

## COMPARATIVE RATES OF RECRUITMENT TO POLLEN SOURCES BY AFRICANIZED AND EUROPEAN HONEY BEES (*APIS MELLIFERA* L.)

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### SUMMARY

The use of recruitment by Africanized and European honey bee pollen foragers was studied. Comparisons were made of rate of initiation, duration, and tempo of recruitment dances, the number of recruits following dancers, and number of pollen sources visited. Rate of recruitment (the product of rate of dance initiation and number of followers per dancer) to pollen sources was higher in European colonies, due mostly to a higher rate of dance initiation in European colonies. Dance tempo was faster for Africanized foragers. Duration of dances and number of resources used were each similar for the two bee types.

### INTRODUCTION

Colonies of Africanized honey bees typically devote a larger portion of their foraging effort to pollen collection than do colonies of European honey bees (DANKA *et al.*, 1987; PESANTE *et al.*, 1987). One factor that might contribute to this difference is differential use of recruitment to pollen sources by foragers of these two bee types. In nectar foraging, for example, European bees show both high recruitment and high collection relative to Africanized bees (RINDERER *et al.*, 1984; 1985). The difference presumably exists because of differences in resource distribution in tropical and temperate ecosystems. The experiment reported here was designed to determine if pollen recruitment rate differs between Africanized and European honey bees.

### MATERIALS AND METHODS

Testing took place near Sarare, Venezuela (09° 44' N, 69° 08' W). Bee sources were Africanized colonies started from local feral swarms and European colonies headed by commercially bred queens imported from the United States.

On 16 March 1985, eight two-frame observation hives with 500 g of adult bees each were established for each bee type. For each type, workers were collected from five stock colonies, pooled, and held for 24 h before being hived. The lower comb in each hive contained  $1\,300 \pm 100$  ( $\bar{X} \pm \text{SD}$ ) sq cm of brood of mixed ages. The upper comb contained nectar, honey and a caged queen of the same type as the workers in the hive. No pollen stores were present. Brood nest size was remeasured at the end of the study.

Recruitment by pollen-foraging bees was assessed on four consecutive mornings beginning on 21 March. The number of recruitment dances initiated during three 5-min periods, at 30-min intervals, was recorded for each colony. Waggle dances of three to nine pollen foragers were observed in four colonies per bee type; overall, 92 dances per bee type were evaluated. Bees carrying pollen were chosen as they entered a hive and began to dance, and were followed until they deposited their pollen loads into a storage cell. For each dance, total number of bees that attentively followed the dancer, duration (s), tempo (number of straight runs per 15 s), and pollen source advertised (according to color of pollen pellets and direction of the straight runs of the dance) were monitored. The rate of pollen-foraging recruitment within each colony was calculated as the product of new dances per five min and number of dance followers (RINDERER *et al.*, 1984). The number of pollen foragers returning in a 5-min period was also recorded three times for all colonies on the last two test mornings. Differences in dance parameters for the bee types were evaluated with two-tailed *t*-tests.

## RESULTS

Pollen-foraging recruitment rate was over twice as high in European colonies as in Africanized colonies (Table 1). The difference arose principally from a greater number of pollen recruitment dances initiated per five min in European colonies. A greater percentage of dancing European bees had pollen (48 %) than did dancing Africanized bees (33 %). Dance tempo was faster by Africanized bees. The number of following bees per dancer, the number of pollen collectors returning to the colonies per 5 min and dance duration were each similar for the two bee types. The numbers of different pollen sources

TABLE 1. — *Components of recruitment dances performed by Africanized and European honey bee pollen foragers*

Means are  $\bar{X} \pm \text{SD}$ . Followers/dancer, duration and tempo statistics are based on three to nine foragers in each of four observation colonies per bee type on each of four test days. Dances initiated / 5 min / col (three observations on four days) and pollen collectors returning / 5 min (three observations on two days) are from eight colonies of each bee type. Recruitment rate is the product of dance initiation and followers/dancer means for the colonies in which these parameters were measured.

Bee type	Recruitment rate (/5 min / col)	Dances initiated / 5 min / col	Followers / dancer	Pollen collectors returning / 5 min	Duration (sec)	Tempo (no. straight runs / 15 sec)
Africanized	$5.6 \pm 5.0$	$0.6 \pm 0.6$	$6.0 \pm 0.5$	$3.6 \pm 3.4$	$66 \pm 9$	$7.0 \pm 0.1$
European	$12.1 \pm 4.1$	$1.3 \pm 0.7$	$6.5 \pm 1.0$	$4.7 \pm 1.7$	$83 \pm 25$	$5.3 \pm 0.5$
Prob > <i>t</i>	0.069	0.002	0.219	0.220	0.145	0.003

advertised by the observed dancers of each of the bee types were nearly equal (12 by Africanized bees, 11 by European bees). After 10 days, Africanized colonies had  $400 \pm 400$  sq cm of brood while European colonies had  $600 \pm 200$  sq cm of brood.

