E-965

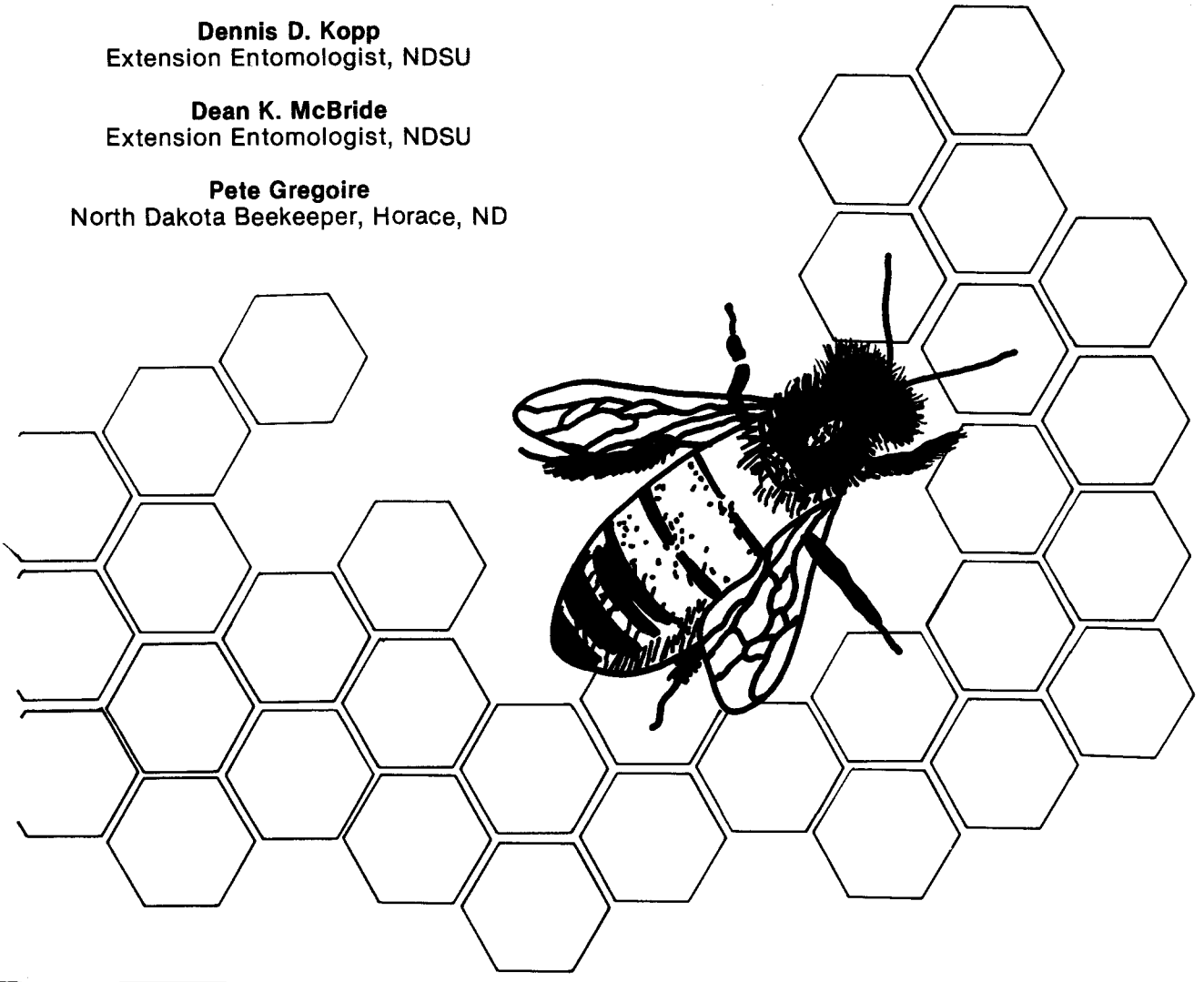
NOVEMBER 1988

THE AFRICANIZED HONEY BEE

Dennis D. Kopp
Extension Entomologist, NDSU

Dean K. McBride
Extension Entomologist, NDSU

Pete Gregoire
North Dakota Beekeeper, Horace, ND



NDSU EXTENSION SERVICE
North Dakota State University, Fargo, ND 58105

16 ENT

The spread of the Africanized honey bee in South America and some negative aspects these insects have on man and agriculture are being followed by the news media. These reports often consist of sensational stories and refer to the bees as 'killer bees' (Stoner & Wilson, 1977). The popular press and the motion picture industry have expanded upon this sensationalism and have caused exaggerated fears. The result has been fiction and misinformation detrimental to an accurate understanding of the issue. This publication presents a realistic assessment of how the Africanized honey bee will affect North Dakota beekeepers and the general public.

