

History of Mosquito Taxonomy in the United States of America

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History is always a fascinating subject, but to a taxonomist it is doubly so since formal taxonomy is built on an historical base. I hope it is not necessary to justify further this attempt to illuminate briefly some of the interesting events in U. S. mosquito taxonomy.

A pivotal point in our story is January 1, 1758, the date established by the International Code of Zoological Nomenclature as marking the beginning of the consistent application of binominal nomenclature in zoology. A few mosquito descriptions were published prior to this date, but they are beyond the pale and do not enter into our considerations.

Considering the history of mosquito taxonomy by half century intervals, we find that 11 individuals published a total of 22 new species (eight of which are presently regarded as synonyms) in the period between 1758 and 1799 (Knight 1972). For only one of these species was the type locality within the United States.

The distinction of being the first mosquito species named from within the continental United States falls to *Psorophora ciliata*, named as *Culex ciliata* by Fabricius in 1794 (Type locality: "Habitat in Carolina - Mus. Dom. Bosc." Restricted to vicinity of Ten Mile Station, Charleston Co., South Carolina by Belkin, Schick and Heinemann 1966, 7). Type specimens are apparently not extant.

Fabricius has been called the "Linnaeus of insects" (Tuxen 1967,6) but beyond that he was probably the first individual to attempt to determine the systematic relationships of insects. We can take pride in his authoring the first species of mosquito to be described from the United States.

Describing the mosquito species of the United States began in earnest in the first half of the nineteenth century, in part as a result of the extensive expansion of the country which began in that period.

Between 1800 and 1849, the world mosquito fauna was increased by 183 species, with 5 additional genera (*Aedes*, *Anopheles*, *Megarhinus*, *Psorophora*, and *Sabethes*) being added to the one previously existing (*Culex*). Of this total, only 16 species were described from within the United States (Table 1).

The first individual to publish new mosquito species from our area in the nineteenth century was Christian Rudolph Wilhelm Wiedemann (1770-1840). Wiedemann was a German entomologist and zoologist and a professor at Kiel who became one of the first authorities on dipterous insects. His work, which was entirely descriptive, has been commended for its accuracy. Of the five U. S. species described by him, only one (*Anopheles crucians*) is presently considered to be valid. One species was described in 1821 and the other four in 1828. It is probable that all of these species are based upon specimens sent to him by Thomas Say. At least some of his type specimens exist in the Naturhistorisches Museum, Vienna, Austria.

Five of the species described in the first half of the nineteenth century were by Thomas Say (1787-1834). Considered as the father of American entomology, Say was born in Philadelphia. He was a Quaker who trained in pharmacy but later gave it up for natural history. In 1818, he participated in a collecting expedition to the coasts of Georgia and Florida and later, during 1819-1820, participated as naturalist on Long's Expedition into the far west. In 1823, he visited the sources of St. Peters River, Lake Winnepeg, and Lake of the Woods.

In 1825, he was induced to join the communal settlement at New Harmony Indiana, where he remained until his premature death (perhaps from dysentery) in 1834. Say's collections became the matter of considerable controversy but finally ended up at the Academy of Natural Sciences of Philadelphia. Unfortunately, none of his mosquito types have survived.

Of Say's six mosquito species, four remain valid today, all four of which are species of notable scientific and economic interest (Table 1).

Three species were described as new in this period by André Jean Baptiste Robineau-Desvoidy (1799-1857) in his *Essai sur la Tribu des Culicides* (1827), the earliest monograph of the mosquitoes of the world. All three of these species are now synonyms.

Robineau-Desvoidy has not been dealt kindly with by history. Swainson (1840) said of him: "A French physician, who has chiefly written various papers on the Diptera. In these he proposes upwards of 300 new generic names for the single family of Muscida. The spirit in which this is done, may be judged by the fact of his having made no allusion to the admirable work of Meigen and scarcely to any modern author. It is hardly necessary to say that the characters of these proposed groups are generally too trivial to deserve notice, and the whole work is undeserving of authority."

