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IDENTIFICATION OF AGRONOMIC TRAITS OF *Centella asiatica* (L.) Urban.  
NATURALLY GROWN AT REGIONS WITH DIFFERENT ALTITUDES

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ABSTRACT

The *Centella asiatica* plant was an important herbal plant in Indonesia. The research was done to describe several agronomic traits that related to yield of the plants grown at regions with different altitudes. The research was carried out at three different regions of highland, midland, and lowland, each at > 500m, 250-500m, and < 250m above sea level. The research location was Pagar Alam, Musi Rawas, and Ogan Ilir, respectively. Research indicated that the agronomic traits of the plants grown at highland, midland, and lowland, regions were about the same for general appearance of leaf shape and flower color. The leaf size, number and length of stolone, number of rosetts, length of rhizomes, and number of flower were varied depending on the region. The plants grown at highland and midland region tend to have larger leaf size, shorter petiole and stolone, more number of rosetts and stolone, longer rhizomes, and more number of flowers per plant, as compared to the plants of lowland region. This could be indication that *Centella asiatica* plants grown on midland, and highland were more productive than plants of lowland region.

Keywords: agronomic-trait, *Centella-asiatica*, herbal, altitude.

INTRODUCTION

Indonesia is well known as a rich country of having abundant species of plants. Many of them (> 1.300 species) were considered as medicine plant including *Centella asiatica* (L.) Urban. (Sangat et al., 2000). Winarto and Surbakti (2002) stated that distribution area of the *Centella asiatica* plants cover large area in tropical as well as in the subtropical region including Southeast Asia, India, Pakistan, China, Middle East, Europe, and Australia. In these area the plants were mainly used for medications and culinary. In China, they called the plants as "a miracle elixir of life" (Khare, 2003). As the increase in science and technology, the use of *Centella asiatica* plant becomes more various not only for medication and culinary, but also for cosmetic purposes (Lasmadiwati et al., 2004).

With respect to the distribution area in Indonesia, the *Centella asiatica* plant has many local names. In many area in Sumatera the plant was called as "Daun Kaki Kuda", "Daun Aga", and "Pegagan". In Java, Madura, and Bali the plant was called as "Gowang", "Dulang Sontak", "Antanan", "Calingan Rambat", "Kos Tesan" and "Taidah". In Celebes, the plant was called as "Daun Wisu-wisu", "Eipubalo", "Kolotidi", "Sarowati", "Kori-kori", "Bebele", and in the Papua island, the plant was called as "Dogaukue", "Gogaukue", and "Sandanan" (Januati and Yusron, 2005; Winarto and Surbakti, 2002; Syukur and Harnani, 2001; Muhlishah, 2002; Hargiono, 1995). Bunyaprapharsara et al. (1999) listed the name of the plant in other part of the worlds. In Europe, the plant was called as "Pennywort" (England), "Cotylione" (France), "Wassernabel" (Germany), and "Padarvoet" (Holland). In India the plant was called as "Barahmi", "Karinga", and "Barhamamanduki". In Thailand the plant was called as "Buak Bok" and in The Phillipine it was called as "Yahong-yahong". Furthermore, Steenis (1977) described the scientific classification of the plant as follows:

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Kingdom	: Plantae
Division	: Spermatophyta
Sub-division	: Angiospermae
Class	: Dicotylodoneae
Order	: Umbellales
Family	: Umbelliferae (Apiaceae or Mackinlayaceae)
Genus	: Centella
Species	: <i>Centella asiatica</i> (L.) Urban or <i>Hydrocotyle asiatica</i> Linn.

The *Centella asiatica* plant was known as a herbaceous annual plants. The plants mature in about three months and the whole plants, including the roots, might be harvested. The plant grows around top soil, with short rizhomes, and long-slender stolone interconnecting one plant to another. The size of the plant, especially, the leaves and stolones as a main component of the yield may be varrious (Januati and Yusron, 2005). Many publications listed that the *Centella asiatica* plant grow in various regions in Indonesia (Januati and Yusron, 2005; Winarto and Surbakti, 2002; Syukur and Harnani, 2001; Muhlisah, 2002; Hargiono, 1995 ), but they did not describe clearly the agronomic traits of each region. This research, therefore, was intended to describe several agronomic traits that related to yield of the *Centella asiatica* plant grown at regions with different altitudes.

