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## ***Rhododendron javanicum* (Blume) Benn. AND *Rhododendron sessilifolium* J.J. Sm. GERMINATION AND SEEDLINGS DEVELOPMENT ON DIFFERENT GROWING MEDIA AND FERTILIZERS APPLICATION**

**Perkecambahan dan Pertumbuhan bibit *Rhododendron javanicum* dan  
*Rhododendron sessilifolium* pada Media Tumbuh dan Pemberian Pupuk yang  
Berbeda**

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### **Abstrak**

Media tanam merupakan salah satu faktor penting yang menentukan keberhasilan introduksi *Rhododendron* dalam konservasi secara *ex situ*. Oleh sebab itu, perlu dilakukan uji coba terhadap berbagai komposisi media tanam terutama yang berasal dari bahan lokal. Medium cacahan akar paku pohon baik digunakan sebagai media perkecambahan dan penyapihan bibit *Rhododendron javanicum* dan *R. sessilifolium*. Medium tanam untuk bibit yang lebih besar dapat menggunakan kompos Cibodas. Penambahan sekam tidak menunjukkan pengaruh yang lebih baik terhadap pertumbuhan bibit *Rhododendron* dibandingkan kompos tanpa sekam. Selain itu, pemberian larutan pupuk tidak berpengaruh nyata terhadap pertumbuhan bibit *R. sessilifolium*. Namun pemberian pupuk dengan dosis rendah lebih dianjurkan dibandingkan dosis tinggi. Beberapa jenis pupuk dan dosis pemberian telah diuji pengaruhnya terhadap pertumbuhan bibit *R. sessilifolium*.

**Kata kunci** : Media tumbuh, pupuk, *Rhododendron javanicum*, *Rhododendron sessilifolium*, *Vireya Rhododendron*

### **Abstract**

Growing medium is one of the most important factor for *ex situ* conservation of *Rhododendron*. Study on different growing media available locally were conducted for germinating and developing the seedlings of *Rhododendron javanicum* and *R. sessilifolium*. Tree fern roots medium was suitable for germination and developing *Rhododendron javanicum* and *R. sessilifolium* seedlings. Growing medium for bigger seedlings using "Cibodas compost" was better than "Cibodas compost and rice husk" for the development of *Rhododendron* seedlings. Fertilizer application did not showed significant effect on *R. sessilifolium* seedlings. However, low concentration of fertilizer was recommended rather than high concentration of fertilizer. Some fertilizers at different applications were tested on the development of *R. sessilifolium* seedlings.

**Keywords** : Growing medium, fertilizer, *Rhododendron javanicum*, *Rhododendron sessilifolium*, *Vireya Rhododendron*

## INTRODUCTION

*Rhododendron* Sect. *Schistanthe* Schltr. previously known and more popular as *Vireya* *Rhododendron* were the biggest plant group under this genus. About one third of *Rhododendron* are *Vireya* (Craven *et al.*, 2011). This plant group are mostly native to Malesia region (Indonesia, Malaysia, Philippines, Brunei and Papua New Guinea), but became popular in Northern Europe, United States, Australia and New Zealand as ornamental plant (Mithcell, 2003; Rahman & Putri, 2009). Based on recent report, 58 species of Malesian *Vireya* *Rhododendron* were threatened to extinction and one species were considered already extinct (Gibbs *et al.*, 2011). Nowadays, Botanic Garden Conservation International (BGCI) cooperates with many botanical gardens worldwide to conserve this group of plant.

Indonesia as a major home for *Vireyas* have to contribute on its' conservation programs. Two botanical gardens in Indonesia: Cibodas Botanic Gardens and Eka Karya - Bali Botanic Gardens were conducting research to support the conservation of *Vireya* (Rahman & Putri, 2009). One of their activity is building an *ex situ* collection. The problem on the introduction of *Vireyas* to the garden is to find a suitable growing medium. Many species collected from the wild and from donation (mostly from Royal Botanic Garden Edinburgh (RBGE) were fail to grow because of lacking experiences on handling the specimen (Rahman & Putri, 2009). Similiar situation occured at the RBGE when they started to build the *Vireya* collection (Sinclair, 1984).

Now, RBGE have been successfully developed a suitable growing medium for wide range of *Vireya* species (Mitchell, 2003). Their success comes from a long experiment on growing this plant with various media compositions. They called the best growth medium for growing *Vireya* *Rhododendron* as "Edinburgh Compost". It is a compost is totally free peat based, eventhough the composition of this compost were published, but it is hard to find the ingredients from local supplier in Indonesia for Cibodas Botanic Gardens. Effort to find the best growing medium from the local materials was conducted in this study.

