

Mosquito Diversity in St. Joseph County, Indiana (Diptera: Culicidae)¹

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Abstract

An intensive mosquito survey of St. Joseph County, Indiana, was undertaken in 1976 to provide information on mosquito diversity, distribution, and abundance within the area. Location of larval breeding sites was emphasized, supplemented by a New Jersey light-trap program and man-bait collections. Over 2000 larval sites were identified in the 500 square-mile area.

Of the 52 species of mosquito known to occur in Indiana, 35 (8 genera) are endemic to St. Joseph County. Larval sites for most species were identified within the county, and 31 species were represented in the light-trap collections.

Introduction

Until recently, all serious study of the native mosquito fauna of Indiana could be attributed to two men, the late Dr. Russell E. Siverly of Ball State University and John Hart of the Hayes Arboretum in Richmond. Siverly's publication, *Mosquitoes of Indiana* (1), is the most comprehensive source of information on the distribution of species within the state. However, only Delaware County (2) has been studied intensively enough to reveal the full complement of disease vector and non-vector species which occur in the area.

In the wake of the 1975 epidemic of St. Louis Encephalitis (SLE), many county health departments in Indiana sought to initiate mosquito control programs. Most counties began their programs with no knowledge of the potential vector species occurring in their areas. This critical information gap was generated by long-standing lack of public interest in mosquito control, apart from the individual efforts of Siverly and Hart. In Indiana, the "species sanitation" approach to mosquito control is advocated, in which only suspected vector species or major pest species are actively attacked. This is, of course, impossible unless (a) the target species are known, and (b) the larval breeding sites of the offending species are located.

In order to implement the species sanitation concept in St. Joseph County, the Vector Biology Laboratory of the University of Notre Dame undertook a large-scale mosquito survey in cooperation with the St. Joseph County Health Department. The objectives of the survey were (a) to locate every major larval breeding site in the county's approximately 500 square miles, and (b) through larval and adult sampling, obtain as much information as possible on mosquito diversity, distribution, and abundance within the county.

¹ This investigation was supported by the St. Joseph County, Indiana, Health Department, and by NIH Research Grant No. A1-02753.

Materials and Methods

Using relatively large numbers of locally trained personnel, each square-mile section of the county was systematically and intensively surveyed for even the smallest breeding sites (e.g., tires, cans, tire ruts, catch basins etc). During May-August, 1976, each section was completely surveyed twice, which often permitted collecting both "spring" and "summer" species at the same sites. Over 2000 breeding sites were thus identified.

Aquatic populations were sampled with long-handled pint dippers or turkey-baster syringes. Late-instar larvae were identified, and, when possible, early instars in each collection were reared to identifiable age as well. Pupae were allowed to complete development and were identified as adults. Also, egg rafts were allowed to hatch, and the larvae produced were identified.

Adult mosquito populations were also sampled. Man-bait collections were made at the larval production sites. In addition, New Jersey light trap stations were established in diverse parts of the county, and daily trap samples were identified.

Results and Discussion

As a result of the intensive survey of St. Joseph County during the summer of 1976, 35 species of mosquito were found (Table 1). Larval breeding sites within the county have been identified for most of these species.

On the basis of their ubiquity and human biting activity, *Aedes vexans* (Meigen), *Aedes trivittatus* (Coquillett), *Aedes triseriatus* (Say), *Aedes stimulans* (Walker) and *Aedes canadensis canadensis*

TABLE 1. *The mosquitoes of St. Joseph County, Indiana—1976.*

<i>Aedes</i>	<i>Coquillettidia perturbans</i> (Walker)
<i>abserratus</i> (Felt and Young)	<i>Culex</i>
<i>aurifer</i> (Coquillett)	<i>erraticus</i> (Dyar and Knab)
<i>canadensis canadensis</i> (Theobald)	<i>pipiens pipiens</i> Linnaeus
<i>cinereus</i> Meigen	<i>restuans</i> Theobald
<i>dorsalis</i> (Meigen)	<i>salinarius</i> Coquillett
<i>excrucians</i> (Walker)	<i>tarsalis</i> (Coquillett)
<i>fitchii</i> (Felt and Young)	<i>territans</i> Walker
<i>hendersoni</i> Cockerell	<i>Culiseta</i>
<i>sticticus</i> (Meigen)	<i>inornata</i> (Williston)
<i>stimulans</i> (Walker)	<i>melanura</i> (Coquillett)
<i>triseriatus</i> (Say)	<i>morsitans dyari</i> Coquillett
<i>trivittatus</i> (Coquillett)	<i>silvestris minnesotae</i> (Barr)
<i>vexans</i> (Meigen)	<i>Orthopodomyia</i>
<i>Anopheles</i>	<i>alba</i> Baker
<i>barberi</i> Coquillett	<i>signifera</i> (Coquillett)
<i>crucians</i> Weidemann	<i>Psorophora</i>
<i>punetipennis</i> (Say)	<i>ciliata</i> (Fabricius)
<i>quadrinaculatus</i> Say.	<i>columbiae</i> (Dyar and Knab) ¹
<i>walkeri</i> Theobald	<i>ferox</i> (Humboldt)
	<i>Uranoaenia sapphirina</i> (Osten-Sacken)

¹ *Psorophora columbiae* (Dyar and Knab) = *Ps. confinnis* (Lynch-Arribalzaga) (4,5).

