ADULT DISPERSAL OF *AEDES COMMUNIS* USING GIEMSA SELF-MARKING

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Univoltine *Aedes* mosquitoes have been implicated in the transmission of Jamestown Canyon (JC) virus in the eastern U.S. and Canada (Artsob 1983, Grayson et al. 1983). Among the suspected vectors is *Aedes communis* (DeGeer), a cold-tolerant species restricted to forests of the northern United States, Canada, Alaska, Europe and Siberia. Information on the adult dispersal of this species, therefore, is important for implementing effective control measures in JC virus endemic areas.

Traditionally, dispersal data for adult mosquitoes have been obtained through mark-release-recapture techniques (Service 1976). Recently, however, a simpler mark-capture method utilizing Giemsa stain was developed to study mosquito dispersal through self-marking adults (Joslyn et al. 1985).

Three features of *Ae. communis* led to the selection of the Giemsa technique for studying this species: 1) the development of *Ae. communis* larvae is synchronous. Because Giemsa optimally stains 4th instars, the large aggregations of larvae that have been reported (Hocking 1953, Iverson 1971) could easily become large numbers of marked dispersing adults; 2) the occurrence of larvae in discrete ponds. Placing the Giemsa stain into small vernal pools containing 4th instars is logistically simple; consequently, no handling of specimens is necessary until captured adults are retrieved from traps; and, 3) the longevity of adults. Adults survive 3–4 months and therefore require a durable marker. In another aedine (Joslyn et al. 1985), laboratory and field tests showed that the Giemsa self-marker remained with adults throughout their lives. We report here the results of an adult *Ae. communis* dispersal study which employed Giemsa self-marking.

Five vernal ponds in Hickory Run State Park in the Pocono Mountains of northeastern Pennsylvania were selected for study. All 5 ponds lay within a 10.24 km^2 area and contained synchronous broods of 4th instars of *Ae. communis* only. On April 23, 1983, a modified Lincoln Index using Giemsa blue stain as a marker was calculated to estimate larval abundance in all 5 pools (Fish and Joslyn 1984), and the centralmost of these pools was selected for this study. The larval population in this pool (20 × 2.8 × 0.3 m) was estimated to be 50,750 (Fish and Joslyn 1984). To mark the total larval population, Giemsa stain (Fisher Scientific Co., Pittsburgh, PA) was applied so that the concentration of dye in the pool was 2 ppm. This concentration was used successfully by Joslyn et al. (1985) to self-mark adults of the saltmarsh mosquito *Aedes sollicitans* (Walker). Nine CDC-4 miniature mosquito light traps (Hausherr's Machine Works, Toms River, NJ), baited with dry ice and operated between dusk and dawn, were used to collect the self-marked adults as they dispersed from the Giemsa-stained snow pool. One trap was located at the pool site itself; the remaining 8 traps were placed along north-south and east-west transects at 0.4 km and 1.6 km distances, designated near and far, respectively, from the stained pool. All traps were suspended approximately 2 m from the ground.

Trapping was initiated on May 7, 1983, 2 weeks after larval staining and continued to July 5, 1983, the ninth and final week of the study. Because of an absence of adult activity during the first 2 weeks, only 8 trap collections could be made.

To detect the Giemsa self-marker, captured adults were anesthetized with ether, identified and placed, three at a time, between two microscope slides. The adults were squashed so that tissues from the different specimens did not come into contact with one another, and were examined for the blue stain at 10-20X magnification against a white background with a dissecting microscope.

While the estimated 50,750 marked larvae in the centralmost pool were developing, 3,924 marked larvae in the 4 other pools of the larval study (Fish and Joslyn 1984) were also completing their development. These marked specimens unavoidably became part of the adult dispersal study as well. Therefore, the potential number of self-marked adults in the test area was 54,674. The actual number of marked individuals was considerably less because the number of mosquitoes at the time of staining had been estimated only, and because laboratory tests indicated that, at an aqueous concentration of 2 ppm, only 57% of treated *Ae. communis* 4th instars resulted in self-marked adults.

