaled phalaenopsis orchid has been successfully propagated by *in vitro* propagation at the Institute of Applied Research and Development, Hung Vuong University [1]. The *in vitro* propagation process consists of 4 main stages: the stage of *in vitro* clean prototyping; the stage of rapid multiplication to produce a large number of seedlings; the stage of rooting to create a complete plant; and the acclimatization stage of *in vitro* plants to natural conditions. Of which the *in vitro* acclimatization training stage is very important and decisive to the success of the propagation process. However, the process of training plants to adapt to the post-*in vitro* stage has not been fully studied. After the *in vitro* propagation period, seedlings taken out of the nursery may dry out or wilt rapidly due to habitat changes [2]. Physiological and biochemical changes of the plant tissue culture during the training period have not been studied. Teixeira da Silva et al. have reported that there are about 100 published *in vitro* propagation studies on the genus *Dendrobium*. However, only about 40% of these studies examined seedling adaptation [3]. During the *in vitro* culture period, controlled biotic and abiotic conditions often lead to vegetative growth, and removal from the nursery often causes structural and physiological disturbances, leading to high mortality, thereby reducing the efficiency of the micropropagation system. The most frequent disturbance is the low rate of photosynthesis due to malfunction of the stomata and reduced pressure in the epidermis. To avoid this, seedlings are usually moved from high humidity to low humidity [4]. On the other hand, *in vitro* plants are often grown in low and controlled

light conditions. The light intensity is about 1,800 - 2,000 Lux, and the appropriate temperature ($25 \pm 2^\circ\text{C}$). Therefore, when transferring the plants directly to the High-intensity sunlight (4,000 - 12,000 Lux) and large temperature fluctuations will cause leaf closure and wilting in seedlings [5, 6]. The *in vitro* plant *D. 'Gradita 31'* achieved 100% survival after two months of growth in the greenhouse under low light conditions from 2,700 Lux to 5,500 Lux [6]. *D. nobile* plants trained in a growth chamber for 8-10 weeks under light conditions of 2,590 Lux and humidity of 80% significantly increased viability when grown in a net house [7]. *D. sonia* plants were trained for 30 days in conditions of 85% humidity, 1,850 Lux light intensity and 25°C temperature; the survival rate was over 80% when grown in a net house [8]. On the other hand, the wavelength of light also affects the survival rate of *in vitro* plants when introduced to the nursery. *D. phalaenopsis* plants, after being trained for 30 days under red fluorescent light, the survival rate increased from 60% to 87.5% [9]. The training of plants to adapt to new environmental conditions to increase the survival and growth rate of plants *in vitro* is a very important stage. Therefore we conduct research on technical measures to improve survival rates and growth of Phu Tho 5-petal white *in vitro* orchids in the nursery stage.

2. Methods

2.1. Research materials and media used

Research materials: Phu Tho white 5-petaled phalaenopsis orchid was propagated by tissue culture method after 12

weeks of transplanting in a rooting medium provided by the Institute of Applied Research and Development, Hung Vuong University.

Substrate: coir peat (25%) and small pine bark (75%). Bark alfa pine bark size S (6-9mm) produced by Alfarroxo Company - Portugal. Eco N coir peat produced by Ecological Source Co., Ltd.

2.2. Research Methods

Effect of plant training regime: Plants with a height of 3 - 4 cm, 3 - 5 leaves and more than three strong roots were sent to the net house for training according to the following modes: (1) Leave the plant pot for one week, do not open the lid; (2) leave the plant pot for one week, then open the lid for two days; (3) leave the plant pot for one week, then open the lid for five days; (4) wash seedlings and spread them on newspaper surface for seven days, moisten five times/day; (6) the control formula was untrained, planted immediately after being transferred from the tissue culture room to the garden. After the training period, the plants were removed from the jars, washed with agar and planted in plastic cups, monitoring the survival rate (%) and the percentage of dead plants (%) after four weeks of planting.

