

CHECKLISTS OF THE MOSQUITOES (DIPTERA: CULICIDAE) OF CHRISTIAN COUNTY AND FORT CAMPBELL, KENTUCKY, AND MONTGOMERY COUNTY, TENNESSEE

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ABSTRACT—The checklist of mosquito fauna for Montgomery County, Tennessee includes 40 mosquito species. The Christian County, Kentucky list includes 38 species. The Fort Campbell checklist, which includes only the Montgomery and Christian County sectors of the military installation, has 49 mosquito species. The checklists document the culicid species in the region, promote an awareness of the variety of the mosquito fauna, and establish a starting point for additional work.

A complete checklist of regional mosquito species is an important epidemiological and ecological tool. The presence or absence of a culicid species, especially when linked with quantitative survey data, can provide significant information regarding the potential for human and veterinary disease. In the Fort Campbell, Kentucky area, including Christian County, Kentucky and Montgomery County, Tennessee (Fig. 1) these diseases may include avian malaria, anuran filariasis, dirofilariasis, encephaliti-des, and other arboviruses. Additionally, the presence of certain mosquito species may present a potential for the local maintenance and transmission of emerging diseases. Mosquitoes are not often used as scientific indicators of ecological health. However, the ubiquitous mosquito is inextricably linked with the food chain of many other species, and may play a role in maintaining a healthy ecosystem. These checklists are provided to document the culicid species in the area, promote an awareness of the variety of the fauna, and establish a starting point for additional work.

MATERIALS AND METHODS

Compilation of the species checklists (Table 1) is based on field collections from May 1996 to May 1998 and several other sources. The sources include unpublished Fort Campbell military installation mosquito surveillance reports obtained under the Freedom of Information Act (FOIA) from the United States Army Center for Health Promotion and Preventive Medicine (CHPPM). Additional unpublished records were provided by B. Harrison, Winston-Salem, North Carolina, and E. S. Saugstad, Frederick, Maryland. The published works of Quinby et al. (1944), Shlaifer and Harding (1946), Carpenter (1952), and Saugstad (1977) also were utilized. Copies of *Aedes albopictus* infestation reports were obtained from the Centers for Disease Control and Prevention (CDC). Mosquito collection reports for Christian County, Kentucky were obtained from the Tennessee Valley Authority under the FOIA.

Larval and pupal field collections during May 1996 to May 1998 were made using dipper, direct pour from small artificial containers, and siphon. Adult mosquitoes were collected using

sweep net, ultraviolet and white light trap, and mechanical aspirator. Some larvae and pupae were reared to adults for identification. Adult and larval specimens were identified to species level using light microscopy and the taxonomic references of Darsie and Ward (1981), Darsie (1986), Harrison and Whitt (1996), and Reinert et al. (1997).

RESULTS

The checklist for Montgomery County, Tennessee includes 40 mosquito species and the Christian County, Kentucky list includes 38 species. The Fort Campbell checklist, which includes only the Montgomery and Christian County sectors of the military installation, has 49 mosquito species.

DISCUSSION

The Fort Campbell Military Reservation includes portions of four counties: Trigg and Christian County, Kentucky and Stewart and Montgomery County, Tennessee (Fig. 1). The United States Army collection records for Fort Campbell do not list the county in which a collection was made. Additional trap records, which could indicate the precise location of mosquito collection efforts, have not been located. Historically, the preponderance of mosquito collection and control efforts on the installation coincides with the locations of family housing areas, office buildings, and troop billets. All of these areas are located within the Montgomery and Christian County sectors of the installation. The portions of Fort Campbell which are within Trigg and Stewart Counties are primarily field training areas, including artillery impact areas, parachute and aircraft landing zones, and maneuver space. It is not likely that extensive mosquito collection efforts were spent in these areas by installation medical personnel. Given this multi-county situation with the historical collection documents, separate checklists were created for Fort Campbell, Christian and Montgomery Counties. Similar checklists for Trigg and Stewart Counties were not compiled.

