FLEAS OF CTENOCEPHALIDAE (SIPHONOPTERA: PULICIDAE) ON CAT AND DOG IN HOME ENVIRONMENT, PALEMBANG CITY

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ABSTRACT

Dogs and cats are often kept as pets, thus they stay close to humans. Parasitic/zoonotic diseases in humans were often caused by ectoparasite in cats and dogs. This study aimed to determine the morphological differences between cat fleas and dog fleas and the prevalence of cats and dogs infested by fleas around the home environment in Ilir Barat 1 District, Palembang City. The method used was descriptive exploratory method with field observation techniques and specimen collection. The study was conducted in November - December 2018 in five Sub-districts, (Bukit Lama, Bukit Baru, Lorok Pakjo, Demang Lebar Daun, and 26 Ilir 1). The results showed that cat fleas (Ctenocephalides felis) and dog fleas (Ctenocephalides canis) had different color and some morphological differences, such as the shape of the head, the number of spines in the genal comb, the number of notches in the tibia, and the number of seta in the metapleural sternum. The highest prevalence of fleas infestation in cats was in Bukit Lama and 26 Ilir 1 (33.3%), while the highest prevalence of infestation in dogs was in Demang Lebar Daun Village (36.6%). Only in Lorok Pakjo Sub-district that no dog fleas infesting dogs are found.

Key words: cat fleas, dog fleas, flea morphology, prevalence

INTRODUCTION

Domesticated and wild cats and dogs can be infested by ectoparasites. Ectoparasites that can harm pets are mites, ticks, and fleas. Ectoparasites can also act as vectors of an organism, as well as a direct cause of diseases such as dermatitis (Bowman et al., 2003; Mosallanejad et al., 2011) and affect owners who are very close to their pets.

Flea is an ectoparasitic arthropod with a high diversity and adaptation ability towards human pets (Nithikathkul et al., 2005), such as cats, dogs, pigs, rabbits, birds, and in humans themselves (Georgi, 1980). Fleas are monophyletic groups that have a close evolutionary relationship with the Superorder Mecopteroidea insects in the order Mecoptera and Dhyptera (Rasnitsyn, 1992). Fleas evolved from winged ancestors during the late Jurassic or early Cretaceous (125-150 million years ago) with marsupials host and insectivores (Mullen and Durden, 2002).

Ectoparasites feed on host blood (Ariojo et al., 2007) and play a role in the spread of diseases, such as epidemics, typhus, tularemia (Taylor et al., 2005), skin irritation, anxiety, and anemia (Yerusham et al., 1996) and are intermediary hosts on some parasitic worms (helminths) (Georgi, 1980). Ectoparasites were also very disturbing because these tick bites humans and pets, such as cats and dogs. Fleas that most often transmit diseases in humans and pets are ticks of the genus Ctenocephalides and are often found in cats and dogs (Ariojo et al., 2007).

The co-evolution that has been formed by various associations between the host and the flea is demonstrated by the specificity of the host and the morphological adaptation of some ticks to the morphology of the host skin or fur (fur or feathers) (Mullen and Durden, 2002). Pets affected by fleas can be seen finding fleas. Black lice droppings or flea eggs on the skin of the buttocks and abdomen could also be found (Ariojo et al., 2007).

Research on ectoparasites, especially fleas, in cats and dogs had found numerous cats and dogs suffered from ectoparasites. Many people in Palembang City kept cats and dogs as pets, but research on fleas in cats and dogs was still lacking, and the morphology of cat fleas and dog fleas were still considered similar. Therefore, the purpose of this study was to determine the morphological differences between cat fleas and dog fleas, and the number of cats and dogs infested by fleas around the home environment in Ilir Barat District 1, Palembang.

MATERIALS AND METHODS

The collection of fleas was carried out in a house environment that had cats and dogs in 5 sub-districts, Ilir Barat District 1, Palembang City. Fleas are
collected from stray cats, domestic cats and pet dogs that are left free with permission from pet owners. Cat sampling was carried out through feeding to make the cat approachable.

**Fleas Collection**

The fleas collection in cats was collected from the entire body of the cat (Felis catus) and dog (Canis lupus familiaris), namely on the head, back, stomach, and tail. Then, the fleas found were stored in 70% alcohol.