Effect of shading mode: After acclimatization training, seedlings were grown in plastic cups and left in 50%, 60% and 70% shading regimes; the control formula was unshaded. Observation parameters: survival rate (%), plant height (cm), number of leaves/plant, leaf width (cm) and leaf color after eight weeks of planting.

Effect of the watering regime: After being trained to adapt, seedlings were planted in plastic cups and watered daily,

including the following modes: Watering once a day in the early morning, Watering once a day in the cool afternoon or twice a day in the early morning and cool afternoon. Water is irrigated by an automatic misting system, 5 minutes/per time. Observation parameters: survival rate (%), plant height (cm), number of leaves/plant, leaf width (cm) and number of roots/plant after eight weeks of planting.

Effect of fertilization regime: 1-month-old orchid seedlings, 5-7 cm in height, were selected to conduct fertilizer experiments according to the periodic spraying regimes of 5, 7 or 10 days, sprayed once; the formula control did not spray. Use foliar fertilizer NPK Grow More 30-10-10, the concentration of 1.0 g/l water, spray in the early morning and spray wet the entire upper and lower surface of the leaves. Monitor parameters: Plant height (cm), stem diameter (cm), number of leaves/plant and number of roots/plant after 4, 8 and 12 weeks of spraying.

2.3. Data processing methods

The experiments were arranged in a completely randomized design with at least 60 samples/experiments and three replications. The data were statistically processed using IRRISART 5.0 software through ANOVA and Excel 2016.

3. Results and discussion

3.1. Effect of the plant training regime

The training regime of Phu Tho 5-petaled white orchid, propagated by *in vitro* method, significantly affected the

survival rate of the plant after four weeks of growing in a net house. The collected data is shown in Table 1.

Table 1. Results of plant training regime after four weeks of growth in a net house

Indicators	Percentage of survival (%)	Rate of mortality (%)
HL1	51.11 ^a	48.89 ^e
HL2	67.22 ^b	32.78 ^d
HL3	89.44 ^c	10.56 ^a
HL4	80.56 ^c	19.44 ^c
HL5	87.78 ^d	12.22 ^b

Note: Within the same column, values with different letters (a, b, c, d, e) indicate a statistically significant difference at $\alpha = 0.05$; HL1: Planting immediately after moving from the tissue culture room to the garden; HL2: Leave the pot in the greenhouse for one week, do not open the lid; HL3: Leave the pot in the greenhouse for one week, then open the lid for two days; HL4: Leave the pot in the greenhouse for one week, then open the lid for five days; HL5: Wash seedlings and spread on newspaper surface for seven days in a net house, spray moisture five times/day.

The data in Table 1 showed the highest survival rate (89.44%) and the lowest mortality rate (10.56%) when the plants were trained in the condition of keeping plants in the greenhouse for seven day, open the lid for another two days before planting. In the regime of washing seedlings and leaving them on the surface of the newspaper, the survival rate reached 87.78%, and the death rate was 12.22% after seven days of planting. In the condition of leaving the pot for one week in the net house, then opening the lid for five days, then planting, the survival rate reached 80.56%, reducing 8.88% compared to the training mode of opening the lid two days after planting. The regime which only left the pot in the greenhouse for one week without opening the lid, the survival rate is low at 67.22%, and the death rate is 32.78%. In the control treatment without training, plants brought from the laboratory and planted immediately into the substrate, the survival rate was low, and the plant mortality rate was high, 51.11% and 48.89%, respectively. Because the plant was getting

used to the conditions in the laboratory with controlled temperature, humidity, light and nutrition when it is taken out into the natural environment, the plant has a sudden change in the new habitat; the roots are affected, the ability to absorb water is reduced, and the survival rate is low. Similar to the Phalaenopsis orchid, which was propagated by the tissue culture method, the survival rate was 71.07%, but the plants were trained to adapt by leaving the vase in the corridor for three days. In the 3-day net house, the survival rate increased to 94.3% [10]. The HL2 and HL4 formulations had a lower survival rate, leading to a high mortality rate because opening the jar lid while the culture medium was still in place for a long time (5 days), fungi and bacteria would enter the flask and growth, affecting the vitality of the plant in the next step. After the plants were transferred to the outside environment, the plant will lose its vitality or continue to be infected with bacteria and die. In addition, the jars are completely unopened, the plants are only trained with light, and temperature

but humidity in the pots are still very high. Therefore when given natural conditions with lower humidity, the plant changes suddenly did not yet adapt.

