

# Bringing In Un-BEE lievable Beneficials



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University of Vermont ~ Entomology Research Laboratory

VNLA Winter Meeting & Trade Show

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# Balancing Beneficials

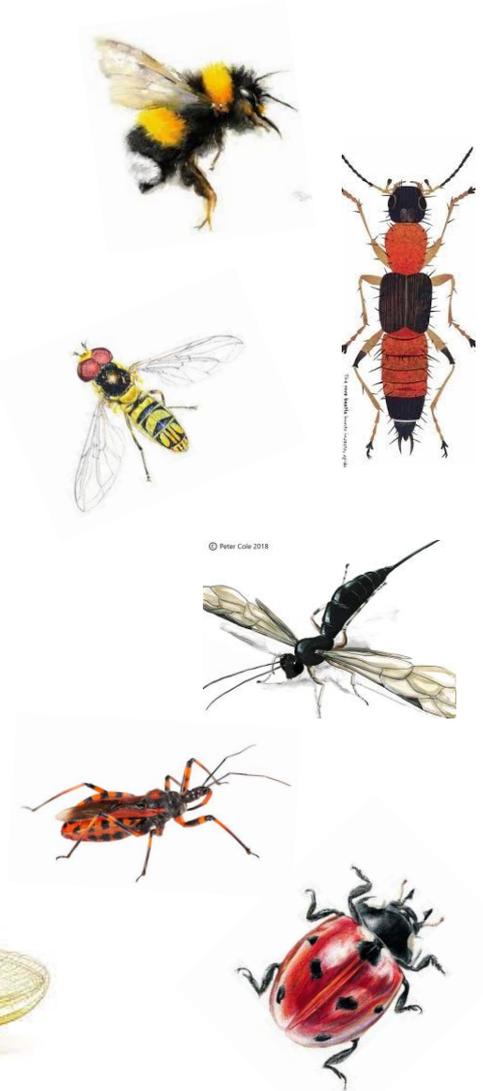
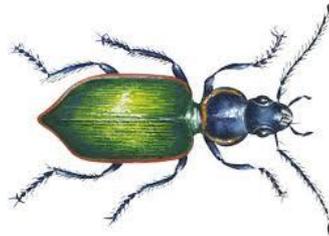
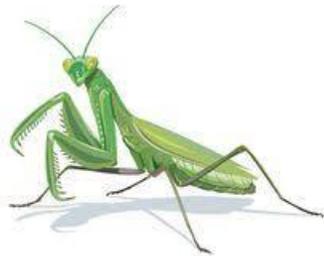
Beneficial insects provide pollination or pest management services

Some provide both (pest-fighting pollinators) i.e. many fly species

Beneficials are under stress

- Habitat Loss (conversion, fragmentation, agricultural intensification, monocultural production systems)
- Climate change (geographical shifts)
- Diseases (Parasites, Viruses)/Disorders (bee colony collapse)
- Pesticides (direct contact, avoidance of treated crops)

Need strategies to promote their establishment & provide protection



# We Are Providing Benefits

We are evaluating the effectiveness **habitat hedges** to attract beneficial insects to growing areas to support biological control of common greenhouse, high tunnel & nursery pests.

Habitat hedges provide a continuous source of pollen, nectar, attracted prey, refuge & reproduction sites for beneficial insects.

Encouraging the establishment of natural enemies of key pests could minimize or eliminate the need for chemical pesticides.



