FIELD IDENTIFICATION OF ADULT AND LARVAL MOSQUITOES
(By Bruce A. Harrison Oct. 2005)

- **NO ONE CAN FIELD-ID ALL OF THE SPECIES IN A GIVEN AREA! Learning to identify mosquitoes in the field is a humbling experience. Don't take an ego into this effort, because it will get crushed.**

- **<u>Definition of Field-ID</u> – Visually identifying live or dead specimens as you collect them in the field. This can be done with or without the use of a hand lens.**

- **Field-ID is a basic throw-back to the era when people did not use microscopes and identified with the eyes or with the assistance of a hand lens.**

- **Field-ID is a preliminary method that is guesswork based on experience and knowledge of mosquitoes and is prone to mistakes. Identifications made in the field should be considered a first step in identifying specimens. The next step should be an accurate ID using a microscope.**

- **Field-ID should not be used in collection records and reports. To do so will surely enter errors that will end up costing more money and time.**

- **With the advent of newer non-morphological identification techniques like chromosomes, electrophoresis, and DNA that have discovered complexes of sibling species in what were originally considered one species, more caution is required when using Field-ID.**

- **Regardless of the above cautions, Field-ID is a valuable preliminary tool in determining the species in a given area. It can also be of real value in establishing and carrying out control measures.**

<u>ADVANTAGES OF FIELD-ID</u>

1. **Provides instant knowledge of some of the species and their numbers in an area**

2. **Can identify the species biting humans in an area and confirm or refute the validity of complaints**

3. **Can pinpoint the time of day a given species is attacking humans**

4. **Can reduce trips and man-hours needed in an area**

5. **Provides on-site information important in locating nearby larval habitats**

6. **Provides on-site information that will help in adult and larval control**

- **<u>How do you learn to Field-ID</u>?**

    - **You must know how to recognize mosquitoes from other flies with a similar appearance.**
    - **You must know the anatomy of a mosquito adult or larva in order to quickly see key characters**
    - **You must learn the key diagnostic characters of the species that you know occur in your area. This takes hundreds, if not thousands, of hours of examining specimens and reading books and papers that provide ID information about those species.**
    - **You must know the phenology (seasonality) of each species**
    - **You must know the habitats frequented by the different species in your area**
    - **You must know the behavior of each species (biting, landing, distance they will fly, shade vs. sunlight, etc.)**
    - **Last and most importantly, you must know the species that possess unique characters that are easily seen**

<u>POSTURE IS THE FIRST DIFFERENCE TO LOOK FOR</u>

- **If the mosquito has very long and thin legs and the abdomen is pointed up and away from the surface it is resting on (regardless of it being on a vertical or horizontal surface) then it is = *Anopheles***

- **If the legs are not exceptionally long and are thicker and the abdomen is horizontal to the surface it is resting on, then it is = to all other genera of mosquitoes in the U.S.**

<u>ADULTS YOU SHOULD NOT TRY TO ID IN THE FIELD</u>

1. **Medium to small brown mosquitoes with blunt abdomens and unbanded legs**
   = *Culex* species
   = *Culiseta melanura*

2. **Medium to small mosquitoes with sharp pointed abdomens and unbanded legs**
   = *Aedes cinereus*
   = *Ochlerotatus* species

3. ***Anopheles* with long palps with white-bands and 3 dark and 2 white spots on wing vein 1-A = *An. crucians* complex (6 species)**

4. ***Anopheles* with long dark palps and wings entirely brown scaled**
   = *An. quadrimaculatus* complex (5 species)
   = *An. atropos*
   = *An. barberi*

GROUPS OF SPECIES THAT OFFER DIFFERENT DEGREES OF DIFFICULTY IN IDENTIFYING FEMALE MOSQUITOES

I. Accurate – IDs. Females of these species have one unique character not seen on other species, or, 2-3 easily seen characters that will correctly ID the species.

