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BEEKEEPING IN VENEZUELA

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Stingless bees, *Melipona* and *Trigona* spp., were the only source of honey and wax in Venezuela until European honey bees, *Apis mellifera* L., were introduced, perhaps as early as the sixteenth century. The Iberian honey bee 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* (Gorbatschev) subspecies. For many years beekeeping was practiced primarily by hobbyists. Then, early in the 1960s, these European-evolved honey bees, primarily the Italians, formed the basis of a honey producing industry (M. Calvo-Díaz, pers. comm.). 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 southwest to San Cristobal (FIGURE 1). In total they had approximately 50,000 colonies. Although many of these bees were kept in primitive hives, they still produced 530 metric tons of honey; 323 tons were exported to Germany, England and the United States (R. Gómez-Rodríguez, pers. comm.).

Africanized bees entered Venezuela from Brazil and Guyana in 1975 as they colonized forest areas in the Amazon Territory and the State of Bolivar (Gómez-Rodríguez, 1986). They were first detected near Santa Elena de Uairén in April of 1976 (Taylor and Levin, 1978). In the next five years they advanced across the country at approximately 320-400 km/yr and were found in the beekeeping region of northeastern Colombia by 1981. During this time Venezuelan honey production decreased drastically. Average colony yields of several commercial beekeepers decreased from 75-125 kg to 25-30 kg or even less. In 1981, Venezuelans produced only 78 metric tons of honey and no longer had surplus

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FIGURE 1. Map of Venezuela.

honey to export (R. Gómez-Rodríguez, pers. comm.). This near collapse of the Venezuelan bee industry was due solely to the Africanized bee.

Many traits of the Africanized bee make them undesirable for beekeeping. Heading the list is their unpredictable and sometimes excessive defensive behavior (Collins *et al.*, 1982). Approximately 400 Venezuelans have been killed by excessive stinging from the bees. Most of these deaths, however, occurred during the first few years after the bees arrived, and have decreased considerably since then. For example, nearly 100 deaths were reported in 1978, compared with 12 in 1988 (R. Gómez-Rodríguez, pers. comm.). Consequently, such behavior requires that beekeepers isolate apiaries and change many of their management procedures. Additionally, this bee's tendency to abscond, swarm, and invade other colonies adds to the problems they cause the beekeeper. Necessary management changes 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 two of the original nine commercial beekeepers went out of business (M. Calvo Díaz, pers. comm.; W. I. Vogel, pers. comm.). Because of increased management difficulties, though, these beekeepers have had to reduce their operations by 50-75%. Prior to Africanization a few beekeepers managed 1,000 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 respectable amounts of honey from each colony (R. Gómez-Rodríguez, pers. comm.). 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 (W. I. Vogel, pers. comm.). People with rustic equipment in particular have found the bees unmanageable, and 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 reverted to the ancient methods of the honey hunters. 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 by high honey prices.[2] Government import restrictions on foreign honey have helped to maintain high domestic prices for honey. Most beekeepers agree that without such support they would be forced to quit.

Nevertheless, 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 begun to increase again. Presently a commercial beekeeper usually can average 45-50 kg from a colony each year. National honey production also has increased. In 1985, 480 metric tons of honey was produced (R. Gómez-Rodríguez, pers. comm.). Such improvements suggest that at least some of the beekeepers have learned to work in an Africanized environment.

VENEZUELA'S MAJOR BEEKEEPING REGION

Most of Venezuela's agriculture occurs in the dry tropical forest life zone; this region covers 38% of the country and accounts for about 85% of the national honey production (Gómez-Rodríguez, 1986). The vegetation of this zone includes virgin forest, secondary forest and savanna grassland. Extensive plains and some of the foothills of the Andes Mountains make up the major land formations; altitude ranges from sea level to between 400 to 1000 m. The region is characterized by a dry season that lasts from four to six months during which the major nectar flows occur. Typically, this season starts toward the end of October and lasts through April, but the length varies regionally and yearly.

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[2]As of August 1989, a kg of honey is selling for 120 Bolivares (Bs) retail and Bs 60 wholesale. Exchange is approximately $1 = Bs 35.

The rainy season, a dearth period for bees, occurs during the remaining part of the year.

