The host preference of three liana species in Situgunung, Gunung Gede Pangrango National Park, Indonesia

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Introduction

Liana constitutes one of the main characteristics of tropical rain forest (Laheye et al., 2005). The name "liana" is a common term for a group of plants that use other plants as climbing support to reach sunlight (Asrianny et al., 2008). Contrary to common belief, liana is not a taxonomic group but belongs to many different plant families (Schnitzer et al., 2010). While liana germinate on soil and grow up like any other plants, they have lost their ability to support their own structure above a certain height. Therefore, they cling to trees and eventually compete with the host tree for sunlight (Gerwing et al., 2006). During the entire growth process, liana's' roots remain anchored on the ground (Thomas & Baltzer, 2002).

Liana are distinguished from other trees and shrubs by their stem-stiffness. The young twigs and small branches of trees and shrubs are flexible, whereas the older parts, such as stems and large branches, are rigid. In contrast to this, young parts of liana tend to be rigid and grow increasingly with age and size (Schnitzer et al., 2010). In many cases, liana also grow small hook-like structures that are used to latch onto host trees (Thomas & Baltzer, 2002).

The role of liana in a tropical rainforests is not well understood. They may connect forests by forming "bridges" throughout the canopy, thereby enabling arboreal animals to traverse the canopy at ease. They may also protect weaker trees from harmful gusts of wind. Whereas the benefits caused by liana are theoretical, the negative implications of liana to host plants are better known. They compete for sunlight and photosynthesis, water and nutrients (Laheye et al., 2005). Eventually, the competition can lead to stunted growth rate of the host tree, and cause mechanical abrasion, leaving the host more susceptible to damage and increasing the risk of collapsing (Garrido-Pérez et al., 2008; Putz, 1984).

Whereas liana exhibits host preference, the mechanisms that determine "preference" is poorly understood. Malizia and Grau (2006) suggested preference is associated with the structure of the host and with the liana's potential success in getting access to sunlight.

This study aims at testing the hypothesis; there is no relation between the abundance of host trees and the preference of liana around Situgunung Lake in Gunung Gede Pangrango National Park, Java, Indonesia.

Methods

Situgunung is a lake surrounded by mountains and forest and measures approximately 100Ha (Dinas Kehutanan Provinsi Jawa Barat, 2007). It is located in Kadudampit Sub-district of Sukabumi Regency between 106°54'37" - 106°55'30" eastern longitude and 06°39'40" - 06°41'12" southern latitude. The lake is located 950--1.036 meter above sea level.

Data collection took place from 29th June – 1st July, 2012. Five plots, each with an area of 20 x 50 meters, were setup 100m apart. All plots were divided into 10 sub-plots, making the size of each sub-plot 100m^2 (Fig. 1). Data was collected from hosts with a trunk diameter above, or equal to, 10cm at 130cm above ground. The species name, total number of individuals of each species and trunk diameter were recorded. Data recorded for liana followed the liana census protocol by Gerwing et al. (2006). Only individuals with a

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trunk diameter above or equal to 2cm were recorded, along with species name, total number of individuals of each species and trunk diameter. The recorded data was used to generate the Important Value Index (IVI) of each liana species and the host preference of liana was determined using Spearman's correlation index (IBM SPSS Statistics 20).

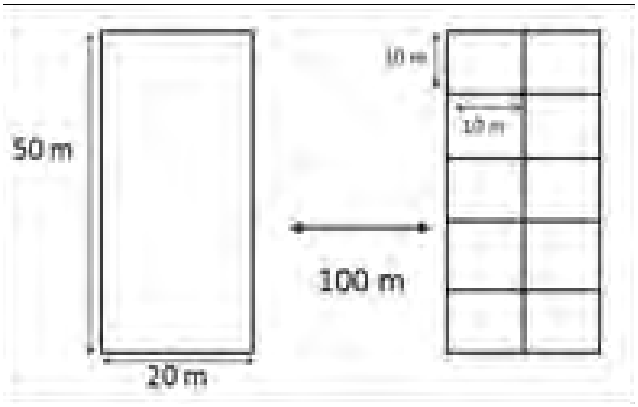

Figure 1. Study setup consisted of five plots of 50x20m that were divided into subplots, each measuring 100m^2.

Results

This study recorded 18 liana species and 52 species of host trees from five plots with a total area of 5000m^2. The liana Important Value Index (IVI) revealed *Uncaria sp*. (Rubiaceae) (0,9507), *Ficus sp*. (Moraceae) (0,4263), and *Piper caducibracteum* (Piperaceae) (0,3395) with the three highest IVI.

