United States
Department of
Agriculture

ACTION PLAN

AFRICANIZED HONEY BEE
Hybrids of *Apis mellifera scutellata*
Lepeletier

Animal and
Plant Health
Inspection
Service

Plant Protection
and Quarantine

Cooperating State
Departments of
Agriculture

November 1987

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Comments

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AUTHORIZATION

This Action Plan provides guidelines and actions for the eradication of an Africanized honey bee (AHB) infestation. This Action Plan supplements information contained in the Plant Protection and Quarantine (PPQ) Treatment, Emergency Programs, and Administrative Procedures Manuals. It is to be used in conjunction with other manuals, such as State manuals, and the Fast Africanized Bee Identification System (FABIS) manual when conducting emergency program activities.

The information and instructions contained in this Action Plan were developed and approved by representatives of the Animal and Plant Health Inspection Service (APHIS), cooperating States, Agricultural Research Service (ARS), Cooperative State Research Service, and affected industry.

All program technology and methodology employed are determined through discussion, consultation, or agreement with the cooperating State officials.

NOTICE

Pesticides recommended in this Action Plan are registered or may be exempted under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), as amended. Precautions on pesticide labels and all instructions in this Action Plan must be carefully followed.

Federal and/or State personnel may not make any warranty or representation, expressed or implied, concerning the use of these products and shall not be responsible for any loss, damage, or injury sustained as a result of the use of any product as specified in this Action Plan.

The use of trade names in this Action Plan does not imply an endorsement of those products or of the manufacturers thereof by Federal-State pest control programs. Equivalent formulations under different trade names are acceptable.

W. F. Helms — July 8, 1987

Deputy Administrator
Plant Protection and Quarantine

Date

William A. Mitchell — July 20, 1987

Chairman
National Plant Board

Date

I. GENERAL INFORMATION

A. Action Statement

This action plan is not intended for use in eradicating a migratory invasion along our southern border. The information contained in this document is intended for use only when an isolated infestation of AHB is known to exist. This action plan is to be used for guidance in implementing eradication procedures and in preventing spread to other locations. This action plan provides technical and general information needed to implement any phase of an AHB eradication program. Specific emergency program action is to be based on information available at that time.

B. Background Information

Taxonomists divide the species Apis mellifera into some 30 subspecies. Of these, three European types, Italian, A. m. ligustica; Carniolan, A. m. carnica; and Caucasian, A. m. caucasica, and their hybrids predominate in the United States. The AHB, A. m. scutellata (formerly called A. m. adansonii), originated in Africa and ranges from the West Coast (Senegal) through South Africa. When introduced into Brazil in 1956, it hybridized with the various subspecies of European bees present. As Africanized bees reproduce more successfully than European bees, Africanization proceeded apace and spread. Today, the AHB ranges over most of Central and South America.

It is extremely difficult to distinguish AHB from European honey bees (EHB). Only after complex laboratory analysis of morphological or other characters is it possible to state the probability that a group of bees is Africanized. That is, scientists have developed a probability table using 0.00 to indicate absolute assurance that bees are European and 1.00 to indicate absolute assurance that bees are Africanized. For the purpose of this action plan, any sample of bees that has a probability of $\geq$0.90 will be considered Africanized.

At the time this action plan was being written, there were several new identification techniques being developed. If one or more of these techniques prove to be superior, the best identification technique should be used.

C. Life History Application

Major behavioral differences which distinguish AHB from EHB are general excitability, defensiveness, frequent swarming, and an ability to nest in a wide range of sites.

The AHB swarms frequently. This behavior is the primary mode of spread. When a swarm finds a suitable nesting site, it may nest there and construct combs. If a shortage of food, water, or space

develops, a swarm will move (abscond) to a more suitable location. As the number of bees in the nest increases, they produce reproductive swarms which seek new nesting sites. Reproductive swarming often occurs up to every 6 weeks, chiefly during nectar flow periods. Absconding swarms appear chiefly during periods of dearth.

Program actions are guided by swarming activity and other information. Eradication treatments, trapping activities, and regulatory functions will all be affected by the appearance of swarms.

D. Program Options

When one or more honey bee swarms, nests, or hives with $\geq$.90 probability of Africanization exists in an area, the following program options are available:

1. If one swarm without comb is detected, complete the following actions:

a. Destroy the Africanized swarm;
b. Contact beekeepers and sample all apiaries within a 2-mile (mi) radius;
c. Ground survey and sample all other bees within the same 2-mi radius; and
d. Through the Extension Service or other Government Agency, alert beekeepers within a 10-mi radius.

2. If one nest with comb and brood or more than one swarm is detected, a comprehensive survey, regulatory, and eradication program is required.

To be effective, a program must contain all options appropriate to specific conditions that are present in a given area at a given time. A chart is provided to guide in the selection of survey, regulatory, and control options. It will help in deciding what responses are required under actual field conditions. These conditions are time of year, location, and resident bees. Other conditions may limit any required option. These are discussed under the appropriate option in the text.

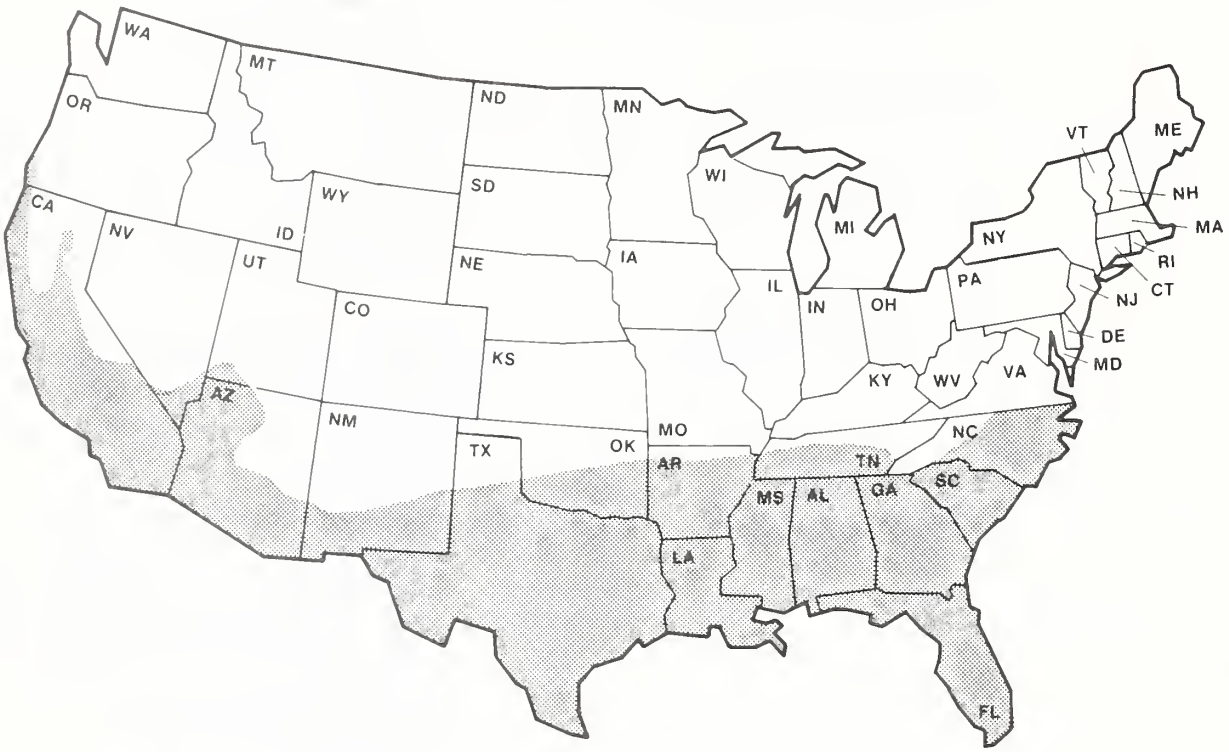
Managed bees may constitute a special problem. An initial survey must first be carried out to determine the number of managed bees in an area. If managed bees are in the process of being moved, it will be necessary to regulate their movement.

E. Definitions

The following is a list of definitions needed to use the program selection guide:

Feral Bees:	Bees found in the wild.
Migratory Bees:	Managed bees transported by beekeepers to various locations.
Nonmigratory Bees:	Managed bees kept in one area on a year-round basis.
Resident Bees:	The bees present in an area, both managed and feral.
Resource-Poor Area:	An area poor in nectar or pollen resources. The conditions may show seasonal variation.
Resource-Rich Area:	An area with ample supplies of nectar and pollen--especially when available throughout most of the year. The conditions may show seasonal variation.
Zone A:	Areas of the United States, including the west coast up to Washington State, southern States from Arizona to Florida, and the east coast up to Virginia where bees may be active on winter days; generally south of the 240 frost-free dayline.
Zone B:	Northern areas of the United States and Southern Canada where there are prolonged pauses in bee activity; generally those parts of the country north of the 240 frost-free dayline (see following map).

Honey Bee Survey Zones



Zone A (Frequent Winter Activity)
Zone B (Little Winter Activity)

*Based on average maximum temperature of 50°F during January

PROGRAM SELECTION GUIDE			
If AHB infestation is in zone:	and resident bees in the area are mostly:	and the season is :	then select program number:
A (South)	Managed Colonies	spring, summer fall or winter	2
	Feral	spring or summer	3
		fall or winter	1
B (North)	Managed Colonies	spring, summer or fall	2
		winter	4
	Feral	spring or summer	3
		fall	1
		winter	4

Actions	PROGRAM SELECTED			
	1	2	3	4
Survey				
Beekeeper Contacts	yes	yes	yes	yes
Survey	yes	yes	yes	yes
Public Reports	yes	yes	yes	yes
Beelining	optional	optional	optional	no
Bait Stations	yes	no	optional	no
Bait Hives	optional	no	yes	no
Colony Sampling	yes	yes	yes	yes
Composite Sampling	yes	yes	yes	no
Regulatory				
Inspection/ Certification	yes	yes	yes	yes
Requeening/ restocking	yes	yes	yes	no
Movement of Hives/ Honey Supers	yes	yes	yes	yes
Control				
Feral Bees	yes	yes	yes	yes
Bait Hives	optional	no	yes	no
Bait Station/ Poison	yes	optional	yes	no
Managed Hives	yes	yes	yes	yes
Pesticides	yes	yes	yes	no

A. Delimiting Survey

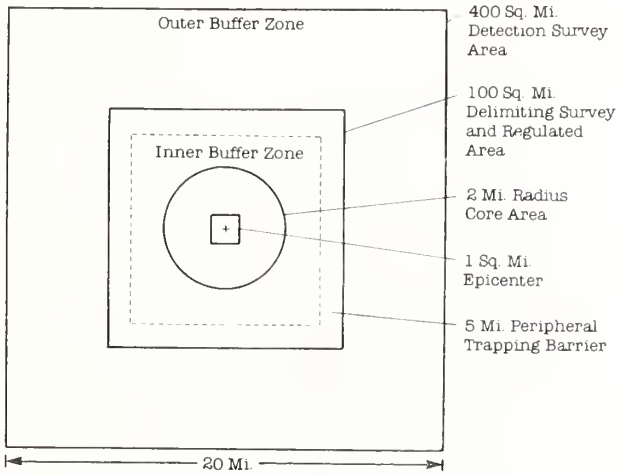
When one or more honey bee swarms, nests, or hives with a high probability ($\geq$ 0.90) of Africanization exist in an area, a delimiting survey will be implemented immediately.

1. Survey Parameters

a. If one swarm without comb is detected, the area within a 2-mi radius will be surveyed on the ground.

b. If one nest with comb and brood or two or more swarms are detected, a survey by air and ground will be performed in a 100-square-mile (mi^2) area surrounding each detection site. In addition, detection surveys in the regulated area will continue for 1 full year after the infestation has been declared to be eradicated.

Africanized Honey Bee Survey Area



	Total Square Miles	Traps Set Per Sq. Mi.	Total Traps Set Per Sq Mi.	Bait Stations Set Per Sq Mi.	Total Bait Stations Set Per Sq. Mi.
Epicenter	1 Sq. Mi.	100	100	15-30	15-30
Core Area	11.57	15-20	174-231	4-8	46-93
Inner Buffer Zone	51.43	0	0	4-8	206-412
5-Mile Peripheral Trapping Barrier	36	20	720	4-8	144-288
Outer Buffer Zone	300	0	0	4-8	1200-2400

2. Locating bees

The following steps will be carried out to locate bees:

a. Check all beekeeper operations

(1) Contact all beekeepers in the area through the use of records from the State extension apiculturist, the State apiary inspector, county extension agents, and beekeeper associations. Ask beekeepers to supply information on all colonies in the area.

(2) On a map, plot the location of apiaries, individual hives, and feral nests as given by beekeepers, the State apiary inspector, or other means.

(3) Record any known movement of bees, managed or feral, within the past year. This includes out-of-State locations where hives were moved even for brief periods. Followup surveys within a 2-mi radius of these exposure sites may be necessary.

(4) Check and record all queen and package bees purchased or sold by beekeepers in the past year. Details of other acquisitions or losses, such as swarm catches and absconding swarms, shall be recorded. Sampling within a 2-mi radius of each location may be necessary.

b. Aerial survey

When required, an aerial survey will be immediately implemented throughout 100 mi^2 surrounding each find. The use of helicopters is recommended. The aerial team (pilot and observer) will mark the location of each apiary on a map. Also record apiary locations on a file card giving Universal Transverse Mercator coordinates, descriptive data, and possible access routes. If covering vegetation, rough terrain, or poor weather impair an aerial survey, consideration must be given to ground survey to find managed bees. This is especially true when other information sources such as beekeepers, public reports, or State records seem inadequate.

Apiary registration records will be compared with aerial survey data in order to identify all registered and unregistered apiaries for survey and regulatory inspections. A map showing all locations will be made, and any discrepancies between aerial reports, ground reports, and apiary records will be settled by an onsite inspection of suspect localities.

c. Public reports

The program will request assistance from the general public through the media, through handouts, and if necessary through direct mailing to individual addresses.

d. Beelining

General or systematic beelining may be started when other elements are well advanced and all bees are to be eradicated from an area. Systematic beelining may be used in areas where few managed hives are present and foraging bees cannot be accounted for by other means.

Beelining techniques are covered in detail in Addendum D.

e. Bait stations (optional)

If there are few or no managed colonies in an area, sets of bait stations can be used as a survey tool to tell whether feral bees are in the area. Bait stations are most effective when food resources are scarce. Under these conditions, foraging bees may be drawn to bait stations.

Bait stations may be used in conjunction with beelining or composite bee sampling. Considerations may involve availability of supplies and personnel, type of terrain, and eradication plans.

Bait stations are usually arranged in a set of five stations each. Stations in a set are placed 20 feet (ft) apart in a circle. There will be three to six sets at the epicenter and one (flat countryside) or two sets (hilly countryside) in each quadrant depending on terrain, probable bee population, and flowering hosts. The sets are arranged in a grid pattern up to a maximum of 100 mi^2 surrounding each find.

Bait stations will be inspected and monitored for bees at 3-day intervals when bees are found and at 2-week intervals when bees are no longer found. When the food source at a station is depleted, it should be replenished. Replace the sugar water if it has fermented.

Each set of bait stations should be easily accessible but away from traffic. Sets should be near sources of food (nectar, pollen, and water) in shaded areas. In open areas it may be necessary to shade bait stations during periods of high daytime temperatures.

The following procedures may increase effectiveness of the bait stations.

Place bait stations near the most attractive plant species at the sites which are in flower. Use the host list given in Addendum E as a guide for herbaceous plants, but do not ignore flowering woody plants such as Linden or Rose Gum which may be even more attractive.

If readily available and not needed for bait hives, a swarm lure (silver bullet) may be stapled under the platform of at least one station on the set. The lure must be replaced every 4 weeks.

When bait stations are used, arrangements should be made to move certified hives outside the regulated area to a place where they can be serviced by beekeepers or other qualified personnel. To aid in such removal, State, Federal, local, or private property should be set aside for this purpose for the duration of the project.

For more information on bait stations, see Addendum C.

f. Bait hives (optional)

If four or more swarms and/or nests are detected, bait hives will be set out in a grid pattern with 100 bait hives in the epicenter mi^2 and 15 to 20 bait hives per mi^2 in the remaining core area.

Establishment of a 5-mi peripheral trapping barrier (optional) may be carried out if the conditions given above are satisfied and managed colonies that have been certified are removed from this area. Bait hives will be set at the rate of 15 to 20 bait hives per mi^2 in that area between 4 to 5 mi out from the epicenter.

The bait hives are to be serviced regularly every 2 weeks until eradication has been achieved.

Bait hives are not generally successful when resource conditions are poor or weather conditions are adverse. Urban areas contain many suitable nesting sites which may reduce the effectiveness of bait hives. Emphasis should be placed on achieving high bait hive densities in rural and parklike areas first. Bait hives should be used whenever swarms are expected.

At the time bait hives are placed in the field, if a bait attractant is available it should may be added. A commercially available swarm lure, called the silver bullet, consists of synthetic Nasonov pheromone and citral (available from the American-Kenya Research and Development Corporation, RFD 4, Box 1174, Ashland, Virginia 23005). The silver cover is stripped from the lure, the green end plugs pulled off (leave one end capped if temperatures are high and lure evaporation must be slowed down), and the polyethylene tube stapled inside the bait hive slightly above the entrance. A modification of this attractant, designed especially for AHB, may be available in pheromone kit form (Bee Research Fund, Endowment Association, Department of Entomology, University of Kansas, Lawrence, Kansas 66045). The lure is in a rechargable plastic vial which, with cap open, may be stapled inside the hive. If this lure is not available, geraniol and citral at technical concentration (T.C.) may be obtained from most chemical firms. Five milliliters of each, at T.C., are placed in a cotton Richmond dental wick 3/8 inch (in) by 1-1/2 in. The wick is attached inside the bait hive slightly above the entrance by means of a twisted wire that keeps the wick from touching the sides of the bait hive.

