C/T/A/H/R
College of Tropical Agriculture & Human Resources
University of Hawaii at Manoa

Cooperative Extension Service
U. S. DEPARTMENT OF AGRICULTURE COOPERATING

Extension Pesticide Programs

The Pesticide Label

Key to Pesticide Safety and Education

May 2007 Department of Plant and Environmental Protection Sciences

Contents

Recertification Topic Articles Index

Here's a list of the "recertification topic" articles in this newsletter's issues of the last two years.

Staff's Notes

If longer days and summer vacation let you and your family spend more time outdoors, Hawaii's six biting mosquitoes will have more chances to get a meal out of you. Learn how to deal with these insects by reading out reprint of the Hawaii Department of Health's practical and concise leaflet "Mosquitoes" (p.2).

Aloha,

Charles Nagamine, Instructor
Pesticide Risk Reduction Education Program

THIS NEWSLETTER IS SUPPORTED IN PART BY THE STATE OF HAWAII DEPARTMENT OF AGRICULTURE.

Hawaii's Biting Mosquitoes

This article contains the same text and pictures as "Mosquitoes," the two-page leaflet issued by the Vector Control Branch, State of Hawaii Department of Health. See original at:

<http://www.hawaii.gov/health/environmental/vector/mosquitoflyer.pdf>

Aedes aegypti Image: USDA, ARS

MOSQUITOES

Hawaiian names:

adult mosquitoes: "makika"

mosquito larva "naio makika"

Mosquitoes in Hawai'i are generally regarded as nuisance pests, but elsewhere they are the vectors of pathogens that cause serious diseases and deaths. Diseases transmitted by infected female mosquitoes biting humans include: West Nile virus; encephalitis, yellow fever, dengue, malaria, and filariasis. Although Hawai'i has none of these human diseases at present, dogs acquire heartworms (filarial worms) from infected mosquitoes biting them, and native birds often die from bird malaria and bird pox in lowlands where infected mosquitoes are prevalent.

Mosquitoes in Hawai'i

The six biting (blood feeding) species of mosquitoes can be divided into two types based on their biting habits:

Day biting Mosquitoes

Aedes albopictus

The four species, Ae*des albopictus (A*sian Tiger Mosquito), *Aedes aegypti (Y*ellow Fever Mosquito), *Aedes (Ochlerotatus) japonicus* (Japanese or Rockpool mosquito), and Wy*eomyia mitchelli* (Pineapple lily mosquito), are active only during the daylight periods and somewhat at dusk *(Aedes japonicus)*. Because of a short flight range of only 100-150 yards, their presence at your home usually indicates a nearby breeding source. Day-biting mosquitoes breed in relatively clean water found in tree holes, plants, rock holes, and all types of man-made containers. *Aedes* mosquitoes are particularly attracted to discarded tires. They do not normally breed in ground pools or in water that contains soil. *Wyeomyia mitchelli* breeds almost exclusively in leaf axils of bromeliads (pineapple lilies). *Aedes albopictus*, *Aedes aegypti* and *Aedes japonicus* are black mosquitoes with white markings. *Wyeomyia mitchelli* is brown with an abdomen that is white on the lower half. *Aedes albopictus* is the most common day-biting mosquito. Currently, *Aedes aegypti* and *Aedes japonicus* are found only on the Big Island of Hawai'i.

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RECERTIFICATION CREDITS may be earned by certified applicators who score at least 70% on the set of comprehension evaluation questions for "recertification topic" articles in this newsletter. These articles have a title which ends with "(Recertification Topic)." Comprehension evaluation questions are written and handled by the staff of the Hawaii Department of Agriculture (HDOA). Inquire about this chance to earn recertification credits at one of these HDOA offices: Kauai 274-3069, Oahu 973-9409 or 973-9424, Maui 873-3960, Hawaii 974-4143. The area code for all offices is 808.

ASAE 572 Spray Droplet Classification (Recertification Topic)

Instructions on your pesticide label may refer you to the ***ASAE 572*** standard. If so, you can bet the instructions are about balancing spray coverage and drift control.