The Correlation Coefficient (*R*) of the hosts and the three liana species with the highest IVI are presented in Table 2. *Uncaria sp*. showed the highest R-value with the host *Flacourtia rukam* (0.371), with *Ficus sp*. correlated strongly to the host *Eusideroxylon zwageri* (0.510) and *Piper caducibracteum* correlated strongly with the host *Trema orientalis* (0.535).

The results show a preference of liana for a specific host species. This is illustrated by comparing the abundance of liana and the abundance of hosts (Fig. 2a-c) with the correlation coefficients. Whereas the highest abundance of *Uncaria sp*. was recorded on sp. 12, it showed the strongest correlation with *Flacourtia rukam* (Fig. 2a). *Ficus sp*. was the most abundant on *Eusideroxylon zwageri* with the number of liana higher than the number of hosts (Fig. 2b). *Piper caducibracteum* was distributed evenly in every host, but had the strongest correlation with *Trema orientalis* (Fig. 2c).

Table 1. Data of Three Liana Species with the Highest Important Value Index (IVI)

Species	Relative Density	Relative Coverage	Relative frequency	IVI
Uncaria sp.	0.1833	0.5934	0.1739	0.9507
Ficus sp.	0.1667	0.1510	0.1087	0.4263
P. caduci…	0.1333	0.0540	0.1522	0.3395

Table 2. Correlation Coefficient of the three liana species with the Highest Important Value Index (IVI) to Host. (–) = negative correlation and (+) = positive correlation.

Name of Liana	Name of Host	*R*
Uncaria sp.	*Altingia excelsa*	0.323
	Schima wallichii	-0.030
	Saurauia pendula	0.106
	Cangkureu	0.196
	Eusideroxylon zwageri	0.110
	Flacourtia rukam	**0.371**
	Blumeodendrom tokbrai	0.311
Ficus sp.	Cangkureu	0.062
	Eusideroxylon zwageri	**0.510**
	Turpinia sphaerocarpa	-0.022
	Castanopsis argentea	-0.027
	Schima wallichii	0.022
P. caducibractum	*Altingia excelsa*	-0.006
	Schima wallichii	-0.025
	Nauclea orientalis	0.206
	Turpinia sphaerocarpa	-0.075
	Trema orientalis	**0.535**
	Macaranga tanarius	0.054
	Konang	0.345
	Persea rimosa	0.156

Discussion

This study reveals that host preferences of liana around Situgunung Lake are not only influenced by host abundance. The highest liana-host correlation was not associated with the abundance of hosts and liana (Tab.2; Fig 2a-c), suggesting that preference is determined by other factors that are probably species specific. It may be determined by a liana's ability to get access to different sources of nutrition under variable

