Companion Plants in Greenhouses: *Potential for Pest Monitoring, Trapping, and Natural Enemy Open Rearing*

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Background

Current greenhouse insect pest management tactics are largely dependent on broadly-toxic insecticides that pose risks to workers, consumers, and our environment. Biological control tactics such as releases of natural enemies are also used and grower interest in them is rising due to increased EPA regulation of insecticides and consumer demand for sustainably and organically produced plants. Unfortunately, repeated natural enemy releases can be costly. Companion plants can provide supplemental resources for natural enemies to support their longevity in greenhouses. Companion plants can also serve as pest monitoring and or trapping tools. The use of companion plants for these purposes has been extensively researched and implemented in field, vegetables, and fruit crops. However, greenhouse use of companion plants has not been adequately addressed.

Our objective was to determine which species of commonly available plants may serve as trap plants for pests or as habitat for natural enemies.

- Calendula (*Calendula officinalis*)
- Dill (*Anethum graveolens*)
- Alyssum (*Lobularia maritima*)
- Poppy (*Papaver somniferum*)
- Eggplant (*Solanum melongena*)
- Pepper (*Capsicum annuum*)
- Barley (*Hordeum vulgare*)
- Blue Hubbard Squash (*Cucurbita maxima*)
- Buckwheat (*Fagopyrum esculentum*)
- Castor Bean (*Ricinus zanzibarensis*)
- Impatiens (*Impatiens balsamina*)
- Fiddleneck (*Phacelia tanacetifolia*)
- Queen Anne's Lace (*Daucus carota*)

Methods

Our experiment was conducted in the 4-acre certified organic Elzinga & Hoeksema Greenhouse in Portage, MI. The greenhouse was in production of herbs and lettuce and practicing regular pest management of natural enemy releases and OMRI approved pesticide applications on their crop. Organic seeds of the plants listed above were organically grown in pots onsite. The plants were transplanted and debudded as needed, and monitored for pests weekly. Debudding ceased prior to setup to allow bloom of flowering plants.

Setup

- Plants placed along lettuce beds in a randomized complete block design
- Three blocks – each with 13 plant plots and ½ m buffers between plots
- One plant plot (½ m) = six pots of one plant species
- One yellow sticky card per plot was placed in the center of the plot
- Green lacewing larvae and minute pirate bugs (5,000 of each) were distributed throughout lettuce beds adjacent to plant plots.


Buckwheat plant plot


Green Lacewing Larva

Data Collection and Analysis

- Weekly visual inspections for natural enemies and pests in plant plots and on sticky cards for 5 weeks
- Data were normalized using appropriate transformations and analyzed using two-way ANOVAs. Multiple comparisons were made using Tukey's HSD.


Krista Buehrer taking visual samples in impatiens plot

Results: Thrips, Fungus gnats, Aphids , Aphid mummies, and Parasitoids

Fig.1. Thrips on sticky cards in plant plots over 5 weeks.

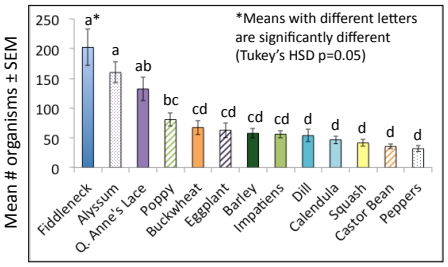


Fig.2. Fungus gnats on sticky cards in plots over 5 weeks.

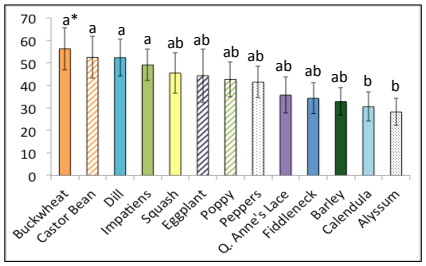


Fig.3. Plant plot visual samples of aphids over 5 weeks.

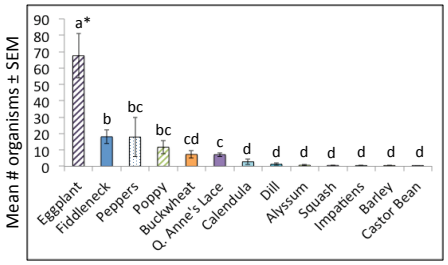


Fig.4. Visual samples of aphid mummies over 5 weeks.

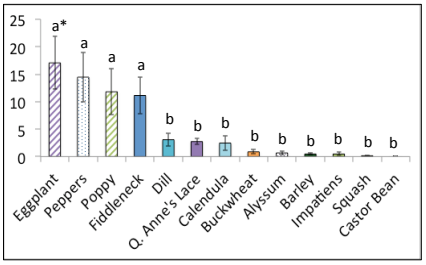
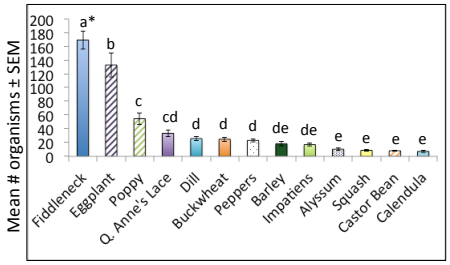


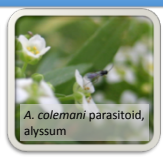
Fig.5. Parasitoids on sticky cards in plant plots over 5 weeks.



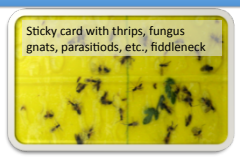
- Thrips densities on sticky cards were greatest in fiddleneck and alyssum plots (Fig. 1).
- Buckwheat, castor bean, dill and impatiens had more fungus gnats on sticky cards than calendula and alyssum (Fig. 2).
- Eggplant had the highest aphid density (Fig.3).
- Eggplant, peppers, poppy, and fiddleneck plots had the most aphid mummies (Fig. 4).
- Parasitoid densities on sticky cards were greatest in fiddleneck and eggplant plots (Fig. 5).

Conclusions


Minute pirate bug, calendula


A. colemani parasitoid, alyssum


Ladybird beetle, fiddleneck


Sticky card with thrips, fungus gnats, parasitiods, etc., fiddleneck


Mummies, eggplant

- No lacewings and few minute pirate bugs (<5) were observed in plant plots throughout the experiment.
- Minute pirate bugs, parasitoids, and ladybird beetles were observed visiting alyssum, fiddleneck, and dill.
- Fiddleneck and alyssum have high bloom densities that were attractive to thrips.
- Anecdotally, fungus gnat densities were correlated with the amount of exposed soil surface area in plant plots.
- Growers did not report economic aphid densities in crop, but eggplant was heavily infested by aphids.
- Mummies were most prevalent on eggplant, peppers, poppy, and fiddleneck. These plants may be good hosts to rear parasitoids (e.g. banker plants).
- Fiddleneck was difficult to grow and manage. Implementing it as a companion plant may not be feasible.
- **Potential companion trap or indicator plants: eggplant for aphids; fiddleneck and alyssum for thrips**
- **Potential companion resource plants for natural enemies: alyssum, dill, and fiddleneck**

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