

The diversity of insects in opened land utilization with a cultivation of *Brachiaria mutica* forage in 'Sentrum Agraris Lotta' *by Wisje Toar 2*

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The diversity of insects in opened land utilization with a cultivation of *Brachiaria mutica* forage in ‘Sentrum Agraris Lotta’

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Abstract. An opened land which has been abandoned could be revitalized by forage cultivation could be a good alternative, but the extent to which the diversity of insects visiting and or engaging in this cultivation was not well known. The presence of insects in *Brachiaria mutica* cultivation site could play an integrated role on various components of the environment. This study aimed to determine the level of insect diversity found in *B. mutica* grass cultivation sites on opened land without restriction of solar radiation. The identification of insects in this study was carried out at the family level. The collection of insect visiting and or engaging at the *B. mutica* cultivation site was carried out at 10 points on the transect line using a pitfall-trap at 5 points A and a swing net trap at 5 points B. The insect diversity was calculated based on the Shannon-Wiener index calculation. The results obtained were fourteen insect families detected at the research location, and the most widely monitored were from the Formicidae family (n=219), followed by Acrididae (n=23), Termitidae (n=17), Tortricidae (n=17), Tettigoniidae (n=15), Pentatomidae (n=16), Culicidae (n=14), while the other families detected were between 1 and 7 individuals. The obtained Shannon-Wiener index value was $H' = 1.520$ which indicated that the diversity level of insects at the observation site was at a moderate level.

1. Introduction

The efforts to develop food production during the Covid-19 pandemic are an important step in anticipating the possibility of a difficult period to distribute food stuff as related to a recent report [1,2]. These efforts can be supported by the optimization of agricultural lands that are still being left unattended, especially on open lands [3,4].

Empty land without plants or shade trees that are available in various locations are suitable to be used as medium of forage cultivation for fodder will support food production of ruminant livestock. In line with these efforts, environmental aspects need serious attention. The diversity of insects can be an indication of environmental conditions [4].

Insects play an important role in an environment in which they are active and develop [2], including in the area of forage plant cultivation while insects could be used for animal husbandry [5,6].




The observations at the species level or at the family level could indicate a level of diversity of insects. The value of insect species diversity could be measured using the Shannon-Wiener index calculation [7].


2. Material and methods

Insect sample collection was carried out at coordinate points of $1^{\circ} 25'04''\text{N}$, $124^{\circ} 50'35''\text{E}$ in the agricultural area of 'Sentrum Agraris Lotta' (SAL) located in Lotta-Pineleng, Minahasa Regency Indonesia.

This activity includes the collection of insects that are active on the ground and on the part of the *Brachiaria mutica* plant cultivated in opened land area. Insect sample collection was carried out on 2 transect lines with a zigzag formation. Each row was set with 5 points A as insect collection points in the soil and 5 points B for insect collection on the leaves and stems of *B. mutica*. Placement on the first line, starting from point A11 then point B11 in sequence and alternating with a distance of 1 meter from one point to the next to point A15 and ending with point B15. In the second line starting from point B21 then point A21 to point B25 and ending with point A25. The circumference of the location was equipped with a guardrail to prevent domestic animals from entering the survey location.

The collection of insects was carried out using swing net-traps with a diameter of 30 cm and a length of 40 cm. These caught insects were put in a collection bottle. The collection of insects that were active on the ground was carried out using a pitfall trap which was placed at 10 points (point A) on the ground. The trap well in point B was placed for 1×24 hours using a plastic container containing 60 ml of 70% alcohol and added about 0.05 ml of vinegar.

Point A  Inteded as a place for catching insects on the ground about *B. mutica*

Point B  Inteded as a place for catching insects in the *B. mutica*

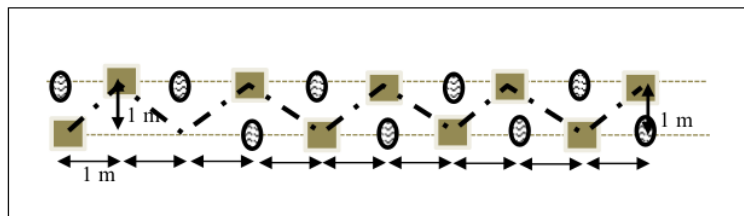


Figure 1. Scheme of placement of insect sample collection points of *B. mutica* cultivation areas on opened land.

The value of insect diversity was calculated using the Shannon-Wiener Diversity Index [8].

