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A scientific note on the drone flight time of *Apis mellifera*
capensis and *A. m. scutellata*

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Honeybee drones go on mating flights during a species-specific period of the day. During this period, drones leave the colony and fly to drone congregation areas where they may mate with visiting queens (Koeniger et al. 2005). Honeybee queens mate multiply, are all of a similar size and secrete the same sex attractant pheromone, 9-ODA (Koeniger and Koeniger 2000). Thus, in areas where different honeybee species occur in sympatry, the potential for interspecific mating is high. Where more than one species (Koeniger et al. 1994; Hadisoesilo and Otis 1996) or subspecies (Koeniger et al. 1989) inhabits the same area, mating times tend to be offset such that there is no overlap of mating flights of the different species. The drone flight time may vary across the range of a species in response to the presence of heterospecifics. For example, the drone flight time of *Apis cerana* in Japan (where it is the only native *Apis* species present) extends from 1300 h to 1700 h (Yoshida et al. 1994). In Sri Lanka however, where multiple species co-occur, the drone flight time of *A. cerana* is truncated, with flights only occurring between 1530 and 1730h (Koeniger and Wijayagunsekera 1976). This shift in flight time may be an adaptive response to the prevention of interspecific matings. Divergent drone flight times within a species may also be evidence of speciation, occurring before reproductive isolation is complete (Otis et al. 2000; Oldroyd et al. 2006).

The honeybees of South Africa, the Cape honeybee *Apis mellifera capensis* (hereafter *capensis*) and the African honeybee *Apis mellifera scutellata* (hereafter *scutellata*), are separated by a zone of overlap situated mainly within the Great Karoo ecotone (Hepburn and Crewe 1991). The exact nature of this zone of overlap is unclear, but neither subspecies appears to be able to increase its range, despite *capensis*'s ability to become a social parasite of other honeybee subspecies (Allsopp 1992) and *scutellata*'s potential for invasiveness (Winston 1992). This status quo (Hepburn and

Radloff 1998) may be due to an asynchrony of mating flight times. Here we test the hypothesis that *scutellata* and *capensis* have offset mating flight times by comparing the flight times of drones of the two subspecies at a single locality in Stellenbosch, Western Cape, South Africa. We determined the drone flight times of four colonies of *scutellata* and four colonies of *capensis* by observing the time at which drones left the colonies over a period of 27 days during November and December 2006.

Scutellata colonies were obtained from a region north of the hybrid zone in Douglas, Northern Cape, two months prior to observations. *Capensis* colonies were obtained within the *capensis* native range. Colonies were located at separate apiaries but within 2 km of each other. The two subspecies cannot be kept in the same apiary because of problems with interspecific parasitism.

To determine each subspecies' typical drone flight times, we made preliminary observations from sunrise to sundown. We then observed the experimental colonies 30 minutes prior to and following the first and last drone flights recorded in the pilot studies. One observer per subspecies counted all drones leaving each of four colonies for one minute before moving to the next colony. Hence, at every colony, drone exits were counted for one minute every five minutes. Observations were made simultaneously by the second observer at the other subspecies' apiary. We calculated the number of drones leaving per fifteen-minute period across all days for each colony and then averaged across colonies. Drones were given a score according to their time of departure equal to the number of minutes after 14:00 hrs (solar time) that they left the colony. Solar time was calculated by adding or subtracting 4 minutes for each degree of latitude west or east of the centre of the time zone respectively (Otis et al. 2000). As Stellenbosch is 6.5 degrees east of the time zone centre (Cape Town) solar time was calculated by subtracting 26 minutes from the local time. The frequency distributions of

departing drones across time intervals were compared using a Kolmogorov-Smirnov test (Figure 1).

The drone flight times of *capensis* and *scutellata* were not significantly different ($P = 0.541$, $D = 0.286$, $N = 14$), indicating that drones of both subspecies perform mating flights simultaneously in the zone of natural overlap and that inter-subspecies matings are likely to occur unless drone congregation areas are spatially isolated (Koeniger and Koeniger 2000). Hence, the causes that maintain the status quo must be sought in reasons other than offset mating times.

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