**Flea Preparation**

Cat fleas and dog fleas that had been preserved in 70% alcohol, were then soaked in lactophenol for 1 month. Then, cat and dog fleas were placed on the object glass. One drop of polyvinyl lactophenol was added and was then covered with a glass cover. Observed mites must have complete body parts.

**Flea Identification**

Identification was carried out in accordance with the description using the Triplehorn and Johnson (2005), also Mullen and Durden (2002).

**Data Analysis**

The flea infestation prevalence can be calculated using the formula (Nuchjungreed and Somprasong, 2007):

\[
\text{Infestation prevalence} = \frac{\text{Infected animals}}{\text{Sum of animals checked}} \times 100\%
\]

**Flea Morphology**

Morphologically, cat and dog fleas can be distinguished by several notes (Table 1). The main differences between these fleas were around the head, tibia and the number of seta in the Lateral Metanotal Area (LMA).

Morphological variations in fleas did not always resulted from interbreeding between species (Amin and Sewell, 1977; Linardi, 1984). Ctenocephalides fleas had genal combs and pronotal combs, whereas other flea species only had genal combs or pronotal combs or none of it (Georgi, 1980; Bowman et al., 2003).

Adult fleas have small body (measuring around 1-8 mm), no wings (Ford et al., 2004), thick chitin layer and was one of the holometabola insects. In addition, there were collections of combs or ctenidia in each segment of the body. Combs in the ventral head were called genal combs or genal ctenidium and combs that were in the posterior area of of prothorax called pronotal combs or pronotal ctenidium. Basically, ctenidia and seta which were specialized often reflect host habits. The main important sensor in adult fleas is sensillum and on its front side, in most species, there was a pair of antensensial seta located in the posterior part of the 7th tergum (Figure 1a) (Mullen and Durden, 2002).

Adult fleas mouth parts had developed well for piercing and sucking. The sensor called labial palps would find a suitable area to suck the host's blood. Three structures in the same length and small shape (slender) called styllets would then pierce the host's skin. Styllets consist of two sideways branches, knife-shaped styllet is the maxillary laciniæ and the other in the middle is the epipharynx. Laciniae pierced the skin of the host and the tip of the epipharynx into the host blood vessel (Figure 1b) (Mullen and Durden, 2002).

**Fleas Prevalence**

The prevalence of fleas in cats varied (Table 2). Residential areas in Bukit Lama and 26 Ilir 1 had the highest prevalence rate of 33.3% (10 out of 30 cats) followed by residential areas in Bukit Baru at 30% (15 out of 50 cats), whereas housing areas in Lorok Pakjo and Demang Lebar Daun had the lowest prevalence rate of 20% (5 out of 25 cats). Meanwhile, the prevalence of fleas in dogs also varied (Table 3).

### Table 1. Differences in cat fleas (Ctenocephalides felis) and dog fleas (Ctenocephalides canis)

| No. | Characteristics       | Cat fleas (Ctenocephalides felis) | Dog fleas (Ctenocephalides canis) | Description |
|-----|-----------------------|------------------------------------|-----------------------------------|-------------|
| 1.  | Alive Body Color      | Hazel                              | Dark brown                        | -           |
| 2.  | Head Shape            | Arched                             | Rounded                           | Figure 1    |
| 3.  | Genal Comb Shape      | The first thorn is almost the same length as the second thorn | The first thorn is shorter than the other thorn | Figure 2    |
| 4.  | Number of notches in hind tibia | 1                                  | 2                                 | Figure 3    |
| 5.  | Number of seta in LMA | 2                                  | 3                                 | Figure 4    |

### Table 2. Prevalence of cat fleas (Ctenocephalides felis) in cats (Felis catus) obtained from the research site

| Research location | Number of cats examined | Number of infected cats | Prevalence (%) |
|------------------|-------------------------|-------------------------|----------------|
| Bukit Lama       | 30                      | 10                      | 33.3           |
| Bukit Baru       | 50                      | 15                      | 30             |
| Lorok Pakjo      | 25                      | 5                       | 20             |
| Demang Lebar Daun| 25                      | 5                       | 20             |
| 26 Ilir 1        | 30                      | 10                      | 33.3           |

