

Insect Diversity In Forest Of Mount Klabat, Kauditan Subdistrict North Minahasa Regency

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Abstract

This study aims to assess The population and insect diversity in Forest of Klabat. Sequens of this study consisted of determining the location of the sample, the sample unit, and forest. This research was conducted using survey methods, identification and analysis data. The result study showed that insect populations and diversity obtained from forest of Klabat is a total of 190 individuals consisting of 29 orders and 23 families, with the amount of each individual as follows : 34 Diptera, Hymenoptera 25, 21 Coleoptera, Lepidoptera 18, .and Orthoptera 5. The populations the highest of the forest that is on the order Diptera Family Lauxamidae. Insect Diversity in the forest of Klabat at altitude 301 -400 masl is $H = 4,76$, and in the forest of Klabat at altitude 401 - 500 masl is $H = 2,31$.

Keywords: population, insect, diversity, forest of Klabat

INTRODUCTION

North Minahasa District is a district that is located in the North Sulawesi. This area surrounding mountain slopes Klabat an agricultural area, plantation, fruits, woods and stone mining. Kauditan subdistrict is part of the North Minahasa district has 11 villages. Every village is located in the Kauditan subdistrict has agricultural land and plantations. Agricultural land, forest and plantation many found around the slopes just before harvest fruits season such as mango, olive, mangosteen and others are found some kind of insect diversity. The increase in the insect population at the time of the flowering and fruiting plants. Insect species found during the season were of the order Diptera and Hymenoptera.

The emergence of the existence of the diversity of insects when the flowering and fruits harvest season is any directional changes in time called succession. Community structure is one of the important properties of these changes (Rondonuwu 2006). A number of trends have been associated with

vegetation succession generalist or strategis generally dominate early successional stage (Brown *et al* 1986) Level is very high diversity of insects that can adapt to the conditions of both the natural habitats such as primary forests and man-made habitats such as agricultural land and plantations (Siswanto & Wiranto 2001). Location and agricultural plantations in the surrounding Klabat mountainside the slope generally high land. Therefore, it is necessary to identify of territory slope. The aim of insect identification is to assess whether the diversity of insects that were found in the location with a different slope will be different from the other. In view of the a forest it is clear that the spread of insects around the mountain slopes will be different each location, because of the difference in altitude of the land. Some long lived perennials may endure adverse conditions favor out crossing and seeding recruitmen ,such windows of oppoturnity are unpredictable requiring annual investment.(Archer *et al* 1991).

Forest sites around the Klabat mountain side has a population density of forest plant species is higher than the plantations and crops., Therefore in the forest habitat more carnivorous insect numbers and diversity of species of insects are much higher and more complex than the agroecosystem (Janzen 1987). Many leaf chewing insects are also messy eaters, dropping clipped leaves or fragment of leaves (greenfall) to the forest floor.(Risley L S (1986). If insects were disturbed forest habitats such as the logging, manufacture of mining land and land stones agricultural that to forest insect community will be extinct or migrated to other areas, is likely to be competent with important pests in agricultural cultivation. In case the immigration to the area of forest insect crop because its habitat is disturbed, then the succession will occur in community structure. Insects are the components of biodiversity are most numerous, have important ecological functions and can be indicators of environmental degradation. (Scowalter 2000). Although a considerable proportion of forest cannopies can be turned over annually by insect herbivore. (Lowman 1992).

Insect diversity around the plantation area adjacent to the foot of the mountain will decline as a result of deforestation. Herbivorous insects that diteli by researchers in the Britain said that 80% of insect herbivore is monofag, and 10% less eat the plants more than three family (Scoonhoven *et al* 1988). Similary herbivore induced changes in light availability may influence litter quality through efect on leaf chemistry (Van der wale *et al* 2000). Different land use will also affect the changes in the structure and composition of vegetation on the land and in the end will affect the stability of the new ecosystem.

Ecosystem change into a new ecosystem involves not only vegetation, but also involves a good fauna that live on the land and the land surface, meaning fauna will also experience a sequence of parallel changes with the level of plant fibers. The fauna insect of Kuwait has undergone a change since at the first period of 474 species of insect were recorded from Kuwait (356 genera, 109 families, 19 orders) but the numbers of species increased to 492 (273 genera, 116 families, 19 orders) during the second period. (Wasnia Al Houty 2009).

