

# The Diversity of Understory (Shrubs And Herbs) in Mount of Nglanggeran

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**Abstract:** Mount of Nglanggeran is areas that have diversity of unique flora. This area is uninhabited, so many diversity flora that not identified and have not experienced exploration. Therefore, further exploration of plant diversity is needed. The research is aim to inventory, documentation, and find out the diversity of understory (shrubs and herbs) on Mount Nglanggeran. This research used survey and exploration methods. The researchers documented shrubs and herbs species. Based on result, found 44 family consist of 144 species shrubs and herbs. Those species are flora that has specifically characteristics.

**Keywords:** Mount of Nglanggeran, Shrubs and Herbs, Understory

## INTRODUCTION

Mount of Nglanggeran is located at Nglanggeran village, Patuk sub-district, Gunung kidul district. According to Surono (2008) this region was formed on the tertiary era when the early miocene to the middle Miocene ( $\pm 23$  million years ago). Geologically and geomorfologically this area is interesting, these conditions are influence structure and the composition of vegetation that flora grows. Mount of Nglanggeran has many diversity of wild flora (some species have not been identified regarding local knowledge) and unique flora (some species have specifically characteristic). According to Widodo (2015), some species are founded also have the same characteristic with the species in another place, for example Sulawesi, India, and Sri Lanka. Eventually this conditions encourage researchers for studying flora diversity in this region.

The meaning of diversity is different conditions or have different forms or character. The diversity of species in an area can be observed on two levels, there are number of species same life form and present of species with different life form (Ewusie, 1990). Mount of Nglanggeran is region dominated with understory. Especially diversity of shrubs and herbs. Understory is plants vegetation which is under the forest stand except tree regenerations includes grass, herbs, and shrubs. The types of understory have character *annual*, *biennial*, and *perennial*. The type of distribution occurs randomly, clustered and equally. Commonly understory are able to grow-well under canopy. A few species understory are able to grow under the sun directly. Usually found in cluster, so that it form shrubs (Robert and Thomas, 1998). Ecologically understory vegetation are able to observe according to plant life forms (Sumardi and Widyastuti, 2004).

In tropical forests stratification, understory includes shrubs, sub-shrub, and layers of ground cover

(Soerinagara and Indrawan, 2008). *Herbaceous* is a soft trunked plants and contains a lot of water (Pirnanda, 2016). Muller-Dombois and Ellenberg (1974) mention, herbs is plants without woody stems living in ground cover. Herbs are divided in three cluster that are *ferns*, *graminoids*, *forbs*. While the shrubs is plants that are not large in size, the woody stems but small and branching near of surface (Tjitrosoepomo, 1994). According to Haris (1979), usually, the shrubs smaller than the tree, shrubs usually have a height of less than 5 meters. The mostly of shrubs have many bud at the base and along stems.

Diversity exploration of flora are needed because for documenting and diversity inventory of the species genetic, learn the distribution of flora, learn of taxonomy, conservation effort for prevent extinction, learn molecular structure of plants, learn secondary metabolite, etc. (Nurbani, 2015). This research have aims for documented diversity of understory (shrubs and herbs) in Mount of Nglanggeran. The data of result can be help for studying a variety of plants species the shrubs and herbs in systematic and visual. The existence of the species diversity in Mount Nglanggeran needs to be disseminated to present the richness of flora on the island of Java. Currently, the knowledge about the diversity of flora on Java island, especially wild plants is less known (Widodo, 2017).

## MATERIALS AND METHODS

### Study Area

The research was conducted on the main climbing route of Mount Nglanggeran which is an ecotourism area in Gunungkidul, Yogyakarta, Indonesia (Figure 1) from Januari 2018 to May 2018. Photographic documentation was done as the first step of the identification process. The photoshoot focused on

stems, leaves, and inflorescence morphology to simplify identification process. Identification were done along with observe the understory vegetation.

### Tools and Materials

Equipment used for observation and data collection consists of digital cameras, worksheet about data species, and plants identification book.

### Work Procedure

The working procedures were as follows: photographing and observation of specimen in situ, identification with compared to illustrations in Flora of Java (Backer and Backhuizen, 1963). Flora (Steenis, 2006), Encyclopedi of Flora (LIPI, 2009), and other existing literature, from website *naturesloveyou.sg*, *plantsystematics.org*, *planet.com*, checking and matching with herbarium types and illustrations/drawings in the literature to identify the specimen.



Figure 1. Climbing route for exploration and observation.

