Short communication

Prestomal teeth of some flies of medical importance

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Abstract

Comparison of prestomal teeth of adult Chrysomya megacephala, Chrysomya rufifacies, Chrysomya nigripes, Lucilia cuprina, Parasarcophaga dux and Musca domestica was accomplished by use of scanning electron microscopy. The prestomal teeth of C. megacephala, C. rufifacies, L. cuprina and P. dux are all similar in appearance in having various degrees of bifurcation at their tips. In contrast, the tips of the prestomal teeth in C. nigripes are very shallowly serrated, but are comparatively more deeply serrated in M. domestica. These features may help account for the roles these flies may play in matters of medical or veterinary importance, such as causing physical irritation or acting as vectors of disease agents.

Keywords: Prestomal teeth; Flies; Scanning electron microscopy

Prestomal teeth are structures that are located proximally at the medial edges of the labellar lobes of the sponging proboscis of an adult fly. They are used in a variety ways for uptake of food, depending on the nature of the particular food (Smith, 1985). In the ‘direct feeding’ position described by Graham-Smith (1930), the labellar lobes are completely turned backward, thereby allowing the blade-like prestomal teeth to tear and rasp the surface of a food item. Using mouthparts such as these, the feeding activities of some cyclorrhaphan flies, like the face fly, Musca autumnalis, can inflict damage to eyes of cattle as well as transmit pathogens (Giangaspero and Broce, 1993). The study by Broce and Elzinga (1984) involving scanning electron microscopy of the prestomal teeth of this fly species also provided supportive evidence of this. In addition, Greenberg (1973) reported blood loss in bovids as a result of the scraping from prestomal teeth of Musca crassirostris. Most of the previous studies on prestomal teeth have focused on fly species in the family Muscidae, while those on species of blow flies and flesh flies are minimal. Therefore, due to this deficiency as well as our ongoing interest in fly species of forensic and medical importance, we present a comparative investigation of the prestomal teeth of some blow fly and flesh fly species with those of Musca domestica. These features may be morphologically distinct among fly species in the families Calliphoridae, Sarcophagidae and Muscidae and may provide information pertaining to the feeding ability of these flies and roles of medical importance in the future.

Fly species used in this study, which include Chrysomya megacephala, Chrysomya rufifacies, Chrysomya nigripes, Lucilia cuprina, Parasarcophaga dux and M. domestica, were obtained from laboratory colonies of the Department of Parasitology, Faculty of Medicine, Chiang Mai University. Fifteen adult flies of each sex were removed from rearing cages (30 \times 30 \times 30 \text{cm}^3) using glass tubes and were killed by freezing in a refrigerator for 15 min. They were then decapitated and the head portion of each fly was rinsed several times with normal saline solution. Heads were fixed in a fixative agent consisting of 2.5% glutaraldehyde at 4°C for 24 h. The fixed specimens were then subjected to post-fixation in 1% osmium tetroxide and dehydrated in a graded alcohol series. This was followed by treatment in acetone and critical point drying. Finally, the heads were mounted on stubs, sputter-coated with gold, and viewed with a JEOL-JSM840A scanning electron microscope (Japan).

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The prestomal teeth are clearly seen toward the end of the proboscis when held in intermediate feeding position in *C. nigripes* (Fig. 1). In this position, the aperture of the food canal is visible between the proximal rows of prestomal teeth; but, while the pseudotracheae are everted, the aperture is not at the same level as the teeth. Comparative morphology of the prestomal teeth of *C. megacephala*, *C. rufifacies*, *C. nigripes*, *L. cuprina*, *P. dux* and *M. domestica* is shown in Figs. 2–7, respectively. Those of *C. megacephala*, *C. rufifacies*, *L. cuprina* and *P. dux* are all similar in appearance in having their tips sharply bifurcated (Figs. 2, 3, 5 and 6). However, the teeth of *C. megacephala* are much more deeply bifurcated than the other three species bearing bifurcated teeth (Fig. 2). This gives these teeth the appearance of being much sharper. In contrast, the tips of the prestomal teeth of *C. nigripes* are finely serrated with very shallow serrations (Fig. 4). The prestomal teeth of *M. domestica* are deeply serrated in comparison to *C. nigripes* (Fig. 7). Incidentally, no sexual differences in prestomal teeth were observed in the species examined in this study (data not shown).

