gestive tracts contained large clumps of fungal conidia mixed with the larval food, but the possibility that physical blockage caused death in so short a time is unlikely. The fact that this rapid death has not been observed before may be attributable to altered procedures for growing and maintaining this particular culture of *C. clavisporus* yielding more potent batches, as consistently low LC_{50} values would appear to indicate.

This phenomenon of rapid death is under further investigation, with a toxin being suspected as the likely cause. This may have an important bearing on its potential application to the field. Presently one of the limitations of *Culicinomyces* as a biocontrol agent is its apparent inability to demonstrate significant persistence after application to the field (Sweeney 1981). If *Culicinomyces* must eventually be considered for use as a bio-insecticide with short-term effect, then further development of more potent, rapid killing preparations will be one direction which research on this fungus should take.

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CLIMATIC EFFECTS ON *COQUILLETTIDIA PERTURBANS* IN BARRINGTON, RHODE ISLAND

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The freshwater mosquito, *Coquillettidia perturbans* (Walker), is an important pest in the community and breeds in Echo Lake, which is large and mostly overgrown with emergent aquatic vegetation. The larvae of this species attach themselves with a modified siphon to the roots of these plants to develop. The pupae remain attached until the adult emergence in the spring and summer. The females bite actively during the early part of the night, are strong fliers, and are readily attracted to light traps (Carpenter and LaCasse 1974).

In 1975 the Barrington Mosquito Control Project was started and the primary species of concern was *Aedes sollicitans* (Walker), a salt marsh mosquito. Residents in Barrington, RI felt that adulticiding alone was ineffective and undesirable. The mosquito control program therefore sought to identify breeding areas, develop a larviciding project, and institute a program of open marsh water management (Ferrigno et al. 1975).

The data presented are part of the breeding area identification program. All adult populations of mosquitoes were monitored by New Jersey light traps model #1:w, equipped with a 40-watt bulb and a 24-hr timer. The light traps were operated from 8:00 p.m. to 12:00 midnight, 7 days a week, from June 1 to September 10 each year. The mosquitoes were collected each Monday, sorted and identified. The traps were located in seven areas in Barrington. Two traps were located north of Echo Lake.

Initial trapping indicated that as much as 70% of the mosquito population came from salt marsh, so a basic program of open marsh water

management was undertaken (Boyes and Capotosto 1980). However, in 1983 the salt marsh mosquito sample represented only 3–5% of the adult mosquitoes in these traps. The greatest population was *Cq. perturbans* which comprised 50–70% of all mosquitoes trapped. Since the Town does not adulticide and the larvae of *Cq. perturbans* reside among the submerged aquatic vegetation, conventional control measures were deemed impractical.

The breeding area of most concern is Echo Lake, a shallow freshwater pond. The average depth ranges from 6 to 8″ (15–20 cm) in the north end, to 18″ (45 cm) to 4′ (1.2 m) in the south end where there is an overflow structure which allows water to flow under a road into a cattail marsh. The pond supports aquatic vegetation including *Nymphae odorata* (white water lily), *Spirodela polyrhiza* (big duckweed), *Potamogeton* spp. (pondweeds), *Vallisneria americana* (wild celery) and *Cabomba caroliniana* (fanwort). The edge supports emergent vegetation including *Decodon verticillata* (water willow) and *Typha latifolia* (broad-leaved cattail). There are two other small ponds which drain into Echo Lake via pipes.

Coquillettidia perturbans seem to be affected by cold weather and ice which normally persist from December to February in southeastern New England. The monthly average temperatures for these 3 months were obtained from the local climatological data sheets from Providence, RI, at the Theodore Francis Green Airport by the National Oceanic and Atmospheric Administration (NOAA). The average monthly temperatures for December, January and February were collected and averaged. Table 1 shows the mean winter temperatures (MWT) by year (no standard deviations are reported).

The mean winter temperatures were compared to the population densities of *Cq. perturbans* of the following year by correlation analysis. There was a high positive correlation (r = 0.85) between the light trap data and the mean winter temperatures for the 8 years analyzed. Figure 1 shows the linear regression between mean winter temperature and population density of female mosquitoes trapped during one year in traps #2 and #5. The MWT is useful to represent ice accumulation; ice freezing occurs from late November to early March in this region of the country. At higher temperatures, ice accumulation is drastically lower with no ice formation and at lower temperatures, the depth of ice increases. The data demonstrate that low temperatures in the 1976–77 winter produced an ice depth of more than a foot (30+ cm), which trapped many of the larvae. In the 1979–80 winter some ice formed but it was only 3″ to 6″ (8–10 cm) deep and took a long time to establish. This time gave the larvae a chance to survive the winter and more emerged the following year. The winter of 1982–83 had above mean temperatures and there was no ice formation at all; the population density soared to a level (see Fig. 1).

Table 1. Mean winter temperatures (MWT) for the months of December, January and February in Rhode Island.

