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POLLEN COLLECTION AND USE BY AFRICANIZED HONEYBEES

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Introduction

The relatively high rate of colony reproduction by Africanized honeybees is perhaps the most significant ecological and apicultural feature in the life history of these neotropical bees. Since this reproduction must be supported by efficient resource collection and use, studies were conducted to compare foraging strategies of Africanized honeybees and temperately-evolved European honeybees. We sought to see if higher reproductive rate, an integral element in the success of Africanized honeybees, is supported by measurably increased pollen collection rates and how these rates compared with those of European honeybees.

Study area

Resource collection and use studies were conducted in Venezuela during 1983-85, approximately seven to nine years after colonization by Africanized honeybees. The study area was lowland deciduous forest, interspersed with patches of secondary successional grassland and agricultural plots. The rainy season extended from April to October, total rainfall for 1983 was 2164 mm. Daily high temperatures were from 28 to 34°C in 1983.

Results

In a ten-month, side by side study, Africanized colonies were observed to have twice as many pollen collectors as European colonies (Fig. 1) (Pesante *et al.* 1987a). In a similar study (Pesante *et al.* 1987b), Africanized colonies had a higher proportion of returning bees which carried both nectar and pollen than did European colonies, and a lower proportion carrying nectar only.

When colonies of the two honeybee types had equalized levels of stimuli known to regulate pollen foraging, Africanized colonies again had higher proportions (Fig. 2) and greater numbers (Fig. 3) of pollen collectors (Danka *et al.* 1987). The daily differences in pollen foraging were greatest between bee types early in the day (07.00 h) when pollen was most abundant. Differences were greatest during the dry season, when pollen generally is most available.

The weight of the pollen loads carried by Africanized and European honeybees were similar (Pesante *et al.* 1987, Danka *et al.* unpublished observation). Danka *et al.* (unpublished observation) found some indications of lower numbers of pollen grains on the bodies of Africanized foragers compared to European foragers.

These foraging trends resulted in Africanized colonies having nests with larger areas of sealed worker brood (Fig. 4) and stored pollen (Fig. 5), and smaller stores of nectar and honey, during a ten-month observation period (Pesante *et al.*

unpublished observation). Pollen and nectar storage patterns were consistent when pollen collection stimuli had been equalized among the two honeybee types (Danka *et al.* 1987).

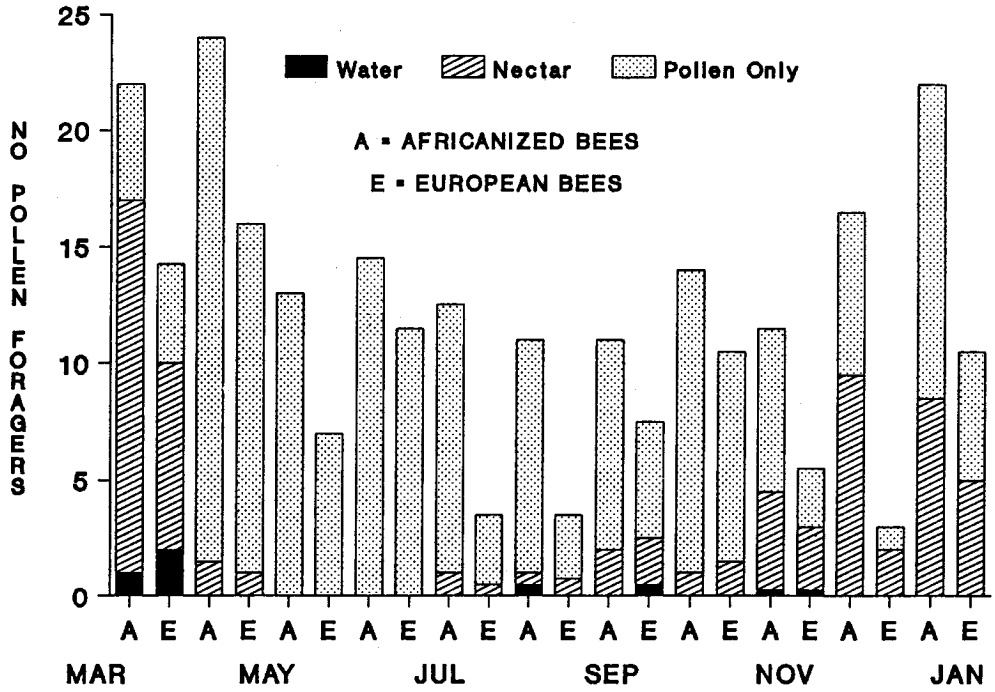

Fig. 1. Numbers of pollen foragers by month, which were engaged in: pollen and water foraging, pollen and nectar foraging, and foraging of pollen only.

