

# **Integrated Pest Management Curriculum for the German Cockroach**

## **Curriculum Outline**

Time Required: 4 hours (11:00 am to 3:00 pm: 3 ½ hours of class time and ½ hour for lunch)

Suggested Class size: 15 to 20 participants

### **Objectives:**

1. Learn to distinguish German cockroaches from other common cockroach species using the naked eye, a hand lens, and behavioral clues.
2. Understand how German cockroach biology affects the success of management practices.
3. Learn about effective sanitation, alteration of harborage sites, exclusion techniques and chemical management techniques, their advantages and limitations, and explore examples of appropriate uses for each technique.
4. Use a group exercise to gain more insight into monitoring and management techniques for cockroaches.

### **Synopsis of Class**

#### **A. Lecture and Discussion**

1. Introduction, page 3

Discuss why German cockroaches are considered pests and name some of their particular characteristics.

2. Identification, page 3

Discuss the differences between German and field cockroaches and examine specimens with hand lenses.

3. Biology and Management, pages 3-9

Explain which biological facts are important for management and how they affect management. Discuss components of an IPM program including monitoring techniques.

#### **B. Hands-on Exercises**

Exercise 1: Students examine German and field roaches with hand lenses, page 4

Exercise 2: IPM Plan for a Concord Restaurant, page 9

Students read notes from an inspection of a restaurant and answer questions together in small groups about how to manage the cockroaches at the site. Each group presents its findings to the rest of the class.

#### **C. Class exam for the Structural Pest Control Board (SPCB), page 12**

Students take a short exam to qualify for continuing education credits from SPCB

### **Materials for Class**

- Supplies for hands-on exercise (page 9)
  - Instructions, restaurant description and IPM Plan worksheet
  - Photos of restaurant

- Handouts (included starting page 21)
  1. Important Biological Facts about the German Cockroach
  2. Questions to Answer during a Site Inspection for Roaches
  3. Summary of Cockroach Management Techniques Compatible with an IPM Program
  4. Other Roaches
  5. CDC Pictorial Key to Cockroaches
  6. Characteristics of Common Cockroach Species
- References and resources (see page 28)
- Visual aids
  - Photographs of various cockroaches
  - Photographs of habitat, poor sanitation, good sanitation, bait placement
- Specimens
  - German cockroaches
  - Field cockroaches
  - Turkistan cockroaches
- Monitoring tools
  - Flashlight and head lamp
  - Small telescoping mirror
  - Hand lens
  - Ziploc bag and vial for specimens
  - Tweezers for collecting specimens
  - Thin, flexible blade for examining cracks and crevices
  - Pen, pencil and clipboard
- Products used in management
  - Vacuum with HEPA filter
  - Exclusion materials such as various kinds of high quality caulk, caulking gun, spackle, various kinds of door stops, door sweeps, drywall corner
  - Exclusion tools such as tape measure, hammer, screw drivers, pliers, utility knife
  - Sticky traps with and without pheromone
  - Gel baits
  - Bait stations
  - Boric acid powder
  - Bulb duster

# Integrated Pest Management Curriculum for the German Cockroach Lesson Plan

**Note:** Throughout the presentation, it is important to engage the audience with questions that will elicit information about their experiences with cockroaches and especially about their most difficult situations.

## 1. Introduction

**Class participation: Ask class why roaches are considered a pest.**

- They contaminate food and eating utensils.
- They can destroy fabric and paper products.
- They can transmit disease-causing bacteria, including bacterial that cause food poisoning.
- They are responsible for allergy and asthma problems.
- The public perceives them very negatively.

**Class participation: Ask class to give you some of the distinctive characteristics of German cockroaches.**

- Favor warm, moist places since they come from S.E. Asia.
- Thigmotactic: they enjoy squeezing into tight places
- Cannibalistic: they eat each other.
- Coprophagous: they eat each other's feces (because they digest less than ½ of the food they eat, their feces are a good source of food)

Note: Because cockroaches are cannibalistic and coprophagous, poisons can be passed from roach to roach.

- Omnivorous: they eat just about anything
- Nocturnal: they are active at night
- Negatively phototropic: they avoid light
- German cockroaches carry their egg case (ootheca) around with them until about a day before the eggs hatch.

## 2. Identification

**Contrast German Cockroaches with Field Cockroaches.**

- A field cockroach inside a building will die within three days.  
*It is not necessary to treat for Field cockroaches inside a building.*
- A German cockroach inside a building will find a warm spot, and, provided it has enough water and food, it will take up residence and reproduce.
- The easiest characteristic to use to distinguish between the two is the line between the eyes of the field cockroach.
- The German cockroach is almost always found inside buildings, does not fly, is repelled by light and lives in groups (is semi-social). The German cockroach has no line between its eyes.
- The field cockroach develops outside, flies (readily at temperatures above 86 degrees), is indifferent to light and lives solitarily. The field cockroach has a line between its eyes

**Class Activity: Examine specimens of German and field roaches using hand lenses.**

**Explain Appearance and Occurrence at Different Instars.**

Younger stages of nymphs have a greater tendency to stay close to home, as do gravid females. Older nymphs and other adults will search more widely for food.