"ASAE" stands for the American Society of Agricultural Engineers. The ASAE S572 standard is a method for classifying spray patterns into six classes: (1) very fine, (2) fine, (3) medium, (4) coarse, (5) very coarse, and (6) extremely coarse. This classification is based on the proportions of different size spray droplets expected to make up the spray pattern. Pesticide manufacturers name several of these spray droplet classes in instructions on their product labels when explaining how to apply their products as liquid sprays. Here's an example from an insecticide label:

> *For ground boom applications, do not apply within 25 feet of rivers, natural ponds, lakes, streams, reservoirs, marshes, estuaries and commercial fishponds. Apply with nozzle height no more than 4 feet above the ground or crop canopy and when wind speed is 15 mph or less at the application site as measured by an anemometer.* ***Use medium or coarser spray according to ASAE 572 definition*** *for standard nozzles or VMD for spinning atomizer nozzles.*

In this example, "Use medium or coarser spray" means you should choose nozzle tips and spraying pressures that will produce a spray pattern which is "medium," "coarse," "very coarse," or "extremely coarse," but not a "fine" or "very fine." It is now possible to find suitable nozzle tips by checking nozzle manufacturers' catalogs since these catalogs refer to the same six classes.

Here is a chart (reprinted from a catalog) for a series of 10 stainless steel nozzle tips:

TR 80° - Total Range - Stainless Steel Insert

	15 PSI	20 PSI	30 PSI	40 PSI	50 PSI	60 PSI
TR80-01	M	F	F	VF	VF	VF
TR80-015	M	F	F	F	F	VF
TR80-02	M	M	F	F	F	F
TR80-03	C	M	M	F	F	F
TR80-04	C	C	M	M	M	F
TR80-05	C	C	C	M	M	M
TR80-06	C	C	C	M	M	M
TR80-08	VC	C	C	C	C	M
TR80-10	VC	VC	VC	C	C	C
TR80-15	XC	VC	VC	C	C	C

Notice the colors used to identify each class. Catalogs of ASAE 572-classified nozzle tips (paired with different spraying pressures) distinguish the classes by using these abbreviations and colors:

Very fine	VF	Red
Fine	F	Orange
Medium	M	Yellow
Coarse	C	Blue
Very coarse	VC	Green
Extremely coarse	XC	White

(These are not the colors of the nozzle tips; these are the colors printed in catalogs.)

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ASAE 572 Spray Droplet Classification, *continued from page 3*

Look in the chart at the rows for these three nozzle tips:

TR80-01. This would produce an unsuitable “fine” pattern *if* the spraying pressure is 20 PSI but a suitable “medium” spray pattern at 15 PSI.

TR80-03. This tip would produce a “coarse” spray pattern at 15 PSI and a “medium” spray pattern at 20 PSI, both allowed by the label.

TR80-08. This tip would produce a “very coarse” spray pattern at 15 PSI and a “coarse” spray pattern at 20 PSI, both allowed by the label.

For this type of chart to be accurate, your sprayer’s pressure gauge must function properly, you must know how to read it, and you must be able to adjust the spraying pressure.

The lesson to learn from the chart is this: From one specific nozzle type, you will get *more fine* droplets and *fewer coarse* droplets when you *raise spraying pressure*. Having more fine droplets could provide better spray coverage of the target but, at the same time, it could also allow more of the spray mix (in the form of fine spray droplets) to drift downwind of the treated area. A spray drift researcher called this the “applicator’s dilemma.”

There is a risk—in addition to causing more drift—to raising sprayer pressure to get better coverage. As one sets the pressure higher and higher, there will be a pressure at which there will be so many fine droplets (and so few coarse droplets) that the amount of tank mix actually depositing on the target will be too little to provide satisfactory coverage. In other words, the spray mist will just blow away and be wasted. “Drift loss” is a term for this.

More and more pesticide labels are giving drift control guidance to applicators. In addition to droplet size classification, applicators should heed label restrictions about:

- Buffer zones (“25 feet” in the example above)
- Nozzle-to-target distance (“4 feet” maximum boom height, in the example above)
- Wind speed maximum (“15 mph or less” in the example above)
- Temperature inversions (low-level) overlying the treated site. An explanation is given in another article “Mechanics of Drift” in this newsletter.
- Wind speed minimum (for example, 2 mph or 3 mph, because these are indicators of variable wind speed and direction during low-level temperature inversions)

Delaying an application may be necessary where these precautions cannot satisfactorily counter the risk of wind blowing towards a nearby “sensitive area” such as a school or wildlife preserve.

