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QUANTITATIVE ASSESSMENT OF S. CALCITRANS INFESTATION IN COWS SUFFERED SKIN DEFECTS, GRAZED ON TWO PASTURE TYPES

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Abstract

The purpose of this study was to quantitatively assess the Stomoxys calcitrans flies on Ongole-Crossbred (OC) cows suffered skin defects. This cross-sectional study used OC cows grazed in two pasture sites, namely under coconut canopy and on open grassland with a seven-day rotation system for each location. A sample collection of flies used a swipe net sized 23 cm X 35 cm. The result showed that the total of flies found in cows under the coconut canopy was 143 higher than in cows grazed on open land which reached 106 individuals. Diversity index of flies which activity in cows grazed in these two locations is categorized as 'medium' level. The abundance of S. calcitrans in OC cows grazed under the canopy compared to open land was significantly different (P <0.05). Skin defects that occurred in the cows in both locations are not only related to the role of S. calcitrans but also with other insects that interacted on the cow's skin, especially Haematobia irritans as blood-sucking flies.

Key words: flies; insect diversity; cows; crop cultivation

INTRODUCTION

The level of abundance and diversity of flies that interact with farm animals varies by location [26], especially in locations that are often used for grazing cattle such as under canopy of coconut plantations and in open land locations. This quantity has an impact on livestock conditions in an environment where livestock are grazed [19] According to [1] a variety of specific factors in each region can play a role in the development and activity of insect flies, especially in cattle that have skin defects [19], where these insects are active in animals and the surrounding environment to obtain food and reproduce [8]. When *S. calcitrans* flies on the skin of cattle to look for food can cause irritation and development of wounds on the skin of the cow, and can even transmit harmful pathogens in cattle as reported by [12].

The impact of *S. calcitrans* insect activity on cattle skin defects is related to the report of [16], [17] and [12]) which can cause a growth disruption and abnormal weight gain, reduce the economic value of skin production or even lead to diseases that are very detrimental to [1]. The cases like this can occur in OC animal that were farmed by farmers in villages in Indonesia specifically in the Minahasa area [14]. The factors that influence to the level of fly infestation in livestock according [4], [13], can be related to the way of maintenance, conditions and arrangement of the environment in which animals are located.

Animal farming which carried out with a low sanitation control can support the activities and breeding of the flies in an environment [21]. The cows that are kept by farmers in the Minahasa area are generally a OC cows descendants, small-scale and traditionally carried out, which are faced with challenges in controlling pests and diseases that have an effect on achieving maximum livestock yields, especially those related to fly types *S. calcitrans* [20]. The cows that are kept are generally used as working cattle such as pulling a cow cart (cow cart) for

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transportation or to pull plows in the processing of agricultural land. Installing a saddle on a cow regularly when used in pulling a cart or plow can result in friction, triggering the appearance of blisters on the skin that can trigger the interest of insects to land on the blister location.

The best effort to overcome the problem of *S. calcitrans* in livestock with skin defects in the grazing environment is with an integrated pest control pattern where one part of this effort is to assess the detection of the quantity of these flies in cows like these that are grazed in two locations agriculture is on grazing land under coconut cultivation and on open land. The use of lemongrass oil has been reported by [27] which contains the natural insect repellent to avoid the presence of flies. The purpose of this study is to be a scientific information in controlling fly pests in cattle that have suffered skin damage and damage towards increasing agricultural production on these lands in this area as well as other areas that graze cattle as working livestock and beef cattle that produce livestock meat. in turn, it can increase the income and welfare of farmers.

MATERIALS AND METHOD

Location of observation

This experimental research was carried out at an agricultural location in 'Sentrum Agraris Lotta' (SAL) in Lotta village, Minahasa Regency, North Sulawesi Province, Indonesia at a position of 230 meters above sea level, geographically at coordinates 1°25'03" North Latitude and 124°50'32" Longitude East. The average temperature under coconut canopy was 28.5°C while that on open land was 32°C with humidity on the land under coconut canopy ranging from 81-94% while in open land it ranged from 74-86%. Various types of vegetation that were cultivated in this agricultural location, namely coconuts, brown trees, fruits and seasonal crops such as chili, tomatoes and corn. Coconut plantations *(Cocos nucifera)* have an average age of 25 years cultivated in the northern part of the SAL agricultural area, while the open land located in the eastern and northern parts. In this location a variety of forage grasses were both grown on land under the canopy of coconut plants and on opened land such as *Brachiaria humidicola, Imperata cylincdica, Ageratum conyzoides, Setaria spachelatta. Eleusin indica. Synedrella nudiflora, Gliricidia sepium, Pueraria phaseoloides*

