

Morphologic study of dog flea species by scanning electron microscopy

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SUMMARY. Fleas taxonomically belong to: Phylum *Arthropoda*, Class: *Insecta* Order *Siphonaptera*. The most frequent flea species occurring in dogs are worldwide represented by species from *Pulicidae* family, including *Ctenocephalides spp.* (Hopkins and Rothschild, 1953).

The purpose of this study was to make a detailed morphologic study of the two most frequent flea species from the dog, *Ctenocephalides canis* and *Ctenocephalides felis felis*, by scanning electron microscopy (SEM).

The morphological examination of this two flea species was made by Scanning Electron Microscopes (SEM): TESLA BS 340 and Jeol JSM 5510 LV with Elemental Analysis System (EDX) and Inca 300.

As a result *Ctenocephalides felis felis* was described with a head length twice than the high, both the 1 and the 2 spine of the genal comb have the same length and the hind tibiae of all 6 legs have 4 to 5 setae. *Ctenocephalides canis* is flea specie with a head length equal with the high, the 1st spine of the genal comb is half as long as the 2nd spine and the hind tibiae of all 6 legs have 7 to 8 setae.

Conclusion. *Ctenocephalides felis felis* and *Ctenocephalides canis* can be described with a high specificity by SEM.

Key words: flea, morphology, electron Microscopy, dog.

Introduction

Flea infestation is the most common ectoparasitic condition of dogs and cats with a high veterinarian, medical and economical importance.

Fleas are wingless insects with laterally compressed body of about 1, 5- 4 mm length. Like all insects they possess six legs and three body segments (Krämer and Mencke, 2001).

Taxonomically they belong to: Phylum *Arthropoda*, Class: *Insecta* Order *Siphonaptera*. The most frequent flea species occurring in dogs are worldwide represented by species from *Pulicidae* family, including *Pulex spp.* and *Ctenocephalides spp.* (Hopkins, Rothschild, 1953).

General morphology. The flea is a dark brown in color, wingless and possesses a laterally compressed chitinous abdomen. The glossy surface of the body allows easy movement through hair and feathers. Compound eyes are absent, legs are long, strong and adapted for leaping.

In some species there are a number of large spines on the head and the thorax known as combs or ctenidia. These *ctenidia* belong to one of the three sets of characteristics in morphological taxonomy for identifying fleas, the so-called chaetotaxy. Other aspects of the head and the hind tibia are the other two characterizing sets (Krämer and Mencke, 2001).

Concentrating on pets, particularly on dogs, only a restricted number of flea species, in most of cases from *Pulex spp.* and *Ctenocephalides spp.*, occur in large amounts and are dominate in Europe and other parts of the world, including here the *Ctenocephalides felis felis* and the *Ctenocephalides canis* species.

The morphological differentiation of this two flea species is based on the aspects of the length and high of the head and the 1 and 2 spine of the genal comb; the setae distribution on the hind tibia.

Materials and methods

The collected flea samples were examined in the Electron Microscopy Centre, research base in the University „Babeş-Bolyai”- Biology Department, Cluj Napoca. *Ctenocephalides felis felis* and a *Ctenocephalides canis* flea samples were analyzed by Scanning Electron Microscopes (SEM).

The flea samples processing included the following phases:

1. Critical point drying
2. Vacuum evaporator usage and metal coating
3. Qualitative elemental analysis by SEM. The examination devices were represented by Scanning Electron Microscopes (SEM): TESLA BS 340 and Jeol JSM 5510 LV with Elemental Analysis System (EDX) and Inca 300.

The morphological examination was based on the aspects of the head, the hind tibia for the two main flea species differentiation and the last abdominal segment for the sexual differentiation.

Results and discussion

Fleas are wingless insects with laterally compressed body of about 1.5-4 mm length. Like all insects they possess six legs and three body segments (head, thorax and abdomen) (Krämer and Mencke, 2001).

The flea is a dark brown in color, wingless and possesses a laterally compressed chitinous abdomen. The body of *Ctenocephalides felis felis*, equipped with numerous stout bristles, is flattened laterally for ease of movement between the hairs of the host. Note small size of **head** with a head capsule high, narrow and cunneate, (Fig. 1.A) in relation to long powerful **hind legs** (Fig. 1.E) allowing jumps of up to 30cm horizontally and 20cm vertically.