Sources:
1. Tom Dorn. University of Nebraska – Lincoln, Cooperative Extension. “Sprayer Nozzle Tip Selection.” <http://lancaster.unl.edu/ag/factsheets/289.htm>
2. Spraying Systems Company. 2004. “A User’s Guide to Spray Nozzles.” <http://www.teejet.com/MS/TeeJet/support.asp>. At this webpage, under the subtitle “Documents,” click on “User’s Guide to Spray Nozzles.”

Mechanics of drift (Recertification Topic)

Three aspects of a pesticide application that determine how much drift results are: (1) wind speed and direction, (2) pesticide particle size and density, and (3) distance from nozzle to target.

WIND SPEED AND DIRECTION. An air current's speed influences how far a particle will move from the point of application before it settles out of the air. Generally, faster air currents move particles farther away from the target sites. The direction of an air current is critical because if it is blowing towards a sensitive area, drift is more likely to cause problems.

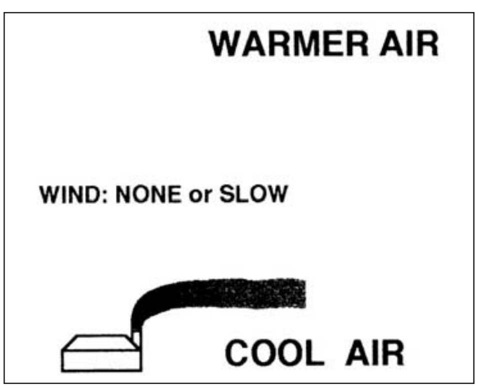
Here is a brief discussion of common wind patterns in Hawaii and an atmospheric condition called a low-level "temperature inversion."

Except during severe weather, wind patterns in Hawaii are dominated by the tradewind which, in certain situations, gives way to local patterns and breezes.

(1) Tradewind. Welcomed for the pleasant weather it brings to Hawaii, the *tradewind* is a steady wind from the east or northeast. It is the dominant wind, being most common in summer and least common in winter. (In Honolulu, it occurs about 92% of the time in August and 50% of the time in January.) It can speed up, change direction, and become more turbulent as it moves over ridges, between two mountains, through gorges, and around headlands and buildings. But when it weakens or disappears (as happens during "kona weather") or where it is blocked by large mountains (such as Mauna Kea), local breezes can dominate.

(**2) Local breezes.** When the trade wind has faded or cannot reach local areas, four breezes may develop. Two that develop near shorelines are a sea breeze and a land breeze. A *sea breeze* blows from the sea toward the shore during the day after sunshine has heated the land more than the seawater nearby. In the late afternoon through early evening when the land has cooled off more than the seawater nearby, a *land breeze* may blow in the opposite direction, from the shore toward the sea.

Along mountain slopes, there may be a valley breeze and a mountain breeze. A *valley breeze* blows up a slope during the day after sunshine has heated the slope more than the surrounding air. A *mountain breeze* (also called a *drainage wind)* blows down a mountain slope at night after the slope has cooled more than the surrounding air.



Low-level **temperature inversions** extend from ground level to a height of hundreds of feet. The coolest air is at ground level and the warmest air is at the top.

(3) Temperature inversion. Where outdoor air at ground level is cool and calm during early evenings through early mornings, and under clear skies, there is probably a low-level *temperature inversion* (also called a *thermal inversion).* This is a layer of cool, slow-moving air that would extend from the ground to a height of hundreds of feet. Within this layer, the coolest air would be at ground level and the warmest at the top. Spray particles and vapor formed near ground level (where the air is coolest) would *not* rise as they moved downwind, because this coolest air would be heavier than the warmer air above it. So the particles and vapor would stay at about the same level and form an undiluted, horizontal spray plume that could extend into a non-target site.

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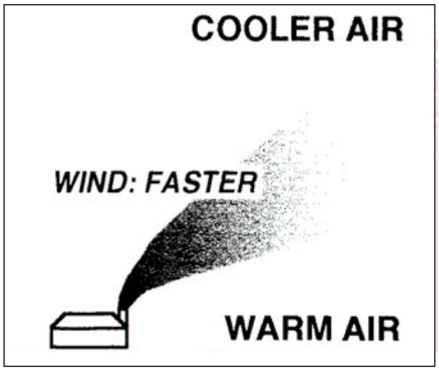
Mechanics of Drift, *continued from page 5*

This would not happen if the temperature inversion was *absent* and the ground-level air instead had a motion that caused vertical mixing. It would usually happen on cloudy mornings or by mid-day; wind would be faster than in a temperature inversion; and a spray plume which formed at ground level would not only extend downwind but also rise. (Unlike in a temperature inversion, the warmest air would be at ground level and would tend to float upwards through the cooler air above it, thus causing vertical mixing.) This rising motion would dilute the spray plume more and more as it extended farther and farther downwind.

