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## STUDIES OF OVERWINTERING LARVAE OF *COQUILLETTIDIA PERTURBANS* MOSQUITOES IN MINNESOTA

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In an effort to determine if *Coquillettidia perturbans* larvae are able to survive in solidly frozen material, the following studies were conducted during the winter in a suburban area south of Minneapolis.

STUDY A. In late January, we cut 2 plugs of frozen material from a 45-acre cattail marsh. We had found *Co. perturbans* larvae in this site the preceding September.

The plugs were cut with an ordinary ice chisel. In each instance we marked a circular area approximately 1 ft.$^2$ and chiseled a 6 to 8 in. wide trench around the plug. The trench enabled us to scoop the ice chips away from the plug until we had chopped deeply enough to pull it free. We cut the ice and frozen root structure through the bottom of the frost line and removed the plug from the hole. Then we shaved off all the roots projecting outside the plug. (Since September, this site had dried to a depth of only 20 in. and it was now frozen to the bottom). We also scraped 6 in. of unfrozen (slightly moist) peat from beneath plug No. 1.

Both plugs contained 1/2 to 1 in. of clear ice at their surface. Beneath this, each plug consisted of a mass of cattail roots, peat and muck. Additionally, plug No. 2 contained sedge grass.

On our return to the county headquarters, we added enough tap water to the unfrozen material from beneath plug No. 1 to completely cover it. We submerged both plugs in tubs of tap water to prevent the roots and larvae from drying as the ice melted.

The following day we screened the unfrozen material from beneath plug No. 1. While carefully washing it through a 10-mesh sieve into one of 20-mesh, we searched for larvae but found none. The following 2 days were spent screening the thawed plugs. Plug No. 1 yielded 66 larvae—all dead, and plug No. 2 contained 3 dead larvae. Because of their advanced state of decomposition, I suspect that the larvae had died before the site had frozen.

STUDY B. Four days later we cut a plug from a 75-acre floating bog where we had also found *Co. perturbans* larvae in September.

In this instance, we changed the sample cutting technique. We used a 13-½ in. diameter cylinder, equal to a 1 ft.$^2$ of surface area. This tube was 3 ft. long and rolled from 26-gauge

galvanized iron. A section of coarse band saw blade was spot welded around its bottom perimeter and two handles were welded to opposite sides near its top.

We selected an isolated clump of cattails at the open water edge of the bog. Then we placed the cylinder around the clump and rotated it several times to mark the size plug desired. Following this, we cut a circular trench around it, as in Study A, being careful to maintain a size plug that would fit snugly inside the cylinder. After we had chopped the trench through the ice and freed the plug, we slipped the cylinder around it. Before lifting the plug from the hole, we forced the cylinder into the muck and compressed peat at the bottom of the pond to prevent larval movement beneath the ice. We then lifted the frozen plug from the cylinder and laid it on the ice surface with its lower end projecting over the cylinder. We shaved all protruding roots off and allowed them to fall back into the cylinder.

There were several inches of muddy water at the bottom of the hole. A test dip produced numerous *Co. perturbans* larvae. We then dipped a few inches of water and muck from the bottom, within the cylinder, and placed these in a container. The same screening method, used for the first survey, was employed on the unfrozen water and muck. This material contained 1718 larvae—1537 alive and 181 dead.

This plug was treated differently from the first two. We cut it in half horizontally, placing the upper 10 in. in a wash tub and the lower 10 in. in another. Instead of using tap water, we submerged both halves in stream water.

Two days later the 2 segments of the plug had thawed. We again employed the same careful screening process. The upper section (pond surface to 10 in. depth) previously had a layer of 2 to 3 in. of clear ice at its top; changing to gradually thickening muck and roots below. This section contained but one larva—a living one. The lower section of the plug (10 to 20 in. depth) consisted of muck and roots and contained 415 larvae—50 dead and 365 alive, an 88% survival rate (Table 1).

Of a total 2,134 larvae beneath one representative square foot of surface, 1903 were alive. Of these 366 (19%) were in solidly frozen material.

The lack of visible decomposition of the dead larvae, coupled with the fact that the greatest numbers of dead were found near the end of the screening operation, suggests that they were killed by the intensive handling.

*Study C.* The following day we brought a fourth plug to the headquarters. This isolated clump of cattails again came from the open water edge of the floating bog, but about 30 ft. distant from the plug in Study B.

Table 1. *Coquillettidia perturbans* larvae found in a frozen habitat—Study B.

| Section | Larvae | | | % of Total Alive |
|---|---|---|---|---|
| | Live | Dead | Total | |
| Upper frozen layer | 1 | 0 | 1 | 100 |
| Lower frozen layer | 365 | 50 | 415 | 88 |
| Unfrozen layer beneath plug | 1537 | 181 | 1718 | 89 |
| Totals | 1903 | 231 | 2134 | 89 |

The method of cutting and removing was identical to that used in the second study. The plug was again cut in half and the sections immersed in separate tubs. In this instance, the top half of the plug had 6 to 7 in. of clear ice beneath the surface and contained very few roots. Again each portion was carefully screened and the larvae counted. Dead larvae were discarded and the live ones added to the aquariums in which we had placed cattail plants. No larvae were found in the top 10 in. of frozen material. The lower 10 in. yielded 17, of which 9 (53%) were alive (Table 2). The unfrozen material, dipped from the cylinder beneath the frozen plug, yielded a total of 421 larvae of which 267 (63%) were alive.

Table 2. *Coquillettidia perturbans* larvae found in frozen habitat—Study C.

| Section | Larvae | | | % of Total Alive |
|---|---|---|---|---|
| | Live | Dead | Total | |
| Upper frozen layer | 0 | 0 | 0 | — |
| Lower frozen layer | 9 | 8 | 17 | 53 |
| Unfrozen layer beneath plug | 267 | 154 | 421 | 63 |
| Totals | 276 | 162 | 438 | 63 |

Again, since there was no decomposition of the dead larvae, I assumed mortality was caused by handling.

In conclusion, since 17% of the living larvae were found in a frozen habitat, this demonstrates that *Co. perturbans* larvae can survive freezing for an extended period.