**3. Biology and Management**

**Class Participation: Ask class to name some ways to reduce roach habitat.**

Limiting Factors: Water, Food, Harborage and Warmth (too hot and too cold will control them.)

- Seal cracks and crevices.
  - It is not necessary to seal all cracks and crevices. Start by sealing in areas where roaches are most numerous and if necessary, move to areas with lower populations. Technicians can carry caulk with them when they are monitoring and caulk high priority areas each time they visit the site.
  - If necessary, vacuum, wash, or steam clean the area to eliminate all egg cases, fecal matter, dead and live roaches, and other debris.
  - Where gaps can't be sealed, they can be widened to make them less attractive to roaches. For example, moving the shelves away from the wall can widen the space between freestanding shelves and a wall. An inch-wide gap is not attractive to roaches.
  - For commercial kitchens, stainless steel shelving on wheels is available. Can be moved for cleaning and eliminates much roach habitat. Also portable stainless steel storage containers with tight lids.
- Reduce clutter
  - Especially near areas of prime habitat, e.g., cardboard, newspaper and paper bags
  - Clutter vastly increases habitat
- Use good sanitation practices
  - A portable steam-cleaning machine can be very useful for encrusted grime.
  - Eliminating as many sources of food as possible is very important because
    - The starvation that results makes cockroaches more susceptible to traps and baits.
    - Roaches tend to congregate in areas physically attractive to them. If those areas do not contain food and water, the population declines.
  - Sanitation alone will not provide control. With water, German roaches can survive a month without food and American roaches more than 3 months.
- Store food in roach-proof containers
  - Screw top glass or plastic jars with a rubber gasket on the lid
  - Plastic or glass containers with tight-fitting snap-on lids
  - Metal containers with tight-fitting lids
- Reduce available moisture
  - Increase ventilation in humid areas
  - Eliminate leaks
  - Keep surfaces as dry as possible

## Keeping Cockroaches Out

- Inspect items you bring into the house, especially from restaurants and grocery stores.
- Seal around pipes and electrical outlets, and even baseboards between some infested apartments.
- In close housing situations, it is possible for German cockroaches to travel from home to home, so tight fitting weather stripping and screens on the windows can be important. These will also keep out Oriental and field cockroaches and other outside dwelling cockroaches.
- In commercial accounts, inspect packaging for roaches when deliveries come in.
- In commercial accounts, break down corrugated boxes and store in a cool place away from kitchen and food prep.

## Where to Look for Cockroaches and Why

- Look for cockroaches where you have seen them before.
- Look for cockroaches under things, in tight corners, in seams along the wall, in paper items, near warmth, near water, near food.
- Remember: They like tight places (thigmotactic).

### Tricks for inspecting

- Corrugated Cardboard the many cracks and crevices in cardboard make ideal habitat for cockroaches. So look for cardboard and paper bag storage areas.
- “Go to the tropics” Cockroaches originated in S. E. Asia so they seek out warmth, then water and then food. Look for them in warm spots with plenty of water.

### Display: Tools for inspecting

- Good flashlight—the more light, the more you can see; a head lamp leaves hand free
- Thin flexible blade—for probing cracks and crevices and also for cleaning them out
- Mirror—for checking under and behind equipment and other items
- Sticky traps—for monitoring for cockroaches, for trapping cockroaches which develop outside and for pinpointing the areas German cockroaches congregate
- Optional:
  - Plastic sheet—to make it more pleasant and comfortable to lie down on dirty and wet floors when inspecting and treating for cockroaches
  - Heat gun or compressed air for flushing
  - Headlamp, to keep your hands free while working

## Sealing or Treating Cracks

- Sealing cracks eliminates desirable harborage for roaches and hence, lowers the number of pests.
- If cracks cannot be sealed, they can be treated with boric acid.
- Cracks can also be used as a bait station. Apply small amounts of bait in the crack; it is already a place the cockroaches like.
- Demonstrate caulking. Emphasize neatness and cleaning up. Use high quality caulk (sealant) and use water or soap and water to smooth the bead.
- Demonstrate using bulb duster. Explain safety equipment necessary for using boric acid.

Safety equipment: In the state of California, with a few exceptions, gloves, coveralls (long sleeve shirt and long pants), and safety glasses with temple and brow protection must always be worn when handling pesticides. On the label no protective wear is required however safety glasses are recommended, contact with eyes and skin and clothing are to be avoided and clothes must be washed before they are worn again.

### **How to use baits**

Insecticides sprays are usually applied at the rate of 150 to 1291 mg active ingredient/ meter squared but only *nanograms* of active ingredient are required to kill an insect. Baits are much more effective.