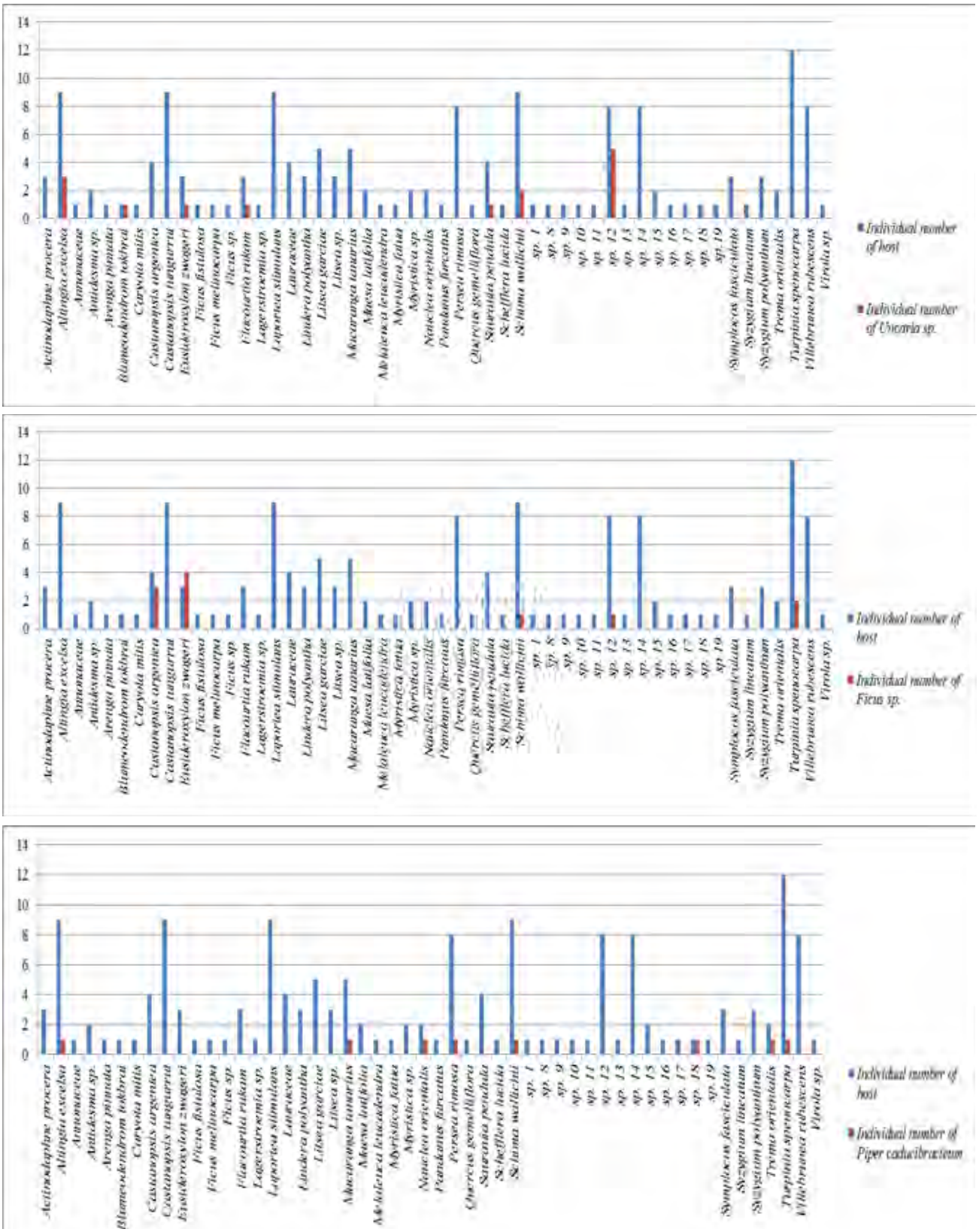

Figure 3a-c. The relationship between hosts abundance and the preference of *Uncaria sp*.(a), *Ficus sp*. (b) and *Piper caducibracteum* (c).

environmental circumstances. This may reduce and balance inter species competition that is important to maintain a healthy tropical forest (Begon et al., 2006). Malizia and Grau (2006) suggest that preferences are influenced by host specifics, such as roughness of bark, diameter and height of trunk, the acceleration of growth, stem flexibility and crown illumination.

This study suggests there is no correlation between host abundance and preference of liana. However, more studies about variables affecting the host preference are needed to understand the interaction between host and liana, as well as its role and impact on the ecosystem.

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References

Asrianny, Marian and N.P. Oka (2008). The diversity and abundance of liana (climbing plants) in the natural forest of Hasanuddin University experimental forest. *Jurnal Perennial* **5(1)**: 23--30.

Begon, M., Towsend, C.R. and J.L. Harper (2006). Ecology from individuals to ecosystems. Blackwell Publishing, Liverpool. 700pp.

Dinas Kehutanan Provinsi Jawa Barat (2007). Taman wisata alam Situgunung. http://dishut.jabarprov.go.id/index.php?mod=manageMenu&idMenuKiri=473&idMenu=486.

Garrido-Pérez, E.I., Dupuy, J.M., Durán-García, R., Gerold, G., Schnitzer, S.A. and M. Ucan-May (2008). Structural effects of lianas and hurricane Wilma on trees in Yucatan peninsula, Mexico. *Journal of Tropical Ecology* **24**: 559--562.

Gerwing, J.J., Schnitzer, S.A., Burnham, R.J., Bongers, F., Chave, J., DeWalt, S.J., Ewango, C.E.N., Foster, R., Kenfack, D., Martinez-Ramos, M., Parren, M., Pathasarathy, N., Pérez-Sallcrup, D.R., Putz, F.E. and D.W. Thomas. 2006. A standard protocol for liana censuses. *Biotropica* **38(2)**: 256--261.

Laheye R., Civeyrel, L., Speck, T. and N.P. Rowe (2005). Evolution of shrub-like growth forms in the lianoids subfamily Secamonoideae (Apocynaceae s.l.) of Madagascar:Phyolgeny, biomechanics, and development. *American Journal of Botany* **92(8)**: 1381--1396.

Malizia, A. and H.R. Grau (2006). Liana-host tree associations in subtropical montane forest of north-western Argentina. *Journal of Tropical Ecology* **22**: 331--339.

Muhidin, S.A. and M. Abdurahman (2007). Analisis korelasi, regresi, dan jalur dalam penelitian. CV Pustaka Setia, Bandung: 280 hlm.

Putz, F.E. (1984). How trees avoid and shed lianas. *Biotropica* **16(1)**: 19--23.

Schnitzer, S.A. and W.P. Carson (2010). Lianas suppress tree regeneration and diversity in treefall gaps. *Ecology Letters* **13**: 849-857.

Thomas, S.C.. and J.L. Baltzer (2002). Tropical forests. http://www.forestry.utoronto.ca/courses/for201/Resources/Tropical%20Forests%20Thomas%20and%20Balzer.pdf.