Much later, in describing the early outstanding dipterists, Coquillett (1904) said "On the other hand, at the very bottom of the list, one would be inclined to place the ubiquitous Robineau-Desvoidy; while his larger groups show some approach to a natural arrangement, his conception of a genus and species and his futile attempts at describing them, are as unsatisfactory as they well could be..."

The origin of the specimens used for two of his species is discussed in Belkin et al (1966).

Asa Fitch (1809-1879) described one mosquito species in 1847, now a synonym. Fitch was the first American entomologist commissioned by a state. He was educated as a physician but gave it up to enter upon a career in entomology in 1840. Eventually his systematic work was almost as extensive as his economic studies.

In 1848 and 1856, Francis Walker (1809-1874) described five species of mosquitoes from the United States. Three of these species are valid today and two of them are notorious as serious economic pests (*Aedes sollicitans* and *Mansonia perturbans*). A long-time curator of insects at the British Museum (Natural History), Walker was an industrious worker who published very extensively. He traveled widely and in the process amassed a great amount of material for the British Museum. He was held in sufficient regard in this country to have been posthumously elected an honorary member of the California Academy of Sciences, January 3, 1883.

A total of 13 species were described between 1850 and 1899 (table 2), with Walker being the only author describing species in both halves of the 19th century.

Frederik Maurits van der Wulp (1818-1899) described a synonym of *Mansonia perturbans* in 1867. He was a Dutch dipterist of renown and noted for his ability as an illustrator. After 1867, he had access to large collections of North American Diptera which undoubtedly accounts for the mosquito species which he named.

The well known diplomat and entomologist, Baron Carl Robert Osten Sacken (1828-1906), described *Uranotaenia sapphirina* in 1868 and a synonym of *Aedes cinereus* in 1877. A detailed account of his life was recently published by C. P. Alexander (1969). Osten Sacken resided in the United States from 1856 until 1877, for much of this time serving as Secretary of the Russian Legation and Consul General of Russia in New York City. Most of his work on Diptera, which is highly regarded, was done during this period. In 1878, he published the "Catalogue of Diptera of North America."

The only name in the list of Culicidae contained in Osten Sacken's catalog that is not based on U. S. specimens is *Anopheles maculipennis* Meigen. This was due to a long standing failure to recognize that the European *A. maculipennis* was distinct from the American entity, *A. quadrimaculatus*.

Samuel Wendell Williston (1852-1918), an American Dipterist well known for his "Manual of North American Diptera," described one new (and still valid) mosquito species in 1893. An M. D., as well as a PhD in paleontology and anatomy, he was one of the gifted amateur entomologists who subsequently attained full professional standing in the field. His total scientific output is quite impressive.

The last three culicid species described from the United States in the nineteenth century were by Daniel William Coquillett (1856-1911). All three of his species are valid and well known today. Reared on a farm in Illinois and with a strong early interest in natural history, Coquillett moved to Anaheim, California in 1882 because of failing health due to tuberculosis.

Recovering fully, he took up the study of insects with specialization in the Diptera. His work won the approval of C. V. Riley who in 1885 gave him an appointment in California as field agent of the Division of Entomology. He shares with Albert Koebele the honor of establishing the vedalia lady-beetle in California as a predator of the cottony cushion scale. His systematic work on Diptera began in 1886. In 1893, he moved to Washington, D. C. in the Division of Entomology and in 1896, he became an honorary custodian at the U. S. National Museum. Economically, the most important mosquito species named by him was *Culex tarsalis*, the primary vector of western encephalitis.

Space does not permit an elaboration of the 45 individuals who have described new mosquito species in the United States since 1900 (Table 3). Undoubtedly, many interesting events could be told about these individuals and about the significance of their contributions to the development of mosquito systematics.