Regarding bionomics of these flies, prestomal teeth help the flies acquire nutrients from various food sources, such as carbohydrates (from flowers, nectar, honeydew, and other sweet foods), as well as proteins (from carrion, corpses, and wounds). This has been documented in adult fly species such as *L. cuprina*, *C. megacephala* and *Wohlfahrtia magnifica* (Sarcophagidae) (Zumpt, 1965; Smith, 1985; Kettle, 1995; Byrd and Castner, 2001). As presented in this study, the morphology of the prestomal teeth of some calliphorids (*C. megacephala*, *C. rufifacies*, and *L. cuprina*) and a sarcophagid (*P. dux*) are quite similar to each other and are also in accordance with those of *Lucilia illustris* (Calliphoridae) and *Boettcherisca peregrina* (Sarcophagidae) that were reported by Iwasa (1983). Based on this characteristic among species, we may assume that the feeding behavior or food sources of these species are similar, and that their bifurcated prestomal teeth could serve them in their feeding accomplishments. Therefore, flies belonging to the same genus or family may have evolved different feeding behaviors based on changes in morphology of the prestomal teeth. On the other hand, flies in different genera or families may have similar feeding.

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**Fig. 1.** SEM micrograph of the labellar lobes of *Chrysomya nigripes* in ‘intermediate feeding position’ seen in ventral view. Aperture of food canal (A), pseudotracheae (P), prestomal teeth (PT). Scale bar = 100 μm.

**Fig. 2.** SEM micrograph of prestomal teeth of *Chrysomya megacephala*. Scale bar = 10 μm.

**Fig. 3.** SEM micrograph of prestomal teeth of *Chrysomya rufifacies*. Scale bar = 10 μm.

**Fig. 4.** SEM micrograph of prestomal teeth of *Chrysomya nigripes*. Scale bar = 10 μm.
behaviors based on retention of pleisiomorphic conditions of the morphology of this organ. The *C. nigripes* utilized in our study were reared from larvae that were collected from a corpse found in a mountainous area of Chiang Mai. This species has only been previously reported from several natural forested areas in Thailand, but not in urban or suburban areas (Tumrasvin et al., 1979). The morphology of the prestomal teeth of *C. nigripes* differs from all other species addressed in our study and may indicate a distinct biology and feeding behavior of *C. nigripes* in comparison to these others. However, information concerning the biomics of *C. nigripes* is limited and further studies concentrating on this fly species will be necessary in order to test this hypothesis.

Prestomal teeth have been reported as a crucial apparatus of muscoid flies that utilize a sponging proboscis for feeding (Greenberg, 1973; Kovacs et al., 1990). The role of prestomal teeth of *L. cuprina* could include causing lesions in sheep, since adults have been observed feeding at potential sites and then shuffling backwards (Kettle, 1995). When scraping a surface, blow flies could bring several prestomal teeth into action and effectively scarify something such as the eye surface or conjunctiva of an animal (Greenberg, 1973). CSIRO (1997) included some blow fly species (i.e. *C. rufifacies*, *Chrysomya varipes*, *Calliphora stygia*, *Calliphora nortic*, and *Calliphora augur*) as having prestomal teeth used as an apparatus to scrape surfaces, which sometimes resulted in the sensation of a 'bite' on an experimental rabbit. This may enable them to be contamination species, similar to the Australian bush fly, *Musca vetustissima*, that are capable of transmitting viruses.

There was no difference in morphology of the prestomal teeth of *M. domestica* in this study similar to those studied by Broce and Elzinga (1984). Based on these observations, the consumption of similar foods can be implied for both males and females. With regards to capacity for mechanical transfer of bacteria, both males and females of *C. megacephala* and *M. domestica* have been found not to significantly differ as mechanical carriers of bacterial organisms (Sukontason et al., 2003). According to the results of this present study, the prestomal teeth of the blow fly and flesh fly species described herein are supportive evidence of structures in these flies that may be involved in transmission of various pathogens, as previously reviewed by Greenberg (1973).

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**References**