# Habitat is Happiness

Established habitat hedges of (mostly native) annual plants (approx. 10 x 3ft)

Some harvestable annual habitat plants (to attract consumer attention)

Mix of transplants & direct seed (to provide floral resources all season)

Visual & plant tapping surveys for beneficials (primarily those that manage most common pests)

Also examined perennials during bloom periods in display gardens or container stock

Collected data 2x month (May-September)

Year 2 completed, will continue for 3 more



# Habitat Hedge Constituents



Indian Blanket



Zinnia



Sunflower



Marigold



Plains Coreopsis



Wild Cosmos



Sweet Alyssum



Royal Carpet Alyssum



Blue Cornflower



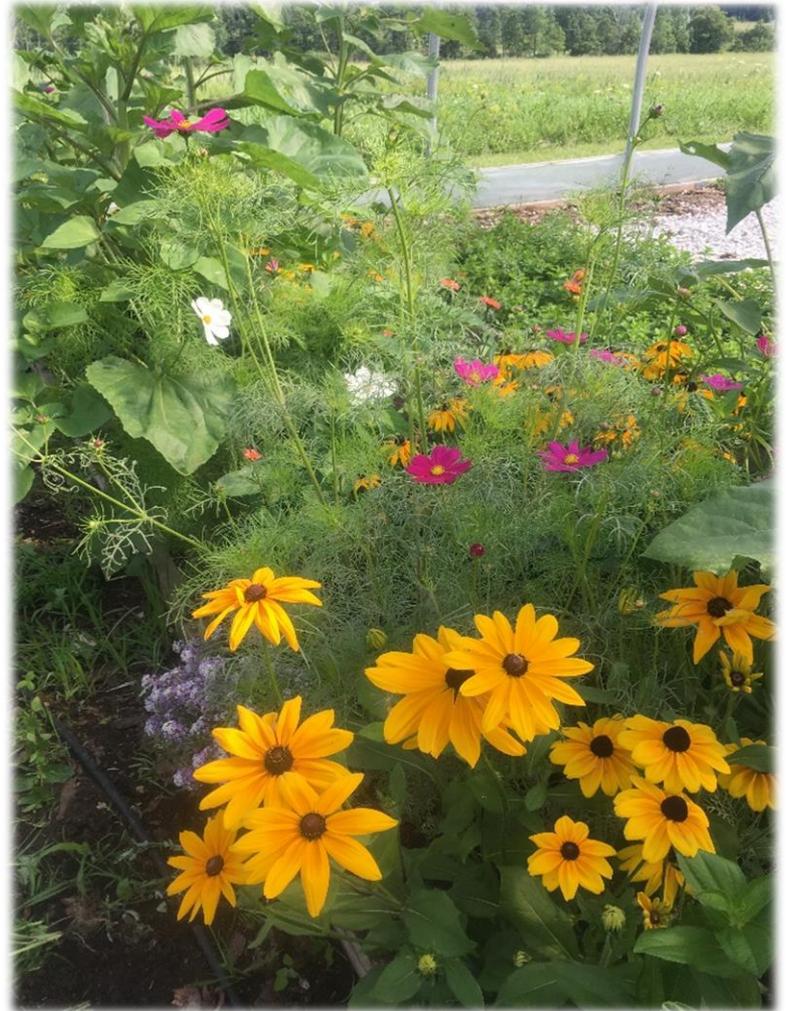
Lacy Phacelia

Provide a diversity of colors, structures (floral shapes/sizes & vertical heights) & bloom periods