If desired and to increase attractiveness, an empty, used frame without comb may be placed in the bait hive. This is feasible if the bait hives are standard or waxed fiberboard commerical beehives.

Apply a thin strip of vaseline, paraffin oil, or fluon at the entrance to bait hives to discourage ants. To the extent possible, high points on the terrain with ample shade (for example, groves of trees) should be used as sites. Bait hives should be of an acceptable size to attract the AHB. There are four types of honey bee bait hives which may be employed. One type consists of a standard wooden box used in beekeeping with a standard bottom and top. The second type is a waxed fiberboard "nuc" box. For the third type, standard cardboard boxes may be employed. Finally, bait hives of pulp flower pots can also be used. Detailed descriptions of these bait hives are found in Addendum C.

3. Sampling

The following two sampling procedures are applicable. Unless safety factors intervene, bee sampling is carried out before killing bees.

a. Hive, nest, or swarm (colony) sampling

Collect a minimum of 50 bees in a bottle, plastic bag, sweep net, or vacuum collector. Bees should be collected randomly. When bees are clustered, such as in a swarm or a hive frame, tapping or shaking some into a bag may be adequate. When taking samples from a managed hive, care must be taken not to remove or injure the queen. Should she take flight during handling, she will generally return to the hive. Such behavior should be noted, as it is characteristic of Africanized queens. Place live bees in a plastic bag and label bag with as much information as possible; such as, collector's name, collection date, apiary and colony identification number, location of apiary, hive number, nest, or swarm. If sample is collected in an apiary, supply the identifier with the exact number of colonies in the apiary. Collected samples will be killed by freezing in a freezer with dry ice and will be stored in the freezer.

When sampling feral nests, a sample of comb (if present) should always be included.

b. Composite bee sampling

If one nest with comb and brood or more than one swarm is detected in an area, composite bee sampling will be employed.

(1) Conditions

Sampling teams of two persons each will be sent throughout the survey area within a 5-mi radius of each find to collect composite samples of honey bees. Generally, this technique is employed in the early stages of a program. It should not be used within 2 mi of beekeeping operations as managed bees may flood the samples. If possible, managed hives in the area should be moved or screened during the sampling periods. This may be accomplished by prior arrangement with beekeepers. Hives should be closed the evening before and not opened until noon. Composite sampling is carried out during morning hours. This procedure is difficult for both the bees and the beekeepers. Therefore, it is recommended that managed hives should be certified free of Africanization and moved outside the regulated area.

(2) General procedure

The survey area will be divided into quadrants of 1/4 mi^2. Bees in each quadrant must be sampled on a once-per-month basis. Survey

four sites in each quadrant in the epicenter and one site in each quadrant elsewhere in the 100-mi^2 survey area. Select sites with flowers or where water is available. If enough bees cannot be found to make up a sample, then use a beeswax candle with a a few drops of honey in the depression to attract enough bees.

Check for alternate sites within each quadrant and sample these alternate sites every other month.

(3) Sample composition

Each composite sample consists of a minimum of 15 to 40 bees. Bees are collected by using a sweep net on or near flowers, water, trash containing attractive substances, honey houses, and other locations where bees may be found. Note that samples collected around very attractive sources, such as honey houses, should consist of at least 100 bees.

Place sample in a plastic bag and label the bag. Label information should include collector's name, collection date, and exact location of composite sample. Collected samples will be killed by freezing in a freezer or freezing with dry ice, and stored in the freezer.

B. Monitoring/ Evaluation Survey

All elements of the survey system serve to monitor the success of the program. This will include the collection of composite bee samples and samples taken from managed hives under the regulatory program. Bait stations and bait hives, if employed, will also be used to monitor the effectiveness of the program.

C. Detection Survey

Detection surveys to determine if AHB is present will be conducted at high risk locations up to 5 mi beyond the limits of the regulated area. In addition to these detection survey activities, certain data gathering elements will extend 15 mi outside the detection survey area. Information about possible Africanized bees will be gathered from public reports, beekeeper reports, and routine apiary inspections.

1. Locating Bees

The visual survey will include the following elements:

a. Aerial survey (detection)

Upon completion of the aerial delimiting survey within the 100 mi^2, the aerial detection survey will extend coverage to 400 mi^2 surrounding each find.

b. Ground survey (detection)

The ground detection survey will rely on public and beekeeping reports and the checking of apiaries through routine inspections.

2. Composite Bee Sampling

Composite bee sampling will be carried out at high risk locations within this 400-mi^2 area.

D. Orientation of Survey Personnel

New personnel will be trained on the job by experienced personnel. Three working days may be necessary to teach the many important facets of the AHB survey.

E. Survey Records

Records of the areas surveyed, sites trapped or baited, dates, locations in which detections were made, an inventory of apiaries (counts of colonies and hive bodies), locations and dates of composite bee samples, and, if relevant, the host plants the bees were visiting will be recorded.

III. REGULATORY PROCEDURES

A. Instructions to Officers

Regulatory and quarantine actions will continue until the infestation has been declared eradicated. Officers must follow instructions for regulatory actions when authorizing the movement of regulated articles. Understanding the instructions and procedures will serve as a basis for explaining such procedures to persons interested in moving articles affected by the quarantine and regulations. Only authorized treatment procedures may be used.

B. Regulated Articles

1. All life stages of honey bees;

2. Fresh and frozen bee semen;

3. Unprocessed comb;

4. Equipment, shipping containers, storage containers, and vehicles which are used at apiaries or used to carry regulated articles; and

5. Any other products, articles, or means of conveyance of any character whatsoever when it is determined by an inspector that they present a hazard of spread of AHB and the person in possession thereof has been notified.

C. Quarantine Actions

When nests with comb or more than one swarm is confirmed as having $\geq$ 0.90 probability of Africanization, implement the following in sequence:

1. All establishments and individuals known to be involved in the handling, moving, or processing of bees or their products within a minimum of 100 mi^2 around the detection site will be issued Emergency Action Notifications within 48 hours. These notifications require treatment or other approved handling procedures of regulated articles. Emergency Action Notification (PPQ Form 523) and/or comparable State notifications are issued by field personnel to any individual or manager of establishments handling, moving, or processing bees, bee sperm, equipment, containers, or products capable of spreading AHB. A notification may be issued pending identification and/or further instruction from the Deputy Administrator.

2. If necessary, the Deputy Administrator will issue a letter directing PPQ field offices to initiate specific emergency actions under the Federal Plant Pest Act (7 U.S.C. 150 dd) until emergency regulations can be published in the Federal Register. For information on other legal authorities, refer to the Emergency Programs Manual, Section II, A and B.

3. The Deputy Administrator, through the National Regional Directors, will notify State cooperators of the AHB detection, actions taken, and actions contemplated.

A description of the regulated area with support documents will be developed by the U.S. Department of Agriculture (USDA) and cooperators and provided to the Domestic and Emergency Operations (DEO) staff, National Programs.

4. APHIS will publish emergency regulations in the Federal Register under the Federal Plant Pest Act.

D. Use of Authorized Chemicals

Action Plan Eradication Procedures contain the authorized chemicals, methods of application, rates, and any special application instructions. Concurrence by DEO is necessary for the use of any chemical or procedure for regulatory purposes.

E. Approved Regulatory Actions

Inspect apiaries of commercial and hobby beekeepers, as well as semen-producing, package bee, and queen-rearing establishments to certify that the breeding stock does not contain AHB.

1. Queen rearing and package bee establishments may be certified if all the following conditions are met:

a. All breeder queens are certified as producing European progeny, and queen excluders are in place.

b. All package bees are free of drones and came from colonies with certified queens.

c. In addition, personnel of the establishment should attempt to maintain an AHB-free zone of a 2-mi radius around mating apiaries. This will be done by visually checking the surrounding area for feral swarms/nests and destroying all such finds within the prescribed area.

2. Certification of Queens

a. Queens brought in from outside the regulated area may be certified if they are maintained in queen cages, packages, or other enclosures and attended only by worker bees.

b. Artificially inseminated queens may be certified through written documentation.

Documentation will include:

(1) Name of inseminator;
(2) Date inseminated;
(3) Location of operation; and
(4) Certification that sperm originated from drones of certified European queens.

c. Breeder queens may be certified if progeny have been certified as European and queen excluders are in place.

3. Inspection and certification of semen-producing establishments will be based on the following criteria:

a. Standard identification procedure confirming that workers are not Africanized; and

b. The establishment and maintenance of an AHB-free zone within a 2-mi radius.

4. Inspection and certification of apiary equipment, vehicles, products, and any other items that pose a hazard.

a. Movement out of the regulated area

Equipment, vehicles, unprocessed comb, and supers moved out of the regulated area must be found free of bee swarms or clusters of bees before departure, must not have brood comb or brood cells with any brood, and should be covered en route. No stops will be permitted en route out of the regulated area except for normal traffic conditions and brief refueling.

b. Beekeeping activities within the regulated area

Vehicles and equipment are to be inspected to ensure that they do not contain any reproductive stages of the Africanized bee. A visual check for swarms, nests, queens, and drones is necessary. Vehicles and equipment must be free of clusters of bees when moved.

Apiary equipment includes honey houses and other buildings on site, and a visual inspection must be carried out on a daily basis by establishment personnel to ensure freedom from feral swarms. Certification by program personnel must include written assurance that such activity is regularly conducted, and the inspector shall conduct a visual survey on each inspection visit for compliance. The establishment will be required to maintain a daily record for examination at the request of the inspector.

5. Inspection of managed colonies to certify that they contain no AHB.

a. A sample of a minimum of 50 bees should be taken from each hive for standard identification. Bees are collected live and transferred to a plastic bag with all necessary information. As soon as possible, the bags (one sample per bag) are placed in an insulated container with dry ice.

b. When the probability of Africanization of a colony is <0.70, the hive should be numbered, dated, and certified for unrestricted movement.

c. When the probability of Africanization of a colony is ≥ 0.70 but <0.90, requeening, including destruction of the current queen and any immature queens, queen cells, and drone brood, shall be at the discretion of the beekeeper. In addition to resampling all colonies, the apiary shall be checked visually. If nervous and aggressive behavior is observed when hives are slightly disturbed, the whole apiary may be requeened or queen excluders fitted on hives pending identification results.

d. When the probability of Africanization is ≥ 0.90, the queen and all reproductive brood in that colony will be destroyed. Second samples of bees from each remaining colony in the apiary will be taken for identification. Observations will be carried out in the apiary. If nervous and aggressive behavior is evident when hives are disturbed, all colonies may be requeened and all queens and drone brood destroyed. If requeening of remaining colonies does not take place, the hives will be fitted with queen excluders to prevent swarming while identification is pending. With beekeeper assistance, these excluders will be checked as frequently as needed to destroy trapped drones and keep entrances open.

6. Stack and Box Inventory--Movement of Honey Supers

Honey supers may be stacked, boxed, and moved from apiaries for processing, provided visual inspection confirms that no swarms or clusters of bees are present on the comb, that no brood is present, and that supers are enclosed in a suitable beeproof container, cover, or truck.

F. Principal Activities

The following identifies principal activities necessary for conducting a regulatory program to prevent the spread of the AHB. The extent of regulatory activity required is dependent on the degree of infestation.

1. Advising regulated industry of required treatment procedures.

2. Supervising, monitoring, and certifying regulated articles.

3. Contacting:

a. Apiculturists/beekeepers;
b. Growers of host crops;
c. Commercial haulers of beehives and other regulated articles;
d. Emergency Programs, Veterinary Services, APHIS;
e. Center for Infectious Diseases, Public Health Service, Department of Health and Human Services;
f. Pest control operators;
g. Local rescue and ambulance units, police departments, fire departments, and hospitals; and
h. Extension service and State/county apiary inspectors.

4. Monitoring the movement of regulated articles through post offices, major airports, and other transportation centers.

5. Monitoring major highways and quarantine boundaries for movement of regulated articles.

G. Orientation of Regulatory Personnel

Only trained or experienced personnel will be utilized. Replacement personnel will be trained by experienced PPQ personnel, State apiculturists, county apiary inspectors, extension bee experts, or experienced beekeepers. A training period of sufficient duration will be scheduled for the orderly transfer of these functions.

H. Regulatory Records

Records will be maintained as necessary to carry out an effective, efficient, and responsible regulatory program. See Addendum E of this Action Plan.

PPQ, in consultation with methods and research agencies, outlines treatments to be used. The DEO staff must be notified of all treatment plans. If treatments selected or proposed are not in conformance with current pesticide labels, an emergency exemption can be provided under Section 18 of FIFRA, as amended. For detailed instructions refer to Emergency Programs Manual, Section V, B.

A. Eradication/ Control Method Selection

The following criteria determine the minimum actions to be used in achieving eradication. Expanded or additional treatment actions can be applied if mutually agreed upon by cooperating agencies. All initial actions are based on swarm or nest detections.

Eradication activities will continue until eradication has been declared. Eradication will be declared in Zone A after 3 months of negative detections. In Zone B, eradication will be declared after 6 months of negative detections. Detection activities will be performed in the regulated area for a period of 1 year after eradication has been declared. An active public information and assistance program will also continue through the 1-year period after eradication.

1. If one swarm, feral nest, or managed colony having $\geq$0.90 or greater probability of Africanization is detected, destroy the feral swarm, nest, or colony.

2. If two or more swarms, feral nests, or managed colonies having $\geq$0.90 or greater probability of Africanization are detected in:

a. Feral Swarms or Nests

(1) Destruction of all feral swarms and feral nests within the core area.

b. Managed Colony

(1) Destruction of all bees and brood in colony.
(2) Destruction of all feral swarms and feral nests within the core area.
(3) Queen excluders are placed on all managed colonies within the core area until identification activities are complete.
(4) Any subsequent detection of Africanized bees found in the same or an adjacent apiary will be considered an extension of that detection. Any subsequent Africanized detections found in another physically separate location is a new detection.

B. Recommended Materials

1. Insecticides

Allethrins	Diazinon\	Methoxychlor
Aluminum Phosphide	Dichlorvos	Propoxur
Baytex\	Ethylene oxide	Pyrethrins
Bendiocarb	Gardona\	Pyrethroids
Carbaryl	Lindane	Resmethrin
Cyanide	Malathion	
Cygon\	Magnesium Phosphide	

2. Solvents

Gasoline
Kerosene
Heating Oil
Diesel Fuel
Ammonia
Ammonia plus Water plus Soap

C. Approved Eradication Treatments

1. Destruction of Feral Swarms and Nests

Feral nests may be found in bait hives or in almost any conceivable habitat--holes in the ground, trees, chimneys, attic space, farm machinery, and barns.

If at all possible, feral nests or swarms will be sampled and confirmed as Africanized before they are destroyed. If comb is present, a 4-in by 4-in section should be collected for measurements once bees are dead.

When a resting swarm is located, clear immediate area of people and animals. If possible, turn off any nearby machinery.

Put on proper protective gear, then spray the swarm directly with a quick knockdown material such as a pyrethrin aerosol. If the swarm is in an enclosed space, it may be possible to treat the area with an automatic microgenerator (fogger) or spray unit. If a spray is employed, concentrate the material on the swarm. If a swarm can be knocked down into a net or bag, this procedure may be utilized first, especially if the swarm is outdoors where its dispersal on being sprayed may be a problem. A swarm enclosed in a net or bag may be disposed of through direct application of an insecticide or solvent.

The spray should be directed into the nest and any observable openings used frequently by the bees. Spray bees or nest openings

for 10 to 15 seconds. In the case of underground nests, multiple openings can be covered with soil. Nest disposal will include destruction of bees, brood, and possibly comb. Continued monitoring is necessary to ensure that bees have been destroyed. If the feral nest was in a bait hive, it may be necessary to destroy the hive.

If the honeycomb in a feral nest cannot be destroyed, screen the nest opening and place a warning sign so that the contaminated honey cannot be taken by bees or humans. If the honeycomb is within the walls or attic of a building or other inaccessible place where the honey and honeycomb cannot be allowed to decompose, then a different approach is necessary. One procedure is to kill all the bees with a nonresidual treatment (see 2, step 2, Fumigant chemicals) and then place a full hive of European bees near the nest entrance to retrieve the honey. The alternative is to break through the wall or other structure, cut out the comb, and then repair the damage.

a. Solvents/other materials

Application of a suggested solvent will also kill bees in a nest or hive. These materials will work as quickly, or nearly so, as most insecticides, and a 10- to 15-second drench may be sufficient. All bees should be dead within a short period of time. While this technique is not feasible in open areas, a swarm enclosed by a net, bag, or other covering can be safely disposed of with solvents.

Suggested Materials:

Gasoline
Kerosene
Heating Oil
Diesel Fuel
Ammonia
Ammonia plus Water plus Soap
(2 gallons (gal) water plus 1 pint (pt) cloudy ammonia plus sufficient liquid soap to make a sudsy solution.)

b. Pesticides

Application of an approved insecticide will kill bees in a swarm or nest. In an enclosed space which can be sealed off, a 10- to 15-second application may be all that is necessary. All bees should be dead within 30 minutes after application. In an open space, spray should be applied until all bees have been knocked to the ground or are unable to fly. It may be possible to put a net, bag, or other covering over a swarm and then apply a spray.

Suggested Insecticides:

Resmethrin--1-2 percent active ingredient (ai) as an aerosol is used as knockdown material and is specifically registered for bee treatment.

Other insecticides which may be used but require approval:

Allethrins	Dichlorvos	Propoxur
Bendiocarb	Lindane	Pyrethrins
Carbaryl	Malathion	Pyrethroids
Cyanide	Methoxychlor	
Diazinon®	Phosphine	

c. Other Methods

Vacuum retrieval may be employed in place of bee knockdown where small swarms are involved. An electric bee blower with a swarm retriever attachment is employed for this purpose. When the operator is in position to reach the swarm with the attached boom (roughly 10 ft long), the blower may be switched into reverse (for vacuum) and applied to the swarm with a gentle back and forth motion to sweep all bees into the boom. Once the bees are inside, it is possible to dispose of them by various means including spraying a nonflammable insecticide into the nozzle while the vacuum is on.

