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Population Abundance of Flies Collected in Different Traps in Small Ruminants in Ladang Pasir Akar, Besut, Terengganu

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ABSTRACT

Flies are common ectoparasites to livestock. Some species of flies are important to small ruminants because they can spread disease and cause disturbance to animals, thus lowering their productivity. Considering the impact of flies to the productivity of small ruminants, it is important to identify the species of flies that occur in an area for early control actions. The study was aimed to determine the species of flies in Diptera family that occur in Ladang UniSZA Pasir Akar and their population abundance. The flies were collected using three types of traps: Malaise trap, yellow pan trap and yellow sticky trap for three consecutive weeks. The traps were set up in three different locations in small ruminants rearing area in the farm. Nine Diptera families significant to livestock were identified: Calliphoridae, Ceratopogonidae, Culicidae, Muscidae, Psychodidae, Rhiniidae, Sarcophagidae, Simuliidae and Tabanidae. The family Sarcophagidae recorded the highest abundance in the farm (26.57%), while the lowest of flies count was from the family Tabanidae (0.82%). The most diverse family of Diptera was collected by Malaise trap and the lowest diversity was recorded from yellow pan trap. The results from this study had provided the first insight of the flies important to small ruminants occurred in this farm.

Keywords: Ectoparasite, Diptera, diversity, goat, sheep.

INTRODUCTION

Small ruminants refer to goats, sheep and their relatives (Yusoff, 2016). Goat and mutton meat consumption in Malaysia has been on an increasing trend due to the increase in population growth (Fachrudin, 2020). To fulfil the demand, the government is planning to increase the local production of the meat. However, ectoparasite infestation is still one of the factors hindering high productivity for small ruminants in Malaysia (Syamsul et al., 2020).

Ectoparasites are organisms that live outside of their animal hosts, for example ticks, fleas, lice and flies. Flies are unique insects of the order Diptera, and they are eaily recognized by the halteres, which are their modified

hind wings (Marshall, 2017). There are several Diptera family significant to animal such as Tabanidae, Muscidae, Calliphoridae, Sarcophagidae, Culicidae, Simuliidae, Ceratopogonidae and Psychodidae (Marshall, 2012).

Some species are important vectors for pathogens such as bacteria, protozoa, nematode and virus to livestock (Pérez de León et al., 2020). The transmissions of the pathogens can cause many serious diseases, for example trypanosomiasis, leishmaniasis and onchocerciasis (Khadijah et al., 2015). A study by Rohaya et al. (2017) reported that there was a high prevalence of blood parasites in goats and sheep from blood samples collected from several states in Malaysia in 2012. Nurulaini et al. (2013) had reported high mortality in livestock due to trypanosomiasis outbreak in Perak. They have identified that the outbreak was caused by biting flies from the family Tabanidae. Besides that, flies also cause nuisance to animal: the animal will stamp their feet to avoid the flies. The annoyance by flies resulting stress and loss energy to the animal, and indirectly will cause reduction in milk production and weight gain (Skovgård & Nachman, 2017).

Considering the veterinary importance of some species of flies, and their impact to the productivity of small ruminants' industry, it is crucial to identify the species that occur in an area. And, along with the understanding of the population abundance of flies, early control measures can be taken to control them (Wilson et al., 2020). To date, there is no study has been conducted on the fly abundance in small ruminant in Terengganu. Therefore, this study was aimed to determine the Diptera family and their population abundance in Ladang UniSZA Pasir Akar. The flies' diversity based on different traps were also discussed.

MATERIALS AND METHODS

Sampling area

The study was conducted at Ladang UniSZA Pasir Akar, Besut, Terengganu, Malaysia (5.788° N, 102.587° E) in small ruminants rearing area. This farm rears four breeds of goats: Saanen, Boer cross, Jamnapari cross and Boer cross Jamnapari, and three breeds of sheep: Dorper, Santa Lues and Balckbelly. The small ruminants were kept in four different sheds (Shed A, Shed B, Shed C and Shed D), with only Shed B with a mixture of goats and sheep. The farm also has one cattle shed located about 500 meter from the small ruminants rearing area. This farm is mainly surrounded by forest.

