

MANAGING AFRICANIZED HONEYBEES FOR HONEY PRODUCTION

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Introduction

Stingless bees, *Melipona* and *Trigona* spp., were the only source of honey and wax in tropical America until European honeybees, *Apis mellifera* L., were introduced, perhaps as early as the 16th century. The Iberian honeybee native to Spain *A. m. iberica* Goetze, was the first subspecies imported, followed by the black European *A. m. mellifera* L., Italian *A. m. ligustica* Spinola, Carniolan *A. m. carnica* Pollmann, and Caucasian *A. m. caucasica* Gorbachev subspecies. For many years beekeeping was practised primarily by hobbyists. Then, early in the 1960s these European-evolved honeybees formed the basis of a honey-producing industry in Venezuela (Calvo-Diaz 1986). This industry peaked in 1976 at which time there were nine major commercial beekeepers. These commercial beekeepers and most of the other beekeepers were located in an agricultural belt that extends from Caracas south-west to San Cristobal. In total, they had approximately 50 000 colonies. Although many of these bees were kept in primitive hives, 535 tonnes of honey were produced in 1976; 323 tonnes were exported to Germany, England and the USA (Gomez-Rodriguez 1986b).

Africanized bees entered Venezuela from Brazil and Guyana in 1975 as they colonized forest areas in the Amazon Territory and the State of Bolivar (Gomez-Rodriguez 1986a). They were first detected near Santa Elena de Uairen in April 1976 (Taylor & Levin, 1978). In the next four years they advanced across the country at approximately 300-400 km/year, and were found in the beekeeping region of north-eastern Colombia by the end of 1980 (Villa 1987). During this time Venezuelan honey production decreased drastically as average annual colony yields of several commercial beekeepers decreased from 75-125 kg to 25-30 kg or even less. In 1981, Venezuelans produced only 78 tonnes of honey and no longer had surplus honey to export (Gomez-Rodriguez 1986b). This near collapse of the Venezuelan bee industry was due solely to the Africanized honeybee.

Many traits of the Africanized honeybee make them undesirable for beekeeping. Heading the list is their unpredictable and sometimes excessive defensive behaviour (Collins et al. 1982). According to information gathered by Gomez-Rodriguez (1986b), 350 or more Venezuelans have been killed by excessive stinging from these bees since 1975. As many as 100 people were killed in 1978, but fewer people have died since then, presumably because of increased public awareness. In 1985, 20 deaths from stinging were reported. Such defensive behaviour requires that beekeepers isolate apiaries and change many of their former management procedures. Additionally, this bee's tendency to abscond, swarm, and invade other colonies adds to the problems they cause the beekeeper. Altered management practices have increased production costs, and apiary sites, since they must be isolated, are more difficult to find and are more vulnerable to vandalism and theft.

Despite these problems, only a few of the original commercial beekeepers went out of business (Calvo-Diaz 1986, Vogel 1986). However, because of increased management

difficulties, these beekeepers have had to reduce their colony numbers by 50-75%. Prior to Africanization, a few beekeepers managed 1000 colonies or more, but in 1981 no beekeeper managed over 500 colonies. When the beekeepers had European bees, they often placed 50 or more colonies in an apiary and harvested profitable amounts of honey from each colony (Gomez-Rodriguez 1986b). Now increased competition from feral Africanized colonies appears to have reduced nectar availability. This, plus problems with defensive colonies, requires that beekeepers place no more than 30 colonies in an apiary.

Africanization has had an even more serious impact on part-time beekeepers, as 90% or more were forced to quit (Vogel 1986). Most backyard beekeepers, disillusioned by stinging instances, have realized that keeping bees is no longer an enjoyable hobby.

Interestingly, many people who abandoned beekeeping, plus many others, have adopted honey hunting methods very similar to those that are traditional in Africa. They locate feral colonies during the day and harvest honey during the night. Increased numbers of feral colonies have made this a common activity.

Both honey hunters and beekeepers are motivated to produce honey because of high honey prices. Government import restrictions on foreign honey and a shortage of domestic honeybees helped to maintain high prices for honey. Most beekeepers agree that without such support they would be forced to quit.

Venezuelan beekeeping has improved somewhat since its worst year, 1981. Although annual colony yields are considerably less than they were prior to Africanization, they have increased. Presently a commercial beekeeper usually can average 45-50 kg from a colony each year. National honey production also has increased to near the levels prior to Africanization. In 1985, 480 tonnes of honey were produced (Gomez-Rodriguez 1986b). Such improvements suggest that at least some of the beekeepers have learned to work with Africanized bees.