The first major nectar flow occurs in the savanna and some of the secondary forest areas, typically from the first part of November through December. Nectar sources are primarily annual species such as: tara, *Oyedea verbesinoides* DC; cruceta, *Thevetia peruviana* (Pers.) Schum.; mastranto, *Hyptis sauveolens* (L.) Poit.; and bejuquillo, *Ipomoea nil* (Roth.). Another significant nectar flow occurs in all three areas of vegetation, usually from mid-to-late February though March. The important nectar sources during this flow are primarily perennial species such as: chapparo, *Byrsonima crassifolia* (L.) HBK.; matarratón, *Gliricidia sepium* (Jacq.) Steud.; araguaney, *Tabebuia chrysantha* (Jacq.) Nich.; apamate, *Tabebuia pentaphylla* (L.) Hemsl.; and bucare, *Erythrina glauca* (Willd.). Beekeepers in the states of Portuguesa, Barinas, and Cojedes produce honey from both major nectar flows, whereas beekeepers in the states of Carabobo, Aragua, and parts of Miranda, produce honey only during the second nectar flow. For more information concerning Venezuelan nectar sources consult: Thiman and Aymard (1982), Gómez-Rodríguez (1986), and López-Palacios (1986).

SEASONAL MANAGEMENT

Dry Season

Before the first nectar flow, each colony is inspected for population strength (September or October). Strong colonies are not inspected further, but weak colonies are checked for brood quality and the presence of a queen. If requeening is necessary the beekeepers either give the colony a new queen or allow the colony to rear a queen from young brood taken from another colony. Generally all colonies are fed sugar either as syrup (50% vol) or in a fondant form that is four parts sugar mixed with one part honey. Pollen or pollen supplement, if available, is added to this mixture (~5% vol). Such feeding ensures proper colony development in the absence of reliable pollen and nectar sources during this time of 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. Africanized bees, when 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 was not a serious problem. During this time, beekeepers generally

FIGURE 2. Beekeepers removing honey supers.

gave their colonies two or three empty supers, then harvested honey every three or four weeks. Consequently, beekeeping with Africanized bees compared to beekeeping with European bees requires two or even three times more visits to the apiary during strong nectar flows.

When 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 as many bees often enter the supers as are shaken out. Thus, beekeepers prefer to use bee blowers when they have access to them (FIGURE 2). 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 encounters. Fume boards, which also tend to reduce stinging problems, are being used by a growing number of beekeepers (W. I. Vogel, pers. comm.).

Capturing swarms in bait hives (particularly in the early 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 European

colonies (Otis, 1982). This, therefore, explains the observed increase in the incidence of swarming in Venezuela since Africanization. In one case, over a hundred swarms were caught in bait hives from October to January in a ten hectare mango orchard near Acarigua (unpubl. data). When such swarms are caught early in the dry season, they often produce surplus honey. Capturing swarms not only increases the beekeepers' colony numbers, but also reduces competition for nectar sources by decreasing feral colony populations. Beekeepers usually do not requeen such colonies. However, this eventually could cause problems as the beekeepers unintentionally select for bees that are more apt to swarm.

Rainy Season

Honey bee colonies are not as active during the rainy season because, in most areas, there are no major nectar flows. Colony populations decrease to one-half to one kg levels during July and August and do not build up appreciably until October. Often apiaries 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 beekeeper activities during this season.

In May, the beekeepers often divide strong colonies in an effort 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 as a means of increasing colony numbers, but also 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 honey was occasionally harvested. Since Africanization, migratory beekeeping has been practiced by fewer beekeepers (M. Calvo-Díaz, pers. comm.). The defensive and absconding behavior 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.

RECOMMENDATIONS FOR BEEKEEPERS IN AFRICANIZED AREAS

Beekeepers in Venezuela, like many beekeepers around the world, seldom agree on beekeeping methods. Nevertheless, the following are common-sense recommendations that the authors feel represent the opinions of the majority of

Venezuelan beekeepers. These recommendations are based on talks with several 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 honey bee 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. Bees commonly follow a walking person 300 m or more and can be transported several kilometers inside vehicles. Consequently, access roads also require some isolation and should not pass near houses or areas where livestock are confined. If beekeepers anticipate driving past such areas while leaving an apiary, they should stop one or more times to brush and smoke bees out of their vehicle. These procedures, plus simply driving faster than the bees can fly, around 20-25 km/hr, reduces or even eliminates stinging encounters. Stinging encounters also appear to be reduced when dense and relatively high vegetation separates the apiary or access road from potential problem 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, if possible, bring an emergency sting kit. Additionally, beekeepers should always be prepared to reassemble open colonies and leave the apiary if the defensive response of the bees at any time becomes unmanageable.