A. Species with unique characters

- ***Coquillettidia perturbans* – has wide preapical pale band on hindtibia**
- ***Ochlerotatus fulvus pallens* – is golden orange with two black spots on the scutum**
- ***Ochlerotatus japonicus* – has 3 broad pale bands on the hindtarsi, and last two hindtarsal segments entirely dark**

B. Species with 2-3 easily seen characters

- ***Aedes aegypti* – has a silver lyre-shaped markings on the dark brown scutum and 5 broad white bands on the hindtarsi (abdomen sharp)**
- ***Aedes albopictus* – has median longitudinal silver stripe on a black scutum and 5 broad white bands on the hindtarsi (abdomen sharp)**
- ***Aedes vexans* – has narrow basal pale bands on the hindtarsi and a median notch on the basal pale bands on the abdominal segments (abdomen sharp)**
- ***Anopheles punctipennis* – has black palps, a distinct pale yellow spot on the leading margin of the wing before the tip, and two dark spots on wing vein 1-A (Abdomen blunt)**
- ***Anopheles walkeri* – has narrow pale bands on the palps and wings entirely brown scaled**
- ***Culiseta inornata* – is a late Fall or Winter mosquito that comes out to bite when temperatures are 50^{o} F or higher, the proboscis, legs and abdomen are speckled brown and white, and the wing is very broad (abdomen blunt)**
- ***Culex tarsalis* – has pale bands on the legs, a pale band on the proboscis, and longitudinal pale stripes on the foretibia (abdomen blunt)**
- ***Ochlerotatus grossbecki* – is a large black and white speckled mosquito that occurs only in late Winter (Feb.-March), has speckled wings, femurs, proboscis, abdomen, and 5 medium length pale bands on the hindtarsi (abdomen sharp)**
- ***Psorophora columbiae* – is a large black and white speckled mosquito that likes to bite in full sunlight in grassy fields, has apical pale patches on the abdomen and broad pale bands on the hindtarsi and on the proboscis (abdomen sharp)**

- ***Psorophora cyanescens* – is a medium sized purple-black mosquito that likes to bite in full sunlight, has hindtarsi entirely dark purple, proboscis dark, and apical pale patches on the abdominal segments (abdomen sharp)**
- ***Toxorhynchites rutilus* – a giant blue-green iridescent mosquito with a long downward curving proboscis that does not bite (abdomen blunt)**

II. <u>Ballpark – IDs</u>. The following females are best identified as groups of 2 or more closely related species that need a more accurate identification using a microscope.

- ***Ochlerotatus atlanticus/tormentor, Oc. dupreei,* and *Oc. infirmatus* – have legs entirely dark, abdomen dark except for lateral patches, and a median white longitudinal scale line on the scutum that rubs off very easily, and they stay in the woods and bite above the waist (except *dupreei* which feeds on birds) (abdomen sharp)**
- ***Ochlerotatus atropalpus* and *Oc. canadensis* – have pale bands across the hindtarsal joints and the last hindtarsal segment entirely white (abdomen sharp)**
- ***Ochlerotatus sollicitans* and *Oc. taeniorhynchus* – are coastal salt marsh species, have a pale band on the proboscis and broad pale bands on the hindtarsi (abdomen sharp)**
- ***Ochlerotatus triseriatus* and *Oc. hendersoni* – have hindtarsi entirely dark scaled, silver scales laterally on the scutum, and the last two segments of abdomen flattened laterally (like a flea) (abdomen sharp from dorsal view, blunt from lateral view)**
- ***Mansonia dyari* and *Ma. titillans* – are large brown-black species with speckled scales on the wings, abdomen, proboscis with narrow pale band or patch, and medium length pale bands on hindtarsi (abdomen blunt)**
- ***Orthopodomyia signifera* and *Or. alba* – have fine white longitudinal white stripes on the black scutum, black and white speckled wings, pale bands crossing the hindtarsal joints, and the last hindtarsal segment entirely white (abdomen blunt)**
- ***Psorophora ciliata* and *Ps. howardii* – are giant mosquitoes that appear black and purple that will bite in open sunlight, and have erect black scales (like a bottle brush) on the hind tibia, and on *ciliata* also on the first hindtarsomere (abdomen sharp)**
- ***Psorophora ferox, Ps. horrida,* and *Ps. mathesoni* – stay in the woods and prefer to bite above your waist, are deep purple with the last one or two segments of the hindtarsi entirely white (abdomen sharp)**

III. <u>Difficult – IDs</u>. Females on this list are best carried back to the laboratory and identified under a microscope.

