ACTIVITY OF GRAVID *AEDES TRISERIATUS* IN WOODED FENCEROWS[1]

ROGER S. NASCI

Vector Biology Laboratory, Department of Biology, University of Notre Dame,
Notre Dame, IN 46556

ABSTRACT. Ovitraps were used to monitor the oviposition of *Aedes triseriatus* and *Ae. hendersoni* over a 9-week period in 2 woodlots, 2 fencerows connecting the woodlots, and the surrounding open fields. There was no difference in the number of *Ae. triseriatus* eggs collected per trap in the fencerows and woodlots. In addition, there was no difference in the frequency with which eggs were laid in the 2 areas. *Aedes hendersoni* eggs were collected in greater numbers in the woodlots. The results suggest that fencerows can act as corridors for movement of *Ae. triseriatus* between woodlots.

INTRODUCTION

The frequency of *Aedes triseriatus* (Say) dispersal from its woodland larval habitat influences the degree of potential contact between this vector of LaCrosse encephalitis and susceptible hosts. This dispersal potential is one factor delimiting the expansion of LaCrosse virus from isolated foci. Information concerning *Ae. triseriatus* dispersal ability is critical in agricultural areas where the woodlot habitats of this mosquito are often islands isolated from similar habitats by open fields or the "agricultural mosaic" (Levenson[2]).

Studies of *Ae. triseriatus* dispersal have produced differing results. Some authors feel that dispersal by *Ae. triseriatus* is very limited and that this species rarely leaves the vicinity of the woodland larval habitat (Sinsko and Craig 1979). Others suggest that *Ae. triseriatus* disperse across large open areas (Garry and DeFoliart 1975, Scholl et al. 1979, DeFoliart and Lisitza 1980), and dispersal of gravid females through open areas is evident by the presence of *Ae. triseriatus* larvae in tires located in an open tire-yard (J. C. Beier, University of Notre Dame, unpublished data). The disparity between these observations is probably due to variations in habitat which may influence dispersal flight.

Bidlingmayer (1971) demonstrated with other mosquito species that the characteristics of the open spaces between wooded areas (ie. amount and type of vegetation) influences flight across these areas. Similarly, Beier and Trpis (1981) suggested that the presence of *Ae. triseriatus* in a relatively open area, as indicated by oviposition, was influenced by the vegetation in and around the open area. Haramis[3] suggested that a corn field provided a "vegetation bridge" facilitating flight of *Ae. triseriatus* between woodlots.

This paper examines wooded fencerows (ie. "the line originally following a fence which develops a distinguishable line of vegetation that may outlast the fence" Wegner and Merriam 1979) as potential vegetation bridges for dispersal between woodlots, and compares the rates of oviposition occurring in fencerows, woodlots and adjacent fields.

MATERIALS AND METHODS

The study site was located in Potato Creek State Recreation Area in St. Joseph County, Indiana. It consisted of 2 typical

---

[1] Supported by NIH grants AI06123 and AI02753.

[2] Levenson, J. B. 1976. Forested woodlots as biogeographical islands in an urban-agricultural matrix. Unpublished dissertation. University of Wisconsin-Milwaukee.

[3] Haramis, L. D. 1981. Survivorship, gonotrophic cycle, and dispersal of *Aedes triseriatus*. Unpublished dissertation. Ohio State University.

northern oak-beech-maple woodlots (each ca. 15 ha) surrounded on all sides by open fields of mowed grass or uncut low grasses (Fig. 1). In mid-summer the height of the grass did not exceed 10 cm in the mowed field and 1 m in the unmowed fields. Two fencerows, each approximately 100 m long, ran between the woodlots. The fencerows consisted of a one tree wide line of oak, maple, and apple trees, ranging in trunk diameter from 12–65 cm, interspersed with an understory of low herbaceous vegetation similar to that in the unmowed field.