In all, 941 *Ae. communis* female adults were captured. Of these, 7 were positive for the Giemsa self-marker (Table 1), and the last marked specimen was recovered June 15, 7 weeks after larvae were stained. Five of the 7 marked specimens were recovered a distance of 0.4 km from the stained pool, while the other two came from a distance of 1.6 km. This finding supports those reported elsewhere on the limited dispersal range of *Ae. communis* (Jenkins

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Table 1. Giemsa-marked vs. unmarked *Aedes communis* females trapped in Hickory Run State Park, PA (1983).

Trapping date	Total no. trapped	No. of Giemsa-marked specimens (*)	No. of unmarked specimens
May 7	7	0	7
May 15	1	0	1
May 23	257	1 (0.4 km south)	256
May 31	44	0	44
June 14	213	5 (2 from 0.4 km east) (2 from 1.6 km east) (1 from 0.4 km north)	208
June 15	202	1 (0.4 km south)	201
June 16	209	0	209
July 5	8	0	8
	941	7	934

* Trap from which marked specimens were recovered is indicated in parentheses.

and Hassett 1951, Nielsen 1957, Carpenter 1970, Smith 1966).

Despite numerous pools with larvae in the study area and elsewhere in the park, we noted low *Ae. communis* adult activity throughout this study. For example, no adult males were ever seen; and inspection of both undisturbed habitats and developed areas at various elevations in the park revealed no adults until 4 weeks (May 23) after emergence when tree foliage had developed sufficiently to form a canopy. Neither were adults to be found during the first 2 weeks of June when sudden cold fronts moved in and nighttime temperatures declined to less than 10°C. Such weather was not conducive to trapping and the continual absence of adults in the area prevented specimen collection of any kind, including human-baiting and aspiration of resting individuals. Also, the attraction of *Ae. communis* to the CDC-4 light traps is not known. It is possible that this trap is not the most effective way to sample this species. Despite the low recovery rate, however, the trapping data of Table 1 show that females may be found close to breeding sites even after 7 weeks. The fact that 5 of the 7 positive specimens were recovered from the near traps is not surprising since the distance from the probability of a capture decreases as the distance from the source increases (Service 1976). That there were marked adults so close to the source from the 4th to the 7th weeks after larval marking seems to suggest low vagility for *Ae. communis*, but further study involving larger samples, various kinds of traps and daily monitoring will be necessary to confirm these results.

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References Cited

Artsob, H. 1983. Distribution of California serogroup viruses and virus infections in Canada. p. 277–290, *In:* C. H. Calisher and W. H. Thompson (eds.) California serogroup viruses. Alan Liss, New York.

Carpenter, S. J. 1970. Observations on the distribution and ecology of mountain *Aedes* mosquitoes in California. XV. Mosquito problems in the Yosemite National Park Recreational Region. Calif. Vector Views 17:101–107.

Fish, D. and D. J. Joslyn. 1984. Larval population estimates of *Aedes communis* using Giemsa marking. Mosq. News 44:565–567.

Grayson, M. A., S. Srihongse, R. Deibel and C. H. Calisher. 1983. California serogroup viruses in New York State: A retrospective analysis of subtype patterns and their epidemiologic significance, 1965–1981. p. 257–268, *In:* C. H. Calisher and W. H. Thompson (eds.) California serogroup viruses. Alan Liss, New York.

Hocking, B. 1953. Notes on the activities of *Aedes* larvae. Mosq. News 13:77–80.

Iverson, T. M. 1971. The ecology of a mosquito population (*Aedes communis*) in a temporary pool in a Danish beech wood. Arch. Hydrobiol. 69:309–332.

Jenkins, D. W. and C. C. Hassett. 1951. Dispersal and flight range of subarctic mosquitoes marked with radiophosphorus. Can. J. Zool. 29:178–187.

Joslyn, D. J., L. B. Conrad and P. T. Slavin. 1985. Development and preliminary field testing of the Giemsa self-marker for the salt marsh mosquito *Aedes sollicitans* (Walker) (Diptera: Culicidae). Ann. Entomol. Soc. Am. 78:20–23.

Nielsen, L. T. 1957. Notes on the flight range of Rocky Mountain mosquitoes of the genus *Aedes*. Utah Acad. Sci. Arts Letters Proc. 34:27–29.

Service, M. W. 1976. Mosquito ecology: Field sampling methods. John Wiley, New York. 583 pp.

Smith, M. E. 1966. Mountain mosquitoes of the Gothic, Colorado, area. Am. Midl. Nat. 76:125–150.