## METHODS

The experiment were conducted at Cibodas Botanic Garden from 2010 to 2012. There were four experiments: Experiment 1 were to compare two substrates for seed germination. Experiment 2 were comparing three substrates for young seedlings. Experiment 3 were testing the compost. Experiment 4 were evaluating the effect of liquid fertilizers.

Experiment 1, the seeds of *Rhododendron javanicum* were germinated on fine tree fern roots in plastic pot and moistened tissue paper in petri dishes. Each pot of fine tree fern roots containing 50 seeds. While, seeds on petridish containing 200 seeds, all were replicated 3 times. The experiment were arranged in Completely Randomize Design. Germination rates were evaluated after 1 and 6 months after sowing.

Experiment 2, the seeds of *Rhododendron sessilifolium* were germinated on moistened tissue paper. Soon after germinated, the seedlings were transfered into 3 different media: sand, tree fern roots and compost. Thirty young seedling were place on each medium with 3 replications. The experiment were arranged in Completely Randomize Design. Survival rates, shoot height, number of leaves, lamina length, and root length were observed 6 months after transplanting.

Experiment 3, two years old seedlings of *R. javanicum* were used to determine the effect of growing medium and fertilizer application on seedling establishment. The experiment were arranged in Completely Randomize Design with two factors. First factor is growing media which consist of Cibodas compost + rice husk (1:1 v/v), Cibodas compost + rice husk (1:2 v/v) and Cibodas compost only (control). The second factor was the feeding interval which consist of two treatments, fertilizer application were every two and four weeks. Each treatment consists of 10 replicates. Feeding treatment using compound fertilizer (Growmore). Dosage of fertilizer was 1 gram/l. Each plant was sprayed with 8 ml fertilizer solution. Seedling height, crown diameter, number of leaves, and number of shoot were measured after 4 months.

Experiment 4, one year old seedlings of *R. sessilifolium* were used to evaluate the effect of source and rates of liquid nutrition feeding. The experiment were arranged in Completely Randomize Design with two factors. First factor is type of fertilizer, i.e. Growmore, Hyponex, Gandasil, and Control (no feeding). Second factor was dosage: 0.5; 1; 1.5 and 2 gram/l. Each plant was sprayed with 8 ml fertilizer solution every week. Observations were conducted on the survival rates, the relative growth rates (RGR) of seedlings, the number of leaves, RGR of leaves and RGR of the crown, 12 weeks after planting. The relative performance index (RPI) was calculated using modified Elliot *et al.* (2000) as follows:

$$RPI = \sum \left( \frac{\text{mean \% survival} \times 10}{\text{max.mean \% survival}} \times \frac{\text{mean \% RGR} \times 10}{\text{max.mean \% RGR}} \right)$$

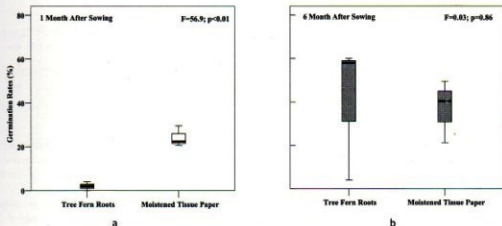


Figure 1. Mean ( $\pm$ SE) of germination rates of one month (a) and six months (b) old *R. javanicum* seedling on two different growing media. Box with similar color on each seedling ages means no significantly different at  $\alpha=0.05$ .

Experiment 2, the young seedlings of *R. sessilifolium* have different responds to the three different growing media tested (Figure 2). The survival rates, the seedling height, the root length, the number of leaves and the length of lamina. The lowest seedling survival rates was found on compost medium. The best growth medium is fine tree fern roots. Eventhough the plants that grew

Based on RPI, the relative rank among the treatment were established.

## RESULTS

Experiment 1, the result shows that *R. javanicum* seeds on moistened tissue paper germinated faster than on fine tree fern roots (Figure 1), but the rates of germination were not significantly different after six months. After one month, the rates of germination ranging from 0-2% (on tree fern roots) and 20.72-29.59% (on moistened tissue paper). The germination rates increased after 6 months, it ranges from 20-66% (on tree fern roots) and 30.61-51.8% (on moistened tissue paper).

on sand have similar survival rates with the ones on the tree fern roots, but it shows a poor performance on the other parameters. The color of the leaves also showed differences when growing on different growing media. The leaves showed dark green colour on tree fern roots and on compost, but showed yellowish colour when growing on sand.

