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A MODIFIED METHOD FOR REARING MIDGES (DIPTERA: CHIRONOMIDAE)

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ABSTRACT

A small scale rearing chamber that provides a continuous source of different life stages of *Glyptotendipes barbipes* Staeger for bioassay studies was developed. A modified glass aquarium containing a substrate of shredded paper hand towels and artificial medium was employed. The amount of protein fed to the larvae can be used to trigger peak emergence, oviposition, and the rate of maturation. Fifty-three egg masses were sampled and 68% were fertile. Ninety-five percent of these hatched and 85% emerged as adults.

Several methods have been described in the literature for rearing chironomids (Diptera) under laboratory conditions. Biever (1965) cultured *Chironomus sp.* #51, *C. fulvipilus* Rempel, *C. monochromus* van der Wulp, *Pentaneura pilosella* Loeu, *Tanypus grodhausi* Sublette, and *Micropsectra nigripilus* Johannson. Hilsenhoff and Narf (1967) grew *Chironomus plumosus* while Derr and Zabik (1972) presented a method for culturing *Chironomus tentans* Fabricius.

Some problems were encountered in the application of the above listed methodologies in rearing larvae of *Glyptotendipes barbipes* Staeger. Hilsenhoff and Narf's method required too much laboratory space, while Biever's, and Derr and Zabik's techniques produced a low percentage of fertilized egg masses. A combination of all three methods with some modifications enables us to culture *Chironomus tentans, Psectrotanypus sp.* and *G. barbipes.*

It is the purpose of this paper to describe the procedure employed in isolating and culturing the sewage midge *G. barbipes* in a clean environment for biossay and bioaccumulation studies.

MATERIALS AND METHODS

A stock culture of midges was maintained in a 38 liter aquarium which was covered by a roof-like cover made of 0.6 cm plywood to allow mating space for the emerged imagos (Fig. 1). The aquarium contained 12 liters of medium and was aerated continuously with two airstones. Two 1.3 m lamps, one Gro-Lux and one fluorescent, were placed above this rearing house to provide a 16 hour light and an 8 hour dark period. Congregation of the imagos and enhancement of copulation was induced by placing a night light outside near the top of the rearing chamber, which emitted a faint light during the dark period. This procedure resulted in a higher percentage of fertile eggs which were deposited into a white enamel pan containing Peter's osmotic solution (1921). From this pan, egg masses were easily collected and adults removed with a wide bore pipette. Ambient room temperature was maintained at 21°-22°C which simulated summer conditions.

The substrate was prepared by blending 50 gm of shredded paper hand towels (Nibroc, Brown Co., #23) and 2 gm food supplement (Sliver's Dog Treats, Gro-Kote, Inc.) in 2 liters of distilled water for 5 minutes. This mixture was added to an aquarium containing approximately 10 liters of Peter's medium. Late instar midge larvae were then transferred to this suspension for culture.

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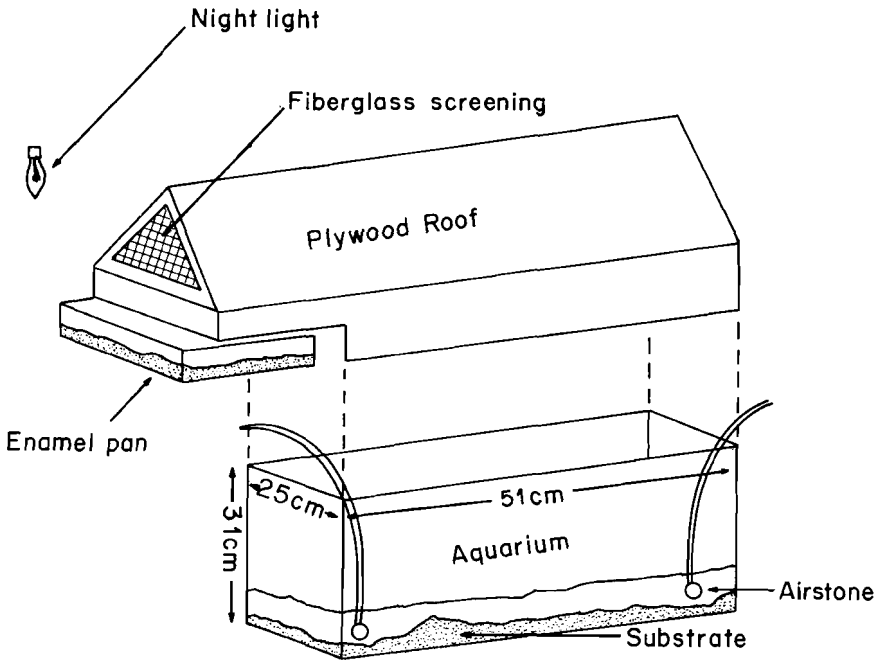