Many basal treeholes containing water and actively producing mosquitoes were located in the woodlots during an initial survey. No treeholes were found in the fencerows. In addition, resting mosquitoes including *Ae. triseriatus* and *Ae. hendersoni* Cockerell were routinely collected for blood-meal identification studies in the understory of the woodlots with a large battery powered aspirator (Nasci 1981, 1982). No mosquitoes were collected in 2 similar attempts in the fencerows. Human-bait biting samples collected *Ae. vexans* (Meigen) and *Ae. trivittatus* (Coq.) in both areas while *Ae. triseriatus* and *Coquillettidia perturbans* (Walker) were collected only in the woodlots.

Ovitraps (Loor and DeFoliart 1969), half-filled with deionized water and containing a presoaked balsawood paddle (Novak and Peloquin 1981) were attached to the base of trees (ca. 0.5 m from the ground) and at 20 m intervals through the fencerows and extending into the woodlots (Fig. 1). One ovitrap was placed

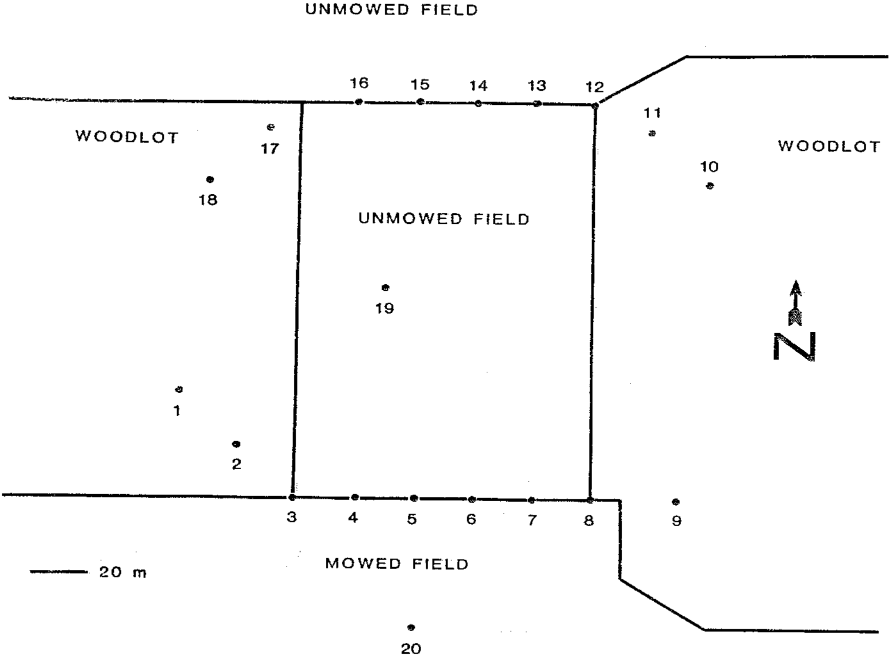

Fig. 1. Relative position of ovitraps in woodlots, fencerows and fields.

in a small clump of 4 maple saplings (5–8 cm diam) located in the unmowed field surrounded by the fencerows and woodlots (Fig. 1, Trap 19). The clump of saplings was 30 m from the nearest woodlot. The field contained no other stands of saplings. An additional trap was attached to a 1.5 m high metal post in the mowed field 50 m from the nearest trees (Fig. 1, Trap 20).

The paddles were removed and replaced and the water level adjusted once a week for 9 weeks from 5 August through 29 September 1980. In the laboratory, the eggs on each paddle were counted using a binocular dissecting microscope and hatched. The larvae were reared to 4th instar and identified to species. Statistical analysis was performed as described in Sokal and Rohlf (1969).

RESULTS

Over the 9-week period 11,260 eggs were collected. They were distributed as shown in Table 1. The mean number of *Ae. triseriatus* eggs collected per trap was 691 in the woodlots, 500 in the fencerows, and 58 in the fields. The frequency with which eggs were collected and the number of eggs collected by each trap indicated extreme variation between traps and among habitats. Only 1 trap (woodlot #18) contained eggs each of the 9 weeks of the study. Several traps contained eggs only 1 or 2 weeks, and 2 traps never collected eggs. When eggs were present in the traps, the numbers ranged from 8–598 per week in the fencerows and 39–656 per week in the woodlots.

