International Journal of Science and Research (IJSR)
ISSN: 2319-7064
ResearchGate Impact Factor (2018): 0.28 | SJIF (2019): 7.583

Analysis of Plant Vegetation and Abundance of Spider in Malang District Based on Height Differences

Idham Cholid[1], Amin Setyo Leksono[2], Nia Kurniawan[3]

[1] Department of Biology, Faculty of Mathematics and Natural Sciences, Brawijaya University, Malang, Indonesia
idhamkholid95[at]gmail.com

[2, 3]Department of Biology, Faculty of Mathematics and Natural Sciences, Brawijaya University, Malang, Indonesia
aminleksono72[at]gmail.com/wawanunibraw[at]gmail.com

Abstract: ***Indonesia is one of the countries in the world that has a very high biodiversity, both flora and fauna, this is because Indonesia's topography is composed of islands and each island has its own characteristic ecosystem. Ecosystem is influenced by several things, one of which is the height of an area.This research was conducted in 3 sub-districts in Malang Regency, namely Poncokusumo District which has a height ranging from (729-2365 masl), Lawang District has an altitude (454-603 masl), and Bantur District has an altitude (303-357 masl).The results of research on spiders based on differences in height in Malang Regency: Location of Poncokusumo (1482m above sea level) at the location of the ecosystem where the highest IVI of spiders is shaded is the genus Leucauge, namely 1.54, while in open ecosystems the highest IVI value is obtained by genus Tetragnatha 1.60 and index The highest diversity was obtained by the genus Leucauge 0.5, Location Lawang (446m asl) at the location of the ecosystem that was shaded by IVI of spiders, the highest was genus Laucauge, namely 0.61, while the highest diversity index was obtained by genus Argiope 0.5 Whereas in the open ecosystem the highest IVI value was obtained by the genus Leucauge, namely 2.08 and also had the largest diversity index, which was 0.33, Bantur location (321mdpl) in the location of the highest IVI spider ecosystem was Leucauge genus, namely 1.54 and index The highest diversity was obtained by the genus Tetragnatha and Laucauge which was 0.5. Whereas in open ecosystems the highest IVI value was obtained by genus Tetragnatha 1.60 and the highest Diversity Index was obtained by genus Leucauge 0.53.***

Keywords: Vegetation, Abundance, Spider, Arthropods

1. Introduction

Indonesia is one of the countries in the world that has very high biodiversity. Biodiversity is the variability among living things from all sources, including the interaction of terrestrial, coastal and ocean ecosystems and aquatic ecosystems. This includes species diversity, between types and ecosystems (Siregar, 2009). According to Untung 2006, Ecosystems are generally divided into 2, namely natural ecosystems and artificial ecosystems, natural ecosystems are ecosystems whose development and growth do not involve humans, and only develop naturally, such as forests, etc., while artificial ecosystems are ecosystems whose development depends on human intervention, such as agriculture, plantations, etc. Differences in governance make the constituents of the ecosystem different, because the presence of flora will also affect the existence of the flora, the more diverse the flora, the more diverse the fauna will be. Apart from differences in ecosystem management, there are also factors that cause different ecosystem diversity, one of which is the height of an area.

Altitude area is the height from sea level (elevation). The altitude of the area affects changes in air temperature. The higher an area, such as mountains, the lower the air temperature or the colder it is. The lower the area, the air temperature will be higher / warmer. Climatic factors include air temperature, sunlight, humidity and wind. These elements greatly influence the growth process of flora and fauna. Therefore, the height of a place affects the ecosystem of an area (Hamzah, 2010). Research conducted by Russell-Smith A and Stork NA (1994), on the island of Sulawesi, Indonesia. has identified 1642 individual spiders from the family Clubionidae, Castianeirinae, Theridiidae, Salticidae, Araneidae, and Lyniphiidae. In an area with an altitude of 400 m there are 69 species, with a total of 648 individuals; 6% of the total spiders are Clubionidae and Araneidae. Whereas at an altitude of 1150 m, the most common families found are Lyniphidae and Clubionidae. These data indicate that the difference in height greatly affects the presence of arthropods.

