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AFRICANIZED HONEYBEES IN VENEZUELA:

HONEY PRODUCTION AND FORAGING BEHAVIOUR

T.E. Rinderer

Bee Breeding and Stock Center Laboratory, USDA,
Agricultural Research Service, Baton Rouge, LA 70820, USA

Introduction

Honeybees, Apis mellifera scutellata (Ruttner, 1975), were imported to Brazil from South Africa with the goal of improving Brazilian honey production (Kerr, 1967). The Africanized descendants of these bees have retained several objectionable characteristics (Michener, 1975; Collins et al., 1982) which have continued to cause serious problems for beekeepers in the Americas. Hopes of improved honey production based on Brazilian reports (Kerr, 1967; Gonçalves, 1975) have not been fulfilled elsewhere.

This paper examines the effects Africanized bees have had on Venezuelan honey production, and suggests changes in management to regain some losses.

Venezuelan honey production prior to Africanization

In 1975 commercial apiculture was in a period of early but strong development (G. Vogel, 1979). At least 18 full-time modern commercial beekeepers were known to own bee businesses, and several of these, in addition to providing livelihoods for their owners, employed full-time helpers and beekeepers for both honey house and apiary operations. A rapidly growing honey production had reached 580 tonnes (Dietz, 1982), and for the first time production exceeded the demands of the local market. A loose organization was formed by six beekeepers to pool resources and export 100 tonnes of honey to Europe.

Impact of Africanization on honey production

Africanized bees were first reported in Venezuela in 1976 (Taylor, 1977); in the following five years they spread throughout the country and now exist in large populations in all areas suited to commercial apiculture. Only 2 full-time modern commercial beekeepers are now known to own bee businesses. Only one still employs full-time helpers and beekeepers and even this one has reduced its staff. Annual honey production is 100 tonnes or less (Dietz, 1982). Despite reduced honey production the remaining beekeepers continue to operate, partly because of increased prices protected by tariff.

Reasons for reduced production

Stinging

Africanized bees are the sole cause of the near collapse of the Venezuelan beekeeping industry. Their vigorous defensive behaviour has had the following results. Most hobby and side-line beekeepers and some commercial beekeepers

have left beekeeping because they will not tolerate the excessive stinging of Africanized bees. The remaining beekeepers have had to move apiaries further away from dwellings and animals, and so are able to give less attention to the management of their bees especially in the rainy season when farm roads are often impassable. Ironically, Africanized bees are very susceptible to night-time thieves because of their tendency to run from smoke. This is especially true in remote locations where colonies are robbed of honey and are often destroyed in the process.

Absconding

In the rainy season Africanized bees often abscond because for 4-5 months no nectar or pollen is available. At least one commercial beekeeper has cited frequent absconding during this dearth as his reason for leaving beekeeping. Clearly, absconding increases the difficulties of maintaining the number of colonies and has contributed to the reduction in the number being managed by Venezuelan beekeepers both collectively and individually.

Swarming

The European bees kept in Venezuela prior to Africanization rarely swarmed, and swarm-control procedures were not generally employed by beekeepers. Such techniques are still uncommon although Africanized bees are known to swarm excessively (Taylor, 1977). Swarming seriously reduces honey production during the nectar-flow season; it also leads to smaller colonies at the beginning of the rainy season. This situation may enhance absconding.

Competition with feral colonies for nectar and pollen

The strong swarming and absconding tendencies of Africanized bees lead to large populations of feral colonies, although no direct estimate of their number has been made. The number of Africanized swarms trapped in Venezuela by Rinderer et al. (1982a) was similar to the number of European swarms trapped in Louisiana using 4 times as many traps. The result suggests that the Venezuelan populations of Africanized bees are quite large; this conclusion is supported by observations of foraging bees and of stationary and flying swarms in locations distant from apiaries.

These large feral populations clearly have reduced honey yields from commercial apiaries. Records kept through the years by one company show a reduction in yield of 60% or more, regardless of the stock of bees used (W. Vogel, 1982). This reduction seems to stem solely from competition for nectar and pollen from the many feral colonies, since land use and flowering patterns appear to be unchanged.

Differences in nectar foraging behaviour of Africanized and European bees

In apiaries containing both Africanized and European bees, the Africanized colonies sometimes have produced more honey (Kerr, 1967; Gonçalves, 1975). Contrary reports concerning honey production by Africanized bees have come from Venezuelan and Colombian beekeepers (personal communication). These reports have stimulated a series of studies comparing the honey production and nectar-foraging habits of Africanized and European bees.