Venezuela's major beekeeping region

Most of Venezuela's agriculture occurs in the dry tropical forest zone; this region covers 38% of the country and accounts for about 85% of the national honey production (Gomez-Rodriguez 1986a). Vegetation cover of this zone includes virgin forest, secondary forest, and savanna grassland.

Extensive plains and foothills of the Andes Mountains make up the major land formations; elevation ranges from sea level to between 400 and 1000 m. The region has a dry season that lasts from four to six months during which time the major nectar flows occur. Typically, this season starts towards the end of October and lasts through April, but the length varies regionally and yearly. The rainy season, a dearth period for the bees, occurs during the remaining part of the year.

Seasonal management

Dry season

Before the first nectar flow, each colony is inspected for population strength (September or October). Colonies with five or more frames of bees are not inspected further, but weaker colonies are inspected for brood quality and presence of a queen. If requeening is necessary the beekeepers either give the colony a new queen

* As of December 1986, a kg of honey is selling for 90 Bolivares (Bs) retail and Bs 50 wholesale. Exchange is approximately US\$1 = Bs 25.

or allow the colony to rear a queen from young brood taken from another colony. Generally all colonies are fed sugar either in syrup (50% v/v) or in a foundation that is four parts mixed with one part honey. Pollen or pollen supplement, if available, is added to this mixture (~5% volume). Such feeding ensures proper colony development because pollen and nectar sources are not reliable during this time of the year. The beekeeper's objective is to have hives with approximately 3-4 kg of bees before the nectar flow starts.

Most beekeepers place only one empty super on a colony at a time. They have observed that Africanized bees, when they are given two or more empty supers at once, have a tendency to scatter honey stores and often swarm before enough honey is capped for harvesting. Restricted comb space forces the bees to consolidate their honey, and requires that beekeepers visit apiaries every 10-14 days during strong nectar flows. During these visits beekeepers replace a honey-filled super with an empty one and in some colonies replace honey-filled combs with empty combs. Prior to Africanization, such intensive management was not required because swarming and the tendency to scatter were not serious problems. Beekeepers during this time generally gave their colonies two or three empty supers, then harvested honey every three or four weeks. Consequently, beekeeping with Africanized honeybees compared with beekeeping with European honeybees requires two or even three times more visits to the apiary during strong nectar flows.

Some beekeepers maintain exclusively European apiaries. Such apiaries require less management despite the needs of requeening. The chief difficulty is in obtaining European stock.

Harvesting honey: many Venezuelan beekeepers remove Africanized bees from honey supers by smoking the supers with large amounts of smoke, then by brushing or shaking out any remaining bees. A major disadvantage of this method, especially when bees are agitated, is that often as many bees enter the supers as those that are shaken out. Thus, beekeepers prefer to use bee blowers when they have access to them. With either of these methods, though, most beekeepers put honey supers into a closed vehicle. This lessens the threat of a robbing frenzy and also reduces stinging occurrences en route to the honey house. An increasing number of beekeepers remove honey at night because it is an effective way to reduce stinging incidents. Fume boards, which also tend to reduce stinging problems, are being used by a growing number of beekeepers (Vogel 1986).

Capturing swarms: the use of bait hives to capture swarms (particularly in the dry season) is a procedure that is being used by many beekeepers to increase colony numbers. Africanized colonies, at least in the tropics, produce more swarms than do European colonies (Otis 1982); therefore, swarm occurrences in Venezuela have increased substantially since Africanization. In one case, more than 100 swarms were caught in bait hives from October to January in a ten hectare mango orchard near Acarigua (unpublished data). When such swarms are caught early in the dry season they often produce surplus honey. Capturing swarms not only increases the beekeeper's colony numbers, but also reduces competition for nectar sources by decreasing feral colony populations. Beekeepers usually do not requeen such colonies; this eventually could cause problems as the beekeepers may be unintentionally selecting for bees that are more apt to swarm.

