

University of Florida Book of Insect Records

Chapter 8 *Most Spectacular Mating*

DOUG SIEGLAFF

*Department of Entomology & Nematology
University of Florida, Gainesville, Florida 32611-0620*

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*The extensively cultivated insect, *Apis mellifera* is judged to have the most spectacular mating because a “comet” of drones pursues the female with the winner forfeiting a portion of his phallus at the end of coitus and dying soon thereafter (Woyke & Ruttner 1958, Winston 1987).*

Copulation in the honey bee usually occurs above ground in flight (Gary 1963). Consequently, many of the observations of the mating process have been accomplished through manipulation of the queen and/or drone [ie— Woyke and Ruttner 1958, Gary 1963, Koeniger et al. 1979].

The queen is pursued by a large swarm of drones, “drone comets,” where copulation occurs (Winston 1987). Insemination ends with the eventual death of the drone, and the queen receiving the “mating sign” (Woyke and Ruttner 1958, Winston 1987). The queen mates multiple times but the drone inevitably only once (Gary 1963, Starr 1984, Winston 1987). The aforementioned features warrant my designation of it being the most spectacular mating among insects.

Methods

An initial search was performed on Agricola. The more useful resources were personal communication with faculty members of the University of Florida, review books about animal and/or insect mating, journal articles on the reproductive behavior of *Apis mellifera*, and correspondence with individuals on the Internet.

Results

Copulation occurs on the wing, within a drone

congregation site 15-30 m above ground (Gary 1963). An aggregation of drones “lazily” fly within their congregation site awaiting the arrival of a queen, and once she appears a fast-paced chase commences where copulation is attempted (Winston 1987). The term “drone comets” visually describe the continual consolidation and disassembly of this following drone swarm (Winston 1987). Koeniger et al. (1979), utilizing a tethered queen, report that the drone clasps the queen in a dorso-ventral position and everts his endophallus directly into the queen’s sting chamber. The drone then becomes “paralysed” and falls backwards (Koeniger et al. 1979). Woyke and Ruttner (1958) state the eversion of the endophallus occurs from haemostatic pressure caused by abdominal muscles. Ejaculation occurs into the bulb portion of the drone’s endophallus prior to full eversion, and semen is discharged through a small opening in the bulb into the queen’s vagina during copulation (Woyke and Ruttner 1958). Winston (1987) figuratively asserts that the drones “explode” their semen into the queen’s copulatory orifice, and consequently toward her oviduct. Through subsequent pressure the bow of the bulb and chitinized plates, the “mating sign,” detaches from the endophallus of the drone and remains inside the queen (Woyke and Ruttner 1958). Winston (1987) concludes this may help thwart the flow of sperm from the queen’s vagina after copulation, and that it does not function as a “mating plug” used to discourage multiple matings. After the pair separate the endophallus is still fully everted with its associated strong pressure, and with loss of the “mat-

ing plug” the endophallus may burst at the tip (Woyke & Ruttner 1958). At the end of copulation, the drone falls to the ground and dies either in minutes or hours (Woyke and Ruttner 1958, Winston 1987).

Woyke (1962) calculated that a single drone on average contains 1/8 to 1/9 the semen required to fill the queen’s spermatheca. The average number of times a queen mates has been reported to be from 7-10 (Woyke 1962) and up to 17.25 (Adams et al. 1977). Sperm mixing occurs within the queen’s spermatheca, and comparable spermatozoa representation of all mates follows at fluctuating intervals (Laidlaw and Page 1984), leading to a low average relatedness among the worker caste [ie- potentially 0.25] (Page and Metcalf 1982, Laidlaw and Page 1984).

Discussion

The conditions intrinsic to the mating process of *A. mellifera*, whether it be the death of the drone or the decrease in relatedness among the sterile caste, obviously is to the betterment of the queen and unfortunate to the effected. However, the possible prevention of sperm flow out of the vagina after copulation (Winston 1987) would be to the advantage of the drone, and given the alternatives of mating or not mating, the former should most definitely be chosen—at least if the drone’s genes are in control!

The properties of the drone comet, partial phallus detachment and the resultant death of the drone warrant its title of the most spectacular mating.

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