

SHORT COMMUNICATION

SEX DETERMINATION IN BEES. XXIII. BROOD OF A LAYING QUEEN TREATED WITH JUVENILE HORMONE III

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ABSTRACT

A laying queen of *Melipona compressipes fasciculata* was treated for a total of 9 days with 28 doses of 2.2 μg Juvenile Hormone III dissolved in 1 μl acetone solution. Within 8 days the queen laid 77 eggs, 34 of which aborted due to manipulation. Twenty five pupae were counted and found to be composed of 20 workers and 5 queens. Indications are that Juvenile Hormone III applied to the laying queen has no effect on caste determination. The hypothesis raised by Kerr (Anais do 3^o Congresso Brasileiro de Apicultura, Piracicaba, SP, 1974, pp. 179-187; Genetics 795: 73-74, 1975) thus far is the most plausible.

INTRODUCTION

Passera (1982) demonstrated the action of Juvenile Hormone (JH) in bringing about sexual larvae in ants. The stages which are sensitive to JH vary according to the species. *Pheidole pallidula* is sensitive at the end of oogenesis; in *Solenopsis invicta*, first-stage larvae react with JH, and in *Myrmica rubra* last larval stages are sensitive. In *Melipona*, the stage sensitive to JH is the larva that is beginning to spin the cocoon (Kerr *et al.*, 1975; Campos, 1975; Campos *et al.*, 1975; Velthuis and Velthuis-Kluppel, 1975). The genetical interpretation is that JH turns on the female determining genes (Kerr 1974a, 1975; Kerr *et al.*, 1975; Campos, 1978; Bonetti, 1982).

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The objective of this research was to determine if application of JH to a laying *Melipona* queen has any effect on the frequency of virgin queens in her offspring through a hypothetical effect on the eggs, since this was found to be the case in *Pheidole pallidula* (Passera, 1982).

MATERIAL AND METHODS

This is a short note on the direct application of JH to the abdomen of a queen of one species (*Melipona compressipes fasciculata*) of Meliponini (Apidae). A sample each of eleven colonies headed by untreated queens of the same species was used as control (see Table I) to determine whether treatment induced a significant increase in the production of queens. Owing to the variation occurring in the biology of *Melipona* bees, we suggest that similar experiments be conducted with other species.

Table I - Number of workers and queens counted in 11 samples of colonies headed by untreated queens.

Colony	Workers	Queens	% queens
L 73-2-83	30	5	14.3
C 81-1-83	26	9	25.7
C 80-2-83	10	5	33.3
C 83-1-83	25	7	21.9
C 82-1-83	49	9	15.5
L 75-1-82	22	5	18.5
C 85-1-83	31	7	18.4
O 88-2-83	23	5	17.9
C 90-1-84	25	5	16.7
PN 89-2-87	13	4	23.5
Q 135-2-87	22	5	18.5
Total	276	66	19.3

The colony was housed in an experimental observation hive composed of an outer 48 x 45 x 12 cm wood box and an inner 34 x 32 x 8 cm box covered with glass, and both covered with a 5 cm thick styrofoam sheet. The inner box of this observation hive contained a *Melipona* colony whose queen (no. 081-2-83) was born on July 5, 1984. The present experiment, with controlled egg laying, was started on July 14, 1985. All brood cells with eggs and larvae were removed, leaving only the pupae. Three

brood combs with emerging brood from another hive (queen V23-01-83) were added to the colony.

Juvenile hormone III was applied according to the following schedule. Each application consisted of 0.2 μg JH III in 1 μl of acetone solution:

August 22, 1985: 1 application at 15:00 h.

August 23, 1985: applications at 10:05, 15:10 and 18:10 h.

August 24, 1985: 1 application at 18:40 h.

August 26, 1985: applications at 9:40, 11:50 and 18:20 h.

August 28, 1985: applications at 12:00, 14:50, 18:00, 18:10, 18:20 and 19:50 h.

August 29, 1985: applications at 10:15, 10:45, 17:45, 18:30 and 18:35 h.

August 30, 1985: applications at 18:20, 18:30, 18:35, 18:45, 19:00, 19:20 and 19:25. Five cells were opened and the contents were removed by the bees.

August 31, 1985: applications at 18:55 and 17:10.

When the colony was examined on September 4 and 5, the queen was no longer visible. On September 6, a new queen (no. 081-03-85) was observed. This queen began egg-laying on September 13 and laid 10 eggs in the experimental combs. The two experimental combs were transferred to hive R-205, and on September 17 we found that there were less than 40 cells left in hive R-205.

RESULTS AND DISCUSSION

On October 1st, 1985, the two brood combs containing the cells with eggs laid by the treated queen were opened and the castes of the pupae were determined. These pupae had white, rose, and red eyes, i.e. they were 34 to 40 days old (the prepupae were 31 to 33 days old).

The lower comb had 34 sealed cells and 13 empty cells (cells opened and emptied by the workers) and the upper one had 9 cells and 21 empty cells. The upper comb had only spinning larvae. The lower comb cells contained 20 workers, 5 queens, zero males and 9 larvae.

The 20 workers and 5 queens were in agreement with the expected segregation of 3/4 queens to 1/4 workers ($\chi^2 = 0.33$, $P = 0.43$) and did not differ from the control (Table I). The dosage of JH III may have been too high since it killed the queen after 28 applications of 0.2 μg .

The opening of cells usually occurs with repeated handling and this may explain why 70% of the cells in the upper comb were empty in contrast to only 28% in the lower comb, which was protected by the upper one from mismanagement.

The conclusion of this experiment is that application of JH III to a laying queen had no impact on caste determination in *Melipona compressipes*. The hypothesis of Kerr (1974b, 1975) thus far is the only one that explains all the available evidence.

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RESUMO

Uma rainha de tiuba (*Melipona compressipes fasciculata*) foi tratada com 28 doses de 0.2 µg de Hormônio Juvenil III dissolvidos em 1 µl de acetona, por 9 dias consecutivos. Ela pôs 77 ovos dos quais 34 abortaram devido a excessivo manejo da colônia.

De 25 pupas examinadas 20 eram operárias e 5 rainhas, o que nos indica que Hormônio Juvenil III aplicado a uma rainha não afeta a segregação das castas.

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