Certainly, Harrison Gray Dyar (1866-1929) was the most significant worker of this period. Not only did his work cover the whole of the Americas, but it contributed significantly to the creation of the classification framework used in mosquito systematics today.

Table 4 summarizes the numbers of new mosquito species described from the United States for each decade since 1790. As is evident, the bulk of the new names was added between 1900 and 1929 and was the result in large part of Dyar's work.

Table 1 - New Mosquito Species Named From Within the United States
in the Period 1800-1849.

| Year Named | Original Name | Current Name | Type Location |
|---------------|---|---|----------------|
| 1821 | <i>Culex molestus</i> Wiedemann | <i>P. (Psorophora) ciliata</i> (Fabricius) | Georgia |
| 1823 | <i>Culex punctipennis</i> Say | <i>A. (Anopheles) puncti- pennis</i> (Say) | Maryland |
| 1823 | <i>Culex dammosus</i> Say | <i>Aedes (Ochlerotatus)</i> <i>taeniorhynchus</i> (Wiede- mann) | Pennsylvania |
| 1823 | <i>Culex triseriatus</i> Say | <i>Aedes (Finlaya) tri- seriatus</i> (Say) | Pennsylvania |
| 1823 | <i>Culex quinquefascia- tus</i> Say | <i>C. (Culex) quinquefas- ciatus</i> Say | Louisiana |
| 1824 | <i>Anopheles quadrimacu- latus</i> Say | <i>A. (Anopheles) quadri- maculatus</i> Say | Minnesota |
| 1827 | <i>Culex rubidus</i> Robineau-Desvoidy | <i>P. (Psorophora) ciliata</i> (Fabricius) | South Carolina |
| 1827 | <i>Culex boscii</i> Robineau-Desvoidy | <i>P. (Psorophora) ciliata</i> (Fabricius) | South Carolina |
| 1827 | <i>Culex consobrinus</i> Robineau-Desvoidy | <i>C. (Culex) p. pipiens</i> (Linnaeus) | Pennsylvania |
| 1828 | <i>Anopheles crucians</i> Wiedemann | <i>A. (Anopheles) crucians</i> Wiedemann | Louisiana |
| 1828 | <i>Culex taeniatus</i> Wiedemann | <i>Aedes (Stegomyia)</i> <i>aegypti</i> (Linnaeus) | Georgia |
| 1828 | <i>Culex pungens</i> Wiedemann | <i>C. (Culex) p. quinque- fasciatus</i> Say | Louisiana |
| 1828 | <i>Anopheles ferrugi- nosus</i> Wiedemann | <i>C. (Culex) p. quinque- fasciatus</i> Say | Louisiana |
| 1829 | <i>Culex musicus</i> Say | <i>Psorophora (Janthino- soma) ferox</i> (Humboldt) | Indiana |
| 1847 | <i>Culex hyemalis</i> Fitch | <i>A. (Anopheles) puncti- pennis</i> (Say) | New York |
| 1848 | <i>Culex excitans</i> Walker | <i>Aedes (Stegomyia)</i> <i>aegypti</i> (Linnaeus) | Georgia |

Table 2 - New Mosquito Species Named from Within the United States in the Period 1850-1899.