After leaping at its host the flea tumbles forward with its legs extended. The tarsus terminates in two strong **claws** for grasping host hair and are used like grappling hooks (Fig. 1.F) (Hopkins and Rothschild, 1953).

Compound eyes are absent and the head is showing small round **ocellus** (simple eye) (Fig. 1.C). The **mouthparts** of the flea are modified for piercing and sucking – between two maxillary palps are seen two maxillary lances (Fig. 1.B). One antenna is lying in a deep lateral groove to the right of the eye and behind the eyes fleas have **antennae** in the antennal fossa. The antennal fossa divides the head into anterior and posterior parts (Fig. 1.C).

The abdomen of the adult flea includes 10 segments (Fig. 1.D) (Hopkins and Rothschild, 1953).

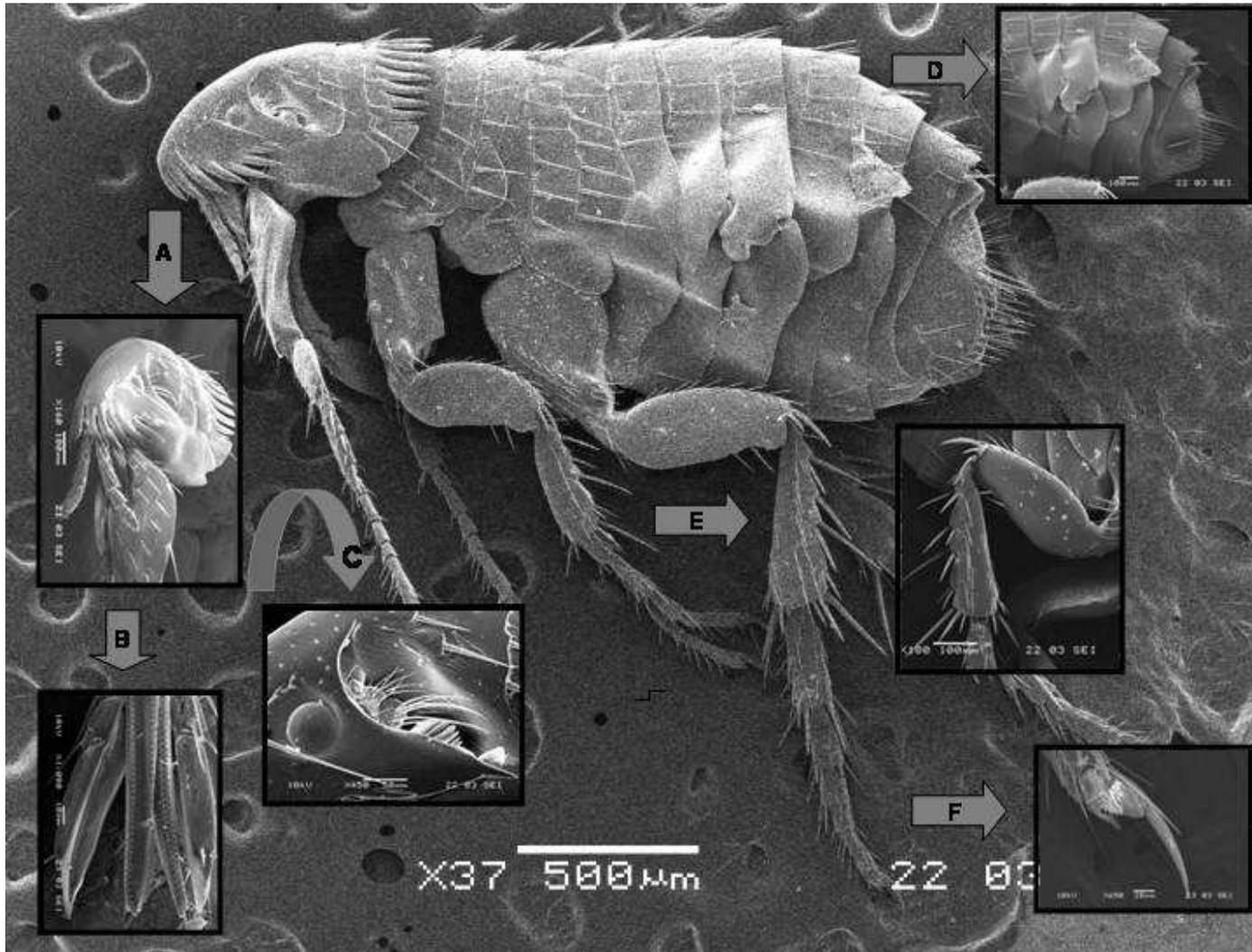


Figure 1
General morphology of the *Ctenocephalides* spp. by SEM

In species belong to *Ctenocephalides spp.* there are a number of large spines on the head and the thorax known as combs or *ctenidia* (Fig. 1.A). These *ctenidia* belong to one of the three sets of characteristics in morphological taxonomy for identifying fleas.

