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Scientific note

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

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***Apis mellifera capensis* / *Apis mellifera scutellata* / drone flight time / hybrid zone / South Africa**

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 1730 h (Koeniger and Wijayagunesekera, 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).

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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

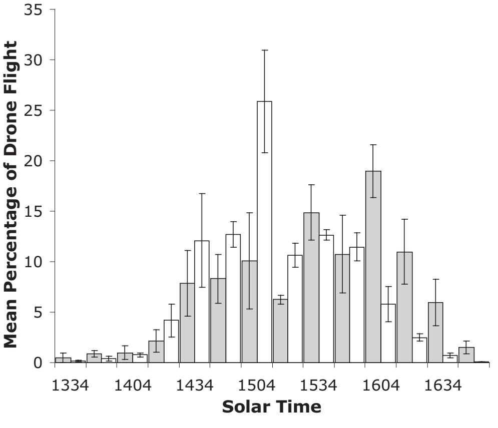

Figure 1. Mean (± s.e.) percentage of total number of drones leaving *A. m. capensis* (shaded bars) and *A. m. scutellata* (open bars) colonies per fifteen-minute interval.

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 1400 h (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 (Fig. 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 intersubspecies 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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Note scientifique sur la période de vol des mâles d'*Apis mellifera capensis* et d'*A. m. scutellata*.

Eine wissenschaftliche Notiz über die Drohnenflugzeit von *Apis mellifera capensis* und *A. m. scutellata*

REFERENCES

Allsopp M. (1992) The *Capensis* Calamity, S. Afr. Bee J. 64, 52–57.

Hadisoesilo S., Otis G. (1996) Drone flight times confirm the species status of *Apis nigrocincta* Smith, 1861 to be a species distinct from *Apis cerana* F, 1793, in Sulawesi, Indonesia, Apidologie 27, 361–369.

Hepburn H.R., Crewe R.M. (1991) Portrait of the Cape Honeybee, *Apis mellifera capensis*, Apidologie 22, 567–580.

Hepburn H.R., Radloff S.E. (1998) Honeybees of Africa, Berlin, Springer-Verlag.

Koeniger G., Koeniger, N., Pechhacker H., Ruttner F. (1989) Assortative mating in a mixed population of European honeybees, *Apis mellifera ligustica* and *Apis mellifera carnica*, Insectes Soc. 36, 129–138.

Koeniger G., Koeniger N., Tingek S. (1994) Crossfostered drones of *Apis cerana* Fabricius, 1793 and *Apis koschevnikovi* v. Buttel-Reepen, 1906 fly at their species-specific mating times, Insectes Soc. 41, 73–78.

Koeniger N., Wijayagunesekera H.N.P. (1976) Time of drone flight in three Asian honeybee species (*Apis cerana, Apis florea, Apis dorsata*), J. Apic. Res. 15, 67–71.

Koeniger N., Koeniger G. (2000) Reproductive isolation among species of the genus *Apis*, Apidologie 31, 313–339.

Koeniger N., Koeniger G., Gries M., Tingek S. (2005) Drone competition at drone congregation areas in four *Apis* species, Apidologie 36, 211–221.

Oldroyd B.P., Reddy M.S., Chapman N.C., Thompson G.L., Beekman M. (2006) Evidence for reproductive isolation between two colour morphs of cavity nesting honey bees (*Apis*) in south India, Insectes Soc. 53, 428–434.

Otis G., Koeniger N., Rinderer T.E., Hadisoesilo S., Yoshida T., Tingek S., Wongsiri S., Mardan M. (2000) Comparative Mating Flight Times of Asian Honey Bees, 7th Int. Conf. on Tropical Bees, Chiang Mai, Thailand, International Bee Research Association.

Winston M.L. (1992) The Biology and Management of Africanized Honey-Bees, Annu. Rev. Entomol. 37, 173–193.

Yoshida T., Saito J., Najigaya N. (1994) The mating flight times of native *Apis cerana japonica* Radoszkowski and introduced *Apis mellifera* L in sympatric conditions, Apidologie 25, 353–360.