| Date Named | Original Name | Current Name | Type Location |
|------------|--|---|---------------------------------------|
| 1856 | <i>Culex territans</i> Walker | <i>C. (Neoculex) territans</i> Walker | South Carolina |
| 1856 | <i>Culex perturbans</i> Walker | <i>Mansonia (Coq.) perturbans</i> (Walker) | South Carolina |
| 1856 | <i>Culex conterrrens</i> Walker | <i>P. (Psorophora) ciliata</i> (Fabr.) | South Carolina |
| 1856 | <i>Culex sollicitans</i> Walker | <i>Aedes (Ochl.) sollicitans</i> (Walker) | South Carolina |
| 1867 | <i>Anopheles annulimanus</i> Van der Wulp | <i>A. (Anoph.) quadrimaculatus</i> Say | Wisconsin |
| 1867 | <i>Culex testaceus</i> Van der Wulp | <i>Mansonia (Coq.) perturbans</i> (Walker) | Wisconsin |
| 1868 | <i>Aedes sapphirina</i> Osten Sacken | <i>Uranotaenia sapphirina</i> (Osten Sacken) | District of Columbia & New York |
| 1869 | <i>Culex incidens</i> Thomson | <i>Culiseta (C.) incidens</i> (Thomson) | California |
| 1877 | <i>Aedes fuscus</i> Osten Sacken | <i>Aedes (A.) cinereus</i> Meigen | Massachusetts |
| 1893 | <i>Culex inornata</i> Williston | <i>Culiseta (C.) inornata</i> (Williston) | California |
| 1896 | <i>Megarhinus rutilus</i> Coquillett | <i>Toxorhynchites (Lynch- iella) rutilus</i> (Coquillett) | Florida |
| 1896 | <i>Culex signifera</i> Coquillett | <i>Orthopodomyia signifera</i> (Coquillett) | District of Columbia |
| 1896 | <i>Culex tarsalis</i> Coquillett | <i>C. (Culex) tarsalis</i> Coquillett | California |

Table 3 - Authors and Publication Dates of Articles Carrying New U. S. Mosquito Species Descriptions for the Period 1900-1973.

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|------------------------|---|-----------------------|------------------|
| Giles | 1900 | Baker | 1936 |
| Coquillett | 1901, 1902, 1903, 1904, 1906 | King | 1939 |
| Theobald | 1901, 1903, 1906 | Vargas | 1939, 1943 |
| Adams | 1903 | Aitken | 1939 |
| Felt & Young | 1904 | Ross | 1943 |
| Felt | 1904, 1905 | Randolph & O'Neill | 1944 |
| Grossbeck | 1904, 1905, 1906 | Middlekauf | 1944 |
| McCracken | 1904 | Roth | 1945 |
| Ludlow | 1904, 1905, 1906, 1907, 1911 | Buren | 1947 |
| Dyar | 1905, 1916, 1917, 1918, 1919, 1920, 1921, 1922, 1923, 1924, 1928, 1929 | Dodge | 1947 |
| Dyar & Knab | 1906, 1907, 1908, 1909, 1910, 1918 | Wirth | 1948 |
| Howard, Dyar & Knab | 1913 | Basham | 1948 |
| Knab | 1916 | Bohart | 1949, 1950 |
| Cockerell | 1918 | Thurman & Winkler | 1950 |
| Dyar & Ludlow | 1921 | Smith | 1952 |
| Hearle | 1923, 1927 | Belkin & McDonald | 1957 |
| Dyar & Shannon | 1924 | Barr | 1957 |
| Turner | 1924 | Rueger | 1958 |
| Matheson | 1933 | Belkin & Hogue | 1959 |
| | | Chapman & Barr | 1964 |
| | | Stone & Hair | 1968 |
| | | Zavortink | 1969, 1970, 1972 |
| | | O'Meara & Craig | 1970 |

Table 4 - Number of New Mosquito Species Described Per Decade from Within the United States.

| <u>Decades</u> | <u>#Nominal Species Described</u> |
|----------------|-----------------------------------|
| 1790-1799 | 1 |
| 1800-1809 | 0 |
| 1810-1819 | 0 |
| 1820-1829 | 14 |
| 1830-1839 | 0 |
| 1840-1849 | 2 |
| 1850-1859 | 4 |
| 1860-1869 | 4 |
| 1870-1879 | 1 |
| 1880-1889 | 0 |
| 1890-1899 | 4 |
| 1900-1909 | 94 |
| 1910-1919 | 28 |
| 1920-1929 | 19 |
| 1930-1939 | 6 |
| 1940-1949 | 11 |
| 1950-1959 | 7 |
| 1960-1969 | 4 |
| 1970-1973 | 4 |

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