In some cases it may be possible to kill bees by sealing up nest openings with various materials, including cloth or concrete.

d. Bait Station Poisoning

If an Africanized nest or colony cannot be found or accessed through other means, poisoned bait stations may be used. This will be either one of the regular bait stations or a special bait station positioned as near to the colony as is practical. Poisonous baits dissolved in sugar solution may not be attractive to bees during nectar flow periods and may not be effective at such times. Such baits may also be hazardous to other beneficial insects (ants, bees, wasps, etc.). Before poisoning is undertaken, all certified colonies in the area must be either removed or foraging restricted by screens or other suitable methods.

To poison the bees, add a carbaryl based pesticide to the sugar solution to make 0.1 percent solution ai. In a set of five bait stations, about 1 quart (qt) of poisoned bait (1/5 qt per station) is sufficient. Once the bees have started visiting this

bait, leave it in place for 2 hours and then remove the poisoned bait completely. Refill with sugar solution. After 3 days, reinspect station to see if bees are still present or still visiting the bait station.

If a safer but slower poison is desired, add 0.2 fluid ounce (fl oz) Alsystin 4 Flowable to 1 gal of sugar solution. This is a chitin inhibitor which stops brood rearing. If it is transmitted to the queen, it renders her eggs sterile.

During the operation of poisoned bait stations, personnel will remain and maintain a watch on the bait stations to prevent interference by or accidental poisoning of persons, birds, or animals.

2. Destruction of Bees in Managed Hives

Apiary Colony Depopulation

Since most of the insecticides listed for use against feral swarms and feral nests have residues, it is not desirable to employ them in a managed colony. Instead, bees may be killed by other means. Procedures have been developed which are designed to cause the least amount of economic loss to beekeepers and to avoid contaminating beekeeping equipment with pesticide residues. These goals can be accomplished in a three step process: (1) Honey removal, (2) depopulation of adult bees, and (3) depopulation of brood.

Step 1: Honey Removal

Honey must be removed before depopulating adult bees. This step is performed by the beekeeper.

Step 2: Depopulation of Adult Bees

It is best to work at a time when most bees are in the hive, such as during cool or wet weather and/or during periods of low light intensity (early morning, evening, night, dull overcast days).

Use a smoker to calm the bees as much as possible at the outset. Actual depopulation should be by one of the methods listed below.

If an entire apiary is being depopulated, any airborne bees may be partly controlled by attraction to a nearby bait hive. They may later be disposed of after all the colonies in the apiary have been depopulated.

Fumigant Chemicals:

a. Cyanide

Bees and brood may be killed simultaneously by placing a small quantity (0.26 ounces (oz) for a small hive; 0.78 oz for a larger hive) of calcium cyanide powder in a covered petri dish on the bottom of the hive. Add two or three drops of water to activate the cyanide. The lid of the petri dish should have at least 2 dozen 1/16-in holes to permit dispersal of the gas. The hive must be kept closed until all bees are dead (1 hour). The bees may then be removed, the hive aerated for at least 24 hours, and the hive with comb intact restocked with bees.

Where the use of a cyanide gun is permissible when working with bees, it may be employed in killing bees in a colony. The use of cyanide must be approved by the Environmental Protection Agency (EPA).

b. Phostoxin

It is possible to use phosphine in a manner similar to cyanide, as tablets (either as aluminum phosphide or magnesium phosphide) at the rate of one or two 3 gram tablets per hive (depending on size) for 3 days at 70 ^{o}F or above. The hive must be covered with a 4 millimeter (mm) plastic or rubberized tarp. Three to four in of soil must be piled on the tarp all around the base of the hive. Phosphine is much slower acting than cyanide. Brood is killed by the same dosage that kills adult bees. Equipment must be aerated for at least 24 hours after fumigation before reusing the combs.

c. Resmethrin

Where the bee equipment will not be reused, resmethrin can be used directly on the colony as a registered chemical. Close hive entrance and apply over the top of the frames.

Step 3: Disposal of Brood/Bee Equipment

Cyanide and phostoxin will kill brood. Resmethrin will not kill brood but does contaminate bee equipment, which cannot be reused.

Method (a): Removal and Disposal of Contaminated Brood/Bee Equipment:

Remove all frames, cut out all comb, and dispose in large, sealed plastic trash bags in a sanitary landfill in at least 18 in of soil. Frames and hives can be smashed and disposed of in a similar way.

Method (b): Disposal of Dead Brood:

Manual Method:

After the adult bees are disposed of, remove all combs which contain brood, whether sealed or unsealed. Separate these combs from all others for additional processing. Burr comb containing brood should also be treated. Queen cells and drone brood are of special interest since they belong to the reproductive castes. These can be smashed on the spot by using a sharp knife or hive tool. Use a sharp knife to remove all other brood comb, and dispose of it in large, sealed plastic trash bags in a sanitary landfill under at least 18 in of soil. Alternatively, combs of brood can be burned in an open pit (with the aid of kerosene) if local ordinances allow. Empty frames and hives can then be reused by the beekeeper.

Housecleaning Method:

The dead brood may be placed in a super on top of a populous hive. Eventually the housecleaning bees will uncap the cells and remove the dead brood.

3. Destruction of General Feral Population (optional)

There will be no widespread program application of pesticides in any effort to reduce the general feral population of bees. Limited pesticide applications will only be permitted as a last resort.

These applications will only be used in select locations when AHB cannot be eradicated by other means. All managed hives must be certified and removed from the area before treatment begins. If not certified, hives can be screened on the spot until it is safe to release bees again. If necessary, bees can be fed sugar, water, or honey. Bees must be covered if any nearby spraying is underway.

Most pesticides are not registered for use against honey bees. Any application of a nonregistered pesticide must be approved by the EPA.

Selective Bee Depopulation

These pesticides were selected on the basis of their effect on queens and/or colonies in the process of rearing queens and/or brood. Such pesticides might help prevent absconding as a result of treatment. However, a chance also exists that it will cause AHB to abscond from the regulated area.

a. Foliar applications with ground equipment

Ground application of pesticides can be used in select locations, as defined above. The pesticide will be applied to plants that foraging bees frequent. The material will be applied as a spray every 7 days.

Acephate (Orthene\ 75S)--1 1/2 pounds (lb) (1.13 lb ai) of 75 percent acephate in 20 to 100 gal of water per acre (a) depending on type of equipment. Apply as a spray when detections are made.

Carbaryl (Sevin 50-W)--2 lb (1 lb ai) of 50 percent carbaryl in 3 to 40 gal of water per a depending on type of equipment. Apply as a spray when detections are made. European bees have been shown to be more resistant to carbaryl than Africanized bees in topically applied tests, but the reverse is true for other formulations (none listed herein). The differences are relatively small.

Dimethoate (Cygon\ 400)--16 fl oz (8 avoirdupois (avdp) oz ai) of 43.5 percent dimethoate in 25 to 40 gal of water per a depending on type of equipment. Apply as a spray when detections are made.

Fenthion (Baytex\ 4)--3 fl oz (0.33 avdp oz ai) of 45 percent fenthion in 40 to 100 gal of water per a depending on type of equipment. Apply as a spray when detections are made.

b. Aerial application

Aerial pesticide applications as an ultralow-volume spray can be used over selected areas of favorable host plants and under the restrictions given above. The pesticide could be applied every 10 to 14 days.

Acephate (Orthene\ 75S)--1 1/2 lb (1.13 lb ai) of 75 percent acephate in a minimum of 2 gal of water per a, depending on type of equipment. Apply as a spray when detections are made.

Carbaryl (Sevin XLR PLUS)--16 to 48 oz (1/2 to 1 1/2 lb ai) of 43.4 percent carbaryl in an equal amount of water per a, depending on type of equipment. Apply as a spray when detections are made.

Dimethoate (Cygon\ 400)--16 fl oz (8 avdp oz ai) of 43.5 percent dimethoate in 1 or more gal of water per a, depending on type of equipment. Apply as a spray when detections are made.

Baytex\ Liquid Concentrate Low-Volume Spray--1 1/3 fl oz (1.6 avdp oz ai) of 93 percent fenthion per a, depending on type of equipment. Apply as a spray when detections are made.

c. Pesticide monitoring

The monitoring program will include the following elements:

(1) Evaluating dye cards to monitor aerial applications.

(a) Droplet size information;
(b) Droplet distribution information;
(c) Identification of wind drift components; and
(d) Verification of spray block boundaries.

(2) Sampling to evaluate effect on environmental components.

(a) Water sampling to detect insecticide levels through direct application, leaching, and runoff;
(b) Soil sampling to determine insecticide levels and residues;
(c) Foliage sampling to identify residues;
(d) Biological organism sampling to determine impact of insecticides; and
(e) Air sampling to determine presence of pesticides in respirable air.

D. Orientation of Eradication/Control Personnel

Only trained and experienced personnel will be utilized. Replacement personnel will be trained by the individual being replaced. A period of 3 working days may be necessary for the orderly transfer of these functions.

E. Eradication/Control Records

Records noting the location of detections, dates, number and type of treatments, and materials and formulations used will be maintained for all areas treated (see Addendum G).

F. Monitoring

An effective monitoring program will be implemented to aid in the evaluation of program efforts and environmental impact. The application and use of pesticides and other controlled substances will be assessed through the use of appropriate monitoring program criteria.

If pesticides are employed as an elective option, the monitoring program will include those elements listed under Pesticide Application (optional), IV.C.4.c.

The monitoring program is to be a combined effort between the State in which the emergency program is being conducted and PPQ. If specific plans need to be developed for these monitoring activities, the DEO will request assistance and guidelines from Program Planning and Development Staff.

V. CONTACTS

When an AHB eradication program has been implemented, its success will depend upon the voluntary cooperation, assistance, and understanding from other involved groups. The following is a list of groups which either are involved or should be kept informed of the operational phases of an emergency program:

A. Other Federal, State, county, and municipal agricultural and apiary officials and specialists;

B. Beekeeping organizations;

C. Trade groups, shipping companies, etc.;

D. Universities; colleges;

E. National, State, and local news media;

F. State and local law enforcement officials;

G. General public in affected area;

H. Foreign agricultural interests;

I. Public health departments and organizations/facilities;

J. Veterinary organizations; and

K. Post offices.

VI. ADDENDA

Addendum A--Definitions

Absconding:	Situation in which the entire colony of bees leaves the nest or hive.
Africanization Probability:	A laboratory identification of submitted life forms (specimens) having a probability of being AHB. This is stated as the probability the probability of Africanization of a given sample between 0.0 to 1.0.
Africanized honey bee:	The population of hybrid colonies which have resulted from cross breeding of AHB (*Aphis mellifera scutellata*) and EHB.
Apis mellifera scutellata Lepeletier:	The scientific name of African parents of the AHB hybrids. Previously identified as *Apis mellifera adansonii* Latreille.
Bait Hive:	An artificial nest cavity to attract swarms.
Bait Station:	A site or location containing an artificial food source to attract scout bees and foraging bees.
Beelining:	Tracking bees to their nest.
Bee Sampling:	Collecting live bees by various means from swarms, feral nests, and hives. Also includes taking a section of feral comb large enough for three independent measurements of 10 cells each if such comb is found.
Beeswax:	Wax secreted from glands on the underside of the worker bee abdomen and molded by bees into honeycomb.
Breeder Queen:	A queen which is used to produce larvae with which to raise daughter queens.

Burr Comb:	Comb built out of place and found between movable frames or between hive bodies.
Certified Hive:	A managed colony from which a minimum sample of 50 worker bees has been examined through standard identification procedures and verified as of European descent.
Colony:	A group of honey bees consisting of a queen and worker bees, with or without drones, organized as a social community.
Composite Bee Sampling:	A collection of live bees of unknown origins taken at foraging, watering, honey houses, trash, or other locations. Insect nets are generally used to collect bees.
Confirmed Detection:	A positive laboratory identification of submitted life forms (specimens) as AHB.
Core Area:	An area that includes a minimum of a 2-mi radius surrounding any confirmed AHB detection. This includes the epicenter.
Delimiting Survey:	A survey conducted to determine the extent of the infestation in an area where AHB has been detected.
Detection:	The collection and identification of any swarm or nest as AHB.
Detection Site:	The immediate area where an AHB collection is made. If at an apiary, all hives at the same site are to be considered part of the same detection determination if any prove to be Africanized.
Detection Survey:	A survey conducted in an area suspected to be infested with AHB.
Drone Congregation Area:	A defined airspace where drone bees are found during major periods of their reproductive flight.
Epicenter (Focal Point):	The 1-mi^2 area within the core area which includes the initial site of an infestation (find) as its focal point.

Established Colony:	A colony located in a nest or cavity with comb.
Exposure Site:	A place where AHB were located at some previous time.
Feral Nest or Colony	Wild bees not kept or managed by humans.
Food Plant Source:	A plant species that provides nectar and/or pollen.
Grid Pattern:	A trapping pattern in which bait hives and/or bait stations are evenly distributed thoughout an area and equidistant from each other. A pattern also employed in the event systematic beelining is elected and surveys are carried out in designated blocks.
High Risk Location:	Areas most likely to have been exposed to AHB movement associated with the regulated area. High risk locations include locations to which bees have been moved before discovery of Africanization, apiaries, honey houses, areas where many hosts are in flower, or areas where nesting sites are abundant.
Hive:	A human-constructed nest or cavity for bees.
Honeycomb (comb):	A structure of beeswax built by bees in an array of hexagonal cells for storing nectar, honey, and pollen and brood.
Infestation:	The presence of one or more established AHB colonies or two AHB swarms.
Infested Area:	The area so declared by program officials where criteria for "infestation" have been met.
Insecticide Application:	The application of an insecticide spray that is particularly harmful to bees.
Managed Colony:	A colony of bees in a hive kept or managed by humans.
Monitoring/Evaluation Survey:	A survey, using bait hives or survey teams, conducted in an area where an eradication treatment has been applied and the effectiveness of the treatment is being evaluated.

Nasonov Pheromone:	A pheromone which is highly attractive to other bees and is produced by a special gland (Nasonov) located near the tip of a bee's abdomen.
Nest:	A cavity or area which contains comb produced by honey bees usually including the walls of a protected space. May or may not have bees at time of inspection.
Nesting Site:	A location with partly to almost completely enclosed space in, on, or above the ground. Alternately, any place where comb can be constructed.
Pheromone:	A substance secreted by an individual which stimulates a behavioral or physiological response from another individual of the same species.
PPQ-APHIS-USDA:	Plant Protection and Quarantine, Animal and Plant Health Inspection Service, United States Department of Agriculture.
Preferred Nesting Site:	Any protected location with space ranging in size from 3 to 7 cubic feet such as found in attics, sheds, farm machinery, etc.
Propolis:	A glue or resin from trees or other plants collected by bees and used to close holes and cover surfaces in the hive. Also called bee glue.
Quadrant:	One quarter of a mi^2 (1/4 of a mi^2).
Queen and Drone Trap:	A screen cage designed to let worker bees out of the hive but prevent the queen or drone bees from leaving. As used in this program, it will also prevent Africanized bee drones or queens from moving into a hive or, if already inside, from leaving again. This trap goes at the entrance to a hive.

Queen Excluder:	A screen with openings of 3.5 mm (0.163 in) to permit worker bees to pass through while excluding queens. Used to restrict the queen to the hive and/or certain parts of the hive. As used in this program, queen excluders must be placed under the bottom hive body and not between hive body supers as is the usual practice. It serves the same purpose as the queen and drone trap in this program.
Regulated Area:	An area that extends at least 5 mi in any direction from the epicenter.
Regulatory Sampling:	Sampling conducted around establishments which handle regulated articles.
Smoker:	Device used to blow smoke on bees to disorient them and thus reduce stinging.
Sugar Solution:	A 50 to 60 percent solution of sugar (sucrose) in water to attract bees.
Swarm:	A colony of bees not situated in a nest.
Treatment Area:	An area where treatments are being carried out.
Urban/Residential Area:	Noncommercial crop production area generally containing multiple- or single-family dwellings.

Addendum B--Safety

1. GENERAL INFORMATION

a. Pesticide Use

Personnel and public safety must be prime considerations at all times. Safety practices should be stressed in preprogram planning. Supervisors must enforce on-the-job safety procedures.

Pesticides authorized for use vary in toxicity. When used in accordance with label instructions, materials do not constitute a threat to people or wildlife. Specific safety precautions for each pesticide are listed on the label. In addition, any special precautions listed in this or specific manuals shall be observed.

Keep pesticides in closed, properly labeled containers in a dry place. Store them where they will not contaminate food or feed and where children and animals cannot reach them.

When handling a pesticide, follow all precautionary labeling.

Should there be contact through spillage or otherwise, wash immediately with soap and water. Should clothing become contaminated, wash before wearing again. Refer to PPQ Treatment Manual, Section X, for additional information.

Empty pesticide containers should be disposed of in an approved sanitary landfill by incineration or by other satisfactory methods approved by the EPA whereby they will not present a hazard or problem. Arrangements for disposal of such containers should be completed and thoroughly understood by all parties directly involved with a program prior to the actual start of operations. PPQ Regional Offices and the NPPS should be consulted for pertinent information in States where operations are conducted.

When applying a pesticide, consider the potential impact of the pesticide on all components of the total environment, including humans, crops, livestock, wildlife, aquatic life, and nontarget insect species. Avoid contamination of lakes, streams, ponds, or watersheds.

b. First Aid Suggestions

In case of accidental poisoning or as soon as any person shows symptoms of having been affected by any pesticide:

(1) Remove the person to a place where there will be no further contact with the pesticide.

(2) Have the person lie down and keep quiet.