Sampling of flies

Flies samples were obtained by capturing using a net having a diameter of 23 cm, length of 35 cm. Catching flies is done on the skin of the target cows that experienced a skin defect, which were traditionally maintained. Catching flies at one point around the wound carried out in the afternoon between 3:00 p.m. and 4 p.m. To facilitate the catching then cow was slowly approached from the front while hiding sweep-net at the back of a field technician. Netted flies are collected in 70% alcohol bottles, then to assess the quantity of flies, an identification was conducted using the key of determination according to [5] and [23].

Data analysis

The proportion of the quantity of flies was calculated based on the index of the variety of all individuals and species caught by the following calculation based on the Shannon index:

$$H = -\sum(Pi\ Ln\ Pi), \text{ where } Pi = ni/N$$

H = diversity index
Pi = proportion of individuals of insect found in each species divided with all species found (*ni*/N)
ni = all individual found in a species (i^{th})
N = Total all individual in all species
With the criteria for the index of diversity as follows: height if (H> 3), moderate if (1 <H <3), and low if (H <1).

The comparison of group mean value t-test was analyzed according to [25].

RESULTS AND DISCUSSIONS

Species of flies detected

The results of this study indicated that *S. calcitrans* interacts simultaneously with flies

from other species that are almost members of Muscidae family found in a cow suffered skin defect which grazed under coconut canopies or on opened crop field. The only one individual fly cached was identified as *Drosophila mellanogaster* was detected in a cow grazed under the coconut plantations. Other species that were completely monitored when collecting data (Figure 1) were *Musca bakeri, Haematobia exigua, Haematobia irritans, and Musca domestica.*

Abundance and Diversity of Flies

The abundance of the ratio of *S. calcitrans* in observed animals, varied as shown in table 1. Among the six species detected (table 2).

Table 1 Relative abundance of *Stomoxys calcitrans* observed

Time (day)	Grazing Sites	
	Under Coconut Canopy	Opened Field
I	55,6	38,5
II	4,0	23,1
III	13,0	32,0
IV	22,2	37,5
V	43,8	28,6
VI	33,3	13,3
VII	36,8	40,0

Table 2 The abundance and diversity of flies detected at cow suffered with skin defect

Spesies	Grazing site				Total
	under coconut canopy		Opened field		
	Abundance	Pi	Abundance	Pi	
Stomoxys calcitrans	42	0,34	27	0.27	69
Musca bakeri	7	0,06	9	0.09	16
Drosophila melanogaster	1	0,01	0	0,00	1
Haematobia exigua	2	0,02	6	0.60	8
Musca domestica	17	0,14	8	0.08	25
Haematobia irritans	74	0,61	56	0.55	130
Total of Abundance	143		106		249
Index of diversity (H)	1,23		1,30		

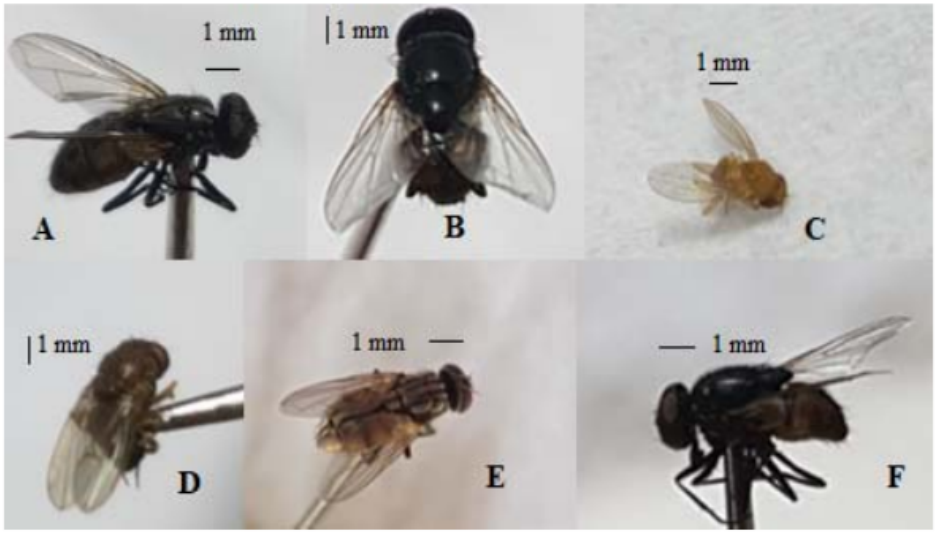

Fig. 1 Species of flies detected at cow suffered with skin defect while grazing in the location observed
A) *S. calcitrans* B) *M. bakeri* C) *D. melanogaster*
D) H. exigua E) *M. domestica* F) *H. irritans*

The abundance of flies on cows under coconut canopy was 143 individuals higher than when cattle were grazed on open land which reached 106 individuals. Diversity index of flies that activity in cows grazed in these two locations was categorized as 'medium' where value of H was greater 1 but smaller than 3.