## RESULT AND DISCUSSION

The result from this research is inventory of understory in Mount Nglanggeran. Data presented based on life form (*habitus*), which includes understory are shrubs, herbs, and several lianas. This is show the result of diversity understory:

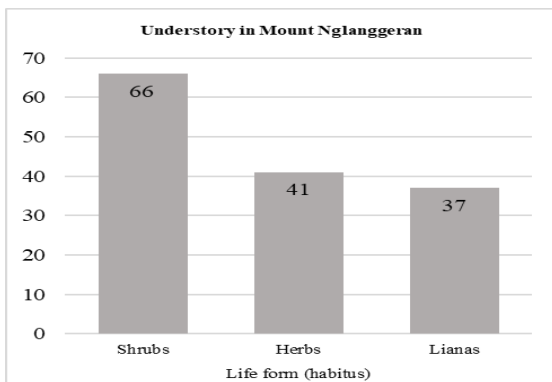


Figure 2. The total distribution of understory species that found on Mount Nglanggeran.

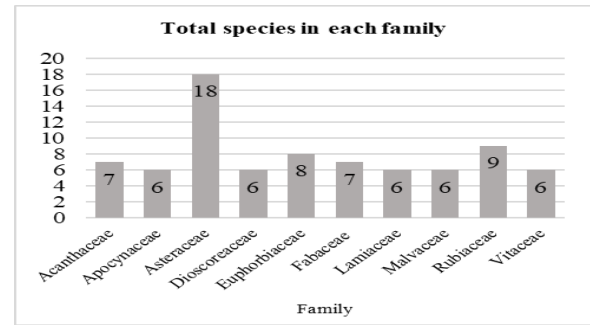


Figure 3. Ten family of understory that have high number in Mount Nglanggeran.

Based on life form (*habitus*), understory that dominate in Mount Nglanggeran is shrubs. The shrubs consist 66 species, 41 herbs species, and 37 lianas species. The shrubs are very easily to find, because they reproduce using seeds and can adapt quickly. Shrub communities that dominate around climbing path are *Memecylon caeruleum* (Figure 4) and *Ardisia humilis* (Figure 5). The species of *Memecylon caeruleum* grows in forests with dry land. The spread is also very easy through seeds (Bharathi et al., 2016). So that the species of *Memecylon caeruleum* dominates more on Nglanggeran. The plants of *Memecylon caeruleum* are more commonly found associated with *Ardisia humilis*, *Pavetta indica*, *Melastoma malabathicum*, and *Psychotria* sp. (Widodo, 2015).



Figure 4. *Memecylon caeruleum*.



Figure 5. *Ardisia humi*.

Based on the identification results, there were 144 species of shrubs and herbs found in Nglanggeran, with

a total of 46 families. The plant list of (shrubs and herbs) species were found in Mount Nglanggeran.