Other aspects of the head and the hind tibia are the other two characterizing sets (Krämer and Mencke, 2001).

The best distinction between the two main two flea species in dog is the fact that:

Ctenocephalides felis felis (cat flea) **front** is more oblique than in any other known form of the genus. **Genal comb** normally with 8 spines each side, of which the first have usually the same length then the second (Fig. 2) (Hopkins and Rothschild, 1953).

The dorsal margin of the **hind tibia** from all 6 legs has 4 to 5 teeth (Fig. 4) (Krämer and Mencke, 2001).

Ctenocephalides canis (dog flea) **front** strongly rounded in both sexes; head length is equal with

the height. Bristles are more numerous than in other species. **Genal comb** on each side is with 7 or 8 spines and the first spine is shorter than the second (Fig. 3) (Hopkins and Rothschild, 1953).

The dorsal margin of the **hind tibia** from all 6 legs has 6 to 8 teeth (Fig. 5) (Krämer and Mencke, 2001).

The sexual differentiation of *Ctenocephalides spp.* is based on the aspect of the last abdominal segment. The terminalia of *male holotype* has a large process of clasper with 8-10 bristles on the outer surface (Fig. 6).

The apex of abdomen of *female paratype* has 8-9 bristles along apical and ventral margins (Fig. 7) (Hopkins and Rothschild, 1953).

Conclusion

Ctenocephalides felis felis and *Ctenocephalides canis* can be described with a high specificity by SEM.

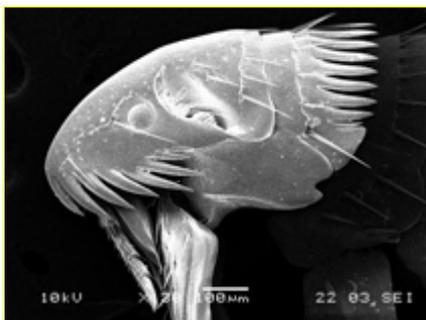


Figure 2. *Ctenocephalides felis felis* head



Figure 3. *Ctenocephalides canis* head

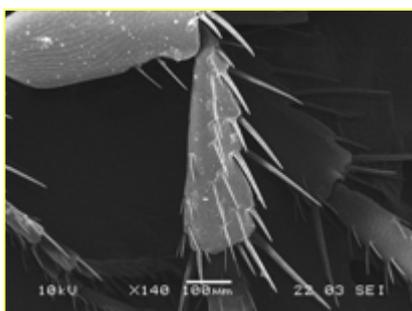


Figure 4. *Ctenocephalides felis felis* hind tibia

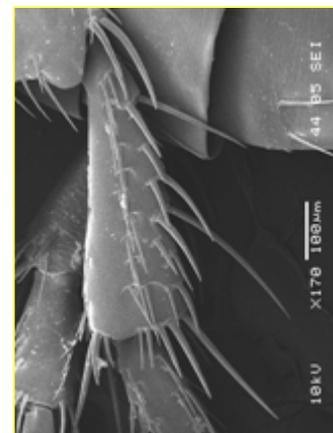


Figure 5. *Ctenocephalides canis* hind tibia

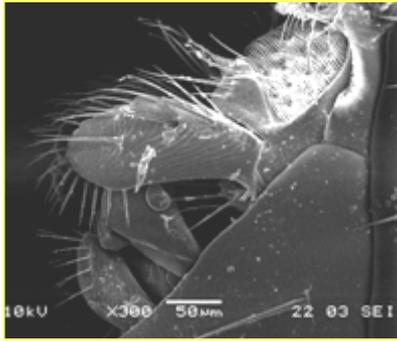


Figure 6. The male *holotype*



Figure 7. The female *paratype*

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