THE DEVELOPMENT OF SOLDIERS IN INCIPIENT COLONIES OF MASTOTERMES DARWINIENSIS FROGGATT (ISOPTERA)

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SUMMARY

The first soldiers produced in incipient colonies of Mastotermes darwiniensis are in the sixth instar, and have a relatively narrow head and long, slender mandibles with an elongate apical tooth and a reduced first marginal tooth. Soldiers from older colonies headed by primary reproductives develop from pseudergates of later instars, and the later the instar, the shorter the mandible and the broader the head. Data on the largest soldiers from laboratory colonies, with 21-22 segmented antennae, intergrade with data from small soldiers collected in the field, but the patterns of mandibular allometry appear to differ in the two groups of soldiers. The differences among soldiers are interpreted in terms of juvenile hormone and a maturation pheromone produced by the primary reproductives.

RÉSUMÉ

Le développement des soldats dans les colonies naissantes de Mastotermes darwiniensis Froggatt (Isoptera)

Dans les colonies naissantes de Mastotermes darwiniensis, les premiers soldats appartiennent au sixième stade. Ils ont la tête assez étroite. Leurs mandibules sont longues et minces; la dent apicale est allongée et la première dent marginale est réduite. Dans des colonies plus âgées où les reproducteurs fonctionnels sont des sexués imaginaux, les soldats se développent à partir de pseudergates de stades plus avancés, et plus le stade est avancé, plus les soldats ont les mandibules courtes et la tête large. Les données établies à partir de grands soldats obtenus en laboratoire (21-22 articles antennaires) sont en bonne continuité avec celles établies sur des soldats avec 21-22 articles antennaires récoltés dans la nature. Les soldats des stades précoces semblent cependant présenter des coefficients d'allométrie légèrement différents de ceux des stades plus avancés. Les différences entre les soldats sont interprétées par l'action conjuguée de l'hormone juvénile et d'une phéromone de maturation produite par les reproducteurs primaires.
INTRODUCTION

The first soldiers produced in incipient colonies of termites, and those from small but established colonies (« nanitic » soldiers), are commonly smaller than soldiers from large, mature colonies. There may also be differences in form, but in kalotermitids, termopsids, rhinotermitids and termitids, these appear to be minor when compared with differences in size (Kalshoven, 1930; Castle, 1934; Pickens, 1934; Light and Weesner, 1955; Noirot, 1955). In the lower termites, the differences in size and form have been attributed to differences in the instar from which the soldiers have arisen, while in at least some termitids, nanitic soldiers can belong to the same instar as soldiers from mature colonies (Light and Weesner, 1955; Noirot, 1969).

Studies on the development of Mastotermes darwiniensis in incipient and mature colonies have shown that as in other termites, the soldiers develop from pseudergates through a presoldier stage; but the first soldiers in incipient colonies are very different in form from those found in mature colonies in the field (Watson, 1971; Gay and Watson, 1974; Watson and Metcalf, 1974). There is, however, relatively little difference in size.

This paper documents the morphological differences between the nanitic soldiers of Mastotermes and their mature counterparts, and examines the development and origin of soldiers in colonies of different ages.

PROCEDURES

Incipient colonies of Mastotermes were set up from alates collected in Darwin, N. T. in November 1971 and November 1972, and in Townsville, Qld, in December 1971, as described in Watson and Metcalf (1974). The colonies were maintained in Canberra at a constant temperature of 32 °C, the optimal temperature for incipient colonies of Mastotermes (Watson and Metcalf, 1974), in 9 cm petri dishes or larger containers. All incipient colonies retained their primary reproductives throughout. After two years, the largest colonies numbered up to 1,200 individuals. Some additional soldiers were provided from cultures established by C. D. Howick and M. Lenz, at the C.S.I.R.O. Forest Products Laboratory, Melbourne, from alates collected in Townsville in December 1972.

Soldiers from mature colonies were selected from material preserved in the Australian National Insect Collection, Canberra. All of this material had been collected in the field, but we have no data on the sizes of the colonies from which it was obtained.

Five measurements were made on each soldier:

1. Length of head—measured in the midline from the anterior edge of the frons to the posterior margin of the head capsule.
2. Maximum width of head.
3. Length of left mandible—measured from the tip to the outer posterior margin.
4. Distance from the tip of the left mandible to the tip of the left first marginal tooth.
5. Number of antennal segments.

Two ratios were calculated from these measurements, that between the length of the mandible and the length of the head, and the ratio between the length and width of the head capsule.