**Table 1.** Plant list of shrubs and herbs in Nglanggeran.

No	Family	Species	Life-form (Habitus)	No	Family	Species	Life-form (Habitus)
1	Acanthaceae	<i>Andrographis paniculata</i>	H	16	Dilleniaceae	<i>Tetracera scandens</i>	S
		<i>Asystasia gangetica</i>	H	17	Dioscoreaceae	<i>Dioscorea alata</i>	L
		<i>Blechum pyramidatum</i>	H			<i>Dioscorea bulbifera</i>	L
		<i>Dicliptera foetida</i>	H			<i>Dioscorea hispida</i>	L
		<i>Ruellia napifera</i>	H			<i>Dioscorea nummularia</i>	L
		<i>Strobilanthes crispus</i>	S			<i>Dioscorea oppositifolia</i>	L
		<i>Thunbergia fragrans</i>	L			<i>Dioscorea pentaphylla</i>	S
2	Amaranthaceae	<i>Cyathula prostate</i>	H	18	Euphorbiaceae	<i>Acalypha indica</i>	H
3	Annonaceae	<i>Popowia sp</i>	S			<i>Bridelia stipularis</i>	S
4	Apiaceae	<i>Centella asiatica</i>	H			<i>Euphorbia heterophylla</i>	S
		<i>Eryngium foetidum</i>	H			<i>Euphorbia pulcherrima</i>	S
5	Apocynaceae	<i>Anodendron paniculatum</i>	S			<i>Glochidion eriocarpum</i>	S
		<i>Chonemorpha fragran</i>	L			<i>Jatropha multifida</i>	S
		<i>Cosmostigma racemosum</i>	L			<i>Phyllanthus muriculatus</i>	H
		<i>Hoya cumingiana</i>	S			<i>Sauropus sp.</i>	S
		<i>Hoya diversifolia</i>	L	19	Fabaceae	<i>Centrosoma pubescens</i>	L
		<i>Rauvolfia verticillata</i>	S			<i>Mimosa pudica</i>	S
6	Araliaceae	<i>Schefflera arboricola</i>	S			<i>Flemingia sp.</i>	S
7	Asteraceae	<i>Acmella repens</i>	H			<i>Phyllodium pulchellum</i>	S
		<i>Ageratum conyzoides</i>	S			<i>Pseudarthria viscida</i>	H
		<i>Bidens pilosa</i>	S			<i>Puereria phaseloides</i>	S
		<i>Blumea sp.</i>	S			<i>Uraria crinite</i>	S
		<i>Chromolaena odorata</i>	S	20	Gentianaceae	<i>Fagraea ceylanica</i>	S
		<i>Cosmos caudatus</i>	S	21	Gesneriaceae	<i>Epithema horsfeldii</i>	H
		<i>Crassocephalum crepidioides</i>	H	22	Helicteraceae	<i>Helicteres hirsute</i>	S
		<i>Elephantopus scaber</i>	H	23	Lamiaceae	<i>Clerodendrum paniculatum</i>	S
		<i>Elephantopus spicatus</i>	H			<i>Gophostemma javanicum</i>	S
		<i>Emilia sanchifolia</i>	H			<i>Hyptis suaveolens</i>	H
		<i>Erigeron sumatrensis</i>	S			<i>Leucas sp</i>	H
		<i>Porophyllum ruderale</i>	H			<i>Leucas aspera</i>	H
		<i>Spilanthes costata</i>	H			<i>Plectranthus sp.</i>	H
		<i>Synedrella nudiflora</i>	H	24	Lindernaceae	<i>Torenia sp.</i>	H
		<i>Vernonia cinerea</i>	H	25	Loranthaceae	<i>Scurrula parasitica</i>	S
		<i>Wedelia trilobata</i>	H	26	Lythraceae	<i>Lawsonia inermis</i>	S
		<i>Tithonia diversifolia</i>	S	27	Malvaceae	<i>Abelmoschus moscatus</i>	S
		<i>Ageratina adenophora</i>	S			<i>Hibiscus surattensis</i>	S
8	Balsaminaceae	<i>Impatiens sp.</i>	H			<i>Sida acuta</i>	S
9	Boraginaceae	<i>Ehretia microphylla</i>	S			<i>Sida retusa</i>	S
10	Capparaceae	<i>Capparis micracantha</i>	S			<i>Urena lobata</i>	S
11	Celastraceae	<i>Celastrus scandens</i>	L			<i>Waltheria indica</i>	S
		<i>Celastrus sp.</i>	S	28	Melastomataceae	<i>Clidemia hirta</i>	S
12	Colchicaceae	<i>Gloriosa superba</i>	H			<i>Melastoma malabathricum</i>	S
13	Convolvulaceae	<i>Argyreia mollis</i>	L			<i>Memecylon caeruleum</i>	S
		<i>Ipomea lacunose</i>	L	29	Menispermaceae	<i>Stephania hernandifolia</i>	L
		<i>Ipomea purpurea</i>	L			<i>Tinospora glabra</i>	L
		<i>Merremia hastate</i>	L	30	Moraceae	<i>Maclura cochinchinensis</i>	S
		<i>Ipomea pes-tigridis</i>	L			<i>Malaisia scandens</i>	S
14	Costaceae	<i>Costus speciosus</i>	H	31	Oleaceae	<i>Jasminum pubescens</i>	S
15	Cucurbitaceae	<i>Tricosanthes villosa</i>	L	32	Oxalidaceae	<i>Biophytum reinwardtii</i>	H
		<i>Mimordica charantia</i>	L			<i>Oxalis corniculata</i>	H
		<i>Tricosanthes tricuspidata</i>	L			<i>Oxalis sepium</i>	H

