

# **EFFECT OF TWO OVERWINTERING TEMPERATURES ON EGG VIABILITY AND HATCHING TIME OF BLACKHEADED FIREWORM (*Rhopobota naevana*)**

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## **INTRODUCTION**

The cultural practice of flooding cranberry beds during the late fall affects both the cranberry plant and pests. This project examined if the winter flood used to protect the buds of the cranberry plant may also protect blackheaded fireworm (BHFw) eggs from unfavorably low temperatures. We assessed (1) if egg mortality is increased when eggs are exposed to below freezing temperatures for extended periods of time (2) if egg hatch is delayed by low over-wintering temperatures and (3) if prolonged post-freezing chilling affects egg survival (i.e., if a lengthy period of cold spring weather is detrimental to BHFw eggs).

## **METHODS**

We collected 2,000 BHFw eggs from a Monroe County marsh in October, and stored them at 39°F for 3 months. In mid-January half of the eggs were placed at 32°F (0°C), and the other half at 14°F (-10°C). The eggs were held at these temperatures for various lengths of time and then returned to 39°F (“post-freezing chilling”) for different lengths of time. After the freezing/chilling treatments, eggs were transferred to 73°F and hatch recorded.

Different groups of eggs were held at the two freezing temperatures for 1, 2, 4, 6, 8 and 10 weeks. Subgroups were then chilled 1, 2, 4, or 6 weeks before transferal to 73°F.

## **RESULTS AND DISCUSSION**

### **NUMBER OF EGGS HATCHING**

#### **Freezing Time**

Exposure to 32°F simulated temperatures beneath the ice, and the 14°F temperature reflected colder conditions that might occur without the winter flood. Significantly fewer eggs held at 14°F hatched than eggs exposed to 32°F (Figure 1) except for the eggs held at 14°F only one week. Short term exposure to this colder temperature did not negatively affect hatch as did long term exposure.

The length of time eggs were held at 14°F significantly influenced egg viability. As length of freezing time increased, percent egg hatch decreased (Figure 2). In contrast, the length of exposure time at 32°F (0°C) did not significantly influence egg hatch, although there was a slight downward trend as freezing time increased.

## Post-freezing chilling

Chilling at 39°F simulated the post-freezing chilling that would occur during cold spring weather. For eggs held at the 14°F temperature, as length of post-freezing chilling increased, the percent egg hatch decreased. Significantly fewer eggs hatched after being refrigerated for 6 weeks, than at 1, 2 or 4 weeks at all freezing time periods. Embryos stressed by cold temperatures often developed to a stage in which the black head capsule and body of the larva were visible microscopically within the egg. But the embryo would die instead of the egg hatching.

Eggs originally held at 32°F were slightly affected by post-freezing chilling, but not as severely as eggs held at 14°F. This suggests that a prolonged cold spring could be detrimental to egg viability, especially if eggs were previously exposed to unfavorably cold temperatures.

## HATCHING TIME

In most treatments, eggs frozen at 32°F took significantly less time to hatch than those frozen at 14°F. This suggests some type of development occurs at 32°F and not at 14°F, or that eggs are somehow stressed. Table 1 indicates the average number of days to egg hatch.

**Table 1.** Average number of days needed for blackheaded fireworm egg hatch at 73°F after various freezing and chilling regimes. These are selected examples. Comparisons should be made between rows (between 32° and 14°F)

		<u>Weeks Frozen/Weeks Refrigerated</u>						
		1/1	1/2	2/1	2/2	4/2	6/1	10/2
Temp								
32°		6.9	6.5	5.1	6.2	5.4	5.4	5.2
14°		8.7	7.0	7.1	7.7	7.4	8.4	7.3

Eggs frozen for only 1 week at either 32°F or 14°F tended to take longer to hatch than eggs frozen longer. This indicates eggs must be exposed to cold temperatures for a certain minimum period of time to break dormancy.

Most of the eggs exposed to the 32°F freezing temperature hatched within 3 to 5 days of being transferred to 73°F (Figure 3). In contrast, most of the eggs exposed to 14°F required 6 to 8 days to hatch. Very few eggs from either freezing temperature required longer than 9 days to hatch.

## CONCLUSION

At some point below 32°F, cold temperatures increase the mortality rate of overwintering BHF<sub>W</sub> eggs. Prolonged cool weather after freezing has a detrimental affect on eggs especially if the eggs were previously exposed to unfavorably low temperatures. We also know from data collected from the UWEX Cranberry IPM Program that if temperatures rise rapidly in the spring and eggs hatch prematurely, significant larval mortality will occur because of freezing night temperatures.

It is probable that some development occurs at 32°F but not at 14°F. The possibility of some type of development taking place underneath the ice or development being inhibited by cold temperatures complicates the use of models to predict egg hatch.

