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Emergence time and period of chironomid midges occurring from an indoor drainage

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Abstract: Mass emergence of chironomid midges often leads to severe nuisance conditions in food industries. We tried to clarify the seasonal abundance and the emergence time of chironomids caught by a light traps in this industry. A total of 38,708 chironomids was collected during the study period, and the largest number of adult was recorded in fall. In addition, some chironomids were collected even in the winter. These results suggest that air temperature in winter at this industry is high enough for emergence of chironomids. As for emergence time, the number of chironomids increased around dawn and dusk, and decreased in the day and night. The results of the present study would be useful information for drafting plan to prevent outbreaks of nuisance midges from indoor sewage drain.

Keywords: Chironomidae - Adult midges , Seasonal abundance , Emergence time , indoor sewage drain

Introduction

The family Chironomidae contains more than 10,000 species and has worldwide distribution (Langton and Pinder 2007). Chironomid larvae are frequently the most abundant group of insects in freshwater environments (Pinder 1986), although a part of the species is terrestrial (Wiederholm 1989), and which play an important role in the transmission of nutrients along the food chain. Adult chironomids emerging from eutrophic lakes or polluted bodies of waters have become intolerable because their high densities are a severe nuisance and cause economic problems (Ali 1995; Tabaru et al. 1987). Especially, indoor adult midges stain furnishings, contaminate food or other industries and create distressful conditions (Ali 1995). Generally, chironomid midges invade the interior of buildings from the outdoor habitats (Kamimura 1999). In recent years, Tanikawa et al. (2009)

reported that chironomids also emerged from the indoor drainage.

In a certain food industry, mass emergence of the adult midges often leads to severe nuisance conditions. All materials attached to and caught in the drainage, e.g.leftover and organic detritus which would be food for larvae, were collected due to collect the emerging adults. In addition, swarming adults were collected by sweeping net in the industry. All adults were identified only one species, *Limnophyes* sp. (G. Kimura unpublished).

In the present study, we collected the chironomid midges emerged from an indoor sewage drain in the food factory to clarify the seasonal abundance and emerging time of the nuisance species.

Materials and methods

A certain food industry is located in Chiba City, Chiba Prefecture, Japan. Adult midges were collected by six light traps (Optclean OC-105, IKARI Corp., Tokyo, Japan) in the industry. Each trap was equipped with a 20-W black fluorescent lamp. The seasonal abundance of adult midges was monitored from 14 July to 15 August (32 days; summer), 14 October to 11 November (28 days; fall) in 2008, 16 January to 23 February (28 days; winter) and 20 April to 19 May (29 days; spring) in 2009. Each sampling carried out about one month. All traps were operated throughout the day, and the sticky sheets to capture adults were replaced each investigation period. The numbers of adult midges were counted under the binocular microscope in the laboratory.

Moreover, we also tried to clarify the emergence time of adult midges caught by a light trap (OptCounterFIS-003, IKARI Corp., Tokyo, Japan) in the industry. The trap was equipped with a 20-W black fluorescent lamp. Adult midges were collected from 0:00 to 23:59 (24 hours) on 24 August 2009. The numbers of adult midges were automatically counted during the investigation period.

All the data analyses were conducted using the software KyPlot 5.0 (KyensLab Inc., Tokyo, Japan).

Results and discussion

A total of 38,708 adult midges were collected throughout a year. Some other insects, especially Psychodidae, were also collected, although the abundance was negligible. The most abundant season was the fall (mean abundance; 86.5 ± 43.1 ind. trap^{-1} day^{-1}), followed by spring (68.1 ± 11.4 ind. trap^{-1} day^{-1}), summer (56.6 ± 16.9 ind. trap^{-1} day^{-1}) (Fig 1). In addition, some adult midges were also collected in winter (11.4 ± 5.5 ind. trap^{-1} day^{-1}). However, there are significant difference in the mean daily abundance between the winter and other seasons ($p < 0.05$, Steel-Dwass test). Thermal conditions are fundamental factors which determine the flying activity, larval development, emergence period and number of generations per year that govern the seasonality of insects (Gullan and Cranston 1994). Except some Orthocladiinae species, adult midges are not collected by light trap in winter outdoor (e.g., Sasa and Nishino 1995; Tanaka et al. 2003). Our results suggest that air temperature in winter at this industry is high enough for emergence of chironomid midges.

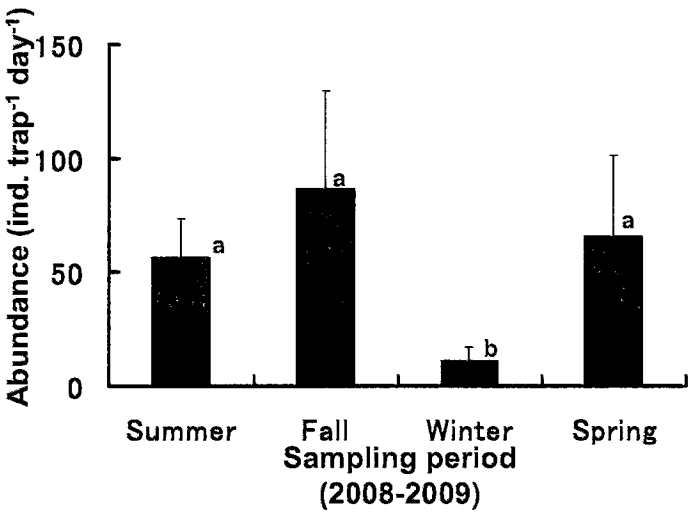

Figure 1. Seasonal abundance of adult midges in a food industry. a, b: Differences between the seasons were significant ($n = 6$, $p < 0.05$, Steel-Dwass test).

In the study of emergence time, a total of 121 adult midges were collected throughout a day. The number of adults was strikingly large around dawn (sunrise time: 5:5) and dusk (sunset time: 18:18) (National Astronomical Observatory of Japan 2009), and was small in the day and night in terms of individuals (Fig 2). Environmental

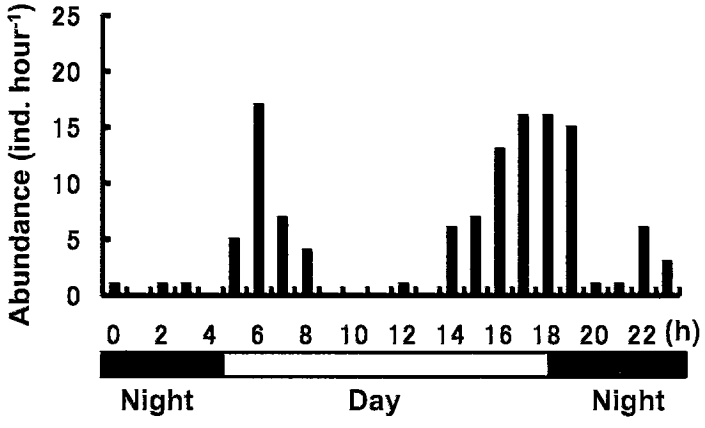

Figure 2. Emergence pattern of adult midges in a food industry.

cues for the timing of emergence have been attributed to changes in light intensity (Armitage 1995). In addition, Kawai et al. (2002) reported that numbers of *Limnophyes minimus* were collected from midnight to dawn. The results of the present study are in agreement with the previous results. However, seasonal differences in the timing of emergence peaks have also been observed in lotic chironomid midges (Coffman 1974). Since the present study was carried out throughout only one day, determines the emergence pattern for this species should be clarified by conscientious seasonal studies with the accurate measurement of environmental factors. These results expect to be useful information for drafting plan to prevent outbreaks of nuisance midges from indoor sewage drain.

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