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MORPHOLOGICAL IDENTIFICATION AND PREVALENCE OF THE DOG FLEA *CTENOCEPHALIDES CANIS* (CURTIS, 1826) AND THE CAT FLEA *CTENOCEPHALIDES FELIS* (BOUCHÉ, 1835) IN DHAKA CITY, BANGLADESH

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Ctenocephalides felis (Bouché, 1835) and *Ctenocephalides canis* (Curtis, 1826) are the most important flea parasites of dogs and cats throughout the world; they themselves affect the host and act as vectors of diseases. The main aim of the present study was to assess the prevalence of *Ctenocephalides* spp. in both stray and pet dogs and cats in Dhaka City.

A total of 25 flea infested dogs and 25 flea infested cats were collected from 57 dogs and 77 cats, respectively. A higher prevalence was recorded in stray dogs (61.11 %) and cats (79.17 %) than that in pet dogs (14.29 %) and cats (11.32 %). The prevalence of flea infestation was 48.28 % in young dogs and 39.29 % in adult dogs, respectively. In case of cats, 34.62 % young and 31.37 % adults were found to be infested by fleas. Among the examined dog fleas, 9 (60 %) were *C. canis* and 6 (40 %) were *C. felis*. Again, among the examined fleas of cats, 2 (13.33 %) were *C. canis* and 13 (86.77 %) were *C. felis.* Of the 11 *C. canis* identified, were 8 (72.73 %) female fleas and 3 (27.27 %) male fleas. Of the 19 examined *C. felis* identified as 18 (94.74 %) were female fleas and 1 (5.26 %) male flea. Both fleas have public health significance. Therefore, proper attention needs to be paid for the prevention of flea borne diseases through the control of dogs and cats.

Keywords: *Ctenocehalides canis*, *Ctenocephalides felis*, morphology, prevalence, Dhaka City, Bangladesh

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Fleas, particularly species of the genus *Ctenocephalides*, are common ectoparasites of dogs and cats throughout the world (Mircean et al., 2010; Gracia et al., 2013; Hajipour et al., 2015). Fleas are clinically significant parasites for human health since they may play a role as parasites by themselves causing allergic dermatitis or other conditions due to their feeding activities. But, which is more important, they also serve as vectors transmitting important pathogens. The cat flea, *Ctenocephalides felis*, is a known vector for *Bartonella henselae, Bartonella clarridgeiae,* and *Rickettsia felis*, which can cause cat scratch disease, endocarditis, and cat flea typhus in humans, respectively (Dryden, Rust, 1994; Kenny et al., 2003; Kramer, Mencke, 2001). Dog and cat fleas are known to be intermediate hosts of *Dipylidium caninum*, which can be transmitted to pets and humans (Soulsby, 1982; Guzman, 1984). Domestic animals such as dogs, cats, or other pets, may play an important role as bridging hosts for fleas of different wild animals, domestic animals, and humans, as they come into contact with different animals due to their seeking behavior and therefore acquire the fleas of different animals (Dobler, Pfeffer, 2011). Fleas are the common etiology of dermatitis, being responsible for producing allergic dermatitis (Sousa, 2012). Fleas infestations can cause considerable irritation to animals and humans, and can lead to severe disorders, such as anaemia and dermatological problems, because repeated infestation of dogs and cats may result in hypersensitivity to components of flea saliva, which, in its turn, can cause flea allergic dermatitis (Dryden, Rust, 1994; Kunkle et al., 2003; Newbury, Moriello, 2006). These cat and dog fleas are known as vector of pathogens causing plague, murine typhus, and feline leukemia. Approximately 94 % of all flea species are reported to feed on mammals. The dog flea, *C. canis*, is an important ectoparasite of both wild and domestic canids around the world (Durden et al., 2005). It is similar in appearance to the ubiquitous cat flea, *C. felis*, but is encountered less frequently and thus has not been studied thoroughly. At least 36 important zoonotic diseases are acquired from dogs worldwide, although the occurrence of some important zoonotic diseases acquired from dogs have reported from Bangladesh but the inland reports on this aspect are very limited.