The term "Africanized honey bee" (AHB) is a common name that is given to a race of honey bees whose genetic line can be traced back to an accidental escape of imported research bee colonies in the vicinity of Sao Paulo, Brazil.

There are a number of races of honey bees in Africa. One race is a wild tropical African honey bee, *Apis mellifera adansoni,* which evolved traits that allowed it to be adapted to and competitive in a tropical environment. The aggressive foraging behavior of this bee was regarded as a desirable trait to be incorporated into the gene pool of the domesticated honey bee in tropical areas. In 1956, *Apis mellifera adansoni* was brought to Brazil for research purposes by a noted geneticist. Through human error, colonies escaped from captivity. Reproductives from escapes of *A. mellifera adansoni* colonies crossed with the domesticated Italian or European race of honey bee, *Apis mellifera ligustica*. Crosses or hybrids of these two races are known today as the "Africanized honey bee" (Kerr, 1967; Mitchener et al., 1972).

These interbreedings produced AHB hybrids favorably adapted for survival in tropical and semi-tropical climates. The AHBs are more aggressive foragers than the originally imported European honey bee (EHB) strains, and in areas where both are present, the AHB could replace the EHB. Over the last three decades AHB hybrids have spread over most of Brazil and adjacent South American countries and into Central America (Taylor, 1977; McDowell, 1984; Taylor, 1985).

Authors of this circular believe the following predictions to be accurate: 1) The Africanized honey bee will enter the United States and successfully establish feral (wild) colonies in at least the southern states; 2) The range of the AHB will be limited in the U.S. by climatic factors similar to factors that now limit distribution in Argentina and South Africa; 3) Traits of the AHB, such as aggressive colony defense, swarming, absconding, small quantities of stored honey and hybridization with EHB stocks, will make this insect more difficult to manage than the EHB; 4) The impact the AHB has had on beekeeping, agriculture and human health in tropical South America will **not** necessarily apply in the United States; 5) Most AHB problems will be from feral populations in colonized areas; 6) Initial suppression of feral AHB populations will be required to protect the U.S beekeeping industry and to minimize the general publics encounters with bees; and 7) United States beekeepers will maintain only EHBs.

Expansion of the Geographic Range of the Africanized Honey Bee

The exact northern boundary of the AHB will not be known until the insect becomes established in North America. Today we can only speculate about the northern range of AHBs in North America, and these speculations are based upon climatic parameters in the Southern Hemisphere.

The current range of the AHB in the Western Hemisphere extends from Argentina (Kerr et al., 1982) northward into Mexico. No known geographic barriers will prevent this insect from spreading northward into the United States. Taylor (1977, 1985) accurately predicted the rate of spread of this insect into the northern half of South America and Central America. If his predictions continue to hold, the AHB will be into the southern U.S. by the early 1990s. Taylor's (1985) AHB entry scenario for the United States predicts that the two most likely points of immigration will be first at Brownsville-McAllen, Texas and slightly later, into south central and western Arizona. Taylor further predicts the AHBs will enter New Mexico during the warmer months and eventually enter the coastal regions of California from Baja, California.

The initial immigration will be by a small number of swarms which may go unnoticed for several months. These undetected colonies will produce additional swarms which will move to new locations, expanding their range. In Texas, because of the warmer climate along the coast, he predicts the distribution will expand more rapidly eastward than to the north and west. Central Arizona as far north as Phoenix and western Arizona will be colonized rapidly. Even though AHBs may enter California from Baja, they most likely will first enter the Imperial Valley and somewhat later enter the coastal areas.

In most regions of the United States the initial densities of the AHB will be low. There are three regions (south central Texas, the vicinity of New

Orleans, all of Florida and part of southeastern Georgia) where climatic conditions, the availability of pollen, nectar and nesting sites may allow feral colonies of AHBs to reach high densities. In these three regions the average high temperatures are 66°F or above. Kerr et al. (1982) in studies of the AHB winter survival in Argentina found that feral colonies would survive in areas with an average cool season temperature of 60°F to 66°F, but not as successfully as in warmer areas.