(3) Call a physician and provide the name and formulation of the pesticide in use and first aid given.

(4) Keep the local Poison Control Center telephone number posted where pesticides are stored and used. The number may also be found on the inside front cover of the telephone directory. Call Chemtrex on toll free Area Code (800) 424-9300 for additional assistance in the event of spills, leaks, fires, exposures, accidents, or other chemical emergencies.

2. PRECAUTIONS AGAINST STINGS

All persons, including media personnel, must be kept out of treatment areas. A minimum safety zone of at least a 200-yard (yd) radius is required, unless shelter in buildings and/or vehicles is available and all doors and windows are shut. Warning signs will be posted around the perimeter of the safety zone. These precautions are due to the protective characteristics of the AHB which can be more defensive in the immediate area of the hive. For this reason, every reasonable effort must be taken to avoid being stung, since the initial sting can lead to repeated stinging or even a full-scale attack on anything moving or stationary (including confined animals or people). Personnel known to be hyperallergic to bee venom will not be assigned to project activities. AHB will also sting domestic animals. Animals should be released from confinement and taken outside the safety zone or moved to protective shelter.

a. When looking for the AHB, wear nonwoolen, light-colored clothing. This will not protect the wearer against attack but can decrease the intensity of the attack.

Do not do more than verify that bees are in the area unless full protective gear is available. Unprovoked attacks on people or animals are one indication of AHB. Try to locate the nest if at all possible, but do not approach the nest site until time to dispose of it. Nests hidden in storage boxes, cargo holds, or on rafters may be difficult to find. It is recommended that protective clothing be worn as a precaution against attacks.

b. It is best to kill bees at night, as human and animal exposure is limited, and all bees are expected to be at or near the nest.

The officers involved must be wearing two layers of protective clothing. A pair of coveralls or bee suit are pulled over the donned clothing, and the legs must be securely taped around the outside of the boots. Stingproof gloves are to be worn over the hands and taped to the sleeves of the coveralls (bee suit). Finally, a good quality commercial bee veil with hat must be worn to protect the head. The veil must be taped to the coveralls (bee suit) on all sides. Use caution since the bees may (and often do) have several exits. Be sure that all AHB are dead or unable to fly before considering the area secure or safe.

3. GENERAL PUBLIC PROTECTION

a. When AHB infestations cover a geographical area in excess of 100 mi^2, the public should be informed by radio, television, newspapers, and posters that colonies and swarms of honey bees should not be disturbed. It should be stressed that bees are not likely to attack unless provoked.

b. Request people seeing swarms or feral colonies of bees to inform the USDA, State regulatory officials, extension personnel, beekeepers, or pest control operators so that swarms or colonies can be disposed of safely.

c. Advise people to seek shelter in buildings or areas with dense cover in the event that bees are disturbed and start stinging. Point out that the bees vision and speed of flight are such that stinging bees can at times be avoided by a quick run. If running is not possible, temporarily cover any exposed individual to reduce further stinging and then remove the victim from the area as rapidly as possible. Open gates for animals or cover, if necessary, and move to a safe distance as soon as possible when bees are no longer around.

d. Advise people who experience dizziness or difficulty in breathing after having been stung that they should seek first aid immediately. Such individuals will require medical attention within 15 to 20 minutes. Administer artificial respiration or CPR if it is warranted. An antihistamine tablet, if available, should be given to the victim. People who are stung repeatedly should be taken to a medical facility and examined in case treatment is necessary. A single bee sting is seldom fatal unless there is a severe allergic reaction. Swelling of the affected area is a normal reaction to bee stings.

e. Practical first aid measures for stinging victims are:

(1) Remove stings with a scraping sideways movement of fingernail or knife to prevent more venom from being pumped in by the venom sac. Do not use tweezers or squeeze sting, as this will inject more venom into victim.

(2) Apply paste of baking soda and cold cream or of wet salt. To be most effective, application should be within 5 minutes of stinging.

(3) Apply an icepack to relieve pain and calamine lotion to relieve itching.

(4) Watch for any unusual reaction, in particular, the appearance of red blotches anywhere on the body in 2 to 20 minutes or of breathing difficulties. Such signs indicate immediate medical assistance must be requested and will be needed within the next 15 to 20 minutes.

(5) Stay with victim until medical care is obtained.

(6) If victim is suffering from massive attack rather than from an allergic reaction, treat for shock. Cover victim with a blanket, keep quiet, and give adrenaline if available. Seek medical care immediately.

(7) If victim is suffering from allergic reaction to one or several stings, keep quiet until help arrives. Project personnel should be trained and authorized to use CPR and sting kits including antihistamine tablets, injections, or other antiallergic medication a few minutes after the allergic reaction occurs.

f. Advise owners of livestock, especially of small animals, poultry, etc., to release their animals from confinement if a bee attack occurs.

4. SAFETY EQUIPMENT

a. Beekeeper hat and veil;
b. Beekeeper suit or two long-sleeve, light-colored, non-flannel shirts; and two pairs of long, light-colored pants/belt; or one pair of light-colored coveralls/belts;
c. One pair of light or tan boots or similar footwear;
d. One pair of ventilated beekeeper gloves;
e. Smoker, large;
f. Sting kit with epinephrine (adrenaline) or equivalent;
g. Duct tape; and
h. Antihistamine tablets.

Suits

If a beekeeper suit is not available, a double layer of non-flannel shirts and pants will serve for protection. Beekeeper gloves are provided with elastic sleeves which prevent the bees from getting inside. Some gloves are not stingproof, but if loose gloves are worn, few stingers will penetrate the skin. The pants or cuffs of the beekeeper suit must be firmly tied by cord or taped around the boots or gloves to keep bees out. The veil must be taped to the suit on all sides or, if zippered, any spacing between zippers taped shut.

Protective clothing must be washed regularly when in use to do away with irritating smells such as pheromones or bee venom on gloves and overalls, or from crushed bees. Sweat, the lingering odor of enclosed domestic animals, and cosmetic scents (perfume, hairspray, aftershave, etc.) tend to arouse honey bees.

Smokers

For the purpose of discovery and eradication of AHB, smokers should be employed to disorient bees while inspecting hives.

If necessary to open a hive, a smoker handled by a second person should be used. The smoker depends on smoldering combustible material in a small enclosed space. Burlap bags cut into strips, wood chips, pine needles, rolled cardboard, straw, dried grass,

and dried cow dung may be used for this purpose. The smoker is generally lighted with paper and fuel material dropped into the smoker where it will smolder.

Using a smoker, a hive is approached from the side or rear, and the entrance is smoked gently to force the bees inside. The cover is then raised at the rear and the frames inside gently smoked right to the back of the hive. When examining frames, break propolis seals between supers and frames slowly and evenly, taking care not to jar or bump combs and bees and to smoke between supers. Immediately after very carefully removing the first frame, direct two to three light puffs of smoke into the cavity, since AHB may fly directly out and sting. Give the bees adequate time to fill-up with honey while smoking the top of the frames and entrance. The hive may now be inspected, lightly smoking here and there as the various supers or brood chambers are inspected. Always smoke the entrance again after reassembly of the hive, for if the bees are Africanized, they may follow one to the next hive and create an uproar in the apiary.

Should bees become excited (especially if Africanized), it is best to slowly replace the cover and back away. (The smoker may be held near the body and directed towards oneself for additional protection until far enough away from the bees.)

5. AFRICANIZED HONEY BEE MASS STINGING

In the event AHB mass stinging occurs, the officer may be called on to assist.

a. If the attack is in progress: (1) Do not expose other people or personnel to extra risk; (2) if attempting to rescue animals, do not risk having protective clothing ripped by the animal; (3) move people out of the area as quickly as possible; (4) if immediate removal is not possible, cover the victim to reduce further stinging; and (5) provide first aid if needed and seek medical attention for the victim.

b. If an attack has left people injured, provide necessary assistance in obtaining medical attention.

6. MANAGING/MONITORING PESTICIDE SPILLS

Supervisors involved in pesticide application must have available and be familiar with "Guidelines for Managing and Monitoring Pesticides Spills" dated March 1981. In addition, the following pesticide spill safety and cleanup equipment must be present at all job sites where pesticides are stored or used:

a. Safety Equipment

(1) First aid kit--bus and truck kit, GSA 66545-00-664-5312 (or equivalent);
(2) Fire extinguisher--5-lb size for class A, B, C fires; and
(3) Portable eye wash kit.

b. Cleanup Equipment

(1) Shovel, square-point "D" handle;
(2) Large heavy-duty plastic bags with ties (25);
(3) Rubber boots (two pairs);
(4) Disposable coveralls (four pairs);
(5) 5 gal of water;
(6) Rubber gloves (four pairs);
(7) Respirators and pesticide cartridges (two sets);
(8) Broom;
(9) Dust pan;
(10) Liquid detergent (1 pt bottle)/paper towels;
(11) Scrub brushes (two);
(12) Plastic cover or tarpaulin to cover dry spills (10 by 12 ft);
(13) Absorbent material to absorb liquid spills (sand, sawdust, vermiculite, "Kitty Litter," etc.); and
(14) 55-gal drum for pesticide disposal (optional).

7. SAFETY TRAINING

In addition to training on the handling and use of pesticides and safety applications, project personnel will also be trained to recognize and diagnose toxic and allergic shock reactions to bee stings. Training will include first aid application and procedures.

Addendum C--Bait Hives and Bait Stations

The technical details of various kinds of bait hives and bait stations are included in this addendum. Insofar as possible, these items may be constructed from locally available materials.

1. BAIT STATIONS

The following describe several kinds of bait stations which may be employed. The American bait station is recommended.

a. American Bait Station

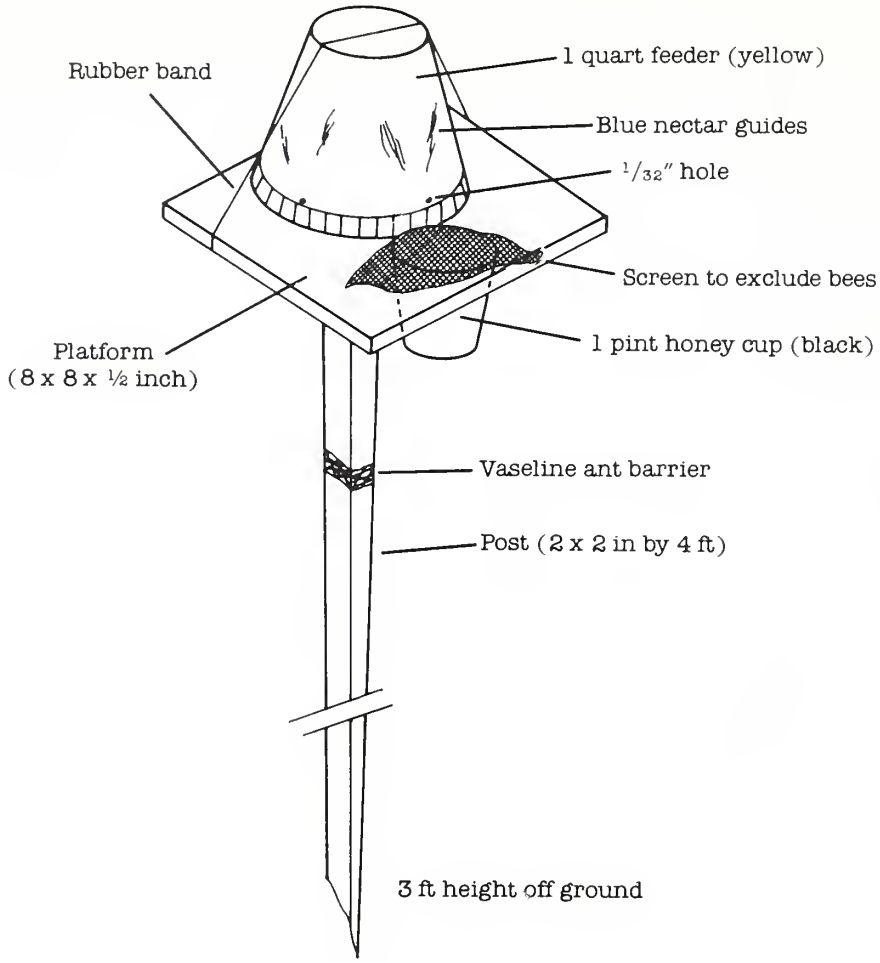
The bait station consists of an attractant and a feeder set on a platform atop a post (2 in by 2 in by 4 ft). The attractant is a 1 pt plastic cup (Genpack Corporation, No. 31016, Glens Falls, New York 12801) which is partially filled with honey. The cup is painted black to help warm the honey and release attractant volatiles. Fiberglass window screening, secured with a rubber band around the lip of the cup, prevents foraging bees from consuming the honey. A snap-on lid can be used to seal the cup during transport. A shield should be added above the cup to prevent rain from diluting the honey.

For trapping, the screened cup is placed into a 3.5-in diameter hole which has been drilled through the plywood platform (8 in by 8 in by 1/2 in). The platform is permanently nailed to the top of the post. The platform and top 12 in of the post are painted yellow to help attract scouting and foraging bees. A ring of petroleum jelly (vaseline) or silicone (fluon) around the post should prevent ants from stealing the honey. By sharpening the bottom of the post, the station can be pushed or driven into the ground at chosen sites.

The feeder is a 1 qt plastic cup (Genpack Corporation, No. 31032) with a snap-on lid. Four equidistant 1/32 in holes are drilled about 1/2 in from the rim of the cup. When the lid is in place, the holes are about 3/8 in from the lip of the lid. The feeder is also painted yellow to attract bees and has blue "nectar guides" painted on to help bees orient to each hole.

The feeder is filled with 50 percent sucrose solution, and the lid is replaced. The feeder is inverted on the platform and is secured with a rubber band running under the platform and over the bottom of the feeder.

American Bait Station



NOTE: It may be necessary to include weather shield above honey cup.

b. European Bait Station

The European bait station consists of a 1-qt opaque container with lid. Four holes 1-in in diameter are punched out approximately the same distance apart around the top of the container.

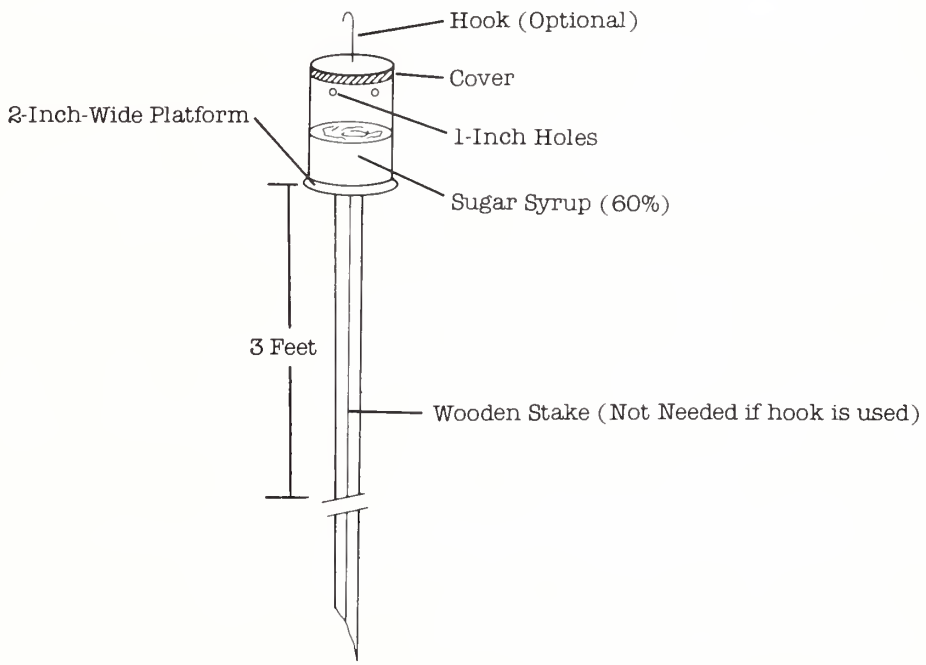
To load the station, the container is half filled with a 60 percent solution of sugar syrup in water. A piece of wood roughly 4 in on each side is placed on the surface of the bait. A plastic cup of about 4-in diameter is partly filled with honey and

covered with fiberglass widow screening secured by a rubber band. It is left to float in the bait solution or is stapled to the side of the container above the waterline. This is in lieu of the European method of leaving a honey-soaked comb in the container. The container is then securely covered.

The bottom of each bait station is securely attached to a small plate. The rim of the plate forms a platform up to 2-in wide all around the station. A good adhesive will be satisfactory. If rubber adhesive is used, it may be painted separately on both container and plate and allowed to dry. The container will then stick to the plate and can be taken off and replaced with ease.

The bait station is securely mounted 3 ft above ground level by attaching it to a wooden post, a tree, or other support. Branches cannot be allowed to obstruct free direct observation and entry to the station. Stations should be protected from animals (including pets and livestock). A ring of vaseline or fluon around the post (or hook) should prevent ants from stealing the sugar syrup.

European Bait Station



2. BAIT HIVES

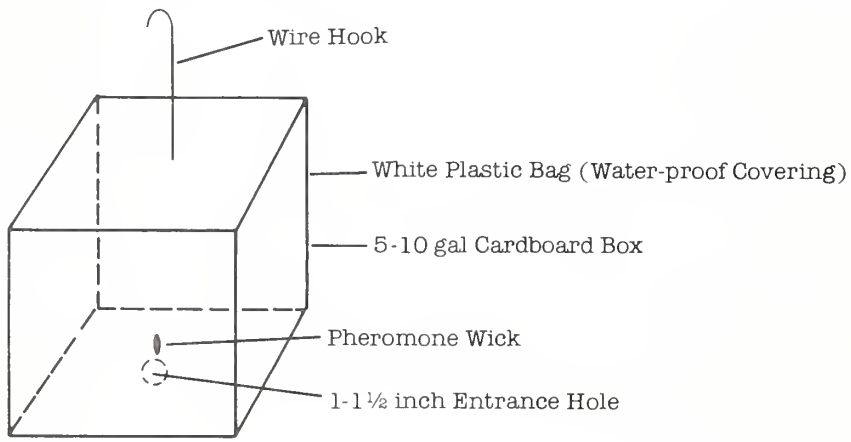
The four types of bait hives are described in more detail here.

a. Cardboard Box Bait Hive

This type of bait hive is exceedingly cheap to make and deploy but is less durable in humid climates than other types.