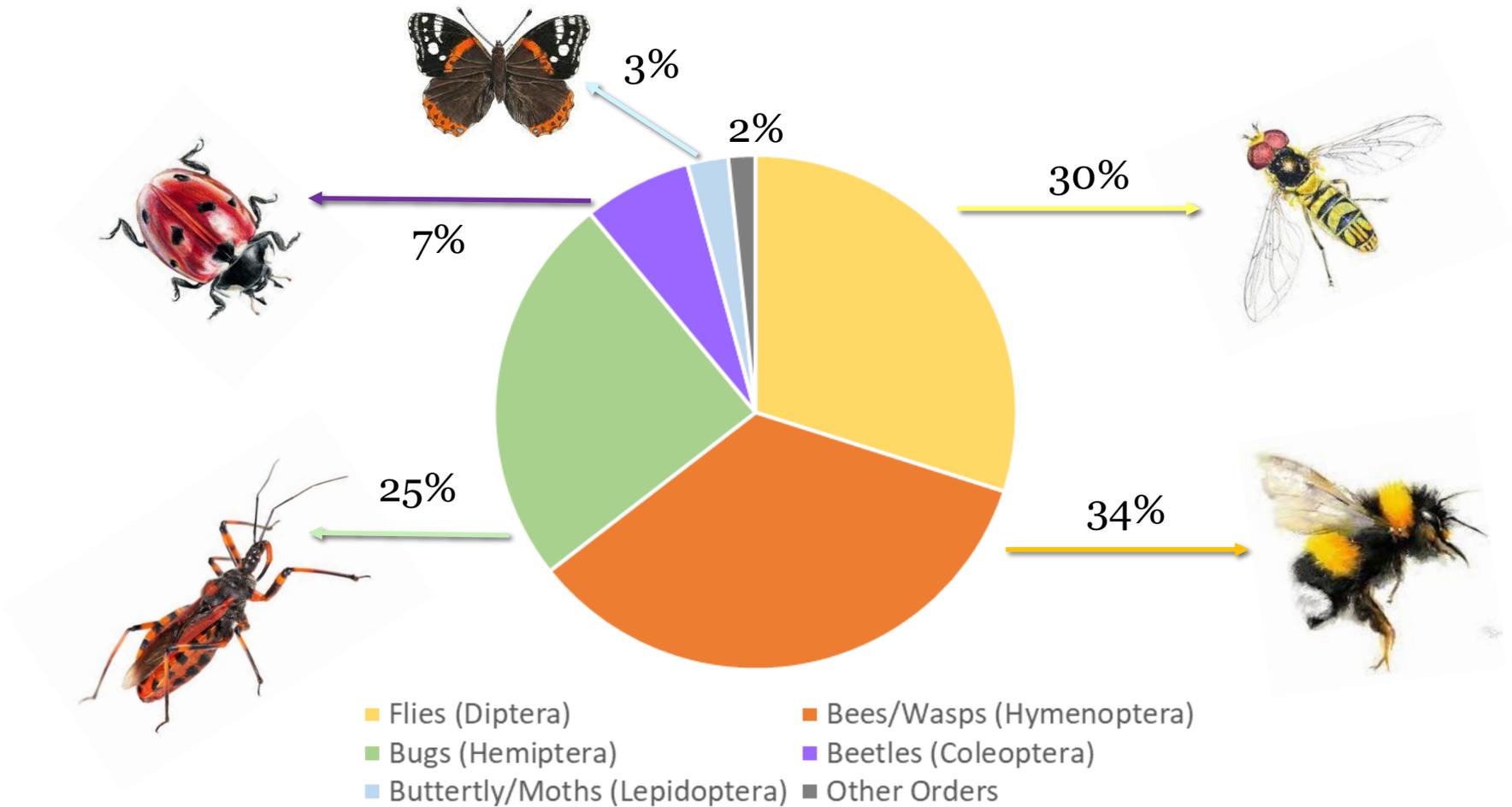
# Examples



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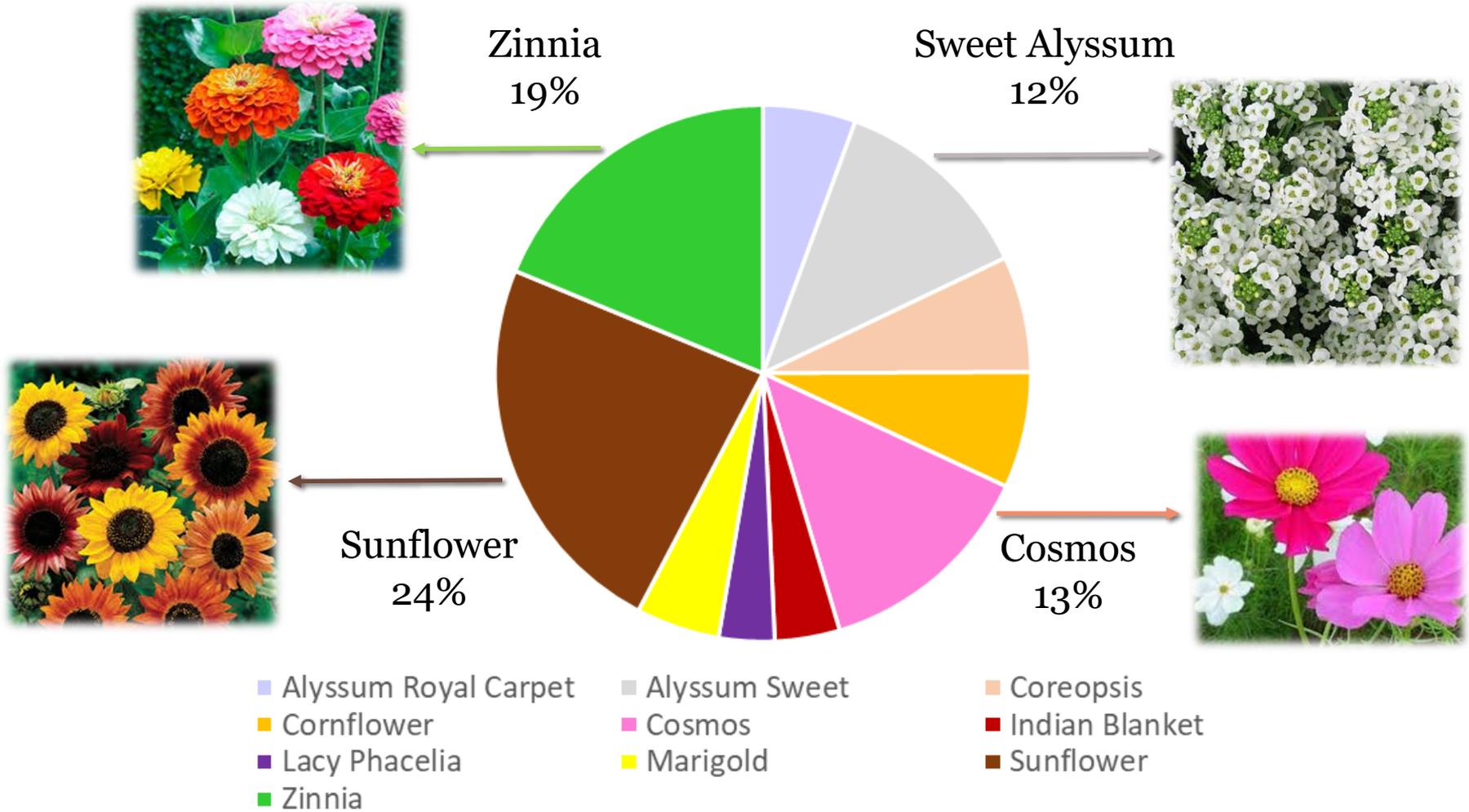


# Maintaining Order in the Hedges



Allocation of insect orders present on plants within habitat hedges (357 occurrences during 41 observations over 2 years)