Bait effectiveness is related to general sanitation because hungry roaches will eat more roach baits. If other food is available, baits may not be consumed at all.

#### **Display:** A variety of cockroach baits

- Gels—The advantage of gel baits is that small amounts can be placed in many different spots. This type of placement is more effective in controlling cockroaches. Gels can be used in areas where bait stations will not fit.
- Dust bait—Avert Dry Flowable Cockroach Bait is an alternative when roaches might be avoiding gel baits. Unlike gel baits, dust baits can be ingested by cockroaches while grooming and can be dusted directly onto the cockroaches rather than making the cockroaches come to them. If applied in a dry environment it can last up to one year. However, even with the same active ingredient, in most situations the dry flowable formulation is less effective than the gel bait.
- Bait stations: Bait stations are most useful for long-term control. The bait inside is protected and can last up to a year. One disadvantage is that the more effective technique of placing small amounts of bait in many locations is difficult and expensive with bait stations. Another disadvantage is that these stations can become ideal harborage for cockroaches.

#### **Instructor Demonstration: Baiting**

- Demonstrate applying bait in cracks.
- Demonstrate applying bait in small drops.
- Bait in the “Tropics”. Cockroaches originated in the tropics so they are most likely found in warm and moist areas.
- Place more bait where cockroaches are present.
- Bait must be placed as close to harborage as possible to be most effective.
- Bait is most effective during the first three days.
- Demonstrate bait station placement.
- Baits only attract over small distances, hence for quicker control, gel bait is more effective (many small placements) and bait stations last longer but have fewer placements.
- Baits must be placed near food and water to control small groups of cockroaches.
- Factors that increase long distance foraging:
  - Over crowding
  - Lack of food in or near harborage
- To be most effective, baits should be part of an IPM program.

### **What to do when there are too many cockroaches to kill with baits**

- Vacuum to remove as many roaches as possible
- Apply Boric acid to areas where you see cockroaches and in the cracks and crevices around them. Remember this is in situations with severe infestations and any tight place or crack is suspect. Check areas such doorways, corners of rooms, and under the baseboards where carpet has been laid.

### **Introduce the concept of action thresholds: class discussion, as there is not just one answer.**

At what point (can it be called a point?) do you decide that this is a population that can be controlled with just baits in one visit? Will take several visits and will be too costly or difficult to get under control with just baits? At what point do you decide this is a chronic and persistent population and you must use growth regulators.

### **Insect Growth Regulators (IGRs)**

- Use for chronic infestations where nonchemical means of control (sanitation, exclusion, etc.) are difficult to impossible. Do not use for small new infestations. Any infestation that lasts over time can be considered a chronic infestation. Any infestation you must battle every visit is a chronic infestation.
- IGRs do not kill the cockroaches directly. They affect the cockroaches in three ways: they render the developing nymphs sterile, they make the cockroaches hungry (so they are more likely to eat bait), and they make the cockroaches less sensitive to light.
- Using IGRs in combination with baits can be particularly effective since the IGRs make the cockroaches hungry.
- Note that IGRs can take between four to six months to control roaches. You must achieve and maintain 80% twisted-wing-effect for decrease in population to be sufficient (monitor with sticky cards).
- Use where long term control concerns are prominent
- Under very severe infestations where a quick knockdown of the population is needed and the human exposure is minimal, spraying with more conventional pesticides could be considered. In these situations use a non-repellant insecticide spray along with the growth regulator. Note that pesticide that lands on grease loses its residual effect, so removing grease deposits (using a steam cleaner) can make pesticide sprays more effective.

### **Other Methods of Control**

- Temperature: In some situations, temperature may be used to control cockroaches. High temperatures, for example above 125 degrees for two hours, will kill all cockroaches in an area. Of course, since cockroaches will move to a more desirable site it is important to do a whole area heat treatment. Consistently low temperatures will discourage cockroaches from establishing themselves.
- Trapping using sticky traps, although effective for monitoring, is not effective for controlling German Cockroaches; however, in the laboratory, sticky traps impregnated with an aggregation pheromone combined with vacuuming have proved as effective as baits
- Electronic pest control devices: No electronic pest control device has been shown to be effective in controlling German cockroaches.

- Biological Control: Nematodes, bacteria and parasites all show potential for controlling cockroaches in the correct situation. Parasites may be useful for controlling brown-banded cockroaches in situations where other alternatives are difficult or impossible. They have been used in the past to control brown-banded cockroaches on the U.C. Berkeley campus.