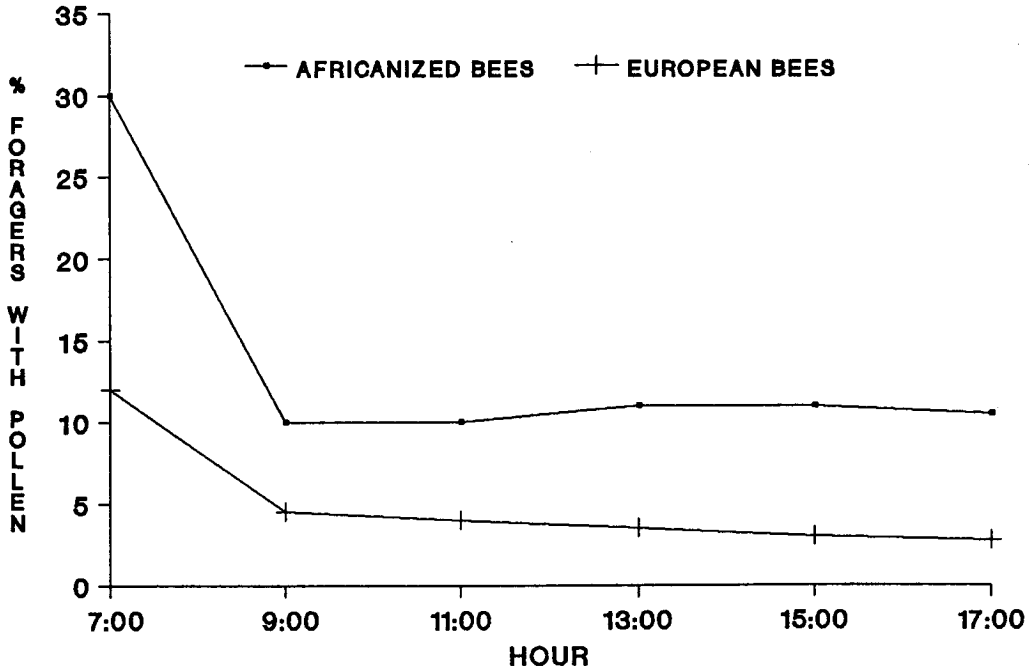

Fig. 2. Percent foragers with pollen returning to similarly established Africanized and European colonies.

The difference in pollen foraging does not appear to lie in differential recruitment. Recruitment rates to both pollen and nectar sources are higher in European nests (Danka *et al.* 1988, Rinderer *et al.* 1985).

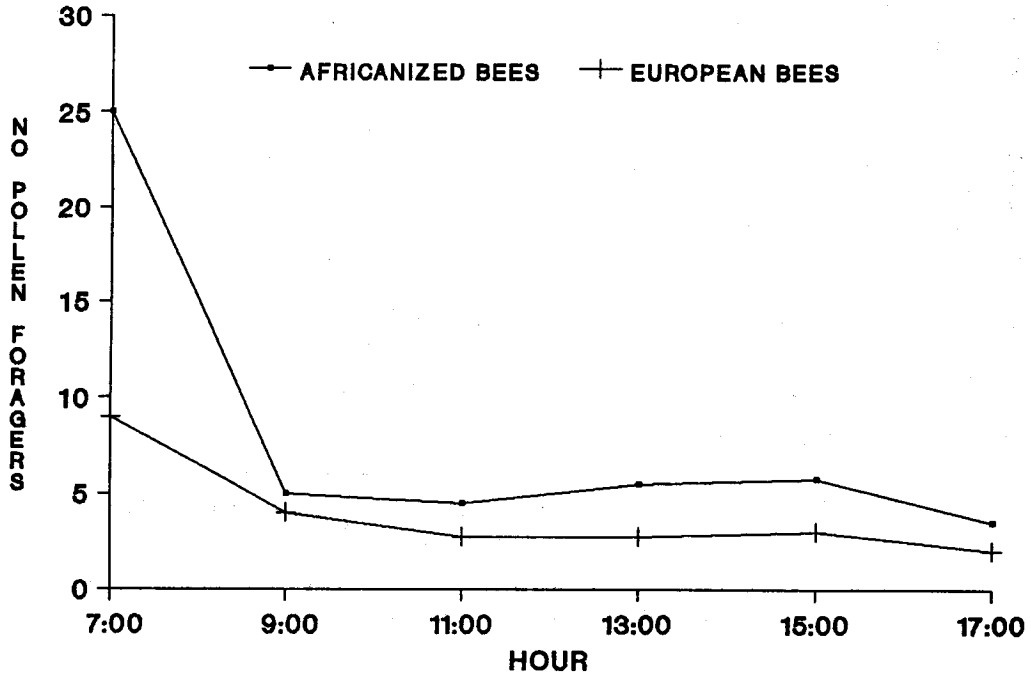

Fig. 3. Number of pollen foragers returning to similarly established Africanized and European honeybee colonies.

