Final report

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Flowering plants to enhance biological control in landscapes

Coordinator

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Collaborators

University of Rhode Island
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SARE grant

$80,344

Match

$16,586

Duration

1997 to 2001

Summary

We have shown coriander and shasta daisies as attractors to natural enemies such as syrphids flies, ladybird beetles and green lacewings. We designed an experiment to plant these flowers as companions with cv. 'Delaware white' azaleas. This cultivar of azaleas is known to be very susceptible to the azalea lacebug. The lacebug population, if left unchecked, will kill the plant through the combined feeding of adults and nymphs. Our reasoning with combining the above flowers with azaleas was that they would be attractive to natural enemies and retain them long enough to reduce lacebugs.

Objectives

To evaluate the effect of incorporating flowering plants into landscapes on beneficial insect herbivore population dynamics.

Produce educational tools via interpretive landscape displays and lectures to educate practitioners and educators on the concepts and benefits of incorporating certain flowering plants into landscapes

Methods

An evaluation of incorporating flowers into the landscape was done by planting shasta daisy plugs ('Little Princess' *Chrysanthemum maximum* and *Marconi Leucanthemum superbum*) and coriander (*Coriander sativum*). These plants, one species on each side, encircled three Delaware white azaleas (*Rhodendron mucronatum*). In all, four treatments were used to clarify the role of flowering plants in reducing the numbers of the azalea bug, *Stephanitis pyroides*, a known pest of the susceptible cultivar. The treatments with flowers and without flowers were replicated 22 times. In 1998, we included the release of larval green lacewings, *Chrysoperla rufilabris,* supplied by Rincon Vitova Insectaries in 11 plots.

Results

In the first year, the plants were inoculated with 20 lacebug nymphs on each azalea in each plot in early June. Green lacewing larvae were placed, five per plant, on the predator-added split plot, with and without flowers, three times at equal intervals beginning in June. Weekly data was collected on azalea, daisy, and coriander flowering. Biweekly data was collected on azalea lacebug and green lacewing from all plots.

Lacewing larvae retention on the azaleas following release was low, and the presence of flowering plants apparently contributed to reduced lacebug numbers because of the buildup of predators such as syrphid, lady beetles and other unidentified predators. There appears to be a seasonal impact of flower species on the duration of predator species and abundance. Coriander flowered earlier but more briefly than the two daisy species, and appeared to harbor more beneficial insect diversity than the daisies. However, there were more species of syrphids in the coriander. The azaleas were small, and we believe that many released lacewings left the plots. Coriander harbored 79 species and 1386 individuals. In coriander there were five species of syrphids. Shasta daisy harbored 91 species and 764 individuals while azalea had 128 species and 413 individuals.

Impact and potential contributions

Coriander and Shasta daisies contributed to increased species diversity of beneficial arthropods in our research plots and apparently contributed to reduced lacebug populations in azalea. The addition of lacewing larvae as a remedial treatment was of questionable value.

Although funding for this project was for two years, we were able to leverage these funds with others to extend it for three years. Forty-four paired plots with Shasta daisy and coriander and azalea, with and without flowers, were planted in 1998. All plots were fertilized, weeded and mulched with pine bark as per horticultural recommendations. The azaleas in both treatments were seeded with azalea lacebug to ensure an infestation. The same plots were used in data collection through summer of 2000.

Data collected in 1998 showed a marginal reduction of lacebug densities following release of *Chrysoperla rufilabris*. More compelling was the fact that retention of lacewings in the plots was very low, at less than 10%. In 1999 and 2000, we did not release lacewings in any plots. This released some plots to increase the replication of flowered and non-flowered plots to 22 each. Data collected from the azaleas showed that species of natural enemies was low, and in fact a high percentage of species were herbivores like oriental beetle and Japanese beetle.

Flowering of coriander was earlier and shorter than daisy. For both years, species diversity was higher in coriander and harbored more species of the beneficial insect syrphids. This insect is a known pollen feeder as an adult and it larvae are polyphyphagous predators. These results are in spite of a profound drought that occurred in 1999. We were able to water our plots but the high heat occurred at the peak of lacebug occurrence. This drought affected our results for testing the beneficial aspects of flowering plants.