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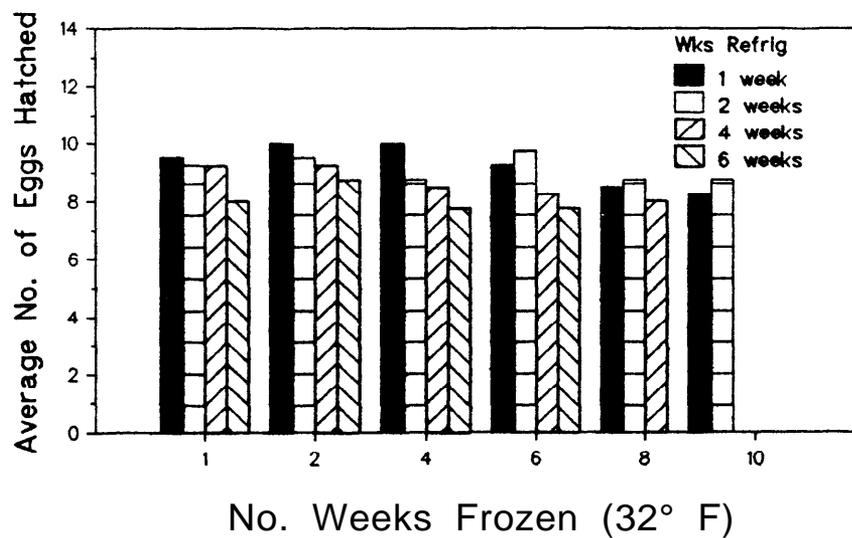
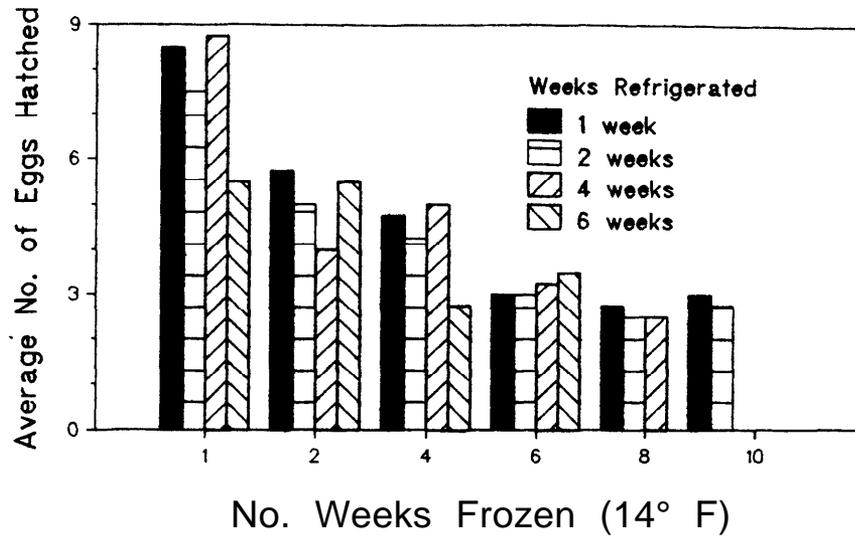


Figure 1. Fewer eggs hatched after exposure to the overwintering temperature of 14°F than eggs exposed to 32°F.

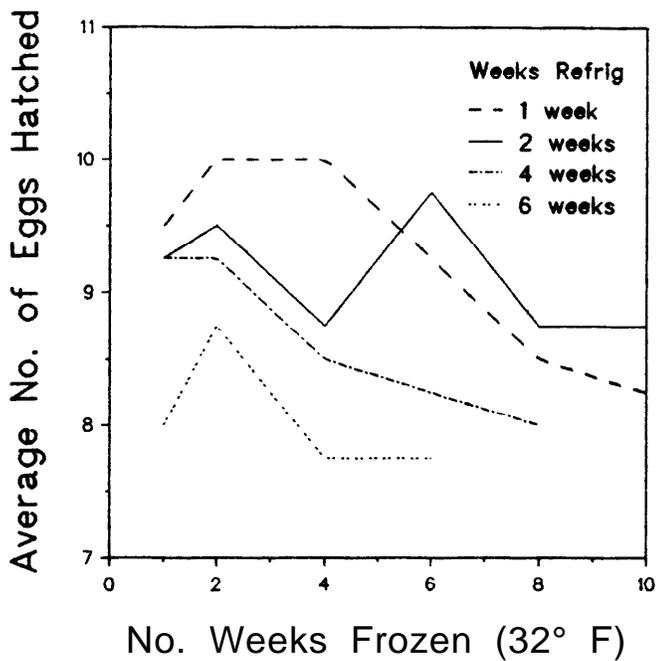
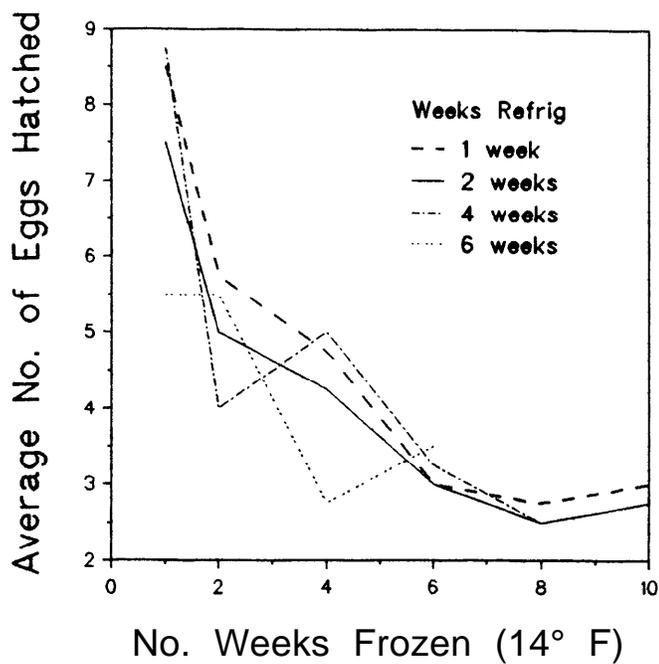