Rainy season

Honeybee colonies are not as active during the rainy season because, in most areas, there are no major nectar flows. Colony populations decrease to about one kilogram during July and August and do not build up appreciably until October. Apiaries often are relocated before they are threatened by flooding or before access roads

are made impassable by heavy rains. High honey prices motivate many beekeepers to harvest nearly all the honey from their colonies at the end of the dry season. Thus, colonies must be fed on a routine schedule throughout the rainy season until nectar is once again available. Feeding colonies, building and repairing equipment, and clearing weeds at the bee sites are normal beekeeping activities during this season.

Beekeepers often divide strong colonies during May to increase colony numbers and to reduce absconding. Africanized colonies, particularly larger colonies with depleted honey stores, have a tendency to abscond. In September some beekeepers again divide strong colonies in order to increase colony numbers and to reduce swarming.

Prior to Africanization many of the commercial beekeepers moved their colonies during the rainy season to dry areas near the coast. Colonies foraged enough to maintain themselves, and occasionally honey was harvested.

Since Africanization migratory beekeeping is practised by fewer beekeepers (Calvo-Diaz 1986). The defensive and absconding behaviour of Africanized bees has discouraged beekeepers from making such moves. Additionally, increased competition by feral Africanized colonies for nectar sources appears to have reduced nectar availability and thus the value of such areas to beekeepers.

Africanized bees that are properly managed survive the rainy season well. For the colonies managed by our laboratory, we developed a system of using Africanized queens during the rainy season when the management goal was to survive the dearths economically. Later in the dry season, before the major nectar flows, we changed to European queens when the management goal was to produce strong, gentle, productive, non-swarmling colonies.

Recommendations for beekeepers in Africanized areas

Beekeepers in Venezuela, like many beekeepers around the world, seldom agree on beekeeping methods. Nevertheless, the following represent common-sense recommendations that we feel represent the opinions of the majority of Venezuelan beekeepers and the experience of members of the USDA-ARS laboratory in Baton Rouge, Louisiana, some of whom have been working with the Africanized honeybee in Venezuela since 1979.

Apiary locations

Apiaries with Africanized bees should be located no closer than 200 m, preferably 300 m, from people or livestock. Access roads also require some isolation and should not pass near houses or areas where livestock are confined. Beekeepers who must drive past such areas should stop one or more times shortly after leaving the apiary to brush and smoke bees from their vehicle. These procedures, plus simply driving faster than bees can fly, at around 20-25 km/h, reduces or even eliminates stinging incidents. Stinging encounters also appear to be reduced when dense and high vegetation separates the apiary or access road from inhabited areas.

Beekeeper safety

Safety should not be compromised in an Africanized apiary. The most important recommendations are to wear a reliable bee suit, never work Africanized colonies alone, carry an adequate smoker, and carry an emergency sting kit. Plus, beekeepers always should be prepared to reassemble open colonies and leave the apiary if the defensive response of the bees at any time becomes unmanageable.

Reliable bee-tight clothing is the beekeeper's best defence against dangerous stinging encounters. This includes overalls with some type of leggings, gloves, helmet and veil. Many of the commercially available suits are adequate; however, stings through overalls and gloves are common even with the most reliable suits. Some beekeepers reduce such stings by padding the shoulder area and by wearing sting-proof leather gloves. A few beekeepers wear two pairs of overalls when they expect the bees will be excessively defensive. A nylon suit is a common choice of the second pair because its slickness reduces the bees' ability to hold on to the surface as they attempt to sting. This two-suit combination, though, can be uncomfortably hot. Under such conditions, drinking water always should be brought along in order to lessen the risk of dehydration and heat exhaustion.

All colonies in Venezuela are placed on hive stands in order to protect colonies from predatory ants. Most beekeepers recommend that colonies should be placed on individual stands and that these stands should be spaced 5 m or more apart. Such an arrangement of colonies tends to reduce instances of stinging.

Colony inspections and requeening

Generally two people are required to inspect a colony because smoking Africanized honeybees is often a full-time job. When beekeepers enter an apiary with suits that are bee-tight and smokers well lit, they should avoid walking near colony entrances. If possible, they should approach a colony from the back or side so that guard bees are not alerted. When ready to open a colony, beekeepers usually smoke the entrance and then under the inner cover, each with three or four puffs of smoke. The more cautious beekeepers then wait 30-60 seconds before dismantling the colony. During this time, they often smoke entrances of colonies that are within 5 m of the colony being examined.

