

Two types of male feeding behavior in the horned beetle *Trypoxylus dichotomus septentrionalis* (Coleoptera: Scarabaeidae)

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Abstract Males of *Trypoxylus dichotomus septentrionalis* show 2 types of feeding behavior, namely feeding behavior with hindleg-swinging behavior and feeding behavior without hindleg-swinging behavior. I kept males and females together in small containers and observed these 2 types of male feeding behavior. When females were absent at feeding sites, males showed both types of feeding behavior nearly equally, that is, at random. In hindleg-swinging behavior, males shook off urine from their abdomens. The urine sometimes fell on females, but they showed no reaction. When showing hindleg-swinging behavior, males sometimes attacked females and kept the females away from the feeding sites. When not showing hindleg-swinging behavior, males did not attack females, who fed together. Hindleg-swinging behavior may be related to fight for food rather than pheromone emission toward females.

Introduction

Males of *Trypoxylus dichotomus septentrionalis* (KONO) often swing their hindlegs in feeding at sap sites. This behavior was first documented by IGUCHI (1997) as “hindleg-swinging behavior” (Fig. 1). Later, HAMANISHI & MIYAKE (1998) observed that males shook off urine from their abdomen by this behavior, and suggested that this behavior might be related to the emission of pheromone.

My recent experiment on this beetle revealed that when showing hindleg-swinging behavior, even small males were more aggressive than usual (IGUCHI, 2001). Through this experiment, I observed two types of male feeding behavior, namely feeding type with hindleg-swinging behavior and feeding type without hindleg-swinging behavior. However, I did not discuss why males show these two types of feeding behavior. In the present study, I observed males and

females feeding at sap sites under laboratory conditions and examined the influence of the two types of male feeding behavior on female behavior. In this paper, I discuss whether male hindleg-swinging behavior is closely related to pheromone emission or intraspecific fight for food.

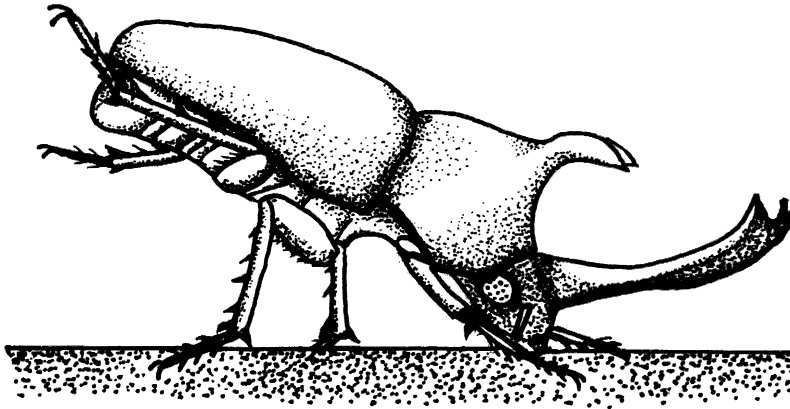


Fig. 1. Lateral view of a male *Trypoxylus dichotomus septentrionalis* showing hindleg swinging behavior.

Materials and Methods

Seven transparent plastic boxes (20 cm × 12.5 cm × 12 cm deep) filled with moist humus to a depth of 2 cm were used as cages for this experiment. A wood block was put in each box, and jelly consisting mainly of brown sugar was put as food on the top of the wood block. A virgin male and a virgin female were then put in each box.

All the boxes were placed in a room where light and temperature fluctuated in room condition. Observations were made at 0, 3, 6, 9, 12, 15, 18 and 21 o'clock and the number of males showing each type of feeding behavior and the number of females feeding were recorded. Observations at night were made under an artificial light of 10–20 lux. Each experiment was carried out for 8 days. After the 1st day, food was added between 0:00 and 0:30.