### **Resistance and Non-preference**

- “Resistance can be said to exist when a population of insects can no longer be killed or controlled by a dosage of an insecticide that was formerly effective in killing or controlling.” From Donald G. Cochran “Insecticide Resistance” a chapter in the book *Understanding and Controlling the German Cockroach* edited by Michael K. Rust, John M. Owens, and Donald A Reiersen.
- 2 types of resistance: physiological resistance or behavioral resistance
- Physiological resistance
  - This is the result of genetic selection
  - Those roaches that are susceptible to the pesticide are killed off and those that are naturally resistant (and there are always some in any insect population that are resistant to almost any chemical we come up with) live to produce resistant young. Eventually all the susceptible roaches are killed; only the resistant ones remain.
  - Exposure to one pesticide may induce resistance to another (“cross resistance”) when 2 different active ingredients cause death through similar physiological mechanisms or when a pesticide induces overproduction of detoxifying enzymes.
- Behavioral resistance
  - Some roaches are more successful at detecting a pesticide or avoiding exposure to it.
  - Roaches having a keen physiological sensitivity to a pesticide are more likely to detect it and live long enough to develop learned avoidance
  - Behavioral resistance can occur with baits if the active ingredient is repellent or if roaches develop an aversion to the bait attractant.
- Resistance to hydramethylnon
  - Because hydramethylnon works slowly, roaches don’t generally learn to avoid it.
  - In 2004 it was reported that roaches had developed behavioral resistance to the bait matrix of hydramethylnon baits
- Resistance to fipronil
  - To date there have been no documented cases of field resistance to fipronil.
  - Roaches still show resistance to chlordane, which has been off the market for 40 yrs. And, because chlordane and fipronil work in the same way, there was some concern that roaches might become resistant to fipronil. However, researchers have concluded that commercial baits are unlikely to cause resistance because they are 100% lethal when consumed.
  - Researchers are concerned about exposures to lower concentrations of fipronil such as in ant baits or in perimeter sprays. Because these lower concentrations do not kill roaches, there is a chance of resistance developing.



- Combating Resistance

IPM is the perfect strategy for combating resistance. Insects cannot become resistant to sanitation, habitat modification, and physical techniques such as vacuuming and trapping. Stressing these methods first lessens the need for and use of pesticides.

## Hands-on exercise

**Time needed:** allow at least 1 hr.

**Instruction for Instructor:** Divide class into groups of 4 to 6 and pass out Assignment, below, along with the photos of the restaurant, also below. Explain the exercise and that they are to work together in groups with one person as the scribe. It will be helpful to verbally describe the situation below before asking them to read the material. At the end of 30 minutes, choose one group to explain their “IPM Action Plan” and allow other groups to add or question as they go along.

## Assignment: IPM Action Plan for Restaurant with Chronic Cockroach Problem

**Definition:** Integrated Pest Management (IPM) is a decision-making process that uses regular monitoring and record keeping to determine if and when treatments are needed to prevent or solve pest problems. Biological, cultural, physical, mechanical, educational and low-risk chemical methods are used to keep pest numbers low enough to prevent unacceptable damage, nuisance or annoyance. The IPM approach emphasizes long-term pest prevention, using a site-specific combination of environmentally friendly, cost-effective strategies.

### Instructions:

1. Your group will prepare an IPM Action Plan that addresses the various cockroach pest problems described in the text below and shown in the photographs. The objective of this exercise is to gain experience using the IPM decision-making process to design a long-term solution to these common pest problems found in restaurants.
2. Select one person to lead your group in discussion and to describe your group’s IPM Action Plan to all workshop participants.
3. Examine the photographs, read the background document then discusses the various pest problem areas shown in the photos, and review a range of management options.
4. Your group has 30 minutes to develop your IPM Action Plan by answering the attached questions.

### Background on the Restaurant

This locally owned restaurant in Concord has been in business about 34 years in the same location. It is one of the nicer medium-priced restaurants in town and important local politicians are frequently patrons. It is the last business at one end of a small strip mall with a gym on the other side. Parking lots are in the front and back of this restaurant. Stray cats are commonly found eating from the garbage and oriental cockroaches develop outside.

In the kitchen, walls are frequently repaired as they deteriorate with the amount of water that is used for cleaning. A hole that cannot be repaired is located under the cooking wall on one side. Frequently the help washes scraps from the day's cooking into the corners and under the equipment.

The specific areas that have chronic problems are the small stove next to the deep fryer and an outlet under the food prep area.

The storage area is too small and very cluttered; however, since it remains dry, roaches are not usually a problem in this area.

