



BEEES: AN UNTAMED FORCE

IN 1956, THE zoologist and bee researcher Warwick Estevam Kerr imported 120 *Apis mellifera scutellata* queen bees from South Africa to Brazil, where the predominant strain until then had been the Italian honeybee, *Apis mellifera ligustica*. In a laboratory 130 kilometers (almost eighty-one miles) west of Rio de Janeiro, he and his team began experimenting with crossbreeding the two strains. They could not have foreseen that the results of their endeavors would one day gain infamy throughout the world as “killer bees.”

The background to Kerr’s experiments was a contract from the Brazilian government to look for a strain of bees that could better cope with the local climate conditions than the imported species of European honeybees.

Until the fifteenth century, *Apis mellifera ligustica* was unknown in both North and South America. The first immigrants and settlers brought the bees with them by ship to the New World. The western honeybee strains, used to mild continental or Mediterranean conditions, “worked” in the New World, but in tropical and subtropical zones were much less productive than in their native habitats.

Five hundred years later, Warwick Kerr searched for solutions to resolve these issues by crossbreeding African bees, which are less sensitive to heat, with European ones. He hoped to combine the good characteristics—the gentleness of the European bee and the heat tolerance of the African bee—in one bee. The objective was a productive bee that could cope with the climate of South America.

Kerr was well aware that his bees were not to escape to the wild, but even test colonies cannot be kept in complete isolation. Bees are dependent on their workers’ gathering nutrition in the form of nectar and pollen, and so to prevent the spread of new hybrid bees while allowing this natural requirement to gather, Kerr devised a special grid for the entrance holes that was just wide enough to allow the workers but not the slightly larger drones and queens through. This appeared to be safe enough as only these latter bees could breed. The grid would normally have prevented the test bees from gaining freedom had not one day a particularly animal-loving member of Kerr’s staff removed the grids. He felt sorry for the foragers that, on returning to the hive, had to shed their pollen baskets in front of the small entrance holes.

Thirty-six queens swarmed out and formed their own colonies. Shortly afterward, their drones mated with the local *ligustica* and the uncontrolled crossbreeding of both races began. The offspring coped splendidly with the tropical climate, but to general dismay, the following generations failed to display the relative gentleness of the African *scutellata* and absolutely none of the marked gentleness of the European *ligustica* drones from whose genetic makeup they had been developed. Instead, the paradoxical result was mild + mild = wild.

The Africanized honeybees (AHB), as the new entity was soon named, defended their hives with a vigor that surprised everyone. And terrorized! With European bees, only the few guard bees attack potential enemies—whether they are humans or bears zeroing in on the bees’ life insurance of honey supplies—but the Africanized bees follow raiders for a kilometer or more (more than half a mile) en masse. Thousands of years of domestication seemed to have been blown away—it was comparable to a phlegmatic European lap cat being crossed with a mild Egyptian one, with the result being a wild cat that not only arches its back and hisses but also instantly attacks with extended claws.

Kerr and his colleagues tried to recapture the bees and to poison them, but the speed at which their breed spread gave them no chance. At a rate of three hundred to five hundred kilometers (186–310 miles) per year, the Africanized bees conquered the continent, entered Central America, and from the 1980s onward began occupying the southern states of the USA. By 2005 the “killer bees” had claimed a seven-hundred-kilometer (435-mile) strip from southern California almost to the Mississippi, and have since reached Florida.

The flying capability of the Africanized drones is a significant factor in their high rate of expansion. They start earlier in the afternoon and remain airborne for several hours longer than their European counterparts. On top of this, they fly faster, so they are more likely to be where they need to be when a sexually mature queen appears.

Kerr was a 30-year-old scientist when he accidentally became the father of the “bee disaster.” He spent the majority of his time into old age explaining the background to the episode and trying to placate beekeepers, scientists, and the general public.

But he continued, even in Brazil, to try to introduce gentleness into the breed. In 2005, in an interview on the fiftieth anniversary of the “killer bee” Big

The Africanized honeybees (AHB), as the new entity was soon named, defended their hives with a vigor that surprised everyone. And terrorized!

