

Africanized Bees And Pollination¹

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The collective results from this work and some previous findings demonstrate potentially significant problems, and a few possible benefits, if Africanized bees are used as crop pollinators.

THROUGH the years the agricultural community has become increasingly aware of the importance of pollination carried out by bees. Pollination is the most critical phase in the production of many crops, and growers often rely upon honey bees to carry out pollination at a level which maximizes crop yields. Recommendations for using honey bees as pollinators are available from past research into the exact pollination requirements of many crops. Presently, bee pollination contributes to the production of nearly \$19 billion worth of agricultural commodities annually in the United States.

Unfortunately, recent advances in pollination technology stand to be set back as Africanized honey bees enter U.S. agricultural systems near the end of this decade. Original predictions were that Africanized bees would become permanently established in southern and coastal areas of the United States, where they could affect the pollination of more than 50 fruit, vegetable, seed, fiber and oil crops. However, recent research in Argentina shows that the bees may move further north than originally predicted, and eventually colonize most of the United States; thus, even more crops could be affected.

Significant advances have been made in studying defensive behavior, honey production, mating biology, and identification of Africanized bees, but until recently no research has evaluated the effectiveness of Africanized bees as crop pollinators. However, it is in this area that Africanized bees pose their greatest threat to agriculture; potential problems such as higher production costs

and lower crop yields could affect all consumers. To begin evaluating the pollination abilities of these bees, we recently undertook field research in Venezuela to compare their traits with those of typical U.S. ("European") bees. Since pollination is simply a by-product of food-collecting activities of honey bees, most studies focused on foraging behavior of the bees, both in-

dividually and at the colony level. In addition, another type of test simulated a commercial pollination management program. Colonies of both types of bees were moved during two months to six different locations where sesame, mango and citrus crops were grown. Other research compared the bees' tolerances to several insecticides. The collective results from this work



In Venezuela, crops such as sesame provided opportunities to study differences in foraging behavior between Africanized and European bees. (USDA photo).

and some previous findings demonstrate potentially significant problems, and a few possible benefits, if Africanized bees are used as crop pollinators.

FORAGING BEHAVIOR. The foraging behavior of individual European and Africanized bees shows several differences. European bees make more foraging trips from the hive per day, but in the field seem to work much more slowly among flowers than Africanized bees. The rapid, darting flight patterns of Africanized bees may lead to better pollen dispersal. An interesting observation was that Africanized bees are often aggressive toward other foragers when bees come into contact on a flower.

At the colony level, Africanized bees tend to forage more for pollen, while European bees collect more nectar. Pollen gathering bees are regarded as being superior pollinators in many cases. Africanized colonies probably collect larger amounts of pollen to support their accelerated brood rearing and colony growth rates. Vigorous growth leads to frequent reproductive swarming, which detracts significantly from the pollinating worth of Africanized colonies. Also, bee populations in Africanized colonies reach only relatively low levels before swarming, which probably limits the number of available foragers.

Even when colonies are of equal size, European colonies have more foragers than Africanized colonies. Also, nectar flow and colony size conditions have a bigger influence on European colonies than on Africanized colonies. The best foraging activity was noted in large European colonies during a good nectar flow. This means fewer colonies might be needed to pollinate a crop under these conditions. Africanized foraging populations are more uniform, which could be beneficial in pollinating crops which are not good nectar producers.

DEFENSIVE BEHAVIOR. Africanized bees are often extremely defensive of their nests, and this will undoubtedly be the biggest obstacle in using these bees in any beekeeping operation. Stinging is especially troublesome after a hive disturbance, but can also be unreasonable even when colonies are not manipulated. For example, an entire apiary often responds defensively to someone merely entering the area. Stinging can cause problems not only for beekeepers, but also for farm workers, livestock, and neighbors some distance from an apiary. Sensitivity of a colony often remains high for days after an initial defensive episode. This type of behavior may cause serious difficulties when loading and moving bees during pollination work. Also, suitable apiary sites may have to be remote in crops which require ongoing management during bloom. This could cause access problems for beekeepers and result in inadequate pollination if col-



Moving colonies and positioning them in target crops will be hampered by the extreme defensiveness of Africanized bees. (Photo by James Tew, ATI, Wooster, Ohio).

onies cannot be dispersed sufficiently throughout the crop.

Colony inspections are an integral part of good bee management. Inspections of Africanized colonies are hampered not only by excessive stinging, but also as bees run on combs, hang in festoons, and fly in large numbers when a hive is opened and combs re-

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moved. Finding queens is often particularly difficult.

Complex issues of quarantines and liability will probably arise as a direct result of the defensive behavior of Africanized bees. These issues ultimately may profoundly influence the future of commercial crop pollination in the U.S.

BEES' RESPONSE TO BEING MOVED. When the bees were moved to different crops, over twice as many Africanized colonies as European colonies lost large numbers of adult bees. In these cases, the lowered worker populations in the hives probably decreased the worth of the colonies for pollination. Absconding may be worse when Africanized colonies are kept in areas with low quality forage. Stinging is often a problem. All of these factors could prove troublesome for beekeepers in the migratory crop pollination business.