One of the regions in Indonesia that has various heights is Malang Regency. Malang Regency is located in a highland area, with coordinates 112 ° 17 '10.9 "- 112 ° 57" 0.0 "East Longitude and 7 ° 44" 55.11 "- 8 ° 26" 35.45 "South latitude. The area of Malang Regency is 334,787 Ha, consisting of 33 subdistricts spread over urban and rural areas. Malang Regency is located between an altitude of 0-2000 m above sea level (Malang Regency Government, 2015). Based on the description above, the authors feel the need to conduct research on "Diversity and Abundance of Spiders in Malang Regency Based on Altitude Differences" in order to analyze the spider habitat according to the height of the area in Malang Regency.

2. Methods

This research was conducted in 3 sub-districts in Malang Regency, each of which has different heights. Poncokusumo District has an altitude ranging from (729-2365 masl), Lawang District has an altitude (454-603 masl), and Bantur

District has an altitude (303-357 masl) (Figure 1). Each area has II observation stations, which are divided into Station I: is a Sheltered Ecosystem and Station II is an Open Ecosystem. The total research stations for spider observation are 6 stations, each location has 2 stations. Whereas for each location there are 5 plots arranged randomly, according to the location of the vegetation to be observed. Observations of spiders were carried out using the Visual Encounter Survey method, which was conducting direct observations on 1 transect line using binoculars and cameras as documentation tools. Observations of spiders are carried out at 09.00-14.00 WIB. While the total research stations in the vegetation analysis are 6 stations, and each location has 5 plots. At Station I: shaded ecosystem, 4 square plots, 20x20m, 10x10m, 5x5m and 2x2m are made. while at station II: closed ecosystem only 1 2x2m square plot was made. The abiotic factors observed were temperature, air humidity, wind speed, light intensity, while the biotic factors observed in this study were plant vegetation at each station. Identification of spider morphology is done by observing body color, number of eyes, eye arrangement, carapace shape, prosoma size and ophistosome size, then identifying them using the identification book Barrion and Litsinger (1995), Levi (1990), and Hawkeswood (2003) and BugGuide.net. Meanwhile, identification of plant morphology is done by observing the shape of the leaves, stems, flowers and fruit. Then identify it using a flora identification book (Steniss, 2006), flora of java (Backer et al, 1963), plant list.org (2019).Data were analyzed using the Shannon Wiener Index (H ') analysis, abundance, evenness index (uniformity), important value index, dominance index, and Principal Component Analysis (PCA).

The sampling method used was the Visual Encounter Survey by observing the spiders directly on each predetermined transect with the help of binoculars and cameras as documentation tools. The length of the transect line at Station I: shaded ecosystem is 100m, and the length of the transect line for Station II: Open ecosystem is 10m. According to Ramazas (2012), the transect length used in the Visual Encounter Survey observations for forest vegetation is 50 m-100 m, while for scrub vegetation, the line used is only 5 m-10 m. If this method is used on simpler vegetation, then the line used is only 1 m.Spiders that have been documented are immediately identified and written on the observation table previously provided, the observation table contains data to support further identification, including: species name, number of individuals, and morphology. Advanced Identification is carried out in the Laboratory.