Bang, he explained why his efforts ended in failure: Brazilian beekeepers were simply not interested. They quickly became used to the fact that the Africanized bees produced sixty to eighty kilograms (132–176 pounds) of honey, much more than their European counterparts for whom fifty kilograms (110 pounds) is considered a very good yield.¹ Compared to this, the additional costs for better protective clothing and, if need be, more effective smoking equipment to fend off attacking bees were of little consequence.

Within a short period of time, Brazil was catapulted from nowhere to being the sixth-largest honey exporter after China, the USA, Argentina, Mexico, and Canada (2012). In the northeast of this huge country in particular, beekeeping became a significant economic factor in a region where previously the European bees had only produced modest returns. And so it seemed that the costs to society as a whole in the largest country in South America had suddenly been put into perspective. “Previously,” said Kerr, “125 people a year died as a result of insects in Brazil, twenty-five from bees. From our bee breeding program the number increased to 195 bee deaths. [...] Alone in São Paulo on one particular road we have five times as many traffic deaths annually.”²

Kerr remembers vividly the reversal of his image from Frankenbee breeder to savior: “At conventions up until the beginning of the 1970s, it was common for wives of beekeepers to point at me and tell their children: ‘That’s the evil man who made the killer bees!’ At around 1974/75 this all changed suddenly and the women were saying: ‘That’s the man who rescued farming, thanks to him Dad can buy a new tractor, now go and say thank-you!’”³

In the southern US states that were “colonized” in the 1980s via Mexico, the “killer bees” rapidly gained the status of a hostile army. With or without a political subtext, fear, hysteria, and horror always promise good business and a new “killer bee” subgenre appeared in the horror movie genre. The Japanese movie *Genocide* (1968) predated the “bee invasion,” as did *Terror Out of the Sky* (1978) and *The Swarm* (1978), with its impressive star-studded cast in which not only the bees but also Michael Caine and Henry Fonda were let loose on the public. The movie poster shows an oversized swarm of bees the shape and size of a gigantic tornado that threatens to overwhelm a typical American

skyline. It was the time of the Cold War, and no cliché was too well worn to prepare Americans for attacks on the good guys (USA) by the realms of evil (“killer bees” or communists). Even years later this motif was still good, with such titles as *Deadly Invasion: The Killer Bee Nightmare* (1995), *Killer Bees!* (2002), and the German TV movie *Die Bienen—Tödliche Bedrohung* (released in English as *Killer Swarm*) (2008).

In news programs, “killer bee” attacks flickered on to the screen, with close-ups for millions of viewers at prime time penetrating the public perception more than forest fires or falling coconuts, both of which cause more fatalities in the USA than bee attacks.

Nevertheless, this did nothing to slow the demand for the high-performance honey producers. “Every year,” says Kerr “beekeepers come from the US [to Brazil] wanting to buy our bees. We don’t sell, and anyway importing is illegal.” Markus Imhoof also experienced this contradiction—on the one hand, panic-stricken fear of “killer bees,” and on the other, an open admiration of their abilities. For his bee documentary, he decided to focus his camera on the Africanized bees, asking himself if there wasn’t maybe a ray of hope hidden in what was generally perceived as a threat.

If a biopic were made of Fred Terry, the beekeeper from the southern states whom the director encountered, then the “killer bees” would buzz the theme tune. Terry comes from southern Arizona and looks like Burt Lancaster’s twin brother. He is charismatic, a good raconteur who hones his skills during frequent lectures and even more so as a country singer—a stroke of luck for a filmmaker looking for protagonists who can effortlessly and precisely get to the point.

Terry’s history with “killer bees” had many phases. It began in the early 1990s as he helplessly watched his “good,” domesticated European bees in his hometown of Oracle, Arizona, take a serious battering from bee diseases, and in particular, attacks from *Varroa* mites. At the same time he heard reports of “bad” bees way down south in Brazil, bees that were wild but astonishingly resistant to mites and other bee tormentors. He became interested. How bad could the bees be when they were good against all kinds of epidemics?

Terry traveled to Brazil, and to his astonishment he met beekeepers who successfully worked with Africanized bees in a relaxed way and without risks, and who thought that the fact that their bees were called “killer bees” in the USA was a bad joke. While he was in Mexico, he met one of these beekeepers in a taco bar. “While we were eating I was hinting at my sympathies for Africanized bees. When we were finished and had left the bar my colleague yelled at me: ‘Man! Don’t talk about Africanized bees when others are listening. I’ve got some and I don’t want my neighbors to know! I don’t want any problems!’” Obviously the conflict between humans and bees there still had to be resolved.

