Table 1. Numbers of mosquito larvae collected from field channels after the introduction of predators.

Date of Experiment	Mosquito larvae caught after 24 hrs		Mosquito larvae caught after 48 hrs	
	Experimental	Control	Experimental	Control
6 Aug. 71	No larvae* (17 pupae)	387	No larvae	23
24 Aug. 71	No larvae (33 pupae)	414	No larvae	11 (66 pupae)
27 Aug. 71	44	295	No larvae (14 pupae)	16
4 Sept. 71	No larvae (33 pupae)	403	No larvae	6
7 Sept. 71	20 larvae	384	No larvae	15
15 Sept. 71	No larvae (85 pupae)	361	No larvae	23 (36 pupae)
10 Aug. 72	14 larvae	401	No larvae	6
16 Oct. 72	No larvae	318	No larvae	23 (18 pupae)

* Laboratory experiments showed that the predators exhibited a clear preference for larvae rather than pupae.

introduced into each of these sections. Larvae were sampled after 24 hrs and again after 48 hrs. Only 3rd or 4th stage larvae were counted. The experiment was repeated 8 times. A slightly different procedure was adopted in the 6th experiment when 1000 *Anopheles gambiae* Giles larvae were evenly distributed along the channel (which was previously free of mosquito larvae) and 170 dragonfly nymphs were introduced.

The results are summarized in Table 1. These indicate intense and active predation by dragonfly nymphs on mosquito larvae and suggest that they could be significant factors in natural control of mosquito larvae.

ACKNOWLEDGMENT. Grateful thanks are due to Dr. F. T. Abu Shama for his continuous encouragement, supervision of the work and critical review of the manuscript.

REDUCED TEMPERATURE AND EMBRYONATION DELAY IN *CULEX TARSALIS* [1]

S. MONICA ASMAN [2]

One disadvantage in using *Culex* species for research purposes is the inability to control egg hatch, especially in autogenous strains where blood meals are not required. The lack of a "holding stage" is also an important factor in considering production of large numbers of individuals for release programs. While it is known that in nature female adults of *Culex tarsalis* go into diapause in the late fall where climatic conditions initiate such an over-wintering phase, the environmental factors for duplicating this mechanism in the laboratory are not yet understood. Thus for the present, other holding stages to prevent uncontrolled development in this particular species would be useful. It seemed reasonable to attempt to store eggs at a reduced temperature to delay embryonation and hatch.

Single egg rafts of similar age (5–10 hrs.) and from the same laboratory strain were allowed to embryonate 5–10, 29–34, and 53–58 hrs. at approximately 72° F before being refrigerated at 45° F. In each test, three egg batches were kept at normal rearing temperature (72° F) as controls. Every 24 hrs. for 6 consecutive days, three isolated egg rafts were removed from the colder environment to 72°. The percent hatch of each raft was recorded. After hatching, a specified number of

[1] This research was supported in part by a U. S. Army Contract/Grant No. DAMD-74-C-4128 U. S. Army Medical Research and Development Command, Wash., D.C., 20314.

[2] Division of Entomology and Parasitology, and the School of Public Health, University of California, Berkeley, California 94720, U.S.A.

Table 1. Egg hatch and development in *Culex tarsalis* after various intervals of egg storage at 45° F prior to placing eggs in 72° F.

Age of eggs prior to storage	Storage in 45° F (days)	% egg hatch *	% of hatched larvae reaching adulthood
5–10 hrs	0	96	81
	1	97	64
	2	93	70
	3	95	65
	4	90**	25
	5	82**	2
	6	0	0
29–34 hrs	0	99	79
	1	90	70
	2	93	41
	3	36**	26
	4	51**	31
	5	0	0
	6	0	0
53–58 hrs	0	100	72
	1	96	43
	2	60	32
	3	63	35
	4	15**	9
	5	17**	23
	6	0	0

* Average of 3 egg rafts.
** Many died after hatching.

1st-instar larvae—usually 150 unless low hatch made this impossible—were reared in the normal manner. Emerging adults were counted to ascertain any evidence of adverse effects in continued development due to cold and/or the interruption in embryonation. The complete test was repeated twice using the UCB line which is a composite strain that holds some of the genotype of other laboratory colonies and consequently shows considerable hybrid vigor. Since the results were similar in the two trials, only one set of data is shown in Table 1. The percent emerged did not appear to favor 1 sex, so the adult number is not separated by sex.

From the data it appears that eggs of *C. tarsalis* may be stored at 45° F for 1 to 3 days and still give approximately 80 to 30% adults depending on several factors. The shorter the embryonation time prior to cold storage, the greater seems to be the chance for 1st-instar larvae to develop normally once a favorable temperature is restored. Similarly the length of time in a cold environment not only affects percent egg hatch but also interferes with continued development to the adult stage. There appeared to be no appreciable delay in time of egg hatch or time of development to adults once the eggs were returned to normal rearing temperature. Among the progeny surviving the hatching process, the greatest amount of mortality was seen in the late pupae stage and during emergence to the adult stage.

Adverse effects on viability and vigor of emerged adults were not determined. The holding of *C. tarsalis* eggs could possibly result with less mortality during embryonation and continued development at a slightly higher temperature than that utilized in this experiment. Changes in temperature and other variables will be considered in future tests of this kind.

THE LARVAL HABITAT OF *ECHINOHELEA LANEI* WIRTH (DIPTERA: CERATOPOGONIDAE) [1]

WILLIAM L. GROGAN, JR.

Department of Entomology, University of Maryland, College Park, Maryland 20742

Wirth (1951) described *Echinohelea lanei* from Virginia, and although it has since been collected in many eastern states, nothing is known of its breeding habitat. A single male of this species was reared from a pupa collected by Paul G. Bystrak from under the bark of a rotting tulip poplar (*Liriodendron tulipfera*) at Odenton, Anne Arundel County, Maryland. This specimen was taken on 8 March 1970 and emerged 11 March, but the pupal exuviae was not recovered. This pupa was found in association with the larvae and pupae of *Forcipomyia* (*F.*) *simulata* Walley, on which it may possibly prey. This habitat is somewhat unusual as most of the other members of its subfamily (Ceratopogoninae) are aquatic.

Literature Cited

Wirth, W. W. 1951. New species and records of Virginia Heleidae (Diptera). Proc. Entomol. Soc. Wash. 55:313–325.

---

[1] Scientific Article No. A2096, Contribution No. 5052 of the Maryland Agricultural Experiment Station, Department of Entomology.