

Growth and Development Characteristics of *Hoya multiflora* Blume

Sri Rahayu

Bogor Botanical Gardens, Indonesian Institute of Sciences
Jl. Ir. H. Juanda 13 Bogor, Indonesia
srihayukrb@yahoo.com

Abstract

Hoya multiflora is one of the valuable germplasm in Indonesia utilized as ornamental and medicinal plants. This epiphytic plant faces problems in decreasing habitat, while the culture technique of this species has not established yet in Indonesia. It is important that all useful plant can be maintained to prevent the exploitation from the wild. Biological data on growth and development will provide a guideline to establish good culture techniques. The research aim was to investigate the growth and development of the seedlings of *Hoya multiflora* in two different conditions and growing media i.e. (1) in the natural habitat at the Bodogol Research Station of Gunung Gede Pangrango National Park, and (2) in a shade house of the Bogor Botanical Gardens as artificial habitat. Three different growing media was used in observation, i.e. (1) its phorophytes observed at natural habitat, (2) organic matter conducted at the shade house (3) tree fern log conducted at the shade house. The results showed that general, the growth and development of *Hoya multiflora* started by seed germination characterized by opened cotyledon, seedling establishment characterized by formation of alternate leaves arrangement, followed by growth of young plant characterized by formation of opposite leaves arrangement, growth and development of adult plant, flowering and fruiting. The critical point was at the seedling establishment phase, which best reached at the cocopeat medium. When the seedling established and developed to adult, there were no differences at the different growing media used. The best recruitment, growth and development of *Hoya multiflora* was at the cocopeat media located in the shade house.

Keywords: Gede Pangrango National Park, *Hoya multiflora*, growth and development, Bogor Botanical Gardens

Introduction

Hoyas (*Apocynaceae: Asclepiadoideae*) are becoming increasingly popular as ornamental plant, particularly in Europe, USA and Australia (Goyder, 2008). The international trade of this genus is increasing, but their existence in the nature obtains less attention, eventhough the conservation status was not state yet. In contrary, their habitat as epiphyte rapidly decrease mainly by the deforestation i.e. logging, burning, and forest conversion into plantation. The rapid increase on palm oil plantation especially prompted by the potential use as biofuel will multiply habitat lost for Hoyas as epiphyte.

The genus naturally originated from India, distributed to Australia and the Pacific Islands, with the greatest diversity is now found in South East Asia, particularly in Indonesia (Kleijn & Donkelaar, 2001; Wanntorp, 2006). There are about 150-200 *Hoya* species in the world (Hoffman *et al.*, 2002), 50-60 of which are in Indonesia (Rahayu, 2001). *H. multiflora* widely distribute from India to New Guinea (Goyder, 2008) from 50-1500 m above sea level (Rahayu *et al.*, 2010). This species is characterized by its short (non vein) plant, leathery (non succulent) oblong leaves and arrow head form white corona with yellow tip of the corolla. Flowers arranged in umbel appear at interpetiolar node. This plant produces white latex from all of its part.

Some indigenous people in the country have been utilizing some species of Hoyas as traditional medicine. The uses are for treat burns, cuts, convulsions, coughs, asthma, pneumonia, elephantiasis, encephalitis, fractures, gonorrhea, hemorrhoids, inflammation, insect bites/poisonous fish stings, orchitis, phthisis (tuberculosis), Pyoderma (skin disease caused by microorganisms), rashes, rheumatism/arthritis, swellings, traumatic injures/wounds, stomach and

intestinal ailments, and childbirth tonic (Zachos, 1998). A recent study shows their high potential as insecticide to the "Dengue" mosquito. *Hoya multiflora* Blume is one of the economic important as ornamental plant, and has been used traditionally as medicine, particularly to treat arthritis-rheumatism (Burkill, 2002) and stomach/intestinal ailments (Ambasta, 1986). The active compound of this plant unrevealed yet, but it could be Indomethacine like compound. Indomethacine, a common non-steroidal anti inflammatory drug (NSAID), has been used for more than 30 years to treat symptomatic pain of rheumatoid arthritis. Recently, this compound has been tested as a new class of anti HIV drug (Bourinbaier & Lee-Huang, 1994) and seems to be specific since no toxicity at clinical doses.