Thus drift problems are more likely when applying in a temperature inversion. In fact, a pesticide label gives this summary:

Drift potential is high during a temperature inversion. Temperature inversions restrict vertical air mixing, which causes small suspended droplets to remain close to the ground and move laterally in a concentrated cloud. Temperature inversions are characterized by increasing temperature with altitude and are common on nights with limited cloud cover and light to no wind. They begin to form as the sun sets and often continue into the morning. Their presence can be indicated by ground fog; however, if fog is not present, inversions can also be identified by the movement of smoke from a ground source or an aircraft smoke generator. Smoke that layers and moves laterally in a concentrated cloud (under low wind conditions) indicates an inversion while smoke that moves upward and rapidly dissipates indicates good vertical air mixing.



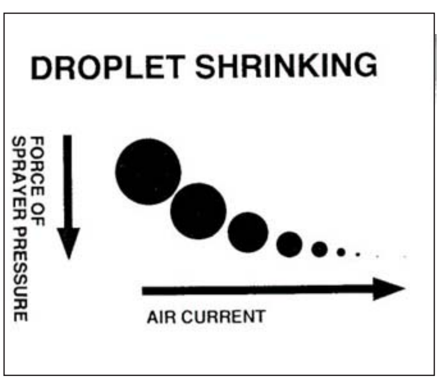
Where a temperature inversion is absent, the warmest air is at ground level and cooler air is above.

PARTICLE SIZE AND DENSITY. Let's first review how a popular type of sprayer forms droplets and what happens to the droplets.

Hydraulic sprayers produce droplets by applying pressure to a liquid and forcing it through an *orifice,* the small hole in the tip of a nozzle. (Most nozzles have just one orifice but specialty nozzles have more.) Depending on the nozzle's design, the liquid exits the orifice as a short-lived sheet or thin stream (a "ligament"). Except for the stream made by "wide-angle flat fan'' nozzles (described below), either one soon breaks apart into droplets because a stretching or a slicing force, or both, act upon it. The forces result from pumping pressure and from any air flowing onto the face of the orifice or across it.

A "wide-angle flat fan" nozzle produces droplets by directing a stream of liquid across a short gap and then against the angled surface formed by an extension of the nozzle tip. The liquid stream impacts the angled surface and throws out droplets in a fan pattern.

Just after exiting the nozzle, a droplet's direction will mainly be the same as the direction in which the sprayer nozzle is pointing. But the droplet soon shrinks and slows down or completely loses its forward motion so that any air current will determine which way it goes. The droplet shrinks because it loses liquid by evaporation. While it is shrinking, the droplet slows down because it loses its forward motion to resistance ("drag") from the surrounding air.



As a spray droplet shrinks, an air current has more effect on its direction of travel.

The droplet continues to shrink and slow down, and it does so faster and faster because both evaporation and "drag" are much more effective against shrunken (smaller) droplets. As a result, any air current will carry off droplets that do not deposit on a surface within a short distance from the nozzle.

The larger droplets will deposit on some surface, either by falling onto it or by striking it. A droplet is likely to strike the surface only when the nozzle is placed relatively close to the target because only at that range would it still have forward motion from the sprayer pressure.

Droplets that strike the target's surface will do one or more of three things: shatter, bounce back, or stick to the surface. Droplets that shatter, usually the larger ones, will throw off smaller droplets. "Bounce back" happens just after a droplet strikes a surface; it rebounds and becomes airborne again. "Bounce back" is more likely to happen when a droplet contains lots of water and when the surface is already wet or is waxy like some leaves. Also, watery droplets are less likely to stick than oily droplets.