It consists of a standard 1-1/2 ft cardboard box cube (25 gal=95.6 liters (L)) covered by a plastic garbage bag. A long metal hook such as one made from a coathanger is attached to the top end. The bottom end has a hole of 1- to 1-1/2 in diameter to serve as an entrance hole. This may be crossed with two nails to keep birds from getting in.

Cardboard Box Bait Hive

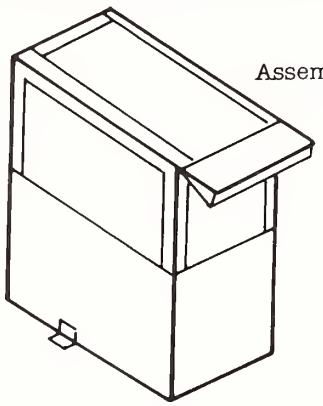


In service, the hook is employed to hang the bait hive in trees, on posts, or from other places off the ground. The hook should be securely wrapped around the support, using additional wire or rope if need be. Consideration should be given to wiring around the whole box and ties to several side supports if appreciable winds are expected, as bees would be repelled by movement.

b. Waxed Fiberboard Nuc Box

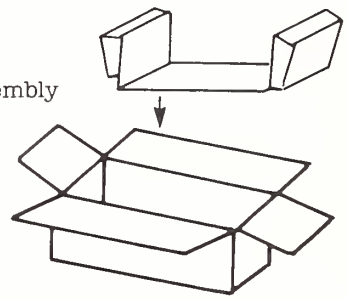
The six frame, 10.6 gal (40 L) waxed fiberboard nuc box (available from American-Kenya Research and Development Corporation, RFD 4, Box 1174, Ashland, Virginia 23005) serves as the basic unit for this type of bait hive. It is fitted with a cardboard insert (frame rest) which is supplied with the box. It can be increased to a more acceptable size 21.2 gal(80 L) for AHB by stacking and taping two such hives together or by raising the top flaps, taping the corner edges, and either taping down a separately obtained top or using the insert if you do not have a frame inside the bait hive. Place a nail or two across the entrance hole to discourage birds.

Waxed Fiberboard Nuc Box



Assembled 80L Bait Hive

Hive Assembly

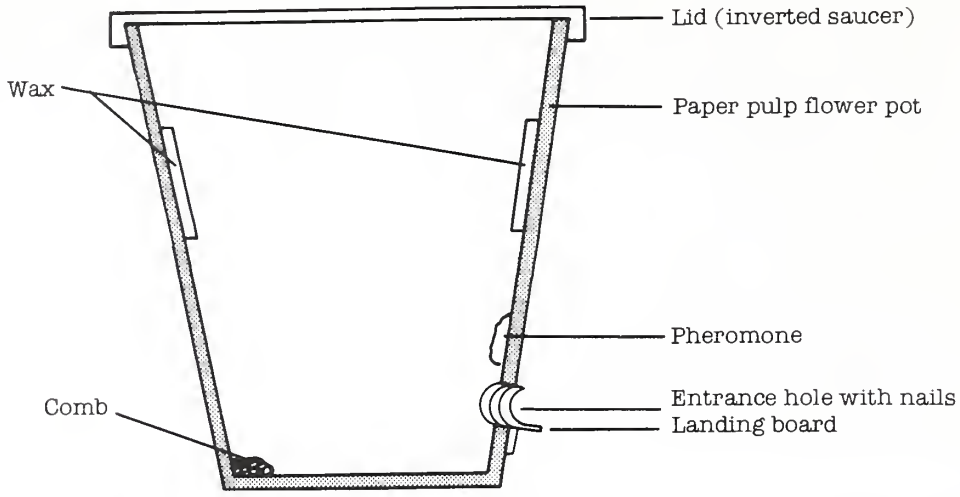


Be sure the tapes cover all edges and staples to ensure a light and waterproof bait hive. A strong wire hook may be employed to hang these traps off the ground in trees or other places. They may otherwise be placed on stands as is normally done with beehives.

c. Paper Pulp Flower Pot Bait Hive

The pulp flower pot bait hive consists of a light-colored paper pulp pot at least 8 gal (34 L) and preferably 10 gal (42.5 L) or larger in size, over which a saucer of sufficient size to cover the mouth of the pot is inverted for a snug fit. A 1-1/4 in hole is drilled near the bottom of the pot to serve as an entrance hole. A landing board the width of the entrance hole goes under the latter. Two nails are driven crosswise into the entrance to prevent birds from entering. Melted beeswax is added to two 4-in by 4-in square areas inside, one on the back board, and one near the entrance.

Paper Pulp Flower Pot Bait Hive

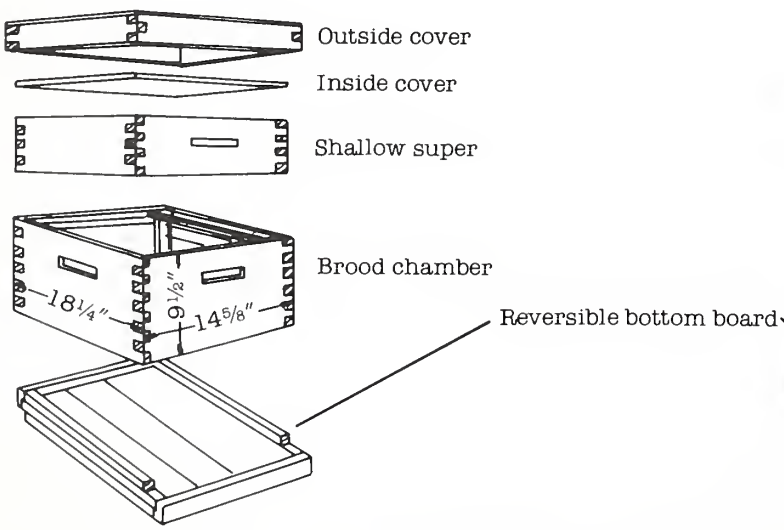


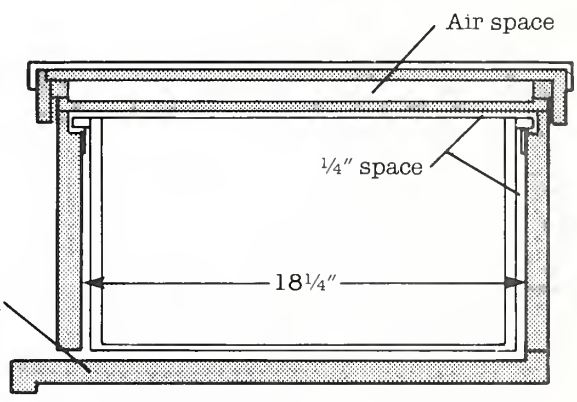
In service these traps are nailed or wired to trees, posts, or fences 3 ft or more above ground level.

d. Standard Hive

The 10-frame, 10.98 gal (41.6 L) Langstroth hive is the standard hive in use today. As modified for this action plan, it consists of a standard hive body, bottom board, and top. If necessary, nails spaced every in along the bottom board at the entrance will prevent various other animals from getting inside.

Standard Hive





Cross Section of Hive Body and Frame

The standard hive can be increased to a more acceptable size by adding a super to the top of the hive body. However, this is not necessarily cost effective, and supers may not always be available. Generally, 40 L is towards the bottom of the optional size range acceptability for AHB swarms.

The standard hive is usually placed on a stand.

e. Placement and Service--All Bait Hives

Bait hives may be placed on a post stand approximately 8 ft high, hung from or tied to trees, or put on top of buildings.

Bait hives should be in the shade. If not, they may be shielded from the sun by stapling aluminum foil to the top and sides (excluding the entrance side) and covered in turn by several layers of muslin, burlap, or cheesecloth. A "space blanket" with the foil side down will give the same result. Covering of bait hives is especially important if internal temperature exceeds 96 ^{o}F to 97 ^{o}F.

To reduce visibility and minimize theft or vandalism, the bait hive may be painted green or brown or covered in these colors. This has no effect on selection by bees. To the extent possible, such bait hives should be placed in inconspicuous locations.

Although the bees may nest in a variety of situations, they seem to orient themselves toward prominent landmarks, high buildings, and the edges of woods. Bait hives should be placed in shade and faced away from prevailing winds. They are preferably located along wood edges but may be hung in trees, along roadways, or on the roofs of buildings. Preference should be given toward sites which have flowering plants. The herbaceous host list given in Addendum E will serve as a guide for annuals and perannuals, but care must be taken not to overlook flowering trees and other woody plants.

Bait hives are serviced at least every 2 weeks. When servicing a bait hive, observation of the hive while approaching it should confirm if bees are moving in and out of the entrance. If bees are observed, they are to be collected, sampled for identification, and destroyed. Any other insects (ants, wasps, etc.) are to be cleared out. The petroleum jelly, paraffin oil, or silicone and attractive wick are replaced. If a silver bullet is employed, it is replaced once every 4 weeks. If a rechangeable plastic vial is employed, it is rechanged with a pheromone applicator to add 5 to 10 drops of pheromone to the vial every 3 to 4 weeks. If new comb is discovered, a 4-in by 4-in section will be collected for measurements.

Addendum D--Beelining

This addendum lists the basic equipment and procedures needed for tracking foraging bees back to their nest, hive, or swarm (AHB).

The information in parts I and II is publicly available from various sources. Part III is a special section expressly written for eradication programs, for use under certain circumstances when beelining is a major option in the suppression and eradication of bees from a given area.

I. EQUIPMENT

Vertical bait box	Scent bottle
Bait bottle	Chalk (white and colored)
Bait box stand	Small artist's brush
Insect net	Survey map

Propane or butane backpacker stove, scent can, and large candles.

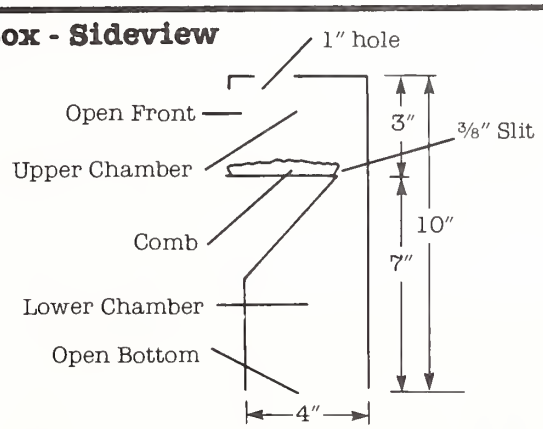
Hunting Wild Bees--Donovan, 1980.

A. Vertical Bait Box

This is the most important piece of equipment. It enables an artificial beeline to be set up and lead the tracker straight to the hive or nest.

The vertical bait box is readily constructed from 1/4 in to 3/8 in plywood or any other suitable wood. It is essentially an open-ended box, 10 in by 4 in by 4 in, shaped like a milk carton without a bottom. A handle may be added to the top for ease of carriage and other needs. In addition, clear plastic and opaque covers are necessary to cover the 1-in diameter hole and open end in the upper chamber. These are held in place by rubber bands and interchanged as the need arises.

Vertical Bait Box - Sideview

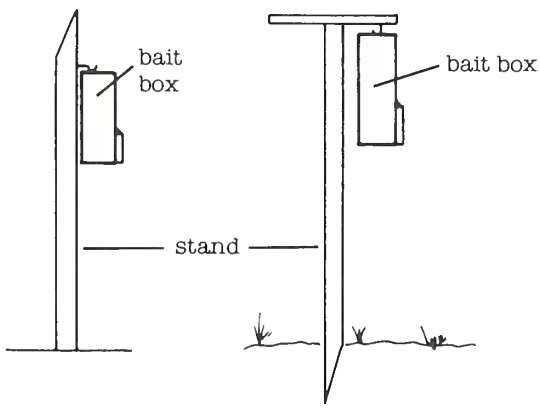


The outside of the bait box must be painted white. A piece of bee comb cut to approximately 3 in by 4 in is fitted snugly into the upper chamber, being careful not to cover the slit in the back. Anise oil or Nasonov pheromone is sprinkled over the outside of the bait box prior to any bee survey or outing.

B. Bait Box Stand

The bait box can be hung on a tree limb or even a stick while beelining, but sometimes no such support is available. It may be necessary to employ a broom handle for support. One end of the broom handle is sharpened to a point. The other end is nailed to the center of a 6-in by 6-in board. Each end of the handle will have a small hook. The end with the board can be placed flat on the ground, and the bait box can be hung from the hook at the sharpened end. If it is not possible to do this (for various reasons) it may still be possible to drive the sharp end into the ground and hang the bait box from the hook on the board end.

Bait Box Stand



C. Heated Honey:

In areas where few bees are present, it may be necessary to heat honey. It is necessary to boil the honey so that the air is filled with a heavy, sweet aroma. This is done by several means, as follows:

1. Backpacker stove. This is the most convenient source. A small, highly portable stove is screwed directly on top of a fuel can, and a small container such as a jar lid is placed on top with a teaspoonful of honey.

2. Scent can. A device made from any large tin can. The top is removed and a rectangular hole about 3 in by 4 in is cut in the side of the can near the bottom. The open end of a jar lid is welded or otherwise securely fastened to a length of wire (i.e., coathanger) slightly longer than the diameter of the can. A series of holes is

punched in opposite sides of the can into which the wire ends can be slipped to suspend the lid inside the can. Finally, a candle (preferably beeswax) is lit and placed inside the can. Honey is then added to the jar lid.

3. Large candle. A large beeswax candle of 3 in or more diameter is placed on the ground and lit. When a depression of melted wax forms, honey is poured into this depression. Add as much honey as is possible without extinguishing the flame.

D. Passive Scents

Several means are available to enhance attractiveness and thus strengthen any possible beeline in the quickest time possible, short of heating honey.

1. Bait bottle. A small squeeze bottle with sugar water or diluted honey as bait. This is sprayed over the comb in the bait box prior to collecting bees.

2. Scent bottle. A small squeeze bottle with scent, generally anise oil or Nasonov pheromone. The bottle is opened just before releasing bees from the bait box. The scent of the contents is allowed to permeate the immediate area to serve as a guide for returning bees. The scent may be enhanced by sprinkling on the bait box or on a cloth which is then vigorously waved on an 8- by 10-ft pole near the bait box to attract bees.

II. PROCEDURES

Beelining should be carried out by teams of two persons each, partly for safety reasons. If available, "Hunting Wild Bees" by R. E. Donovan may help beginning bee hunters get the feel of beelining, especially Chapters 3 to 6.

A. General Beelining (for all Beelining Operations)

At the selected site (preferably an open area such as a field, lawn, or in a clearing), if bees are present, collect 15 to 20 bees. This is done by first filling the bee comb in the upper chamber of the bait box with sugar water or diluted honey from the bait bottle. Then cover the front and top openings of the bait box with transparent covers, using rubber bands to hold them in place. Place the open end of the bait box over each bee if possible, either putting the box over the bee or quickly trapping it inside by slowly bringing the bottom of the bait box and a piece of wood together with the bee between them and, when 6 in apart, slapping them together. Allow 10 to 20 seconds for the bee to get to the top chamber.

When enough bees are trapped, cover the front and top openings with wood covers. The darkened chamber will cause the bees to search the chamber and, in so doing, discover the bait. After about 4 to 5 minutes, the bees will have filled up and are ready to be released.

To release bees, hang the bait box is a convenient location and remove the cover from the top hole. Stand well away from the bait box and watch the direction of flight after the bees finish circling. As the circles get larger, they tend to veer toward the bee nest or hive before the bees take off for home. This helps to indicate the line of flight. In about 15 minutes or so, bees should be headed back as well. Usually, within 1/2 to 1 hour there will be a steady stream of bees working the bait. As the beeline becomes established and the direction of flight more certain, mark some of the bees. This is done by scraping a bit of powder off a piece of chalk, wetting it with a drop of water or saliva, dipping in the paintbrush, and quickly dabbing a bee on the abdomen. One engrossed in the honeycomb is best. Use different colored chalk for different bees.

When the marked bee leaves, note the time of departure and the time of return. The following chart will give the distance based on overall averages. A careful record must be kept of all marked bees.

Round-Trip Time (minutes)	Distance between bait and nest (estimated) (yards)	(miles)
3.0	110	1/16
4.1	220	1/8
5.2	440	1/4
7.3	880	1/2
8.4	1,100	9/16
9.5	1,320	3/4
11.6	1,760	1.0
13.8	2,200	1 1/4
15.0	2,420	1 3/8

Do not bother with beelines taking more than 15 minutes for a round trip. However, the approximate location should be carefully noted on a map for later use when the block from which those bees might have come is surveyed.

Beelines taking more than 8.4 minutes and less than 15 minutes may be within the block under survey. These locations may be tracked down.

All beelines 8.4 minutes or less are likely to be within the block and are to be tracked down.

During these proceedings, it may be necessary to check the comb and add more sugar water or diluted honey, as necessary.

B. Few Bees, No Bees, Bees Out of Reach

If there are apparently no bees or bees are hard to reach, the following will be carried out.

Hang the bait box about 2 to 3 ft off the ground or use the bait boxstand. Fill the bee comb with sugar or diluted honey and place in bait box. Do not put any covers over the front or top openings.

Next, place the backpack stove, scent can, or candle under the bait box. Start the stove or light the candle. Fill the honey cup with honey and make necessary adjustments to bring the honey to a slow boil (except for large candle which, when properly lit, has honey poured in the melted depression). This will quickly fill the air with the smell of boiling honey. Foraging bees from up to 200 yd or more should be attracted to this scent within 30 minutes. Attracted bees will first check the scent can, the white bait box, and then they will feed from the comb. Mark the bees and try to establish a good beeline and probable distance.