### Table 3. Prevalence of dog fleas (Ctenocephalides canis) in dogs (Canis lupus familiaris) obtained from the research site.

| Research location | Number of dogs examined | Number of positive dogs | Prevalence (%) |
|------------------|-------------------------|-------------------------|----------------|
| Bukit Lama       | 20                      | 5                       | 25             |
| Bukit Baru       | 10                      | 1                       | 10             |
| Lorok Pakjo      | 5                       | 0                       | 0              |
| Demang Lebar Daun| 22                      | 8                       | 36.6           |
| 26 Ilir 1        | 10                      | 1                       | 10             |
Residential areas in Demang Lebar Daun had the highest prevalence rate of 36.6% (8 out of 22 dogs) followed by housing areas in Bukit Lama of 25% (5 out of 20 dogs), while residential areas at 26 Ilir 1 had lowest prevalence of 10% (1 in 10 dogs).

The prevalence rate of each residential area was affected by the environmental conditions of the house and the fur of cats and dogs, as well as poor maintenance management, especially the cleanliness of the cage and its surrounding. In addition, some dogs had long, thick fur throughout the body, making it a suitable place for breeding and hiding. Home environment conditions that were not cat friendly caused many cats to experience rashes and sores. Cats that had a lot of rashes and wounds also had plenty of fleas. Dogs with poor care, especially the cleanliness of the cage and the surrounding were prone to infesting fleas.

Ectoparasites commonly found in cats and dogs were fleas and mites (Mosallanejad et al., 2011) and the highest prevalence rate of ectoparasites infestation were fleas, ticks and mites (Estares et al., 1999). Prevalence of cat fleas (Ctenocephalides felis) (73.07%) was higher compared to other ectoparasites in cats on the border of Iran and Iraq (Bahrami et al., 2012) and the prevalence of dog fleas (Ctenocephalides canis) was also higher in Romanis (Neagu et al., 2013). Cat fleas could live in various hosts besides cats (Linardi, 2002), for example birds in Brazil (Linardi and Santos, 2012). On the other hand, dog fleas could only live in dogs (Linardi and Santos, 2012). Cat fleas was a common fleas found on dogs, in addition to dog fleas and Pulex irritans in Romania (Morariu et al., 2006) and Brazil (Linardi and Nagem, 1973). The distribution of dog fleas was less common in areas with high or low temperatures (Linardi and Nagem, 1973). Summer season with low humidity could cause death in flea larvae due to heat and dryness (Thiemann et al., 2003; Blagburn and Dryden, 2009).

Fleas were one of the cat and dog ectoparasites around the world that could cause skin diseases (flea bites) in humans (Lannino et al., 2017). A lot of fleas in a cat could easily move, and disturbed other animals and acted as a vector of disease (Rust and Dryden, 1997). Cat fleas caused allergic dermatitis (Halliwell et al., 1987) and in severe infestations could also cause anemia in dogs, cats, goats, cattle and sheep and young animals (Harvey et al., 1982; Yeruham et al., 1989). About 20 different endosymbiont or pathogens had been found to be related to the Ctenocephalides species as biological vectors or intermediate hosts, including bacteria, protozoa and worms, thus making it a potential health risk for humans (Beard et al., 1990; Krämer and Mencke, 2001; Linardi, 2001).

Fleas were also capable of transmitting pathogens to humans (zoonosis). This ectoparasite played a historic role in the plague of human diseases, for example the bubonic plague (black death) that were estimated to have caused the death of a third of the world's population during the Middle Ages (Alvarez-Hernández and S-Rivera, 2017). Bartonella species was the most common caused in human infection in the Cat scratch disease (CSD) (Lannino et al., 2017). Flea droppings were the main source of infection with Bartonella henselae species which could move to other cats, or accidentally to humans through contaminated cat's claws (Gil et al., 2013).
CONCLUSION

The different morphology of cat flea (Ctenocephalides felis) and dog flea (Ctenocephalides canis) could be seen from the body color, head shape, the location of the notch on the tibia, and the number of seta in metepisternum. Prevalence of flea in cats and dogs was varied among districts. Data on the fleas’ host, distribution and prevalence of infestation could be used in identifying the species of fleas found.

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