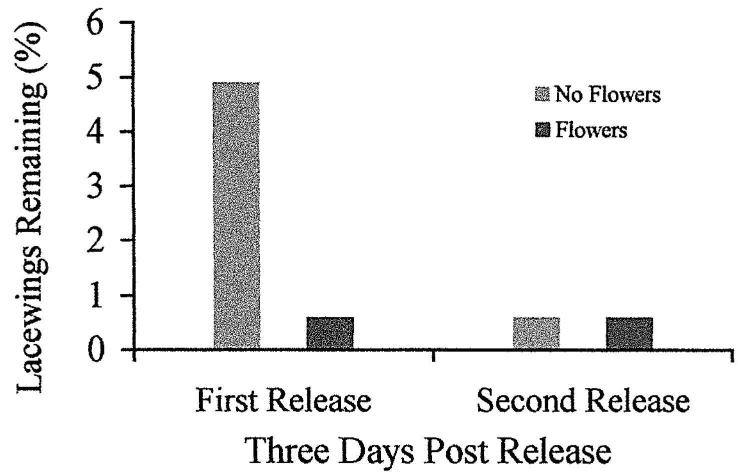
Data collected in 2000 on lacebug populations did not show a beneficial effect of flowers on lacebug populations. In fact, the data are somewhat equivocal. It is clear that these plants harbor many species of beneficial insects, who use the plants for alternate food, a source of prey for offspring, mating sites, and resting areas. Our observations are that these pollen-bearing plants can be managed as a system, but using lacebugs as a test insect is difficult.

We were unable to gather reliable data on *Lathrolestes,* the parasitoid of birch leaf miner. The wasp is at very low levels and did not respond to flower treatments. We put out thousands of birch leaves in condiment cups to rear the wasp, but we were unable to run a conclusive test on flower attractiveness.

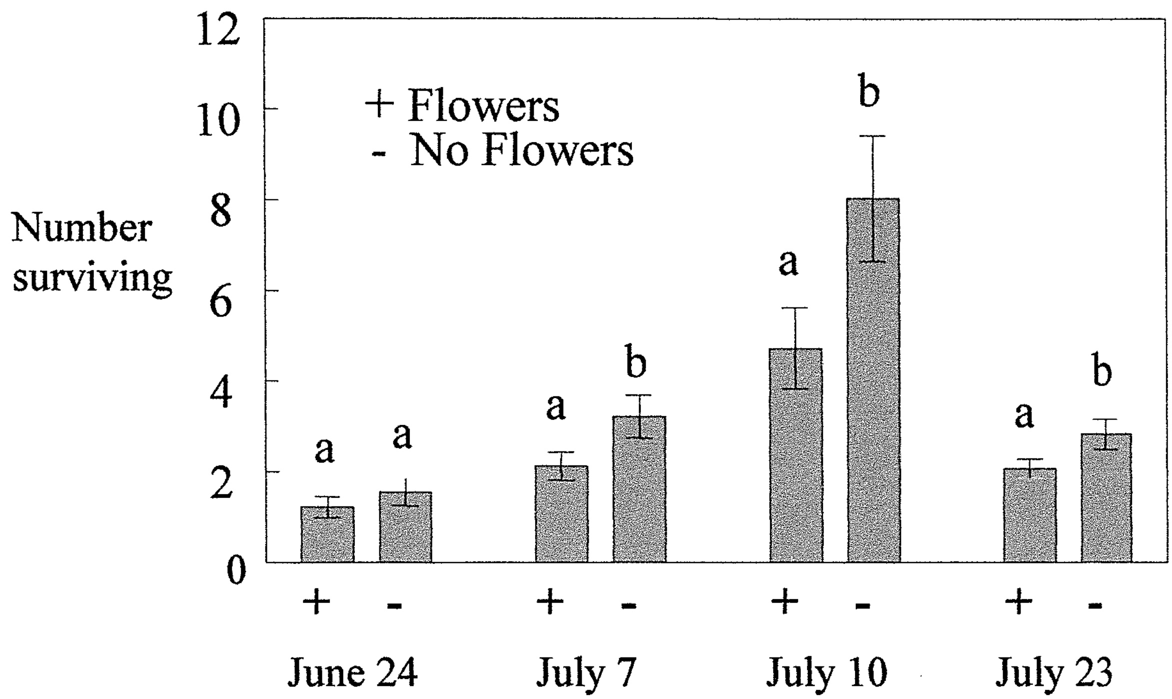
Outreach

In New Jersey and Rhode Island we are establishing teaching gardens to demonstrate that the coriander and daisy are useful for attracting, retaining, and allowing reproduction of beneficial insects. Both plant species are inexpensive and cultivatable by a people possessing a wide array of gardening skill. We are adding to the plant list for beneficial insect attractor plants. We have video of some species and will be using that as a basis for teaching more about biological control..