3.2. Effect of shading regime

Use shading materials with different shading levels of 50% (green shade net, three strands/cm of vein thread), 60% (dark blue shade net, four strands/cm of vein thread) and 70 % (black shading net, five strands/

cm ribbed thread) for shading. The pot of qualified tissue plants was trained to be kept in a greenhouse for one week, then opened for 2 days to allow the plants to adapt to natural conditions. Remove the plants from the jar, wash the agar and sort the plants; proceed to plant in the cups arranged in the trays and put them in the shaded area according to the experimental recipes. The experimental results are shown in Table 2.

Table 2. Effect of shading regime after eight weeks of growth in a greenhouse

Shading mode	Survival rate (%)	Plant height (cm)	Number of leaves/plant	Leaf width (cm)	Leaf color
100% natural light	37.78 ^a	3.15 ^a	4.03 ^a	1.74 ^b	Leaves tips turned yellow
Shading 50%	92.78 ^d	4.12 ^b	6.42 ^d	1.72 ^b	Dark blue
Shading 60%	87.78 ^c	4.25 ^c	6.01 ^c	1.56 ^a	Light blue
Shading 70%	81.55 ^b	5.09 ^d	5.48 ^b	1.47 ^a	Light blue

Note: Within the same column, values with different letters (a, b, c, d) indicate a statistically significant difference at $\alpha = 0.05$.

The data in Table 2 show that the shading regime greatly affects the height and number of leaves of tissue-cultured orchids. It can be seen that in the control formula without shading, the orchid plant died a lot, the survival rate was only 37.78%, the number of surviving plants was the lowest plant height (3.15 cm), and the plant after 8 weeks of observation, there was no change in height. The 50%, 60% and 70% shading formulas had a marked change compared to the control. The 50% shading formula gives the best results; although the plant has little growth in height, the plant height is 4.12 cm shorter than the 60% and 70% shading formulas, and the plant height is 4.25 cm and 5.09 cm, respectively. However, the number of leaves/plant in the 50% shading treatment was higher than the

number of leaves/plants in the remaining treatments 6.42, 6.01 and 5.48, respectively. This is completely suitable when there is a lack of light, the plant will grow vertically, but the leaves will be less, and the leaf color is also pale; the leaves are thin. The leaf width criteria in the 50% shading formula and the non-shading formula were similar, and in the 60% and 70% shading formulas, smaller leaf widths are 1.56 and 1.47 cm. In terms of leaf color, the 50% shading formula leaves were dark green and healthy. In the more shading formula, the leaves are light green, possibly due to lack of light, while in the control formula, the leaves are not shaded. The leaves are yellow, and there is burning at the tips of the leaves. The study of La Viet Hong *et al.* also showed that *in vitro*

seedlings of Phi Phap orchid were grown in 50% shading mode and watered with mist, and the survival rate was 89.9. %, sturdy, healthy plants after 6 weeks of planting in net houses [11].

3.3. Effect of watering regime

The watering regime is especially important for seedlings in general and plants

derived from tissue culture in particular. When the roots of the plant are not strong, the watering needs to be enhanced; watering and misting to keep moisture through the leaves regularly will help the plant reduce transpiration through the leaves. The results of the study with different watering regimes are shown in Table 3.

Table 3. Effect of the watering regime after eight weeks of planting in a greenhouse

Watering mode	Survival rate (%)	Height (cm)	Number of leaves/plant	Leaf width (cm)	Number of roots/plant
Watering once in the early morning	85.56 ^a	4.22 ^a	6.18 ^a	1.71 ^a	8.07 ^a
Watering once in the cool afternoon	87.22 ^a	4.18 ^a	6.25 ^a	1.74 ^a	8.03 ^a
Watering twice in the early morning and late afternoon	92.22 ^b	4.35 ^b	6.77 ^b	1.85 ^b	12.05 ^b

Note: Within the same column, values with different letters (a, b) indicate a statistically significant difference at $\alpha = 0.05$.