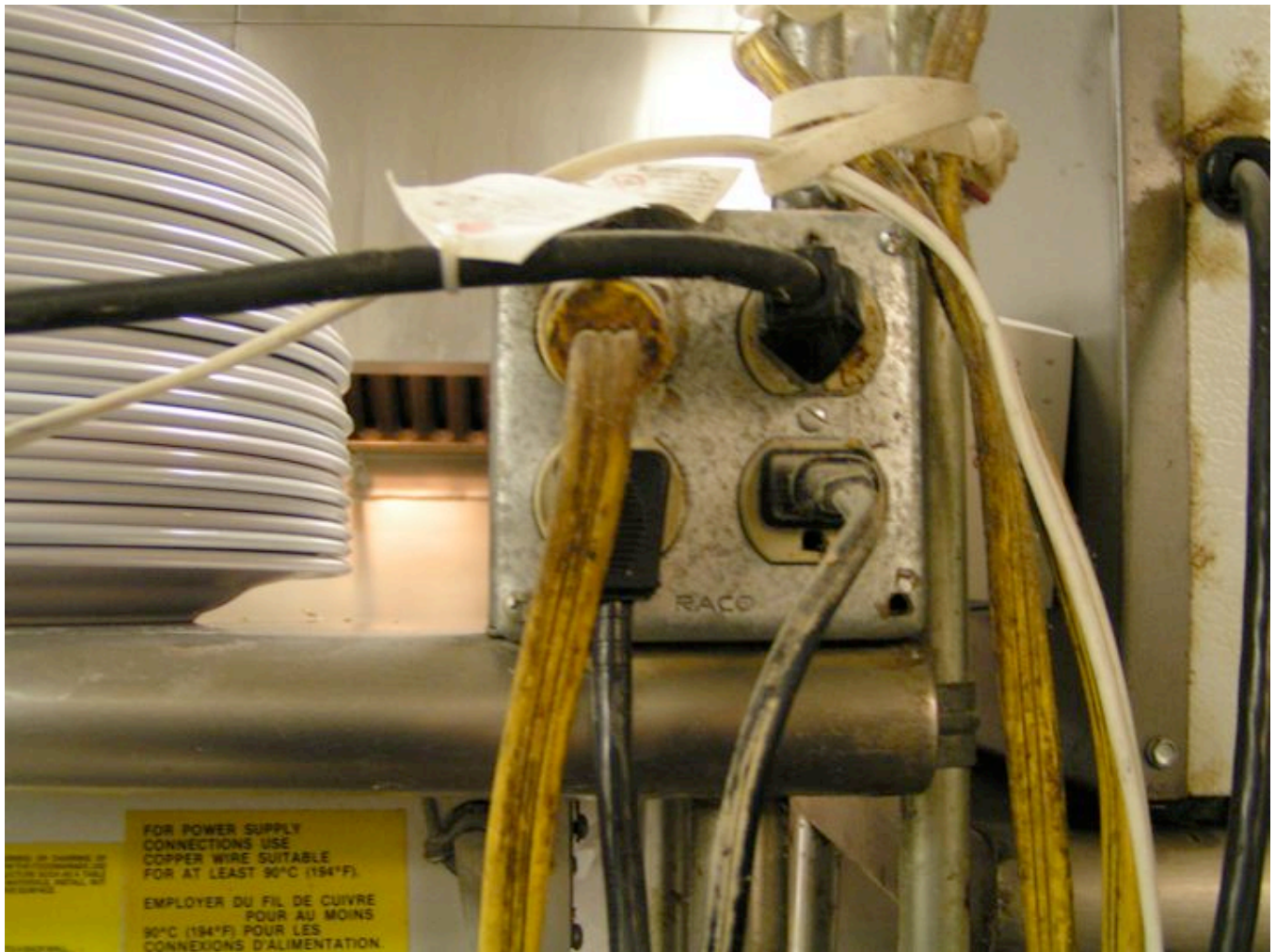
The office is small. Some papers are stored there, but only occasionally are cockroaches found in the office.

Cockroaches have been found in the dining room, especially the wine refrigerator area by the cash register and the soda fountain in the banquet room.

The restaurant is successful and there is little initiative on the part of the managers to change from the current program to one that involves the better control methods that can be found in a more intense IPM program.

















## **IPM Action Plan Summary Sheet**

1. What are your pest management objective(s) for this site?
  
2. What treatments would you prescribe at different cockroach infestations levels and how would you determine those levels: (you may add other levels if you need to)

Level One (lowest):

Monitoring method:

\_\_\_\_\_ Number of Cockroaches per \_\_\_\_\_

IPM Control Methods best suited to this level:

Level Two:

Monitoring method:

\_\_\_\_\_ Number of Cockroaches per \_\_\_\_\_

IPM Control Methods best suited to this level:

Level Three (highest):

Monitoring method:

\_\_\_\_\_ Number of Cockroaches per \_\_\_\_\_

IPM Control Methods best suited to this level:

3. How will you determine whether or not your method was successful?
  
4. Using the cockroach biology you have learned, or that you already know, mention two control methods you could use under each of the following categories:

Cultural:

Physical or Mechanical:

Reduced Risk Chemical Methods:

Education:

Other:

5. How does your plan reduce the likelihood of future occurrences of cockroach pest problems?

6. List items that should be included in your budget for this project:

7. List items that would need to be covered by the restaurant's budget:

8. List any obstacles to successfully implementing this IPM Cockroach control program and ways to overcome them.

## **Class Exam for Structural Pest Control Board Cockroach Session Exam**

1. Which of the following would lead you to identify the cockroach you are working with as most likely a German cockroach rather than a Field Cockroach:
  1. One or two are noticed walking across the wall during the day.
  2. Cockroaches are hiding under the sink or behind the refrigerator.
  3. Most cockroaches are dead on the floor.
2. T or F: If you need to identify these cockroaches further, a line between the eyes indicates a Field Cockroach.
3. T or F: To observe under or behind surfaces one must lie down and turn one's head in a difficult and exact position.
4. What is the most likely way German cockroaches get into a single-family home?
  1. They walk in under the front door.
  2. They fly in on a warm summer night
  3. They come in with food from restaurants and stores.
  4. They follow pipes that go through the wall from the outside.
5. How can you tell an oriental cockroach from a female Turkistan cockroach?
  1. Oriental cockroach nymphs are all black.
  2. Oriental cockroaches associate with small American cockroaches.
  3. Oriental cockroaches have cream colored "shoulder pads".
  4. Oriental cockroaches are found high in the corners of steam filled rooms.
6. T or F: When applying bait to a particular crack the best way to kill the most German cockroaches is to fill the crack with the bait.
7. T or F: Cockroaches like electrical junction boxes because the boxes are warm and have many tight places.
8. Which of the following should not be used in an IPM approach to controlling German cockroaches:
  1. Fixing water leaks
  2. Caulking places the cockroaches like to hide
  3. Vacuuming the cockroaches
  4. Using a B& G to spray the cupboards and baseboards
  5. Painting over the spots left by cockroaches
  6. Bait stations for cockroaches
  7. Careful application of Boric acid in the cracks and crevices.
  8. Cleaning with soap and water
  9. Using an aerosol "bomb"
  10. Applications of cockroach gel bait
  11. Replacing extension cords that are too long and tied in a knot
9. T or F: Correctly applied insect growth regulators will kill most cockroaches within three days.

### Answers:

#1 = 2; #2 = T; #3 = F; #4 = 3; #5 = 1; #6 = F; #7 = T; #8 = 4 & 9; #9 = F

## Class Handouts

### Handout 1

# Important Biological Facts about the GERMAN COCKROACH (*Blattella germanica*)

### Biological Facts

- The German roach is the most common species in commercial kitchens.
- The German roach originated in Southeast Asia, so look for them in “tropical” locations, i.e., warm & moist.
- German roaches reproduce rapidly. Missing one pregnant female is all you need for the problem to rebound.
- German cockroaches have become resistant to many pesticides.
- Fast-killing pesticides and flushing agents will cause them to scatter and will make them harder to control.
- German roaches carry their egg cases until they hatch, so loose egg cases are usually empty.
- German roaches generally travel short distances to feed. In other words, they dwell near where they feed.
- German roaches are usually transported accidentally from one place to another as adults because adults are most resistant to desiccation.
- Roaches have a strong need to be touched on all sides at once so they like to hide in narrow cracks and crevices.
- Roaches are rarely dispersed throughout a building. They choose a spot based on temperature first, then availability of water and thirdly, availability of food.
- Roaches are generally active mainly at night and remain hidden during the day, but they will learn to avoid site-specific human activity cycles.
- A roach sheds its skin (molts) a number of times during its life. When molting, the roach remains in its harborage and doesn't feed until its new skin has hardened. During this period the roaches may be less attracted to the baits.
- Insect growth regulators (IGRs) like hydroprene (Gentrol) make cockroaches hungry enough that they will feed when they otherwise would not eat. IGRs sterilize immature roaches but do not affect adults. By using baits along with IGRs you will achieve faster and more effective control. IGRs are most effectively used with chronic infestations; acute infestations do not need the application of IGRs.

## Handout 2

### QUESTIONS TO Answer DURING A SITE INSPECTION FOR COCKROACHES

- Which cockroach species is/are present?  
The species will indicate the harborages, what they may be feeding on, how fast they reproduce, what types of controls are appropriate, and where to place the controls.
- What type of site are you inspecting? What is it used for and at what times of the day?  
Provides information on maximum infestation possible (carrying capacity), infestation rates, and appropriate control methods.
- If possible, you want to be able to service the entire site.  
For instance, servicing a restaurant in an apartment building is very difficult if you cannot service the apartment as well. You may be able to reduce the roach populations in the restaurant, but it will be continually re-infested by roaches emigrating from the apartments.
- Where do building occupants see pests? How many? How often? At what time of year? What do they look like? Are there any specimens?  
This will give you clues to harborage sites and to the species of roach causing the problem.
- Is the problem new? Chronic? Associated with other events such as a change in suppliers?  
This will help to pinpoint sources of the problem and indicate where to concentrate efforts.
- What is the history of pest control for the pests at this site? What is being done currently?  
This will indicate how large the problem is and how hard it may be to solve.
- Who are the responsible parties? Who can give you answers to which questions? Who can enforce recommendations for improved sanitation? Who can authorize repairs?
- Clarify what your license covers and what it doesn't. Specify your responsibilities and those of the owner/manager. Avoid misunderstandings.

