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THE RELATIONSHIP BETWEEN ABUNDANCE, DIVERSITY WITH COWS SKIN DEFECTS ACCORDING TO DIFFERENT ALTITUDE, HUMIDITY AND TEMPERATURE IN THE REGION OF SOUTHERN MINAHASA

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Abstract

This study aims to study the relationship between diversity and abundance of flies with cow skin defects according to differences in temperature and humidity in North Sulawesi. This research was carried out in two different regions: in the highland region, and in the lowland region. In the highland data was collected in cattle farms in Minahasa District such as in Kawangkoan and in Tompaso. The activities in lowland realized in South Minahasa Regency such as in Tengah, Poigar. Identification of fly species carried out according to differences the temperature and humidity. The results showed that insect abundance in cows skin defects was significantly affected by humidity (P = 0.023), but was not influenced by altitude (P = 0.341) or temperature (P=0.145). Cow skin defect was influenced by 66.8% by height, humidity, temperature, abundance, and diversity, and the remaining 43.2% was influenced by other factors. The diversity has a significant influence by altitude (P=0.034) and temperature (P=0.048) but was not the same to the humidity (P=0.138). It was obtained R2 value of 0.085 or 8.5% which meant that the diversity was influenced 8.5% by altitude, humidity, and temperature, and about 91.5% was influenced by other factors.

***Keywords**: abundance, diversity, path analysis, skin defect.*

INTRODUCTION

Flies as ectoparasites in cattle in Indonesia have become a priority for mitigation, but still lack on information such as a list of species that are existing cow skin defects in this area, including their biological and ecological geographical distribution. Koningsberger (1903), revealed the infestation of flies to livestock in Indonesia and reported findings in the form of *Tabanus ruficantris* flies, *Chrysops dispar, Stomoxys calcitrans* and *Haematobis exigua* sp. Partoutomo et al (1981), reported that the types of flies found in cattle located in North Sulawesi were, *Haematobia irritans, H. exigua, Sarcophagi* sp., *Musca conducens.*

The flies faund in cattle farm such as *Muscidae, Calliporidae, Tabanidae* and *Hippoboscidae*, and *Stomoxys calcitrans* fly cages (Muscidae) both male and female are blood eaters which are carried out twice a day. Haematobia irrtans and *Haematobia exigua* (Muscidae) known as cattle flies that found in Indonesia (Toar et al., 2018), India, Malaysia, China, Philippines and America (Soulsby, 1982). Both female and male blood-sucking flies, the main landlady are buffalo, cattle and horses (Rumokoy et al., 2017). The high or low diversity and abundance of flies depends on the season, rainfall, humidity, this condition depends a lot on the height of the cattle center area.

According to Kette (1977), it is estimated that a cow can tolerate flies of up to 100-300 birds, without adverse effects, but in fact 500 - 1000 tails even 5000 flies are found in this animal and are at very risk of causing negative influences, such as a decrease Animal weight can also cause skin quality problems, with injuries to livestock. According to Herms and James (1961), it is estimated that 100 - 300 flies on an animal can still be tolerated without adverse effects, but 500 flies will have a significant effect on livestock health. The diversity and abundance of flies in cattle according to geographical area (altitude) of livestock centers can be identified after capture.

Some fly species are known to play a very large role in cow skin defects. Flies live foraging on wounds to potentially increase the damage to cow skin. Mites, ticks and mites are ectoparasites whose entire life depends on the body of the host (cattle), with the mouth part used to pierce and suck the blood of livestock.
Flies from various species that cause a skin defects can be found in almost all parts of the animal's body, many contributing to increasing damage to the tails of livestock. Furthermore, fly density is a condition for a species to enlarge the skin defect, so it is important to know the diversity, abundance, breeding of flies in an area and type of defect and the number of defects and defect positions according to the overall topography of the animal's body.
The distribution of diversity and abundance of flies that cause skin defects is important to be studied according to differences in temperature and humidity with regard to the extent of defect, type of defect, number of defects and position of defects in North Sulawesi.