Comparisons of oviposition between

Table 1. Distribution of *Aedes triseriatus* and *Ae. hendersoni* eggs in ovitraps placed in woodlots, fencerows, and open fields.[1]

Trap number	Location	Total eggs *Ae. triseriatus*	Total eggs *Ae. hendersoni*	Number of weeks trap contained eggs
1	Woodlot	87	18	1
2		156	0	2
9		1479	165	8
10		386	0	4
11		97	0	1
17		48	0	1
18		2586	530	9
Total woodlot		4839	713	
3	Fencerow	8	0	1
4		732	0	2
5		51	0	1
6		627	13	8
7		1001	0	3
8		300	61	5
12		0	0	0
13		349	0	2
14		85	0	1
15		1815	0	7
16		532	11	5
Total fencerow		5500	85	
19	Field	116	7	1
20		0	0	0
Total field		116	7	
Grand total		10455	805	

[1] Total of 9 weekly collections.

the woodlots and fencerows showed no differences in the total number of *Ae. triseriatus* eggs collected per trap in either site (ANOVA $p>.05$). In addition, there was no difference between the fencerow and woodlot traps in the frequency with which oviposition occurred (ANOVA $p>.05$). The results from the ovitraps in the mowed and unmowed fields were omitted from the statistical analysis because only 1 trap was placed in each site, and oviposition only occurred once in these traps during the course of the study.

When the woodlot and fencerow habitats are considered separately, significant differences were detected in the number of *Ae. triseriatus* eggs collected among traps as well as in the number of *Ae. triseriatus* eggs collected by the same trap from week to week in the woodlots (2 way ANOVA $p\leq.05$ among traps, $p\leq.001$ between weeks) and in the fencerows (2 way ANOVA $p\leq.05$ among traps, $p\leq.01$ between weeks).

Aedes hendersoni eggs were also collected in all 3 trap sites. They comprised a significantly greater proportion of the total number of eggs collected in the woodlot traps (12.8%) than in the fencerow traps (1.5%) (test for equality of 2 percentages, $p\leq.0001$). Again, the results from the field traps were omitted from statistical analysis due to the small sample size.

DISCUSSION

The detection of similar *Ae. triseriatus* oviposition rates in the fencerows and woodlots, without the resident mosquito population in the fencerows, and the extreme amount of variation in the oviposition patterns have several implications. The data indicate that gravid females fly extensively in search of oviposition sites, and that flight is not limited to woodlot habitats. The fencerows provided enough shelter to serve as corridors for flight by gravid females but because of their generally sparse understory and exposure to windy conditions relative to the woodlots, the fencerows in this study did not provide acceptable conditions for resting mosquitoes. It is likely that a fencerow with a heavier understory could contain resting mosquitoes since it has been demonstrated that the structure of the understory in a woodlot can influence the distribution and density of the resting mosquito population (Beier 1982). Nongravid *Ae. triseriatus* also may move through the fencerows, and bloodfeeding may occur in the fencerows since potential small mammal hosts use fencerows for dispersal (Wegner and Merriam 1979). If the fencerow understory is sparse, engorged females would have to fly out of the fencerow to find a suitable resting site.

Open fields do not appear to pose an absolute barrier to gravid *Ae. triseriatus* females since eggs were collected during 1 week in the trap sheltered by the small clump of saplings 30 m distant from the woodlot. It is possible that *Ae. triseriatus* flying in an open field would visually orientate toward patches of heavy vegetation for shelter, and that crossing large open spaces would be facilitated by such patches of vegetation.

The extreme variation in the number of eggs collected among traps, and from week to week by the same trap, in both the fencerows and woodlots, was an expected result of the effects of weather on flight activity and oviposition as well as the effect of ovitrap placement on collection efficiency. The observations that the numbers of eggs collected per trap and the frequency of oviposition in the fencerows and woodlots were statistically similar was less expected. Oviposition activity in the woodlot may have been severely underestimated due to the competition between woodlot ovitraps and natural treeholes (Beier and Trpis 1981), while the fencerow ovitraps experienced less competition and served as concentrated corridors of potential oviposition sites.

