

## A LIST OF THE MOSQUITOES OF PENNSYLVANIA WITH NOTES ON THEIR DISTRIBUTION AND ABUNDANCE<sup>1</sup>

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The earliest records of mosquitoes from Pennsylvania are apparently those of Thomas Say (1) who in 1823 stated that *Culex damnosus* (*Aedes teniorhynchus* Wiedemann) and *Culex triseriatus* (*Aedes triseriatus* [Say]) inhabited Pennsylvania. Howard and Marlatt (2) listed three species of mosquitoes from Pennsylvania including new records of *Anopheles punctipennis* Say and *Culex posticus* Wiedemann (*Psorophora ferox* [Humboldt]). Howard (3) added a new record of *Culex pungens* Wiedemann, which obviously refers, at least in part, to *Culex pipiens Linneaus*. Giles (4) gave four species as occurring in Pennsylvania of which *Anopheles crucians* Wiedemann and *A. quadrimaculatus* Say were previously unrecorded. Howard (5), in addition to the species listed in his previous paper, stated that *Psorophora ciliata* (Fabricius) "is known to occur in Pennsylvania."

Howard, Dyar, and Knab (6) reported eight species of mosquitoes from Pennsylvania including five new state records. These were *Culex territans* (*C. apicalis* Adams), *C. restuans* Theobald, *C. salinarius* Coquillett, *Aedes atropalpus* Coquillett and *A. canadensis* Theobald. Dyar (7) added new records of *Aedes dorsalis* (Meigen) and *A. sollicitans* (Walker), and later (8) he added a record of *Anopheles barberi* Coquillett. More recently Stabler (9) published a list of 17 species of mosquitoes which he had taken by means of light trap and biting collections in Delaware County, Pennsylvania.

<sup>1</sup>We wish to express our appreciation to Major Russell W. Gies for furnishing us with many collection records for Delaware and Philadelphia Counties and to Dr. Robert M. Stabler for permitting us to study specimens collected in Delaware County. We are indebted to Mrs. Miriam Boyers Horn and Miss Mary Louise Fagley for performing much of the identification work and for assisting in the compilation of data.

This list included eight species that were previously unrecorded and made a total of 24 species known from the state.

In the present paper we are listing 34 species of mosquitoes now known to occur in Pennsylvania. This list includes new records of all the previously reported species except *Aedes atropalpus* and *A. dorsalis*. It also includes ten species which are here reported for the first time from Pennsylvania. In addition to this State list we are including a considerable number of new locality records for most of the species as well as notes on the abundance of the various species in different sections of the state.

The data herein presented are based on four years of mosquito survey work performed in Pennsylvania by Malaria Control in War Areas personnel. This work was initiated during the summer of 1941 when an extensive survey was made in Philadelphia and adjacent areas of Delaware County under the supervision of Major Russell W. Gies, USPHS. Survey at Butler and Phoenixville were performed by Capt. Roy F. Fritz, USPHS in August, 1943. Since that time the writers have made additional collection in the above-mentioned areas and have carried out surveys in 17 other localities.

Although our work has been primarily concerned with determining the anopheline mosquito populations in the vicinity of Army and Navy establishments, we have also collected and identified most of the culicine species which were encountered. In addition to our regular survey a number of miscellaneous collections have been made in various sections of the State as the opportunities afforded. Altogether, we have made collections in 37 localities in 23 of the 67 counties in Pennsylvania. Counties in which collections have been made are: Allegheny

Bucks, Butler, Chester, Cumberland, Dauphin, Delaware, Erie, Forest, Franklin, Huntingdon, Lancaster, Lawrence, Lebanon, Lehigh, McKean, Mercer, Monroe, Philadelphia, Pike, Potter, Warren, and York. In addition to these collections, we are including some records of the Delaware County Mosquito Commission which were furnished us through the kindness of Dr. R. M. Stabler.