The data in Table 3 show that the watering regime affects the survival rate and the growth of the plants. For Phu Tho white 5-petaled plants *in vitro*, misting twice a day in the early morning and afternoon cool is appropriate, the research results for the survival rate and growth criteria were higher than the other two treatments, which were watering once a day in the early morning or in the afternoon. Regarding the survival rate of plants, watered twice a day gave the highest survival rate of 92.22%; the remaining two treatments watered once a day, the survival rate decreased slightly, and the remaining 85.56% and 87.22%, respectively. In terms of plant height, the number of leaves/plant and leaf width between the experimental treatments,

there was no significant difference; however, watering two times/day still gave the best results; the plant height was 4.35 cm; the number of leaves/plant is 6.77, and the leaf width is 1.85 cm, the two treatments are watered once/day in the early morning, or late afternoon, the plant height is 4.22 and 4.17 cm, respectively. The number of leaves/plant is 6.18 and 6.25, respectively, and the leaf width is 1.71 and 1.74 cm, respectively. Moreover, plants watered twice a day in the early morning and late afternoon, the number of roots/plants increased significantly to 12.05 roots, an increase of 3.98 and 4.02, respectively compared to the two formulas of watering once/day in the early morning and cool afternoon. In the new stage of planting

in net houses so that the plants can adapt well and grow well, it is very important to rebuild the roots for the plants; in addition to using a suitable medium to both retain water and aerate, watering the plant plays a decisive role in the development of the root system of the plant. A regular supply of water evenly distributed throughout the day helps in the formation of new roots and the restoration of damaged roots. When the roots are strengthened, the process of absorbing water is also stronger, the metabolism is carried out easily, and the plants grow healthy. For the care of *Dendrobium anosmum* DL. from seedlings *in vitro*, when the temperature is above 35°C, the seedlings are irrigated with a misting system twice a day in the early morning and late afternoon, or when the temperature is below 35°C, the plants are watered once and in the early morning or late afternoon [12]. For *Dendrobium officinale*,

Kimura et Migo orchids *in vitro* outside the nursery, water 3ml/pot/day of plant growth. The best [13]. Plant D. ‘Zahra FR 62’ were planted in plastic pots with 50% shade and maintained at 85-95% humidity for a survival rate of 90-100% [14].

3.4. Effect of fertilization regime

When the orchid *in vitro* is one month old fertilizing was started. NPK Grow More 30-10-10 foliar fertilizer with the concentration of 1.0 g/l water, was sprayed in the early morning and wet the entire upper and lower surface of the leaves. The results of the effect of fertilizer application on the growth of orchids are shown in Table 4. Research results show that the time of fertilizing has a positive effect on growth, plant height, number of leaves/plant, and number of roots/plant, but little effect on stem diameter, specifically:

Table 4. Effect of fertilization regime on the growth of Phu Tho 5-petal white orchid in the nursery stage

Fomula	After 4 Weeks				After 8 Weeks				After 12 Weeks			
	A	B	C	D	A	B	C	D	A	B	C	D
BP1	4.19 ^a	0.87 ^a	6.59 ^a	11.21 ^a	5.13 ^a	0.91 ^a	7.52 ^a	12.21 ^a	6.14 ^a	0.94 ^a	9.01 ^a	12.76 ^a
BP2	4.79 ^b	0.89 ^{ab}	7.23 ^b	13.08 ^{cd}	5.90 ^b	0.95 ^{ab}	8.73 ^b	14.12 ^b	6.99 ^b	1.01 ^a	11.11 ^c	14.97 ^b
BP3	5.60 ^c	0.91 ^b	7.82 ^d	13.89 ^d	7.67 ^d	0.99 ^b	9.03 ^c	14.83 ^c	8.55 ^d	1.11 ^b	12.09 ^d	16.10 ^d
BP4	5.53 ^c	0.87 ^a	7.58 ^c	12.40 ^b	6.77 ^c	0.91 ^a	8.75 ^b	13.95 ^b	7.86 ^c	0.99 ^a	10.94 ^b	15.27 ^c

Note: Within the same column, values with different letters (a, b, c, d) indicate a statistically significant difference at $\alpha = 0.05$; BP1: No fertilizing; BP2: Spray periodically every five days; BP3: Spray periodically every seven days; BP4: Periodically spray every ten days; A: Plant height (cm); B: Body diameter (cm); C: Number of leaves/plant; D: Number of roots/plant.