The results of statistical analysis by t-test showed that there were no significant differences (P> 0.05) between the abundance of *S. calcitrans* insects on cows used in both studies.

The abundance rate of *S. calcitrans* was the second highest after *H. irritans* as in Table 2 which is found on OC cows that were grazed under the canopy and in opened grazing fields on SAL. The abundance *of S. calcitrans* detected in the cows under the canopy was not significantly different compared to those in opened agriculture field (P> 0.05) this could explain as the report of [24] that the presence of suitable media could ensure the development of *S. calcitrans* larvae [18] then this fly will develop well whereas in the same time it could be restricted by physical-chemical factors including humidity, temperature, pH. Further [3] mentioned that *S. calcitrans* was able to find a target using its sensory organs, although on different land there were various plants that produced elicitor type chemical components to inhibit the interest of insects activating in these locations such as α-glutamic acid [2], sulfoxy fatty acids [9]. It was assumed the reason of similar quantity of *S. calcitrans* in the two grazing sites of this study was caused by the substrate development of flies being evenly distributed at each location, namely as decaying grasses, animal dung that has been grazed supported by suitable humidity and temperature [3]. These insects when engaged in their host, especially to find food was by sucking blood [1]. Another species as a blood sucking fly detected was *H. exigua*. whereas the flies of other species that were not blood-sucking as well as *M. domestica, M. bakeri* which usually utilize organic materials that were attached to the fur and skin of animals as a food source [11].

The above facts showed that *S. calcitrans* worked together with other flies on cows which were grazed in two habitats as mentioned above. Because of its nature to move from one host to another, it has the potential to become a pathogen agent vector. [19] suggested that various species of flies such as *S. calcitrans* acted as parasites by sucking their host's blood and the presence of these insects had a great potential in exacerbating the health conditions of livestock through the wounds that already exist on skin. Mechanical transmission of various pathogenic viruses played by *S. calcitrans* in large livestock could occur [6], [22] when flies been active on animals studied, such virus was rediscovered in the digestive tract of fly and so it was ready to be infected to other livestock while sucking blood.

Diversity index (H) of flies detected on cows, grazed under coconut canopy was 1.23 and in opened land was 1.30, shown the level of diversity of fly species in both locations was in the category of moderate, and the ecosystem productivity was ‘adequate’ with a moderate of ecosystem pressure on species obtained. [20] suggested that the development of the quantity of *S. calcitrans* in an agricultural land was related to the availability of decaying organic matter. On the other hand, this level of diversity indicates that *S. calcitrans* on cows occured collectively with other species of flies observed. It was probable due to the presence of other blood-sucking insects as *H. irritans* and *H. exigua* related to skin defects in animals used in this study. This condition could be linked to [7] that *Stomoxys* spp. and other blood-sucking flies could induce a lesion in the epidermal tissue and damaged the host's skin. Skin lesions in cattle caused by worm parasites can become 'media' infection of germs when flies make physical contact.

The presence of lesions on the skin of cow was able to disrupt the behavior and production of cattle as reported by [8].

Fly species that was not commonly used in livestock detected during the collection was *Drosophila melanogaster*. It was suspected that the presence of fruit fly was related to the fermented plant organic matter attached to the cow's skin in the research

location. [10] suggested that *D. melanogaster* utilized also ethanol and organic acids from microbial fermentation as a food source.

CONCLUSIONS

The presence of *S. calcitrans* insects in cattle with skin defects was accompanied by the presence of various other types of harmful flies that needed to be calculated in parallel in preventing and controlling of disturbances caused in cattle to reduce the effects of skin damage and infections that have an economic impact on cattle production. Further research that still needs to be explored is the extent of the presence of *S. calcitrans* and other fly species as pests on the development of skin lesions and feeding-behavior of cattle when grazing on opened land or on under coconut canopies according to environmental factors to involve urgency and predict impacts and the right strategy in dealing with these problems.

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