MATERIALS AND METHODS

This research was realized in two different regions: in the highland region, and in the lowland region. The data from highland was collected in cattle farms located in Minahasa District such as in Kawangkoan and in Tompaso. The activities in lowland realized in South Minahasa Regency such as in Tengah, Poigar. Identification of fly species carried out according to differences of temperature and humidity in high and low land. Data were analysed by using Ordinary Least Square (OLS) analysis according to Faraway, (2002) and described a path effect of each variable.

RESULTS AND DISCUSSIONS

The effect of height, humidity, and temperature on abundance is illustrated in the Table 1.
The R2 value 0.059 showed that abundance was low affected by height, humidity, and hemperature, and the remaining 94.1% is influenced by other factors. The first equation obtained is:
Abundance = 0.114 Z Altitude - 0.369Z Humidity - 0.211 ZSuhu + e^1

Table1. OLS on Abundance (Y_0)

Independent variable	Beta coefficient	T_{caunt}	Sig
Height	0.114	0.958	0.341
Humidity	-0.369	-2.324	0.023
Temperature	-0.211	-.469	0.145
$R^2 = 0.059$, $t_{tabel} = 1.987$ Dependent variable → abundance			

Table 1 represent a path coefficient obtained from the OLS beta coefficient between the altitude variable to Abundance is 0.114, with a t_{count} of 0.958 and Sig of 0.341. Because the absolute value of $t_{count} < t_{tabel}$ (0.958 <1.987) and Sig> 0.05 (0.341> 0.05), it can be concluded that there is no influence of Altitude on Abundance. This means that regardless of the height value, it will not affect the high or low abundance.
The beta coefficient of humidity variable on abundance was negative 0.369, with a t_{count} of negative 2.324 and sigmificance value of 0.023. Because the absolute value of $t_{count} > t_{table}$ (2.324> 1.987) and Sig <0.05 (0.023 <0.05), then there was an effect of humidity on bundance. Because the path coefficient is negative (-0.369) indicated a negative relationship. This means that the higher the Humidity then the less abundance will be resulted.
Path coefficient was obtained from the beta coefficient of OLS results of temperature variables to Abundance was negative 0.211, with t_{count} value -1.469 and Sig of 0.145 which the absolute value of $t_{count} < t_{table}$ (1.469 <1.987) and Sig> 0.05 (0.145> 0.05) showed that there was no influence of temperature on abundance. This means that regardless of the temperature value, it will not affect the high and low abundance.
The effect of altitude, humidity and temperature on diversity decribed in Table 2.

Table 2. OLS on Diversity (Y_1)

Independent variable	**Beta coefficient**	**T_{caunt}**	**P**
Height	0.253	2.149	0.034
Humidity	-0.234	-1.497	0.138
Temperature	-0.285	-2.005	0.048
$R^2 = 0.085$, $t_{tabel} = 1.989$ dependent variable→diversity			

R^2 value of 0.085 indicated that diversity was 8.5% influenced by height, humidity, and temperature, and 91.5% influenced by other factors. The second equation obtained is: Diversity = 0.253 Altitude - 0.324 Humidity - 0.285 Temperature + e^2

Table 2 shows that the path coefficientobtained from the OLS beta coefficient between the altitude variable ondiversity was 0.253, with a t_{count} 2.149 and Sig 0.034.

Because the absolute value of tcount> ttable (2.149> 1.987) and Sig <0.05 (0.034 <0.05), it can be concluded that there is an effect of Altitude on Diversity. Because the coefficient of path is positive, it showed a positive relationship. This means that the higher the altitude, the higher diversity will result.

The magnitude of the path coefficient (obtained from the beta coefficient of OLS results) between the variables of Humidity to Diversity is -0.234, with the value of t count of -1.497 and Sig of 0.138. Because the absolute value of tcount <t table (1.497 <1.987) and Sig> 0.05 (0.138> 0.05) It can be concluded that there is no effect of Humidity on Diversity. This means that high and low humidity, will not result in a change in a lot of diversity.