Figure 2. The length of time eggs were held at 14°F influenced egg viability. As the length of freezing time increased, percent egg hatch decreased. The length of time eggs were held at 32°F did not significantly influence egg hatch.

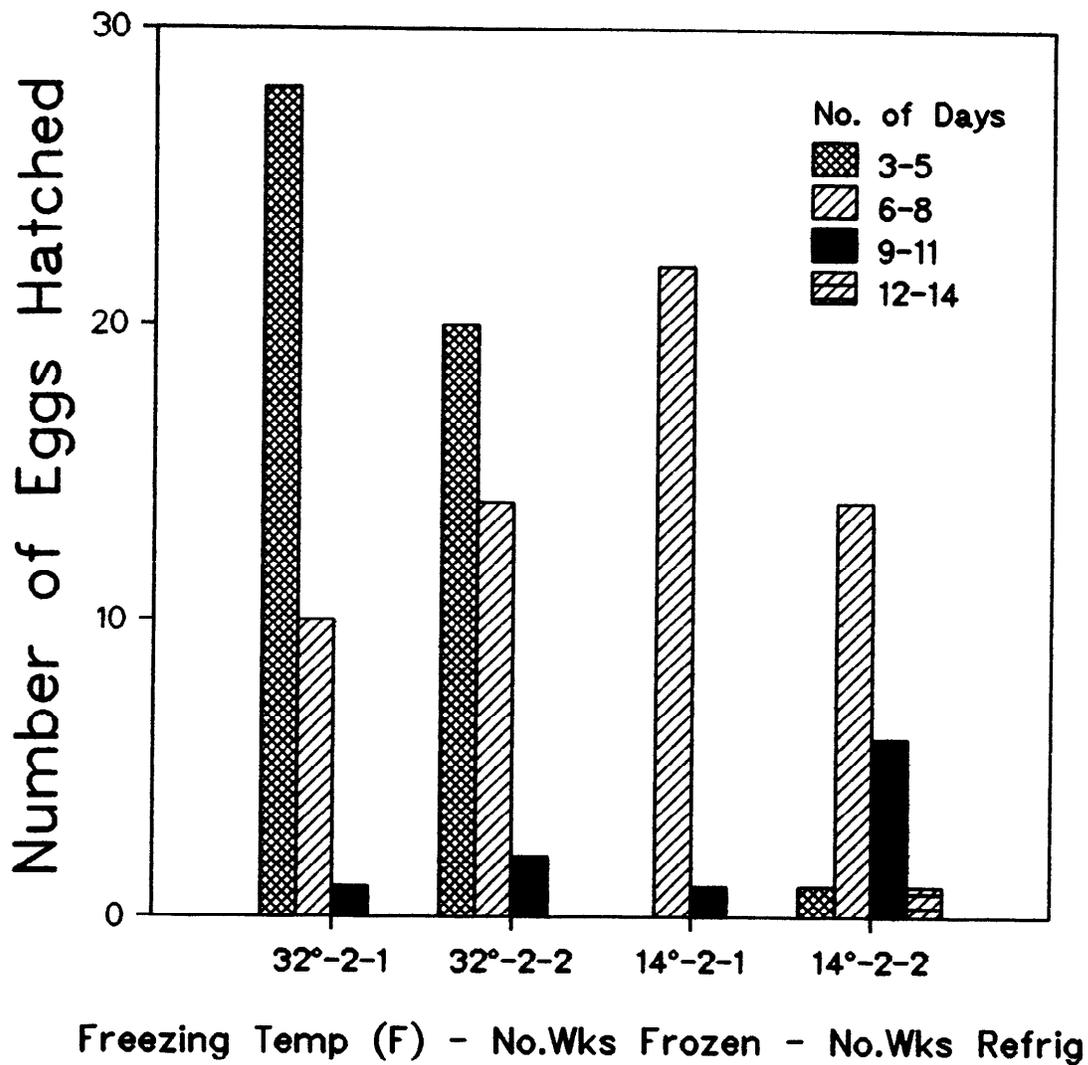


Figure 3. Most eggs exposed to 32°F freezing temperature hatched within 3 to 5 days of being transferred to 73°F. In contrast, most eggs exposed to 14°F required 6 to 8 days to hatch. Very few eggs from either freezing temperature required longer than 9 days to hatch.