## Handout 3

# Summary of COCKROACH Management Techniques Compatible with an IPM Program

### Monitoring

- Use a small mirror to inspect under and behind objects and equipment.
- Use a thin, flexible blade to probe cracks and crevices and clean them out.
- Use sticky traps.
- Use a heat gun or compressed air to flush out roaches instead of aerosol spray; vacuum up any roaches you flush.

### Physical/Mechanical Controls

- Exclusion/Habitat Modification

Make general building repairs.

Caulk or paint closed cracks and crevices.

Fill gaps around pipes, cables, and wires that pass through walls both inside and outside the structure.

Weather-strip doors and windows.

Screen doors and windows.

- Vacuum up roaches (use vacuum w/HEPA filter) to remove pest quickly and to prevent exposure to air-borne allergens.

### Sanitation/Habitat Modification

- Store garbage in garbage cans or dumpsters outside the building.
- Remove garbage containing food wastes from building before nightfall. Use plastic liners in trash containers.
- Store food (including pet food) in roach-proof containers (screw top jars are not roach-proof unless lid has a rubber gasket).
- Thoroughly clean cans and bottles before storing for recycling.
- Thoroughly clean food preparation and eating areas daily. Do not leave dirty overnight.
- Regularly steam clean large appliances in commercial kitchens.

See Chemical Control Chart on following page.

## Handout 3, cont.

### Chemical Controls

Note that new products are constantly coming on the market.

PRODUCT	ACTIVE INGRED.	NOTES
<b>Sticky Traps</b> Use for monitoring. Cleaning crews in commercial kitchens may destroy.		
Lo-Line	N.A.	Low profile to fit in tight places.
Victor Roach Pheromone Trap	Pheromone to attract roaches	Box-like and pre-folded
<b>Roach Bait</b>		
Avert gel	Abamectin	Gels are most attractive the first 3 days after application
Maxforce gel	Hydramethylnon	Gels are most attractive the first 3 days after application
Siege gel	Hydramethylnon	Gels are most attractive the first 3 days after application
Maxforce FC gel	Fipronil	Some roach resistance has been noted.
Pre-Empt gel	Imidicloprid	
Magnetic Roach Food paste	Boric Acid	
Roach X paste	Boric Acid	non-drying formula, stays attractive for 4-5 months
Niban granular	Boric Acid	
<b>Roach Bait Stations</b> Bait stations may be harmed by steam cleaning. Client may think bait stations are unsightly. Roaches can use empty bait stations as harborage.		
Avert	Abamectin	
Maxforce (also a granular formulation)	Hydramethylnon	Use granules outside for Oriental roach.
Maxforce FC	Fipronil	
<b>Dusts</b> Use in wall voids and cracks and crevices. Not good in wet sites. Use in wall voids and cracks and crevices. Apply as a light dusting.		
Borid	Boric acid	Brownbanded roach will avoid.
TimBor	Borate	
Diatomaceous Earth (many brands)	Diatomaceous earth	Repellent
<b>Insect Growth Regulator (IGR)</b> Stands up to 800°F. Vapor heavier than air, so place higher rather than low. Hydroprene sterilizes young roaches. Does not affect adults. Makes roaches hungry enough that they will eat bait that is otherwise not palatable. No need to use in acute infestations, best to reserve use for chronic infestations.		
Gentrol Point Source	Hydroprene	Lasts 3 months. Use with baits for faster control.
Gentrol concentrate	Hydroprene	Lasts 4 months. Use with baits for faster control
Archer	Pyriproxifen	Lasts 7 months. Use with baits for faster control.
Nylar	Pyriproxifen	Lasts 12 months. Use with baits for faster control.



## Handout 4

# Other Cockroaches

### *Blattella* genus

The two common *Blattella* cockroaches in California are the Field cockroach (*Blattella vaga*), and the German cockroach (*Blattella germanica*). They are similar in appearance but radically different in biology.

- A Field cockroach inside a building will die within three days.

*It is not necessary to treat for Field cockroaches inside a building.*

- A German cockroach inside a building will find a warm spot, and, provided it has enough water and food, it will take up residence and reproduce.

The easiest characteristic to use to distinguish between them is the line between the eyes of the Field cockroach as shown below:



**Field cockroach's face**



**Field cockroaches & German cockroaches**

- The German cockroach is almost always found inside buildings, does not fly, is repelled by light and lives in groups (is semi-social). The German cockroach has no line between its eyes.
- The Field cockroach develops outside, flies (readily at temperatures above 86 degrees), is indifferent to light and lives solitarily. The Field cockroach has a line between its eyes.

Two other species are not found in California at this time: the Asian cockroach (*Blattella asahinai*), which is currently in Florida and the False German cockroach (*Blattella lituricollis*), which is currently in Hawaii. They are very difficult to distinguish from the German cockroach by appearance. However these two do fly. The German cockroach is unable to fly and the Field cockroach is reluctant to fly if the temperature is less than 86 degrees. If you find cockroaches that fly and look like German cockroaches take them to your county agricultural department for further identification.