Year	MWT (degrees centigrade)
1975–76	−0.91
1976–77	−3.70
1977–78	−3.17
1978–79	−2.38
1979–80	−0.41
1980–81	−1.82
1981–82	−2.20
1982–83	+1.27

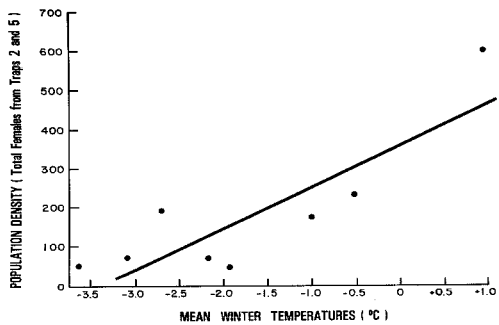

Fig. 1. Relation between mean winter temperature and adult population density of *Cq. perturbans* at Barrington, R.I. The sample regression line is based upon the equation: $\hat{y} = 180.6 + 98.9\ (x + 1.7)$. × is the MWT and $\hat{y}$ is the estimated population density.

It appears that manipulation of the overflow structures of wetlands during the winter months could be an effective control measure. The drop in water levels coupled with winter ice formation could reduce the number of larvae surviving. Mosquito control through water management has proven effective in the case of *Aedes sollicitans*. Manipulation of the breeding ground of *Cq. perturbans* could be a viable solution to the problem. Continual monitoring of temperatures, and mosquito levels would determine the effectiveness. We urge all districts to pursue this form of evaluation, and to experiment with water manipulation in an effort to achieve greater control of this difficult pest.

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A NEW RECORD OF *CULISETA ANNULATA* WITH NOTES ON MOSQUITO SPECIES IN SUFFOLK COUNTY, LONG ISLAND, NEW YORK

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On June 16, 1983, a female *Culiseta* was taken in a CDC trap operated in Manorville, Suffolk County, Long Island, NY. Using available keys, this specimen was identified as *Cs. particeps* (Adams) which is characterized by the presence of broad pale-scaled bands on the hindlegs and narrow subapical pale bands on the femora. According to Darsie and Ward (1981) *Cs. particeps* has been reported only from Arizona, California, Washington and Oregon. The specimen was then sent to the National Museum of Natural History, Smithsonian Institution, Washington, DC, for confirmation. Dr. Bruce A. Harrison, Manager, Walter Reed Biosystematics Unit, identified the specimen as *Cs. (Cus.) annulata* (Schrank, 1776) which is a common species in western and central Europe, Scandinavia, the USSR, Middle Asia, the Mediterranean and North Africa (Faran and Bailey 1980).

According to Harrison (personal communication) and Faran and Bailey (1980), the Manorville specimen is the third known female specimen of *Cs. annulata* captured in the USA. The first was collected in 1950 on an airplane arriving at Kennedy International Airport from Stockholm, and the second in 1978 was an overwintering female from Fort McHenry and Historic Shrine, Baltimore, Maryland. Trapping *Cs. annulata* from Manorville which is ca. 88 km NE of Kennedy Airport and 100 km E of New York Harbor would eliminate the possibility of a recent introduction of this species through these ports. Grumman Corporation which is ca. 6 km N of the collection site has a military airport. It is possible that this species was introduced through a military flight. Whether *Cs. annulata* became established or not has to be confirmed by intensifying the larval surveillance program in this area in the coming mosquito season.

Culiseta annulata is known to breed in natural or artificial fresh water breeding sites which are very common in the Manorville area. It can be distinguished from *Cs. particeps* by the number and width of the light-scaled bands on the tarsomeres and the scales on cross veins r-m and m-cu (Faran and Bailey 1980).

The latest listing of mosquito species from Suffolk County (Guirgis and Sanzone 1978) included 36 species together with *Orthopodomyia* spp. which were collected only in the adult stage from 2 sites and not identifiable to species. Since then, adult *Orthopodomyia* were taken in 8 more traps distributed all over the county. Species identification was not confirmed until the larval stage was located. *Orthopodomyia alba* Baker larvae were collected together with *Aedes triseriatus* (Say) on July 17, 1978, from a hole in a maple tree (*Acer rubrum*) in Bayport, Islip and *Or. signifera* (Coquillett) larvae were found on June 28, 1979 in old tires piled in the yard of an excavating company in Bellport, Brookhaven.

White and White (1980) reported the breeding of *Aedes atropalpus* (Coquillett) in an artificial container on Plum Island. Recently, we found a report (Mosquito Extermination Commission 1940) which indicates that a single *Ae. atropalpus* female was trapped from Shelter Island. Both islands are part of Suffolk County. Unfortunately, this report does not indicate the exact date of trapping nor the name of the person who identified the specimen.

The addition of *Ae. atropalpus, Or. alba, Or. signifera* and *Cs. annulata* to the Suffolk County mosquito list (Guirgis and Sanzone 1978) brings the number of the county species to 40.

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