

AN EXTENDED SURVEY OF MOSQUITO POPULATIONS IN AN ECOLOGICAL RESEARCH TRACT IN EASTERN NEW YORK

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ABSTRACT. In successive years 8 species of the genus *Aedes* were recorded by capture of females alighting on/or biting man. The pattern in each year was an early peak in collections of *Aedes punctor* (Kirby) followed by a decline and a subsequent peak in collection of *Aedes stimulans* (Walker), the two most numerous species. Apparent lower activity for all species was noted during

late June. Some individuals survived until September. Those *Aedes* spp. which were more numerous in adult collections were also found in larval surveys. Two *Culex* spp., two *Culiseta* spp., and *Wyeomyia smithii* (Coquillett) were collected as larvae but were not taken as adults. Larval surveys indicated that development of the *Aedes* spp. is limited to a single generation per year.

To establish the composition of the resident population of anthropophilous mosquitoes as a basis for subsequent studies, samples were taken over a 5-year period in a woodland in Otsego County, New York. The area studied is the upland portion of the Biological Field Station of the State University College at Oneonta, N. Y. It is located west of Otsego Lake and just north of the village of Cooperstown. The area consists of mature 2nd growth deciduous forest and of plantings of some conifers. A small amount of open grassland around the edge of a 40 (\pm) acre man-made pond, an old field lying between 2 segments of abandoned, unpaved airport runway, and a remnant of an old bog are also included in the research area.

Six sampling sites for collection of adult female mosquitoes were chosen in the spring of 1968. These consist of circles of 100-foot radius and were selected on the basis of proximity to apparent sources of larval development, position with regard to the total area to be sampled and differences in general aspect of the sites. They are referred to herein as sites I through VI.

Area I lies in a plantation of Norway spruce. The trees are about 25-30 ft. high and provide a generally dense cover. Area II lies on a rather steep west-facing slope which rises above a 40-acre pond. The canopy is largely hemlock and mixed hardwoods, and there is a rather sparse understory. Area III covers a slope at the east end of an abandoned airfield runway on the opposite side

of the pond. It is a largely open area of grass and weed growth and includes a small portion of a plantation of red pines about 5-8 feet tall. Area IV is a low, poorly drained area with thick undergrowth beneath higher deciduous trees. The understory is rather dense and includes numerous trees and shrubs, many of them fallen. Area V covers part of a well-drained southwest facing slope but lies largely in an adjacent poorly-drained low area. The canopy consists largely of mature hardwoods and the understory is rather sparse and open. Area VI lies on a south-facing slope in a relatively mature mixed hardwood stand with a well-developed understory.

Routine collections during the seasons of 1968, 1969, and 1970 were made by removal of adult female mosquitoes from human hosts. Collectors inverted a small killing vial over a single mosquito on the body surface. The vial was stoppered quickly as the mosquito flew upward. By using 3 to 5 such vials and alternately transferring the knocked-down individuals to a common vial the collectors could procure more alighting mosquitoes than with suction aspirators. This method was used for sampling during the latter part of 1968 and in 1969 and 1970. Collectors remained at each site for 20 minutes, collecting as many individuals as possible.

Due to problems involving multiple responsibilities of the collectors, the timing of sampling was somewhat variable. In 1968

two collectors working together took all 6 sampling sites on one day each week between the hours of 8:30 and 3:30 p.m. Sequence of sampling was altered each week in an attempt to minimize the effect of time of day on sampling success.

A single collector was involved in the sampling during 1969 and another during 1970. In these seasons samples were taken between 6 and 10 a.m., and all areas were not sampled on the same day. The sampling sequence was such that each site was visited once weekly. Samples were taken under prevailing weather conditions. Due to low numbers collected in the open situation of area III, this sampling site was abandoned early in 1970. It is recognized that quantitative comparisons must be made cautiously due to differences in collectors and timing of sampling (Khan *et al* 1971). As can be noted from Table 1 some sampling sites were

more productive than others in terms of species taken, and there was variation from year to year.