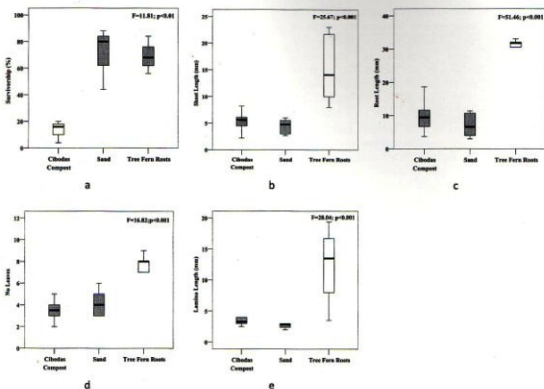


Figure 2. Mean ( $\pm$ SE) of Survival Rates (a), Shoot Length (b), Root Length (c), Number of Leaves (d) and Lamina Length (e) of six months old *R. sessilifolium* seedlings on three different growing media. Box with similar color on each parameters means not significantly different at  $\alpha=0.05$ .

Experiment 3 showed that there was no significant interaction between growing medium and feeding interval on *R. javanicum* seedlings (Table 1). The growing medium composition have a significant effects on *R. javanicum* seedlings. The height of seedling and the length of the lamina showed differences, but not on the number of leaves. The best medium for growing *R. javanicum* seedlings were 'Cibodas compost' without additional of rice husk (Fig. 3).

Experiment 4, significant effect of different fertilizer application on the development of *R. sessilifolium* were not found (Table 2), but their performances were different. Their performance were count based on all the parameters. From the ranking list, it showed that the seedling with high concentration solution were poorer on all growing parameters and their performances compared to the control treatment.

Table 1. The effect of Growing Medium and Interval Feeding on Growth of *R. javanicum* Seedling.

Effect	Parameters	df	F value	P value
Growing Medium	Shoot Length	2	9.33	<0.001
	Lamina Length	2	7.4	<0.01
	No. of Leaves	2	2.57	0.08
Feeding Intervals	Shoot Length	1	0.086	0.77
	Lamina Length	1	0.87	0.35
	No. of Leaves	1	0.12	0.72
Growth Medium x Feeding Intervals	Shoot Length	2	1.93	0.15
	Lamina Length	2	1.38	0.26
	No. of Leaves	2	0.14	0.86

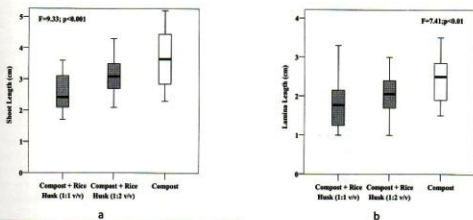


Figure 3. Mean ( $\pm$ SE) of Shoots Length (a) and Lamina Length (b) of *R. javanicum* seedling, Six months after transplanting on three different growth media. Box with similar color on each parameters means not significantly different at  $\alpha=0.05$ .

Table 2. Survival rates, Relative Growth Rates (RGR), number of leaves, the length of leaves, the width of the crown and Relative Performance Index (RPI) of *Rhododendron sessilifolium*.

Fertilizer	Doses (gram/l)	Survival (%)	RGR in Height (cm month <sup>-1</sup> )	RGR in no. leaves (month <sup>-1</sup> )	RGR in Leaves Length (cm month <sup>-1</sup> )	RGR in Crown Width (cm month <sup>-1</sup> )	RPI	Relative Rank
Growmore	0.5	100	0.11	0.93	0.06	0.14	286.07	2
	1	100	0.12	0.86	0.1	0.18	330.68	1
	1.5	80	0.093	0.13	0.03	0.03	91.32	4
	2	60	0.046	-0.13	-0.01	-0.08	-16.42	9
Hyponex	0.5	60	0.003	-0.13	0.02	0.05	15.39	7
	1	60	-0.053	-0.2	0.01	0.04	-19.86	10
	1.5	40	-0.06	-0.33	-0.02	-0.01	-38.34	12
	2	60	-0.04	-0.33	0.01	0.02	-28.68	11
Gandasil	0.5	60	0.073	0.07	0.06	0.09	85.3	5
	1	80	0.14	0.46	0.16	0.2	279.57	3
	1.5	60	0.027	0.07	0.05	0.08	58.83	6
	2	40	-0.08	-0.66	-0.03	-0.05	-68.74	13
Control		80	0.033	0	-0.02	0	8.85	8
Statistic			F=0.72; p=0.73	F=0.83; p=0.62	F=0.69; p=0.75	F=0.53; p=0.88		