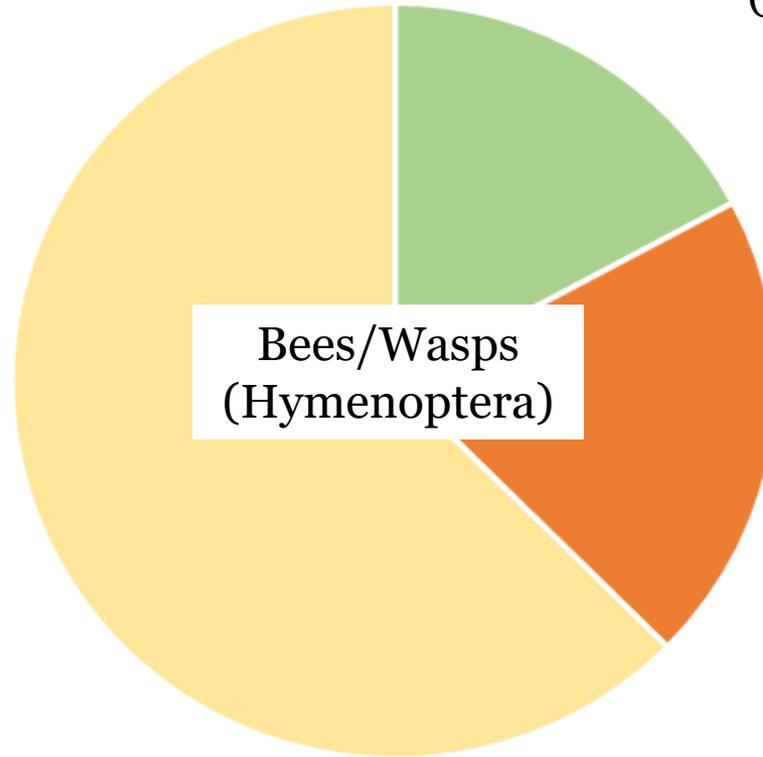
# A Matter of Preference



# Beneficial Break Down



Bees 83%



Small wasps <0.5cm  
(23%)



Large wasps/hornets  
(27%)



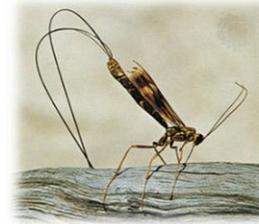
# Natural Enemies of Particular Interest

## Parasitic & Predatory Hymenoptera

Adult parasitic wasps lay eggs within/on); larvae are predatory killing host; adults mostly feed on nectars & some are predatory



*Cotesia* pupae on hornworm (after feeding within)



Parasitic  
Ichneumon Wasp



*Trichogramma* on  
moth eggs



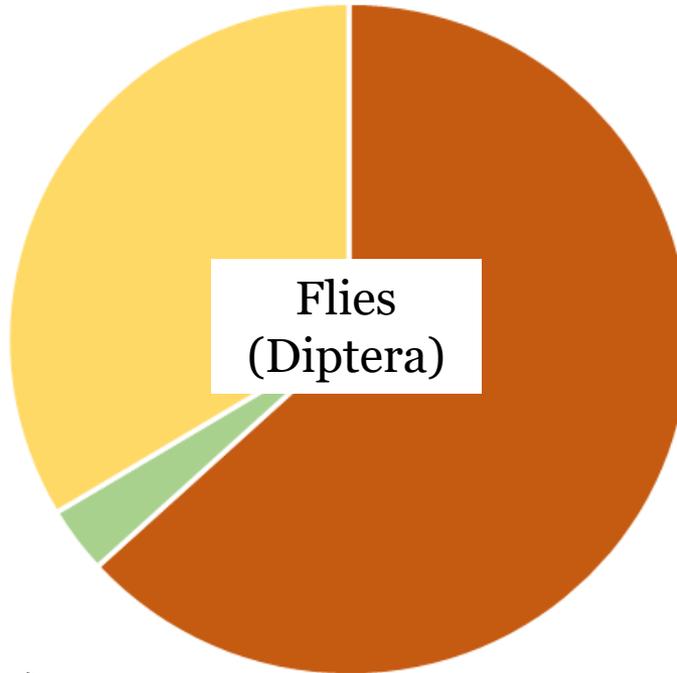
Hornets & many wasps consume a variety of insect pests in addition to floral resources

*Aphidius* attacking aphids (wasp pupa in aphid mummies)

# Beneficial Break Down

Others (39%)

Predatory  
Syrphids (74%)



Parasitic  
Tachinids (4%)



# Pollination Power of Flies

Second to bees for pollination

Some commercially produced for pollination  
(Blue Bottle Fly)

Pollinate in wide range of ecosystems  
(high latitudes, elevations)

Some provide pest control services to commercial  
growers (syrphids, tachinids, etc.)