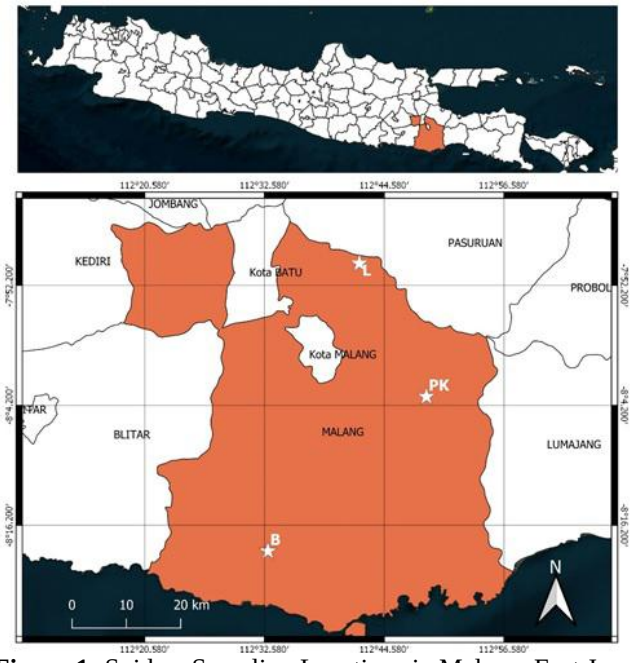

Figure 1: Spiders Sampling Locations in Malang, East Java, Indonesia. Note: **L**= Lawang, **PK**=Poncokusumo, **B**= Bantur

3. Result

3.1 Comparison of the abundance of spider at 3 observation locations

The results showed that there were differences between the 3 research locations. The highest abundance for shaded ecosystems was at the Poncokusumo and Bantur locations, while for the Lawang location the abundance was relatively lower (Figure 2). This is because at the Lawang location the presence of tree-level plants is relatively rare compared to the Bantur and Poncokusumo locations (Figure 3). The location of Poncokusumo has an altitude of 1482m above sea level making large trees such as Eucalyptus sp and Pinus sp very easy to grow and develop high which will become a home to make nests for spiders and minimize the presence of predators due to the relatively high nest location. Meanwhile, the Bantur location, with an altitude of 321m above sea level, is a habitat for the Tabernaemontanamacrocarpa plant. According to Nurlaela (2017) Tabernaemontanamacrocarpa is a plant that flowers throughout the year, with the number of fruits and the number of seeds in the fruit reaching tens of seeds. Its natural habitat is a karst ecosystem. With these conditions, Tabernaemontanamacrocarpa is a species that easily grows in an environment with various disturbances. Tabernaemontanamacrocarpa is the plant most often used by spiders to make nests at the Bantur location, because the structure of the twigs which support each other and are not too far apart makes it easy for spiders to make nests.

The diversity of spiders at 3 locations was also included in the medium category, ranging from 1-3. According to Leksono (2007) if H '<1: low diversity H' 1 - 3: moderate diversity H '> 3: high diversity. The highest diversity is found in the Lawang location, this is because the spiders that are found in that location are very diverse. The Lawang location also has a high species richness index compared to the Poncokusumo and Bantur locations. According to Campbell & Reece (2008), diversity contains individuals and

groups of individuals are populations that occupy a particular place. There are two components in species diversity, namely species richness which is the number of different species in a community, then the second component is relative abundance, which is the proportion represented by each species of all individuals in the community. According to nurlaela (2017), one of the factors causing increased species diversity is the lack of competition in each species and the abundance of food and the environment that supports growth and development. The research that has been done proves that differences in height affect the abundance of spiders. Because the altitude of different locations also affects the biotic and abiotic components therein. This is evidenced by the genus found in 3 different locations, the Poncokusumo location with an altitude of 1482m above sea level is dominated by the genus Leucauge, while the Lawang location is dominated by the Argiope genus and the Bantur location with an altitude of 1482mdpl is dominated by the Leucauge genus (Figure 4). According to Nurlela (2017) the genus leucauge. The genus Leucauge has a black silver color in males and yellow in females. Leucauge makes identification of the genus relatively easy; they have two rows of long, slender curved hair on the thighbone of the fourth leg. In most cases the web is tilted more than vertical and the spider is in the center of the web with its bottom facing up.

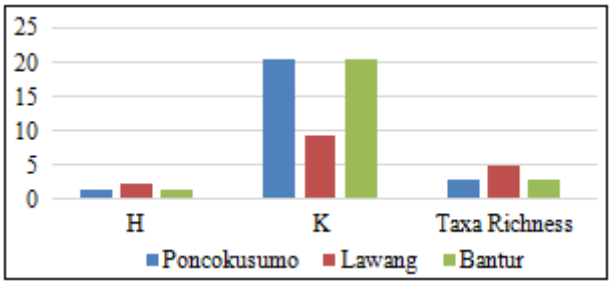

Figure 2: Comparison of abundance of spiders in shaded ecosystems.