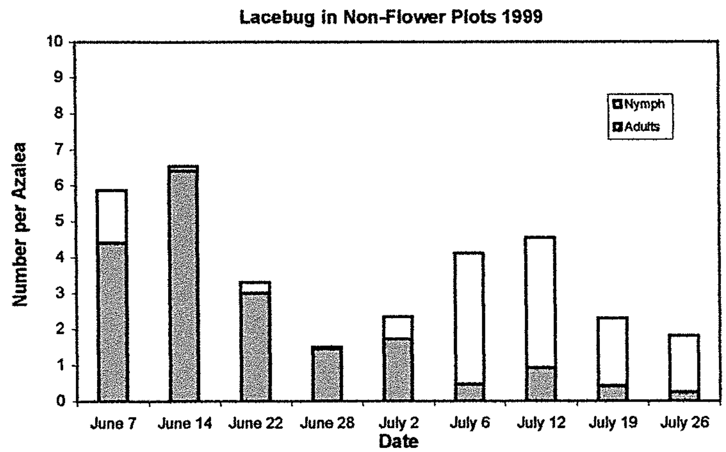
Reported March 30, 2001

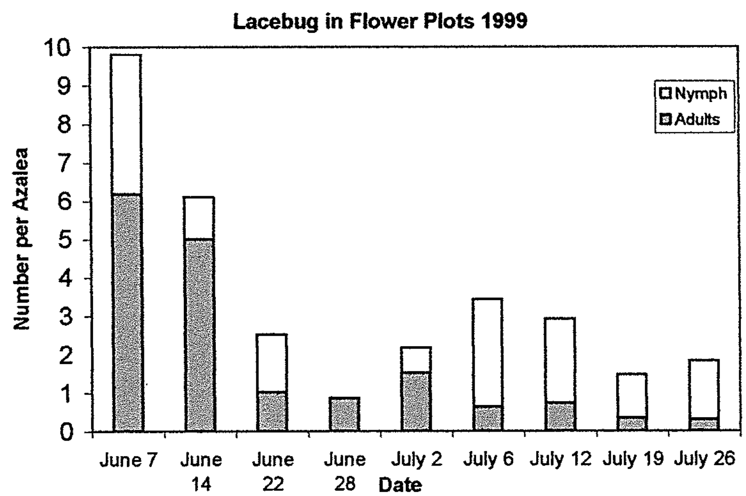


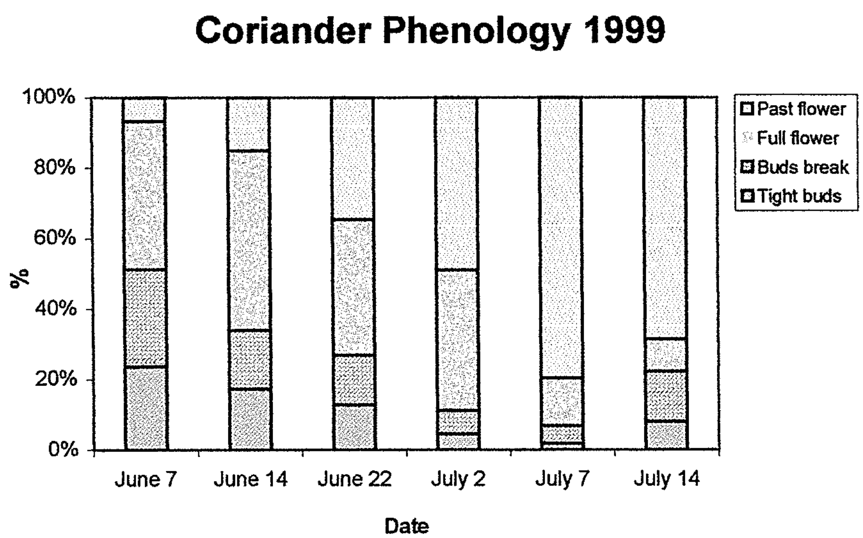
Effect of Flowers on Green Lacewing Retention 1998



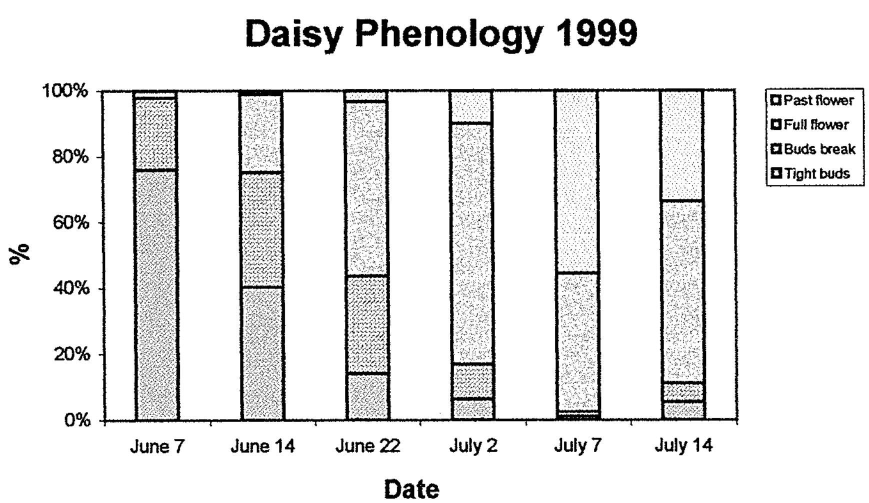
Effect of Flowers on Azalea Lace Bug Survival 1998