Comparative hoarding

Measurement of hoarding behaviour is a laboratory technique for predicting the honey-producing ability of honeybee stocks (Free & Williams, 1972; Kulinčević & Rothenbuhler, 1973; Kulinčević et al., 1974). This technique involves

putting a small number of bees in a laboratory cage supplied with a piece of comb and then measuring the rate at which the bees remove a sucrose solution from a gravity feeder and place it in the comb. Studies with European bees in hoarding cages have shown that when comb is treated with 2-heptanone, hoarding rates increase (Rinderer, 1982a). This effect is similar to that of increasing the amount of empty comb in the cages (Rinderer & Baxter, 1978).

In a comparative experiment Africanized bees hoarded less than European bees, whether or not the cages had combs treated with 2-heptanone. Also, the increase of hoarding with the 2-heptanone treated combs was less for the Africanized bees than it was for the European bees (Rinderer et al., 1982).

These results suggest that Africanized bees are not superior honey producers in all conditions. For European bees, high hoarding rates correlate well with honey production in specific North American conditions (Kulinčević & Rothenbuhler, 1973; Kulinčević et al., 1974; Rinderer & Baxter, 1978; Rothenbuhler et al., 1979). Africanized bees, with their lower rates of hoarding, would probably not be superior honey producers in similar conditions.

Field studies on foraging and honey production

Preliminary study

In our first field study of comparative foraging (Rinderer et al., 1984) we measured the relative energy contents of nectar loads collected by Africanized and European bees, the number of foraging flights made and also rates of successful foraging. The results showed that on some days Africanized bees collected more carbohydrate energy, while on other days European bees collected more energy. European bees consistently made more foraging flights. Bees from Africanized colonies returned to the nest more often without a nectar load, but percentages of successful foragers were intermediate as well as high and low. Bees from European colonies generally were more successful in securing a nectar load, but the percentage of successful foragers tended to be either high or low.

Overall, these results suggest that Africanized bees are adapted to nectar resource conditions that are, in many cases, best exploited by individual foragers that do not recruit others. Such conditions exist in North America in late summer and autumn (Rinderer, 1982); typically, nectar sources are scattered and they supply only limited amounts of nectar. Under such conditions, bees that forage individually without recruitment (using recruitment only for sources richer than the minimum requirements for foraging) are more successful (Rinderer, 1982).

Expanded study

The hypotheses formed in the first field experiment were tested in an expanded field study (Rinderer et al., 1985). Comparisons were made during two periods with different nectar-availability. Field colonies were used to study honey yields, nectar-load characteristics, and flight activity. Colonies in observation hives were used to study dance communication and recruitment. During the first experimental period, European bees produced more honey, collected much more carbohydrate energy in the average nectar load, had a greater percentage of successful nectar foragers and used dance communication much more intensely. During the second nectar-flow period Africanized bees produced more honey. In this period, dancing was reduced and bees tended to forage individually. Generally, European bees were superior nectar-foragers and honey-producers in conditions of good nectar availability while Africanized bees were superior in conditions of weak nectar availability.

Management implications

Knowledge of the reasons for reduced honey production as a result of Africanization can be exploited to increase honey production. Probably never again will large honey crops be produced with the ease and small numbers of colonies employed prior to Africanization. Nonetheless, the profit for beekeeping enterprises can be improved.

If Africanized bees are used, then beekeepers must be prepared to deal with stinging behaviour. Those working with full-sized colonies of Africanized bees must have protective equipment; apiary locations must be secure but remote, with good all-weather access. Special handling techniques must be learned, such as employing one person to smoke the colony continuously as it is worked. Techniques to prevent absconding and swarming will allow beekeepers to increase and maintain colony numbers. Colonies that are provided with small amounts of sugar syrup throughout the rainy season are much less likely to abscond. Swarming in Africanized colonies is effectively reduced by the standard swarm prevention techniques of providing an expanded brood nest and cutting out queen cells.

Competition for nectar and pollen resources from feral colonies remains a serious problem. Feeding hived colonies during the rainy season not only reduces absconding but also can be used to build strong colonies before the nectar-flow season. The early nectar flows, which previously were used to develop large colonies, can then be exploited as honey-production flows before the annual build up of feral populations. Where competition is strong the yield per colony can be increased by keeping fewer colonies in each apiary.

Africanized bees are suited to less intense nectar flows. Like European bees they respond to the stimuli of empty comb (Rinderer & Baxter, 1978; Rinderer, 1982 and 1982a), and during an occasional strong nectar flow, the provision of additional comb will stimulate Africanized bees to more intense nectar collection. However, most South and Central American nectar flows appear to be weak. European bees can be used as productively as Africanized bees on these nectar flows if they are given minimal amounts of empty combs - sometimes as little as one or two frames. European bees also have obvious economic advantages because of their lower tendencies toward stinging, absconding and swarming. Despite the increased production costs incurred by importing European queens, with proper management European bees appear to be the most profitable for commercial apiculture in Venezuela.

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