In our country, no detailed research on the mentioned flea species was performed. In the present work, we had examined fleas collected from dogs and cats in Dhaka city.

MATERIALS AND METHODS

Site selection

Fleas were collected from several areas in Dhaka city, including as the Central Veterinary Hospital (CVH) at Alauddin road, People for Animal Welfare (PAW) at Lalmatia, Care for Paws (CFP) at Bosila and Sher-e-Bangla Agricultural University (SAU), Bangladesh. Both stray and pet dogs and cats were considered as study animal for the collection of fleas.

Restraining of animals

Pet dogs and cats were restrained with the help of the owners. On the other hand, stray dogs and cats, were restrained with the help of the assistant by covering the mouth with mask. Some dogs and cats, which were anaesthetized during neutering or spaying, were examined for the presence of fleas.

Sample collection and preservation

Dogs and cats of all age groups and sexes in Dhaka City were considered as study animals. Dogs and cats were exhaustively examined for fleas through an inspection of the head, neck, body, sides, tail, and ventral regions of each animal. Fleas were collected by the use of forceps, and hand picking. Collected fleas were stored in collection vials with proper labeling, and using a record book for further information. Captured fleas were transported to laboratory of Microbiology and Parasitology, Sher-e-Bangla Agricultural University, Bangladesh. Collected fleas were preserved in 70% ethanol for their preservation and identification based on morphological features to the species level.

Clearing: Fleas were cleared by dissolving in 10 % potassium hydroxide (KOH) solution at room temperature for overnight to allow transmitted light to pass through them. After clearing with KOH, specimens were returned to distilled water or alcohol before being passed through the alcohol series for dehydration.

Staining: Hematoxylin dye was used to stain the specimens. Specimens were kept in Hematoxylin for overnight. Hematoxylin was added to the specimens while they were in 70 % alcohol. The specimen became darker and darker as time in the stain was increased. Some of the stain leached from the specimen in later stages of the dehydration series, so over staining was done to produce proper darkness of the specimen.

Dehydration and mounting: Water was removed by dehydration because water in the specimen would cloud the slide and make it difficult to see the desired characteristics as well as to prevent specimen from spoiling by bacteria. Dehydration was accomplished by passing the specimens through a series of increasingly concentrated grades of ethanol for 30 minutes in each step.

After dehydration in 100 % ethanol, the specimen was soaked in xylene before mounting on slides. The amount of time spent in each step depends on the thickness of the specimen. The dehydrated specimen was observed under microscope just before mounting in Canada balsam medium to observe whether it is cleaned. If clouding was visible, the specimen was returned to earlier stages in the dehydration series. After mounting, slides were dried very slowly by allowing them for several days. The specimens were handled with care during the mounting process. Fine forceps, needles and insect pins were used to handle the specimens during the mounting process.

Microscopic examination for morphology study

All fleas were identified microscopically at the laboratory, according to the keys and description for identification (Lewis, 1993; Menier, Beaucournu, 1998; Durden, Traub, 2002).

RESULTS

A total of 15 fleas from 5 infested dogs, and 15 fleas from 6 infested cats were objected to morphological identification. Two species, *C. canis* and *C. felis* were identified. Morphological differences between the revealed species are shown in Figs. 1 and 2, and in Table 1.

A total of 57 dogs and 77 cats were examined for infestation by fleas belonging to the genus *Ctenocephalides* from different veterinary clinics and animal welfare associations of Dhaka City (Table 2). A total of 25 flea infested dogs and 25 flea infested cats were found from 57 dogs and 77 cats examined, respectively. In this study, a higher infestation rate of flea was recorded in dogs (43.86 %) than in cats (32.47 %) (Table 2).

Higher infestation rate of flea was recorded in dogs (50%) rather than cats (24 %) in the Central Veterinary Hospital (CVH). The prevalence of flea was observed in dogs (42.86 %) and cats (34.09 %) in the veterinary clinics of People for Animal Welfare (PAW) at Lalmatia (Table 3).