Results and Discussion

As shown in Table 1, males showed both types of feeding behavior more frequently when females were absent at feeding sites than present. This difference was highly significant for both types of feeding behavior (Binomial test, $P < 0.0001$ for both types). This result was consistent with the observation

of HAMANISHI & MIYAKE (1998). However, the important point in the present study was that when females were absent at feeding sites, males showed both types of feeding behavior nearly equally (Binomial test, $P > 0.8$). That is, both types happened at random despite the fact that males and females coexisted in the small containers. In this situation, urine splashed by male hindleg-swinging behavior sometimes happened to fall on females. Nevertheless they showed no reaction. These results suggest that hindleg-swinging behavior may not be pheromone-emitting behavior to attract females. In hindleg-swinging behavior, males were so aggressive that they sometimes attacked females and kept the females away from the feeding sites. Therefore, hindleg-swinging behavior may be related to fight for food rather than pheromone emission toward females. HAMANISHI & MIYAKE (1998) observed that when two or more males were feeding together, they showed hindleg-swinging behavior more frequently. Their observation may also suggest the connection between hindleg-swinging behavior and male fight for food. However, there is no statistical data to prove this connection at present.

Table 1. Frequency of two types of male feeding behavior observed when females were present at the feeding sites and when females were absent there.

	Females	
	present	absent
Male feeding type		
with hindleg-swinging behavior	2	52
without hindleg-swinging behavior	14	55

In the present study, males frequently courted females feeding. As shown in Table 1, when females were present at feeding sites, males fed without hindleg-swinging behavior more frequently than with hindleg-swinging behavior (Binomial test, $P < 0.005$). As pointed out by OBATA & HIDAKA (1983), males were not aggressive toward females feeding motionlessly. In the present study, therefore, males may rarely have shown hindleg-swinging behavior toward females feeding. I repeatedly observed that males did not show hindleg-swinging behavior while courting females. This means that hindleg-swinging behavior is not included in the sequence of male courtship behavior as described by IGUCHI (1996).

要 約

井口豊：カブトムシ雄における2種類の摂食行動 —— カブトムシ雄は2種類の摂食行動を示す。すなわち、後脚振行動を伴う場合と伴わない場合である。本研究では7個の小型容器で雄雌1ペアずつ飼育し、雄の2種類の摂食行動と雌の摂食行動の関連を調べた。その結果、小型容器に雄雌が共存しているにも関わらず、雌が餌場にはいない時、雄は2種類の摂食行動をほぼ等しく示した。後脚振行動の時、雄は尿を振り払い、それが時々雌にかかったが、雌は何の反応も示さなかった。これらのことから、後脚振行動はカブトムシ雌を引き寄せるフェロモン散布行動ではないと推察された。後脚振行動の時、雄は雌を攻撃し餌場から排除することがあった。後脚振行動は雌に対するフェロモン散布行動というよりも、むしろ餌をめぐる闘争行動と関連があるかもしれない。雌が餌場にいる時、後脚振行動を伴う摂食行動は、後脚振行動を伴わない摂食行動ほど頻繁には現れなかった。これは、静止して摂食している雌を雄が攻撃しないことと関連があるのかもしれない。

References

- HAMANISHI, Y. & MIYAKE, S., 1988. *Allomyrina dichotoma septentrionalis* shaking off urine-like liquid by its hindlegs (Abstract). *The 58th annual meeting of the Entomological Society of Japan*: 105. (In Japanese.)
- IGUCHI, Y., 1996. Sexual behavior of the horned beetle *Allomyrina dichotoma septentrionalis* (Coleoptera, Scarabaeidae) in the artificial condition. *Jpn. J. Entomol.*, **64**: 870–875.
- , 1997. Hind-leg swinging of the horned beetle *Allomyrina dichotoma septentrionalis* (Coleoptera, Scarabaeidae) in feeding. *Jpn. J. Entomol.*, **65**: 73–74.
- , 2001. Differences in the frequency of fights between minor and major males in the horned beetle *Trypoxylus dichotomus septentrionalis* (Coleoptera: Scarabaeidae). *Ent. Rev. Japan*, **56**: 11–14.
- OBATA, S. & T. HIDAKA, 1983. Recognition of opponent and mate in Japanese horned beetle, *Allomyrina dichotoma* L. (Coleoptera, Scarabaeidae). *Kontyu*, **51**: 534–538.