The checklist for Fort Campbell, Kentucky, which includes portion of Christian and Montgomery Counties, includes 49 mos-

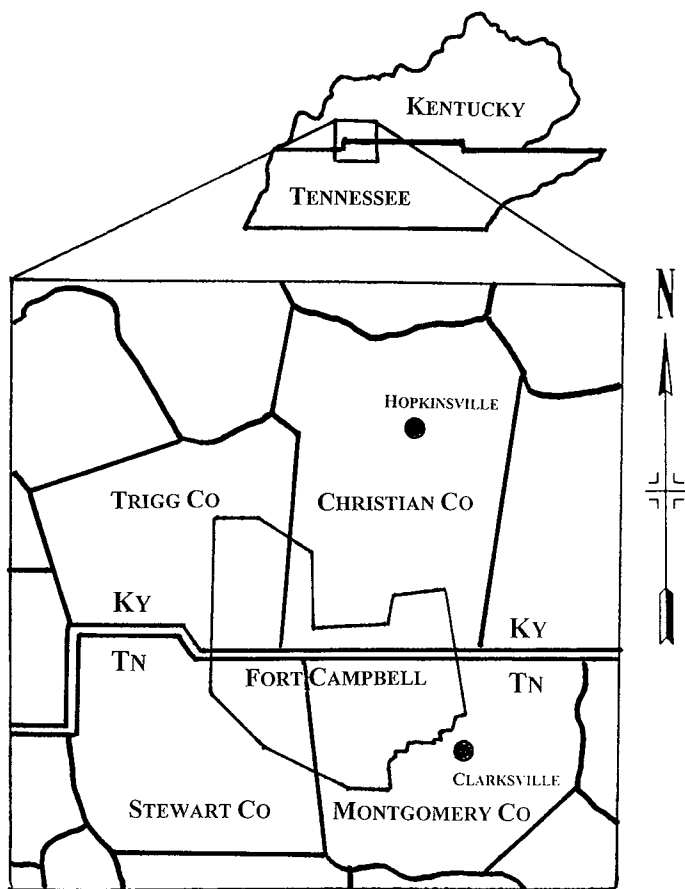


Fig. 1. Map of Kentucky and Tennessee counties covered by the checklists.

quito species. The record of six of these species is based solely on United States Army collection records, in the absence of voucher specimens. These species are *Aedes atlanticus*, *Aedes mitchellae*, *Aedes sollicitans*, *Aedes taeniorhynchus*, *Coquillettidia perturbans*, and *Culex nigripalpus*. Despite extensive larval and adult collection efforts during 1996 to 1998, no specimens of these six species were found.

United States Army historical records have reported the collection of adult and larval “*A. atlanticus-tormentor*” (sic) on Fort Campbell (CHPPM, personal communication; E. S. Saugstad, personal communication). As noted by Saugstad (1977), it is uncertain why the larval collections were not identified to species, given the distinct morphologies of the larvae. According to the expected geographic distributions (Darsie and Ward, 1981), both species may occur in the Fort Campbell area. During 1996–1998, the author collected *A. tormentor* larvae, but failed to confirm the presence of *A. atlanticus* in the area.

United States Army records for 1963 and 1966 reported the collection of four adult *A. mitchellae* on Fort Campbell. This southeastern species is not normally found in northern Tennessee (Darsie and Ward, 1981), but it may temporarily inhabit the area during shifting weather patterns. No specimens of this species have been collected on Fort Campbell since 1966. Its local presence at this time is unknown.

Aedes sollicitans may occur in the area. Fort Campbell collection records include 90 adult specimens captured in New Jersey light traps from 1963 to 1987 (CHPPM, personal communication; E. S. Saugstad, personal communication). No specimens

have been collected since 1987. Although this species is normally associated with salt marshes and brackish water (Carpenter and LaCasse, 1955), anthropogenic activities, civilian and military, may create ideal larval habitat for the species. Potential military activities include spillage of brine water associated with reverse osmosis water purification units (ROWPU), surface water contaminated by various salt-based products, and the use of decontamination agents in chemical warfare training.

The geographical distribution of *A. taeniorhynchus* is less certain. Darsie and Ward (1981) have depicted a widespread distribution for the species along the United States Atlantic, Gulf, and southern California coasts, with numerous foci in inland areas. These foci include central Kansas, west Texas, east central Alabama, and northwestern Pennsylvania. It is conceivable that the Fort Campbell area may be an additional focus for this species. In 1987, 63 specimens were collected by New Jersey light traps on Fort Campbell (CHPPM, personal communication), but none have been collected since that time.