Provide pollination 'insurance' – more adaptable to  
land use changes than bees - use resources from  
diverse landscape (cover, alternative foods, etc.)

Value as pollinators & pest managers for many yet to  
be determined



# Natural Enemies of Particular Interest

Predatory (Syrphid) & parasitic (Tachinid) flies

Adults feed on pollen & nectars, larvae of many kill host

Preference for small flowers

Syrphids mimic bees/wasps to scare off predators

Is it a fly or a bee?

- 1 pair wings (bees have 2 pairs)
- Mostly short bristle-like antennae (bees have long)



M. J. Raupp

Syrphid



Fly



Bee



Tachinid

# Basic Syrphid Characteristics

## Is it a syrphid?

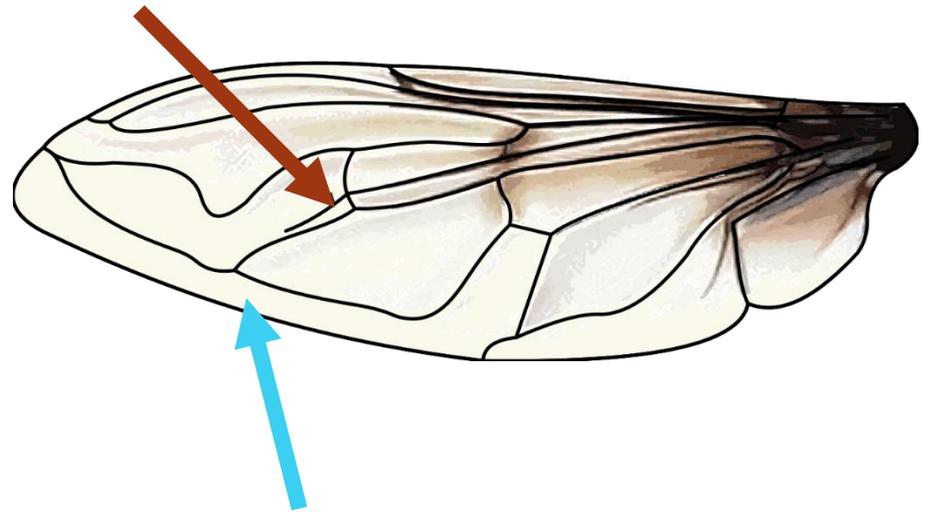
Other than they resemble bees  
& have 2 wings.....

Observe behavior - called 'hover  
flies' or 'flower flies' because of  
tendency to hover in place  
around flowers



In case your **really** inspired to tell  
it's a syrphid, check out wings  
(under magnification)

Floating/false vein in wing (Vena spuria)



Great part of wing edge is without veins

# Syrphid Life Cycle

Not all syrphids have predatory maggots, many consume decaying matter

Generally overwinter as immatures in duff layers

Adults emerge in spring & seek pollen, nectar &/or sugary aphid honeydew 'poop' - need proteins for egg laying & sugars for flight energy

Adults lay eggs near aphid colonies & are active April-November

Several generations per year

Flowering plants encourage localized early establishment & overwintering

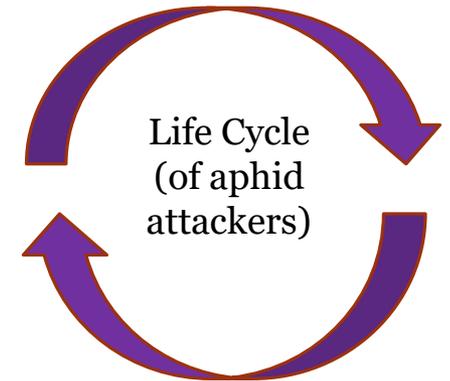
Adult



Pupa



Egg



Larva/maggot (3 stages)



# Syrphid Diversity

- ★ small pests
- ★ decaying matter

*Neoascia* sp.