### Turkistan

The Turkistan cockroach was recently recognized as a problem in California. The untrained technician may assume that they have a mixture of American or Wood cockroaches and Oriental cockroaches. This is because the male looks very much like a Wood or a small American cockroach. Moreover, the female looks very much like an Oriental cockroach. However, by using the information below, it is very simple to determine which type you have:

- The female Turkistan has cream-colored areas on its shoulders.
- The male Turkistan, as below, is a medium sized brown cockroach.
- The nymphs are black toward the abdomen end and partly brownish-red in the head and thorax area. In older nymphs the black area is larger than in younger nymphs.

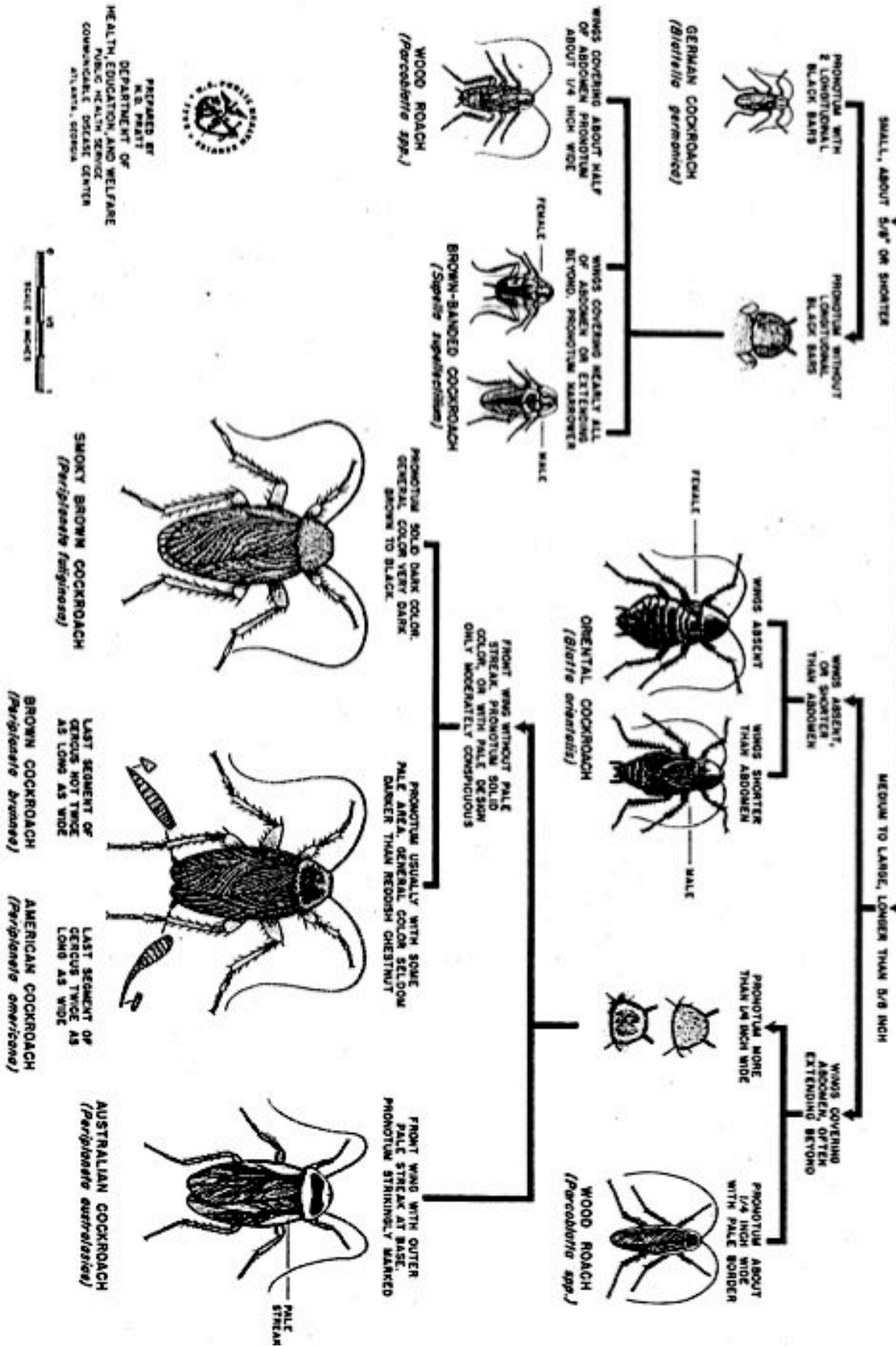
Turkistan cockroaches behave much like Oriental cockroaches except that the males fly late at night (about eleven p.m.) during the summer.



Male Female

**Turkistan Cockroaches**

# PICTORIAL KEY TO SOME COMMON ADULT COCKROACHES



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