

Where do spotted wing drosophila go in the WINTER?

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WHAT'S A WINTER MORPH?

SUMMER MORPHS

WINTER MORPHS



Figure 1. Female (top) and male (bottom) summer morph (left) and winter morph (right) spotted wing *Drosophila* from lab-reared colonies. Summer morphs are reared under 25° C and 16:8 L:D, while winter morphs are reared under 10° C, 12:12 L:D conditions. Notice the longer wings and darker body color of the winter morphs.

Winter morphs form when spotted wing *Drosophila* (SWD) eggs or early instar larvae are subjected to cold temperatures ($\leq 10^\circ\text{C}/50^\circ\text{F}$). They take 3 times longer to emerge as adults at $10^\circ\text{C}/50^\circ\text{F}$. Summer morphs can live for 1 month in colony, while winter morphs can live for >13 months in colony.

Winter morphs are darker, have a smaller body, and longer wings (Shearer et al. 2016; Wallingford et al. 2016). They can withstand colder temperatures, have decreased egg production, and reduced cell division (Shearer et al. 2016).

SWD likely experience severe climatic pressure during the winter, thereby reducing the surviving population in the spring. Our objectives were to better understand SWD winter biology, including their phenology, survival, and reproductive capacity, which can help us control this pest while it's population is low.

WHEN DO WE SEE WINTER MORPHS IN MICHIGAN?

Beginning in **October**, we start to catch flies with **longer wings**, indicating a shift to winter morphs (black line, Figure 2). Flies are not caught in traps after **December**.

This shift is highly correlated with ambient **temperature** (red dotted line, Figure 2).

There is a gradient of increasing wing length, indicating variability within winter morphs.

We can also identify winter morphs by using **body color** (Figure 3).

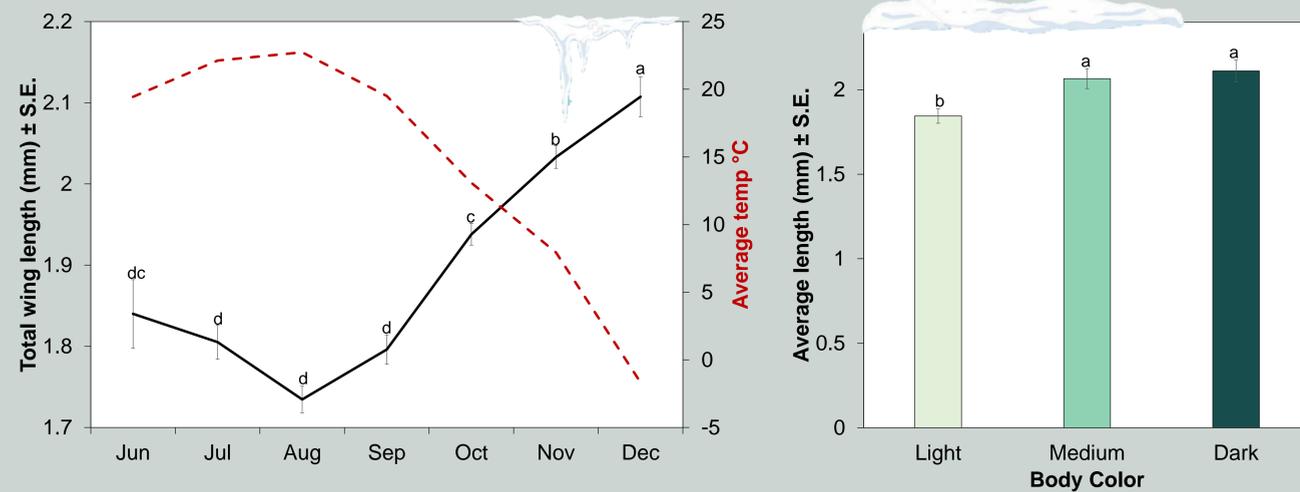


Figure 2. Average wing length (\pm S.E.) of SWD caught in traps in Fennville, MI (black line) from June through December. The red dotted line indicates the average ambient temperature. Different letters within each month represent significantly different means ($\alpha = 0.05$).

Figure 3. Average wing length (\pm S.E.) across three different body color categories (light, medium, and dark). Different letters within each color group represent significantly different means ($\alpha = 0.05$).

CAN THEY SURVIVE?

After placing winter morphs under the leaf litter in late November, we found that there was **no survival** past 6 weeks (Figure 4).