After four weeks of plant growth: the BP3 formula was fertilized periodically every seven days for the best results; plant height reached 5.6 cm, stem diameter reached 0.91 cm, the number of leaves/plant was 7.82 leaves, and the number of roots/plant is 13.89 roots. The plants are all healthy, with dark green and thick leaves.

When the amount of fertilizer was increased once every five days or decreased every ten days, the growth of the plants decreased. Specifically, the BP2 formula is fertilized every 5 days gave a height of 4.79 cm; stem diameter of 0.89 cm, with 7.23 leaves/plant, and the number of roots/plant is 13.08 roots. The BP4 formula was fertilized periodically every ten days for a plant height of 5.53 cm, stem diameter of 0.87 cm, the number of leaves/plant was 7.58 leaves, and the number of roots/plant was 12.4. The control treatment BP1 without fertilizers, the plant grew slower than the plant height by 4.19 cm, the stem diameter was 0.87 cm, the number of leaves/plant was 6.59 leaves, and the number of roots/plant was 11.21 roots, light green leaves. After 8 weeks of planting, the growth indicators of orchids increased, especially in plant height, number of leaves/plant and number of roots/plant in BP3 formula, applying fertilizer periodically every 7 days/time, still giving the best plant height reached 7.67 cm, an increase of 2.07 cm compared to 4 weeks, stem diameter of 0.99 cm increased by 0.08 cm, number of leaves/plant reached 9.03 leaves increased by 1.21 leaves, and the number of roots/plant is 14.83 roots, increasing by 0.94 roots. The BP4 formula fertilized every ten days/time, increasing by 1.25 cm compared to 4 weeks, stem

diameter increased by 0.05 cm, the number of leaves/plant increased by 1.17 leaves, and the number of roots/plant increased by 1,56 roots. The BP2 formula fertilized periodically every five days, resulting in an increase in plant height compared with four weeks of 1.11 cm, stem diameter increased by 0.06 cm, and the number of leaves/plant increased by 1.5 leaves and number of leaves. Roots/plant increased by 1.04 roots. In the control formula without fertilizing, the monitoring indicators increased more slowly. Specifically, the height of the plants increased by 0.94 cm compared to the 4-week period, the diameter of the trunk increased by 0.04 cm, the number of leaves/plant increased by 0.93 leaves, and the number of roots/plant increased by 1.0 roots.

In the next period, after 12 weeks of culture, the growth parameters still increased steadily in the experimental formulas in which the plant height and the number of leaves were two indicators that increased strongly; the BP3 formula applied fertilizer every seven days/time still giving the best results, the number of leaves/plant increased the most, the specific criteria were as follows: the height of the plant reached 8.55 cm, an increase of 0.88 cm compared to the time of 8 weeks, the diameter of the trunk reached 1.11 cm, increased 0.12 cm, the number of leaves/plant was 12.09 leaves, increased 3.06 leaves and the number of roots/plant was 16.1 roots, increased by 1.27 roots. The BP4 formula fertilized periodically every ten days/times, the growth indicators also increased, the plant height increased by 1.09 cm compared to 8 weeks, the diameter of the trunk increased by 0.08 cm, the number

of leaves/plant increased by 2.19 leaves and the number of roots/plant increased by 1.31 roots. The BP2 formula fertilized periodically every five days/time and the growth indicators increased slower than the two treatments, BP3 and BP4 with a height 1.09 cm, stem diameter increased by 0.06 cm, and the number of leaves/plant increased by 2.38 leaves, and the number of roots/plant is 0.85 roots. In the control formula BP1 without fertilizer, the monitoring parameters increased slower than plant height by 1.0 cm, stem diameter of 0.03 cm, the number of leaves/plant by 1.48 leaves and the number of roots/plant 0.55 roots.