- ***Ae. cinereus***
- ***An. atropos***
- ***An. barberi***
- ***Cx. erraticus***
- ***Cx. nigripalpus***
- ***Cx. peccator***
- ***Cx. pilosus***
- ***Cx. pipien/quinquefasciatus***
- ***Cx. restuans***
- ***Cx. salinarius***
- ***Cx. territans***
- ***Cs. melanura***
- ***Oc. mitchellae***
- ***Oc. sticticus***
- ***Oc. thibaulti***
- ***Oc. trivittatus***
- ***Ps. discolor***
- ***Ur. lowii***
- ***Ur. sapphirina***
- ***Wy. Smithii***

LARVAL MOSQUITOES

FIELD IDENTIFICATION OF LARVAL MOSQUITOES

- **Field ID of larvae is much more difficult than that for female mosquitoes. You must find the larvae, but the females come to you.**

- **Because of the difficulties inherent in field-ID of larvae, most specimens cannot be identified until they are heat killed (tepid, not boiling water), preserved in 80% ethyl alcohol, and examined under a microscope with at least 60X or higher magnification.**

- **Before you can find the larvae, you must first find the correct habitat where the target larvae may or may not occur. Larvae of many mosquito species have specific habitat requirements.**

- **Once you find the larvae they are still difficult to collect because they are generally small, very active, and often hide to avoid detection.**

- **Stealth is usually required in collecting larvae. Heavy footsteps, stepping in the water, casting a shadow where you plan to collect, and indiscriminate dipping without fore-thought about where the larvae might be will usually send the larvae to the bottom and your dipper will come up empty.**

- **When you collect larvae they do not hold still for you to examine them with a hand lens, thus the normal technique is to observe the larvae in a dipper. This is complicated by many habitats having turbid or stained water and the larvae cannot be seen.**

- **However, if you are successful in collecting larvae and able to learn larval field-ID it presents a number of advantages to you.**

- **Field-ID of larvae is very important for Proactive mosquito control (i.e., kill mosquitoes before the adults emerge).**

- **Field-ID of larvae can help you verify complaints about adult mosquitoes.**

- **Once you confirm through field ID that larvae collected are responsible for complaints about adult mosquitoes you can initiate immediate on-site control measures. This can eliminate an ongoing problem or in other instances, stop a problem before it occurs, and this can be done without having to visit the site a second time.**

- **Field-ID of larvae saves man-hours, money, and time.**

- **<u>How do you learn to field-ID larvae?</u>**

    - **You must be able to distinguish mosquito larvae from the immature stages of other insects.**
    - **You must know the anatomy of a mosquito larva in order to quickly see important characters**
    - **You must be able to distinguish early (1^{st}-2^{nd}) instars from late (3^{rd}-4^{th}) instars because key characters are normally based on 4^{th} instars.**
    - **You must learn the diagnostic characters for the larvae of species in your area. This requires examining hundreds, if not thousands, of killed preserved larvae under a microscope. It also requires reading books and papers that provide larva ID information for the species in your area.**
    - **You must know the phenology (seasonality) of each species in your area.**
    - **You need to know the different types of larval habitats in your area.**
    - **You must know the habitat requirements for each species in your area.**
    - **Knowing the behavior patterns can greatly assist in finding larvae of certain species.**
    - **You must know the species that possess unique characters that are easily seen in the field.**

INTIAL SORTING

- **No siphon, larva lays parallel to the surface = *Anopheles***

- **Siphon present, long or short, but without sharp pointed tip, larva hangs down from the surface = *Aedes, Culiseta, Culex, Ochlerotatus, Orthopodomyia, Psorophora, Toxoryhnchites, Uranotaenia, Wyeomyia*.**

- **Siphon present, very short with sharp pointed tip, usually attached to plant roots, if not attached, then hanging down from surface =*Coquillettidia* and *Mansonia***

SORTING FOR CONTROL PURPOSES*

- **Larvae that are laying parallel to the surface of the water =*Anopheles* (CONTROL!)**