The species of mosquitoes now known from Pennsylvania are given in alphabetical order in the following list. The records are those of Malaria Control in War Areas collections except when otherwise indicated. Species not previously reported from the State are preceded by an asterisk. Under each species we have included the localities where it has been taken, the type or types of collections, its abundance, and the earliest and latest months during which it was collected. The name of the nearest town or city that can be located on an ordinary road map is used to indicate the locality.

Symbols are used to indicate the type of collections as follows: (B)—biting; (L)—larval; (N)—sweeping vegetation with an insect net; (R)—adults reared from larvae or pupae; (S)—diurnal resting station; and (T)—light trap. Density ratings are based on the maximum number of specimens taken in the locality in a single collection. A species is generally considered to be rare in a given locality at a given time if no more than nine specimens were found in any one collection; it is considered to be common if from 10 to 99 specimens were taken in one collection; and abundant if 100 or more were taken in a single collection. For some of the rarer species the exact number of specimens, as well as the specific dates of collection are given. General statements relative to the abundance of species in the State are based on more than three years' experience in collecting mosquitoes in this and neighboring States.

In addition to the species included in the following list, three species which we have taken in neighboring states should be listed as of probable occurrence in

Pennsylvania. These species are: *Aedes aurifer* (Coquillett), *Anopheles occidentalis* Dyar and Knab, and *Wyeomyia smithii* (Coquillett).

#### *Aedes atropalpus* (Coquillett)

This species breeds in rock holes along streams and other bodies of water. We have not taken any specimens in Pennsylvania but it was reported from Shenk's Ferry (Lancaster County) by Howard, Dyar and Knab (6).

#### *Aedes canadensis* (Theobald)

This is a common mosquito in Northeastern United States and is usually the first species found in early spring. It occurs in diminishing numbers throughout the summer.

Allentown, (B), rare, July. Buckingham, (L), common, May. Butler, (B), common, June. Galeton, (B), common, August. Glen Mills (9). Kane, (B,L), common, July. Phoenixville, (S), rare, May-June. Sheffield, (B,L), rare, July. Shenk's Ferry, (Lancaster County) Oct. (6). Tobyhanna, (B), rare, July. West Middlesex, (B), common, July.

#### *Aedes cantator* (Coquillett)

*A. cantator* is common along the North Atlantic Coast where it breeds in the brackish coastal marshes. It is a fairly troublesome pest in the southeastern part of the State.

Glen Mills, (B,L,T), common, July (9, in part). Phoenixville, (T), rare, June-Aug. (Identification verified by male genitalia). Ridley Park, (T), rare, June. Swarthmore, (S), rare, June.

#### \**Aedes cinereus* Meigen

This small brown *Aedes* has been taken in very small numbers from only four localities in the State. It is a common pest in the more northern states where it breeds principally in woodland pools.

Chester, 1 female, Aug. 12, 1945, R. M. Stabler. Hawley, (B), 1 female, Aug. 1, 1945. Norwood, 2 females, Aug. 12, 29, 1945, R. M. Stabler. West Middlesex, (B), 1 female, July 18, 1945.

*Aedes dorsalis* (Meigen)

This species is generally rare in the Eastern States. We have not taken it in Pennsylvania but it has been reported from Philadelphia by Dyar (7).

*\*Aedes excrucians* (Walker)

*A. excrucians* is apparently much less common in Pennsylvania than in the more northern States. It is difficult to separate the females of this species from those of *A. fitchii* and *A. stimulans* and these records should be regarded as tentative. Its occurrence in Pennsylvania seems probable, however, since it is known from New York and New Jersey. We have only four specimens, all females, which were taken in a biting collection in a wooded area near West Middlesex, July 18, 1945.

*\*Aedes fitchii* (Felt and Young)

We have four females from Buckingham which appear to be this species. These specimens were collected by sweeping vegetation with an insect net on May 18, 1945.

*Aedes sollicitans* (Walker)

This is the famous "Jersey" mosquito which is abundant along the Atlantic and Gulf Coasts from Maine to Texas. It is a fierce biter and a strong flyer, often travelling many miles from its breeding areas in the coastal marshes. It has also been found occasionally to breed in inland areas in saline waters from salt wells, oil wells, etc. (10). It is a serious pest in the southeastern part of Pennsylvania but has not been taken elsewhere in the State.

