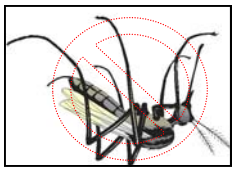

Variations on Female Mosquitoes that Cause Identification Problems in Keys

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PHPM, NCDENR

THE BITING TIMES

FOR ADDITIONAL INFORMATION CONTACT:

One shortcoming of most mosquito keys is they do not address common or uncommon variations that occur on most species. A specimen that does not possess a particular character that it is supposed to have, or that has additional scale patterns that are not normally there will not go correctly through a couplet and can lead you down a blind alley where the specimen does not appear to fit any species in the key. A major priority in devising keys is to keep it short and thus, the taxonomist tries to find one to three unique characters for each species at the expense of infrequent or even common variations. However, identification problems occur most often when only one character is used in a key couplet. Ideally each key booklet should contain a section for each species that discusses known variations that are frequent or infrequent on that species. This would aid identifiers and greatly reduce confusion and misidentification of species.

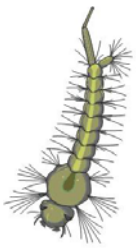
Population genetics affects mosquitoes just as it does humans. Variations on a given mosquito species can be as common as black, blond, or red hair (or eye colors) are in humans. Did you know that some mosquito species produce albino individuals or melanistic (black) individuals (Sucharit et al. 1979), when the normal species coloration is black and white spotted? Usually the most commonly encountered species or species that emerge in huge numbers are the ones expressing the most variations. This is because they are living in optimum habitat and very successful in that area and because the dense populations (millions) increase chance mutations that can change characters, or changes in the environment can stimulate the expression of less common alleles (hence traits) found in the genetic makeup of the species.

Below I am initiating a series of articles that address variations on commonly encountered species. These articles will each focus on several species and initially tell you (1) the problem encountered in current keys, (2) what the variations are and how they impact the keys, and (3) comments and characters to assist you in correctly identifying the variable specimen(s).

I. *Ochlerotatus mitchellae* (Dyar)

Problem. In Darsie and Ward (2005, page 25, couplet 3) and Slaff and Apperson (1989, page 5, couplet 5), species are separated by either having or not having a pale-scaled band near the middle of the proboscis. There are only three species of *Ochlerotatus* that occur in North Carolina and Virginia that normally have a pale band on the proboscis. Those three species, *Oc. mitchellae*, *Oc. sollicitans*, and *Oc. taeniorhynchus* are all most common in the coastal plain. The first is a freshwater species that can also occur in the piedmont, while the last two are salt marsh species that normally occur only along the coast. When this pale proboscis band is absent the specimen will not come out at the correct couplet in the keys.

Variation. Occasional specimens of this species will lack a pale band on the proboscis. I have one specimen collected in 1995 from Bolivia, Brunswick Co., NC, with this variation. This specimen will not go through couplet 3 in Darsie and Ward to couplets 4 and 5 where it would be correctly identified, but instead the specimen will come out in couplet 14 as either *Oc. bahamensis* or *Ae. albopictus*. In Slaff and Apperson, this specimen will not key out where it should in couplet 7, but will take you to couplet 12 and *Oc. stimulans,* which does not occur in North Carolina.



Solution. Specimens of *Oc. mitchellae* without a pale band on the proboscis are still easily identified by having the following combination of characters: (1) dark wing scales, (2) a median longitudinal yellow stripe down the abdomen, (3) speckled white scales on the femur and tibia of each leg, and (4) hindtarsomere 5 entirely white.

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Looking For "White Boots"
By Parker Whitt

June of 2008 came in with some heat here in the piedmont region of NC. We had around 10 days of 95-99 degree temperatures. May had given us some nice days of good rainfall. I had just finished my 8th mosquito ID course of 2008 at the CDC in Atlanta, GA. As I was handing out adult specimens, I noticed I was woefully short on *Ps. ferox*. A very common mosquito here in Winston-Salem, I thought to myself that when I returned home I'd go out to some nearby woods and collect some of these woodland pool mosquitoes.

On my first day back in the office Ryan Harrison gave me a call and told me out on Cottontail Lane the mosquitoes were really bad. He had gone out there and treated the place and said the mosquito numbers were around 100 per minute. It's a woodland pool habitat known for breeding lots of *Ps. ferox*. I told him, "Great, I'll go out there tomorrow and check the place out! Thanks."

I had been there many times in the past and as I pulled up and parked my truck I knew I'd get plenty of fresh, new, mosquitoes for future ID classes. I was equipped with my mouth aspirator and my dipper, and a can of Cutter. The owner of the property rode up on his 4 wheeler and greeted me. He wanted to know who I was and what I was up to, and as we talked, the mosquitoes were all upon us. He said the usual, "Take as many as you want, I'm outta here!"

I started aspirating as fast as I could. Mosquitoes were all over me. All of them had white boots, so I assumed I was getting the species I was after. I collected and collected, and after about 1 hour, I figured I had around 200 nice fresh *Ps. ferox*, as well as some other species too. I noticed some standing water, so after I made all of the adult collections I needed, I sprayed on the Cutter and went to dipping for larvae. The Cutter works, for I never got another bite!