DIFFERENCE IN ADULT MORTALITY AND DISEASE CONTRACTION. Only minor differences were

found in the daily worker mortality rates in Africanized and European colonies. However, Africanized colonies may be more susceptible to infection by European foulbrood, although this was not the case during the pollination management study. This needs to be examined more closely, along with American foulbrood susceptibility. Neither honey bee tracheal mites nor *Varroa* mites were detected in bee colonies in our Venezuelan tests. Still, Africanized bees are expected to provide a means of ingress to the United States for *Varroa* from South America. This mite causes serious problems for beekeepers in many other areas of the world. It could seriously hamper pollination practices, both directly through colony destruction, and indirectly as quarantines are established.

DIFFERENCES IN SUSCEPTIBILITY TO INSECTICIDES. An insecticide toxicity study compared how the two types of bees reacted to four common insecticides: carbaryl (Sevin®), methyl parathion, azinphosmethyl (Guthion®), and permethrin (Ambush® or Pounce®). We treated young adult bees with droplets of insecticide. Africanized bees are more tolerant than European bees to each chemical except carbaryl. However, the differences in susceptibility were minor, and probably will not significantly affect rates of pesticide poisoning in field situations.

AFRICANIZED BEE EFFECTS ON NATIVE POLLINATORS. When Africanized bees spread into an area, they tend to displace native pollinators. This could threaten pollination in plants which have special associations with insects other than honey bees.

Feral colonies of Africanized bees often reach high densities in rural areas. An abundance of wild nests in agricultural areas could decrease the need for supplemental pollinating colonies.

OUTLOOK. We continue to analyze the data from the Venezuela experiments, and other laboratories are becoming more involved in Africanized bee pollination research as well. Future studies will test Africanized and European bees as pollinators of specific crops, and evaluate production of those crops. This type of research on specific crops is time-consuming and difficult, but necessary to fully assess the abilities of Africanized bees. USDA is moving toward implementing these tests.

Techniques which improve pollination efficiency need to be examined. For example, entomologists specializing in genetics are questioning how bees might be genetically altered to improve pollinating traits. Selection and management practices can be used to increase pollen foraging by colonies, and minimize swarming and absconding. Currently, there is research on selection of Africanized bees for gentleness. Other USDA research is examining bees other than honey bees, such as orchard bees (*Osmia*) and carpenter bees (*Xylocopa*), as potential pollinators. Other species of insects, such as flies, are also valuable pollinators in some situations and may be used instead of honey bees to pollinate some crops. Pollination inserts and disposable pollination units might be used advantageously in certain situations.

Africanized bees may vastly change many routine beekeeping and horticultural practices in this country. Research must continue to ensure that regardless of changes, the success of crop pollination, a unique and crucial phase of agricultural production, is preserved.

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International Africanized Bee and Mite Conference Scheduled for April 1987

WE ARE organizing an international conference on Africanized bees and mites of bees to be held at the Ohio State University on March 30-April 2, 1987. Individuals directly involved with research on Africanized bees and parasitic mites of bees are invited to submit papers. For further program information please contact:

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ABOUT THE CONFERENCE TOPIC

In the mid-1950's an African honey bee race was introduced into Brazil as part of a controlled breeding study. Since 1957 a population with similar characteristics has grown throughout most of South and Central America. Native and commercial bees have been competitively replaced, while these feral bees have maintained many of the characteristics of their African ancestors. The growth of this feral population in our lifetime and the persistence of the ancestral characteristics present biologists with one of the most exciting ecological and population genetic phenomena in natural history.

Along with the spread of Africanized honey bees in South America has been the spread of two parasitic mites, *Varroa jacobsoni* and *Acarapis woodi*. *Varroa* is an ecto-parasite that feeds preferentially on drone brood and in some cases can dramatically affect the mating system of populations by severely reducing the numbers of males. *Acarapis* also known as the tracheal mite, lives in the respiratory system of bees. Each of these mites has an interesting

yet poorly understood relationship with its host and each has a different geographical distribution.

Currently, there is no consensus with respect to the behavioral, ecological, and genetic mechanisms of Africanization or the potential impact of Africanized bees on ecosystems, commercial beekeeping, or public health. The same can be said about the *Varroa* and tracheal mites. Clearly all three represent model systems for studying fundamental principles of population biology including ecology, genetics, behavior, physiological ecology, systematics and host-parasite relationships.

CONFERENCE PURPOSE

Our objective is to bring together acarologists and bee biologists who are working in basic and applied areas of research that relate to Africanized honey bees and mites parasitizing honey bees.

WHY OHIO AND THE OHIO STATE UNIVERSITY AS A MEETING SITE?

Since the early 1960's, the Department of Entomology has developed an international reputation for excellence in honey bee biology and in acarology. Professors Walter C. Rothenbuhler and G. W. Wharton were responsible for establishing these international centers for apiculture and acarology research. The Agricultural Technical Institute at nearby Wooster, Ohio has also been instrumental in the education of apiculturists on an international scale. In addition, Ohio has 10,000 registered beekeepers and historically is rich in bee tradition. L. L. Langstroth, the discoverer of bee space and inventor of the movable frame hives, was from Oxford, Ohio. One of the most famous producers of beekeeping equipment, the Root family, is located in Medina, Ohio.

CALL FOR PAPERS

We encourage scientists to submit papers dealing with principles of host-