No	Species	Life-form (Habitus)	No	Family	Species	Life-form (Habitus)
	<i>Coccinia grandis</i>	L			<i>Pavetta indica</i>	S
33	Passifloraceae	<i>Passiflora suberosa</i>			<i>Pentas lanceolata</i>	S
34	Piperaceae	<i>Peperomia sp</i>			<i>Psychotria celebica</i>	S
		<i>Peperomia pellucida</i>			<i>Vangueria spinosa</i>	S
		<i>Piper aduncum</i>	40	Rutaceae	<i>Clausena excavate</i>	S
		<i>Piper nigrum</i>	41	Smilacaceae	<i>Smilax anceps</i>	L
		<i>Piper retrofactum</i>			<i>Smilax celebica</i>	L
35	Primulaceae	<i>Ardisia humilis</i>			<i>Smilax glauca</i>	L
36	Ranunculaceae	<i>Clematis sp.</i>	42	Solanaceae	<i>Solanum torvum</i>	S
		<i>Clematis sp.</i>	43	Thymelaeaceae	<i>Phaleria octandra</i>	S
		<i>Unidentified</i>	44	Urticaceae	<i>Laportea interrupta</i>	H
		<i>Ranunculaceae</i>			<i>Pauzolzia zeylanica</i>	H
		<i>Unidentified</i>				
		<i>Ranunculaceae</i>				
		<i>Unidentified</i>	45	Verbenaceae	<i>Clerodendron serratum</i>	S
		<i>Ranunculaceae</i>				
37	Rhamnaceae	<i>Zizhipus oenoplia</i>			<i>Lantana camara</i>	S
		<i>Zizhipus mucronata</i>			<i>Stachytarpheta jamaicensis</i>	S
38	Roscaeae	<i>Rubus moluccanus</i>	46	Vitaceae	<i>Cayratia molissima</i>	L
39	Rubiaceae	<i>Borreria laevis</i>			<i>Cissus repens</i>	L
		<i>Borreria ocymoides</i>			<i>Leea asiatica</i>	S
		<i>Hedyotis corymbusa</i>			<i>Tetrastigma</i>	L
					<i>leucostyphallum</i>	
		<i>Hedyotis verticillata</i>			<i>Vitis discolour</i>	L
		<i>Mussaenda sp.</i>			<i>Vitis riparia</i>	L

**Information:** S = Shrubs H = Herbs L = Lianas

Based on the table and graph above, explains that the Asteraceae families were understory that has the largest number of species, Asteraceae (18 species), then the Rubiaceae family (9 species), Euphorbiaceae (8 species), Acanthaceae and Fabaceae (7 species) Apocynaceae, Dioscoreaceae, Lamiaceae, Malvaceae, and Vitaceae (6 species). Based on exploration, the Asteraceae family found in the Mount Nglanggeran grows wild in various locations. This plant often grows in the undercanopy and places that are exposed to direct sunlight.

Asteraceae are families that has high number diversity in Mount Nglanggeran and Asteraceae were the second largest in the kingdom Plantae (Lawrence, 1958). According Cronquist (1981), this families has 20.000 species which consists of 1.100 genera. This amount is less than the number of members of the family Leguminosae which is the largest family in the kingdom of Plantae with a number of species of more than 20,000 species (Banson, 1957).

Researchers found several unique plant and rarely found in all locations. Some plant species were only found in certain habitats so that the plants has not experienced exploration. Researchers try to describe some species that are considered unique and have their own characteristics to grow. These plants include *Hoya* sp. (Figure 6), *Hoya diversifolia* (Figure 7), *Cayratia molissima* (Figure 8), and *Smilax anceps*. (Figure 9), these plants have a life form (*habitus*) lianas and vines. Because they live in habitats that were hard to reach, so the researchers was difficult to capture them.



**Figure 6.** *Hoya* sp. A. Flowers, B. Leaves and Flowers structure, C. Habitus.





**Figure 7.** *Hoya diversifolia* A. Flower, B. Flower and flower buds, C. Habitus.

*Hoya* sp. (Figure 6) is group of Apocynaceae. This plants is found on the east side in Mount Nglanggeran and epiphyte in rock cliffs. *Hoya*, also known as wax plants belongs (Siar, 2005). *Hoya* species are mostly vines and epiphytic climbers (Wanntorp, 2009). *Hoya* plants are popular ornamentals owing to its waxy foliage and attractive flowers (Borlagdan et al., 2016; Widiarsih et al., 2011). *Hoya* plants are distributed from India to Pacific islands (Wanntorp et al., 2006). In Asia, it is believed that the southeast region is the center of diversity for *Hoya* (Rodda and Ang, 2012). Characteristic of *Hoya* sp is different with *Hoya diversifolia*. (Figure 9). Both have *folia opposita*. Some *Hoya*'s species are using to traditional medicine (Jhoanna and Inocencio, 2017). Based on study comparison with herbarium in National Museum D'Histoire Naturelle Philippines, this *Hoya* sp. alike *Hoya cumingiana* (MNHN-P-P0063983). The researchers cannot confirm furthermore about this species. Because must be through taxonomically and genetically studies to ensure of status *Hoya*.



