Male trimorphism in the horned beetle *Allomyrina dichotoma* septentrionalis (Coleoptera, Scarabaeidae)

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Abstract: I reared larvae of the honed beetle Allomyrina dichotoma septentrionalis (Kono) under an experimental condition and measured the horn length and body length of male adults obtained from those larvae. The allometric relationship between horn length and body length showed that the males were divided into three groups; namely, small, medium, and large males. However, the frequency distribution of horn sizes was bimodal presumably due to the small horn sizes of the males treated here.

Key words: *Allomyrina dichotoma septentrionalis*, horned beetle, dimorphism, trimorphism, allometry.

カブトムシのオスの 3 型について

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Introduction

Males of *Allomyrina dichotoma septentrionalis* (Kono) usually show morphological dimorphism and the frequency distribution of male horn sizes in this beetle is clearly bimoda1. Therefore, males of this species are divided into two morphs based on horn size, minors and majors (Siva-Jothy, 1987; Iguchi, 1998). However, Siva-Jothy (1987) pointed out the possibility of the trimodality of male horn sizes in this beetle. It is still unclear whether males of this beetle show morphological trimorphism. Therefore, it is important to gather information on the size distribution of this beetle. In this paper, I report an example of male trimorphism.

Materials and Methods

For this study, 71 final instars were collected in the soil (5m × 5m × 0.5m deep) near a forest of assorted trees in the western part of Tatsuno-machi, Kamiina-gun, Nagano Prefecture on 6 June 1999. The soil was dark, soft, moist humus that contained many chips of decayed wood. Each larva was reared in a glass bottle (9cm in diameter and 16cm in height) filled with the soil (12cm deep) in which the larva had lived. The bottle was covered with a metallic lid. All the bottles were placed together outdoors in Okaya City, Nagano Prefecture. Throughout this study, no more humus or soil was added, but water was sprinkled to keep the soil moist.

In this rearing experiment, 30 males and 34 females emerged. For the present study, however, only the males were used. For each male, the length of the head horn and the length of the body excluding the horns were measured to 0. 1mm with a slide caliper.

Results and discussion

On the basis of the allometric relationship between horn length and body length (Fig. 1), the males were divided into three groups; namely, small, medium, and large males. In some dimorphic beetles, such an allometric relationship is often sigmoidal (e.g. Eberhard, 1987; Rasmussen, 1994; Emlen, l996). In the present study, however, the males showed no clear sigmoidal allometric relationship. This is consistent with the field observation of Siva-Jothy (1987). In the present study, the allometric relationship between horn length and body length was discontinuous (Fig. 1). There is no previous report of such a discontinuous allometric pattern in this beetle. This discontinuous allometric pattern may be related to differences in the level of larval nutrition, because the male dimorphism of this beetle is affected by larval nutrition (Iguchi, 1998; Fujiyama & Konno, 1999). To discuss the trimorphism of this beetle, it is necessary to get further information on various allometric patterns in this beetle.

Although the males were divided into three groups in the allometric relationship (Fig. 1), the frequency distribution of horn length was bimodal (Fig.

2). However, Siva-Jothy (1987) showed that the horn size distribution of males collected in the field was trimodal rather than bimodal. This may be due to the differences in horn size between the male populations treated in these two studies. In fact, the male horns in this study (range: 4-14mm in length) were considerably smaller than those in Siva-Jothy (1987) (range: 6-33mm in length). Therefore, the size distribution of the horns in this study may have been bimodal rather than bimodal.

要　約

カブトムシの幼虫が飼育され，そこから得られた♂成虫の角長と体長が測定された．角長と体長のアロメトリーから，♂は3グループ（大型，中型，小型）に分けられた．しかしながら，角長の頻度分布は2山型だった．角長の頻度分布が3山型にならなかったのは，角長が全体的に小さかったためと思われる．

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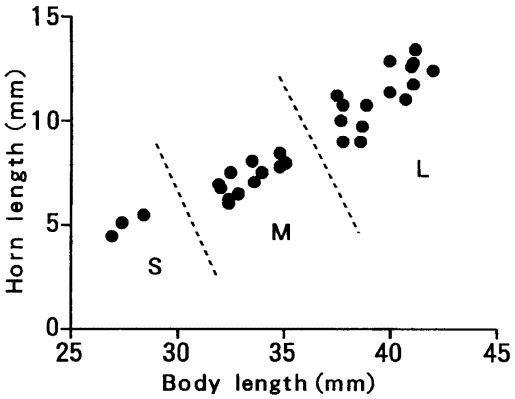

Fig. 1. Allometric relationship between horn length and body length for 30 males obtained from a rearing experiment. The males were divided into three groups; namely, small (S), medium (M) and large (L) males.

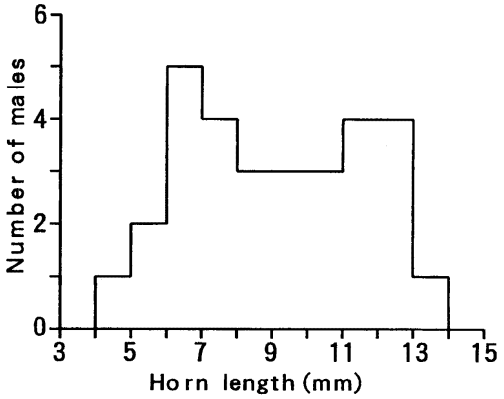

Fig. 2. Frequency distribution of horn length for 30 males obtained from a rearing experiment.