In the woodland pools were hundreds of larvae and pupae. I was hoping they were *Psorophora*, but they just didn't look quite right to me. No swollen siphons! I collected about 5 whirl-pak bags and quit for the evening. The next day I started my ID's with the larvae. They were all *Cx. restuans*. The pupae that were hatching off were *restuans* too. I figured as much, for they had the classic *Cx.* herky jerky movement common to that genus.

I then got out the adults to ID. Lots and lots of beautiful specimens to ID. However, as I looked under my scope… what…no….these aren't *ferox*! Too dark! Black proboscis! Ummmm…. All *Ps. horrida*! I couldn't believe my eyes for there wasn't a *ferox* in the bunch. I was tickled to death to get this many *horrida*. They come off so fast from egg to adult, that I missed the larvae. In fact, I've only collected *horrida* larvae one time in my life.

But this day, even though I didn't get the *ferox* I was after, I got a nice batch of *horrida* for the ID classes. I saved all of the *Cx. restuans* that had the classic 2 spots on the thorax. Some of the other mosquito species in my aspirating collection were *Oc. sticticus* and *Ae. vexans*. I still need some nice *Ps. ferox*, but you just never know what you may get until you go into the woods!

New for 2008!

The Association will be offering the following items for sale at the annual meeting in November. You are encouraged to pre-order as only limited quantities will be on hand for sale, especially of the smaller and larger sizes.

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Ball Cap

Low profile cap, embroidered with the association logo - one size fits most. $12.00 each.

Variations on Female Mosquitoes (continued from page 1)

II. *Ochlerotatus sollicitans* (Walker) – Eastern Salt Marsh Mosquito

Problem. The same problem as in "I" above, i.e., the presence or absence of a pale band on the proboscis

Variation. Mahmood (2008) recently pointed out that occasional specimens of *Oc. sollicitans* lack a pale band or only have an incomplete pale band on the proboscis. If the band is completely missing (e.g., a specimen from New Hanover Co., NC, collected in 2005), it will not go to couplet 4 in Darsie and Ward, and eventually to *Oc. sollicitans*, but will go to couplet 7 and then on through other couplets to possibly end in couplet 17, where the average individual would identify the specimen as *Oc. nigromaculis* (a western U.S. species) because of the median longitudinal yellow stripe on the abdomen. However, the specimen would not fit the first character in couplet 17, as *Oc. sollicitans* usually has a few pale scales at the tip of the palpi, while the palpi of *Oc. nigromaculis* are entirely dark. So, correctly identifying the specimen in couplet 17 and beyond is impossible. In Slaff and Apperson, the specimen will not go to couplet 6 and then to *Oc. sollicitans* in couplet 7, but will go to couplet 8 and beyond to *Oc. stimulans* in couplet 12.

Solution. First, it is important to understand that *Oc. sollicitans* normally emerges in moderate to huge numbers, so you will probably have a considerable number of specimens that key correctly through couplet 3 (i.e., they have a pale band on the proboscis). So, if you suddenly encounter a specimen with the proboscis entirely dark, but it otherwise looks like an *Oc. sollicitan*s, check the color of the wing scales. If the wing scales are speckled black and white, then it is *Oc. sollicitans*. The wings on both *Oc. mitchellae* and *Oc. taeniorhynchus* have only black scales. Also, the specimen will have a median pale band on hindtarsomere 1 on *Oc. sollicitans*, while the middle of hindtarsomere 1 on *Oc. mitchellae* and *Oc. taeniorhynchus* are dark scaled. Caution, *Psorophora columbiae* has speckled scales on the wing and a median pale band on hindtarsomere 1, but this species has a broad imprecise pale band on the proboscis, and a narrow preapical pale band on the hindfemur. I have never seen a *Ps. columbiae* with the proboscis entirely dark.

II. *Ochlerotatus taeniorhynchus* (Wiedemann) – Black Salt Marsh Mosquito

Problem. Again the same problem as in "I" and "II" above, i.e., the presence or absence of a pale band on the proboscis.

Variation. Gargan and Linthecum (1986) conducted a study based on specimens from Assateague Island, VA, and determined that nearly two percent of *Oc. taeniorhynchus* specimens they examined lacked a pale band on the proboscis. I have three specimens from NC exhibiting this variation (2 from Carteret County and 1 from Craven County). These specimens would not be identified as *Oc. taeniorhynchus* in Darsie and Ward, but would go through couplet 11 to *Ae. vexans* and *Oc. cantator*, or on to later couplets and *Oc. stimulans* in Slaff and Apperson.