DISCUSSION

In the present study, two species of the genus *Ctenocephalides* were found in both dogs and cats.

The population of *C. canis* was observed on dogs and cats from all the geographical localities of Dhaka City. The individuals presented typical characteristics of this species: head strongly convex anteriorly in both sexes and not noticeably elongate; the length of the head was not twice longer than wide. Genal ctenidium presenting the first spine was approximately shorter than the second one. Three spines were observed in the metepisternite or LMA in all the individuals. Hind tibia with seven to eight seta-bearing notches along the dorsal margin and presence of two single, short and stout bristles located between the postmedial and apical long bristles were found in hind tibia. The manubrium of the clasper was dilated towards its apex in case of male individuals. Typical spermatheca with apical part of elongated hilla was observed in the posterior end of females. These above mentioned morphological characteristics were agreed with those cited by Lewis (1993), Menier, Beaucournu (1998), Beaucournu, Launay (1990), and Durden, Traub (2002). However, the degree of dilation of the apex and the degree of elongation of the apical part (hilla) of the spermatheca was the most differential character between both species what was in agreement with Menier and Beaucournu (1998) and Lewis (1993), respectively. The length observed between the first and the second genal spines was the most specific biometrical parameter observed between both species and it was in agreement to Durden and Traub (2002), the length and wide ratio of the head was a specific parameter to differentiate *C. felis* and *C. canis.*

In this study, an overall high prevalence of fleas was recorded in both dogs (43.86 %) and cats (32.47 %) in Dhaka City. This high prevalence suggests that these fleas are very common, and present major problems with regard to the health, and performances of these important animals in the study area. Higher prevalence of fleas was observed in dogs than that in cats, which may be due to more efficient grooming behavior of cats (Eckstein, Hart, 2000). Higher prevalence of fleas in stray dogs and cats than pet dogs and cats in Dhaka

Table 1. Differential morphological properties between C. felis and C. canis

Characteristics	*C. felis*	*C. canis*
Shape of the head	Length is generally greater than twice of the height of head (Fig. 1*Ba*)	Length is not twice of the height of head (Fig. 1*Ca*)
Length of the 1st and 2nd spine of genal comb	First two spines are approximately equal in length (Fig. 1*B a*)	First spine is half as long as second spine in length (Fig. 1*Cb*)
Number of bristles on the LMA or metepisternite	Two (Fig. 1*D*)	Three (Fig. 1*E*)
Number of notches on tibiae	Tibiae of all 6 legs have 5 to 6 notches (Fig. 1*F*)	Tibiae of all 6 legs have 7 to 8 notches
Number of stout bristles on the dorsal margin of the hind tibia	One stout bristle in the interval between post-median and apical long bristles (Fig. 2*A*)	Two stout bristles in the interval between post-median and apical long bristles (Fig. 2*B*)
Metatibial formula of chaetotaxy	2-2-2-2-1-3	2-2-2-2-2-1-1-3
Male: shape of the manubrium of the clasper	The clasper of the manubrium is not expanded apically (Fig. 2*C*)	The clasper of the manubrium is expanded apically (Fig. 2*D*)
Female: length of hilla of spermethica	Spermatheca contains short hilla (Fig. 2*E*)	Spermatheca contains comparatively long hilla (Fig. 2*F*)

Table 2. Overall number of animals was examined for flea infestation

Animal	Animal infested, %
Dog (*n*=57)	25 (43.86)
Cat (*n*=77)	25 (32.47)
Total (134)	50 (37.31)

Table 3. Comparison of the overall number of examined animals according to collection site

Location	Animal	Animal infested, %
Central Veterinary Hospital (CVH)	Dog (*n*=18)	9 (50)
	Cat (*n*=25)	6 (24)
People for Animal Welfare (PAW)	Dog (*n*=35)	15 (42.86)
	Cat (*n*=44)	15 (34.09)
Sher-e-Bangla Agricultural University (SAU)	Dog (*n*=1)	–
	Cat (*n*=6)	3 (50)
Care for Paws (CFP)	Dog (*n*=4)	2 (50)
	Cat (*n*=1)	–
Total	(134)	50 (37.31)

