Product, 150 mm glass flow meter enclosed in a protective plastic tube and attached at both ends with a ½-inch diameter Tygon tube, 4 ft long regulated the correct amount of CO_2. One end of the tubing was attached to the CO_2 regulator valve outlet while the other end was under the cover plate of the CDC trap (Fig. 1).

A flow rate of 2 liters per minute was found to be the most desirable rate with respect to the frequency of replacing emptied CO_2 cylinders. CO_2 cylinders were replaced on an average of every 5 days. Using Snoddy's technique of one lb CO_2 per hr., replacement would occur approximately every 2 days. The optimum flow rate was not statistically determined. However, the authors feel that the flow of 2 liters of CO_2 per minute is sufficient for trapping adequate numbers of blackflies for tabulating indices.

Each of the 2 traps was constructed with an acetate funnel fused to the plastic sides of the CDC trap. The bottom of the funnel extended about half way down into the cloth trap bag. (Fig. 1. The purpose of the funnel was to prevent loss of specimens due to possible power failure; however, none occurred. The 2 traps were placed 5 ft above ground approximately 150 yards apart in new secondary vegetative growth which is typical of the local fauna and operated for 32 continuous days from 0900 to 1800.

The mean trap index for both traps, over the 32 day test period was 1282. The range of specimens trapped was from a low of 12 to a high of 14,800 with the overall total for both traps being 82,042. See Fig. 2. Identification of species has not been completed.

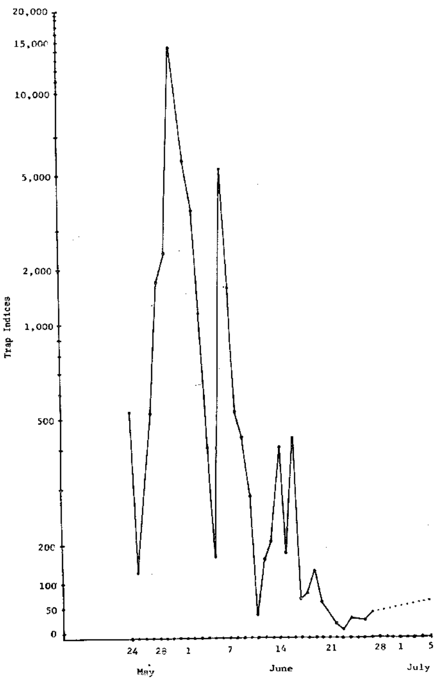

FIG. 2. Adult blackfly trap indices. Indices obtained using 2 modified CDC traps with CO_2 as attractant.

Reference Cited

Snoddy, E. L. and K. L. Hayes. 1966. A carbon dioxide trap for Simuliidae (Diptera). J. Econ. Entomol. 59(1):242–243.

LABORATORY *VS* FIELD RESULTS WITH PHOXIM AS A MOSQUITO LARVICIDE

D. P. WILTON [1]

Laboratory tests of Phoxim [Bay 77488, OMS 1170 (Phenylglyoxylonitrile oxime O,O,-diethyl phosphorothioate)] have indicated it to be a very effective mosquito larvicide. McDuffie and Weidhaas (1967) obtained 100% kill of 4th stage *Anopheles quadrimaculatus* larvae at a concentration of 0.025 p.p.m. Tests with *A. albimanus* showed Phoxim to be highly effective also in the form of a floating insecticidal bait. Wheat flour treated with 0.025% technical Phoxim and applied to the water surface of test dishes at a rate of 0.012 mg/cm² (equivalent to .03 mg technical insecticide/M²) caused 94% mortality of the 3rd stage, larvae feeding on it (Wilton *et al.*, 1973).

In the field, however, Phoxim has sometimes proven far less effective than would be expected on the basis of laboratory results. It was one of the least effective of 22 insecticides applied outdoors in Georgia to dry grassy plots as "prehatch or preflood" larvicides (Taylor and Schoof, 1971). It was disappointing in field trials of larvicidal baits in El Salvador; applications of 920 mg/M² of 0.05% bait (.46 mg technical/M²)

[1] Central America Research Station, Bureau of Tropical Diseases, Center for Disease Control, Public Health Service, U. S. Department of Health, Education, and Welfare, San Salvador, El Salvador, C.A.