Aedes hendersoni appeared to be more restricted to the woodlot habitat than its sibling species *Ae. triseriatus*, though it also used ovitraps in the fencerows and field to some extent. More *Ae. hendersoni* activity may have been detected had sampling been conducted higher in the trees forming the fencerows and woodlots since this species oviposits frequently at upper elevations (Scholl and DeFoliart 1977, Sinsko and Grimstad 1977).

In summary, it appears that wooded fencerows provide suitable habitat for ovipositing *Ae. triseriatus* females, and serve as flight corridors between woodlots. These results demonstrate that the physical structure of the habitat influences the flight patterns of *Ae. triseriatus* and should be carefully considered when designing experiments to study dispersal as well as comparing results between areas.

ACKNOWLEDGMENTS. The author thanks Drs. J. C. Beier, G. B. Craig, Jr., and L. D. Haramis for their comments on a previous draft of this manuscript.

References Cited

Beier, J. C. 1982. Horizontal distribution of adult *Aedes triseriatus* (Diptera:Culicidae) in relation to habitat structure, oviposition, and other mosquito species. J. Med. Entomol. 19:237–45.

Beier, J. C. and M. Trpis. 1981. Local distribution of *Aedes triseriatus* (Diptera:Culicidae) at the Baltimore zoo. Mosq. News 41:447–55.

Bidlingmayer, W. L. 1971. Mosquito flight paths in relation to the environment. 1. Illumination levels, orientation, and resting areas. Ann. Entomol. Soc. Am. 64:1121–31.

DeFoliart, G. R. and M. A. Lisitza. 1980. Activity by *Aedes triseriatus* in open terrain. Mosq. News 40:650–52.

Garry, C. E. and G. R. DeFoliart. 1975. The effect of basal tree hole closure on suppression of *Aedes triseriatus*. Mosq. News 35:289–97.

Loor, K. A. and G. R. DeFoliart. 1969. An oviposition trap for detecting the presence of *Aedes triseriatus* (Say). Mosq. News 29:487–88.

Nasci, R. S. 1981. A lightweight battery-powered aspirator for collecting resting mosquitoes in the field. Mosq. News 41:808–11.

Nasci, R. S. 1982. Differences in host choice between the sibling species of treehole mosquitoes *Aedes triseriatus* and *Aedes hendersoni*. Am. J. Trop. Med. Hyg. 31:411–15.

Novak, R. J. and J. J. Peloquin. 1981. A substrate modification for the oviposition trap used for detecting *Aedes triseriatus* and *Aedes hendersoni*. Mosq. News 41:180–81.

Scholl, P. J. and G. R. Defoliart. 1977. *Aedes triseriatus* and *Aedes hendersoni:* Vertical and temporal distribution as measured by oviposition. Environ. Entomol. 6:355–58.

Scholl, P. J., C. H. Porter and G. R. DeFoliart. 1979. *Aedes triseriatus:* Persistence of nulliparous females under field conditions. Mosq. News 39:368–71.

Sinsko, M. J. and G. B. Craig, Jr. 1979. Dynamics of an isolated population of *Aedes triseriatus* (Diptera:Culicidae). J. Med. Entomol. 15:89–98.

Sinsko, M. J. and P. R. Grimstad. 1977. Habitat separation by differential oviposition of two treehole *Aedes* in Indiana. Environ. Entomol. 6:458–87.

Sokal, R. R. and F. J. Rohlf. 1969. Biometry. The principles and practice of statistics in biological research. W. H. Freeman and Co. San Francisco. 776 p.

Wegner, J. F. and G. Merriam. 1979. Movements by birds and small mammals between a wood and adjoining farmland habitats. J. Appl. Ecol. 16:349–57.

REVIEW OF APPLIED ENTOMOLOGY, SERIES B

The papers published in *Mosquito News* are selectively abstracted and indexed in the *Review of Applied Entomology, Series B*, compiled by the Commonwealth Institute of Entomology, London and published by the Commonwealth Agricultural Bureaux.