Fig. 1. Rearing chamber for chironomid culture.

RESULTS AND DISCUSSION

Larvae of *Glyptotendipes barbipes* were collected with an aquatic hand net from the local sewage lagoon and the late instars were transferred in the laboratory to the culturing aquarium. After approximately a month, all life stages were present in the rearing chamber. It is from this midge population that the following descriptive observations were made.

Adults lived from 3 to 5 days, with males emerging several days prior to the females. Mating occurred immediately, but not in flight. Seventy-three percent of the females laid eggs and 68% of these egg masses were fertile. The females usually died shortly after oviposition. Fifty-three egg masses, ranging in size from 7 to 22 mm in length to 1.5 to 4.4 mm in width, were examined. The average egg mass was 15 mm long by 3 mm wide and contained 503 eggs (S.D. ± 126). This differs from the data given by Sublette and Sublette (1973) in which eggs per mass varied from 1500 to 2000.

Hatching occurred within 3 to 6 days at a mean water temperature of 22°C. Every fifth fertile egg mass was sampled for hatchability. Out of seven samples examined, a total of 3610 eggs were laid and 3432 larvae emerged resulting in over 95% hatchability success. The early instars remained in the gelatinous matter of the egg mass for 2 to 3 days, after which they became free swimming. Immediately thereafter tube building started, first on the walls of the aquarium and then in the substrate. Molting to second instar occurred shortly after initial tube building.

An 85% survival rate from hatching to adult was recorded from seven randomly collected egg masses. Of the 3432 fertile eggs, 2917 adults emerged with 481 larvae and 34 pupae dying during the maturation process. The most critical period appeared to be the free swimming stage (Instar I) during which the greatest mortality occurred. The pupal stage lasted from 2 to 5 days with death at this stage very low (<1%).

A temperature change of ± 3°C from 22°C had little effect on development time. At 19° and 25°C, maturation from immature to adult was 35 and 34 days respectively, whereas 35 days was required for those exposed to 22°C.

The amount of protein fed to the larvae had a considerable effect on maturation. Peak emergence and oviposition was triggered by increasing the food level 9 to 13 days prior to the desired emergence. On the other hand, by reducing the food supply and by lengthening the time interval between feedings, the developmental cycle of this midge was retarded as much as 20 days. In experiments where larvae were fed 0.5 gm of Sliver's every 10 days, maturation from the first instar to adult took 55 days. Approximately 2 gm of Sliver's Dog Treats provided sufficient food for 2500 to 3000 larvae for 4 days. With the larvae and pupae occupying the lower chamber and adults mating in the upper one, a continuous cycle was maintained.

CONCLUSION

This rearing technique enables one to maintain in a small area a culture of midges which over several generations can cleanse themselves of environmental pollutants. The midge concentration can be manipulated by controlling the food supply in the substrate. This system allows the researcher to select the life stages desired for experimentation. Additionally, owing to the success in survival, it provides a method for carrying out long-term chronic bioassays that could cause genetic alterations of successive populations.

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