The magnitude of the path coefficient obtained from the OLS beta coefficient between the Temperature variable to Diversity is -0.285, with a t-count of -2.005 and Sig of 0.048. Because the absolute value of t count> t table (2005> 1,987) and Sig <0.05 (0.048 <0.05), it can be concluded that there has an effect of temperature on diversity. Because the path coefficient has a negative sign indicating a negative relationship. This means that the higher the temperature, the lower the diversity will be.

The following is an analysis of the path effects of altitude, humidity, temperature, abundance, and diversity on cattle defects.

Table 3. OLS on Skin Defect (Y_2)

Variabel Independen	Beta	t_{caunt}	P
Height	0.214	2.885	0.005
Humidity	0.124	1.246	0.216
Temperature	0.129	1.441	0.153
Abundantly	0.711	10.937	0.000
Diversity	0.265	4.022	0.000
R^2 = 0.668, t_{tabel} = 1.989 dependent variable→Skin defect of cattle			

When R^2 value is 0.668, it means that cattle defect influenced by 66.8% by height, humidity, temperature, abundance, and diversity, and the remaining 43.2% is influenced by other factors. The third equation obtained is:

Defect Skin = 0.214Z Altitude + 0.124Z Humidity + 0.129 ZSuhu + 0.711 Z Abundance + 0.265 Z Diversity + e^3

Table 3 presents that the path coefficient obtained from the beta coefficient of OLS results between the height variable on skin Defect is 0.214, with a tcount of 2.885 and P of 0.005. Because the absolute value of t_{count}> t $_{table}$ (2.885> 1,989) and P<0.05 (0.005 <0.05), it can be concluded that there is an effect of Altitude on Cattle Defect. Because the coefficient coefficient is positive, it shows a positive relationship. This means that the higher the altitude, the higher the defect of the cow will be.

The magnitude of the path coefficient (obtained from the beta coefficient of OLS results) between the variables of humidity to skin defect is 0.124, with a tcount of 1,246 and P of 0.216. Because the absolute value of t_{count} <t_{table} (1.246 <1.989) and P>0.05 (0.216> 0.05) it can be concluded that there is no effect of Humidity on Cow Defects. This means that the high and low humidity, will not result in a change in the least amount of cow defects.

The magnitude of the path coefficient (obtained from the beta coefficient of OLS results) between the temperature variables on cattle skin defects is 0.129, with a t_{count} of 1.441 and P of 0.153. Because the absolute value of t_{count}<t_{table} (1.441 <1.989) and P>0.05 (0.153> 0.05) it can be concluded that there is no effect of temperature on skin defects. This means that the high and low temperatures, will not result in a change in the least amount of cow defects.

The magnitude of the path coefficient (obtained from the beta coefficient of OLS results) between the abundance variables on cattle defects is 0.711, with a tcount of 10.937 and P of 0.000. Because the absolute value is t count> t table (10.937>1.989) and P<0.05, it can be concluded that there is an effect of abundance on cattle defects. Because the path coefficient has a positive sign that shows a positive relationship. This means that the higher abundance, the higher the skin defect will be.

The magnitude of the path coefficient between the variables of diversity on cattle skin defects is 0.265, with a tcount of 4.022 and Sig of 0.000. Because the absolute value is $t_{count} > t_{table}$ (4.022>1.989) and P<0.05 (0,000<0.05), it can be concluded that there is a diversity of defects Cows. Because the path coefficient has a positive sign that shows a positive relationship. This means that the higher diversity, the higher the cattle defect will be..

The coefficient of total determination obtained represent as following equation:

$$R^2_{total} = 1- Pe_1^2 Pe_2^2 Pe_3^2$$

$$R^2_{total} = 1 – (1-R_1^2) (1-R_2^2) (1-R_3^2)$$

Where R12 = 0.059, R22 = 0.085, and R22 = 0.668, respectively, are the R square values of the first, second, and third equation models so that the total R2 value is 0.7141 or 71.41%.