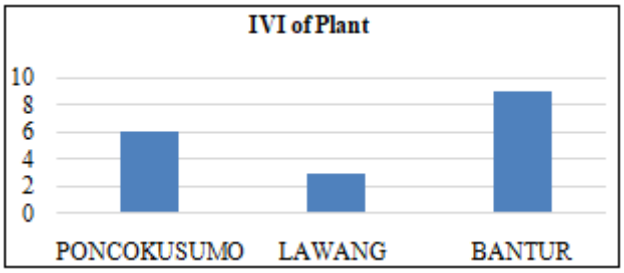

Figure 3: Comparison of the IVI of plants in shaded ecosystems

The next abundance of spiders is in the open ecosystem which is dominated by shrubs and herbs. The highest abundance in open ecosystems is at the Poncokusumo and Bantur locations, while the lowest is at the Lawang location. However, the highest species richness is at the Lawang location (figure 5). This is because the location of Poncokusumo with an altitude of 1482m above sea level and the location of Bantur with an altitude of 321m above sea level, the conditions of the undergrowth are very dense so that many spiders are found living in undergrowth, especially for the genus Tetragnatha which is found hiding behind the undergrowth. The genus Tetragnatha according to Prastowo (2013) is a web spider that has very long front legs, and has an extraordinary ability to hide, such as hiding behind leaves, branches, even in places that are almost invisible to natural enemies such as bushes, etc. That is the reason why the genus can survive and thrive in an open ecosystem environment dominated by seedling plants. Whereas the Lawang location is dominated by the genus Leucauge (Figure 6)