- **Giant larvae (about ¾ inch long)**
  - **Red – orange color, short siphon, many thick spines = *Toxorhynchites* This is a valuable predator species. DO NOT KILL**

  - **Gray – opaque color, long siphon, spines not obvious = *Psorophora* (This include two species, *Ps. ciliata* and *Ps. howardii*)= CONTROL!**

- **Short larvae hanging from the surface by a long siphon at about a 45^{o} angle = most *Culex* and *Culiseta melanura* = CONTROL!**

- **Short larvae hanging from the surface by a short siphon = some *Culex*, *Culiseta inornata,* some *Aedes, Ochlerotatus, Psorophora* = CONTROL!**

- **Long larvae that hang from the surface at a 60 to 90^{o} angle = most *Aedes* and *Ochlerotatus* = CONTROL!**

- **Larvae attached to plant roots, siphon very short and sharp pointed = *Coquillettidia* and *Mansonia* = CONTROL!**

*** *Orthopodomyia* and *Uranotaenia* larvae hang from the surface at about a 45^{o} angle, while *Wyeomyia smithii* larvae remained submerged on the bottom of the pitcher plant where they are found. These 3 genera are not a target for control**

UNIQUE CHARACTERS THAT CAN BE USED TO IDENTIFY 4TH INSTAR LARVAE OF CERTAIN SPECIES OF MOSQUITOES

SOLID COLORS

- **Pink to red-orange, small larvae = *Orthopodomyia* species (unless they are early instar *Toxorhynchites* larvae)**
- **Pink to red-orange, giant larvae = *Toxoryhynchites rutilus***
- **Green larvae with a long siphon = *Culex erraticus* (when it has been eating green algae, other specimens may not be green)**

BANDED OR OTHER COLOR PATTERNS*

- **Head dark, thorax pale, abdominal segments I-VI dark, VII-VIII pale = *Ochlerotatus atlanticus* and *tormentor***
- **Head dark, thorax dark, abdominal segments I-III dark, IV pale, and V-VIII dark = *Culex territans* (nearly 40% of specimens examined from the Southeastern and Mid-Atlantic U.S. have segment IV pale banded, while over 60% do not have this band)**
- **Antennae and very long thin siphon entirely dark brown = *Culiseta melanura***

SIPHON CHARACTERS

- **Exceptionally long thin siphon that is narrower in the middle than at the base and apex = *Culex territans***
- **Very short siphon that is bent dorsally and has exceptionally long branched setae to the apex of the siphon = *Culex pilosus***
- **Long siphon with a black band around the middle = *Culex peccator***
- **Siphon obviously swollen (broader in middle than at the base or apex) = *Psorophora, columbiae, cyanescens, ferox, horrida,* and *mathesoni***

OTHER CHARACTERS

- **Anal papillae exceptionally long and spread out in 4 directions = + when larva hanging from surface, small larvae= *Ochlerotatus dupreei***
- **Long creamy-white larva with long equal length anal papillae = *Ochlerotatus hendersoni***

***Various color patterns (stripes, spots, red, green, black, white, tan, yellow, brown, cream, etc.) observed on *Anopheles* larvae cannot be used to accurately ID larvae. These are characters often induced by the food the larva eats, shade/sunlight, muddy water, associated vegetation, and other environmental and genetic factors.**

BASED ON THE FEW SPECIES THAT CAN BE IDENTIFIED IN THE FIELD (ABOVE) IT SHOULD NOW BE OBVIOUS THAT ALL COLLECTED LARVAE SHOULD BE IDENTIFIED UNDER A MICROSCOPE.

ALSO, IT SHOULD NOW BE OBVIOUS THAT PEOPLE THAT CAN IDENTIFY MOSQUITOES SEMI-ACCURATELY HAVE EITHER FOCUSED ON LEARNING THIS TECHNIQUE THROUGH INTENSE EFFORT OVER A SHORT PERIOD (MONTHS), OR THEY ARE LONG-TERM MOSQUITO WORKERS WITH YEARS OF EXPERIENCE

TRY IT! It makes fieldwork more interesting and fun, particularly when you discover that you can do it. Also, it will speed up the identification process and save manpower, time, and funds.