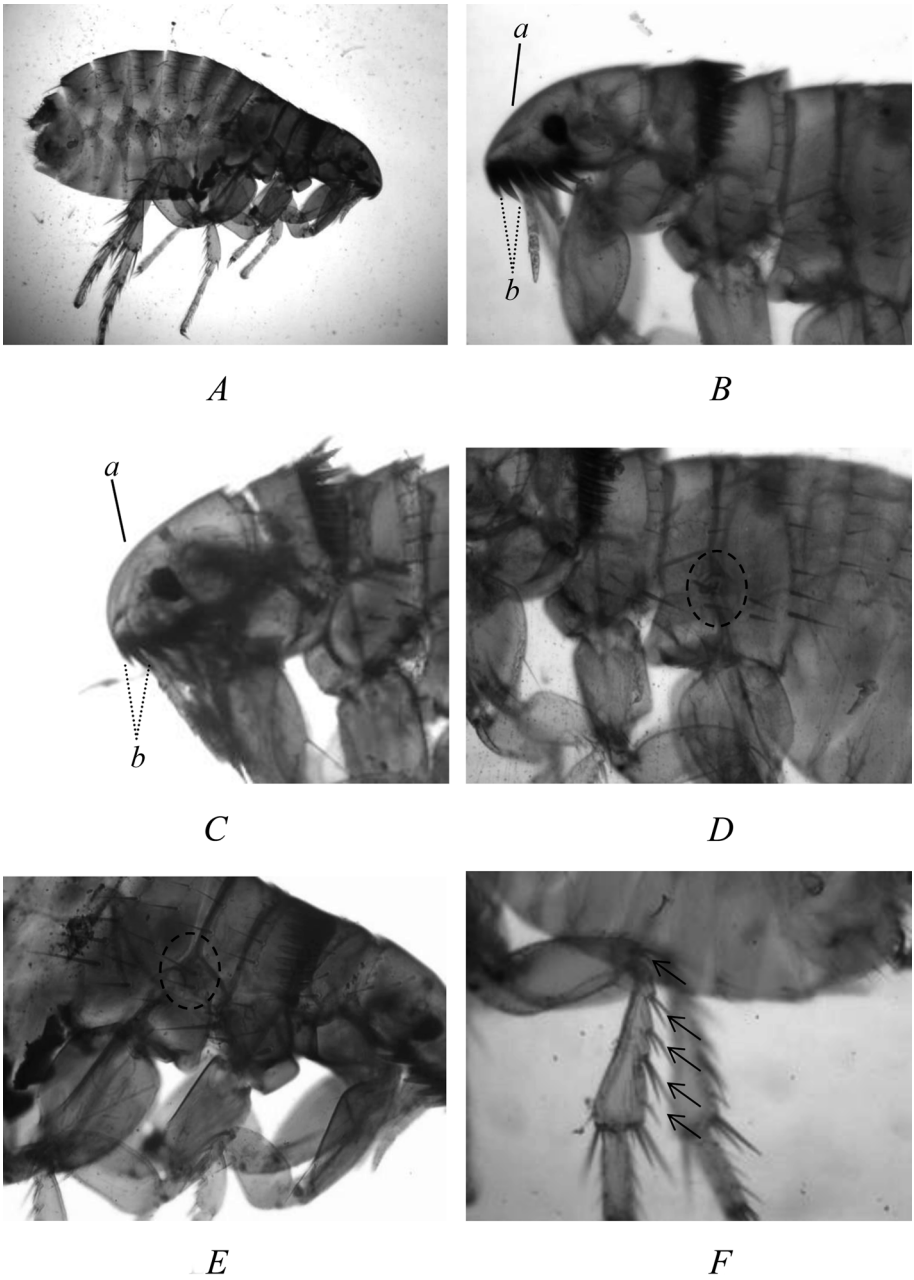

Figure 1. *A* − morphology of the genus *Ctenocephalides* (female); *B* − female of *C. felis* (10X). *a* − shape of the head (black line), *b* − Length of the 1st and 2nd spines of genal comb (broken lines); *C* − female of *C. canis* (10X), *a* − shape of the head (black line), *b* − length of the 1st and 2nd spines of genal comb (broken lines); *D* −female of *C. felis* (10X). Number of bristles on the lateral metanotal area (LMA) or metepisternite (broken circle); *E* −female of *C. canis* (10X). Number of bristles on the lateral metanotal area (LMA) or metepisternite (broken circle); *F* −Female of *C. felis* (10X). Number of notches (5) on the hind tibia (black arrow).