3. Result and discussion

The observation results showed that Acrididae ($n = 23$), Termitidae ($n = 17$), Tortricidae ($n = 17$), Tettigoniidae ($n = 15$), Pentatomidae ($n = 16$), Culicidae ($n = 14$), while there are seven other families. Which only numbered between 1 and 7 individuals. The quantities of these various insect families were shown in figure 2 as below:

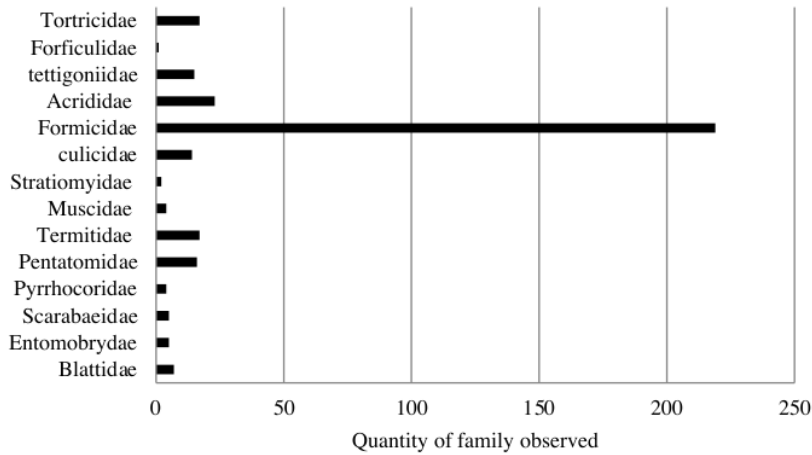


Figure 2. The quantity of insect observed in *B. mutica* cultivation.

Based on the data above, the result of Shannon-Weiner index value was $H' = 1.520$ which indicates that the level of diversity of insects in the *B. mutica* cultivation site was moderate ($1.5 \leq H' \leq 3.5$).

Table 1. The biodiversity of insects based on the observation.

Ordo	Family	Number	$PiLnPi$	H' value
Blattaria	Blattidae	7	-0.078407256	
Collembola	Entomobrydae	5	-0.060825702	
Coleoptera	Scarabaeidae	5	-0.060825702	
Hemiptera	Pyrrhocoridae	4	-0.051218081	
	Pentatomidae	16	-0.141317281	
Isoptera	Termitidae	17	-0.14719655	
Diptera	Muscidae	4	-0.051218081	
	Stratiomyidae	2	-0.029581231	
	culicidae	14	-0.129009181	
Himenoptera	Formicidae	219	-0.292418459	
Orthoptera	Acrididae	23	-0.179227184	
	tettigoniidae	15	-0.135258813	
Dermaptera	Forficulidae	4	-0.01677671	
Lepidoptera	Tortricidae	17	-0.14719655	
				0.246

This condition indicated that such forage cultivation had a potential to guarantee the life activities of various types of insects regardless of whether it was beneficial or detrimental to the cultivated plants themselves.

The various environmental factors in the field that played a role in this result including: the soil surface as a growing medium for these plants using a type of organic dry mix manure-manure (ODMM) fertilizer in cultivation beds for *B. mutica* cultivation at a distance ranging from 30 to 200 meters. There were various types of agricultural crops in this observation field such as coconut, vegetables and fruits. In addition, there was an animal farm located about 100 meters from the insect catching area.



Figure 3. The environment in location observed in Lotta.

The figure 3 showing components found around the observed location of open land: (a) *B. mutica* cultivation; (b) coconut plantation; (c) vegetable crop; (d) farm; (e1) pond; (e2) river flow areas; (f) residence; (g) office and agriculture training rooms; (h) fruits trees. In addition, there are other factors at the location that can be mentioned, such as humidity, sunlight, rainfall and so on. There are no environment factors that can be neglected with regard to the diversity of organisms in an environment [9,10]. This is in line with the report Berhanu et al (2019) that various environmental factors affect the biodiversity of insects [11], including trees to maintain the sustainability of insect diversity multiple localities within a region must be preserved [12].

4. Conclusion

The diversity of insects in these locations of forage cultivation of *Brachiaria mutica* on open land as in the agricultural area of 'Sentrum Agraris Lotta' has a moderate level of diversity, based on the Shannon-Wiener index value measured. A cultivation of *B. mutica* in open land locations could be a place for the activity of various types of insect families that have a potential to maintain the balance of the ecosystem in the area.

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