Larvae aquatic

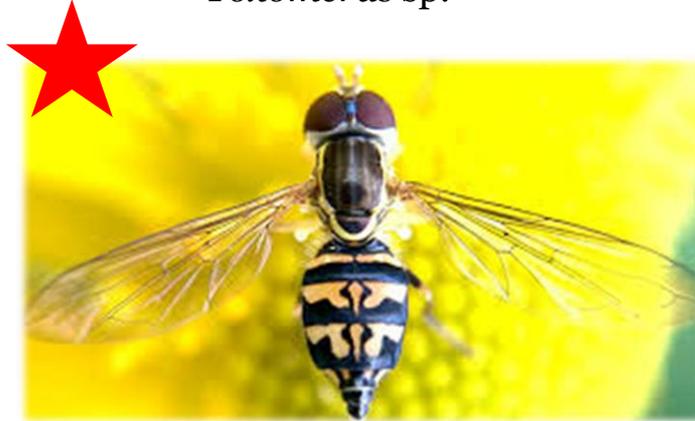
*Eristalis tenax* (Drone fly)  
Honey bee mimic



Rat tail maggot



*Toxomerus* sp.



*Melanostoma mellinum*



*Allograpta obliqua*



*Mallota posticata*  
Bumble bee mimic



*Chrysotoxum* sp.  
Yellow jacket mimic



Larvae ground dwelling & suspected to prey on ants

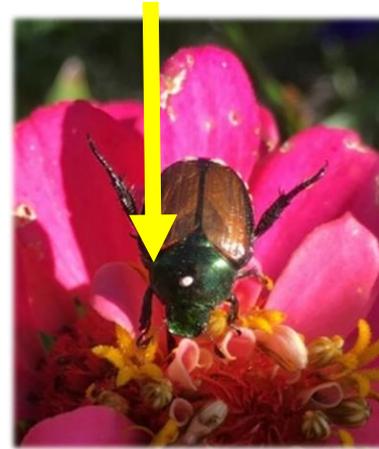
# Tachinid Life Cycle

Parasitized Japanese Beetle by Tachinid fly on Zinnias (JB really like zinnias)

Larvae are internal parasites of caterpillars, beetles & bugs

Eggs laid on (for larvae to burrow into), near (for ingestion) or within hosts

After consuming host, larvae burrow out to pupate on ground substrates



Pupae



Larva

Resemble houseflies but have stout bristles on tips of abdomen



# Natural Enemies of Particular Interest

Who wants freebies?

General Predators of aphids, mites, thrips

- *Orius insidiosus* (minute pirate bug)  
(60% of bugs that were present)
- Lady Beetle spp. (42% of beetles)

Both commercially available

- ~\$188 for ~ 2000 *Orius insidiosus*  
(20/100ft<sup>2</sup>)
- ~\$50.00 for ~9000 Lady Beetle  
(*Hippodamia convergens*) (500 per  
100 ft<sup>2</sup>)
- ~\$20 plus for shipping



*Orius* adult



Thrips adult



Lady beetle adult (above)  
& larva (below) eating aphids



*Orius* adult eating aphid

# What Else Did We See?



Predatory Thrips. Yes, some thrips are good thrips!  
Banded thrips



Jagged Ambush Bugs



Soldier Beetles

# Project Highlights



## Flower Power at Hildene

Hildene's garden staff teamed up with UVM researchers to create a flower garden that attracts pest-fighting insects. Pictured is the group at the Dene Farm. Andrea Luchini, Hildene horticulturist, is on the right. See page 25.



