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 ± 100 (X ± 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>
<thead>
<tr>
<th>Bee type</th>
<th>Recruitment rate (5 min / col)</th>
<th>Dances initiated / 5 min / col</th>
<th>Followers / dancer</th>
<th>Pollen collectors returning / 5 min</th>
<th>Duration (sec)</th>
<th>Tempo (no. straight runs / 15 sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africanized</td>
<td>5.6 ± 5.0</td>
<td>0.6 ± 0.6</td>
<td>6.0 ± 0.5</td>
<td>3.6 ± 3.4</td>
<td>66 ± 9</td>
<td>7.0 ± 0.1</td>
</tr>
<tr>
<td>European</td>
<td>12.1 ± 4.1</td>
<td>1.3 ± 0.7</td>
<td>6.5 ± 1.0</td>
<td>4.7 ± 1.7</td>
<td>83 ± 25</td>
<td>5.3 ± 0.5</td>
</tr>
<tr>
<td>Prob &gt; t</td>
<td>0.069</td>
<td>0.002</td>
<td>0.219</td>
<td>0.220</td>
<td>0.145</td>
<td>0.003</td>
</tr>
</tbody>
</table>
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 récruées 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


REFERENCES