‘PREDATOR-FOOLHARDINESS’ IN AN EPIDEMIC CICADA POPULATION

Masaaki Nagamine* and Yosiaki Itô**

* Okinawa Agricultural Experiment Station, Naha 903, Japan
** Laboratory of Applied Entomology and Nematology, School of Agriculture, Nagoya University, Nagoya 464, Japan

INTRODUCTION

Lloyd and Dybas (1966a, 1966b), discussing the evolution of the periodical cicadas (Magicicada spp.), remarked that the adults of these species are far easier to be captured at the time of their outbreaks than non-periodical cicadas, not only by men but also by birds which flock to prey upon these. This phenomenon, ‘predator-foolhardiness’ (Lloyd and Dybas, 1966b), can be resulted from two mechanisms; the first is the evolutionary loss of behavioural trait to escape from bird predation due to high survival rate at periodical peaks when any birds should have satiated to prey on cicadas, and the second is the effect of massive chorus which suppress the manifestation of escape behaviour.

Mogannia minuta Matsumura (formerly Mogannia iwasakii Matsumura) is a cicada which reached an epidemic status in sugarcane fields of the Okinawa Island (Itô and Nagamine, 1974; Nagamine et al., 1975). In the heavily infested area, where more than 300 adults emerge per 1 m² of a sugarcane field, their massive chorus is so noisy that farmers cannot communicate each other in fields unless they cry aloud. Cicadas in such a field can be captured by hands very easily; sometimes they don’t fly away even when we touch them. Thus we carried out field experiments to determine whether this behaviour is due to genetic differentiation through long-continued outbreak or not.

MATERIALS AND METHODS

Sugarcane fields which lie near the centre of the heavily infested (outbreak) area (Azama) and in the peripheral zone (Umino) between the infested and uninfested areas were selected for the study. Distance between two areas was ca 2.5 km. Two persons, walking along rows of sugarcane, tried to capture the cicadas found on sugarcane plants by hands for a given time. Numbers of successful and failed (escaped) trials were recorded by the third person. In 1975, two fields from the outbreak area and three from the peripheral zone were examined while, in 1976, three fields were selected from each of the two localities. Capturing trials were carried out for 8

1 The work was supported in part by Grant-in-Aid No. 439017 from the Ministry of Education, Science and Culture.
Fig. 1. Relationship between cicada density and rate of failed trials (escape) of hand-capturing. Density is expressed by the number of trials (successful and failed, males and females combined) per 8 minutes (1975) and 10 minutes (1976). Hollow circles mean males and solid circles females.

minutes in 1975 and 10 minutes in 1976 when the weather was shine and cicadas were singing actively.

RESULTS AND DISCUSSION

Fig. 1 shows the results of experiments. Here the relative density of cicadas was expressed by the number of trials (both of the successful and failed) made for a given time, that is, the number of cicadas found during an experiment. It is clear that the rate of failure to catch males was significantly lower in the outbreak area than in the peripheral zone (see Table 1). In the outbreak area, nearly 90 percent of males found could be captured by hands. On the other hand, there was no relationship for females between the rate of failure and the population density. The rate of failure was high in both of two areas.

The microgeographical distribution of this cicada is unique, that is, the population density suddenly rises from zero to an enormously high level with a narrow transient zone (Itô and Nagamine, 1974). The cicadas can move frequently across the intermediate zone as the width was only ca 500 m (Notwithstanding this, the expansion of distribution range was remarkably slow. See Itô and Nagamine, 1974). Thus the observed difference in the rates of escape in males between both the areas can not be