**Figure 8.** *Cayratia mollissima*: A. Habitus, B. Fruits.



**Figure 9.** *Smilax anceps* A. Leaves, B. Caulis and spinosus, C. Habitus.

*Cayratia mollissima* (Figure 8) was found on the eastern side of the Nglanggeran Mount. This species grows climb in higher plant species. This species is *Herbaceous* climber. Researchers only found this species in one location. Taxonomically these plants belong to the Vitaceae family, with special features having tendrils and fruit that resemble grapes (Chnar et al., 2011). *Cayratia* is a tropical and subtropical genus distributed in Asia, Africa, Australia and the Pacific Islands, consisting of 63 species (Wen, 2007). Stem cylindrical, 1–3 mm diam, branched, hairy with soft villous hairs to 1 mm long, ridged; tendril 2–3-furcate, slender, wiry, leaf-opposed, cylindrical, peduncle straight, 1.5–4 cm by 0.5–1 mm, then bifurcating and coiling for 2–7 cm, hairy as stem. Leaves 3-foliate, alternate; petiole 1–3.5 by c. 1 mm, hairy as stem, central petiolule 0.5–1.5 cm long, lateral petiolules 0.3–0.7 mm long, hairy as stem; central leaflet blade ovate to ovate, 3–6 by 1.5–3 cm Trias-Blasi et al., 2011).

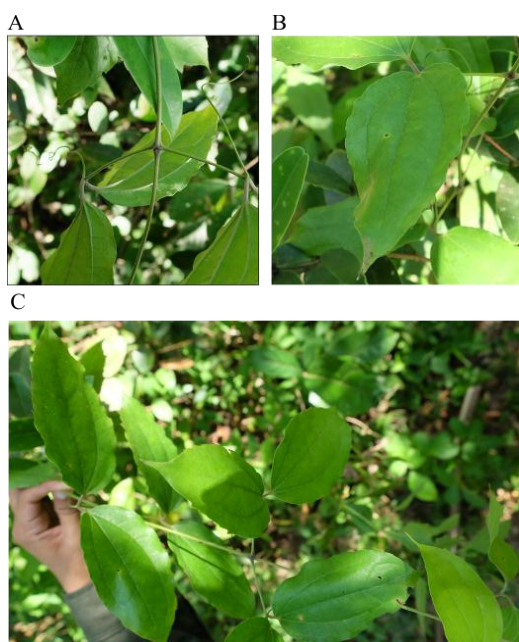
*Smilax anceps* (Figure 9) is a creeper that is covered by many other plants, so the species is difficult to find. Researchers only found this species in one location. This species was found in the east and under other creepers. *Smilax anceps* is a family of Smilacaceae. Taxonomically, *Smilax* is difficult genus as the plants are dioecious, show wide phenotypic variation and many herbarium specimens were lack flowers or fruits that make them difficult to identify (Lulut Dwi et al., 2018). This species has *spina*, *cirrhous* throughout the stem, and it has *folium disticha*. *Smilax* stems are very hard and strong. It has *folium compositum*, the lamina was *laevis*. This plant can propagate up to 5 meters (Hyde, 2018).



**Figure 10.** Unidentified Ranunculaceae Life form (*habitus*) the species from Ranunculaceae that has not been identified.



**Figure 11.** Unidentified Ranunculaceae: A. Habitus, B. Lamina and twisted stem.



**Figure 12.** *Clematis* sp: A. The phyllotaxis and tendrils, B. Lamina, C. Habitus.

Some plant species also attracted the attention of researchers. Because it's difficult to identify. One family of understory that is difficult to identify comes from the Ranunculaceae family (Figures 10, 11, and 12). Ranunculaceae is often regarded as the most primitive of *herbaceous* angiosperms (Tamura, 1968). Plants from the Ranunculaceae family have diverse morphological features (Khatere et al., 2010). Ranunculaceae has been a source of debate for centuries. some authors refrained from final taxonomic conclusions at the generic level because of incomplete sampling of taxa or markers from Ranunculaceae species (Khatere et al., 2010).

*Clematis* sp. (Figure 11) is a family of Ranunculaceae. This plant was found on the right side of the climbing path with shady habitat. Researchers only found this species in one location. It is very difficult to find references to this plant. This species adapts well in highland areas (Masoud et al., 2009). This plant is very unique because of the shape of the leaves. The leaves are *folium oppositum*, with a modified stem to become *cirrus* (tendrils). Helps to grow climbing (Ralph, 1996).

## CONCLUSIONS

The diversity of understory (shrubs and herbs) in Nglanggeran Mountain consists of 144 species with a total of 44 families. Based on the life form (*Habitus*), the plants that dominate Nglanggeran Mountain were shrubs. Asteraceae were the most common family. Based on the results of the data collection, there were 66 species of shrubs, 41 species of herbaceous, and 37 species of lianas. Some shrubs and herbs were difficult to find because they have special characteristics habitat to grow.

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