Almost a year after this encounter he read in a trade journal that the Mexican beekeeping convention had officially decided to view working with Africanized honey bees as standard practice. Terry made a decision: “I will stop fighting them. I will join them!”

For Terry, what finally tipped the scales to switching from European honeybees to Professor Kerr’s accidental new breed was confirmation of a rumor that the number one scourge of bees, the *Varroa* mite, was unable to harm Africanized bees. This *Varroa*-tolerance was until then only known in the small Asiatic *cerana* bees, which somewhere in East Asia, in the process of evolution, had developed resistance while passing on the plague to the defenseless European honeybees.

Terry quickly became an active champion of what was generally being presented as a threat. The pro arguments, however, fell on deaf ears during the heated discussions on the “attacking death squads” in the USA in the 1980s and 1990s. The debate revolved solely around whether and how the “killer bees” could be stopped from crossing the border into the USA on a grand scale. There were discussions about, for instance, fine mesh nets and corridors saturated with pesticides to keep the area free of bees. The idea of making the Central American isthmus a no-go area for bees even made it to talk shows and reader forums.

Suggestions were made, all of them bordering on insanity, but the line dividing reason and madness became blurred in the face of floods of reports



**The idea of making the
Central American isthmus
a no-go area for bees
even made it to talk shows
and reader forums.**

about people being attacked and cattle stung to death. Running parallel to the reports on catastrophes, magazines and newspapers featured articles with tips on how to prevent the stings from taking your own lifeblood. There were even serious discussions on a nationwide inoculation campaign using an antiserum from the blood of beekeepers who are exposed to frequent stings.

Terry is still surprised to this day, thirty years after the first outbreak of “killer bee” hysteria: “As far as I know, in the last twenty-five years there have been eighteen fatalities from bee attacks and most of them elderly. Every year in the USA there are thirty thousand deaths from firearms, forty thousand die on the roads.” But according to Terry there is little tolerance for such comparisons: “Among other things, it’s because we Americans are terrified of being invaded. It’s only happened once since the foundation of the United States, on March 9, 1916, as the Mexican revolutionary Pancho Villa with some hundred soldiers attacked Columbus, New Mexico, burned down the town and made off with military equipment. The invasion only lasted one day, but after all, Pancho Villa came from Mexico just like the killer bees.”

Killer bee phobia even brought prosperity to a number of people. Terry says that some of the KKBees, as he refers to the killers of “killer bees,” amassed millions of dollars by working as pest controllers who specialized in destroying swarms that had landed near human habitation or even in the rafters of houses. The recapturing of swarms, which beekeepers have dealt with for no pay for centuries, suddenly cost up to US\$1,000 per assignment.

Prices collapsed as word spread at the end of the 1990s that the incarnation of evil wasn’t really as evil as the bee busters in Terry’s neighborhood claimed in their US\$2,000–US\$3,000 advertisements. Nevertheless, this new version of homeland security remains in business to this day and is still being touted online. One such provider uses a kind of Batman mask for his assignments and markets his honey as Killer Bee Honey.

Fred Terry does just the opposite. His honey jars are labeled “Desert Honey from the Singing Beekeeper.” He doesn’t kill the killers when he recaptures swarms, and he doesn’t charge anything for gathering them from roofs, or garden sheds, or wherever else they might have settled. His payment is the

bees themselves; he takes them home and works with them. He just doesn't broadcast it.

As to why the hysteria spread like a wildfire, Terry suggests a classic fear—the wild horde. “A swarm is always a good bogeyman.” How real and immediate the danger actually is plays a minor role. Danger always contains a large portion of subjectivity. Terry loves relating the amusement that the beekeepers in Brazil and other South American countries get when told that their bees are called “killer bees” in the USA.

Let's be honest, isn't it strange that we accept that there are many gunshot victims but nobody speaks of “killer guns.” We accept that there are even more victims of car accidents, but nobody speaks of “killer cars.” We don't call other insects like spiders or scorpion “killers.” In the USA there is a wasp called yellow jacket that is credited with far more “murders” than the “killer bee.” Nobody has suggested calling this wasp the “killer jacket.”