Drift management researchers can measure the size of spray droplets. In a laboratory, they use lasers and other electronic devices to measure diameters of droplets in midair. The unit of measurement they use is the *micron* (also called *micrometer).* One micron is 1/1,000,000 meter or about 1/25,000 inch. (The shorthand form for "micron" is "µm", a Greek letter and the letter "m") When thinking about sizes of spray droplets, compare them to the approximate thicknesses of these objects:

Human hair ………………….100 microns thick

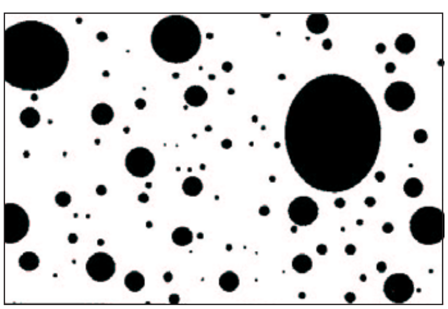
Sewing thread ………………150 microns thick

Toothbrush bristle…………...300 microns thick

Staple ………………………...420 microns thick

Paper clip ……………………850 microns thick

Pencil lead …………………...2,000 microns thick



Liquid droplets of many different sizes are produced by hydraulic sprayers. The larger droplets fall faster and do not contribute to drift as much as the smaller droplets.

Any hydraulic sprayer produces a spray containing droplets of many different sizes, not one size. ("Droplet size spectrum" is the term drift management researchers use to describe the range of droplet sizes in a spray.) Applicators who use these sprayers should consider the opposing effects of small and large droplets: *Generally, small droplets make drift riskier but they have the potential for more thoroughly covering the target's surface. On the other hand, large droplets may not cover the target's surface so thoroughly but they do lessen the risk from drift.*

Because there is no single droplet size spectrum that perfectly balances coverage and drift reduction in every situation, applicators should understand what factors influence sizes of spray droplets. Here is a brief discussion of each.

(1) Spraying pressure. The pressure of a hydraulic sprayer is one of the major forces that causes the sheet or ligament to break into droplets.

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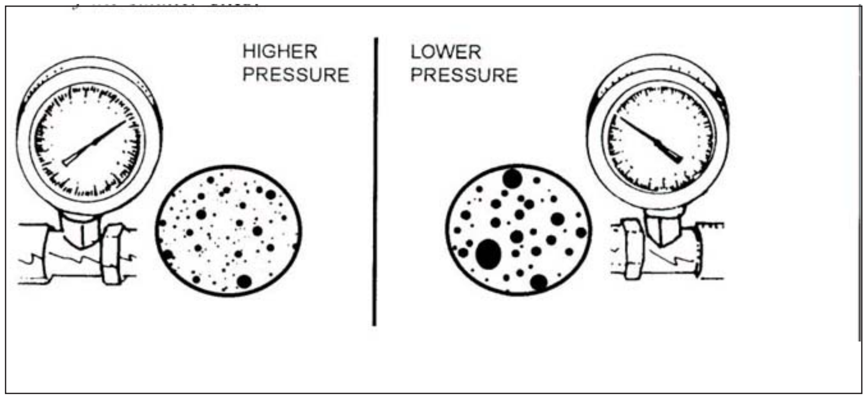
Mechanics of Drift, *continued from page 7*

Lower pressure causes a nozzle to produce more of the larger droplets and less of the smaller ones.



Lowering pumping pressure causes a hydraulic sprayer to produce fewer small droplets and more large droplets

(2) Nozzle choices. Nozzle manufacturers provide three basic nozzle types, and for each of these, choices among different orifice sizes, and different spray angles.

Nozzle Types—The basic nozzle types listed below produce three different spray shapes.

BASIC NOZZLE TYPE	SHAPE OF SPRAY
Hollow Cone	CONE
Solid Cone	CONE
Disc Core	CONE
Regular flat fan	FLAT FAN
Even flat fan	FLAT FAN
Wide-angle flat fan (also called Flooding or Deflector)	FLAT FAN
Straight stream (also called Solid stream)	STRAIGHT STREAM

Generally, one or two of these basic nozzle types are better suited for a particular spraying task than the others, not only because of the spray shapes they produce but also because of the sprays' droplet size spectra. For example, the hollow and solid cone nozzles produce smaller droplets in tightly-spaced patterns and are a good choice for thoroughly spraying leaves. But wide-angle flat fan nozzles produce mostly larger droplets in coarse patterns and are often used when there is no need for small, tightly spaced droplets.