TABLE 1. Percent mortality of 5–6 day old *Anopheles albimanus* larvae (50 larvae per test pan) offered 0.05% Phoxim bait at two water temperatures.

Temp. ° C	Application rate (mg/M²) 460 [1]	230 [2]	0
35	100	100	6
	100	100	0
21–24	..	100	0

[1] .23 mg technical/M².
[2] .13 mg technical/M²

gave only 53% reduction of the *A. albimanus* larvae in naturally infested waters compared with complete mortality from laboratory applications of the same bait at 120 mg/M² (.06 mg technical/M²).

In an effort to explain its reduced effectiveness under field conditions the effects of direct sunlight and high water temperature on the action of Phoxim larval bait have been investigated. Third stage, insectary-reared, *A. albimanus* larvae were tested in lots of 50 in 20- x 20- cm aluminum pans. Water depth was 1.5 cm. Bait applications were made by dropping weighed amounts of dry 0.05% bait on the water surface. Mortalities were determined after 24 hours.

The influence of high water temperature was investigated by placing the test pans in an incubator adjusted to maintain a water temperature of 35° C (95° F). Larvae were added to the pans and bait applications were made as soon as the water had reached that temperature; to measure the effect of water temperature alone, bait was not added to one pan. Controls were placed in an air-conditioned room with a temperature range of 21–24° C during the test period. As shown in Table 1, no decrease in the effectiveness of Phoxim bait was seen at 35° C, making it very unlikely that high water temperatures are responsible for the insecticide's failure in field tests. Observations have shown that water in which *A. albimanus* larvae are found in El Salvador may reach 32° C.

TABLE 2. Percent mortality of 5–6 day old *Anopheles albimanus* larvae (50 larvae per test pan) offered 0.05% Phoxim bait in sun and shade. All applications equivalent to 460 mg (.23 mg technical)/M².

Trial	Test condition: Sun	Shade
1	4	90
2	0	92
3	26	98
4	10	98
Mean	10.0	94.5

Check mortality=0.5%.

The effect of sunlight was tested in two ways: by paired outdoor trials in sunlight and shade and by indoor tests with bait which had been exposed the previous day for 1, 2, 3, or 4 hours to direct sunlight between 10 a.m. and 2 p.m. In the outdoor tests, the pans exposed to sunlight were moved into the shade after 4 hours.

Exposure to sunlight produced a very different result. Whereas bait applications equivalent to .23 mg technical Phoxim/M² caused nearly complete mortality of the test larvae in the shade, in parallel tests in the sunlight only 10% were killed. As indicated in Table 2, mortalities in the sun-exposed pans of trials 1 and 2 were markedly lower than those of trials 3 and 4. It should be noted that trials 1 and 2 were conducted under clear conditions with continuous, bright sunlight, whereas trials 3 and 4 were run when it was generally hazy with intermittent cloud cover during the 4-hour exposure period.

TABLE 3. Percent mortality of 5–6 day old *Anopheles albimanus* larvae (50 larvae per test pan) offered 0.05% Phoxim bait previously exposed to sunlight. All applications equivalent to 460 mg (.23 mg technical)/M².

Trial	Hours exposure to sunlight: 0	1	2	3	4
1	100	56	6	2	0
2	100	44	16	14	0
3	100	10	0	0	0
Mean	100.0	36.7	7.3	5.3	0.0

Check mortality=0.0%.

Further indication of the sensitivity of Phoxim to sunlight is provided by the data in Table 3. The effectiveness of a bait application which consistently caused 100% mortality of the test larvae, was sharply reduced after 1 hour exposure to the sun prior to testing. Four hours of exposure rendered it totally ineffective.

These results show Phoxim to be rapidly degraded in sunlight, negating its usefulness as a larvicide and in other applications where chemical stability in sunlight is required.

References

McDuffie, W. C. and D. E. Weidhaas. 1967. Current research by the USDA of potential significance to world-wide mosquito control. Mosq. News 27(3):447–453.