Despite of their high economic importance, little is known about their cultivation especially in Indonesia. As this plant is loved as ornamental plant and has a medicinal property, the knowledge on its growth and development is needed. The knowledge will be useful for the cultivation and living collection management for *ex-situ* conservation purposes. This research aimed to observe the growth and development characteristics of *Hoya multiflora* Blume.

Materials and Methods

The observation on the growth and development characteristics of *H. multiflora* was conducted both at their own natural habitat at the Bodogol Research Station, Gunung Gede Pangrango National Park, West Java and in a shade house at the Bogor Botanical Gardens. There were 10 mature, 5 young and 3 clumps of seedling observed at Bodogol RS. Observation at the Bogor Botanical Gardens was focused on the flowering and fruiting time using 20 accession collected from the Bodogol RS (2004-2006); and seedling growth and development from the fruit produced (2005). The observation on growth and development conducted at the following parameters:

Germination

The experiment was conducted at the Bogor Botanical Gardens shade house. The shade house condition was under the paranet having 75% canopy. The seeds were shown on the 2 different kinds of growing media, namely (1) cocopeat at the plastic plate and (2) tree fern log. The seeds used were from the harvested mature fresh pod in the green house. Each of 20 seeds were shown on the media two times. The seedlings were watered daily. Parameters observed were seedling percentage, time of opened seed coat, time of hypocotyle, time of first leaf appearance, and time of opposite leaf formation.

Seedling establishment

Observation was conducted using the growing seedling taken from the seed growth germination experiment. The parameter observed was started at the established seedling growth to the young plant, recorded by the formation of opposite leaf arrangement.

Growth

The young plant stated as the seedling formed the first opposite leaves. The observation was done from the growth of shoot and leaf (number of leaf) to the plant formed the first inflorescence.

Flowering and fruiting

Observation was conducted to record the flower formation, time of flowering, and lower product. The process of flowering and fruiting were recorded. Observation also made on the fruit ratio to the number of flower.

Results and Discussion

Generally, the growth and development of *Hoya multiflora* started from (1) seed germination characterized by opened cotyledon, (2) seedling establishment characterized by formation of alternate leaves arrangement, (3) growth of young plant characterized by formation of opposite leaves arrangement, (4) growth and development of adult plant, (5) to flowering and fruiting. The process of growth and development at the different condition are as follows:

Germination (in shade house condition)

The germination process of *H. multiflora* started from seed coat opening, followed by cotyledone opening until the first leaf forming. *H. multiflora* evolve the epigeal germination, which cotyledone above soil surface. According to Copeland & McDonald (2001), there are two germination types based on location of storage reserves. The research showed that the seed of *H. multiflora* grew 2-3 days after showing and had the high viability up to 100% at the cocopeat media. The seed of *H. multiflora* was similar to *H. parasitica* without dormancy (Rahayu & Sutrisno, 2007). Showing seed at the tree fern media resulted in the lower viability (80%) and took longer time (7-30 days) to germinate (Table 1). Overall, the germination process was faster at the cocopeat media than that at the tree fern log. There was microclimate different condition between cocopeat media and tree fern log, especially on the media humidity and water capacity. Cocopeat media was reported to be able to absorb more water and keep wet for a longer time than the log. The time of germination is faster at the cocopeat media, as more water stimulate the seed imbibitions. Besides that, the cocopeat media also provided ready to use nutrient. Media humidity and water content are the main factors for seed germination. Germination of seed involves the imbibitions of water, a rapid increase in respiratory, mobilization of nutrient reserves and initiation of growth in the embryo (Fenner & Thompson, 2006). Water is a basic requirement for germination as it is essential for enzyme activation, breakdown, translocation and use of reserve storage material (Copeland & McDonald, 2001).