Chester, (T), common, June. Darby, (T), common, June-September. Glen Mills (9). Norwood, (T), common, June-August. Philadelphia, (L,T), common, June-September. Philadelphia Neck (7). Ridley Park, (L,T), rare, June-September.

*\*Aedes sticticus* (Meigen)

*A. strictus* is a floodwater species which is distributed over the entire eastern United States. We have observed it in tremendous numbers in neighboring states where at times it renders life almost unendurable. Under favorable conditions, it undoubtedly occurs more abundantly in Pennsylvania than our collections so far indicate. We have collected only one male and eight females from four localities in the state. We have also received two females from Dr. R. M. Stabler which were taken in a biting collection along with great numbers of *A. trivittatus* in Delaware County.

Buckingham, (N), 1 male (verified by genitalia) and 1 female, May 18, 1945. Butler, (B), 1 female, June 21, 1944. Delaware County, (B), 2 females, Aug. 4, 1945, R. M. Stabler. Greenville, (B,S), 5 females, June 22, 1944. West Middlesex, (B), 1 female, July 18, 1945.

*\*Aedes stimulans* (Walker)

This is one of the most annoying of the woodland mosquitoes of the Northeastern States in spring and early summer. It is probably common throughout much of the State.

Buckingham, (N), common, May. Greenville, (B,S), common, June. Philadelphia, (T), 2 females, July 12, 1942. West Middlesex, (B), 3 females, July 18, 1945.

*Aedes taeniorhynchus* (Wiedemann)

This small salt-marsh mosquito is a severe pest along the South Atlantic Coast, but it is not sufficiently abundant in this State to be of much importance. It is known only from the southeastern area.

Glen Mills (9). Philadelphia, (T), 2 females, July 21, 1942; 2 females, August 21, 1942; 2 females, September 16, 1942.

*Aedes triseriatus* (Say)

This species breeds in tree holes and is a severe and persistent biter. It has been taken in widely scattered localities though

it has not been found in very great numbers.

Allentown, (B), 6 females, July 21, 1945. Butler, (B), 5 females, June 21, 1944. Delaware County (2). Galeton, (B), 4 females, Aug. 2, 1945. Greenville, (B), 1 female, June 30, 1944. Philadelphia, (T), 2 females, Sept. 8, 1942. Phoenixville, (T), 1 female, July 3, 1944.

*Aedes trivittatus* (Coquillett)

*A. trivittatus* breeds in temporary pools and sometimes becomes a severe pest after periods of heavy rainfall. On one occasion we encountered this species in great numbers near Allentown. They proved to be severe biters when their shaded retreat was invaded, but would not follow us out into the bright sunshine as we departed. A temporary pool nearby was dipped as carefully as the thousands of biting pests would permit, but only three larvae of *A. trivittatus* were obtained. They were taken in association with a few larvae of *A. vexans* and *Anopheles punctipennis*. Dr. Stabler informs us that he has also taken this species in great numbers in Delaware County.

Allentown, (B,L,N,R), abundant, July-August. Buckingham, (L,R), 2, May 18, 1945. Delaware County, (B), abundant, August 4, R. M. Stabler. Galeton, (L), 1, Aug. 2, 1945. Glen Mills (7). Greenville, (B), 5 females, June 22, 1944. Kane, (B), 1 female, July 18, 1945. Philadelphia, (T), 1 female, Sept. 1, 1942.

*Aedes vexans* (Meigen)

This is the most severe and widespread pest among the *Aedes* mosquitoes of this area. The larvae have been most frequently found in temporary roadside and meadow pools.

Allentown, (B,L,N,R), common, August. Buckingham, (L,N), abundant, May. Chester, (L,T), common, June-September. Darby, (L,T), abundant, June-September. Glen Mills (9). Greenville, (B,S), abundant, June. Kane, (L), rare, July. Lancaster, (L), rare, July. Marienville, (L), rare, July. Middletown, (B), rare, May. Northeast, (B), rare, June.

