COLONIZATION OF CHIRONOMUS PLUMOSUS (DIPTERA: CHIRONOMIDAE)

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Recently several species of chironomids have been successfully colonized in indoor cages. Syrjama (1965) colonized Chironomus strenzkei Fittkau, and Biever (1965) colonized Chironomus sp. #51. Chironomus monochromus van der Wulp, Chironomus fulvipilus Rempel, Pentaneura pilosella Loew, Tanypus grodhausi Sublette, and Microspectra nigripilus Johannsen.

Several efforts to colonize Chironomus plumosus (L.) using the techniques of Syrjama and Biever were unsuccessful, the chief obstacle being the inability to induce swarming and mating in captivity. C. plumosus normally mates in very large swarms, the swarms forming about one hour before sunrise and dispersing about one hour after sunset, with the greatest swarming intensity at dawn and dusk (Hilsenhoff, 1966). Swarming and mating were induced in the laboratory by employing some of the techniques used by Brennan and Harwood (1953) to colonize the mosquito Culex tarsalis Coquillett. The techniques described be-

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fluorescent lamps were then turned on. After 15 hrs. of full light intensity, the fluorescent lamps were turned off and the intensity of the incandescent lamps diminished to darkness over a 1-hour period.

**RESULTS AND DISCUSSION.** In the morning, activity among the flies in the cage was noted as soon as the light was strong enough to enable them to be seen. When the light intensity reached 0.5 ft-c in the center of the cage, many flies could be seen swarming near the top of the cage directly under the lamps. Swarming continued as the light intensity was increased to 32 ft-c, but diminished somewhat after the 8 ft-c intensity was reached. Swarming was usually restricted to the upper part of the cage directly under the incandescent lamps, but when several hundred flies were present the swarm would extend from the top of the cage to just above the surface of the aquaria and would encompass much of the cage. Copulation was observed only within the swarm, the copulating pairs dropping to the floor of the cage before separating. No swarming activity was noted when the room was illuminated by the fluorescent lamps, and the gradual diminishing of the light intensity in the evening produced no activity of any kind.

Three days after the initial swarm, viable egg masses were collected from the sides of the cage. Most females extruded their egg mass during the morning swarming period, and deposited it on the first thing with which they came into contact. When a large white enameled pan containing water was placed on one of the aquaria, some egg masses were deposited in this pan. The majority of egg masses were probably laid in the water of the two large aquaria, but those deposited in the enameled pan and on the sides of the cage were sufficient for our experimental needs. The masses deposited on the sides of the cage were collected and placed into water shortly after they had been laid, the sticky egg masses being most easily removed from the sides of
### Table 1.—Direct light intensity readings in foot-candles in the center of the cage.

<table>
<thead>
<tr>
<th>Direction of Reading</th>
<th>A</th>
<th>A+B</th>
<th>A+B+C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toward top of cage</td>
<td>82</td>
<td>165</td>
<td>165</td>
</tr>
<tr>
<td>Toward bottom of cage</td>
<td>6</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td>Toward front of cage</td>
<td>24</td>
<td>30</td>
<td>185</td>
</tr>
<tr>
<td>Toward back of cage</td>
<td>20</td>
<td>30</td>
<td>64</td>
</tr>
<tr>
<td>Toward right side of cage</td>
<td>22</td>
<td>32</td>
<td>66</td>
</tr>
<tr>
<td>Toward left side of cage</td>
<td>22</td>
<td>38</td>
<td>76</td>
</tr>
</tbody>
</table>

1 **A** = Fluorescent lamps in room containing the cage.

B = Five silver-neck 150-watt incandescent lamps above the front-right corner of the cage.

C = Ten silver-neck 150-watt incandescent lamps 3 ft. from the front of the cage.

are turned on, the fluorescent lamps are also turned on by a time clock, remain on for 15 hrs., and then are automatically turned off. Thus, there is a 1-hr. twilight period, 15 hrs. of full light, and 8 hrs. of darkness each day. With this procedure swarming occurs only during the morning twilight period, and oviposition occurs mostly near the end of this period. The swarming can be intensified by manually increasing the light intensity to 1 ft-c 30 min. after the incandescent lights first come on. To secure the maximum number of egg masses, the cage must be entered shortly after the fluorescent lights have turned on so that the masses can be collected from the sides of the cage before they become dry. A maximum of 22 egg masses have been collected in a single day but undoubtedly this number could be greatly increased by placing over the aquaria large cones that would allow emergence but prevent oviposition in the aquaria.

Larvae will develop to the fourth instar in the mud substrate without the addition of food, but occasional feeding will speed their growth. At 23.5° C. about 5 weeks are required for complete larval development. To initiate pupation and emergence, the addition of food is essential. After testing several types of dog and fish foods, Trainers Dog Rewards were selected because of superior performance and the ease in handling. These are soaked overnight in water and then stirred with a spatula to break up any clumps. A dog food slurry consisting of 8 Dog Rewards is then dispersed uniformly throughout the water in each aquarium, and additional food is added when the water clears (about every 2 days). Large emergences can be produced by withholding larval food until 8 days before the desired emergence. The size of the emergence can be increased by rearing larvae in additional aquaria outside the rearing cage and adding mature fourth instar larvae to the aquaria within the cage. Once an emergence is initiated...
by the addition of dog food, peak emergence occurs after 9–13 days, and peak oviposition after 12–16 days.

References Cited


BIOLUMINOSIS OF CULEX SALINARIUS COQUILLETT. II. HOST ACCEPTANCE AND FEEDING BY ADULT FEMALES OF C. SALINARIUS AND OTHER MOSQUITO SPECIES 2

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Our continued interest in the bioluminosis of Culex salinarius Coq. (Murphey and Darsie, 1962) led to the investigation of its host-feeding activities on the Bombay Hook National Fish and Wildlife Refuge, Delaware, during the summers of 1958 and 1959. Such information could lead to a better definition of its possible role as a mosquito vector of disease agents. Although C. salinarius is not yet a proven vector, it has been associated with several diseases. Davis (1940) was unable to demonstrate laboratory transmission of Eastern encephalitis (EE) by C. salinarius. Later, Burbutis and Jobbins (1957), reported a natural infection of EE virus in eight blood-engorged females. However, they suggested that this mosquito plays a minor part in EE epidemiology because Chamberlain et al. (1954) had demonstrated C. salinarius to be refractory to infection with the virus in the laboratory. Chamberlain (1958) pointed out that as the infection rate of associated bird-hosts was high at the time the collections were made by Burbutis and Jobbins (1957), the detected virus was most likely in recently ingested blood rather than established in the mosquito tissues. In contrast to these findings, Chamberlain et al. (1954) stated that sylvan (enzootic) transmission of St. Louis encephalitis virus to wild birds and fowl is possibly accomplished by C. salinarius because he found it to be an excellent vector in the laboratory. Laboratory tests by Newton et al. (1945) and Eyles and Most (1947) have demonstrated transmission by C. salinarius of the human filarial worm, Wuchereria bancrofti (Cobbold). Also, Huff (1927) demonstrated in the laboratory that this species is a possible vector of bird malaria parasites. Transmission of Plasmodium relictum (Grassi and Feletti) and P. catheremerum (Hartmann) to the English Sparrow, Passer domesticus (L.) and Plasmodium gallinaeum Brumpt to chickens was successfully accomplished in his studies.

Prior to the present work, detailed studies on host feeding by C. salinarius had not been conducted. However, subsequent results obtained by Hayes (1967) from animal baited-trap investigations in-