Taylor predicts the potential North American range of the AHB based upon the insects' demonstrated ability to colonize southern latitudes of Argentina. He believes the AHB will colonize areas of the United States which have a minimum of 240 frost free days per season and where winter temperatures do not fall below 14°F (-10°C). However, ongoing research is addressing the possibility that the AHB may be more tolerant to cold than Taylor has predicted.

Some research points to the possibility of the AHB being considerably more cold hardy than first thought. Research by T.E. Rinderer is presently comparing overwintering ability of AHBs and EHBs at cold high elevations in Mexico. He has found nearly equal survival of colonies of AHBs and EHBs at temperatures as low as -8°F, so AHBs may be capable of overwintering in areas well north of the Gulf Coast states in the U.S.

Extended periods of cold temperatures could be a factor that would affect the survival of colonies of AHBs. The AHB may not be able to survive prolonged periods of cold temperatures as efficiently as the EHB. Although AHBs have not been subjected to the evolutionary pressures of prolonged periods of low temperatures. Perennial colonies (that is, permanent colonies that persist year round) of the African bee *Apis mellifera adansoni* have been found at high altitudes in South Africa where temperatures are below freezing for 6 months of the year and where snowfalls which continue for a week at a time are common (Fletcher, 1978).

Taylor's model would place the northern margin of overwintering survival of feral AHB colonies at the mean high January isotherm of 60°F (Figure 1). Each spring, surviving feral colonies would be expected to expand beyond their overwintering limit. The range of summer expansion and the number of AHB swarms involved will be determined by a number of still unknown factors. Examples of some of these undetermined variables are: swarm-to-swarm intervals; number of swarms per swarm cycle (Otis, 1980); density of the source population, and physical, climatic and geographic factors which might lead to strongly directional swarm movement.

Figure 1. The predicted northern range of feral colonies of Africanized honey bees in the United States. The 60°F (16°C) and 66°F (19°C) isotherms represent the mean high temperatures for January. (Designed after Taylor & Spivak, 1984.)

Traits of the AHB

Certain behavioral traits of the AHB make management of this bee more difficult than management of the EHB. The undesirable biological and behavioral traits of the AHB which make this race of bees difficult to manage are traits which have evolved to better adapt it to climatic, predation and biological conditions in its native tropical range in Africa. The behavior of the AHB currently existing in South America is significantly different from the managed EHB.

The AHB is a much more aggressive nest defender and a more active forager than the EHB (Collins et al., 1982). However, the sting of the AHB is no more venomous than that of our domestic honey bee. The AHB becomes defensive at a much faster rate than the EHB, they sting more readily, recruit a much larger portion of the hive for defense, and chase an intruder for a greater distance.

The AHB will tenaciously pursue a threat to its hive for a distance of up to 1 km (0.6 mile) from the disturbance site. Once disturbed, AHB colonies remain in a defensive posture for a longer period of time, approximately 28 minutes (Collins and Rinderer, 1986). Because of this tenacious defensive behavior, the AHB poses a public health threat when a hive is intentionally or accidentally disturbed.

Swarming is a normal process of colony reproduction in social bees. A queen bee leaves the hive with about half of the worker bees and starts a new colony. Workers that remain behind will produce a new queen and continue the old hive. For beekeepers interested in maximum honey and wax production, the swarming process is detrimental since it interrupts honey production. Therefore, this trait has been selected against for thousands of years in honey management. AHBs swarm much more frequently than managed honey bees; therefore, their colonies spread much faster and store less honey.

Absconding is a form of colony movement during which the entire bee colony leaves its hive and moves to a new location to develop a new hive. European honey bees seldom abscond, but AHBs abscond frequently (Fletcher, 1978). Absconding evolved as a survival mechanism to provide bee colonies with a method to cope with periodic food shortages. Rather than remain in the same location and risk starvation, a colony may abscond in an attempt to find a more favorable nesting or foraging site. The EHB, under similar circumstances, usually will remain in the original nest location and consume stored food supplies and eventually starve if no food becomes available.

The AHB is not as particular as the EHB in selecting nesting sites and will nest almost anywhere. This characteristic makes it possible for large numbers of AHB feral colonies to develop in areas adjacent to managed colonies. These feral colonies will compete tenaciously for available food. Feral AHB colonies are a source of large numbers of drone honeybees which tend to saturate an area and thus maintain a high degree of Africanization in local honey bee populations.