The most abundant species were *Aedes punctor* (Kirby) and *Aedes stimulans* (Walker). The sequence of collections indicated an early season peak for *A. punctor* followed by a decline in numbers and a subsequent later peak for *A. stimulans*. Somewhat smaller numbers of *Aedes canadensis canadensis* (Theobald) were collected, but this species was encountered throughout the summer in 1969 and 1970. An apparent low level for these species and for total species collected in late June suggested the possibility that more than one generation per season might be appearing. Attempts made to locate sites of larval development during the summers of 1968, 1969, and 1970 indicated that there was no apparent development of larvae of the species of *Aedes* encountered

TABLE 1. Adult female mosquitoes collected after alighting on human subjects in six sampling sites during 1968, 1969, and 1970. Roman numerals designate sites of collection, and Arabic numerals following parenthetically denote number of specimens collected at the site.

	1968	1969	1970
<i>Aedes trichurus</i> (Dyar)		I(1);II(10);III(2); IV(3);V(8);VI(9)	
<i>Aedes punctor</i> (Kirby)	I(3);II(1); IV(1);V(5);VI(4)	I(5);II(8);III(1); IV(1);V(104);VI(78)	I(36);II(30);III(1); IV(8);V(73);VI(63)
<i>Aedes canadensis canadensis</i> (Theobald)	I(11);II(12); IV(7);V(16);VI(5)	I(8);II(24);III(2); IV(21);V(26);VI(8)	I(8);II(28); IV(7);V(15);VI(8)
<i>Aedes stimulans</i> (Walker)	I(7);II(2); IV(13);V(5);VI(2)	I(77);II(58);III(10); IV(42);V(47);VI(62)	I(36);II(46);III(1); IV(58);V(57);VI(51)
<i>Aedes cinereus</i> Meigen	IV(1);	I(3);II(3); IV(18); ;VI(2)	I(1); IV(6);V(5);VI(2)
<i>Aedes triseriatus</i> (Say)	I(1); ;V(2);VI(8)	I(1);II(1); ;V(3);VI(1)	;V(1);VI(2)
<i>Aedes vexans</i> (Meigen)	I(1);II(1); ;V(1);	I(2);	
<i>Aedes riparius</i> (Dyar and Knab)		;V(1);	
<i>Mansonia perturbans</i> (Walker)		;II(1);	;II(1); ;V(1);
<i>Anopheles punctipennis</i> (Say)			;V(1);

(with the exception of *Aedes triseriatus* (Say), a treehole breeder) after early June. The apparent lack of larval breeding sites after the disappearance of surface water which accumulated from the snow melt and spring rains seemed to account for this; however, the lack of a regular larval survey schedule and possibility that water could accumulate and remain in some sites long enough for completion of a second larval generation indicated need for more systematic study.

During the summer of 1972 the author surveyed the area to locate sites of larval development and to determine whether occurrence of more than one larval generation could be established. Larvae were located by direct visual observation and collected using a long handled dipper. Larvae thus collected were reared singly until pupation and pupae held singly until adult eclosion. Species collected in this manner are listed in Table 2. No additional species of the genus *Aedes* were collected, and no larvae of any species

of this genus were found in surface water after June 9. The remaining species which were collected and reared had not been represented in any of the collections made by capture of biting and/or alighting females. *Culiseta morsitans* (Theobald) has been collected in the area during the summer of 1971 by the author and Miss Monichia Wang. *Wyeomyia smithii* (Coquillett) had been known to occur since 1970 when the larvae were collected from pitcher plants in the bog.

The remaining species, *Culiseta impatiens* (Walker), *Culex restuans* Theobald, and *Culex territans* Walker were collected initially in 1972. The single collection of *C. impatiens* was made from water which had collected in the pit left by the uprooting of a large tree. The tree was located at the edge of the bog, but the water which collected in the resulting hollow was not confluent therewith and appeared to have collected from runoff from the slope above the bog

TABLE 2. Mosquito species collected as larvae and reared singly to the adult stage during the spring and summer of 1972.

