Proc. 4 int. Conf. Apic. trop. Climates, Cairo, 1988 : 478-480 (1989)

FLIGHT TIME DIFFERENCES BETWEEN AFRICANIZED AND EUROPEAN DRONES

R L Hellmich, T E Rinderer, R G Danka, A M Collins

Honey-Bee breeding, Genetics & Physiology Laboratory, USDA, ARS,
1157 Ben Hur Road, Baton Rouge, LA 70820, USA

Introduction

African and European honeybees have been geographically separated for several thousand years. It is not surprising, therefore, that they are different, morphometrically (Ruttner 1988), physiologically (Crewe 1982) and behaviourally (Collins *et al.* (1982). Both of these bee types, through man's intervention, are now on the South American continent where neither are native. European honeybees were introduced into Brazil as early as 1839 (Nogueira-Neto 1962). Following this many bees from Europe (primarily *Apis mellifera iberica*, *Apis mellifera mellifera* and *Apis mellifera ligustica*) were introduced into South America, but none established large feral populations. In 1956 African honeybee queens, *Apis mellifera scutellata*, were imported to Brazil with the objective of improving honeybee stocks. Descendants from these African queens have hybridized to varying degrees with European subspecies and have established large feral populations.

This 'Africanized' honeybee has spread over much of South and Central America, and more recently into Mexico. These bees have received much public and scientific attention because of the threat they pose to the beekeeping industries of Mexico and the USA. Africanized bees are unacceptable to most beekeepers because of frequent swarming and absconding (Winston *et al.* 1981) and because of their unpredictable and often excessive defensive behaviour (Collins *et al.* 1982).

The rapid change of European colonies into Africanized colonies could come from a mating advantage of Africanized bees. Such an advantage could be numerical in origin, it could be related to behavioural differences between Africanized and European reproductives, or it could be both numerical and behavioural. The work presented here provides detailed information on temporal flight distributions of Africanized and European drones. Biological implications of these distributions, especially as they relate to the success of Africanized bees, are considered.

Methods

The experiment was conducted in an apiary near Sarare, Venezuela. Africanized and European drones, shortly after eclosion, were marked twice on the thorax with enamel paint to denote date and drone type. Drones of each type then were introduced to both Africanized and European test colonies. Observations began when the first drones introduced into the colonies were eight days old. The time to the nearest minute when a drone left a colony was recorded along with its colour markings. Each colony was observed by one person between 13.00 and 18.00 h. Four or five colonies were observed each day; nine sets of daily observations, including a total of 4029 drone departures, were made over a 20-day period.

Results and discussion

European drones flew 20±3 minutes earlier than Africanized drones. This flight time difference, however, is age dependent, as younger drones (age ≤10 days) of the two types differed by 27±3 minutes, and older drones (age >10 days) of the two types differed by 11±3 minutes. Furthermore, flight times of European drones were 45-55% more variable than those of the Africanized drones. Thus, flight distributions are somewhat characteristic of the two types of drones. These flight time differences, however, are probably not a major factor in the process of Africanization for the following reasons:

1. The differences are a temporary phenomenon. There is appreciable gene flow between the populations because overlap of flight distributions is about 70%. As a result, flight time differences will decrease and eventually disappear as the two types of bees interbreed and become increasingly homogeneous. Flight time mean and variance of the resultant population will depend on the relative abundance of the two types of drones.

2. Changing weather conditions will alter both time and variability of drone flight. For example, drones whose flight has been delayed by an afternoon thunderstorm depart colonies in large numbers when the sky clears (Taber 1964). Such weather was not a factor during this study. Yet, flight time differences between the two drone types will be affected during seasons or in regions where weather is more variable.

3. The reproductive potential of Africanized bees, at least in the tropics, is greater than that of the European bees. The annual population growth rate of Africanized colonies due to swarming is estimated to be more than ten times that of European bees in French Guiana (Otis 1982). Additionally, Africanized colony production of drones is greater than that of European colonies (Rinderer *et al.* 1987).

The flight time mean and variance differences could result in a tendency for the drones to mate with queens of their own type (positive assortative mating). This could infer a reproductive advantage to one bee type or the other. Positive assortative mating of the two subspecies was found by Kerr and Bueno (1970) in Brazil (E x E 65%, A x A 58%) and inferred by Taylor *et al.* (in press) in Venezuela (E x E 58%, A x A 60%). Assortative mating, in the first instance, results in an 11% advantage for European bees, and in the second instance, results in a 3% advantage for Africanized bees. Thus, even a 3% advantage due to flight time differences and assortative mating is small compared to a swarming advantage which could exceed 1000%.

Although the mating flight differences are not a major factor in the Africanization process, they are interesting to consider from an evolutionary standpoint. The differences may be due to random drift, varying selection pressures, or both. A survey of the native habitats of these bees should provide clues to important environmental factors that influence flight time means and variability.

Conclusion

Africanized and European drones have characteristic flight distributions. European drones fly about 10-30 minutes earlier than Africanized drones with 45-55% more variability. The importance of these flight time differences to the Africanization process appears to be minimal. Thus, efforts to reduce Africanized bee influence should not be focused on flight time differences, but rather on other activities such as swarm control, queen replacement and drone saturation.

Acknowledgements

The experiment was conducted in co-operation with the Louisiana Agricultural Experimental Station and the Universidad Centro Occidental 'Lisandro Alvarado', Barquisimeto, Venezuela.

References

COLLINS, A M; RINDERER, T E; HARBO, J R; BOLTON, A B (1982) Colony defense by Africanized and European honeybees. *Science, USA* 218: 72-74

CREWE, R M (1982) Compositional variability: the key to the social signals produced by honeybee mandibular glands. Pp. 318-322. *In* The biology of social insects *ed.* M D Breed, C D Michener & H E Evans *Colorado, USA; Westview Press*

KERR, W E; BUENO, D (1970) Natural crossing between *Apis mellifera adansonii* and *Apis mellifera ligustica*. *Evolution* 24: 145-148

NOGUEIRA-NETO, P (1962) O início da apicultura no Brasil. *Biol Agric, Sao Paulo* 49: 5-14

OTIS, G W (1982) Population biology of the Africanized honey bee. Pp. 209-219. *In* Social Insects in the Tropics, Vol. 1 *ed.* P Jaisson *Paris, France: Presses de l'Université Paris-Nord*

RINDERER, T E; COLLINS, A M; HELLMICH, R L; DANKA, R G (1987) Differential drone production by Africanized and European honey bee colonies. *Apidologie* 18: 61-68

RUTTNER, F (1988) Biogeography and Taxonomy of Honeybees. Pp. 20-36. *Berlin, GFR; Springer-Verlag*

TABER, S (1964) Factors influencing the circadian flight rhythm of drone honey bees. *Annals of the Entomological Society of America* 57: 769-775

TAYLOR, O R; KINGSOLVER, R W; OTIS, G W; A neutral mating model for honeybees (*Apis mellifera* L.). *Journal of Apicultural Research. In press.*

WINSTON, M L; DROPKIN, J A; TAYLOR, O R (1981) Demography and life history characteristics of two honey bee races (*Apis mellifera*). *Oceologia* 48: 407-413