Coquillettidia perturbans was previously collected on Fort Campbell (Carpenter, 1952), including eleven specimens in New Jersey light traps during 1987, but could not be confirmed by field collections during 1996 to 1998. The Fort Campbell region is within the expected geographic distribution for the species (Darsie and Ward, 1981). Collection of the species is complicated by the specialized structure of the larva, enabling them to use hollow emergent plants as breathing tubes, rather than travel to the surface of the water. When disturbed, the larvae easily evade collection by quickly relocating to the sediment. The adults of the species are readily attracted to light traps (Carpenter and LaCasse, 1955). Despite numerous light trap operations, however, no specimens have been collected on the installation since 1987. The continued presence of this species in the area cannot be discounted.

Another mosquito species, *C. nigripalpus*, had been previously reported by the United States Army in Fort Campbell collection records (CHPPM, personal communication). However, the accuracy of the United States Army reports of *C. nigripalpus* on Fort Campbell is in doubt (B. Harrison, personal communication) and voucher specimens are not available. Darsie and Ward (1981) indicate that the species may be found in the area. No specimens of this species were collected in 1996 to 1998 efforts.

Aedes atropalpus was first collected in Clarksville, Montgomery County, in 1997 as larvae in waste automotive tires. The species has never been reported from Fort Campbell or Christian County, but is probably present in those areas in low numbers.

The presence of *Aedes dorsalis* in Montgomery County and Fort Campbell represents an extension of the expected geographic distribution (Darsie and Ward, 1981). The species is not expected to be found in Tennessee or the southeastern United States. However, the species was recorded as an adult in United States Army New Jersey light trap collections on Fort Campbell in 1987 (CHPPM, personal communication), and in larval collections in Montgomery County and Fort Campbell in 1998.

Psorophora mathesoni has been recorded in Montgomery County (as *Psorophora varipes*) as early as 1946 (Shlaifer and Harding; 1946). The continued presence of this species could not be confirmed during 1996 to 1998 field collections in the area.

A recently described species, *Anopheles maverlius* Reinert, has not been collected in the area. However, the expected geographic distribution noted by Reinert et al. (1997) indicates it may be present in the area at its extreme northern range.

A complete list of mosquito species for the region, including

TABLE 1. Species checklists (Diptera: Culicidae) for Montgomery County, Tennessee, and Fort Campbell and Christian County, Kentucky.