From the causal relationship between variables on the Path diagram the total determination coefficient is 0.7141 or the information contained in the 71.41% data can be explained by the path model.

So that the results of the path analysis are feasible to use.

In addition to direct influence, in path analysis also known indirect effects.

Tabel 4. Path Analisis of Indirect Effect

Coeficient of Effect indirect	Coefisient of direct effect		Coef	Sig/Non
Hight→Abundance→skin defect	Hight →Abundance = 0.114 (ns)	Abundance →skin defect = 0.711 (s)	0.081	NS
Humidity→Abundance→skin defect	Humidity→Abundance = -0.369 (s)	Abundance →skin defect = 0.711 (s)	-0.262	S
Temp.→Abundance→skin defect	Temp.→Abundance = -0.211 (ns)	Abundance →skin defect = 0.711 (s)	-0.150	NS
Hight →Diversity →skin defect	Hight →Diversity = 0.253 (s)	Diversity →skin defect = 0.265 (s)	0.067	S
Abundance →Diversity →skin defect	Kelembaban →Diversity = -0.234 (ns)	Diversity →skin defect = 0.265 (s)	-0.062	NS
Temp.→Diversity →skin defect	Temp.→Diversity = -0.285 (s)	Diversity →skin defect i = 0.265 (s)	-0.076	S

Note: Temp. = temperature, S=significance, NS=non significance

Based on the table above, the indirect effect of Altitude on cattle defects through Abundance obtained an indirect coefficient of 0.081. Because the direct influence (altitude on abundance, and abundance on skin defec of cattle) is not significant, this indicates that there is no indirect influence significant between the height of the defect of cattle through abundance. This means that regardless of the value of Altitude, it will not result in a change in Cow Defect even though Abundance increases or decreases.

The indirect effect of Humidity on Cattle defects through Abundance obtained an indirect coefficient of -0.262. Because the direct influence (Humidity to Abundance, and Abundance on Cattle Defect) are both significant, this indicates that there is a significant indirect effect between Humidity to Cattle defects through Abundance. With an indirect coefficient that has a negative sign, it indicates a negative relationship. This means that the higher the Humidity value, the greater the Cattle Defect if there is less abundance.

The indirect effect of temperature on defects of cow skin through abundance obtained an indirect coefficient of -0.150. Because the direct influence (temperature to abundance, and abundance of cattle defects) was not significant, this indicates that there is no significant indirect effect between temperature against defects of cattle through abundance. This means that regardless of the value of temperature, it will not result in changes in cattle defects even though abundance increases or decreases.

Indirect effects of height on cattle defects through diversity obtained an indirect coefficient of 0.067. Because the direct effect (Altitude on Diversity, and Diversity on cattle defects) is both significant, this indicates that there is a significant indirect effect between the height of the cattle defect through diversity. The coefficient with a positive sign indicates a positive relationship. This means that the higher the altitude (terrain), the higher the Cow Defect will be, if the diversity is also higher.

The indirect effect of moisture on skin defects through diversity obtained an indirect coefficient of -0.062. Because one of the direct effects (humidity on diversity, and diversity on cow defects) is not significant, this indicates that there is no significant indirect effect between moisture on cow skin defects through diversity. This means that regardless of the value of

humidity, it will not result in changes in the defect of cow skin even though the diversity is getting bigger or smaller.

Indirect effects of temperature on cattle defects through diversity obtained an indirect coefficient of -0.076. Because of the direct effect (temperature on diversity, and diversity on cattle defects) both were significant, this indicates that there is a significant indirect effect between temperature to cattle defects through diversity. With negative signatures the coefficient shows a negative relationship. This means that the higher the temperature, the greater the cattle defect, if the diversity is getting smaller.

CONCLUSIONS

From the results above, the following conclusions are obtained:

- Abundance Insects that cause cattle defects are only significantly affected by Humidity, but are not affected by height or temperature;
- Diversity Insects that cause cattle defects are significantly affected by height and temperature, but are not affected by humidity;
- Cow defects are influenced by height, abundance, and diversity of insects that cause cow defects.

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