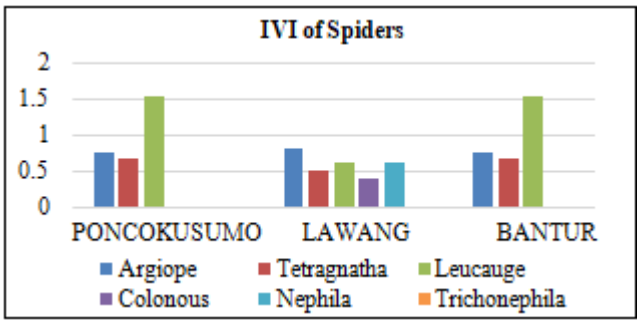

Figure 4: Comparison of the IVI of spiders in shaded ecosystems

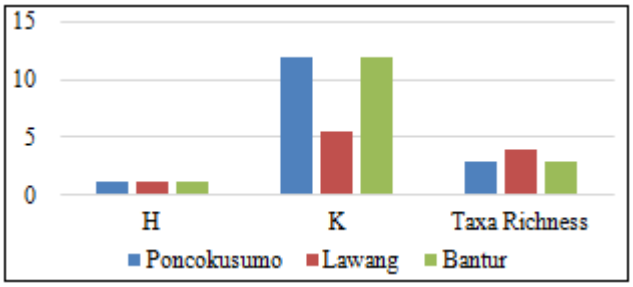

Figure 5: Comparison of the abundance of spiders in open ecosystems

3.2 Analysis of plant vegetation based on differences in height in Malang Regency

The results of tree level identification based on differences in height, Poncokusumo location (1482m above sea level), the plants with the highest IVI were Eucalyptus acmenoides 1.19. Location Lawang (446m above sea level) The plant with the highest IVI was Swietenia macrophylla 1.32. Bantur location (321m above sea level) The plant with the highest IVI was Tabernaemontanamacrocarpa 0.89. Identification results of pole level based on differences in height, Location of Poncokusumo (1482m above sea level) no plants were found at pole level, Location of Lawang (446m asl) The plant with the highest IVI was Leucaena glauca had an IVI value of 1.57, Location of Bantur (321m asl) The plant with the highest IVI was Leeaindica has an IVI value of 1.36. Identification results of sapling levels based on differences in altitude, Poncokusumo location (1482m asl) Plants with the highest IVI were Hibiscus tileaceus had an IVI of 1.07, Locations of Lawang (446m asl) Plants with the highest IVI were Leucaena glauca had an IVI of 2.09, Bantur's location (321m asl) with the highest IVI is Juglans regia having an IVI value of 1.28. Identification results of seedling levels based on elevation differences, Poncokusumo location (1482m asl) Plants with the highest IVI were Oplismenusundulatifolius had an IVI value of 0.29 Lawang locations (446m asl) Plants with the highest IVI were Marsileacrenata having an IVI value of 0.30 Bantur locations

(321mdpl) Plants with IVI The highest is Oplismenusundulatifolius. It has an IVI value of 0.25.

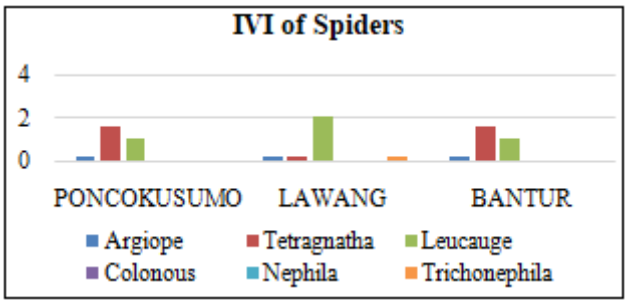

Figure 6: Comparison of the INP of spiders in open ecosystems

3.3 Correlation between abiotic factors and spiders

Based on the results of PCA analysis, it can be seen that Altitude has a positive correlation with the genus Leucauge, Argiope, Tetragnatha, and Altitude has a negative correlation with the genus Colonous (Figure 7). Positive correlation means that the higher an area is, the higher the presence of the genus is, and negative correlation means that the higher an area is, the lower the genus is. According to rahayu (2012) states that altitude is closely related to air temperature which plays an important role and is often a limiting factor because it affects the speed of metabolic processes and insect life in various aspects, including insect eating and development. This is also supported by the results of research by Hoiss et al. (2012) which states that the number of insect species decreases with increasing latitude or altitude caused by environmental influences. In addition, higher ground can slow insect reproduction so that the number of generations and the number of insect populations tends to be less (Duyck et al. 2010).

The next abiotic factors are temperature, temperature has a positive correlation with the genus Colonous, Trichonephila and temperature has a negative correlation with the genus Leucauge, Argiope and Tetragnatha. Positive correlation means that the higher the temperature, the higher the presence of the genus, and negative correlation means that the higher the temperature, the lower the presence of the genus. Air temperature is a limiting factor for spiders. According to Kuntner et al. (2008), air temperature can affect spider activity, at temperatures> 30 ° C spiders tend to stay in the web or hide under the leaves around the web.

Humidity was positively correlated with the genus Colonous, Trichonephila, and negatively correlated with the genera Leucauge, Argiope and Tetragnatha. Positive correlation means that the higher the humidity, the higher the presence of the genus, and negative correlation means that the higher the humidity, the lower the presence of the genus. According to Gosline, (1999), spiders are a group of Arthropods that are able to adapt to various habitats but are very sensitive to disturbances that occur in Spiders like habitats that are protected from extreme temperatures, high humidity, low light intensity, low wind speeds, and avoid plantation areas that use pesticides, ideal humidity for spiders is 70-80%.

Wind speed has a positive correlation with the genus Colonous, Trichonephila and negatively correlated with the genus Leucauge, Argiope and Tetragnatha. Positive correlation means that the higher the wind speed, the higher the presence of the genus, and negative correlation means that the higher the wind speed, the lower the presence of the genus. Wind speed is a major factor in the formation of the net pattern. The wind speed at the research site is an ideal value for a spider to build a web, which is in the range of 0-0.7 m / s. Spiders will find it easier to make webs in areas with slow wind speeds or around 0.2-0.8 m / s. Spiders take advantage of clots and silk (Goledan Kumar, 2008).