Norwood, (T), abundant, June-September. Philadelphia, (L,T), abundant, June-September. Phoenixville, (S,T), common, June-September. Ridley Park, (L,T), common, June-September. Swarthmore, (S), rare, June.

*Anopheles barberi* Coquillett

This small anopheline breeds in tree holes. Matheson (11) states that it is probably more abundant than generally recognized. We have records from only two localities in the State. In both cases the specimens were collected from privies.

Butler, (S), 1 male and 1 female, Aug. 27, 1943, Roy F. Fritz. Pine Grove Furnace, (S), 1 male, Aug. 11, 1944.

*Anopheles crucians* Wiedemann

This species is relatively rare in Pennsylvania. It has been taken only in the southeastern part of the State.

Chester, (T), rare, August-September. Darby, (T), rare, July-September. Norwood, (T), rare, July-September. Philadelphia, (T), common, June-September. Phoenixville, (S,T), rare, June-August. Ridley Park, (T), rare, July-August. Swarthmore, (S), rare, June.

*Anopheles punctipennis* Say

*A. punctipennis* is by far the most common anopheline in Pennsylvania. It breeds in a wide variety of situations and has been taken in practically every locality where inspections have been made.

Allentown, (L,R), common, August. Butler, (S), rare, June-August. Carlisle, (L,R,S), common, August. Chambersburg, (L,S), common, June. Chester, (T), rare, June-September. Cochranville, (L,R), rare, July. Danville (6). Darby, (L,T), rare, June-September. Galeton, (B,L,R,S), common, August. Glen Mills (9). Greenville, (L,S), common, June-August. Huntingdon, (L,R), common, July. Indiantown Gap, (S), rare, June. Lancaster, (L,R), common, July. Marienville, (L,R), rare, July. Middletown, (S), rare, July. Mount Gretna (12). New Castle, (L,R,S), rare, July. Norwood, (T), rare, June-September. Phila-

delphia, (L,R,T), rare June–September. Phoenixville, (L,R,S,T), common, June–September. Pine Grove Furnace, (L,S), rare, August–October. Pittsburgh, (L,S), rare, July. Ridley Park, (T), rare, June–September. Sharpsville, (S), rare, September. Swarthmore, (L,S), rare, June. Tionesta, (S), rare, September. L. E. Perry. West Chester, (L,R), rare, May. West Fairview (6). West Middlesex, (S), rare, July.

#### *Anopheles quadrimaculatus* Say

This is the common malaria mosquito of eastern United States. It was first reported in the State by Giles (4) who stated that it occurred in "the northwestern part of Pennsylvania." *A. quadrimaculatus* breeds principally in permanent ponds and swamps where the water is warm and well supplied with aquatic vegetation or floating debris. So far, we have not found many suitable breeding areas in the State and accordingly we have seldom taken this mosquito in significant numbers. While it is probable that *A. quadrimaculatus* will breed in quantity in any section of the State where local conditions are favorable (such as we have observed occasionally in the northwestern part of the State), we believe that it is generally much less common here than in the neighboring States of New Jersey and New York.

Chester, (T), rare, August–September. Darby, (T), rare, July–August. Greenville, (L,S), common, June–August. Norwood, (T), rare, August–September. Philadelphia, (L,T), common, June–September. Phoenixville, (S), rare, June–July. Ridley Park, (L,T), rare, September. Sharpsville, (L,R,S), rare, September. West Fairview (6). West Middlesex, (L,R,S), common, July.

#### \**Anopheles walkeri* Theobald

This anopheline is probably more common in the State than our collections indicate as both larvae and resting adults are usually rather difficult to locate. We have records from only four localities.

Carlisle, (L), 4, Aug. 9, 1945. Gale-

ton, (L), 1, Aug. 2, 1945. Philadelphia, (T), 3 males, 27 females, Sept. 16, 1942. Phoenixville, (T), 1 female, July 3, 1944.

#### *Culex apicalis* Adams

This small *Culex* occurs in considerable numbers throughout the State, but since it does not bite man its presence usually goes unnoticed.