Taxon	Montgomery Co., TN	Fort Campbell, KY	Christian Co., KY
Order Diptera: Family Culicidae			
Genus <i>Aedes</i> Meigen			
Subgenus <i>Aedes</i> Meigen			
<i>cinereus</i> Meigen	Moore 1999 ¹	**US Army 1967 ²	
Subgenus <i>Aedimorphus</i> Theobald			
<i>vexans</i> (Meigen)	Shlaifer and Harding 1946	Carpenter 1952	Quinby et al. 1944
Subgenus <i>Ochlerotatus</i> Lynch Arribalzaga			
<i>atlanticus</i> Dyar and Knab		US Army 1958 ^{3,4}	
<i>atropalpus</i> (Coquillett)	*1997 ¹		
<i>canadensis canadensis</i> (Theobald)	Moore 1999 ^{1,3}	Carpenter 1952	Quinby et al. 1994
<i>dorsalis</i> (Meigen)	Moore 1999 ¹	US Army 1987 ²	
<i>dupreei</i> (Coquillett)		Moore 1999 ¹	Quinby et al. 1944
<i>fulvus pallens</i> Ross		Moore 1999 ^{2,3}	Moore 1999 ^{2,3}
<i>grossbecki</i> Dyar and Knab		Moore 1999 ¹	Moore 1999 ¹
<i>infirmatus</i> Dyar and Knab		Moore 1999 ¹	Moore 1999 ¹
<i>mitchellae</i> (Dyar)		US Army 1963 ^{2,5}	
<i>sollicitans</i> (Walker)		US Army 1963 ^{2,6}	
<i>sticticus</i> (Meigen)	Shlaifer and Harding 1946	Carpenter 1952	Quinby et al. 1944
<i>taeniorhynchus</i> (Wiedemann)		US Army 1987 ^{2,7}	
<i>tormentor</i> Dyar and Knab		US Army 1958 ^{3,4}	Moore 1999 ¹
<i>trivittatus</i> (Coquillett)	Moore 1999 ¹	US Army 1959-61 ²	TVA 1988 ³
Subgenus <i>Protomacleaya</i> Theobald			
<i>hendersoni</i> Cockerell	Moore 1999 ¹	Moore 1999 ¹	
<i>triseriatus</i> (Say)	Shlaifer and Harding 1946	Carpenter 1952	Quinby et al. 1944
Subgenus <i>Stegomyia</i> Theobald			
<i>aegypti</i> (Linnaeus)	Shlaifer and Harding 1946	Moore 1999 ¹	Quinby et al. 1944
<i>albopictus</i> (Skuse)	CDC 1988 ⁸	CDC 1988 ⁸	CDC 1993 ^{1,3}
Genus <i>Anopheles</i> Meigen			
Subgenus <i>Anopheles</i> Meigen			
<i>barberi</i> Coquillett	Moore 1999 ¹	Carpenter 1952	Quinby et al. 1944
<i>crucians</i> Wiedemann	Shlaifer and Harding 1946	Carpenter 1952	Quinby et al. 1944
<i>perplexens</i> Ludlow	Moore 1999 ¹	Moore 1999 ^{1,3}	Moore 1999 ^{1,3}
<i>punctipennis</i> (Say)	Shlaifer and Harding 1946	Carpenter 1952	Quinby et al. 1944
<i>quadrimaculatus</i> Say <i>sensu lato</i>	Shlaifer and Harding 1946	Carpenter 1952	Quinby et al. 1944
<i>quadrimaculatus</i> Say <i>sensu stricto</i>	Moore 1999 ¹	Moore 1999 ^{1,3}	Moore 1999 ³
<i>smaragdinus</i> Reinert	Moore 1999 ¹	Moore 1999 ²	Moore 1999 ²
<i>walkeri</i> Theobald	Moore 1999 ¹	Moore 1999 ¹	Moore 1999 ¹
Genus <i>Coquillettidia</i> Dyar			
Subgenus <i>Coquillettidia</i> Dyar			
<i>perturbans</i> (Walker)		Carpenter 1952 ⁹	
Genus <i>Culex</i> Linnaeus			
Subgenus <i>Culex</i> Linnaeus			
<i>nigripalpus</i> Theobald		US Army 1963 ^{2,10}	
<i>pipiens</i> Linnaeus ¹¹	Shlaifer and Harding 1946	US Army 1954 ²	Quinby et al. 1944
<i>quinquefasciatus</i> Say ¹¹	Shlaifer and Harding 1946	US Army 1953 ¹	Quinby et al. 1944
<i>restuans</i> Theobald	Shlaifer and Harding 1946	Carpenter 1952	Quinby et al. 1944
<i>salinarius</i> Coquillett	Shlaifer and Harding 1946	Carpenter 1952	TVA 1988 ^{1,3}
<i>tarsalis</i> Coquillett	Shlaifer and Harding 1946	Carpenter 1952	Quinby et al. 1944
Subgenus <i>Melanoconion</i> Theobald			
<i>erraticus</i> (Dyar and Knab)	Moore 1999 ^{1,2,3}	Carpenter 1952	Quinby et al. 1944
<i>peccator</i> Dyar and Knab	Moore 1999 ¹	Moore 1999 ¹	Quinby et al. 1944
Subgenus <i>Neoculex</i> Dyar			
<i>territans</i> Walker	Shlaifer and Harding 1946 ¹²	Carpenter 1952	Quinby et al. 1944 ¹²

TABLE 1. Continued.

