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SURVIVAL OF DRONES FOLLOWING EVERSION(1)

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ABSTRACT

Time was measured between eversion and death of 30 drones, the mean being 92.4 minutes ; (range, 0-198 minutes ; S. D., 51.52). Half of the drones defecated prior to eversion, and 29 everted only partially. Eleven techniques for causing eversion in drones are listed.

INTRODUCTION

Many authors have published excellent descriptions of the male genitalïa of the honeybee, but to the writer's knowledge there has never been any statistical study done of the amount of time that elapses between the time a drone everts his endophallus and the time he dies. Every writer seems to have his own opinion, although the general concensus (e.g., CAIRD, 1935 ; SNELGROVE, 1935 ; LATHAM, 1949) seems to be that the drone dies immediately upon eversion. However, BISHOP (1920) stated that several hours may elapse ; GABELEIN (1955) gave 30 minutes as the figure, while O'BRIAN (1957) implied that several minutes were necessary. The purpose of this paper, therefore, is to settle this seeming discrepancy.

MATERIALS AND METHODS

Thirty *Italian* drones from the same colony were used in this experiment. WOYKE (1957) stated that drones which are leaving the hive evert more readily than those which are returning. Accordingly, the writer placed the queen and drone trap so that only outgoing drones were captured. A

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pinch of the abdomen caused all drones to evert their endophallus. (Three drones everted merely upon being handled.) After eversion, drones were placed individually in openmouth jars, and the time was noted on paper attached to each jar. Jars were inspected every 1-2 minutes, and the time was noted for any drones which were dead (1).

RESULTS

Frequency Distribution

Time from eversion to death, in minutes	Number of drones dying
0 (immediate death)	5
1-30	0
31-60	4
61-90	7
91-120	3
121-150	4
151-180	5
181-210	2
	Total 30

Range, 0-198 minutes.
Modal class interval, 61-90 minutes.
Modal score, 0 minutes.
Median, 88.5 minutes.
Mean, 92.4 minutes (S. D., 51.52).

Only one drone out of the 30 everted completely. This drone, oddly enough, did not die until 3 hours and 8 minutes later. Half of the drones defecated before eversion-which may well have been anticipated, since only outgoing drones were used. The mean time from eversion to death of drones which defecated was 84.7 minutes (S. D., 54.88), as compared with 100.1 minutes (S. D., 65.78) for those which did not.

Some drones became very active after eversion ; one such drone even flew out of his jar to the light. In most cases, however, they became paralysed, or partially so, immediately after eversion, but regained some of their activity within a few minutes. Two of the 3 drones which everted merely upon being handled were among the 5 which died immediately.

DISCUSSION

The fact that most drones became paralysed, or partially so immediately after eversion could in itself account for discrepancies in the literature, as cited above ;

(1) Death was judged on the ability to move. A drone was considered alive if any part of his body could be observed or stimulated to move, even slighlty.

paralysed drones could easily be mistaken for dead ones. It may be that drones induced to evert by pinching take longer to die than those induced to do so by means of some other stimulus ; the writer's last observation warrants this suspicion.

Techniques available for eliciting the eversion response are many. The wide range of response in the writer's experiment warrant further investigation utilizing other techniques. A survey of the literature revealed the following 11 methods of inducing drones to evert.

1. Merely touching them when they are hot and mature (MORISON and BLACKSHAW, 1951).
2. Application of sudden slight pressure by the fingers to the sides of the abdomen (BISHOP, 1920 ; LAIDLAW, 1934).
3. Allowing them to fly to a bright window, warming them to 40°C, then applying sudden slight pressure to the abdomen (BISHOP, 1920).
4. Allowing drones free use of their wings, during which a slight rubbing movement is given them (CAIRD, 1935).
5. Tickling (KURENNOI, 1954).
6. Electrical stimulation (MORISON and BLACKSHAW, 1951).
7. Injection of weak acids (BISHOP, 1920).
8. Decapitation (BISHOP, 1920 ; LAIDLAW, 1934).
9. Squeezing the head (DEMIANOWICZ, 1957).
10. Use of chloroform fumes (MILLEN, 1939 ; HAYDAK, 1957).
11. Attraction of drones to tethered queens suspended in the air (GARY, 1963).

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RÉSUMÉ

SURVIE DES MALES APRÈS L'ÉVERSION DE L'ENDOPHALLUS

Trente mâles *Italiens* provenant d'une même colonie ont servi pour cette expérience. Un simple pincement de l'abdomen provoquait l'éversion de l'endophallus. Le temps écoulé entre l'éversion et la mort de l'insecte allait de 0 à 198 minutes, la moyenne étant 92,4 minutes. 50 p. 100 des mâles ont déféqué avant l'éversion. La plupart restent paralysés un instant puis reprennent leur activité. L'auteur énumère 11 méthodes différentes pour provoquer l'éversion chez les mâles.

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