Solution. Again, like *Oc. sollicitans*, this is another species that emerges in the huge numbers, so if you find a specimen of that looks like *Oc. taeniorhynchus,* but it lacks a pale band on the proboscis, think *Oc. taeniorhynchus*. Specimens of *Oc. taeniorhynchus* without a pale band on the proboscis have the following unique combination of characters: (1) wing scales are dark, (2) abdomen lacks a pale median longitudinal stripe, (3) hindtarsomere 5 is usually entirely pale, or with some apical dark scales on the venter and with pale scales dorsally, (4) lower mesepimeron with 1-2 setae (compare with *Ae. vexans* – without these setae); and (5) hindtarsomeres 1-4 have a few dorsal pale scales at the apex of each segment and occasionally these extend around the segment and appear as a narrow apical pale band. This last character condition could fool some identifiers into keying this species as having apical and basal pale bands on the hind legs. However, normally this is not the case as the pale apical scales are usually only on the dorsum of each segment (Belkin et al. 1970).

This first installment about variations was slanted toward people working in the coastal plain and dealing with salt marsh mosquitoes. The next installment will deal with species that are common throughout NC and VA. If you have found a particular variation on a given species confusing, please let me know and I will address it in a future installment. Comments about these notes are welcome.

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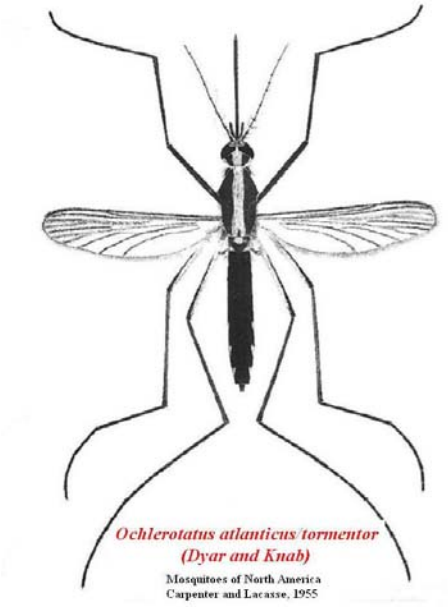
Ochlerotatus atlanticus/tormentor Biology

By Rick Hickman and Jeff Brown
Brunswick County Mosquito Control

Ochlerotatus atlanticus/tormentor is really two separate mosquitoes, *Oc. atlanticus and Oc. tormentor*. The larvae ande male genitalia of these mosquitoes are easily separated and identified. The larvae are found in freshwater temporary pools in open fields and in woodland pools, and in clear shallow pools with grass and other types of vegetation. The larvae have been found from March to November in Brunswick County.

Females *Ochlerotatus atlanticus and tormentor* cannot be differentiated using current mosquito identification keys. The adult females are persistent biters and are often associated with *Oc. infirmatus* and other woodland species following summer and fall rains. The females bite readily and severely during daylight hours in wooded areas. Typically this mosquito can be collected from June through November in Brunswick County. If weather conditions are favorable in the fall months, especially during hurricane season, populations of this mosquito can get out of hand very quickly.

Oc. atlanticus/tormentor is a woodland species that prefers to stay in the woods most of the time. She is what is termed a "crepuscular" biter. This means they are most active during the hours of sunrise and sunset. When they are disturbed while resting in the tree line they will readily attack whatever is moving. Mosquito landing rates of 40 to 80 mosquitoes per minute are not unheard of. Citizens living in the wooded areas of the county are at the greatest risk of being bitten by this mosquito. *Oc. atlanticus/tormentor* was the most abundant floodwater mosquito collected after hurricane Floyd in 1999. We consider this mosquito to be of high importance to the citizens of Brunswick County.



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2008 NCM&VCA Conference

November 12, 13 & 14th, 2008
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Topic	Speaker Name	Affiliation
Minimum Housing Code and Vector Control Issues	George Jones	Rocky Mount Community Code Division
Stormwater and Mosquito Control	Jeff Brown	Brunswick County Mosquito Control
Topic Pending	Tim McGonegal	Environmental Health Biologist, Alexandria Health Dept.
NC Arbo Update, 2008	Marcee Toliver	NC DENR, PHPM
Bedbugs	Amadou Jallow	NC DENR, PHPM
Digital Photography and Record Keeping	Jung 'Woogie' Kim	NC DENR, PHPM
Clara Louise Maass (1876-1901), Yellow Fever Transmission	Capt. Stanton Cope, OSD-ATL	Medical Service Corps, US Navy
AMCA Update	Major Dhillon	Northwest Mosquito Vector Control Department
AMCA Legal Alerts	Joe Conlon	AMCA
Topic Pending	Bryan Byrd	Tulane University
BAMP, THE BONJOUR AFRICA MALARIA PROJECT OF DURHAM	Bouna Ndiaye	Duke University
Ticks and Pathogens They Transmit (preliminary title)	Michael Smith	NCSU
Topic Pending	Nolan Newton, PhD	NC DENR, PHPM
Mosquito Oviposition Attractants	Dr. Charles Apperson	NCSU
Sentinel Chicken Testing	Gaylen Daves	State Laboratory of Public Health
The South's Secret Weapons: Disease, Environment and the Civil War	Dr. Margaret Humphreys	Duke University
Fire Ants	**Pending**	
Rodenticides	**Jim Burnette**	NC AGR
Stinging Insects	**Mike Waldvogel**	NCSU

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