Taxon	Montgomery Co., TN	Fort Campbell, KY	Christian Co., KY ¹
Genus <i>Culiseta</i> Felt			
Subgenus <i>Climacura</i> Howard, Dyar and Knab			
<i>melanura</i> (Coquillett)	Moore 1999 ¹	Moore 1999 ¹	
Subgenus <i>Culiseta</i> Felt			
<i>inornata</i> (Williston)	Shlaifer and Harding 1946	**US Army 1967 ²	Quinby et al. 1944
Genus <i>Orthopodomyia</i> Theobald			
<i>alba</i> Baker	Moore 1999 ¹	US Army 1963 ²	
<i>signifera</i> (Coquillett)	Shlaifer and Harding 1946	Carpenter 1952	Quinby et al. 1944
Genus <i>Psorophora</i> Robineau-Desvoidy			
Subgenus <i>Grabhamia</i> Theobald			
<i>columbiae</i> (Dyar and Knab)	Shlaifer and Harding 1946 ¹³	Carpenter 1952 ¹³	Quinby et al. 1944 ¹³
<i>discolor</i> (Coquillett)	Shlaifer and Harding 1946	Carpenter 1952	Quinby et al. 1944
Subgenus <i>Janthinosoma</i> Lynch Arribalzaga			
<i>cyanescens</i> (Coquillett)	Shlaifer and Harding 1946	Carpenter 1952	Quinby et al. 1944
<i>ferox</i> (von Humboldt)	Shlaifer and Harding 1946	Carpenter 1952	Quinby et al. 1944
<i>horrida</i> (Dyar and Knab)	Moore 1999 ¹	Carpenter 1952	Quinby et al. 1944
<i>mathesoni</i> Belkin and Heinemann	Shlaifer and Harding 1946 ¹⁴		
Subgenus <i>Psorophora</i> Robineau-Desvoidy			
<i>ciliata</i> (Fabricius)	Shlaifer and Harding 1946	Carpenter 1952	Quinby et al. 1944
<i>howardii</i> Coquillett	Moore 1999 ¹	Moore 1999 ^{1,2}	Moore 1999 ^{1,2}
Genus <i>Toxorhynchites</i> Theobald			
Subgenus <i>Lynchiella</i> Lahille			
<i>rutilus septentrionalis</i> (Dyar and Knab)	Moore 1999 ¹	Carpenter 1952	Moore 1999 ¹
Genus <i>Uranotaenia</i> Lynch Arribalzaga			
Subgenus <i>Uranotaenia</i> Lynch Arribalzaga			
<i>sapphirina</i> (Osten Sacken)	Shlaifer and Harding 1946	Carpenter 1952	Quinby et al. 1944

* Personal collection by the author; unpublished data.

** Erroneously reported by the author (Moore 1999) as later recorded.

¹ Collected as larvae or pupae.

² Collected as adult (light trap).

³ Collected as adult (resting, landing, or feeding).

⁴ Record based on specimens collected in 1963–1967; reported by United States Army as “*Aedes atlanticus-tormentor*” (sic) (Saugstad 1977; United States Army Center for Health Promotion and Preventive Medicine (CHPPM), personal communication).

⁵ Record based on adult *Aedes mitchellae* specimens collected by New Jersey light trap: 2 in 1963 and 2 in 1966 (CHPPM, personal communication); no specimens reported since 1966.

⁶ Record based on several *Aedes sollicitans* adults collected by New Jersey light trap: 1 in 1963, 9 in 1964, 42 in 1966, 19 in 1967, and 19 in 1987 (CHPPM, personal communication); no *A. sollicitans* specimens reported since 1987.

⁷ Record based on 63 *Aedes taeniorhynchus* specimens collected by New Jersey light trap in 1987 (CHPPM, personal communication); none reported since 1987.

⁸ Collected as egg during oviposition cup sampling for *Aedes albopictus* (C. Moore, Centers for Disease Control and Prevention (CDC), personal communication).

⁹ Reported as *Mansonia perturbans*.

¹⁰ Record based on United States Army specimens collected by New Jersey light trap: 91 in 1963, 144 in 1964, and 4 in 1967 (CHPPM personal communication); non reported since 1967. However, reports of *Culex nigripalpus* from Fort Campbell military collection records are doubtful (B. Harrison, personal communication).

¹¹ Using the taxonomic reference of Darsie and Ward (1981), *Culex pipiens* and *Culex quinquefasciatus* cannot be separated based on morphological features of larvae or adults. Differentiation may be derived from maps of expected geographical distribution provided by Darsie and Ward (1981). However, Tennessee and Kentucky are located in a region of overlapping distributions for these species. The taxonomic references of previous researchers are unreported. Where previous reports differentiate between the two species, the distinction is continued.

¹² Reported as *Culex apicalis*.

¹³ Reported as *Psorophora confinnis*.

¹⁴ Reported as *Psorophora varipes*.

Fort Campbell and Christian County, Kentucky and Montgomery County, Tennessee probably includes 49 species. This list would include the 49 species listed for Fort Campbell (Table 1), with the exception of *A. atlanticus*, *A. mitchellae*, and *C. nigripalpus*, and the probable addition of *A. atropalpus*, *P. mathesoni*, and *A. maverlius*. There is a continuing need for surveys of mosquito populations throughout Tennessee and Kentucky. Typically, unless an insect poses an immediate nuisance or health threat, causes an intolerable amount of crop damage, or possesses uncommon beauty, it is often ignored, even by entomologists. The ubiquitous mosquito is the focus of extensive control efforts. Less common are efforts to understand and document the bionomics and ecological importance of the family. The connection between mosquitoes and ecological health need further study.

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