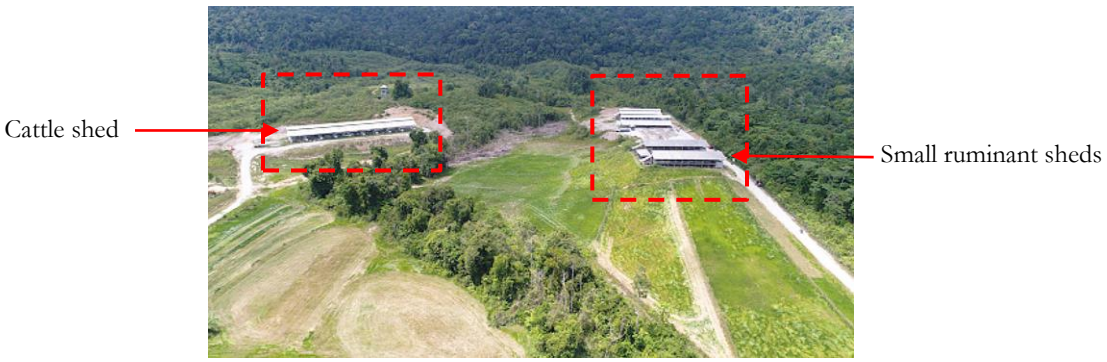

Fig. 1. The location of the small ruminant sheds in Ladang UniSZA Pasir Akar.

Sampling method

Three types of traps with three replications were used to sample Diptera in this study: Malaise trap, yellow pan trap and ready-made yellow sticky trap (20cm x 25cm measurements). The Malaise traps and the yellow pan

traps were placed at the same point in three different locations outside the sheds. While for the yellow sticky traps, they were placed at three different locations at the small ruminants' sheds.

The samples were collected in every four days for three consecutive weeks from 21st March 2021 until 5th April 2021. Samples collected from yellow pan trap were transferred into vials containing 70% ethanol, while the yellow sticky traps collected were immediately kept in a freezer to preserve the samples until identification process. All collection bottles from Malaise trap, yellow pan trap and yellow sticky trap were labelled with collection date, number and location of the traps.

Diptera identification

All samples collected were brought back to the Laboratory of Entomology and Laboratory of Microscopic in Faculty of Bioresources and Food Industry for identification process. All flies were initially sorted from debris and other insect orders. Then, the sorted flies were identified to family level using Leica EZ4D stereo microscope following identification keys by Marshall (2012).

Statistical analysis

The differences of the population abundance of Diptera and the family identified were analysed with One-way ANOVA. The significance of the mean was made using Tukey test. The analysis was done at a significance level of $p<0.05$. Results were expressed as mean and standard error. All analyses were done using Minitab Software version 2018.

RESULTS AND DISCUSSION

Population abundance of Diptera family

A total of 3914 flies were collected in Ladang Pasir Akar (Table 1) from all three types of traps: Malaise trap, yellow sticky trap and yellow pan trap. Nine families of Diptera with veterinary importance were identified: Calliphoridae, Ceratopogonidae, Culicidae, Muscidae, Psychodidae, Rhiniidae, Sarcophagidae, Simuliidae and Tabanidae (Fig. 2). A significant difference ($p<0.05$) was recorded between the Diptera families identified.

Table 1. Total composition of Diptera abundance of different family in Ladang UniSZA Pasir Akar.

Family	Means (±SE)	Total	Percentage
Sarcophagidae	38.50 ± 14.8^{a}	1040	26.57
Muscidae	24.30 ± 8.36^{ab}	657	16.79
Rhiniidae	24.26 ± 9.96^{ab}	651	16.63
Calliphoridae	20.11 ± 7.31^{ab}	543	13.87
Simuliidae	16.85 ± 7.79^{ab}	455	11.62
Culicidae	11.11 ± 3.20^{ab}	306	7.81
Ceratopogonidae	5.44 ± 2.77^{b}	147	3.76
Psychodidae	3.07 ± 1.36^{b}	83	2.12
Tabanidae	1.19 ± 0.43^{b}	32	0.82
Total		3914	100

Mean with the same letters was not significantly different at $p<0.05$

Of nine families identified, Sarcophagidae showed the highest abundance with 26.57% individuals were trapped. This followed by the family Muscidae (16.79%), Rhiniidae (16.63%), Calliphoridae (13.87%), Simuliidae (11.62%), Culicidae (7.81%), Ceratopogonidae (3.76%) and Psychodidae (2.12%). The family Tabanidae recorded the lowest individual count with only 0.82% (Table 1).