## MATERIAL AND METHOD

Research methodology was designed as field survey at several designated area of regions with different altitude followed by descriptive analysis. The area consisted of highland region (> 500 m above sea level); midland region (250-500 m above sea level) and lowerland region (<250 m above sea level). Consecutively, the regions of the research were Pagar Alam, Lubuk Linggau, and Ogan Ilir, South Sumatera Province. Every region covered three condition sites of dry, swampy (wet), and backyard (Picture 1) in which, five observation plots were established (plot size of 1 m<sup>2</sup>). This research, therefore, incorporated 45 observation plots (3x3x5). Research observation was done in October to November 2009. The composite soil samples of each observation plot was taken for soil fertility test. Although the samples were taken from different area as outlined above, the soil fertility seemed to be about the same. The samples indicated that the N % soil were ranged 5.0-6.5%; the P-Bray ranged from 3.2 to 3.6 ppm; the Kdd ranged 3.9-5.0 me/100g soil; and the pH H<sub>2</sub> (1:1) ranged 5.1 to 6.0 (Table 1).

The observations on the plants include some agronomic traits of the leaf (shape, size, number of leaf ; and length of the petiole ); the stolone (the number and the length); the roots (maximum length); and the flower (number of flower per plant). Descriptive analysis was performed on the data by tabulation. Data collection were also enhanced by selected pictures (images) representing the observations.

## RESULTS AND DISCUSSION

Unlike botanical trait that includes all part of the plant, the agronomic trait includes only certain part of the plant that are directly or indirectly related to yield and cultivation purposes. For the *centella asiatica* plant, the agronomic traits include the leaf, the stolone, the root (rhizome), and the flower (Wilson et al., 1972 and Harjadi, 1996).

In general, this research indicated that, the agronomic traits of *centella asiatica* plants grown at regions with different altitudes seemed to be similar. The leaf of the plants grown at higland region (> 500 m above sea level); midland region (250-500 m above sea level) as well lowland region (<250 m above sea level) appeared to be similar in shape of "kidney like" with un-smooth rounded apices and each individual leaf borned in a single pericladial petiols (Picture 2). The size of the leaves, however, relatively varied as shown on Table 2. There was indication that the leaves of the plants grown at mid and higland regions were larger in size with shorter petiole compared to plants at lower region. This indicated that *Centella asiatica* plants grown at midland, and highland were more productive than lowerland plant. The leaf is considered as an important organ of the plant in which the vital metabolism process of photosynthesis occurs (Haryadi, 1996). The shape and number of leaves of the plant were mainly affected by genetics factor, while the size was effected by genetic as well as non-genetic factors (Gardner, 1972). For *Centella asiatica* plant, the leaf is very essential as a main component of the plant production (Halimi, et.al., 1998).

With respect to grow habit of *Centella asiatica* plants that grow around top soil, the stolones appeared to be the main body of the plant. The stolones basically carry the leaves on the rosetts to certain direction of appropriate place to grow. The research indicated that the plants grew at high and midland have more rosetts of 8-16 rosetts per plant, and more stolone of 5-6 stolones per plant compared to lowerland plants. Unlike the number roset and stolone per plant, the length of stolone of the plants grown at lower region appeared to be longer than high and midland plant (Table 3). Apparently, the *Centella asiatica* plants found in lower region were more skinny, longer stolon, with less number of stolone, roset, and leaves (Picture 1). This appearance coincided with the length of roots, in which, the lowerland plants had a shorter root (4-7 cm) compared to high and midland plants (8-15 cm).

The stolones play important role in plant propagation of *Centella asiatica*, although the seeds might be used for it. The seeds are very small and borne on densely reticulated small fruits of 3-5 mm (Lasmadiwati et al., 2004, and Winarto and Surbakti, 2002). Research indicated that flowers of *Centella asiatica* plants naturally grown at highland, midland, and lowland region are similar. The flowers are small (less than 3 mm), and hermaphrodite, consisted of 2 green bractea, 6 corolla, 5 stamens, and 2 styles. The flower color could be white, pink, or red (Table 4), and born in a small and rounded bunches (umbels), axially erected on the roset near soil surface. The number of flowers per plant grown in lower region, however, was smaller (18-25 flower per plant), compared to the midland and highland plants of 28-48 flowers per plant (Table 4). This could be indication that *Centella asiatica* plants grown on midland, and highland were more productive than lowerland plant.

## CONLUSSION

The agronomic traits of *Centella asiatica* plants were about the same for general appearance of leaf shape and flower color. The leaf size, number and length of stolone, number of rosetts, length of rhizomes, and number of flowers, however, were varied depending on the region.