A reliable bee-tight suit is the beekeeper's best defense against dangerous stinging encounters. A suit 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 to be excessively defensive. A nylon suit is a common choice for the second pair because its slickness reduces the bee's ability to hold to the surface and then sting. This two-suit combination, though, can be uncomfortably hot. Under such conditions drinking water should always be brought along in order to lessen the risk of dehydration and heat exhaustion.

Most colonies in Venezuela are placed on hive stands to protect them from predatory ants. Most beekeepers recommend that colonies should be placed on individual stands; and that these stands should be spaced five m or more apart. Such an arrangement tends to reduce stinging incidents. As if Africanized bees

were not enough to worry about, Venezuelan beekeepers also must be wary of poisonous snakes, primarily *Bothrops* spp.

Colony Inspections and Requeening

Generally, two people are required to inspect a colony because smoking Africanized bees is often a full-time job. When beekeepers are prepared to enter an apiary, that is, when the suits are bee tight and the smokers are lit, they should avoid walking near colony entrances. If possible they should approach a colony from the back or side so that the guard bees are not alerted. When ready to work a colony, the entrance should first be smoked lightly (three or four puffs), then a similar amount of smoke should be applied under the inner cover. Then it is necessary to wait 30-60 seconds. During this time beekeepers often smoke entrances of colonies that are within five meters.

When working an Africanized colony, beekeepers have learned that it is necessary to move supers and frames deliberately in order to avoid jerky movements and crushing 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 behavior and robbing. Despite all these precautions, inspection procedures are often difficult because Africanized bees tend to fly or run off frames and often form large festoons.

Festooning and the tendency to run make queen finding difficult, as queens often move to the bottom board or one of the side boards. On the other hand, some Venezuelan beekeepers actually take advantage of a queen's aptness to run when disturbed to find her. They smoke the entrance of the colony (10-15 puffs), then, after four of five minutes, remove the inner cover. Frequently (50-75% of the time) the queen is found on or just under the inner 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 works colonies in which queens have been found.

Introducing queens, especially European queens, into Africanized colonies can be problematic. Often new queens are not accepted or are quickly superseded. Such problems appear to be minimized 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. Bees of flight age return 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 generally is used to produce brood for future divisions.

Maintaining European or Hybrid Bees in an Africanized Area

Obtaining pure-bred European queens is a common problem for Venezuelan beekeepers. Such queens are not produced in Venezuela and often importing queens is too expensive. Fewer than a thousand honey bee queens are produced commercially in Venezuela each year, but many beekeepers rear their own (M. Calvo-Díaz, pers. comm.). European queens from the U.S. are usually used as breeders to produce queens that are naturally mated; these queens produce mostly hybrid progeny. Hybrid progeny, in general, display defensive behavior which is intermediate to European and Africanized colonies (Collins *et al.*, 1988). Many beekeepers prefer hybrid colonies because hybrids often produce more honey than colonies that are European or colonies that are more Africanized (M. Calvo-Díaz, pers. comm.; W. I. Vogel, pers. comm.). 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.

Success in producing mated queens is lower when Africanized bees are used to populate mating colonies than when European bees are used (Hellmich *et al.*, 1986). The efficiency of Africanized mating colonies is decreased by absconding and population dwindling. These problems are greatest in five-liter nuclei, the type of mating colony most commonly used by commercial queen producers. Efficiency of Africanized mating units is improved when bee populations 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 l) mating colonies.

Colony queens have to 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 be more successful when they enter queenless colonies or colonies with failing queens. Little else is known about their biology except that most invading queens are mated and begin laying immediately. The best way to retain a chosen queen is to inspect the colony 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 that some Venezuelan beekeepers have tried involves requeening all colonies in an apiary once a year. This approach reduces management procedures but does not completely eliminate Africanization.

Certainly the most successful beekeepers are those who requeen colonies on a regular basis with queens produced from breeding stock or, more simply, from queens produced from their best colonies. However, there still appears to be a need for increased commercial queen production as queens from the U.S. become more expensive. Quality queens, selected from colonies with favorable European and Africanized traits, could be produced by mating the queens in an area in

which a high percentage of the 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 *et al.*, 1988). Also, mating colonies could be located in areas where feral colony densities are low. Venezuela has many diversified habitats, some of which probably support few, if any, feral honey bee colonies.