Taylor, R. T. and H. F. Schoof. 1971. Experimental field treatments with larvicides for

control of *Anopheles, Aedes,* and *Culex* mosquitoes. J. Econ. Entomol. 64(5):1173–1176.
Wilton, D. P., L. E. Fetzer, Jr. and R. W. Fay. 1973. Insecticide baits for anopheline larvae. Mosq. News 33(2):198–203.

CULICOIDES NUBECULOSUS (CERATOPOGONIDAE) FEEDING ON ENGORGED *AEDES AEGYPTI* UNDER LABORATORY CONDITIONS

M. KREMER, B. MOLET, C. REBHOLTZ-HIRTZEL AND J. C. DELECOLLE

Institut de Parasitologie. Faculté de Médecine, 3, Rue Koeberlé, 67000 Strasbourg, France

It has been reported several times that *Culicoides* and other Ceratopogonidae feed on insects (Wirth, 1956, 1971a, 1971b). A well known example is *Culicoides anophelis* which engorges on mosquitoes (Das Gupta, 1964). We have reported the capture of five different species of *Culicoides* from Madagascar, the *Culicoides* having been caught at the same time as *Anopheles coustani,* and their "entomophagy" seemed very likely (Callot *et al.,* 1968).

We report here experiences with *Culicoides nubeculosus* (Meigen) feeding on *Aedes aegypti.* Both strains of insects have been reared in the laboratory for several years.

First we put in a 125 cc cardboard container, closed with fine nylon mesh, some *Culicoides* which were 4 or 5 days old, and nourished exclusively with sugar-water. Then we introduced one or two *Aedes aegypti* which had just fed on man or mouse. Some females of *Culicoides* were able, but with great difficulty, to cling to the mosquito, then to attack and maintain themselves on the abdomen of the *Aedes.* However, it is obvious that the mosquitoes try to avoid any contact with the *Culicoides.* The female *Culicoides* engorge on the blood previously ingested by the *Aedes,* their abdomens enlarge and take the usual dark red color. We obtained by this procedure viable eggs. (*C. nubeculosus* is not autogenous under our laboratory conditions.)

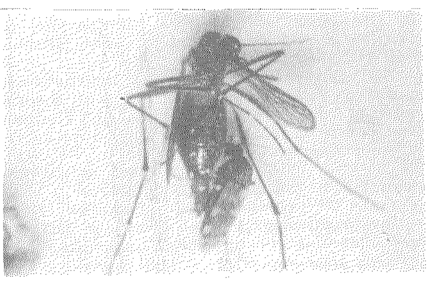

FIG. 1. *C. nubeculosus feeding on engorged A. aegypti.*

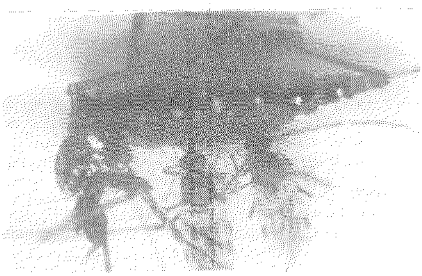

FIG. 2. *C. nubeculosus feeding on engorged A. aegypti.*

To take photographs of the phenomenon, and to observe it better, we introduced engorged *Aedes,* anaesthetized or with a crushed thorax, to reduce movements. (Fig. 1–3.) We observed that the female *Culicoides,* aged 4 and 5 days and still unnourished with blood, regularly attacked their victims, penetrating the abdominal pleural membrance and engorging on blood. They are able in this way to "empty" completely the abdomen of the *Aedes.*

During that time, the males are extremely active and mate with the females. Also, they try to do so with the wounded female *Aedes.*

The same trials done with wounded *Aedes,* which had not fed on blood, failed to show the same phenomenon until now. *Culicoides* of both sexes seem to be "attracted" by the *Aedes,* stay on them, the mouth parts in contact with the cuticle, but they did not attempt to feed. This contrasts with observations of other authors.

FIG. 3. *C. nubeculosus* feeding on engorged *A. aegypti* (detail).