Light intensity has a positive correlation with the genus Colonous, Nephila and negatively correlated with the genera Leucauge, Argiope and Tetragnatha. Positive correlation means that the higher the light intensity, the higher the presence of the genus, and negative correlation means that the higher the light intensity, the lower the presence of the genus.

4. Discussion

Research results based on differences in height in Malang Regency Poncokusumo location (1482m above sea level) at the location of the ecosystem where the highest IVI of spider is the genus Leucauge, namely 1.54, and also has the highest diversity index of 0.5 but still in the low diversity category. Whereas in open ecosystems the highest IVI value was obtained by genus Tetragnatha 1.60 and the highest diversity index was obtained by genus Leucauge 0.5. The location of Lawang (446m above sea level) in the location of the highest spider IVI-shaded ecosystem is the genus Laucauge, namely 0.61, while the highest diversity index is obtained by the genus Argiope 0.5. Whereas in the open ecosystem the highest IVI value was obtained by the genus Leucauge, namely 2.08 and also had the largest diversity index, namely 0.33. The location of Bantur (321m above sea level) in the location of the highest spider IVI-shaded ecosystem was the genus Leucauge, namely 1.54 and the highest diversity index was obtained by the genus Tetragnatha and Laucauge which was 0.5. Whereas in open ecosystems the highest IVI value was obtained by genus Tetragnatha 1.60 and the highest Diversity Index was obtained by genus Leucauge 0.53.Correlation between abiotic factors and spiders: Wind speed humidity and temperature are positively correlated with the genus Colonous, Trichonephila and negatively correlated with the genus Leucauge, Argiope and Tetragnatha. Altitude is positively correlated with the genus Leucauge, Argiope and Tetragnatha, and negatively correlates with the genera Nephila and Colonous. Light intensity has a positive correlation with the genus Nephila, Colonous and negatively correlated with the genus Leucauge, Argiope and Tetragnatha.