Provided training sessions for Korean & Lebanese graduate students on attracting & sustaining natural enemies

Established a link between educators, farm managers & students from a local academy that assisted with planting of habitat hedges & data collection

Produced consumer awareness signs & brochure to educate about importance of habitat for all pollinators



# Future Plans

Examine diversity & identify species within habitat hedge (pan trapping ground level vs elevated canopy)



Focus on perennials observed to be attractive (*Coreopsis verticillata*, Culver's root, Yarrow, *Astrantia*)



Incorporate other annuals into hedges observed to have high activity (*Verbena bonariensis*, *Ageratum*)

# Bee-lieve in the Cause

Provide a diversity of habitat plantings for beneficials with different floral shapes & sizes that bloom all season long

Boost pollination & receive free pest management with less chemical pesticides

Protect pollinators from direct pesticide exposure if you need to treat:

- Treat plants when least attractive (or are most unattractive to beneficials)
- Long before bloom time with systemics
- Early or late in day (when bees not foraging)
- Select least toxic chemistries
- Read directions & apply at correct rates



# Beneficial Insect Resources

Attracting Beneficial Insects with Native Flowering Plants: <http://www.canr.msu.edu/nativeplants/uploads/files/E2973.pdf>

Beneficial Insects: National Pesticide Information Center: <http://npic.orst.edu/envir/beneficial/index.html>

Beneficial Insects in NH Farms & Gardens (UNH): [https://extension.unh.edu/resources/files/Resource000499\\_Rep521.pdf](https://extension.unh.edu/resources/files/Resource000499_Rep521.pdf)

Creating Gardens for Pollinators:: <https://protectingbees.njaes.rutgers.edu/>

Field Guide to the Syrphidae of Northeastern North America:

<http://www.canacoll.org/Diptera/Staff/Skevington/Syrphidae/Syrphidae.htm#General>

Flower Flies (Syrphidae) and Other Biological Control Agents for Aphids in Vegetable Crops:

<http://anrcatalog.ucanr.edu/pdf/8285.pdf>

Grow Wise Bee Smart – Best Management Practices for Bee Health in the Horticultural Industry: <http://growwise.org/wp-content/uploads/2017/01/HRI-Pollinator-BMPs-January2017.pdf>

NRCS Planting Guides for Native Pollinators:

<https://www.nrcs.usda.gov/wps/portal/nrcs/detail/plantmaterials/technical/publications/?cid=stelprdb1044847>

Pesticides & Pollinators: Greenhouse Production Perspective:

[http://www.mapyourshow.com/mys\\_shared/cultivate17/handouts/RaymondCloydPresentationPesticidesandPollinatorsGreenhouseProductionPerspectiveJuly152017%20\[Compatibility%20Mode\].pdf](http://www.mapyourshow.com/mys_shared/cultivate17/handouts/RaymondCloydPresentationPesticidesandPollinatorsGreenhouseProductionPerspectiveJuly152017%20[Compatibility%20Mode].pdf)

Pollinator-Friendly Plants for the Northeast United States:

<http://agriculture.vermont.gov/sites/ag/files/pdf/apiary/wildflower%20picture%20guide%20and%20info.pdf>

Pollinators, Neonicotinoids and Greenhouse Production: <https://ag.umass.edu/greenhouse-floriculture/fact-sheets/pollinators-neonicotinoids-greenhouse-production>

Protecting Bees and Other Pollinators from Pesticides (EPA): <https://www.epa.gov/pollinator-protection>

Selecting Plants for Pollinators (Northeast): <http://pollinator.org/PDFs/Adirondack.rx2.pdf>

Xerces Society Northeast Region: <http://xerces.org/pollinators-northeast-region/>

# Questions ?

Interested in **participating** in this study this summer?  
Please contact me!

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## Participating Growers

Allen Bro's Farm  
Claussen's Florist & Greenhouses  
Full Circle Gardens  
Paquette Full of Posies  
Red Wagon Plants  
Sam Mazza's  
The Hildene

**Thank YOU!**

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