However, temperature **under the soil** stayed **above freezing** (green line), indicating it's potential for an overwintering site.

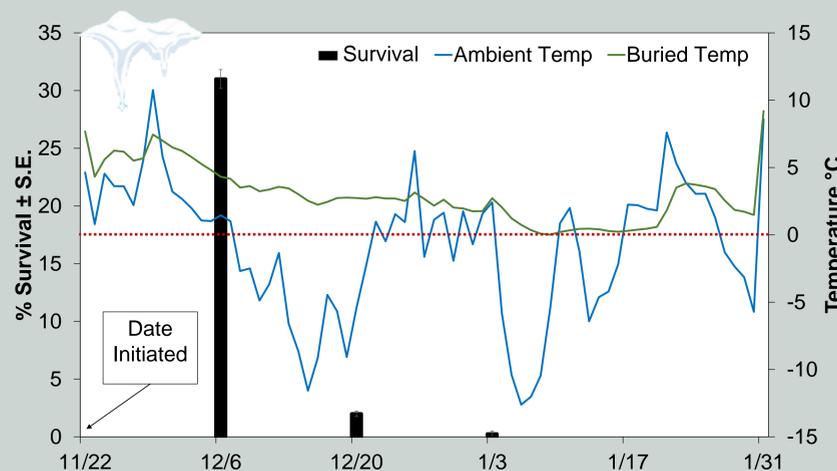


Figure 4. Percent survival (\pm S.E.) (black bars) of winter morph SWD after being placed in the soil beneath leaf litter on 11/22. At two week intervals, 4 groups of 100 flies were brought to warmer temperatures and their survival was assessed. The ambient temperature (blue line) and temperature below the leaf litter (green line) are also shown. The red dotted line indicates the freezing temperature.

CAN THEY REPRODUCE?

Summer morphs can lay **more** eggs than winter morphs at all temperatures tested.

But, when winter morphs are acclimated to **48 hours** of warm temperatures, they can lay **more eggs** than unacclimated flies.

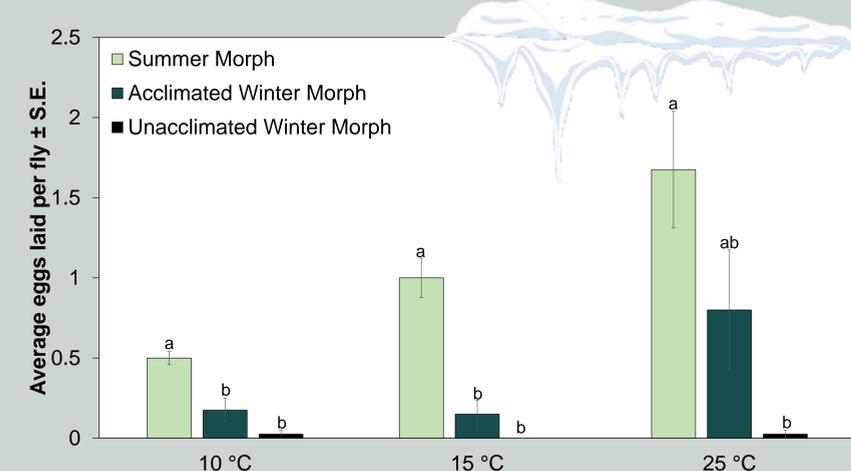


Figure 5. Average eggs laid per female fly (\pm S.E.) after 24 hours in artificial diet at 10°, 15°, or 25° C. Flies used were either summer morphs (reared at 25° C), unacclimated winter morphs (reared at 10° C), or acclimated winter morphs (reared at 10° C and put in 25° C for 48 hours before experiment). Different letters within each temperature group represent significantly different means ($\alpha = 0.05$).

SUMMARY

Winter morphs appear in **October** and until no more flies are caught after **December**.

Flies overwintering underneath the **leaf litter** and in the **soil** can remain in **above freezing** temperatures throughout the duration of the winter.

After being exposed to **warmer temperatures** for 2 days, winter morphs have a **greater reproductive capacity**, allowing them to begin laying eggs during the spring.

SWD likely go through a **bottleneck period**, with few flies surviving winter and starting the spring population, making this time a potential opportunity to manage SWD.

Research is ongoing, and we are focused on understanding where flies overwinter on farms, how annual shifts in winter temperatures affect their survival, and how we can trap them in the spring.

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Questions or Comments? Feel free to contact me! Heather Leach, leachhea@msu.edu