If no bees show up within 30 minutes, this may be regarded as a negative finding, and the team should move on to the next site.

C. Working the Beeline

Beelines are never exact and the true line could be 10 to 20 degrees to either side of a hypothetical line. Once a strong beeline and the approximate distance are established, several other steps may be helpful.

1. Simple Heading. If the location is quite close, i.e., up to 1/8 to 1/4 mi away, and the area is relatively clear of trees, etc., it may be worthwhile to try to follow the beeline in that direction. The direction must be clear, otherwise time is wasted. If there is some uncertainty about direction, watch arriving bees as well. These bees will usually fly slower and will be coming in on a straight line. Silhouetting the bees against the sky is also a help. Another method is to listen for the bees flying in and out while walking around the bait box at about 10 yd away. For more difficult or complicated situations, however, the following three techniques are applicable:

2. Relocation. When a strong beeline is established and there are 10 to 20 bees working the bait, place the transparent covers over the top hole and front opening to keep the bees inside. Cover the bottom opening, too, if the terrain is rough or it will take more than a few minutes to get to the new location.

Move along the beeline for 200 to 300 yd, set the bait box down, and take the transparent covers off to release the bees. Wait for the bees to reestablish the beeline. This should take about 20 minutes. If, however, the bees have not returned by then, go back to the original location for another load of bees, and this time move along the beeline for 100 to 200 yd. It may be helpful to boil a little honey under these circumstances. Repeat if necessary to find location of nest or hive.

3. Leapfrogging. A refinement of relocation. Use a second bait box 200 yd down the beeline, leaving the first bait box in place. Boil a little honey under the second bait box to get the attention of the bees on the beeline. Once this new beeline

is established, bring the first bait box further down the line and repeat procedure. Repeat as necessary, marking bees if it is desirable to recalculate the estimated distance remaining.

4. Intersection. Although not exact, this can be useful under perplexing situations.

First establish a beeline with one bait box. With a second bait box, go 200 to 400 yd to one side of the beeline and establish a second beeline. The hive or nest will be at approximately the point where the two beelines intersect. A map and ruler may be employed for greater accuracy. Timing the bees is also advisable with this procedure. The technique is useful where heavy woods or other obstacles make it difficult to move down the original beeline and establish new bait box locations.

5. Water Tracking. In dry, hot weather, bees must search for water. At such times or in very dry localities, look for bees at leaky outside faucets, water fountains, small streams, ponds, or wherever water is available. When bees are found taking on water, collect bees in the bait box and proceed to build a strong beeline as given above.

D. Other Beelines

During the course of establishing a beeline, some bees may appear to be heading in a different direction. These are bees from other nests or hives. As a general rule, the strongest beeline should be worked first. However, before taking up a bait box from any location, the direction and timing of these weaker beelines should be noted. This will allow the other beelines to be worked later, with priority going to those apparently located within the block being worked.

E. Search for Nest Hive (or Swarm-Africanized)

Once close enough to the source of the beeline, it is necessary to search for it. When only European bees are in an area, this usually means a tree. Look for trees most likely to contain bees. Those generally are live trees of at least 18 in or more in diameter (usually 2 1/2 to 5 ft). There are usually not many such trees, and these should be examined first. Black gum, live oak, black oak, and white oak are trees which frequently develop large cavities in the South, Southeast, and on the west coast. Tulip poplars, on the other hand, rarely contain cavities unless they are very large. Sometimes European bees will nest in structures such as between walls, in the ground, or, if in the open, on a branch.

When examining a tree, check it from all sides. On large trees, bees may actually be in a large branch. The entrance hole may be from ground level on up, but it is usually between 10 to 20 ft. A pair of binoculars is handy if the tree is very tall. Look for a continuous flow of insects in and out of a tree, as no animal behaves quite like the honey bee.

With AHB, the choice of homes is almost unlimited. Expect them anywhere. Since AHB swarms send out foragers, swarms will also be encountered. An AHB nest can be very dangerous and should not be disturbed until time to dispose of it when all precautions are in effect. Bee sampling will be carried out prior to killing bees and consistent with safety requirements. Samples of 50 plus bees can be made up of returning foragers. Samples are treated as given in II.A.3.a. Any comb is sampled after bees are dead.

III. SYSTEMATIC BEELINING PROCEDURE

Systematic beelining will be carried on throughout a designated survey area up to a maximum of 100 mi^2 surrounding each find. The survey area will be gridded into areas of 4 mi^2 blocks (see figure). Each block shall be marked out on a suitable map. The blocks must be covered once every week.

Days of poor or inclement weather when bees and, consequently, survey teams are not out will not be counted for the obvious reason that bees will not be active or swarming on such days, and the status quo is maintained.

Each block will be checked at two sites at a given time in a minimum period of 1/2 day. These sites should generally (but not necessarily) be located in the epicenter and in one corner of each block with a bias for flowering plants and anywhere bees are seen or reported in the block. If any bee traps are in the area, these are to be avoided, as trap personnel will be available to service traps and report on any bees present. Should bees be spotted at any time during movement of the team from one site to another or into or out of the block, these also will be beelined even if in addition to the sites chosen, and additional time is needed.

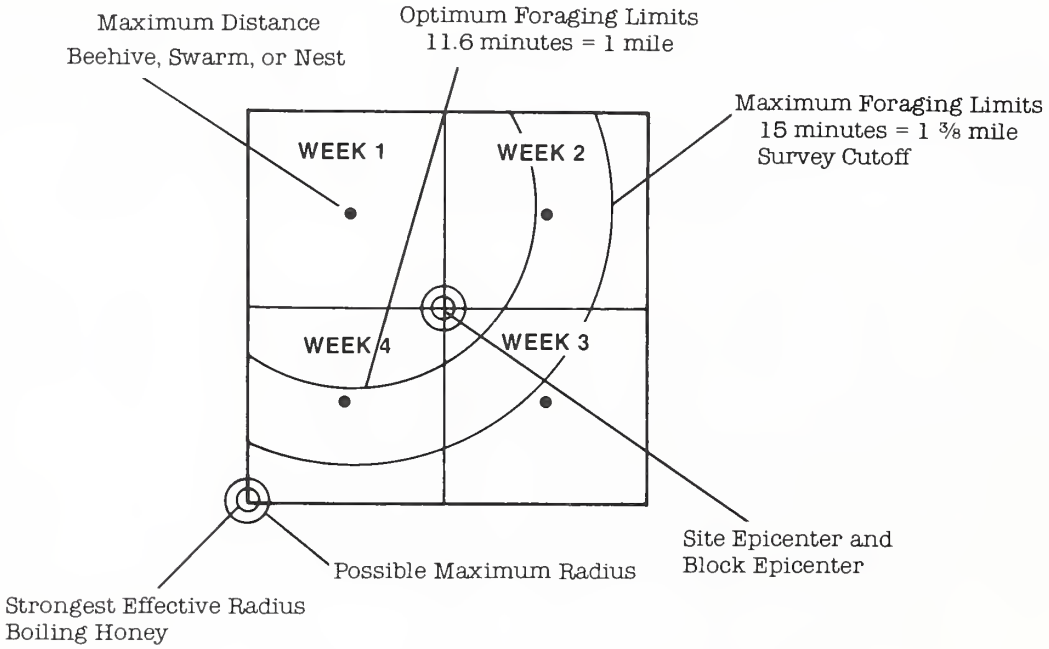
Generally, a team will be expected to proceed to the first site and beeline from there. If this results in a positive finding, they are to spend the time necessary to track down all the beelines established which appear to be within the block under survey (see II.A, last three paragraphs). If, however, no bees are found after 30 minutes and results are negative (see II. B, last paragraph), the team will proceed to the next site within the block and try again. Provided that also is negative, the block may be declared negative for bees for that timeframe, and the team will proceed to the next block. Survey teams should check the same corner of each block in any given week to avoid duplication of effort. Corners are to be related on a weekly basis so that any one corner is not checked more than once per month.

If it appears that a maximum 1-day schedule per block cannot be adhered to for any team due to heavy beelining or difficulties in beelining due to terrain, etc., then additional teams will be sent out to maintain the proper schedule throughout the survey area. It is important to ensure that the survey area is checked once every month or 2 months, depending on the kind of bees present. In some cases, individual teams may need assistance in checking out an area. Generally, as the course of the program goes

on, it should be easier to keep the survey area clear of bees, and the number of survey teams may be cut. A possible exception to this statement would be in an area favorable to AHB at times when swarming is likely to occur.

If only European bees are in the area and these are cleared out of the survey area, and teams are generally able to check two locations within each block in less than the minimum allotted time (1/2 day), consideration may be given to briefly increasing survey activity to two or three additional quadrants in each block and then, if bee finds are negative, to discontinue the survey and rely on other project activity and public reporting for any bees moving back into the area.

Block Grid - Beelining Survey



Addendum E--Life History

1. SYSTEMATIC POSITION

Africanized honey bees--The population of hybrid colonies which has resulted from crossing African, Apis mellifera scutellata (Lepeletier, Ruttner, 1976) (formerly Apis mellifera adansonii Latreille, Ruttner, 1976), representatives with EHB (Hymenoptera, Apidae).

The western honey bee (Apis mellifera) is one of five described species of Apis. Members of the genus Aphis occur worldwide except in the polar regions. Four species are limited to Asia. A. mellifera originally was limited to the Near East. It then spread to western and southern Africa and then to Europe. Modern civilization has now carried it all over the world.

A. m. scutellata is one of many subspecies of A. mellifera. Prior to 1956 this subspecies was confined to Africa south of the Sahara Desert. In 1956 it was accidently established in Brazil. Its hybrids, which we call africanized honey bees, now occupy almost all of South and Central America.

Specimen Identification:	Identification can only be carried out by trained and experienced personnel on a series of at least 10 specimens. Identification is based on probability because characteristics between subspecies vary on a continuum.
Adults:	Color highly variable with most workers having opaque yellow to orange abdominal bands but a small percentage (15 percent) will be dark or exhibit black bands on the upper side. Consequently, mixtures of black, gray, brown, and yellowish bees are frequently seen in the same colony or swarm. Adult size is generally smaller than European bees.
Cell Size:	The measurement across 10 adjacent honey comb cells averages 4.8 centimeters (cm) (range is 4.7 to 5.1 cm) for AHB; for EHB the average is 5.2 to 5.4 cm across 10 cells. There are exceptions to these measurements, depending on availability of food and population size of a given colony.
Defensive Behavior:	The AHB may exhibit defensive reactions when a hive is disturbed or examined. This may include excessive stinging or behavior such as running off of the combs, onto hive walls and bottom boards, forming hanging festoons, and flying. Even the queen may fly away from the comb and the colony when the hive is examined.

The EHB rarely exhibits such behavior unless mishandled. Both subspecies are much more defensive if large amounts of empty comb are present, presumably as a result of volatiles from the comb. The bees are variable in behavior, and caution should be used at all times.

Stinging: Stinging behavior is the best known characteristic of AHB. An individual sting is no worse than a sting by any other honey bee. However, their sensitivity to disturbance and their ability to communicate alarm within colonies can invoke a large number of bees to attack. A slight disturbance can set off a chain defensive reaction within seconds. Bees will pursue and may sting animals or people within approximately 600 ft or more of an apiary. They can take up to a week to quiet down, while EHB, on an average, will become peaceful in much shorter periods of time. Bees may attack persons even before they enter apiaries and will pursue persons or animals that have been stung for distances up to 0.62 mi (1 kilometer). Vibrations from farm machinery or movement (such as passersby) can also result in an attack.

Swarming and Absconding: The AHB is noted for swarming often. They also abscond more often than European bees due to a variety of foraging and/or other environmental conditions. These two characteristics lead to large feral AHB populations.

Generally, it can be said that like all honey bees, AHB produces a primary reproductive swarm with an increase in bee populations when resource conditions (presumably springtime in the United States) are good. However, they tend to produce more brood and swarms than European bees. On average, European bees in the United States maintain a steady population with little, if any, real growth (net reproductive rate = 1.0), but Africanized bees, under tropical conditions, have a very high rate of real growth (net reproductive rate = 16). This leads to an explosive population expansion of Africanized bees, even in the face of a 30 percent colony loss (due to various factors) per year.

Since the AHB and queens are more sensitive to disturbances or adverse conditions and have evolved the survival tactic of leaving when such conditions affect the colony, they may abscond quite frequently. Adverse conditions include but are not limited to restricted nest size, lack of food or water, temperature extremes, physical disturbance of nest, and large or sudden loss of part of the colony such as when pesticides are used or disease is prevalent. If the queen in a colony is lost, more queens are immediately reared. Queen-loss swarming (akin to after-swarms) is likely to occur and the bees usually head to another (queenright) hive or nest. Queen-loss swarming is rare in EHB. However, absconding does not usually occur when brood is present unless there is a serious problem such as marauding ants.

The original African bee has been known to form composite swarms. These may contain as many as 13 queens, and studies of these swarms have been made. European bees also have composite swarms, but such swarms may be less frequent than with African bees. The situation with Africanized bees is not clear, but owing to their swarming habits, it seems reasonable to expect that composite swarms would occur from time to time. Composite swarms have been characterized as being obviously unstable. They may also separate with each queen establishing her own nest. If a single nest is established, usually only one queen will survive to perpetuate the colony (African bees, however, have been known to form composite hives as well (see below). Swarms of this type can be identified by larger than usual size, general nervousness, and if clustered, by the appearance of depressions in the cluster through which queen bees can emerge and disappear. Budding off of small clusters with one queen each also occurs. Usually this portends the departure of that cluster from the main swarm for a nesting site.

Swarms are generally peaceful, and defensive behavior in comparison to established hive or colony defensive behavior is much lower. However, swarms of all subspecies of honey bees have been known to sting and must be viewed with caution.

Social Parasitism:

Africanized bee swarms have been known to take over European hives. These are usually weak or queenless hives or nests. The swarm usually settles near the hive. It is said that workers and/or the queen will enter the hive and kill the resident queen if one is present. If the hive is a strong queenright one, the advantage lies with the resident queen, especially if the intruders are from a different subspecies or even patrilineal subfamily.

European drones are not usually accepted by Africanized colonies although European colonies will accept Africanized drones, which tend to migrate to their colonies. These drones, due to the dynamics governing regulation of drone production, impair the drone production of the host colony. At the same time, owing to the same dynamics, drone production in the parent AHB colony is enhanced. Any European queen on a mating flight is therefore more likely to encounter Africanized drones.

Finally, AHB workers have a tendency to become laying workers when they enter EHB hives or nests. These workers, (in conditions involving this behavior) will produce the majority of laying-worker drone progeny. Such drones, being Africanized, will also enhance Africanization of other hives or nests.

Collectively, these parasitic activities may constitute the driving element in the process of Africanization.

Foraging: Under poor resource conditions, the AHB tends to do better than the EHB. Under good resource conditions, European bees do better. Generally, the EHB sends a larger proportion of bees out to forage and respond to increased nectar flows by increasing their proportion of foragers. Africanized bees maintain a more constant ratio in response to foraging conditions, partly due to the need for more nurse bees for a larger brood and to loss of bees through intense colony defense. Thus, EHB will generally collect more pollen and nectar, resulting in more honey than AHB produces, but they are also more selective as to the quality of the nectar sources used. It should be noted that AHB colonies will collect a higher proportion of pollen.

Over-wintering: Until recently it was believed that the AHB does not possess an overwintering capability. This hypothesis has now been thrown in doubt, and no predictions can be made at the present time. At present, two theories prevail on the extent of potential distribution in the United States based on this capacity. In one, the distribution is limited to the Southern States and southern California. In the other, the distribution ranges throughout most of the United States and into Canada. Natural distribution does not take into account overwintering in managed colonies or as an accidental benefit in underground nests or nests located in or near heated structures, such as the attics of houses or buildings. The most recent studies available, carried out in mountain areas of Columbia and Costa Rica and in Southern Argentina, have apparently established that there is little if any difference between AHB and EHB overwintering capability.

Mating: Africanized colonies produce more drones. Africanized bee drones also tend to spend as little as 4 minutes in the hive between mating flights (versus 17 minutes for Europeans), and their congregation areas are diffuse and larger. These drones are also more persistent in following the queen. These elements and others factors noted above give AHB a strong reproductive advantage.

Venom: So far as is known, the venom of the AHB is similar to that of the EHB. The AHB does have smaller venom glands than its European counterparts.

3. BIOLOGY

Some information was given in the comparative notes above. The following is a brief description of the life history of the honey bee.

Complete metamorphosis takes place in the life cycle of the honey bee--egg, larva, pupa, and adult stages.

Egg: The egg stage (3 days) is the same for all castes. The Eggs are white and sausage shaped. The caudal end of the egg is attached to the base of the cell. A fertilized egg develops into a female bee; a nonfertilized

egg develops into a male bee. The queen bee, after examination of the cell, attaches each egg to the base of an empty cell in combs cleaned by worker bees.

Hatching: Hatching occurs when the egg is approximately 60 hours old.

Larva: Larvae are fed glandular secretions originating in the head of young nurse bees. Mass feeding is practiced with young larvae, and progressive feeding is practiced with older larvae. Queen larvae are mass fed on royal jelly in a peanut-shaped cell.

Molting: Honey bee larval molts occur about once every 24 hours during the first 4 days of larval life. Each new larval instar is slightly larger than the previous one. On the 8th day after the egg is laid, the cell containing the worker is capped, and on the 9th day the larva spins a cocoon. The prepupal stage is reached on the 10th day.

Pupa: On the 11th day (5th molt), the white and motionless pupal form is evident. From the 13th to the 20th day, the eye color develops. On the 20th day (6th molt), the pupa sheds its thin outer skin, becomes an imago (adult), and chews its way out of the cell.