Even Terry, who has only a few hives behind his house, the rest being exiled to the desert a safe distance away just for safety's sake, didn't tell anyone in the early years that he had been keeping “killer bees” since 1991: “We US citizens make up just 4.5 percent of the world population but 75 percent of all lawyers, most of them busy as bees and buzzing around chasing indemnity cases.”

Before Terry, who is by no means a gambler, became an African bee guy, he gathered information from Brazil, a number of Central American countries, and Mexico and discovered that almost every accusation leveled against the “killer bees” was false. He never tires of emphasizing this.

It was said that not only did they not make good honey, they made too little of it. The exact opposite is true. It was said that their pollinating capacities left much to be desired. Wrong: They are in no way inferior to the European bees. And finally, it was said that you couldn't handle them safely. Almost wrong! It would be better to say that Africanized bees cannot be placed near human habitations or busy routes. And even with protective clothing and smoke, you still have to be more careful with them than with tended bees. Beekeeping

in swimming trunks—a popular image of the European domestication ideal—wouldn't be a good idea, and even Terry looks more like a knight in armor when interacting with his bees. He advocates adapting to the bees and not forcing them into some pattern just for the sake of making things easier for humans. He also points out that once it is dark there are no risks involved in approaching the hives: “Honey-stealing bears have known this for ages. They come during the night when no bees fly, not even in emergencies.”

And so Terry, when he is not busy with beekeeping or singing, has become a kind of duty counsel for the defense of the Africans, as he calls them. He finds the formal term, Africanized bees, too colonial.

After he has listed and disproved the standard arguments yet again, it mostly boils down to one thing that is difficult to explain because it's rooted somewhere deep in the collective subconscious: The bad guys are threatening to drive out the good guys. Or, bad beats good. To some extent, this is just another example of un-American activities.

But eventually cracks began to appear in the resistance of the general public, and Terry upped the ante: “Look at cattle: They can survive in dry and dusty Arizona. They are wild and healthy and not fancy, they can even eat cactus. Just imagine trying to get along here with big, fat Holsteins. No chance! Zero! The Africans are not pure bred, not domesticated and tamed; they've remained primal, wild, and resistant.”

With the increasing danger of epidemics and the worsening supply of blossoms, the wild European honeybee swarms have virtually no chances of survival. That was once very different. In the sixteenth and seventeenth centuries, European settlers brought strains of *Apis mellifera ligustica*, *carnica*, *mellifera*, and *lamarckii* honeybees to North America. Swarms that escaped from beekeepers resettled very successfully in the various climate zones, even in semideserts, prairies, or the harsh mountain climates of the Rockies.

Nowadays, there are hardly any wild swarms of honeybees with a European background. Their status lies somewhere between “highly endangered” and “extinct.” “The European bees are the losers and the Africanized the winners. If I was a gambler I would bet on their survival. The Africans will still be here

when we no longer exist,” Terry tells me with a smile, radiating calm and serenity almost as if the peaceful day were approaching when the planet Earth would be rid of *Homo sapiens*.

But before that happens, *Homo sapiens* (particularly in the form of *Homo scientificus*) will try everything possible to deliver the bees from their enemies the *Varroa destructors*, which continue to pose the biggest threat. At the moment, the parasitic mites are on the minds of a couple of thousand scientists worldwide who are working on containing them.

Bees affected by *Varroa* do not die from loss of blood to the blood-sucking mites, which go particularly for larvae but also attack adult bees, but from the secondary effects. Pathogens enter the hemolymph via the bite wounds and then the bloodstream. A typical and striking result of such infection is wing deformity. Workers bitten during the larva stage hatch with stunted wings, making them unfit to fly and condemning them to a short life.

Shortly before the sealing of the brood cells, fertilized female *Varroa* mites invade the cells and give birth to their offspring. These develop in the cells and tap into the hemolymphs of the larvae so that when the bee hatches, a whole mite family joins the colony. In this way, the *Varroa* population in a hive can double in just under one month.