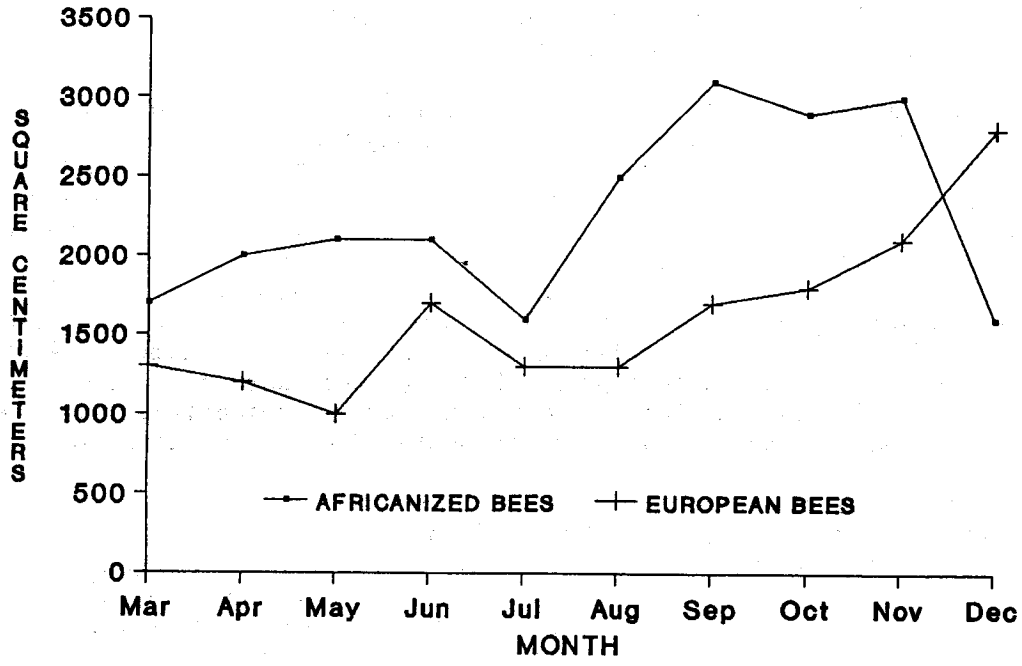

Fig. 4. Comb surface area with sealed worker brood for Africanized and European Honeybees, by month.

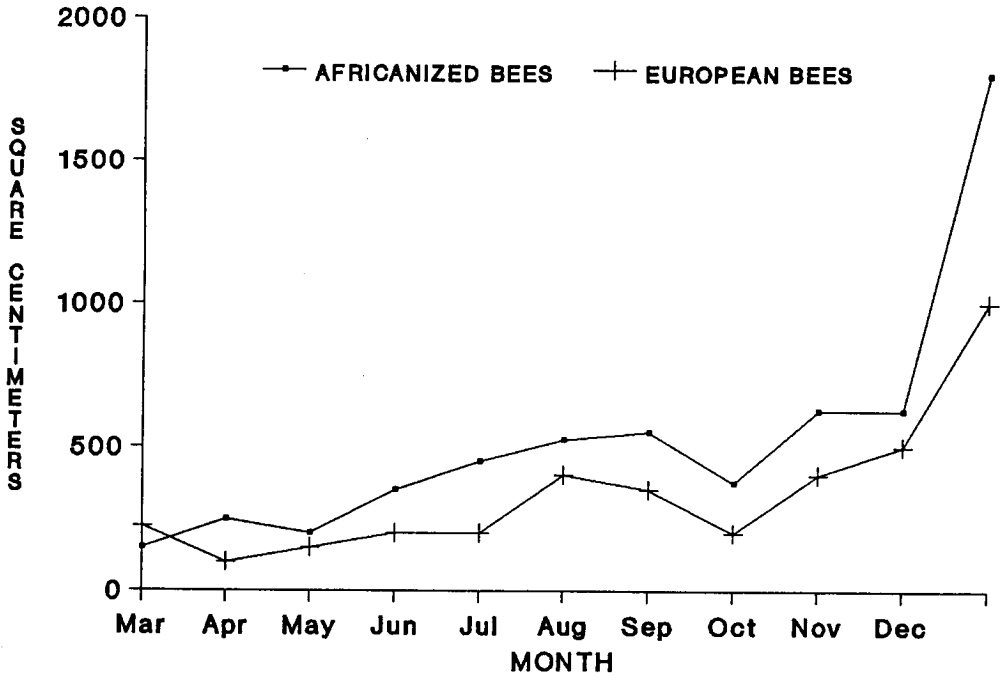

Fig. 5. Comb surface area with pollen for Africanized and European Honeybees, by month.