Orifices Size—*A nozzle tip with a larger orifice will produce more large droplets and less small ones. A* clue about orifice size is the nozzle's "capacity," which may be engraved or printed in a code or shorthand on the nozzle's body or tip. It does not specify orifice measurements but instead indicates how much water would flow through the nozzle in one minute at some standard pressure (40 pounds per square inch for many nozzle types). A nozzle coded for 0.4 gallon per minute *(gpm)* would have a larger orifice than a nozzle coded for 0.2 gpm. The codes are explained in manufacturers' catalogs and are familiar to experienced distributors and applicators. It's important to know that a nozzle's coded capacity applies to a new, unused nozzle. A used nozzle will have a larger orifice because spray liquids flowing through it are abrasive or corrosive (or both) and so will slowly enlarge the orifice. Spray liquids made from pesticides formulated as wettable powders are especially abrasive.

Spray Angles—Generally, more large droplets will come from nozzles designed to produce narrower angles of spray. For example, a nozzle manufacturer's test for droplet sizes produced by two of its nozzles showed that the 80° nozzle produced a "medium" spray while the 110° nozzle produced a "fine" spray. (Both nozzles were operated at 40 psi and discharged 0.2 gpm.) Nozzle spray angles range from 15° to 150°, but like the basic nozzle types discussed earlier, some are better choices for a particular spraying task than others.

(3) Spray liquid ("Tank mix"). Many sprayable pesticides must first be mixed at least with a diluting liquid. Pesticide label instructions often require water as the diluting liquid. But diesel, deodorized kerosene, special oils, or some other oily liquid (alone or with water) are necessary in some cases. The resulting mixture is commonly called a *tank mix.* Other possible components of a tank mix are:

- another pesticide
- fertilizer
- dye (to mark treated areas)
- adjuvant ("helper"), such as a:
    - compatibility agent
    - spreader (wetting agent)
    - sticker
    - drift control agent
    - pH buffer
    - defoamer

USDA Tim McCabe photo

A chemical added to a "tank mix" may affect a spray's droplet size spectrum.

Each added component affects a spray's droplet size spectrum at least a little by changing one or more of these tank mix characteristics: density (weight per gallon), viscosity (thickness), and surface tension (elasticity and strength of a spray droplet's "skin"). A tank mix's viscosity can be increased by adding a drift control agent.

(4) Sprayer speed of travel and nozzle alignment. This combination of factors is important for fast-moving sprayers such as those mounted on aircraft. *More large droplets (and less small droplets) will be produced if the sprayer moves slower and nozzles face backward rather than forward or downward.* This is so because a nozzle facing forward (into the direction of travel) or downward will expose the sheet or ligament more directly to the slicing effect of flowing air and break it apart more thoroughly. This effect will be enhanced by higher speed.

(5) Air temperature and humidity at the target site. These factors affect how fast a droplet shrinks. *Hotter, drier air will speed shrinkage by evaporation and make a spray more prone to drift.*

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Mechanics of Drift, *continued from page 9*

NOZZLE-TO-TARGET DISTANCE. The space between a nozzle and the target is where an air current can blow pesticide particles off course. This is also where spray droplets (especially watery droplets) can shrink by evaporation, fall slower, and become even more prone to being blown off course. So in general, *the risk of drift is less when a nozzle is closer to the target.*

Sources:

1. *Proceedings of he North American Conference on Pesticide Spray Drift Management* . March29-April 1, 1998. Donna Buckley (editor). Maine Board of Pesticides Control and the Pest Management Office, Cooperative Extension, University of Maine.

2. Chapter 2 Climate Control, by Thomas Schroeder, in *Prevailing Trade Winds: Weather and Climate in Hawaii.* Marie Sanderson (editor). 1993. University of Hawaii Press.

3. Chapter 8 Factors Affecting Deposition in *Influence of Weather on the Efficiency and Safety of Pesticide Application.* J.G. Elliot and B.J. Wilson (editors). 1983. British Crop Protection Council.

4. George W. Ware. 1983. *Reducing Pesticide ApplicationDrift-Losses.* Cooperative Extension Service, College of Agriculture, University of Arizona.

Tucson.

5. PesticideDrift. Pesticide Information Program, Entomology Department, Clemson University. [viewed 7/28/99 at *http://entweb.clemson.edu/pesticide/saftyed/drift.htm#Pesticide Drift]*

6. *Agricultural Spray Products Catalog.* 1996. Spraying Systems Co.