Allentown, (L,N,R), rare, August. Butler, (L), rare, June. Chambersburg, (L,S), rare, June. Devon, June (6). Galeton, (L), abundant, August. Glen Mills (9). Greenville, (L,S), rare, June–August. Harrisburg, (S), rare, June. Hawley, (L,R,S), common, August. Huntingdon, (L), rare, July. Lancaster, (L), rare, July. New Castle, (L), abundant, July. New Cumberland, (L,S), rare, July. Norristown, July (6). Philadelphia, (L), common, June. Phoenixville, (L,R,S,T), rare, May–September. Pine Grove Furnace, (L,S), rare, August. Pittsburgh, (L), rare, July–August (6, in part). Pottsville, July (6). Reading, July (6). Ridley Park, (L), rare. Sunbury (6). Swarthmore, (L), common, June. Tobyhanna, (L), rare, July. West Chester, (L,R), rare, May. West Middlesex, (L), rare, July.

#### \**Culex (Melanoconion) sp.* Probably *erraticus* Dyar and Knab

Two specimens of this small dark species were collected in the Philadelphia vicinity by Dr. R. M. Stabler. This is a common southern species which is very rare at this northern limit of its range.

Norwood, 1 female, Aug. 31, 1945, R. M. Stabler. Philadelphia, (Tinicum), 1 female, Sept. 9, 1945, R. M. Stabler.

#### *Culex pipiens* Linnaeus

The common house mosquito occurs throughout the State, breeding in rain barrels, catch basins, polluted water, etc. It is probably the most important of the pest mosquitoes in Pennsylvania.

Altoona (6). Ardmore (6). Butler, (S), rare, June–August. Buckingham, (L), rare, May. Carlisle, (L,R), abundant, August. Chambersburg, (S), rare,

June. Darby, (L,T), abundant, June–September. Devon (6). Glen Mills (9). Greenville, (S), common, June–August. Harrisburg (6). Hawley, (L,R), rare, August. Indiantown Gap, (S), rare, June. Johnstown (6). Mercer, (S), rare, July. New Cumberland, (L,S), common, July. Norristown (6). Norwood, (T), abundant, June–September. Philadelphia, (L,S,T), abundant, June–September. Phoenixville, (L,R,S,T), common, May–September. Pine Grove Furnace, (S), rare, August. Pittsburgh, (S), rare, July. Pottsville (6). Ridley Park, (L,T), common, June–September. Springdale (6). Sunbury (6). Tobyhanna, (L), rare, July. Williamsport (6). York (6).

#### *Culex restuans* Theobald

*C. restuans* is very similar in appearance to the ordinary house mosquito, *C. pipiens*, except for the characteristic white dots which usually occur on the mesonotum. In many cases it has not been possible to separate the females of these two species with certainty. It seems probable, however, from the data at hand, that *C. restuans* is not uncommon in most sections of the State.

Buckingham, (L), rare, May. Butler, (S), rare, June. Carlisle, (L), rare, August. Chambersburg, (S), rare, June. Doylestown, (S), rare, May. Glen Mills (9). Greenville, (L,S), rare, June–August. Hawley, (L,R), common, August. Indiantown Gap, (S), rare, June. New Cumberland, (S), rare, July. Philadelphia, (S), rare, June. Norwood, 1 female, Sept. 13, 1945, R. M. Stabler. Phoenixville, (L,S,T), rare, May–September. Pine Grove Furnace, (S), rare, August. Sheffield, (S), rare, September.

#### *Culex salinarius* Coquillett

This mosquito breeds in both brackish and fresh water and seems to be distributed throughout the State.

Allentown, (N), rare, August. Alltoona (6). Butler, (S), rare, June. Carlisle, (L,S), common, August. Chambersburg, (S), rare, June. Glen Mills (9).

Greenville, (S), common, August. Hawley, (L,R), rare, August. Lancaster, (L), rare, July. New Cumberland, (S), rare, July. Norwood, 1 female, September 13, 1945, R. M. Stabler. Philadelphia, (L,T), rare, June–July. Phoenixville, (L,R,S,T), abundant, June–September. Swarthmore, (L), rare, June. York (6).