#### DISCUSSION

The relatively lower rate of recruitment to pollen sources by Africanized bees is seemingly at variance with the typically higher rates of pollen collection by these bees. The pollen recruitment rate within Africanized colonies does, however, parallel similarly low nectar source recruitment rates in these nests (RINDERER *et al.*, 1985). The success of a foraging strategy which relies less on intense group foraging probably varies with different patterns of resource distribution (e.g., see RINDERER *et al.*, 1984 ; 1985) ; such a strategy may be favored in the tropics where resources are in general patchily distributed (FRANKIE *et al.*, 1974 ; BAWA, 1983).

The difference between the bee types in pollen recruitment rates seems mainly to be a consequence of a lower percentage of Africanized pollen foragers that danced upon return to the hive. It is likely, however, that there was some diminishment of pollen collection in the Africanized colonies because of greater losses of adult bees and brood during the test. This also would have affected recruitment rate. The slight numerical difference in returning pollen collectors (Table 1), however, does not account for the larger difference in dance initiations.

The difference in dance tempo could indicate a difference in dialects used by Africanized and European dancers. BOCH (1957), working with nectar source dancers, determined that dance dialects are shorter for honey bee subspecies from lower latitudes ; our results suggest the trend is consistent for pollen source dancers. The tempo difference may simply indicate, however, that the Africanized bees were using food sources closer to the apiary than were European bees. Appropriate investigations are necessary to test such hypotheses relating dialects and distances to forage resources for these bees.

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## RÉSUMÉ

COMPARAISON DU TAUX DE RECRUTEMENT DES ABEILLES AFRICANISÉES  
ET DES ABEILLES EUROPÉENNES POUR DES SOURCES DE POLLEN

On a étudié le recrutement des abeilles africanisées et des abeilles européennes pour la récolte de pollen. On a enregistré le nombre de danses de recrutement amorcées, leur durée et leur rythme ainsi que le nombre des abeilles recrutées et le nombre de sources de pollen visitées. Le taux de recrutement (produit du nombre de danses amorcées par 5 min et du nombre de butineuses qui suivent la danse) est plus de 2 fois plus élevé, pour la récolte de pollen, chez les colonies européennes, principalement en raison du plus grand nombre de danses de recrutement amorcées par 5 min. le rythme de danse est plus rapide chez les butineuses africanisées. La durée des danses et le nombre de sources exploitées est semblable chez les deux types d'abeilles.

## ZUSAMMENFASSUNG

REKRUTIERUNG BEIM POLLENSAMMELN DURCH AFRIKANISIERTE  
UND EUROPÄISCHE HONIGBIENEN

Die Rekrutierung von Afrikanisierten und Europäischen Honigbienen beim Sammeln von Pollen sollte studiert werden. Dazu wurde die Anzahl der begonnen Rekrutierungstänze, ihre Dauer und ihr Tempo sowie die Anzahl der rekrutierten Bienen und die Anzahl der besuchten Pollenquellen protokolliert. Die Rekrutierungsrate (das Produkt aus der Anzahl begonnener Tänze und der Anzahl der nachfolgenden Sammlerinnen pro Tänzerin) war beim Pollensammeln bei Europäischen Völkern höher, denn vor allem die Anzahl an begonnen Tänzen war bei den Europäischen Völkern größer. Das Tanztempo war bei Afrikanisierten Sammlerinnen schneller. Die Dauer der Tänze und die Anzahl der ausgenutzten Quellen was für beide Bientypen gleich.

## REFERENCES

- BAWA K.S., 1983. — Patterns of flowering in tropical plants. In : *Handbook of experimental pollination biology*, ed. by C.E. Jones & R.J. Little, New York : van Nostrand Reinhold, pp. 394-410.
- BOCH R., 1957. — Rassenmässige Unterschiede bei den Tänzen der Honigbiene. *Z. vergleich. Physiol.*, **40**, 289-320.
- DANKA R.G., HELLMICH R.L. II, RINDERER T.E., COLLINS A.M., 1987. — Diet-selection ecology of tropically and temperately adapted honey bees. *Anim. Behav.*, **35** (6), 1858-1863.
- FRANKIE G.W., BAKER H.G., OPLER P.A., 1974. — Comparative phenological studies of trees in tropical wet and dry forest in the lowlands of Costa Rica. *J. Ecol.*, **62**, 881-913.
- PESANTE D, RINDERER T.E., COLLINS A.M., 1987. — Differential pollen collection by Africanized and European honeybees in the Venezuela. *J. Apic. Res.* **26**, 24-29.
- RINDERER T.E., BOLTEN A.B., COLLINS A.M., HARBO J.R., 1984. — Nectar-foraging characteristics of Africanized and European honey bees in the neotropics. *J. Apic. Res.*, **23**, 70-79.
- RINDERER T.E., COLLINS A.M., TUCKER K.W., 1985. — Honey production and underlying nectar harvesting activities of Africanized and European honeybees. *J. Apic. Res.*, **24**, 161-167.