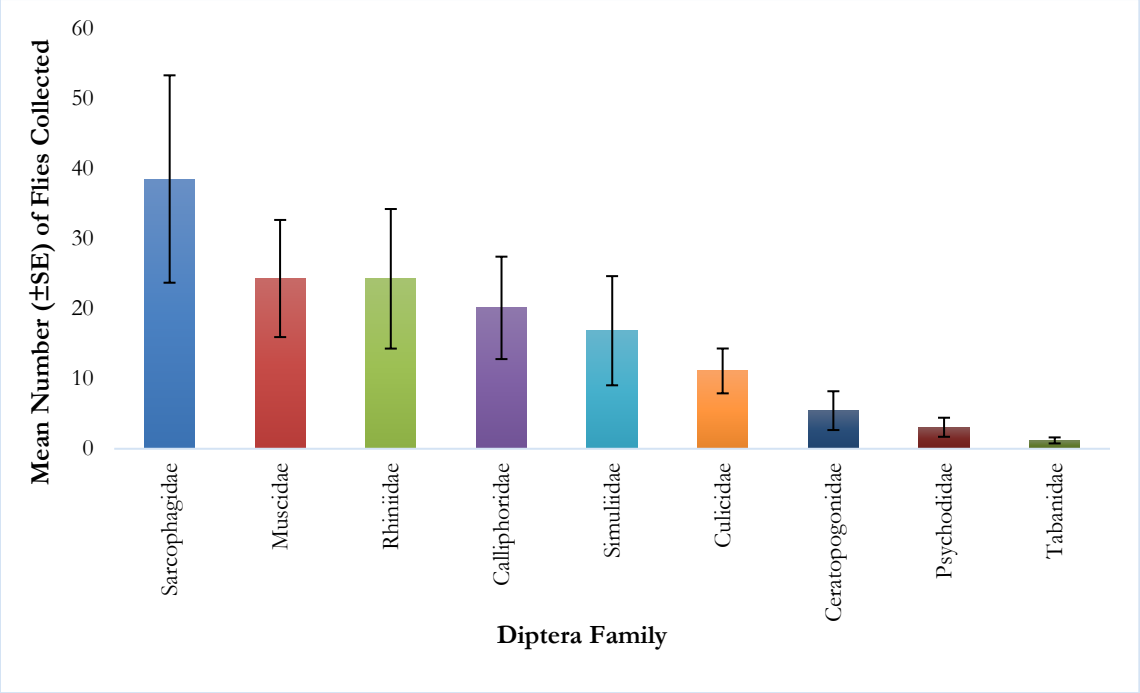

Fig. 2. Mean number (± standard error) of flies sampled from all traps and the Diptera families with veterinary importance identified.

The family Sarcophagidae, or commonly known as flesh fly are distributed worldwide especially in tropical region. Most of sarcophagid feed on decomposing organic matter, but some species have veterinary importance (Valverde-Castro et al., 2017; Buenaventura, 2021). The larvae are parasitic, where they feed on dead or living tissues of animals (Marshall, 2012). Although the results showed Sarcophagidae was the most abundant family of Diptera in Ladang UniSZA Pasir Akar, there was no case of myiasis in small ruminants reported (personal communication). This may be due to the abundance of Sarcophagidae species that can cause infestation to small ruminants were low in this farm. Thus, further identification of the sarcophagid to species level is needed to determine the abundance of the veterinary importance species that occur in this farm.

Despite there are several cases of tabanid fly bites reported in small ruminants in Ladang UniSZA Pasir Akar (personal communication), the common blood feeding flies from the family Tabanidae showed the lowest abundance in this farm. One factor that may influence the low number of Tabanidae collected is due to the flies in the farm were more attracted to cattle. This is because there are cattle sheds situated about 500 meter from the small ruminants' sheds in this farm. A study conducted by Krčmar et al. (2006) using four different animal urines (cow, sheep, horse and pig) showed that the majority of Tabanidae species were attracted to cow urine. The number of tabanids collected was almost twice that of tabanids collected with sheep urine. According to Baldacchino et al. (2014), many Tabanidae are attracted to the phenolic compounds that are converted from the trace chemicals in the urine. In nature, the extent of host-urine odour relationship in this process in unclear. However, studies have shown that the phenols from cattle urine mediate the biting flies to locate their host (Baldacchino et al., 2014).

The diversity of Diptera family in different traps

Three types of traps were used to sample Diptera in this study, namely Malaise trap, yellow sticky trap and yellow pan trap. Malaise trap collected the highest number of Diptera family with nine, followed by sticky trap with eight families and yellow pan trap showed the lowest diversity with only five families (Fig. 3).