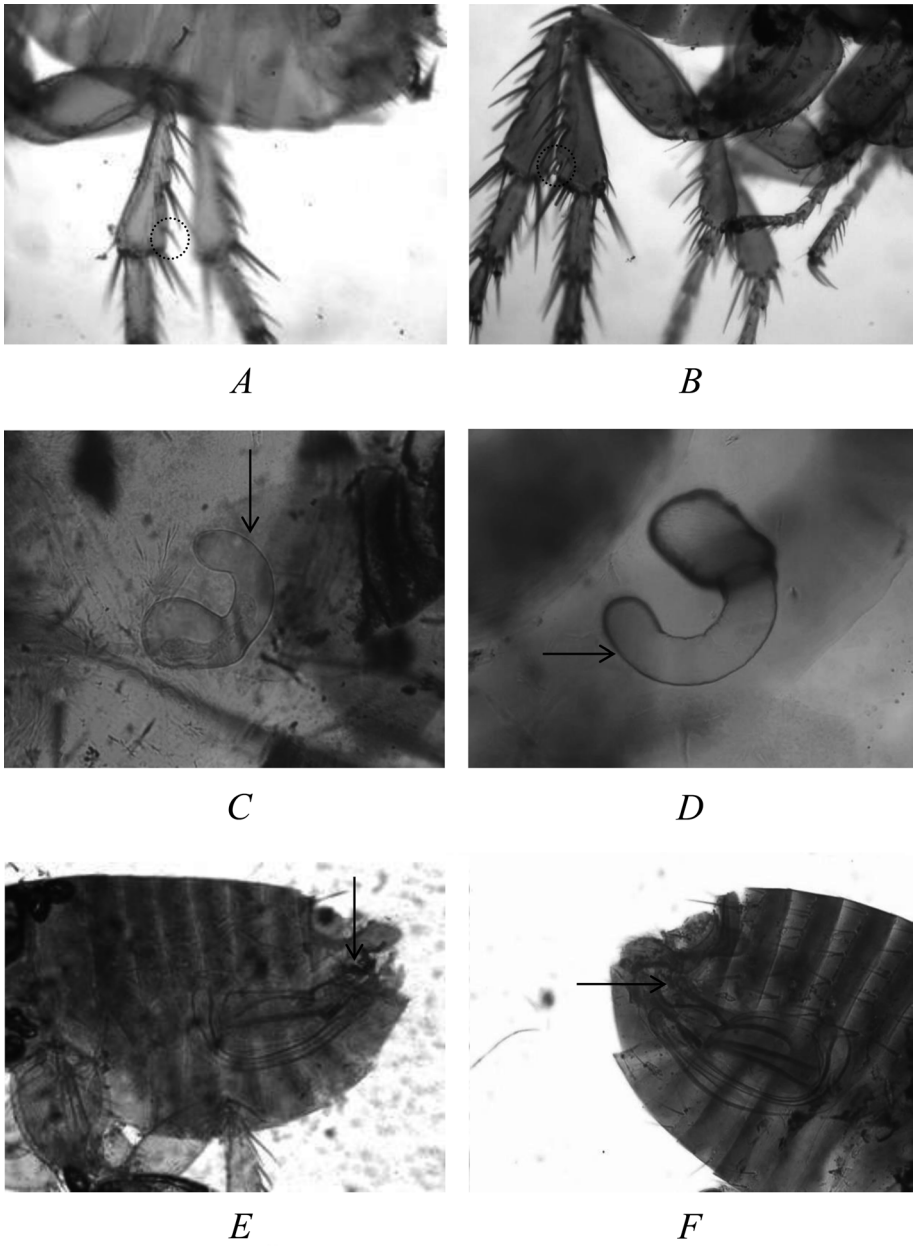

Figure 2. *A* − Female of *C. felis* (10X). Number of stout bristles between post-median and apical long bristles of the hind tibia (broken circle); *B* − female of *C. canis* (10X). Number of stout bristles between post-median and apical long bristles of the hind tibia (broken circle); *C* − female of *C. felis*. Length of hilla of spermathica (black arrow); *D* − female of *C. canis*. Length of hilla of spermathica (black arrow); *E* − male of *C. felis* (10X). Shape of the manubrium of the clasper (black arrow); F −male of *C. canis* (10X). Shape of the manubrium of the clasper (black arrow)

City, which confirms to the previous study (Hsu, Wu, 2001) where it was reported that 80 of stray cats and 60 of stray dogs were infested with *C. felis* in Taipei, Taiwan. Lower prevalence of fleas was recorded in pet dogs and cats may be due to proper supportive care and management by their owners.

The prevalence amongst animals, more female fleas was recorded on animals in this study. The most probable reason for this is that female individuals usually have a longer lifespan than the male individuals. Male individuals also spend more time off the host and are therefore more prone to predation or starvation than female individuals (Durden et al., 2005).

CONCLUSIONS

Fleas are clinically important ectoparasites for animal and human health since they may play a role as parasites by themselves causing allergic dermatitis or other conditions. Sometimes they serve as vectors and transmitting important disease causing pathogens. The information presented here improves our understanding of flea infestation in Bangladesh. In order to avoid any unpleasant situations, adequate preparations of flea control should be implemented in Dhaka city and other parts of Bangladesh.