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Hawaii's Biting Mosquitoes, *continued from page 2*

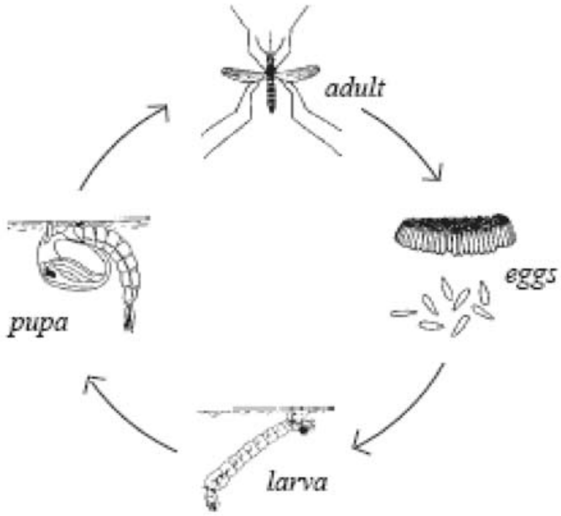
Night-biting Mosquitoes

Culex quinquefasciatus

The two species, *Culex quinquefasciatus* (Southern House Mosquito) and *Aedes vexans nocturnus* (Inland Floodwater Mosquito), are active from dusk into the night. Their presence at your home may not indicate a nearby breeding site. They have a flight range of several miles. *Culex quinquefasciatus* will breed in all types of human-made containers but prefers ground water containing rotting organic matter. *Aedes vexans nocturnus* breeds exclusively in flood waters. Its eggs, laid in dry, lowland soil, remain dormant until flooding causes them to hatch. Both *Culex quinquefasciatus* and *Aedes vexans nocturnus* are brown mosquitoes, but only *Aedes vexans nocturnus* has white stripes around its leg joints. *Culex quinquefasciatus* is found on all islands and is the most common night-biting mosquito in Hawai'i.

Life Cycle

Mosquitoes go through a life cycle known as complete metamorphosis. They start as eggs deposited either singly or in "rafts" by females that have had a blood meal. The eggs hatch into the larval stage, commonly known as "wrigglers", and live in water passing through 4 larval stages.



The next stage is the pupa, commonly known as "tumblers" also living in water. After the pupal stage is the adult stage. Most female mosquitoes feed on blood and males feed on flower nectars or other similar substances in nature.

Control Methods Around the Home

Finding Breeding Sites

Intolerable mosquito nuisance usually indicates a nearby breeding source. Make a systematic and thorough inspection around your home. Common breeding sites are in water found in vine bowls, clogged roof gutters, cans, bottles, old tires, unused swimming pools, unused fish ponds, pineapple lilies, spider lilies, hollow bamboo stumps, hollow traveler's tree stumps, uncapped hollow tile walls, uncapped fence pipes, and overflow trays under house plants.

Permanent Control

1. Remove, repair, or empty everything that could contain water and become breeding areas for mosquitoes on your premises.

2. Use mosquito-eating fish, such as guppies, in fish ponds, unused swimming pools, or other large containers that cannot be removed or emptied. Don't release these fish into natural water sources, such as streams or lakes, as they are not a native species.

3. Install or repair window screens and doors to keep out mosquitoes. Screens are your best protection against mosquito nuisance in your home.

Temporary Control

1. Eliminate adult mosquitoes with aerosol insecticides labeled for flying insects.

2. Use insecticides specifically labeled for controlling mosquito larvae in breeding sites that cannot be emptied or removed. Consult your garden shop or chemical company information on the internet for available insecticides.

3. For personnel protection use insect repellents containing DEET (N, N-diethyl-m-toluamide) at 30 to 33% for adults and 7.5% for children under 12 years. DEET should not be used on babies less than 2 years of age. Another material, picaridin (KBR 3032) at 7%, is also recommended by the Centers for Disease Control. When outside, remain covered up with long sleeves and long trousers to help prevent being bitten by mosquitoes.

CAUTION: *Certain pesticides and their solvents may cause respiratory irritation. Persons with respiratory diseases should consult their physicians before using any pesticide.* ***IT IS A VIOLATION OF FEDERAL LAW IF PESTICIDES ARE NOT APPLIED EXACTLY AS THE LABEL DIRECTS.***

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This newsletter is published by the Extension Pesticide Programs. For information on pesticide programs, please contact:

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Hawaii's Biting Mosquitoes, *continued from page 11*

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Molokai
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4398-B Pua Loke Street
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191 Kuawa Street.
Hilo, HI 96720
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Honoka'a Health Center
Honoka'a, HI 96727
Tel: 775-8860

Kona:
Keakealani Building
Kealakekua, HI 96740
Tel: 322-1507

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