The pupal stage is shortest for the queen, followed by the worker, and is longest for the drone. However, development may vary with individuals and with temperature conditions.

Adult Bees: The worker has a normal life of about 30 days. The normal life span of drones is 5 to 10 weeks. The queen usually lives from 1 to 3 years.

About 80 percent of the queens mate 8 to 12 days following emergence. They leave the hive on mating flights and fly to a drone congregation area where they may mate with at least several to as many as 17 drones on successive flights. Once a queen has filled the spermatheca, mating flights cease, and she does not mate again.

Most mating flights take place in the spring, with some in the autumn. In tropical areas such flights may be at any time but are still concentrated in resource rich periods. Flights generally occur on warm and sunny days in the afternoon (above 68 ^{o}F and with wind speeds less than 4 to 5 meters (m) per second), about 2 to 5 p.m. Drones generally fly for about 30 minutes, while queen flights last from 10 to 15 minutes.

Egg laying begins about 1 day after a queen completes her mating flights and continues most of her life. Should she fly at a time when few drones are present and fail to find enough mates, she will continue to take mating flights until mated. If not mated, she will lay unfertilized eggs

unless balled and killed by the workers. An old queen whose sperm supply is depleted and is laying drone eggs only is also subject to balling, especially if a laying daughter queen is present. Replacement by the daughter queen is supercedure. Without supercedure the colony will die, especially in fall or winter.

Queenless colonies may: (1) Raise a new queen if they have eggs or young larvae; (2) be taken over by a parasitizing queen; or (3) develop laying workers and become hopelessly queenless, except in Apis mellifera capensis, the cape bee, whose workers are capable of parthenogenetic production of females. Dwindling queenless colonies are subject to robbing by other bees.

Workers carry out the physical tasks required in the colony such as foraging, housecleaning, tending to the queen, eggs, and larval stages, building comb, defense, grooming, clustering for winter survival, scouting, etc. Communication is carried out in various ways through recruitment dances, pheromones, buzzing, etc. Foraging strategy includes communication of the source of nectar and pollen, direction and distance to source, and quality of source. Using this information and through subsequent personal experience including memory, color, pattern recognization, and bee scent on empty flowers, individuals efficiently exploit the food source by direct flights and preferential selection of nectar-rich flowers. Defense is usually directed toward fighting off other animals, including other bees, and even foreign queens who attempt to take over a colony. In winter, workers regulate the temperature in a hive by clustering to maintain brood rearing temperatures. During hot weather, workers regulate temperatures by fanning air and by evaporation of water within the hive. Evaporation of regurgitated liquid droplets on the tongue allows individual foragers to fly under hot desert conditions by keeping the head and thorax cooler by several degrees. Generally, though, few bees of any subspecies forage at temperatures below 50 ^{o}F (10 ^{o}C) or above 100 ^{o}F (38 ^{o}C).

Drones do no work within the colony. They feed themselves or are fed by worker bees. Their sole mission in life is to undertake mating flights. In autumn or in times of dearth, drones are often thrown out of the colony to perish. An exception is when a colony is queenless, in which case most of the drones are usually retained.

Overwintering survival depends on adequate supplies of honey to sustain the colony in a sheltered location where workers can regulate the temperature by clustering. The colony must be strong enough to sustain the loss of workers during the winter months. Colonies commence brood rearing in midwinter to produce a larger population by springtime. In areas where the climate limits food collection to a brief period of 3 to 4 months, these factors become very important in long-term survival.

Learning: Since honey bees must cope with a large number of situations owing to their life style, they must learn a variety of specific things in order to navigate, forage, explore new surroundings, abscond or stay put, etc. This is not to say that they are intelligent insects but rather that they are highly adaptable. Their need for learning is sufficiently predictable within behavioral contexts and evident cues, such that it is easily studied owing to its structured organization. The possession of this ability should not be underestimated in dealing with honey bees. Care must be taken throughout the execution of any plans to preclude unexpected results, such as sudden flight or attack, depending on the cues they may perceive.

4. HOSTS:

Generally, most flowering plants are hosts for honey bees. However, some species seem to be more attractive than others to bees. The following lists contain those herbaceaous annual and perannual species in North America which are more than usually attractive. In general terms, these include mints, milkweeds, clovers, and asters. Mountain mint and swamp milkweed seem to be the most attractive species documented at this time. There is no available current literature which ranks woody species such as Linden (Boxwood) or citrus (for example).

Anise hyssop	Agastache foeniculum Ktze.
Arrow leaf aster	Aster sagittifolius Wedemeyer
Borage	Borago officinalia L.
Butterfly weed	Asclepias tuberosa L.
Catnip	Nepeta cataria L.
Chapman Honey Plant	Echinops sphaerocephalus L.
Chivirico	Leonurus sibiricus L.
Common Milkweed	Asclepias syriaca L.
Gill-over-the-ground	Glechoma hederacea L.
Golden honey plant	Actinomeris alternifolia DC
Meadow sage	Salvia pratensis L.
Mountain bluet	Centaurea montana L.
Mountain mint	Pycneanthemem pilosum Nutt.
Motherwort	Leonurus cardiaca L.
New England aster	Aster novae-angliae L.
Oregano	Origanum vulgare L.
Pennyroyal	Mentha pulegium L.
Peppermint	Mentha piperita L.
Persian catnip	Nepeta mussinii K.
Purple loosestrife	Lythrum salicaria L.
Salvia x Superba	
Spearmint	Mentha spicata L.
Swamp Milkweed	Asclepias incarnata L.
Tall cone flower	Rudbeckia laciniata

White sweet clover	Melilotus alba Desr.
Wood figwort	Scrophularia nodosa L.
Yellow sweet clover	Melilotus officinalis Lam.

Addendum F--Identification of Bees

Comparative Characteristics of Bee Colonies to Aid in Specimen Collection for Identification Purposes

The following chart may aid in identification of possible Africanized colonies.

Africanized Honey Bee	European Subspecies
-Defensive behavior.	-Seldom defensive behavior.
-Easily disturbed, leading to chain reaction that can involve entire apiary.	-Disturbances generally limited to individual colony.
-Defensive behavior can develop into massive stinging and can involve targets more than 300 yd away. (200 to 300 m).	-Massive coordinated stings are rare and only under extreme provocation involving a colony and immediate targets which move.
-More guard bees, these highly active.	-Fewer guard bees present, these generally resting.
-Foragers fly straight in and out of hives	-Foragers circle before landing and walk in.
-For feral colonies, comb cells are smaller, ranging about 4.7 to 5.1 cm (roughly less than 2 in per 10 cells or less than 5 in per 25 cells.) Take three independent measurements.	-Feral and domestic comb cell size larger, ranging about 5.2 to 5.4 cm, roughly more than 2 in per 10 cells or more than 5 in per 25 cells). Take three independent measurements.

Preliminary Identification

Composite samples will be biased through selection of smaller specimens for analysis. Other samples will not be so biased and specimen selection will be random.

The PPQ identifier will carry out identification of samples by carrying out FABIS procedures. The identifier is required to properly mount and label worker wings and legs on slides for both current and later verification (see instructions). FABIS analysis consists of wing length, femur length, and degastered weight measurements (See ARS FABIS manual). Only if the sample is indicated as Africanized through FABIS are slides made for image analysis at Beltsville, Maryland.

Sample identification must not be delayed. Preliminary identification of project bees will be accorded high priority to avoid overloading the small Beltsville staff and consequent delays in identification. Project personnel are expected to handle FABIS.

Specimens identified by PPQ identifiers as suspect AHB are to be forwarded in vials of alcohol accompanied by slide mounts of body parts of 12 bees/colony for confirmation to 1/ (see chart) below. These should be accompanied by PPQ Form 391 and marked "Urgent" (see PPQ M390.500).

Storage

Samples in plastic bags are stored in a freezer with dry ice. If freezer capacity is limited or exceeded, remove samples for which body weight analysis has already been completed, then dry and store these samples at normal temperatures. For dry storage, each sample should be removed from the plastic bag, dried quickly and thoroughly, and placed in a paper bag with tissue paper and label data. These are then placed in a properly sealed insect cabinet, storage container, or similar facility with preservative such as PDB or napthalene until shipment or disposal.

Fresh Bee Shipment (Optional)

If live or freshly-killed (<30 minutes) bees are available from the original swarm, place several hundred workers on ice (preferably dry ice) and include in the overnight shipment to Beltsville. These bees will be used in development of biochemical/molecular identification procedures. For additional information contact W.S. Sheppard; Beneficial Insects Lab, Beltsville, MD 20705. Telephone (301) 344-2205.

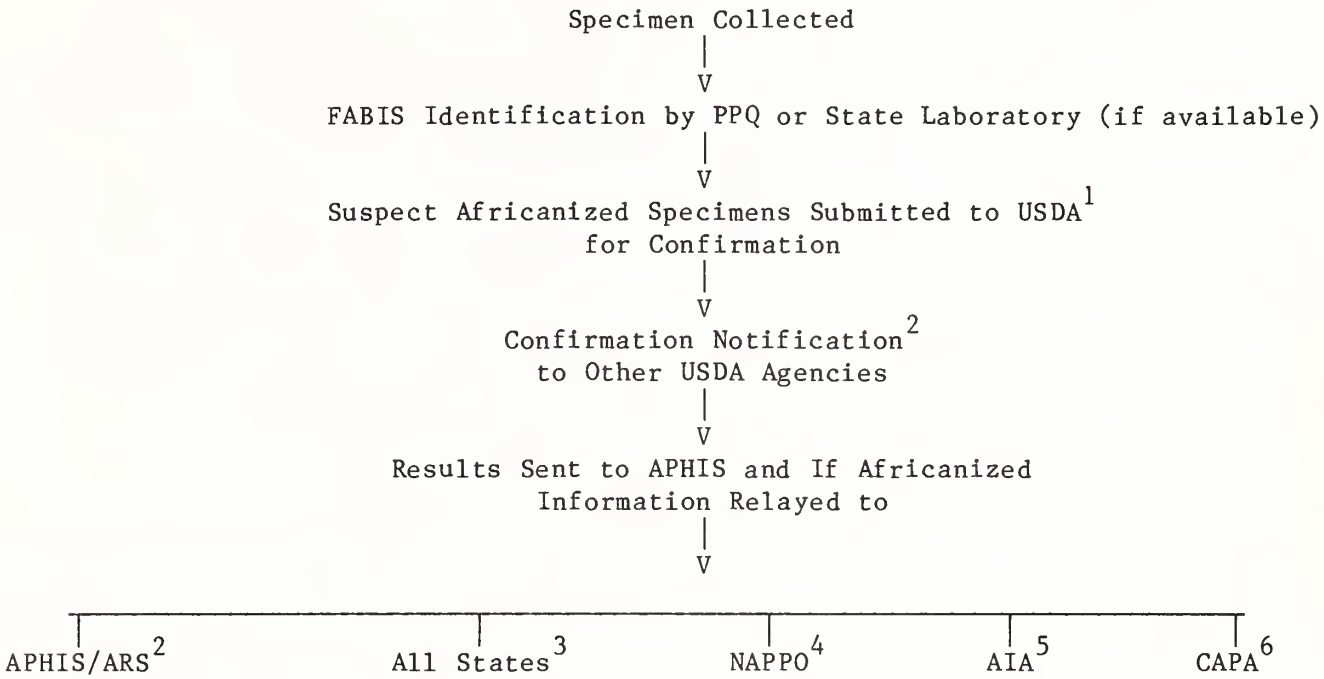
Labeling

Label all slides (and corresponding bee voucher specimens) with the following data in this order:

1. Country;
2. State or Province;
3. City/County;
4. Date of collection (day-month-year);
5. Collector's name;
6. Collector code (if any) and any number associated with code;
7. Origin (from hive, swarm, etc.);
8. Behavior observed; and
9. Any special information (including mean wing length) ($\overline{X}$) and range (R) of wing lengths.

Unless return is requested, the BIL will retain correctly prepared specimens for future research and reference.

Identification of Undesirable Species of Honey Bees



[1]Beneficial Insects Laboratory
BARC-East, USDA
Building 476
Agricultural Research Center
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[2]APHIS — Plant Protection and Quarantine
ARS — Beltsville Agricultural Research Center

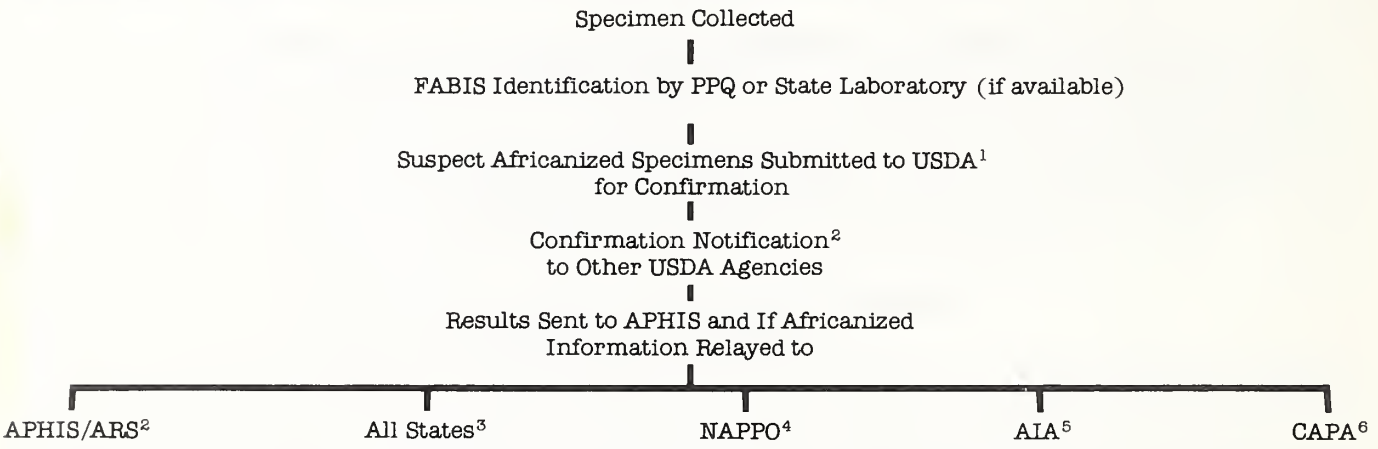
[3]All States — State and Territory Agricultural Regulatory Officials

[4]NAPPO — North American Plant Protection Organization

[5]AIA — Apiary Inspectors of America

[6]CAPA — Canadian Association of Professional Apiculturists

Identification of Undesirable Species of Honey Bees



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[2] APHIS	Plant Protection and Quarantine
ARS	Beltsville Agricultural Research Center
[3] All States	State and Territory Agricultural Regulatory Officials
[4] NAPPO	North American Plant Protection Organization
[5] AIA	Apiary Inspectors of America
[6] CAPA	Canadian Association of Professional Apiculturists

See Notes (next page)
See JO #35686 for
100 copies

Africanized bees and comb

European bees and comb

Addendum G--Forms

To be added later.

Addendum H--Contributors

Contributors to the first action plan on Africanized honey bee in 1983 are hereby acknowledged. The implementation of this plan in 1985 led to many changes and an Africanized Honey Bee Eradication Project critique in 1985. Most of the submitted recommendations have been incorporated in the current version. Acknowledgement of these contributions is gratefully made. Meetings of the American Beekeepers Federation and of the California State Beekeepers Association Ad Hoc Committee on the current draft of the action plan are also acknowledged.

This current version of the action plan was reviewed by the following:

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The above met at the Bee Breeding and Stock Center Laboratory, U.S. Department of Agriculture, Baton Rouge, Louisiana, on November 25, 1986, prior to the full committee meeting.

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The aforementioned individuals were major contributors to the development, preparation, and review of the Action Plan. Other contributors and/or reviewers were research scientists of the Agricultural Research Service and regional and staff personnel of Plant Protection and Quarantine.

Addendum I--References

The literature on the Africanized honey bee and of bees in general is very extensive. The following references are those generally relevant to this document:

Al-Sa'ad, B. N. et al., 1985. Adaptation of worker honey bees (Apis mellifera) to their alarm pheromones. Physiol. Entomol., 10(1):1-14.

Anderson, E. D., 1969. An appraisal of the beekeeping industry. Agricultural Research Service, United States Department of Agriculture, ARS 42-150, 35 pp.

Anderson, L. D. and Atkins, E. L., Jr., 1967. Toxicity of pesticides and other agricultural chemicals to honey bees. University of California, Agricultural Extension Service, AXT-251, 7 pp.

Anderson, R. H., 1981. Queens and queen rearing. S. A. Bee J., 53(3):3-12.

_____, 1985. Honey bees and honey at the Cape of Good Hope. South African Bee Journal, 57(3):49-53.

Ayers, G.S., Hoopingarner, R.A. and Howitt, A.J., 1987. Testing potential bee forage for attractiveness to bees. American Bee J., 127(2):91-98.

Bogdany, F. J. and Taber, S., III, 1979. The significance of odor for bees orienting across a canyon. Apidologie 10(1):55-62.

Bradbear, N., 1984. Newsletter for tropical apiculture. Newsletter No.5, March, 1984. Tropical Apiculture: pp.3-4.

Buchmann, S. L., 1982. Africanized bees confirmed in Panama. American Bee Journal, 122(5):322.

Buys, B., 1985. Cape worker bees dislike African virgin queens. South African Bee Journal, 56(3):63.

Cantwell, G. E., 1974. The African (Brazilian) bee problem. American Bee Journal, 114(10):368-372.

Caron, D. M. and Reese, J. C., 1982. An entomological visit to Panama, the next country in line for African bee invasion. American Bee Journal, 122(2):112-114.

Cheng, K., Collett, T.S. and Wehner, R., 1986. Honeybees learn the colours of landmarks. J. Comp. Physiol. A, 159(1):69-73.