The *Centella asiatica* plants grown at highland and midland region tend to have larger leaf size, shorter petiole, more number of rosetts and stolone, longer rhizomes, shorter stolone, and more flowers per plant compared to the plants of lowerland region. This could be indication that *Centella asiatica* plants grown on midland, and highland were more productive than lowerland plant. The high and midland regions with altitude of >250 mm above sea level appeared to be appropriate area for production of *Centella asiatica* plants.

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Table 1. The Soil fertility (N, P, K and pH) of the composite soil samples taken from the observation sites.

Region	Condition site	Soil sample test for			
		N (%)	P-Bray (ppm)	Kdd (me/100 g)	pH H <sub>2</sub> O (1:1)
Highland > 500 m above sea level	Dry	5.5	3.5	4.4	5.4
	Swampy (wet)	5.0	3.2	5.2	5.5
	Backyard	5.5	3.5	3.9	5.2
Midland > 250 to 500 m above sea level	Dryland	6.5	3.5	4.2	5.9
	Swampy (wet)	6.5	3.6	4.2	5.7
	Backyard	5.0	3.6	4.0	5.1
Lowerland < 250 m above sea level	Dryland	5.6	3.5	4.5	5.5
	Swampy (wet)	5.5	3.6	5.0	5.6
	Backyard	6.5	3.5	5.0	6.0

Table 2. The shape and the size of the leaves and length of the petiole of *Centella asiatica* plants naturally grows at regions with different altitude.

Region	Condition site	Leaf shape	number of leaves/ rosset	Leaf length (cm)	Leafe width (cm)	Petiole length (cm)
Highland > 500 m above sea level	Dry	Kidney	6	3.25	4.40	7.80
	Swampy (wet)	Kidney	4	4.15	5.15	8.50
	Backyard	Kidney	5	3.50	4.90	8.00
Midland > 250 to 500 m above sea level	Dry	Kidney	8	3.30	4.26	9.29
	Swampy (wet)	Kidney	7	3.57	4.26	8.50
	Backyard	Kidney	4	3.36	4.05	8.71
Lowerland < 250 m above sea level	Dry	Kidney	5	3.15	3.01	11.7
	Swampy (wet)	Kidney	6	3.17	3.02	10.2
	Backyard	Kidney	7	3.13	3.04	11.5

Table 3. Number of roset, number and length of stolone, and length of the root of *Centella asiatica* plants naturally grows at regions with different altitude.

Region	Condition site	Number of roset per plant	Number of stolone per plant	Maximum length of stolone (cm)	Maximum length of root (cm)
Highland > 500 m above sea level	Dry	16	5	62.0	12.1
	Swampy(wet)	14	6	58.0	11.5
	Backyard	14	5	65.2	15.1
Midland > 250 to 500 m above sea level	Dry	10	6	66.5	8.55
	Swampy (wet)	10	5	62.2	8.45
	Backyard	8	5	56.7	11.0
Lowerland < 250 m above sea level	Dry	6	4	67.0	5.00
	Swampy (wet)	6	3	67.0	7.00
	Backyard	6	3	97.0	4.15

Table 4. Number of flowers of *Centella asiatica* plants naturally grows at regions with different altitude.

Region	Condition site	Number flower per plant	Flower color observed
Highland > 500 m above sea level	Dry	40	white, pink, , red
	Swampy (wet)	47	white, pink, , red
	Backyard	40	white, pink, , red
Midland > 250 to 500 m above sea level	Dry	35	white, pink, , red
	Swampy (wet)	48	white, pink, , red
	Backyard	38	white, pink, , red
Lowerland < 250 m above sea level	Dry	21	white, pink, , red
	Swampy (wet)	18	white, pink, , red
	Backyard	25	white, pink, , red