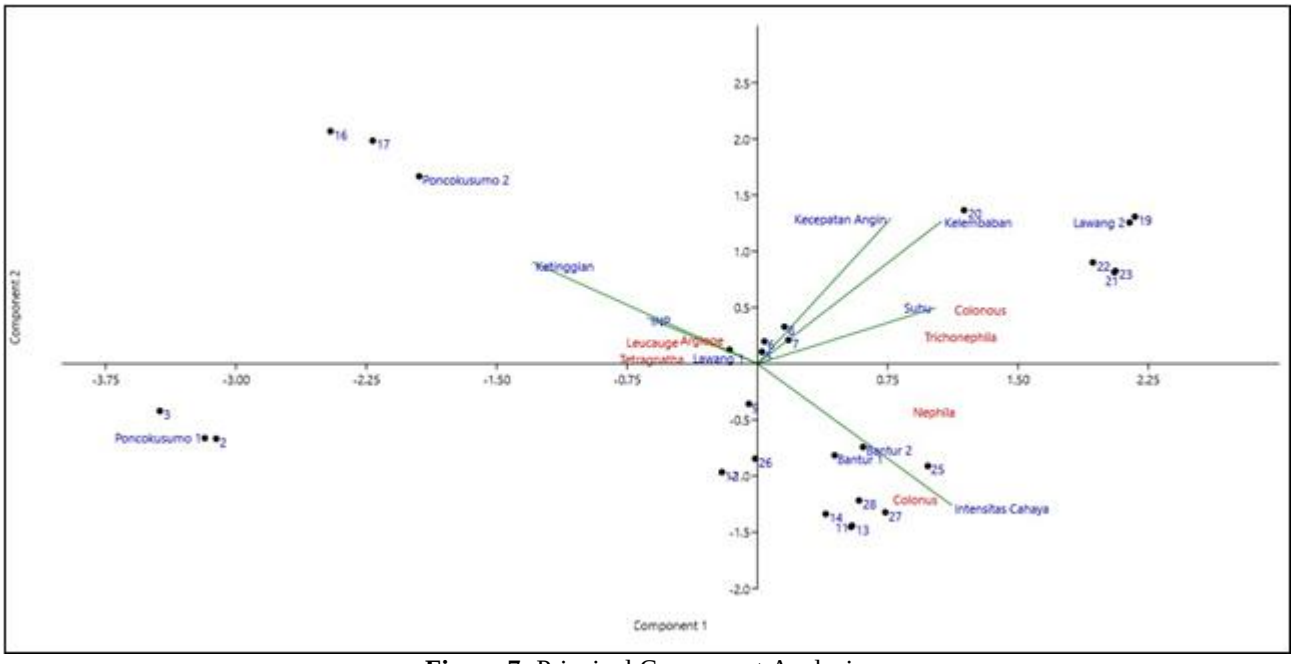

Figure 7: Principal Component Analysis

5. Acknowledgement

The author would like to thank especially to the thesis writing supervisor and to the entire academic community of Universitas Brawijaya.

References

[1] Badan Perencanaan Pembangunan Kabupaten Malang, 2014. ProfilPotensiKabupaten Malang. Malang: CV.CiptaKarya.
[2] Campbell, N. A. & J. B. Reece. (2008). Biologi, EdisiKedelapanJilid3.Terjemahan: DamaringTyasWulandari. Jakarta: Erlangga.
[3] Duyck PF, Kouloussis NA, Papadopoulos NT, Quilici S, Wang JL, Jiang CR, Muller HG, Carey JR. 2010. Lifespan of a Ceratitis fruit fly increases with higher altitude. Biological Journal of the Linnean Society 101:345–350.
[4] Gole, RS & Kumar, P, 2008, 'Spider's silk: investigation of spinning process, web material and its properties', Biological Science and Bioengineering,
[5] Gosline, JM, Guerette, PA, Ortlepp, CS & Savage, KN, 1999, 'The mechanical design of spider silk: from fibrion sequence to mechanical fungtion',Experimental Biology, vol. 202, hal. 32953303,
[6] Hamzah, M. F. (2010). StudiMorfologi danAnatomiDaunEdelweisJawa (Anaphalisjavanica) Pada Zona Ketinggian yang Berbeda di Taman Nasional Bromo TenggerSemeruJawa Timur. Skripsi. Malang: UIN Maulana Malik Ibrahim Malang
[7] Hoiss B, Krauss J, Potts SG, Roberts S, Dewenter IS. 2012. Altitude acts as an environmental filter on phylogenetic composition, traits and diversity in bee communities. Proceedings of the Royal Society B. 279:4447-4456.
[8] Leksono, S. 2007. Ekologi :PendekatanDeskriptif dan Kualitatif. Malang :Bayumedia Publishing.
[9] Nurlaela. 2017. KeragamanJenisLaba-Laba (Arthropoda:Araneae) di Kelurahan Samata Kabupaten Gowa. Skripsi. UIN AllaudinMakasar Press.
[10] Prastowo, P. dan Manik, D. A.W. 2013. Studi Keanekaragaman Laba-LabaPejaring Pada Tegakan PohonJambuBiji (Psidium guajava L). JurnalProsiding Seminar Nasional Biologi
[11] R. Foelix, Biology of Spiders. 3rd ed. New York: Oxford University Press, 2010. .
[12] Russell-Smith A, Stork NA (1994) Abudance and diversity of spider from the canopy of tropical rainforest with particular reference to Sulawesi, Indonesia. J Tropical Ecol 10:545-558
[13] Siregar. 2009. SeranggaBergunaPertanian. Medan : USU Press.

Author Profile

Idham Cholid is a student of Masters in Biology class 2018-present at Brawijaya University. in 2012-2017 I took a bachelor's degree in biology at Uin Maulana Malik Ibrahim Malang.