Table 3. Parity of *Culex pipiens* collected by the Ehrenberg pigeon trap at intervals over the entire nocturnal period.

Collecting period p.m.–a.m.	Number dissected	% parous
7:15– 8:15	11	55
8:15–10:15	20	50
10:15–12:15	16	50
12:15– 2:15	13	54
2:15– 4:15	16	50
4:15– 6:15	8	50
Total	84	Avg. 51

mens. In the opinion of the authors, the Ehrenberg pigeon trap is an effective sampler for *C. pipiens* and should become the collection tool of choice for SLE vector and virus surveillance.

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AN OVIPOSITION ATTRACTANT OF PUPAL ORIGIN IN *CULEX SALINARIUS*[1]

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ABSTRACT. Gravid females of *Culex salinarius* prefer water in which pupae have developed in selecting oviposition sites under laboratory conditions. Selectivity is primarily due to a nonfiltratable oviposition attractant of pupal origin.

INTRODUCTION. Studies on the oviposition of mosquitoes have shown that in at least 2 species a chemical factor associated with the immature stages influences the selection of a suitable oviposition site by gravid females.

Hudson and McLintock (1967) demonstrated a nonvolatile oviposition attractant for *Culex tarsalis* which appeared to be specific as ovipositing females selected emergence water which had contained their species in preference to emergence water from

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Culiseta inornata, Aedes aegypti, and *Culex pipiens*.

Kalpage and Brust (1973) discovered a stable oviposition attractant produced by developing stages of *Ae. atropalpus*. They suggested that this attractant, found in the medium in which larvae and pupae developed, was one of the factors responsible for the repeated selection of the same pools for oviposition sites.

The detection of such an attractant by gravid females would appear to be of considerable advantage in selecting a habitat suitable for larval development by those species that develop in temporary pools, as in the case of *Ae. atropalpus*. However, the significance of such an ovipositional stimulant in those species that occur in more permanent habitats is unclear.

Larvae of *Cx. salinarius* have been reported to develop in a wide variety of environments including permanent grassy pools, ponds and marshes and occasionally in temporary habitats such as rain barrels, cattle tracks and stump holes (Carpenter and LaCasse 1955, Gjullin and Eddy 1972).

The purpose of this study was to determine if an oviposition attractant is produced by the developing stages of this widely dispersed and apparently nonselective species *Cx. salinarius*.

MATERIALS AND METHODS. The colony of *Cx. salinarius* used in this study was originally obtained from Dr. Harold Chapman, Gulf Coast Mosquito Research Laboratory, Lake Charles, La. Adults were maintained in 15x18x15 in. cages at 20°C under natural photoperiod and were constantly supplied with a 5% sucrose solution in distilled water.

Females were fed daily on guinea pigs placed directly into the cage. Egg rafts were deposited into half-pint styrofoam dishes containing 150 ml of each test solution and collected each morning.

Test solutions consisted of: 1. *Pupae in distilled water*. Newly molted pupae were removed from rearing pans, rinsed well in distilled water and 150 each placed into dishes containing 150 ml of water. Controls consisted of dishes containing 150 ml of distilled water only.

2. *Pupal holding water*. Following several rinses in distilled water, 250 newly molted pupae were placed into cups containing 250 ml of distilled water and held for a period of 24 hr. Following this, pupae were removed and the water filtered through Whatman No. 1 paper. The filtrate was then placed into oviposition dishes and utilized as a test solution. Controls consisted of dishes containing distilled water only.

3. *Growth medium*. To test the possible attraction of gravid females to odors associated with the growth medium or its decomposition that may have been retained on the surface of pupae following wash in distilled water, dishes containing a 1 mg/ml mixture of hog chow and yeast in distilled water were used as further controls. This was the amount developing stages were reared upon. This suspension was tested against pupal holding water and distilled water.

After gravid females had been held for a period of 72 hr following the 1st blood meal, 3 dishes of each test and control solution were placed in their cage. Egg rafts were collected and tabulated for a period of 10 days in each experiment. This method allowed for a long series of observations with few rafts laid per night and eliminated egg raft crowding as a factor in oviposition site selection. Egg rafts laid in the oviposition dishes were collected each morning and fresh test solutions supplied daily. The positions of the 6 dishes containing the test and control solutions were reversed daily.

RESULTS. The results are shown in table 1.

In experiment I dishes containing

Table 1. Number of egg rafts deposited by *Culex salinarius* in different test solutions.

Experiment no.	Contents of dish	No. egg rafts laid per dish			Total no. egg rafts laid	%
		1	2	3		
I	water containing pupae	9	8	9	26*	58
	distilled water	6	7	6	19	42
II	pupal holding water	20	18	19	57*	71
	distilled water	8	7	8	23	29
III	pupal holding water	12	12	14	38*	64
	growth medium	7	6	8	21	36
IV	distilled water	10	11	11	32*	63
	growth medium	8	6	5	19	37

* $P<.05$.

pupae in distilled water received significantly more egg rafts than control dishes containing distilled water only. To rule out the possible involvement of visual stimuli in selection of an oviposition site by females, pupal holding water was tested against distilled water (experiment II). Once again, females deposited a significantly larger number of egg rafts in water associated with pupae. In no case in either experiment did any of the 3 control dishes receive more rafts than the test solutions. These results indicate that a nonfiltratable oviposition attractant remained in the water even after removal of pupae.

In experiment III pupal holding water was compared with water containing growth medium to determine if attraction may have been associated with bacterial odors emanating from the medium in which pupae developed. This was not found to be the case as females deposited more egg rafts in pupal holding water than water containing growth medium.

The results of experiment IV, in which distilled water was tested with growth medium, indicate that the preference shown towards pupal holding water over growth medium water in experiment III may have been due to avoidance of the control dishes. However, these results provide further evidence that the preferences shown in experiments I and II were associated with the presence of a chemical factor of pupal origin and not due to avoidance of the control dishes containing distilled water.

DISCUSSION. The preferential responses exhibited by gravid *Cx. salinarius* females, under controlled laboratory conditions, for water associated with developing pupae appear to be primarily due to some chemical of pupal origin. This chemical does not appear to be associated with bacterial odors emanating from growth medium in which immature stages develop.

While the significance of this attractant is unclear in light of the wide dispersal patterns typically exhibited by this species, perhaps egg rafts are not deposited as indiscriminately as the literature indicates.

However, the situation here may be analogous to that observed in *Cx. nig-*

ripalpus. Provost (1969) reported that while gravid *Cx. nigripalpus* females were attracted to hay-infusions, dried oak-leaf infusions, and waters containing almost any newly-cut green vegetation, females typically show lack of selectivity in sites for oviposition in the wild. He suggested this lack of selectivity may be the result of a need to oviposit quickly once flight search has been initiated, resulting in deposition of eggs in the nearest available water in the absence of any oviposition attractant.

Laboratory studies have shown oviposition in *Cx. tarsalis*, which also occurs in a wide variety of habitats, to be influenced by a stimulant associated with its developing stages (Hudson and McLintock 1967).

In conclusion, an oviposition attractant of pupal origin may be involved in the selection of an oviposition site by *Cx. salinarius* females. Further work is needed to determine both the specificity and the effects of such an attractant in the field.

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