Control of the emergence of new pests around the plantation due to deforestation and plantations around the Klabat mountain side is through outreach to the community of farmers who cultivate plants around the mountain area adjacent to the forest. Prohibits the operation of illegal quarrying around the forest and mountain slopes. Replanting in forests damaged by forest and mining overhaul a control that aims to preserve the variety of plants in the forest back endangered and while improving ecosystem disturbance, so the food chain and life cycle of insects re-formed.

Natural phenomena will affect the food chain and life cycle of insects, as well as when changing habitats and landscape changes. Assessing the impact of changes in landscape due to differences in land and geography is through the identification of species and the composition of insects are there to be used as bio-indicators to predict changes in a particular habitat or ecosystem. It is the relationship between biotic and abiotic environmental factors, where the species or populations of plants, animals including insects and microorganisms will be amended presence, vitality and response as the influence of environmental conditions.

Each species will respond to the environment change depending on the stimuli (stimulus) received. The response given to identify the changes and the level of pollution in the environment (Speight *et al* 1999). The location of research partially in the plantation population that is for agricultural ecosystems planted eggplant, corn and rice with an altitude of 100-200 meters above sea level. Location or uncultivated land and forest ecosystems is at an altitude of 200-300 meters above sea level and 300-400 meters above sea level. With to determine topography and ecosystems of the above, then the insect diversity can be investigated and assessed.

MATERIALS AND METHODS

2.1. Time and Place of Research

The research was conducted on land forest and land location. Altitude eggplant 200.300 and 400 meters above sea level and an average temperature of 25°C -30°C at location about 25 km from Location Desa Kaima, around the slopes of the Klabat mountain. The research was conducted for 6 (six) months consisting of 4 (four) months in field locations for sampling insects and 2 (two) months of the identification of insects in the Laboratory of Plant Pests and Diseases Department of the Faculty of Agriculture, University of Sam Ratulangi in Manado, North Sulawesi. Materials and device used consists of Alcohol 75%, cotton, Microscope, brushes, paper towels, funnel, killing bottle, nets / net, emergency lamp, paper labels, sample bottles, altimeter, thermometer, insect identification book (Borror, 1992) and others.

2.2. Research Procedure

1. *Sampling method*

The sampling method used during the conduct of the study consisted of 1) a method of sampling using nets / net to capture the diurnal insects. 2) Insect sampling was done with insects sweep nets. Sweeping were performed 3-6 times.

2. *The method of determination of the sample unit*

This method uses a device consisting of a roller meter and altimeter or GPS. At locations that will be used to advance research surveyed to see location suitable for sampling. Topographic location or altitude measurement location using recording devices height is altimeter or a GPS location. Altimeter is a measure which merely serves as a measure altitude of the location of the surface of the sea, while the GPS as well as a measuring tool that has advantages for measuring the degree of altitude, latitude and longitude. Having in mind the location of ecosystems with distance high measuring instrument, then made experimental plots.

3.2. *Implementation of the study*

Several studies in the field of implementation procedures comprising:

1. The land area for each plot experiment with the size of 20 x 20 meters consisting of three replications / plot. Each plot experiment labeled. A1, A2 and A3. Also on the same sample bottles labeled in order to be identified.
2. Catching insects begin at 07:00 am to 10:00 am with nets. .
3. Prior to the implementation of research the first initial and final temperatures measured
4. Reference are used as references for identification for identification were Chapman, Triplehorn, and Anonymous.
4. Data Analysis

Analysis of insect diversity in the forest and the location of different altitude used Shannon index (and Reynolds 1998: Krebs 1989)

RESULTS AND DISCUSSION

The total number of insect species obtained in the study area for forest of Klabat with different geografl layout is numbered 103 species insects consisting of 5 orders, 23 families. Insects were obtained from forest (Table 1) with 301 -400 masl geographical location (below sea level) consists of 8 orders are Homoptera, Hemiptera, Diptera, Odonata, Coleoptera, Hymenoptera, Orthoptera and Lepidoptera and 15 Families are Tyhcocybinae, Berytidae, Reduviidae, Lygalidae, Otitidae, Hellomycidae, Stratomycidae, Tethinidae, Caloppterygidae, Zygotera, Carolidae, Tenebrionidae, Agromycidae, Acrididae and Tetigonidae. Family Lauxamiidae has the highest population of individual insects that 10 individuals (Table 1) comparison of different groups of individuals on its ecosystem. corn cropping patterns that do not conform to the pattern of the actual plant, causing an explosion of the pest (Evans JW 1963).