The aggressive behavior of the AHB makes it a natural thief for robbing other hives. Robbing is an aberration of foraging behavior. Robbing becomes a problem when natural sources of nectar become scarce. Robbing a weakened colony will usually destroy it. Even strong colonies are detrimentally affected by robbing since large numbers of bees are often killed during colony invasion. The attacked colony becomes weakened and more susceptible to parasites or diseases. Many researchers have reported that AHB swarms will readily take over EHB colonies, particularly colonies that do not have functional queens (Mitchener, 1975).

Public Reaction to the AHB

Public perception that the Africanized honey bee is a public health problem could lead to restrictive apicultural legislation. In an atmosphere of public fear of the AHB, a few chance stinging incidents by any stinging insect could ignite public concern and initiate attempts to enact anti-beekeeping legislation.

An atmosphere of uneducated public fear of bees can have direct implications on the beekeeping industry. Beekeepers would likely be confronted with an increased frequency of nuisance lawsuits, unattainable liability insurance, expensive legal fees, denial of apiary sites by landowners and local laws restricting bee management and transport. Similar problems have been confronted by beekeepers in certain areas of South America (Mitchener, 1975). A forthright education campaign is essential to disarm unrealistic fears and reduce future confrontations.

To prepare the general public for the appearance of the AHB into a region, information should: 1) inform the public of realistic potential dangers of the AHB; 2) promote honey bees and the industry of beekeeping as a national and local biological and economical asset; 3) provide assurance that stinging incidents will decline over time; 4) demonstrate that area beekeepers are managing European and not Africanized bees and that the threat is from

feral, not managed bees; 5) clearly establish that beekeeping restrictions will result in decreased production of U.S. honey and lower yields in U.S. bee pollinated crops but **will not** provide the general public with additional protection against possible accidental stinging incidents; 6) demonstrate to the general public that beekeepers view the AHB problem as a threat to much more than their industry and that they wish to work with their neighbors to address the problem for the benefit of all.

North Dakota's Migrant Beekeeping Industry

Currently most commercial beekeepers in North Dakota are classified as migratory beekeepers because they transport colonies to the southern or southwestern states for the winter. By migrating to southern regions in the fall, northern commercial beekeepers can maintain colony honey production in the south, overwinter fewer colonies, pollinate crops for a fee, and produce their own queens and nuclei colonies to bring north the following spring.

In the fall of the year, migrant beekeepers in North Dakota cull the least productive hives in their beeyards, moving only the strongest south. In the fall of 1986, 90,904 colonies were transported south with the remainder killed to maximize honey yield and reduce transport costs. In the spring of 1987, beekeepers brought 251,181 colonies of honey bees from the southern or southwestern states into North Dakota.

In all likelihood, the arrival of the AHB in the U.S. will have a substantial effect on the activities of the migratory beekeeping industry. Reports of the AHB in the southern United States and the sensationalization of stinging incidents will undoubtedly cause a public outcry for action. It is likely that residents of northern states will view the spring northward movement of migrant beekeepers colonies as a threat by being a possible source of an accidental introduction of the AHB into their state. Public concerns will be addressed to state and federal legislatures and regulatory agencies to initiate legal restrictions aimed at slowing the northward movement of the AHB.

Predictable results of public concern will be legislation to establish zones free of beeyards, to require certification that hives contain EHBs and not AHBs, to require mandatory annual requeening of hives with queens from AHB-free source areas, to enact transport regulations, to enact quarantines or embargos on the shipment of all bees from affected zones and to require mandatory inspections and certification before bees can be moved. While the American beekeeper is not the source or cause of the AHB problem, the beekeeper will be the target of public response.

Many aspects of beekeeping can be negatively affected by the entry of the AHB into the United States. Of greatest concern is the impact that the AHB will have on the production of queens and package bees in the Gulf States, Georgia, the Carolinas, Arizona and California (Taylor, 1985). Most of the U.S. queen breeding enterprises lie within the geographic zone in which the AHB is predicted to be capable of overwintering. The migratory bee industry of the northern states and Canada is dependent upon this source of new bees and queens (Winston, 1983).

If the AHB spreads rapidly across the southern queen breeding region and feral populations go unchecked, it is probable that restrictions may be enacted to prevent northward movement of bee colonies from the AHB invaded regions. This would cripple the established migratory beekeeping industry in North Dakota.