OTHER ASPECTS OF VENEZUELAN BEEKEEPING

Pollination Management

Most crops in Venezuela prior to Africanization were pollinated by native bees, primarily stingless bees. Honey bees were not used in an organized system. The impact Africanized bees have had on native bees and how much they contribute to pollination is likely to be significant (Roubik, 1978, 1979, 1980, and Chapter 13).

Information based on recent foraging studies suggests that Africanized bees pollinate crops as well as European bees (Danka, 1987). But problems develop more frequently in colonies of Africanized bees than in colonies of European bees when they are moved repeatedly to different crops. Problems arose from population losses and excessive stinging (Danka *et al.*, 1987). Such difficulties give Venezuelan farmers and beekeepers little incentive to manage Africanized bees for pollinating crops.

Since 1983, the government has encouraged farmers to use honey bees for pollinating sunflowers, *Helianthus annuus*. However, farmers are advised to use European bees to reduce stinging incidents to field workers (R. Gómez-Rodríguez, pers. comm.).

Honey Bee Enemies and Diseases

•*Ants*. Predatory ants, primarily from the subfamily Dorylinae, destroy more honey bee colonies in Venezuela than all pests and diseases combined. The inability of European bees to establish large numbers of feral colonies prior to Africanization is probably attributable, at least partly, to these ants. In a single night tens of thousands of ants can destroy a large colony. Often all they leave are wax combs, patches of capped brood and a pile of severed wings and legs. Beekeepers protect colonies from such invasions by placing them on hive stands. These stands have a barrier, usually motor oil around the legs, to prevent ants from reaching the colonies.

•*Wax moths*. Venezuelan beekeepers have problems with both the greater (*Galleria mellonella*) and the lesser (*Achroia grisella*) wax moths. The former causes the most damage. Many beekeepers avoid infestations by keeping supers on the colonies even during nectar dearths. A growing number of beekeepers

store supers after they spray combs with a *Bacillus thuringiensis* solution. The problem with wax moths appears to have increased since Africanization (W. I. Vogel, pers. comm.). This may be attributed to more feral nests that have been abandoned.

•*Stingless bees.* The species *Trigona trinidadensis*, often robs honey bee colonies, especially weak colonies, during the rainy season. Another species, the fire bee, *Trigona (Oxytrigona) mellicolor* even uses chemical warfare while conducting its robbing raids, as it repels the defending honey bees with a secretion from its cephalic gland (Rinderer *et al.*, 1988)

•*Parasitic Mites.* The honey bee tracheal mite, *Acarapis woodi*, was reported to be present in Venezuela in 1957 (Gómez-Rodríguez, 1986). In a survey conducted in 1984 about one percent of colonies had low infestations of this mite which was not considered an economically important pest (Gómez-Rodríguez, 1986). Fortunately, the more serious mite, *Varroa jacobsonii*, is not found. Import restrictions on packages and queens appear to have been successful in keeping this pest out of the country.

•*Diseases.* Honey bee brood diseases are not a major problem in Venezuela. Sacbrood virus has been reported (Gómez-Rodríguez, 1986), and European foulbrood, *Streptococcus pluton*, has been observed occasionally (pers. obs.). Several diseases common in the temperate areas, such as American Foulbrood, *Bacillus larvae*, and chalkbrood, *Ascosphaera apis*, do not occur. Nosema disease, *Nosema apis*, (Stejskal, 1972), amoebal disease, *Malpighamoeba mellificae*, (Stejskal, 1966) and gregarinosis, from the larger order of Gregarinida (Stejskal, 1955), are reported adult diseases; although, the pathogenicity of gregarines is questioned by Steinhaus (1967).

Hive Products

Honey in Venezuela is used primarily for medicinal purposes and for the baking and candy industries. Very little is used in food preparation except during the Easter holiday when traditional "bunuellos" (yuca friters), a popular desert, are made. Most of the honey produced by the commercial beekeepers is sold at wholesale prices to national supermarkets. It is not uncommon, however, to see people along the road selling honey to motorists. Pollen and royal jelly are also popular hive products and commonly are used for medicinal purposes. Wax is used in the manufacture of cosmetics and decorative candles.

Beekeeping in the Amazon Territory

A project with the Sanemas Indians in the Amazon Territory was started in 1981 as part of an effort to introduce these people to Venezuela's civilization. In 1985 this project plus two similar ones in the area produced 8.5 metric tons of "puuna pudu" (bee honey) (J. R. Barragan and H. Gonzalez, pers. comm.).