Species collected	number of specimens reared	first and last dates of collection
<i>Aedes canadensis canadensis</i> (Theobald)	39	V-23-1972 VI-9-1972
<i>Aedes stimulans</i> (Walker)	8	V-16-1972 V-31-1972
<i>Aedes punctor</i> (Kirby)	5	V-16-1972 V-26-1972
<i>Aedes trichurus</i> (Dyar)	4	V-16-1972 V-18-1972
<i>Culiseta morsitans</i> (Theobald)	6	V-26-1972
<i>Culiseta impatiens</i> (Walker)	4	VII-12-1972
<i>Wyeomyia smithii</i> (Coquillett)	1	VIII-3-1972
<i>Culex restuans</i> Theobald	21	VII-4-1972 VII-20-1972
<i>Culex territans</i> Walker	15	VII-20-1972 X-6-1972

edge. *C. restuans* and *C. territans* were collected from several sites and in some instances from temporary ground pools that had (when flooded early in the year) supported populations of one or more species of *Aedes*. These collection sites were also of interest in that they retained water for longer periods during 1972 than had been noted during any previous year. This summer had been characterized by unusually heavy and frequent rainfall. Additional sampling of biting adults was done by Mr. George P. Weir while involved in trapping small mammals. This work was done during the time in which these *Culex* species were present as adults, but the only specimens taken in the act of biting or alighting on man were species of *Aedes* which had been collected in previous sampling of this type.

One difficulty encountered throughout the study involved accurate determination of females of two species groups in the genus *Aedes*. *Aedes fitchii* (Felt and Young) females are quite difficult to distinguish from *A. stimulans* and *Aedes barri* Rueger (Nielsen and Horsfall, 1973), and the same difficulty is encountered in separating *A. punctor* from *Aedes punctodes* Dyar and *Aedes hexodontus* Dyar (Carpenter and LaCasse, 1955). Since the most numerous of the species collected in this study are among those listed, a problem exists. The larval surveys have accumulated considerable presumptive evidence for solution of this problem. The larvae of these two groups can be distinguished readily.

During the period covered by this study larvae of *A. punctor* and *A. stimulans* have been collected regularly. No larval specimens of the other species listed have been collected at any time. Although it is possible that the other species may be present and coming from distant larval breeding sites, the size of the area studied and the proximity of larval developmental sites to those of adult collection support the assumption that the specimens in question are *A. stimulans* and *A. punctor*. The compilations in tables in this paper are made on that basis.

The occurrence of *Aedes trichurus* (Dyar)

in all sites during 1969 and its absence in 1968 and 1970 seems somewhat unusual. It is one of the earliest developing species in the spring (Horsfall, 1955), and it is possible that the sampling series may have been started too late with respect to this periodicity. Larvae of this species were collected early in 1972. It would appear it may not be as long-lived in the adult stage under the conditions encountered here as are some of the other species of *Aedes*. Another possibility might be a difference in host selection as the adult ages. This problem is now under investigation.

In summary the principal features of the anthropophilous mosquito fauna of this woodland area appear to be an abundance of a few species of *Aedes* which develop in the water from snow melt and from early rains. Abundance and/or biting activity appears to peak earlier in the season for *A. punctor* and later for *A. stimulans*, the two principal components of the mosquito fauna attracted to man. It may be noted that a similar sequence of emergence for these species was reported by Haufe (1952) from studies made at Goose Bay, Labrador. *A. c. canadensis* is encountered regularly and generally in smaller numbers. Representatives of these species are present through the month of August or later. This appears to represent extended adult longevity, since no larvae of these species have been found later than the second week of June. *A. trichurus*, *Aedes cinereus* Meigen, *Aedes vexans* (Meigen), *Aedes riparius* Dyar and Knab, *A. triseriatus*, *Mansonia perturbans* (Walker) and *Anopheles punctipennis* (Say) have been taken from man in smaller numbers in biting and/or alighting collections. Of these less commonly encountered species only *A. trichurus*, *A. triseriatus*, and *A. cinereus* have been collected in larval surveys. *C. morsitans*, *C. impatiens*, *C. territans*, *C. restuans* and *W. smithii* have been collected as larvae but have not been found in collections from biting surveys. Larvae of the two last named species were collected from sites which had supported *Aedes* spp. populations earlier in the same year. Specimens upon which this study is based are maintained in

the permanent research collection at the SUCO Biological Field Station at Coopers-town, N.Y.

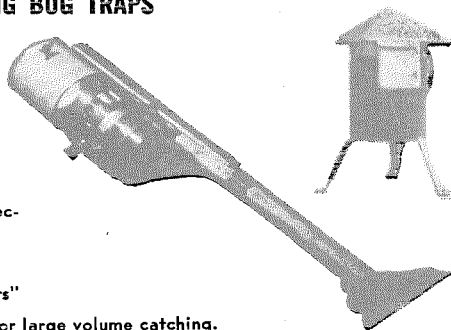
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