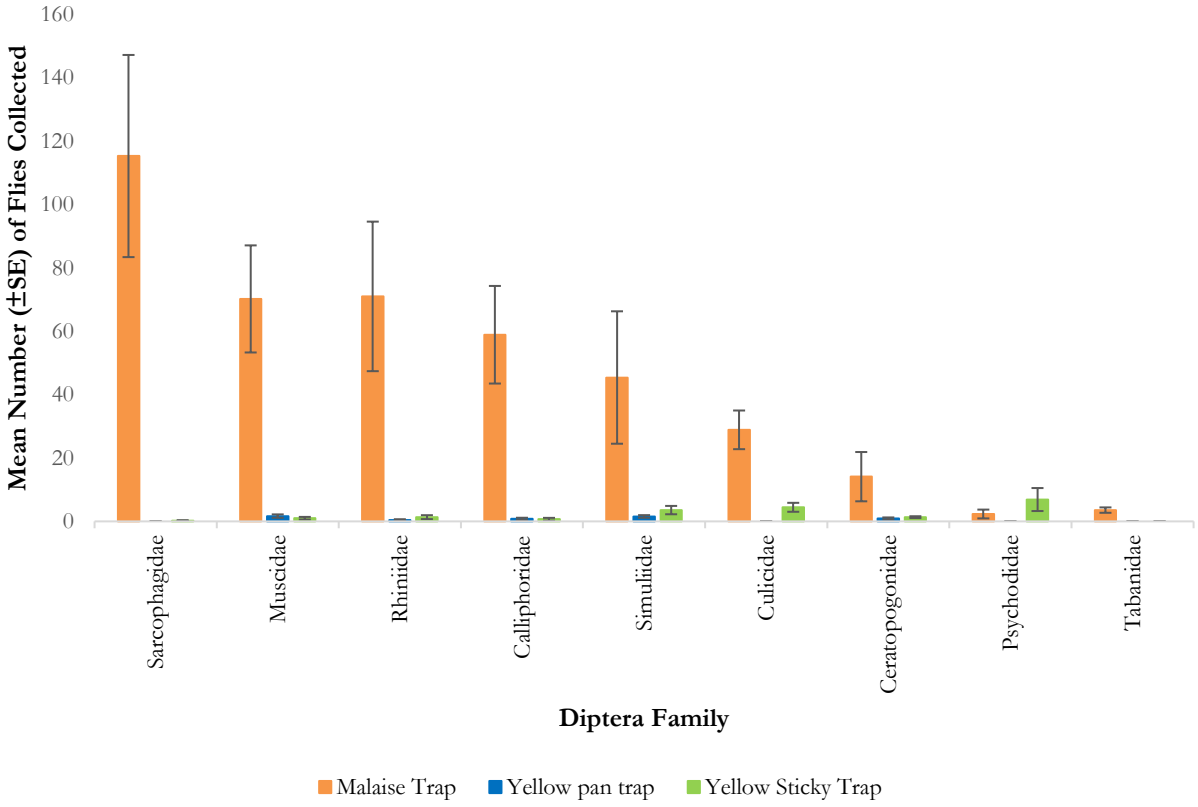

Fig. 3. Mean number (± standard error) of flies sampled from three different traps and the Diptera families.

One of the factors that may influence the higher number of Diptera family collected in Malaise trap is the location of the traps that were set up. All the three Malaise traps used in this study were installed in between vegetation and small ruminants' sheds. Vegetation of an area provides an ecosystem to insects, where it serves as their source of food, feeding, reproduction, growth and resting sites (Triplehorn and Johnson, 2005). In addition to, insect diversity and abundance are often positively correlated with plant diversity (Wenniger and Inouye, 2008). Since the Malaise traps were installed in between the vegetation areas and the animal sheds, the flight activity of more insects between these two locations was intercepted by the trap. Thus, a more diverse group of Diptera was collected by Malaise trap compared to the other two traps.

Studies shown that flies are mostly active during the day (Zahn and Gerry, 2020). Therefore, to capture the diurnal flies, coloured devices such as yellow pan trap and yellow sticky trap are commonly used. Insects are usually attracted to yellow colour due to the colour similarity with their food sources (Shimoda and Honda, 2013). However, a study by Bell et al. (2019) found that the abundance of two species of house fly were higher in blue sticky trap. Therefore, it can be concluded that the yellow colour did not affecting the low diversity of flies obtained from the yellow pan trap in this study. The less diverse family of Diptera captured in this study may be affected by the locations where the yellow pan traps were placed. Although they were placed near to the vegetation areas, their locations were further than the animal sheds as compared to the yellow sticky trap which were placed at the sheds.

CONCLUSION

Nine Diptera families significant to small ruminants were identified in Ladang UniSZA Pasir Akar: Calliphoridae, Ceratopogonidae, Culicidae, Muscidae, Psychodidae, Rhiniidae, Sarcophagidae, Simuliidae and Tabanidae. The family Sarcophagidae was the most abundant family recorded while the least abundant was the family Tabanidae. The most diverse family of Diptera was collected by Malaise trap and the lowest diversity was recorded from yellow pan trap. The results of this study will provide the first insight of the flies important to small ruminants that occurred in this farm. Therefore, early prevention of fly infestation on this farm can be taken in the future. Further identification to species level of these flies should be carried out so that the fly control can be taken on the targeted species that caused injury and transmit diseases to small ruminants.

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