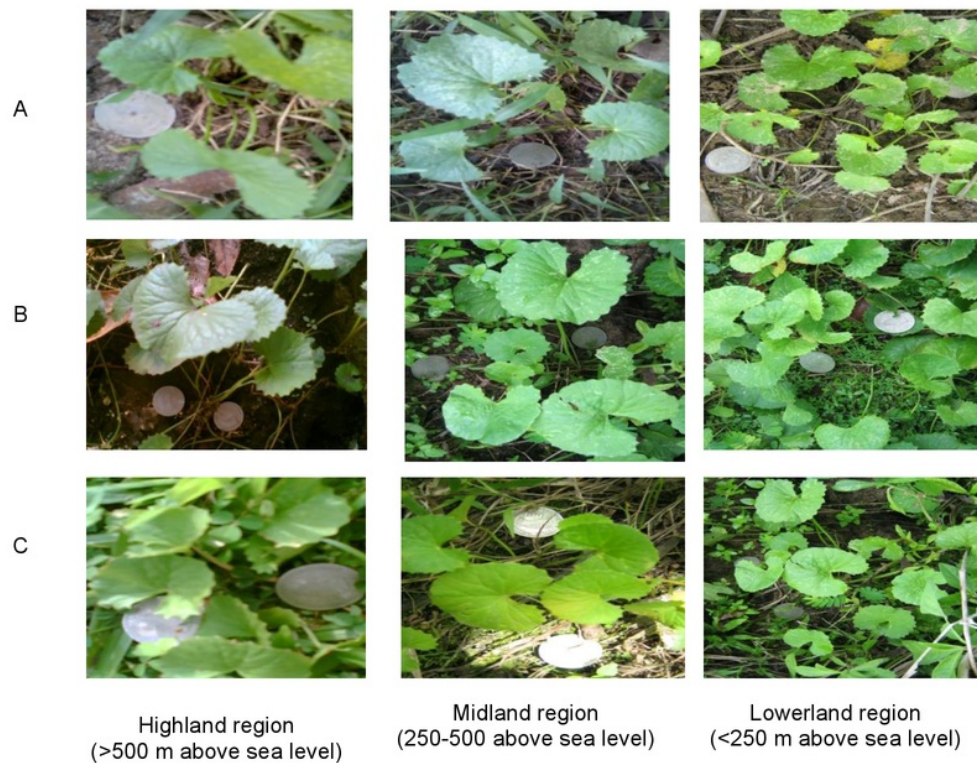


Figure 1. The observation sites of *Centella asiatica* plants naturally grows at regions with different altitude (A:Dry; B:Swampy-wet; C:Backyard)

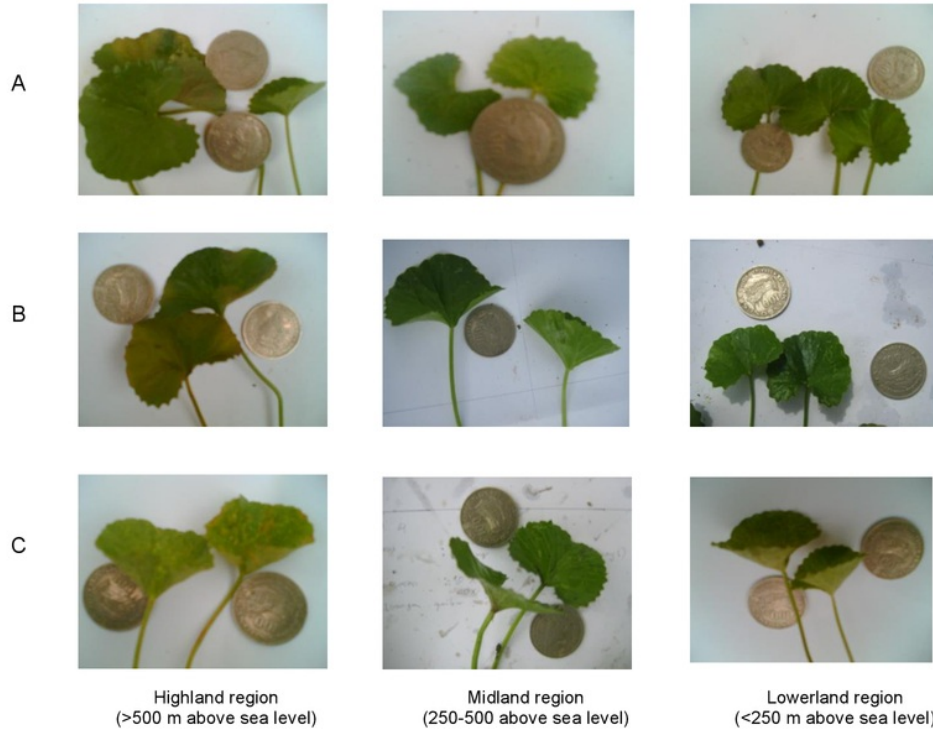


Figure 2. The leaves and petiole of *Centella asiatica* plants naturally grown at regions with different altitude (A: Dry; B: Swampy-wet; C: Backyard).



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