Discussion

Pollen is the main source of protein, lipids, minerals and vitamins required for the production, maintenance and repair of honeybee tissue (Dietz 1975). An alteration in the quantities of pollen imported by the bees could have a significant effect on reproductive rate, at the colony and community levels (Sheesley & Poduska, 1968; Standifer *et al.* 1970). Furthermore, changes in pollen collection behaviour are possible through selection (Hellmich *et al.* 1985).

In the tropics, food resources become limiting factors during parts of the year, their availability mostly dictated by rainfall patterns. Nonetheless, temperatures remain high enough to sustain year-round foraging and brood production. The Africanized honeybee's adaptive response to these conditions has been to invest their pollen and honey reserves in building colony population and subsequently swarming at higher rates than do European honeybees in temperate ecosystems. Higher absconding (Winston 1979), migration and swarming rates (Otis 1977) probably increase the probability of survivorship of at least some of the swarms cast by the parent colony. The relatively greater amounts of pollen collected by Africanized honeybees undoubtedly is needed to support this elevated swarm production. Evidence of this strategy's fitness is the success with which Africanized honeybees have established and expanded their populations in South, Central and North America.

When compared to temperately-evolved European honeybees, Africanized honeybees tend to devote greater effort toward greater pollen collection, brood production and subsequent swarm production. In addition to being a good example of adaptive behavioural ecology, these life history traits have played an integral role in the Africanization of neotropical bee stocks. Everything tends to indicate that the same strategy could be employed in subtropical and mild temperate ecosystems making it likely for Africanized honeybees to establish feral populations in at least some areas of the USA.

Information generated by these studies could have profound ramifications for the beekeeping industry. Selection for increased pollen collection may be advantageous if it results in: 1) increased colony production, 2) decreased colony maintenance, or 3) increased pollination efficiency. Moreover, the excessive swarming behaviour of Africanized bees could possibly be managed by manipulating the colony's pollen income.

References

DANKA, R G; HELLMICH, R L; RINDERER, T E; COLLINS, M A (1987) Diet-selection ecology of tropically and temperately adapted honeybees. *Animal Behaviour* 35: 1858-1863

DANKA, R G; COLLINS, A M; RINDERER, T E; HELLMICH, R L (1988) Comparative rates of recruitment to pollen sources by Africanized and European honeybees (*Apis mellifera* L.). *Apidologie* 19 (3): 255-258

DIETZ, A (1975) Nutrition of the adult honey bee. Pp. 131-136. *In* The hive and the honeybee *eds*. Dadant & Sons *Hamilton Il, USA: Dadant & Sons Inc.*

HELLMICH, R L; KULINCEVIC, J M; ROTHENBUHLER, W C (1985) Selection for high and low pollen-hoarding honey bees. *Journal of Heredity* 76: 155-158

OTIS, G (1977) The swarming biology and population dynamics of the Africanized honeybee. *Journal of the Agricultural Society of Trinidad and Tobago* 77: 313-326

PESANTE, D G; RINDERER, T E; COLLINS A M (1987a) Differential pollen collection by Africanized and European honeybees in Venezuela. *Journal of Apicultural Research* 26 (1): 24-29

PESANTE, D G; RINDERER, T E; COLLINS A M (1987b) Differential nectar foraging by Africanized and European honeybees in Venezuela. *Journal of Apicultural Research* 26 (4): 210-216

RINDERER, T E; COLLINS, A M; TUCKER, K W (1985) Honey production and underlying nectar harvesting activities of Africanized and European honeybees. *Journal of Apicultural Research* 24 (3): 161-167

SHEESLEY, B; PODUSKA, B (1968) Supplemental feeding of honey bees. Colony strength and pollination results. *American Bee Journal* 108: 357-359

STANDIFER, W L; WALLER, G D; LEVIN, M D; HAYDAK, M H; MILLS, J (1970) Effect of supplementary feeding and hive insulation on brood production and flight activity in honeybee colonies. *American Bee Journal* 110: 224-225

WINSTON, M L (1979) Absconding behaviour of the Africanized honeybee in South America. *Journal of Apicultural Research* 18: 85-94