Clauss, B., 1984. Ex-Africa: Botswana. The colony in the course of the year. South African Bee Journal, 54(4):89-93.

_____, 1985. The need for appropriate beekeeping without fear. Coping with the persistent problem of the "aggressiveness" of African honey bees. Newsletter for beekeepers in tropical and subtropical countries, 7:6-9.

Conner, L., 1981. Students of the honey bee. American Bee Journal, 121(9):646.

Collins, A. and Rinderer, T. E., 1985. Effect of empty comb on defensive behavior of honey bees. J. Chem. Ecol., 11(3):333-338.

_____, et al., 1982. Colony defense by Africanize and European Honey bees. Science, 218:72-74.

_____, and Rinderer, T.E., 1986. The defensive behavior of the Africanized bee. American Bee Journal, 129(9):623-627.

Cooper, P. D. and Schaffer W. M., 1985. Temperature regulation of honey bees (Apis mellifera) foraging in the Sonoran Desert. J. exp. Biol., 114(0):1-16.

Corbet, S. A., et al., 1984. Can bees select nectar rich flowers in a patch? J. Apic. Res., 23(4):234-242.

Daly, H. V. and Hoelmer, K., 1985. Rapid identification of Africanized Honeybees. In Press (MS for publication):26pp.

_____, and Balling, S.S., 1978. Identification of Africanized honeybees in the Western Hempisphere by Discriminant analysis. J. Kansas Entomal. Soc., 51 (4): 857-869.

Danka, R. G., et al., 1986. Comparative toxicities of four topically applied insecticides to Africanied and European honey bees. J. Econ. Entomol., 79 (1):18-21.

_____, _____, 1986. A Foraging population sizes of Africanized and European Honey bee colonies. Apidologie, 17(3):193-202.

Dietz, A. R., Krell, R. and F. A. Eischen, 1985. Preliminary investigation on the distribution of Africanized honey bee in Argentina. Apidologie, 16:99-108.

_____, _____, and J. Pettis, 1986. The potential limit of survival for Africanized bees in the United States. American Farm Bureau Research Foundation Africanized Honey Bee Symposium, Atlanta, GA, February 11-12, 1986.

Donovan, R. E., 1980. Hunting wild bees. Winchester Press, Tulsa, Oklahoma, 184 pp.

Fermiano, L. H. M. N. and Stort, A. C., 1985. Study of food-gathering behavior in Italian bees, in Africanized honey bees, and in the descendents of their crossings. Revista Brasileira de genetica, 8(1):29-36.

Fletcher, D. J. C., 1978. The African Bee, Apis mellifera adansonii, in Africa. Annual Review of Entomology, 23:151-171.

_____, 1978. Management of Apis mellifera adansonii for honey production in Southern Africa. Apiculture in Hot Climates: 86-89.

_____, 1979. The Crisp Memorial Lecture. South African Bee Journal, 3-6.

Free, J. B., 1970. Insect pollination of crops. Academic Press, New York, 544 pp.

Gadbin, C., 1979. Approche biometrique de la variete locale d´ Apis mellifica Linneauss dans le sud Tchadien. Apidologie, 10(2):137-148.

Goncalves, L. S., 1978. Impacto causado por las Abejas African izadas en la America. del Sur. Gaceta del Colmenar, 40(8):474-483.

_____, 1984. Atividade de voo de linhagens de abelhas em funcas da temperatura. Anais do 5deg Congresso Brasileiro de Apiculture, Vicosa, MG, Brasil, 23 a 27 de julho de 1980:183-188.

Gould, J.L., 1983. National history of Honey bee learning. The Biology of Learning: Report of the Dahlem workshop on the Biology of Learning. Berlin, Springer Verlag: pp. 149-180.

_____, 1986. Pattern learning by Honey bees. Animal behav. 34 (4): 990-997.

Hallim, K. I., 1980. The presence of the Africanized bee in Trinidad. Journal of the Agricultural Society of Trinidad and Tobago, 80(4):332-349.

Harbo, J. R., Bolten, A. B., Rinderer, T.E., and Collins, A. M., 1981. Development period for eggs of Africanized and European honey bees. Journal of Apicultural Research. 20(3):156-159.

Hellmich, R.L., et al., 1986. Comparison of Africanized and European queen-mating colonies in Venezuela, Apidologie, 17(3):217-226.

_____, et al., 1986a. Laying worker production of drones in mixed colonies of Africanized and European honey bees. Ann. Entomol. Soc., Am., 79(5): 833-836.

Hepburn, H. R., 1983. Comb construction by the African honey bee, Apis mellifera adansonii. J. Ent. Soc. South Africa, 46(1):87-101.

Hicks, C. L., 1984. Quick thinking lures back escaped queen. American Bee Journal, 24(7):546.

Johannsmeier, M. F., 1979. Termite mounds as nesting sites for colonies of the Africanized honey bee. South African Bee Journal, 51(1):9-14.

Johnson, D., 1975. Congress abuzz over fierce honey bees. Congressional Quarterly, Inc., 33(21):3 pp.

Kazeznelson, M., 1971. The Africanized bee in Argentina. American Bee Journal, 111 (2):47.

Kerr, W. E., 1971. Contribuicao a ecogenetica de alqumas especies de abelhas, Cienc. Cult. Sao Paulo, 23(Suppl.):89-90.

_____, Rio, S. de L. D., and Barrionuevo, M. D., 1980. The southern limits of the distribution of the Africanized honey bee in South America. American Bee Journal, 121(3):196-198.

Khouri, L., 1979. Beelining. Vermont Life. 15-20 pp.

Koeniger, N. and Veith, H. J., 1983. Glyceryl--1, 2--dioleate, 3--palmitate, a brood pheromone of the honey bee. Experientia, 39(9):1051-1052.

Kreil, R. A. Dietz, and F. A. Eischen, 1985. Winter survival of Africanized and European honey bees in Cordoba, Argentina. Apidologie, 16:109-118.

Lensky, Y. and Demter, M., 1985. Mating flights of the queen honey bee (Apis mellifera) in a subtropical climate. Comp. Biochem. Physiol., 81A(2):229-241.

Levin, M. D., 1976. The Africanized bee in South America, Africanized bees, Taxonomy, Biology and Economic Use. Apimondia International Symposium, Pretoria, South Africa, 55-57.

Lockard, J. R., 1936. Bee Hunting. A. R. Harding, Pub. Columbus, Ohio, 72 pp.

McDaniel, C. A., et al., 1984. Hydrocarbons of the cuticle, sting apparatus and sting shaft of Apis mellifera L. Identification and preliminary evaluation as chemotaxonomic characters. Sociobiology 8(3):287-298.

McGregor, S. E., 1976. Insect Pollination of Cultivated Crop Plants. U.S. Department of Agriculture Handbook No. 496, 411 pp.

Mel'Nichenko, A. N., 1977. Pollination of Agricultural Crops by Bees. Amerind Publishing Co., Pvt., Ltd., New Delhi, 406 pp.

Michener, C. D., 1975. The Brazilian bee problem. Annual Review of Entomology, 20:399-416.

Moritz, R. F. A., and Hillesheim, E., 1985. Inheritance of dominance in honey bees. Behav. Ecol. Sociobiol., 17(1):87-89.

Morse, R. A., 1976. The international movement of honey bees: history, advantages and dangers. Africanized Bees, Taxonomy, Biology and Economic Use, Apimondia International Symposium, Pretoria, South Africa, 58-62.

_____, 1984. The Mating behavior of African Queens. Gleanings in Bee Culture, 112 (3):125.

Naoshima, Y., et al., 1984. An easy synthesis of (E)-9-OXO-2 decenoic acid, the queen substance of the honey bee, and (Z)-6-Heneicosen-11-1, the sex pheromone of the Douglas fir tussock moth. Agric. Biol. Chem., 48(8):2151-2153.

National Pest Control Association, 1978. Honey bees and their control in structures. Technical Release ESPC 036201:6pp.

Nunamaker, R. A., 1979. Newspaper accounts of Africanized bees are designed to frighten people--being stung by the press. American Bee Journal, Part I, 119(8): 587-592; Part II, 119(9):646-657.

_____, Harvey, A. J. and Wilson, W. T., 1984. Inability of honey bee colonies to rear queens following exposure to Fenthion. American Bee Journal, 124(4):308-309.

_____, Wilson, W. T., and Haley, B. E., 1984. Electrophoretic detection of Africanized honey bees in Guatemala and Mexico based on malate dehydrogenase allozyme patterns. J. Kansas Entomol. Soc., 57(4):622-631.

Ohio State University, 1987. International Conference on Africanized honey bees and bee mites, March 30-April 1, 1987. Ohio State University, Columbus, OH: 47pp.

Oldroy, B. and Moran, C., 1983. The detection of genetic defects of honey bees (particularly Africanization) in imported queens. Apiculture Workshop Papers. NSW, Division Animal Product, Department of Agriculture:89-99 pp.

Organismo Internacional Regional de Sanidad Agropecuaria, May 1979. Work plan against the Africanized honey bee. Panama Department of Sanidad Vegetal. 5 pp.

Otis, G. W., 1982. Population biology of the Africanized honey bee. Social Insects in the Tropics, Proc. 1st International Symp. of International Union for the study of Social Insects and Sociedad Mexicana de Entomologia, Cocoyoc, Morelos, Mexico, 1:209-219.

_____, and Winston, M., 1981. Africanized bee update. American Bee Journal, 121(12):89.

_____, Winston, M. L., and Taylor, O. R., 1981. Engorgement and dispersal of Africanized honey bee swarms. Journal of Apicultural Research, 20(1):3-12

Pretorius, G. F., 1980. Waarnemings op hangswerms van heuningbye tydens afswerming. South African Bee Journal, 52(5):14-16.

Owen, M. D., 1983. The venom system and venom hyaluronidase of the African honey bee Apis mellifera adansonii. Toxicon, 21(1):171-174.

Page, R. E., and Erickson, E. H., 1985. Identification and certification of Africanized honey bees. Ann. Ent. Soc. Am., 78(2):149-158.

_____, 1986. Kin recognition and virgin Queen acceptance by worker honey bees (Apis mellifera L.) Anim. Behav., 34 (4):1061-1069.

Rinderer, T.E., et al., 1981. Size of nest cavities selected by swarms of Africanized honeybees in Venezuela. J. Apicultural Res., 20(3):160-164.

_____, Tucker, K.W., and Collins, A.M., 1982. Nest cavity selection by swarms of European and Africanized honeybees. J. Apicultural Res., 21(2):98-103.

_____, and Sylvester H. A., 1981. Identification of Africanized bees. American Bee Journal, Vol. 121(7):512-516.

_____, et al., 1984. Nectar-foraging characteristics of Africanized and European honey bees in the neotropics. J. Apic. Res. 23(2):70-79.

_____, 1985. Male reproductive parasitism: A factor in the Africanization of European honey bee populations. Science, 228(4703):1119-1121.

_____, 1985. Field and Simplified Techniques for identifying Africanized and European Honey Bees. Apidologie. (MS for publication):22 pp.

_____, 1985. Honey production and underlying nectar harvesting activities of Africanized and European honey bees. J. Apic. Res., 24(3):161-167.

_____, 1986. Bee genetics and breeding. Academic Press, Inc., Orlando, Florida, 426 pp.

_____, 1986a. Africanized Bees: An Overview. American Bee Journal, 126(2): 98-100.

_____, 1986b. Recent developments in the morphometric identification of Honey bees. American Bee Journal, 126(12):834.

_____, et al., 1986c. Field and simplified techniques for identifying Africanized and European honey bees. Apidologie, 17(1):33-48.

_____, et al., 1986d. Regulation of the hoarding efficiency of Africanized and European honey bees. Apidologie, 17(3):227-232.

Robinson, G. E., 1984. Worker and queen honey bee behavior during foreign queen introduction. Insectes Soc., 31(3):254-263.

Rubio, E. M. and Zunino, P., 1982. Apis adansonii and the genetic barrier represented by the palm tree zones in Castillos-Rocha, Uruguay. Apiacta 17(2):59-60.

Ruttner, F., 1976. The present knowledge on the taxonomy of Africanized races of bees. Africanized Bees, Taxonomy, Biology and Economic Use, Apimondia International Symposium, Pretoria, South Africa, 50-54.

_____, and Kauhausen, D., 1985. Honey bees of tropical Africa: Biological diversification and isolation. Proc. Int. Cons. Apic. Trop. Climates. Third Nairobi Conf. Nairobi, Kenya, 45-51.

Schmid-Hempel, P., 1985. How do bees choose flight direction while foraging? Physiological Entomo., 10(4):439-442.

Schmidt, J. O. and Thoenes, S. C., 1987. Honey bee swarm capture with pheromone containing trap boxes. American Bee Journal, 127(6):435-438.

Schober, P. J., 1979. Die Afrikanische Biene in Brasilien. Bienenvater, 11:298-300.

Schonhardt, A. W. M., 1978. Combate a'abelha Africanizeda. As Abelhas 21(251):5-7.

Seeley, T. D., 1982. How honey bees find a home. Scientific American, 247(4):158-168.

Seeley, T. D., and Visscher, P. K., 1985. Survival of honey bees in cold climates: the critical timing of colony growth and reproduction. Ecological Entomol., 10(1):81-88.

Silva, R. M. B. and E. C. A., 1984. Variacao do comportamento agressivo das a belhas Africanizadas em funcao das revisoes. Ann. do 5 Deg Congresso Brazileiro de Apicultura, Vicosa, MG, Brasil, B:109-118.

Slater, L. G., 1969. Hunting the wild honey bee. Terry Publication Company, Olympia, Washington, 94 pp.

Southwick, E. E., 1985. Bee hair structure and the effect of hair on metabolism at low temperature. J. Apicultural Res., 24(3):144-149.

Spivak, M., 1986. Relative Survivorship of Africanized and European honey bees in the highlands of Costa Rica. American Bee Journal, 126(12):834.

Staff Report, 1973. The man hating Africanized honey bee. Insect World Digest 1(2):6-11.

Stearman, A. M., 1981. Working the "Africans" in Eastern Bolivia. American Bee Journal, 121(1):28, 30-35, 43-44.

Stoner, A. S., Wilson, W. T. and Harvey, J., 1985. Acephate (Orthene®): Effects on Honey Bee Queen, Brood and Worker Survival. American Bee Journal, 125(6): 448-450.

Svoboda, J. A., et al., 1986. Sterols of organs involved in brood food production and of royal jelly in honey bees. Insect Biochem., 16(3):479-482.

Sylvester, H. A., and Rinderer, T. E., 1986. Africanized Honey Bees: Progress in Identification Procedures. American Bee Journal, 126(5):330-333.

_____, 1987. Fast Africanized Bee Identification System (FABIS) Manual. American Bee Journal (In Press).

Taber, S., 1984. Bee behavior. American Bee Journal, 124:197-200.

Taylor, O. R. and Williamson, G. B., 1975. Current status of the Africanized honey bee in northern South America. American Bee Journal, 115(3):92-93, 98-99.

_____, 1976. Africanized honey bee in Venezuela. A report prepared for the Ministerio de Agricultura y Cria, University of Kansas, Lawrence, Kansas, 27 pp.

_____, 1977. The past and possible future spread of Africanized honey bees in the Americas. Bee World 58(1):19-30.

_____, 1978. Swarm boxes and Africanized honey bees: some preliminary observation. J. Kansas Entomol. Soc., 51(4):807-817.

_____, 1985. African bees: Potential impact in the United States. Bull. Ent. Soc. America 30(4):15-24.

_____, 1986. Health problems associated with African bees. Ann Internal Medicine, 104(2):267-268.

Tribe, G.D., 1982. Drone mating assemblies. South African Bee J., 54:99-112.

United States Department of Agriculture, 1980. Beekeeping in the United States. Agriculture Handbook 335, 193 pp.

Villa, J.D., 1986. Performance of Africanized colonies at high elevations in Columbia. American Bee Journal, 126(12):835

_____, 1986a. Africanized and European colonies at different elevations in Columbia. American Bee Journal, 127(1):53-57.

Weathersby, A. B., 1984. Wet salt for envenomization. J. Georgia Entomol. Soc., 19(1):6-8

Weaver, R., 1976. The threat of Africanized bees to North America. African Bees, Taxonomy, Biology and Economic Use, Apimondia International Symposium, Pretoria, South Africa, 63-66.

Wetherwax, P.B., 1986. Why do honeybees reject certain flowers? Oecologia, 69 (4):567-570.

Wiese, H., 1976. Apiculture with Africanized bees in Brazil. African Bees, Taxonomy, Biology and Economic Use, Apimondia International Symposium, Pretoria, South Africa, 67-76.

Winston, M. L., 1979. Events following queen removal in colonies of Africanized honey bees in South America. Insectes Sociaux, 26(4):373-381.

_____, and Otis, G. W., 1978. Ages of bees in swarms and after swarms of the Africanized honey bee. Journal of Apicultural Research, 17(3):123-129.

_____, et al., 1979. Absconding behavior of the Africanized honey bee in South America. J. Apicultural Res., 18(2):85-94.

_____, Dropkin, J. A. and Taylor, O.R., 1981. Demography and life history characteristics of two honeybees races (Aphis mellifera). Oecologia, 65(4): 407-413.

_____, 1983. Some differences between temperate European and tropical African and South American honey bees.

Witherell, P. C., 1985. A review of the scientific literature relating to honey bee bait hives, and swarm attractants. American Bee Journal 125(12):823-829.

_____, and Lewis, J. E., 1986. Studies on the effectiveness of bait hives and lures to attract honey bee swarms--a survey tool for use in Africanized honey bee eradication programs. American Bee Journal, 126(5):353-361.

Wolda, H. and Roubik, D. W., 1986. Nocturnal bee abundance and seasonal bee activity in a Panamanian forest. Ecology, 67(2):426-433.

Walker, J., 1973. Experiences with Apis mellifera adansonii in Brazil and in Poland. Apiacta, 8(3):115-116.

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