#### *Culiseta inornata* (Williston)

This large mosquito is rare in Pennsylvania. It is known from only two localities in the State.

Glen Mills, (T), 1 female (9). Philadelphia, (T), 2 females, Sept. 8, 1942; 3 females, Sept. 19, 1942.

#### \**Culiseta melanura* (Coquillett)

We have seen representatives of this species from two places in Delaware County where they were collected by Dr. R. M. Stabler. It is apparently a rare species in this State.

Chester, 4 females, Aug. 14, Sept. 8, Sept. 11, 1945, R. M. Stabler. Norwood, 1 female, Sept. 3, 1945, R. M. Stabler.

#### \**Culiseta morsitans* (Theobald)

*C. morsitans* is common in the more northern States but appears to be rare in Pennsylvania. We have collected it in only two localities.

Butler, (S), 1 female, June 21, 1944. Tobyhanna, (L), 2, July 6, 1945.

#### *Mansonia perturbans* (Walker)

This large mosquito is a fierce biter and a serious pest in many areas in the northeast. So far, we have not found it in very great numbers in this State though it has been taken in small numbers throughout most of the summer in the Philadelphia area.

The breeding habits of this species differ radically from those of other mosquitoes. Breeding takes place in marshes and ponds having a thick growth of aquatic vegetation. The larvae remain below the surface and obtain air by inserting the sharpened tip of their air tube into the stems and roots of plants. The

pupae also have breathing tubes adapted for penetrating the soft tissues of plants, to which they remain attached until ready for transformation into the adult stage.

Chester, (T), rare, June. Darby, (T), rare, June-July. Glen Mills (9). Northeast, (B), 7 females, June 30, 1944. Norwood, (T), rare, June-July. Philadelphia, (T), rare, June-September.

*Orthopodomyia signifera* (Coquillett)

This rare species breeds in treeholes. So far, it has been taken in only two localities.

Glen Mills, (T), 2 females (9). Philadelphia, (T), 2, Aug. 3, 1942.

*Psorophora ciliata* (Fabricius)

This is the largest mosquito known from the state and is also one of the most ferocious biters. Our collections have not revealed it to be present in significant numbers and it has been taken only in the southeastern area.

Darby, 1 female, Aug. 23, 1942. Glen Mills (9). Philadelphia, (T), 1 female, July 7, 1942; 2 females, Aug. 14, 1942; 1 female, Sept. 1, 1942.

*Psorophora confinnis* (Lynch Arribalzaga)

*P. confinnis* is a severe pest in some of the southern states, but it does not seem to be sufficiently abundant here to be of much importance. It has been taken only in the southeastern part of the State.

Chester, (T), 1 female, Aug. 20, 1942. Darby, (T), 13 females, July 26-Aug. 30, 1942. Glen Mills (9). Norwood, (T), 1 female, June 4, 1942; 1 female, July 21, 1942. Philadelphia, (T), 24 females, July 21-Sept. 11, 1942. Phoenixville, (T), 1 male, 2 females, Aug. 16-Sept. 29, 1944; 3 females, Aug. 24-Sept. 7, 1945. Ridley Park, (T), 1 female, Aug. 20, 1942.

*Psorophora ferox* (Humboldt)

This white-footed woods mosquito is extremely rare in Pennsylvania.

Allentown, (B), 1 female, July 22, 1945. Montgomery County (2). Philadelphia, (L), 1, 1942.

*\*Psorophora horrida* (Dyar and Knab)

This species is rare in the Eastern States and has not been previously reported north of Washington, D. C. We have taken a single female in a biting collection in a wooded area near Allentown, August 10, 1945. This specimen has been deposited in the Cornell University collection.

*Uranotaenia sapphirina* (Osten Sacken)

This small brilliantly colored mosquito was only recently reported from the State. It is probably more common than our records indicate since it is not a pest species and is therefore often overlooked.

Glen Mills (9). Greenville, (L), rare, June. Philadelphia, (T), rare, June-September. West Middlesex, (L), common, July.

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