And the *Varroa* of today can breed an extra generation of tormentors—possibly an effect of climate change, because the summers increasingly linger deep into fall. “One reproductive cycle more is really a critical factor!” says *Varroa* expert Dr. Eva Rademacher from Freie Universität, Berlin. Just how diseased a colony is can be measured by the number of *Varroa* mites living in a colony at a particular point of time in the bee year. Eva Rademacher’s rule of thumb estimation—useful as long as it isn’t used as the only indicator—involves the sticky board on the floor of the hive; the fallen bodies of dead mites remain stuck there and are relatively easy to count.

The degree and extent of damage to a colony is significantly influenced by the length of development of the bee brood; the longer an individual bee remains in the sealed brood cell the better it is for the parasitic lodger, although there are differences between male and female bees. Drones need



twenty-four days from egg to hatching, the female workers only twenty-one; likewise, drone larvae need 6.5 to 6.9 days for metamorphosis in the sealed cells and future workers only 5.5 to 6.2 days.

The extra day means that the parasites in the drone brood cells can develop better and in greater numbers. The mites seem to know about the small difference; lab tests at the end of the 1980s and early 1990s established that *Varroa destructors*, if left to their own devices, choose to infest drone broods. Scientists assume that fertile mites carried (involuntarily) by nurse bees receive information from somewhere about whether future drones or future female bees are inside the unsealed brood cells. This information could be a chemical signal, or perhaps the mites are able to recognize the slightly different construction of the cells—the surface of the drone cells is 1.7 times larger than that of the worker cells.

One tested and toxin-free defense strategy of beekeepers is drone cutting, which makes use of the behavioral patterns of the mites by destroying as many of the drone brood as possible before hatching. By doing this, future infestations can be contained. The missing males are not relevant for the survival of the colony.

Special trapping combs that use a similar principle have also proved effective. When there are no broods, for instance, when a newly established colony has yet to produce offspring, the mites are lured to a drone brood comb. The mites pounce on the only available resource and in doing so no longer threaten valuable parts of the bee population. The beekeeper then just has to choose the right time to dispose of the infected and now sealed trapping combs. “The process is highly effective. On average 87.7% of the mites were trapped in the 73 units that were treated,” wrote the scientists Berg, Schmidt-Bailey, and Fuchs.⁴

As is so often the case in scientific and medical research into illnesses, the key question is: Why are some individuals or groups of individuals either not affected or able to live with an illness? How is it that the Africanized honeybees are able to cope so well with the pandemic?

A Brazilian team of researchers studied the higher *Varroa*-tolerance of the Africanized bees and were able to confirm in 2011 what had been obvious in

Latin America for years: “In tropical regions of Brazil, where honeybees are Africanized, the mite effect on the colonies appears to be reduced to the point where no control measures are necessary and no colony losses because of this mite seem to occur.” And another remarkable finding:

Artificial infestation of bee colonies with adult *Varroa* females in São Paulo, Brazil, has showed that Africanized bee workers were almost eight fold more efficient in getting rid of the mites on their bodies compared to pure Italian bee workers. Artificially infested Africanized bees reacted to the presence of *Varroa* from the very beginning of infestation. Strong body movements involving the abdomen, legs and mandibles were performed by infested workers. The movements executed by infested workers permitted nearby workers to identify the *Varroa* on their body. When fellow workers identified the presence of the mite on the body of another worker, they used their tongues and mandibles to attack it.⁵

Proficiency in recognition and removal of mites are not the only advantages. Africanized bees were also able to prove in a scientifically controlled study carried out in Mexico in 2002 that they displayed considerably better grooming behavior than European bees when removing infected broods from the hive.⁶ The “killer bees” were considerably better plague preventers; the Italian bees only cleared away 8 percent of their infected broods while the Africanized bees managed to clear away 32.5 percent.⁷

These comparisons in themselves could provide part of the explanation as to how the descendants of Warwick E. Kerr’s crossbreeding experiment were better suited to fighting the destructors than the previously dominant European honeybees. But there were still other indications. Various groups of scientists had noticed that in colonies with high resistance there were strikingly large numbers of infertile mites. In 1999, an astonishingly high proportion—43 percent—of infertile female mites was registered in “killer bee” hives; in European beehives, the proportion was only 19 percent.⁸ In other words, in European beehives, more than double the number of mites were

busy producing parasitic offspring. Unfortunately, more recent studies—in 2003—found that the mite infertility rates between Africanized and European bees were approximately matched.