SUMMARY

Most beekeepers in Venezuela were not prepared for the Africanized honey bee, so the initial effects of Africanization on the industry were severe. After nearly a decade of experience, though, many beekeepers are learning to manage this bee. Prospects for beekeepers will probably continue to improve as long as high honey prices remain an economic incentive. A new generation of beekeepers appears to be emerging, one that is better educated and better prepared. University courses, government-sponsored workshops, and national conferences have helped to inform beekeepers and non-beekeepers of potential problems and solutions. Yet the bee's unpredictable defensive behavior will pose a lasting threat to the general public. Additionally, Venezuelan beekeepers, even those with European stock, probably will seldom, if ever, see the 75-125 kg annual honey yields per colony which were common prior to Africanization. Increased competition for nectar sources by feral colonies appears to have made this a permanent problem in Venezuela.

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LITERATURE CITED

Collins, A. M., Rinderer, T. E., Harbo, J. R., Bolten, A. B. 1982. Colony defense by Africanized and European honey bees. *Science* 218:72-74.

Collins, A. M., Rinderer, T. E., Tucker, K. W. 1988. Colony defence of two honey bee types and their hybrids 1. Naturally mated queens. *J. Apic. Res.* 27:130-140.

Danka, R. G. 1987. *An assessment of Africanized honey bees (Apis mellifera L.) as crop pollinators.* PhD Dissertation. Louisiana State Univ, Baton Rouge.

Danka, R. G., Rinderer, T. E., Collins, A. M., Hellmich R. L. 1987. Africanized honey bee (Hymenoptera: Apidae) responses to pollination management. *J. Econ. Entomol.* 80:621-624.

Gómez-Rodríguez, R. 1986. *Manejo de la Abeja Africanizada.* Dirreccion General Desarrollo Ganadero, Caracas, Venezuela. 280 pp.

Hellmich, R. L., Rinderer, T. E., Collins, A. M., Danka, R. G. 1986. Comparison of Africanized and European queen-mating colonies in Venezuela. *Apidologie* 17:217-226.

Hellmich, R. L., Collins, A. M., Danka, R. G., Rinderer, T. E. 1988. Influencing matings of European honey bee queens in areas with Africanized honey bees (Hymenoptera: Apidae) *J. Econ. Entomol.* 81:796-799.

López-Palacios, S. 1986. *Catálogo para una Flora Apícola Venezolana.* Consejo de Desarrollo Científico y Humanístico de la Universidad de los Andes, Merida, Venezuela.

Otis, G. W. 1982. Population biology of the Africanized honey bee. In *Social Insects in the Tropics*, Vol. I, ed. P. Jaisson, pp. 209-219. Paris: Université Paris Nord.

Rinderer, T. E., Blum, M. S., Fales, H. M., Bian, Z., Jones, T. H., Buco, S. M., Danka, R. G., Lancaster, V. A., Howard, D. F. 1988. Nest plundering allomones of the Fire Bee *Trigona (Oxytrigona) mellicolor. J. Chem Ecol.* 14:495-501.

Roubik, D. W. 1978. Competitive interactions between neotropical pollinators and Africanized honey bees. *Science* 201:1030-1032

Roubik, D. W. 1979. Africanized honey bees, stingless bees, and the structure of tropical plant-pollinator communities. *Proc. IVth Int. Symp on Pollination, Md. Agric. Exp. Stn. Spec. Misc. Publ.* 1:403-417.

Roubik, D. W. 1980. Foraging behavior of competing Africanized honey bees and stingless bees. *Ecology* 61:836-845.

Steinhaus, E. A. 1967. *Principles of Insect Pathology.* New York: Hafner Publishing.

Stejskal, M. 1955. Gregarines found in the honey bee *Apis mellifera* Linnaeus in Venezuela. *J. Protozool.* 2:185-188.

Stejskal, M. 1966. Amibiasis. *Am. Bee J.* 106:292-293.

Stejskal, M. 1972. Akklimatisierung de Carnica in den Tropen (Acclimatization of Carniolan bee in the tropics). *Allg. Deut. Imkerztg.* 6:319-322.

Taylor, O. R., Levin, M. D., 1978. Observations on Africanized honey bees reported to South and Central American government agencies. *Bull. Entomol. Soc. Am..* 24:412-414

Thiman, R., Aymard, G. 1982. *Flora Apícola de la Mesa de Cavaca.* UNELLEZ, Guanare, Venezuela.