(Theobald) are of considerable importance in St. Joseph County. *Anopheles punctipennis* (Say), *Anopheles quadrimaculatus* Say and *Culiseta inornata* (Williston) were commonly encountered, the latter species being very abundant in May.

Culex restuans Theobald and *Culex territans* Walker were exceedingly common and often locally abundant throughout 1976. *Culex pipiens pipiens* Linnaeus was not prevalent until the latter half of the mosquito season. There was no evidence of man-biting by any *Culex* species in our area, despite the status of *Cx. p. pipiens* as the presumed vector of human SLE in Indiana. Over a period of several years, Shroyer and Siverly (unpublished observations) failed to observe man-biting by *Cx. p. pipiens* in the state.

Though larval sampling was emphasized, 31 species and 8 genera were represented in 19,468 mosquitoes identified in the light trap program. As shown in Table 2, *Ae. vexans* was the most commonly captured species. While larval survey indicated that *Ae. vexans* and the *Culex* species were abundant, relative abundance of the species listed cannot be extrapolated from light-trap data due to the highly biased nature of this sampling method.

Of all adults captured in New Jersey light traps, 74% were females. The impracticality of routine preparation of male genitalia for identification accounts for part of the excess of females. Yet some common species with readily and reliably identifiable males (e.g. *Ae. vexans*, *An.*

TABLE 2. Summary of New Jersey light trap collections, 1976.

Species	No. of females	No. of males	Total no. collected	% of total
<i>Aedes vexans</i> -----	6,888	2,492	9,380	48.2
<i>Culex salinarius</i> -----	940	65	1,005	
<i>Culex restuans</i> -----	239	87	326	
<i>Culex pipiens pipiens</i> -----	215	195	410	
Mixed <i>Cx. restuans/pipiens</i> -----	2,585	198	2,783	32.1
Unidentifiable <i>Culex</i> -----	106	1,613	1,719	
<i>Aedes sticticus</i> -----	1,554	38	1,592	8.2
<i>Anopheles punctipennis</i> -----	428	41	469	2.4
<i>Anopheles quadrimaculatus</i> -----	292	38	330	1.7
<i>Culex territans</i> -----	245	61	306	1.6
<i>Coquillettidia perturbans</i> -----	266	18	284	1.5
<i>Aedes stimulans</i> -----	271	0	271	1.4
<i>Uranotaenia sapphirina</i> -----	86	117	203	1.0
<i>Anopheles walkeri</i> -----	108	0	108	0.6
Infrequently collected species ¹ -----	198	84	282	1.4
TOTAL	14,421	5,047	19,468	

¹ *Aedes triseriatus*, *Psorophora ciliata*, *Aedes excrucians*, *Orthopodomyia signifera/alba*, *Aedes trivittatus*, *Aedes hendersoni*, *Aedes canadensis canadensis*, *Culiseta inornata*, *Culex tarsalis*, *Aedes abserratus*, *Aedes dorsalis*, *Anopheles erueians*, *Culex erraticus*, *Aedes cinereus*, *Anopheles barberi*, *Culiseta melanura*, *Culiseta morsitans dyari*, *Psorophora ferox*, *Psorophora columbiacae*.

punctipennis, *Cx. territans*, and *Coquillettidia perturbans* (Walker)) also show a real paucity of males. This phenomenon could have several biological explanations, all of which remain unexamined. Bidlingmayer (3) reported similar data from New Jersey light traps in Florida.

During his two-decade study of the mosquito fauna of Delaware County, Indiana, Siverly (1, 2) identified a total of 32 species in the 400-square-mile area. The number of species in Delaware County compares favorably with the number found in the somewhat larger St. Joseph County. Prior to the present study, the mosquito fauna of St. Joseph County had not been seriously studied and *Aedes hendersoni* Cockerell (1) was the only resident species reported in the literature. Possibly, a few additional species will be discovered in St. Joseph County in the future.

Literature Cited

1. SIVERLY, R. E. 1972. Mosquitoes of Indiana. Indiana State Board of Health, Indianapolis. 126 p.
2. SIVERLY, R. E. 1972. Mosquitoes of Delaware County, Indiana. *Mosquito News*. 26 (2) :221-229.
3. BIDLINGMAYER, W. L. 1967. A comparison of trapping methods for adult mosquitoes: species response and environmental influence. *J. Med. Entomol.* 4 (2) :200-220.
4. BELKIN, J. N., S. J. HEINEMANN and W. A. PAGE. 1970. Mosquito studies (Diptera: Culicidae) XXI. The Culicidae of Jamaica. *Contr. Amer. Entomol. Inst.* 6 (1) :1-458.
5. ANONYMOUS. 1976. The *Psorophora confinnis* complex. Editorial note. *Mosquito News*. 36 (3) :376.