Table 1. Seed germination of *H. multiflora* at the two different kinds of media

Media	Seed coat opening (days)	Cotyledone opening (days)	First Leaf Formation (days)	Seed viability
Tree fern log	7-30	14-45	41-60	80
Cocopeat	2-3	5-7	13-20	100

Seedling establishment

The seedling is characterized by alternate leaf formation. Seedling establishment was reached 12 month after seed germination. Seed on the cocopeat media had shorter time to grow (Table 2) and the highest establishment (80%). In contrary, at the tree fern log resulted the lowest growth and establishment (30%). Natural phorophyte was better to support seedling establishment of *H. multiflora* compared with the tree fern log media. Tree fern log had the lowest water holding capacity and nutrient availability compared with the cocopeat media and natural phorophyte. At the natural phorophyte, the seedling of *H. multiflora* grew on the ant nest (Rahayu *et al*, 2010), which provided nutrient and water holding capacity for the requirement of the *H. multiflora* to grow. During the seedling establishment, nutrient requirement increase from the former phase (germination). The tree fern log had the most limiting factor for seedling establishment of *H. multiflora*. According to Fenner & Thompson (2006), factor limiting establishment are competition between seedlings and abiotic hazards i.e. occurrence of physical damage and lack of moisture. The limiting factor at tree fern log was dominantly by lack of moisture which caused seedling desiccation. Seedling desiccation is a particularly acute hazard in the branches of trees (epiphytes) and the main cause of

seedling mortality (Fenner & Thompson, 2006). While the limiting factor at the natural phorophyte was dominantly by competition because many seeds were germinated at one hole (ant nest).

Table 2. Time of seedling growth of *H. multiflora* at different media

Media	Number of alternate leaves	Time of first opposite leaf formation (months)	Plant height at the time of first opposite leaf formation (cm)	Successful seedling percentage
Tree fern log	12-13	14 ± 2,0	18,4 ± 1,2	30
Cocopeat	12-13	12 ± 1,0	25,6 ± 0,7	80
Natural phorophyte	13-17	13 ± 1,5	19,8 ± 1,5	50

Young to adult

At this phase, plant growth was determined after seedling establishment, characterized by opposite leaf formation. At this phase, growth and development of plant were dominated by the increase in the node number followed by the increase in leaf number. There are two leaves (opposite formation) at each node. The new node emerged at about every one month. When 12 nodes completed (after one year), new branch developed at the shoot base and followed by the emergence of peduncle. The time at this phase was quite similar to the occurrence at different growing media (Table 3). This condition indicated the stability of the plant after seedling establishment phase.

Table 3. Growth and development of *H. multiflora* at different growing media

Media	Time of node growth (days)	Number of opposite leaves' node at the first flowering	Time of first flowering (Months after germination)	Plant height at the first flowering (cm)	Number of branch at the first flowering
Tree fern log	30 ± 9	12±1	20-28	30±5	2
Cocopeat	28 ± 7	12±1	18-30	30±2,5	0-2
Natural phorophyte	29 ± 8	12 ± 1	18-30	40±10	0-2

Flowering and fruiting

All plant at the different growing media and location developed and produced flowers and fruit. The time of flower and fruit development was quite similar (Table 4). This condition indicated the time for seedling establishment and development to adult plant, when the reproduction process occurred, i.e. plant produced flower and fruit. It means all growing media provided nutrient and basic requirement for the plant development. While fruiting process occurred at both different environments i.e. at the shade house condition and at the natural habitat. The pollination process in *H. multiflora* needs the presence of pollinator (Rahayu *et al*, 2010) and Chasanah (2010) has been identified that Vespidae was the pollinator of *H. multiflora* at the Bodogol forest.

Table 4. Flower and fruit development of *H. multiflora* at different condition

Media	Peduncle development (days)	Bud development (days)	Anthesis (days)	Percentage of fruit set	Fruit development (days)
Tree fern log	30 ± 10	28 ± 5	14 ± 1	0.01	35 ± 4
Cocopeat	29 ± 9	27 ± 4	14 ± 1	0.01	34 ± 5
Natural phorophyte	30 ± 11	29 ± 5	14 ± 1	0.01	36 ± 5

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