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CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest about this publication.

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МОРФОЛОГИЧЕСКАЯ ИДЕНТИФИКАЦИЯ И РАСПРОСТРАНЕННОСТЬ СОБАЧЬЕЙ БЛОХИ *CTENOCEPHALIDES CANIS* (CURTIS, 1826) И КОШАЧЬЕЙ БЛОХИ *CTENOCEPHALIDES FELIS* (BOUCHÉ, 1835) В ДАККЕ, БАНГЛАДЕШ

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РЕЗЮМЕ

Блохи *Ctenocephalides felis* (Bouché, 1835) и *Ctenocephalides canis* (Curtis, 1826) являются наиболее важными паразитами собак и кошек по всему миру; сами блохи вредят хозяевам и, кроме того, служат переносчиками заболеваний. В цели данной работы входила оценка распространения блох у домашних и бродячих собак и кошек в городе Дакка.

Из 57 исследованных собак и 77 кошек, 25 собак и 25 кошек были инфицированы блохами. Блохи чаще встречались на диких собаках (61.11 %) и кошках (79.17 %), по сравнению с домашними собаками (14.29 %) и кошками (11.32 %). Зараженность молодых собак была выше (48.28 %) в сравнении со взрослыми собаками (39.29 %). Среди кошек, 34.62 % молодых и 31.37 % взрослых кошек были заражены блохами. Среди блох, собранных с собак, 9 (60 %) были представлены *C. canis* и 6 (40 %), *C. felis*. В то же время, среди блох, собранных с кошек, 2 (13.33 %) были представлены *C. canis* и 13 (86.77 %) *C. felis.* Из 11 определенных блох *C. canis*, обнаружилось 8 (72.73 %) самок и 3 (27.27 %) самца. Из 19 изученных кошачьих блох *C. felis,* 18 (94.74 %) были представлены самками и 1 (5.26 %) самцом. Оба вида блох важны с точки зрения здравоохранения, поэтому следует уделить особое внимание предотвращению распространения болезней, передаваемых блохами, путем ограничения численности бродячих животных.