When working an Africanized colony, beekeepers have learned that it is necessary to move supers and frames with deliberation in order to avoid jerky movements and smashing bees. These procedures, plus directing a constant flow of smoke over the area that is being worked, help to keep the colonies manageable. Beekeepers also try to keep the part of the colony not being worked covered in order to curtail defensive behaviour and robbing. Despite all these precautions, inspection procedures still are often difficult because Africanized bees tend to fly or run and often form large festoons on frames and other parts of the hive.

Festooning and the tendency for the bees to run make finding queens difficult. Queens often are found on the bottom board or on one of the side walls. Yet, some Venezuelan beekeepers find queens by taking advantage of the queen's tendency to run when disturbed. They smoke the entrance of the colony (10-15 puffs) then, after four or five minutes, remove the inner cover. Frequently (50-75% of the time) the queen is found on or just under this cover. Some beekeepers assign one person to find and cage queens in several colonies with this smoking technique, and then follow that person with a two-man crew that work the colonies in which queens have been caged. This technique is particularly effective when there are two or fewer supers on the colonies. When a queen is not found with this technique, the beekeeper may choose to try again another day, or dismantle the colony and hunt for the queen in the usual manner.

Introducing queens, especially European queens, into Africanized colonies can be difficult. New queens frequently are not accepted or are quickly superseded. Such problems appear to be minimized, though, when queens are introduced into colonies that have only young bees and emerging brood. This is accomplished by putting a new queen into a second hive which has most of the bees and all the brood, and then by moving this hive to a different location within the apiary. Flight-age bees fly to

the original hive leaving only young bees and emerging brood in the relocated colony. The colony with the Africanized queen and the older bees is generally used to produce brood for future divisions. Queen acceptance in the relocated colony is generally 90% or better.

Maintaining European or selected stock in areas with Africanized bees

Obtaining pure European queens: this is a common problem for Venezuelan beekeepers. Such queens are not produced in Venezuela and imported queens are expensive. Fewer than 1000 queen honeybees are produced commercially in Venezuela each year, but many beekeepers produce their own for requeening purposes (Calvo-Diaz 1986). Usually, European queens from the USA are used as breeders to produce queens that are naturally mated; these queens, mated in Venezuela, produce mostly hybrid progeny. Hybrid progeny, in general, display defensive behaviour which is intermediate to European and Africanized colonies (Collins *et al.* in press). Many beekeepers prefer hybrid colonies because hybrids often produce more honey than colonies that are European or colonies that are more Africanized (Calvo-Diaz 1986, Vogel 1986). Many Venezuelan beekeepers are trying hybrids from different strains in an attempt to find less defensive and better honey-producing bees. Hybrids produced from the Carniolan subspecies are popular among several of the beekeepers.

Fewer mated queens are produced when Africanized honeybees are used to populate mating colonies than when European honeybees are used (Hellmich *et al.* 1986). The efficiency of Africanized mating colonies is reduced by absconding and population dwindling. These problems are particularly apparent for the small (5-litre) mating units, the type of units most commonly used by commercial queen producers. Efficiency of Africanized mating units is improved when bee population and hive volume are increased and when brood is added. Thus, queen production with Africanized bees is possible if large mating colonies are used. A few beekeepers have had success mating queens in large (32-litre) mating colonies.

Marking queens: colony queens should be clearly marked so that they can be distinguished from supersedure or foreign queens. A foreign queen may enter a colony accompanied by a small cluster of bees. These so called 'invader swarms' appear to enter queenless colonies or colonies with failing queens more successfully than colonies with prolific queens. Little else is known about their biology except that most of the invading queens are mated and begin laying immediately. The best way to ensure that a colony does not become Africanized is to inspect it every two or three weeks. Such frequent inspections are not practical for large-scale beekeepers, but are essential if maintaining a certain stock is important. A more practical approach some Venezuelan beekeepers have tried involves requeening all colonies in an apiary annually. This approach reduces management procedures but does not guarantee absence of Africanized bees in the apiary.

Certainly the most successful beekeepers will requeen colonies on a regular basis with queens produced from breeding stock or, more simply, from queens produced from their best colonies. Quality queens, selected from colonies with favourable European and Africanized traits, could be produced by mating the queens in an area in which a high percentage of drone population comes from colonies of desirable stock. Populations of drones can be controlled by saturating mating areas with desirable drones, decreasing feral colony populations, or both (Hellmich 1987). Also, mating colonies could be located in areas where feral colony densities are low. Venezuela has several life zones, some of which probably support few, if any, feral honeybee colonies.

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