Insects found in forest (Table 2) at an altitude topography of 401-500 meters above sea level consists of 5 orders namely Hymenoptera, Diptera, Hemiptera Orthoptera, Coleoptera and 14 families that Ichnumoida, Berytidae, Lygalidae, Prombroconidae, Gxilidae, Delphocidae, Culicidae, Ceratogonidae, Adelidae, Pyralidae, Noctuidae, Thytiridae and Leptinidae.

Table 1. Insect Diversity in Forest (Altitude 301 - 400 masl)

No	ORDO	FAMILI	Forest at 301 -400 masl
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			Total Number of Individuals	Number of Individuals
1	Lepidoptera	Prodoxidae Adelidae Pyalidae Noctuidae	18	5 3 4 6
2	Hymenoptera	Formicidae Chepidae Chalcodoidae Ichnumonidae Halictidae	25	5 5 4 3 8
3	Diptera	Lauxamidae Agromyidae Rhagionidae Dolcohodidae Muscidae Culicidae Ceratogonidae	34	10 4 3 5 3 2 3
5	Coleoptera	Scarabidae Cerambycidae Endomycidae Norodendidae Leptinidae	21	5 3 5 4 4
7	Orthoptera	Acrididae	5	2
	Total Index Shannon		103 4,76	103

Table 2. Insect Diversity in Forest of Klabat (Altitude 401 - 500 masl)

No	ORDO	FAMILI	Forest of Klabat	
			Total Number of Individuals	Number of Individuals
1	Hymenoptera	Ichnumonidae	7	7
2	Hemiptera	Berytidae Lygalidae Phombroconidae Gxilidae Delphocidae	49	27 6 6 4 6
3	Diptera	Lauxamidae Culicidae Ceratogonidae	11	6 2 3
4	Lepidoptera	Adelidae Pyalidae Noctuidae Thyiridae	14	3 4 3 4
5	Coleoptera	Leptinidae	6	6
	Total Index Shannon		87 2,31	87

The result processing the data in Table 1 that the percentage population of forest insects in geografi position 301 -400 masl shown in Figure 1 looks the order Diptera have population majority of 33% different with another order. While the lowest percentage of insects in order Orthoptera to found is 5%. The highest percentage of the insect of the insect of order Diptera 33%, than order Coleoptera 20% and Hymenoptera 24% (Figure1), it,s caused of the forest of Klabat I are a heterogeneous forest made up of same kind of plants like corn, mango, and banana, and some of large of the insect of the order Diptera is like Lauxaniidae most the found. Forest area I (301-400 masl) adjacent to smallholder plantations, so that Lauxanidae famili insects utilize land near their habitat interaction their host plants. Diversity of insects on forest ecosystem I (301-400 masl) $H_1 = 4,76$ higher than in ecosystem II (401-500 masl) $H_2 = 2,31$ (tables 1 and 2), this is due to forest structure I partmixed forest or heterogeneous forest and forest I is still adjacent to farmland. The forest of sloped mountains including the dipterocoxoo location ≤ 1000 m and temperatures between $26^{\circ}\text{C} - 21^{\circ}\text{C}$. The most effective temperature of $15^{\circ}\text{C} - 25^{\circ}\text{C}$. This due to the insect diversity forest I (301 -400 masl) more than the forest II (401 - 500 masl).

Population of insects for forest on geographic position 400 -500 masl for consists of 5 orders namely Hymenoptera, Diptera, Hemiptera, Lepidoptera, Coleoptera and 14 families is Lauxalidae, Culicidae, Ceratogonidae, Ichnumonidae, Lygalidae, Berytidae, Phobroconidae, Gxilidae, Delphocidae, Adelidae, Pyralidae, Noctuidae, Thytiridae and Leptinidae. Type insect order Hemiptera dominated by Hymenoptera Families 12, Families while the order is the order Coleoptera least 6 Families. Percentage of insect population of the order Hemiptera 56% is the highers than order of Lepidoptera 16%, 13% Diptera, Coleoptera 7%, and 8% Hymenoptera (Figure 2). it,s caused that order of Hemiptera is like Berytidae and Lygalidae has long legs and eat grows crops, seeds and some predators, thus facilitaty adaptive species insects.

CONCLUSIONS

The total number of observation sites for insects to forest ecosystem, is 190 individuals consisting of 29 Orders and 23 Families. The highest populations of insects found in forest ecosystem 1 (130

individuals) and forest ecosystem 2 (87 individuals). The highest diversity of insects found forest ecosystems I (<span style="font-size:12pt;font-family:"camb

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