Even if the Africanized bees do have numerous advantages, though, nobody would want to give them freedom of movement throughout Europe. “It’s not only about beekeepers working without danger, it’s also about the safety of joggers peacefully jogging past a nearby hive,” says Walter Haefeker, appealing to all those in densely populated central Europe who are rather thoughtlessly recommending switching to Africanized bees because they are the best collectors. Hope in the fight against the mites rests at the moment with those offering and promising anti-*Varroa* weapons and strategies.

The battle against *Varroa* is increasingly becoming a matter of selection for beekeeping. It is hardly possible for hobby beekeepers to deal with mites unless they are completely indifferent to yields and losses. So, just as yields from monocultures of industrialized farming can no longer be obtained without insecticides, fungicides, and pesticides, beekeeping seems to have become impossible without some kind of permanent defense against *Varroa* and other diseases. At least, that is the opinion of the majority. The danger is that the beekeepers who don’t engage in a systematic fight against the *Varroa* endanger other colonies in their neighborhood. Collapsing colonies from uncontrolled *Varroa* infestations infect healthy ones within a large radius.

Bee activity, measured in hatching offspring per working day, and *Varroa* infestation form two very different activity curves. In May/June, life in the hive reaches its zenith with up to fifty thousand bees in the hive. In contrast, the peak of mite density happens in October, when bee life is just ticking over and preparing for the winter rest phase. This is a critical moment, and the mites hit the colony most severely when it is beginning to slow down for winter.

Should the winter generation—the longer-living bees that overwinter with the queen—be severely weakened by mites in fall, the flame of life may flicker or even be snuffed out during the cold winter months. It is almost as if Amundsen were to set off in the extreme cold with a sick and undernourished team.

But a faltering colony is not only a danger to itself. Bees are no angels, and given the chance, they will plunder the food supplies of other, weakened hives. Along with the stolen honey, they bring the parasites of the dying colony back to their own hives. Beekeepers' responsibility to act against bee diseases goes beyond a responsibility to their own hives; they also bear some responsibility for the well-being of other colonies in the vicinity. Beekeepers making a stand against *Varroa* are encouraged by associations and research institutes to use combined defense systems and not to put all their trust in one single substance to provide the solution, even if its properties are extolled by the large chemical multinationals. Many mites have already developed resistance to substances contained in Apistan, Bayvarol, and Klatan, and critics of chemical treatments are worried that the multinationals have unintentionally but effectively created supermites through aggressive marketing and use of their products. However, nobody dares say this for fear of lawsuits.

Bees are no angels, and given the chance, they will plunder the food supplies of other, weakened hives.

Even as far as conventional beekeeping is concerned, before and during the foraging season for nectar and pollen, treatment with chemical substances should not be an option, proclaims the Arbeitsgemeinschaft der Institute für Bienenforschung e.V. (the Association of German Bee Research Institutes). It emphasizes this point with a bold exclamation mark.⁹ Honey cannot afford to lose its reputation as a pure, natural product.

When the final honey harvest has been delivered, the workers continue to raise the brood. At the same time, the offspring are nurturing the mites. Methods of fighting *Varroa* are put into action in order to get at the source of evil after the honey harvest from high summer until October, if possible killing them in the cells or just after hatching. Formic acid is the substance of choice, but its application requires a high degree of skill, experience, and expertise. In winter, when there is nothing to gather and the queen has suspended the laying of eggs, beekeepers are advised to use lactic acid and oxalic acid, finely sprayed and following the recommended dosage. Too much weakens the bees, too little does no harm to the mites.

But on top of “too much” and “too little,” is not a third “something else” possible? As Fred Terry fills his jars with light golden, runny semidesert honey from his “killer bees,” he occasionally shares his thoughts, which are maybe too simple and too true to immediately make sense. “Why don’t we just listen to the bees? Swarming bees fly away from an infested hive. They fly away from the mites and start all over again. Professional beekeepers prevent swarming and in doing so are leaving their colonies to the parasites.” Terry guides a “killer bee” to a small opening in the window in his filling room and watches it fly off before he continues. “We’ve bred out all aggression from bees and maybe also weakened their resistance to all sorts of diseases. Now, suddenly there are bees that are resistant, but we are walking away from them instead of teaming up with them.”