## DISCUSSION

Seeds of *Vireya Rhododendron*: *R. javanicum* are easily germinated. But it has a short lived if we compare to other sections of *Rhododendron*. Rouse (1985) stated that at room temperature (30°C), the *Vireya Rhododendron*

seeds viability are only 2-3 weeks. Therefore, on the first experiment, the germination rates of *R. javanicum* were low (under 70%) when the seeds were germinated more than two weeks after harvest.

After germinated, the seedlings grew slowly. The best growth medium is the one similar with

their natural habitat. Mitchell & Galloway (2006), said that the root system of *Vireya* required good air circulation, high humidity, acidic condition, and have good drainage.

On the early history of *Vireya Rhododendron* cultivation, many growing medium were used and several media were still used today (Whiters, 1984; Rouse, 1985; Clancy, 1991; Monthofer, 2009). The cultivation media has evolved from a loam based compost, through a peat based compost and finally to the totally peat free medium as on "Edinburgh Compost". Even though, peat based composition medium were suitable for *Vireya Rhododendron*, but recently this medium is less popular. Conservation issue on peat bogs as valuable habitats for wildlife and important stores of Carbon caused horticultural industry change peat to sustainable raw material (Alexander *et al.*, 2008). The Edinburgh Compost consisting pine barkchip, fine pine bark, and lime stone. The pine bark is unavailable at the local supplier and this material is not commonly used by the local nurseries.

The media that mostly used for orchid is tree fern roots (mostly from local dead *Cyathea* spp.). The results were showed that tree fern roots medium was better than the sand and the Cibodas compost as growing medium for young seedling of *R. sessilifolium*. The sand provides good air circulation and drainage but unable to keep the humidity for the roots. While, Cibodas compost able to retain water on the root system but it does not provided good air circulation. The Cibodas compost caused the green algae grew faster and the young seedling became deteriorated.

Modification of Cibodas compost to provide better air circulation on root systems for *Vireya Rhododendron* has no positive effect. The seedlings planted on Cibodas compost with additional rice husk have a poor performance compare to the one on compost alone (control). Even though, green algae were grown on the control medium, but the seedlings were survive.

The Cibodas compost were made from all organic litter from the garden (grasses, leaves, and small braches). Based on compost analysis (Fitri, Personal Communication), the Cibodas compost has moderated pH, moderate C/N ratio, and provide trace element of plant nutrient. But, there are some indicators, such as percentage of organic Carbon, water contents, and Fe contains were higher than a minimum standard criteria as a good compost. Water contents of the compost were

three times higher than a standard compost. But, an addition of rice husk to improve the air circulation caused the seedlings poorer than the control. Probably, the composition of the rice husk were too high. It caused the medium losing their ability to provide high humidity environment on the seedling root systems. An experiment to find a proper ratio of rice husk and compost has to be conducted in the future.

Liquid fertilizer is also an important factor on growing *Vireyas* (Mitchell, 2003). *Vireyas* are not vicarious plant for their nutrition. High rates of feeding nutrient have toxic effect on the seedling (Table 2). Low rates with more frequent interval were better than higher dosage for single application. Ranking analysis on Table 2 showed that Growmore were better than Gandasil and Hyponex. The application of Growmore one gram/liter at 8 ml each plant each weeks gave the best result. Three compound fertilizers tested here have different compositions. Growmore contains more Nitrogen (32%) than Hyponex (25%) and Gandasil D (20%). While Hyponex contains less Phosphorus (5%) than Growmore (10%) and Gandasil (5%). Nitrogen form on Growmore have less nitrate (3%) than Hyponex (4.5%). Based on Sinclair (1966), *Rhododendron* plant affected detrimentally if the Nitrogen supply is in form of nitrate.

## CONCLUSION

It is important to find the best medium for growing *Vireya Rhododendron* that available on locally. Based on this experiment, the best medium for growing *vireya* is the fine tree fern root, this medium collected from the wild habitat. Modification of Cibodas compost as an alternative for *Vireya* medium has not yet shown a good result. Future experiment on modification of compost for *Vireya* with local material is needed and fertilizer is also important to provide a good performance of the plants. Based on the experiment, feeding the plants at low rates (1 gram/week) each week give the best result.

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