Summary

North American apiculture will be greatly affected by the immigration of the AHB into the U.S. if the South American experience with the AHB is repeated in North America. The majority of queen and package bee products, in regions where AHB populations become established, wil be severely affected and many may be forced out of business. Migratory beekeeping, as presently practiced, could cease until an acceptable Africanized or African-European hybrid stock is developed. Beekeeping and honey production will decline in the zone of feral AHB populations. Many beekeepers, particulary those who are less efficient or who are fearful of ramifications arising from the AHB problem, will drop out of beekeeping. Total U.S. honey production will decline with reductions in the number of managed bee colonies. Competition between managed bees and feral AHB populations will also reduce yield. McDowell (1985) estimated nationwide loss to the honeybee industry and other agricultural activities could range from $26-58 million per year.

Cautious optimism for a long term solution (10-15 years) lies with events experienced in southern Brazil. A growing body of evidence shows beekeeping there has recovered remarkably from the initial depression caused by the establishment of the AHB (Goncalves, 1975); Mitchener, 1975; DeJong, 1984). Today southern Brazil has more beekeepers, more managed colonies, and higher honey production than prior to the arrival of the AHB. To date, the rebound in apiculture extends only as far north as 20°S longitude. Southern Brazil is where the EHB was most extensively managed prior to the appearance of the AHB. Reasons for the recovery of apiculture are listed by Goncalves (1975) and DeJong (1984) as: 1) improved bee management; 2) improved roads and transportation; 3) improved nectar flow due to the development and expansion of commercial orange and apple orchards; 4) increased government assistance in the development of beekeeping; 5) increased migratory beekeeping; 6) improvements in the manageability and productivity of hybrid and Africanized bee stock; 7) emergence of a new generation of beekeepers having no prior experience with the EHB.

For U.S. beekeeping the most significant development from the Brazilian experience is improvement in the manageability and productivity of bees in southern Brazil. A long-term solution to the AHB problem could involve intensive selection, hybridization with or improvement of a more docile Brazilian AHB race. An intensive selection program may lead to the development of a docile "southern" bee with optimum honey production and pollination characteristics for management within the overwintering zone of the AHB in the U.S. This type of international effort would require cooperative apicultural research programs working closely with the beekeeping industry in southern Brazil.

Acknowledgments

We wish to thank the following for having provided helpful suggestions on content, form and review comments in this circular: H.J. Meyer, M.J. Weiss and B.A. Bates of the Department of Entomology, NDSU; D.R. Nelson and J. Carlson, ND Department of Agriculture; W.L. Gojmerac, Department of Entomology, Univ. Wisconsin-Madison and J.E. Tew, Department of Entomology, Ohio State University. Gratitude is also extended to C.D. Fanning, H.J. Hirning and R.R. Gulbrandson for their constructive critique of this manuscript.

Literature Cited

Collins, A.M. et al. 1982. Colony defense by Africanized and European honey bees. Science 218:72-72.

Collins, A.M. and T.E. Rinderer. 1986. The defensive behavior of the Africanized bee. Amer. Bee J. 126:623-627.

DeJong, D. 1984. Africanized bees now preferred by Brazilian beekeepers. Amer. Bee J. 124:116-118.

Fletcher, D.K.C. 1978. The African bee, *Apis mellifera adansonii,* in Africa. Ann. Rev. Entomol. 23: 151-171.

Goncalves, L.S. 1975. Do the Africanized bees of Brazil only sting? Amer Bee J. 115:8-10.

Kerr, W.E. 1967. The history of the introduction of African bees to Brazil. S. Afr. Bee J. 39: 3-5.

Kerr, W.E., S de Leon Del Rio and M.G. Barrionuevo. 1982. The southern limits of the distribution of the Africanized honey bee in South America. Amer. Bee J. 122(3): 196-198.

McDowell, R. 1984. The Africanized honey bee in the United States: What will happen to the U.S. beekeeping industry? USDA. Agricultural Econ. Rpt. 519

Mitchener, C.D. et al. 1972. Committee on the African honey bee. Washington, D.C.; National Research Council, National Academy of Sciences.

Otis, B.W. 1980. The swarming biology and population dynamics of the Africanized honey bee. Ph.D. thesis. Univ. Kansas, Lawrence.

Taylor, O.R. 1977. The past and possible future spread of Africanized honey bees in the Americas. Bee Wld. 58: 19-30.

Taylor, O.R. 1985. African bees: potential impact in the United States. Bull. Entomol. Soc. Amer. 1985(4): 14-24.

Taylor, O.R. and M. Spivak. 1984. Climatic limits of tropical African honey bees in the Americas. Bee Wld. 65: 38-47.

Stoner, A. and W.T. Wilson. 1977. A review of the public's reaction to Africanized honey bees. Gleanings in Bee Cult. 105(9): 405-408.

Helping You Put Knowledge To Work