When the orchid is young, the need for nutrients is not really excessive. Spray foliar fertilizer every five days, causing excess nutrients, even fertilizer poisoning, thereby inhibiting the growth of orchids. The formula of fertilizing every seven days is the most suitable for young orchids, helping to provide additional sources of NPK for plants in the early stages. Another study also showed that *Dendrobium* orchids propagated by tissue culture method, when grown in a greenhouse, need to adjust the temperature, humidity, shading mode and appropriate fertilizer regime. *D. nobile* plants grown in a net house were shaded with 50% sun, watered three times a week and applied foliar fertilizer NPK 10-30-20 at a concentration of 2 g/l once every 15 days for a survival rate of 95.2% [15].

4. Conclusions

Training the Phu Tho 5-petal white orchid *in vitro* before transplant by leaving the pot in a net house for seven days, then opening

the lid for two days, helping the plants get used to the natural environment for a high survival rate (89.44%). Seedlings planted in net houses were shaded by 50% and watered twice a day in the early morning and cool afternoon for a survival rate of 92.22%; the plant height was 4.35cm, and the number of roots/plant was 12.05 roots, the number of leaves/plant is 6.77 leaves, and the leaf surface width is 1.85 cm. Fertilizer NPK 30-10-10 periodically every seven days after one month of planting at a concentration of 1.0 g/l; after 12 weeks, the plant has a height of 8.55 cm, a trunk diameter of 1.11 cm, the number of leaves/plant is 12.09 leaves, the number of roots/plant is 16.1 roots result in sturdy and healthy plants.

Acknowledgment

The authors would like to thank Hung Vuong University and Phu Tho Department of Science and Technology for funding and supporting experimental equipment through project code 03/DA-KHCN.PT/2020.

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NGHIÊN CỨU BIỆN PHÁP KỸ THUẬT NÂNG CAO TỶ LỆ SỐNG, SINH TRƯỞNG CỦA CÂY LAN PHI ĐIỆP 5 CÁNH TRẮNG PHÚ THỌ *IN VITRO* GIAI ĐOẠN VƯỜN ƯƠM

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Tóm tắt

Huấn luyện cây lan *in vitro* trong ống nghiệm để cây con thích nghi với môi trường ngoài ống nghiệm là giai đoạn quyết định chất lượng cuối cùng của sản phẩm nuôi cấy mô. Sự sống sót của cây lan phi điệp 5 cánh trắng Phú Thọ *in vitro* được thực hiện trong nhà lưới bằng cách kiểm soát độ ẩm và cường độ ánh sáng bằng các kỹ thuật che nắng. Kết quả nghiên cứu cho thấy, để bình cây *in vitro* lan phi điệp 5 cánh trắng Phú Thọ trong nhà lưới 7 ngày, sau đó mở nắp bình 2 ngày tỷ lệ cây sống đạt 89,44%. Cây *in vitro* trồng trong nhà lưới được che sáng 50% và tưới nước 2 lần/ngày vào buổi sáng sớm và chiều mát cho tỷ lệ cây sống đạt 92,22%, chiều cao cây đạt 4,35 cm, số rễ/cây là 12,05 rễ, số lá/cây là 6,77 lá và độ rộng bề mặt lá là 1,85 cm. Bón phân NPK 30-10-10 định kỳ 7 ngày 1 lần sau 1 tháng trồng cây theo nồng độ 1,00 g/l, sau 12 tuần cây có chiều cao là 8,55 cm, đường kính thân là 1,11 cm, số lá/cây là 12,09 lá, số rễ/cây là 16,10 rễ, cây cứng cáp, khỏe mạnh.

Từ khóa: 5 cánh trắng, thích nghi, môi trường, *in vitro*, cường độ ánh sáng.