Lacebug in Non-Flower Plots 1999
Number per Azalea
Nymph
Adults
June 7
June 14
June 22
June 28
July 2
July 6
July 12
July 19
July 26
Date

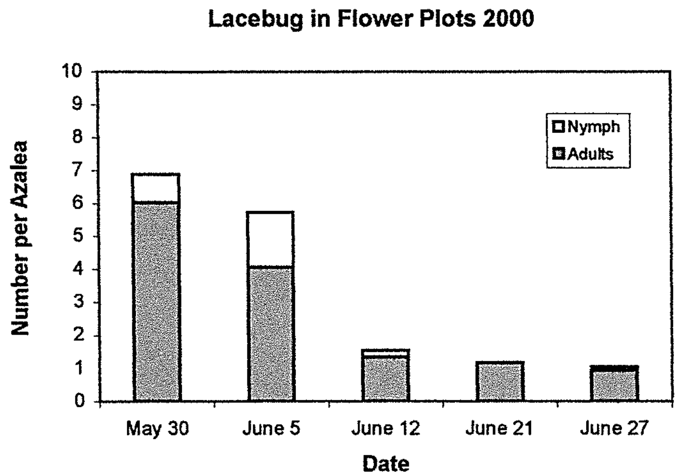

Lacebug in Flower Plots 1999
Number per Azalea
Nymph
Adults
June 7
June 14
June 22
June 28
July 2
July 6
July 12
July 19
July 26
Date

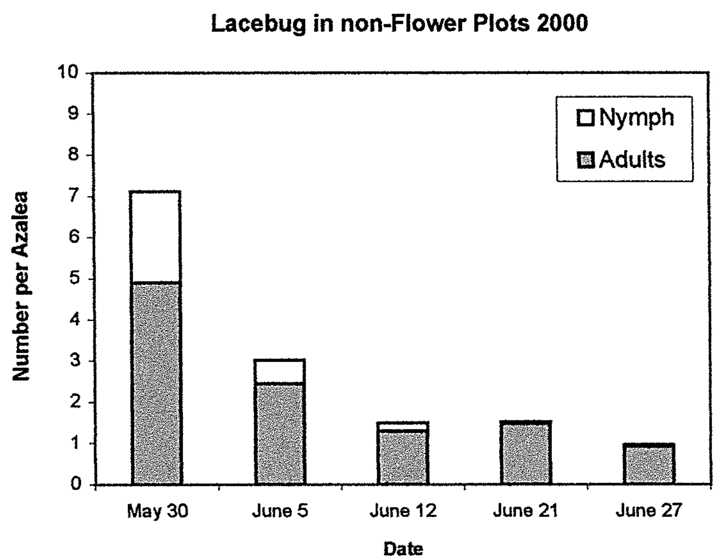


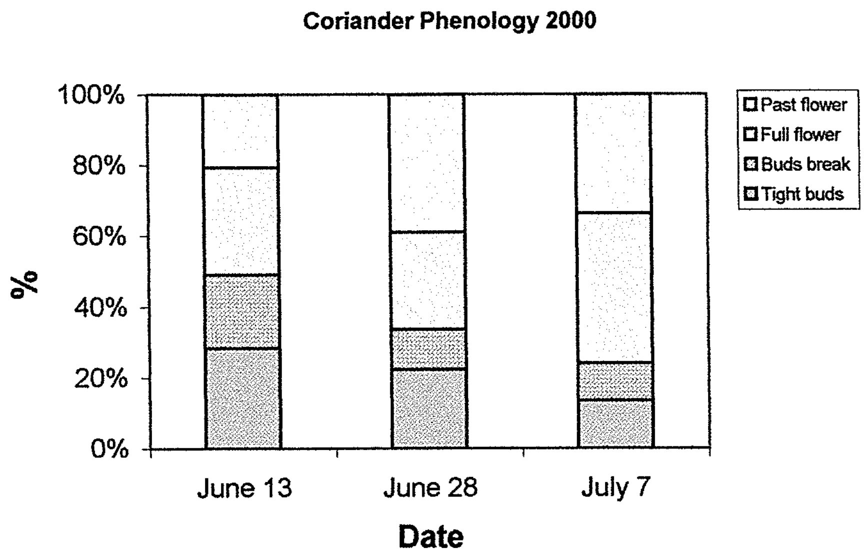
Coriander Phenology 1999
100%
80%
60%
40%
20%
0%
%
June 7
June 14
June 22
July 2
July 7
July 14
Date
Past flower
Full flower
Buds break
Tight buds

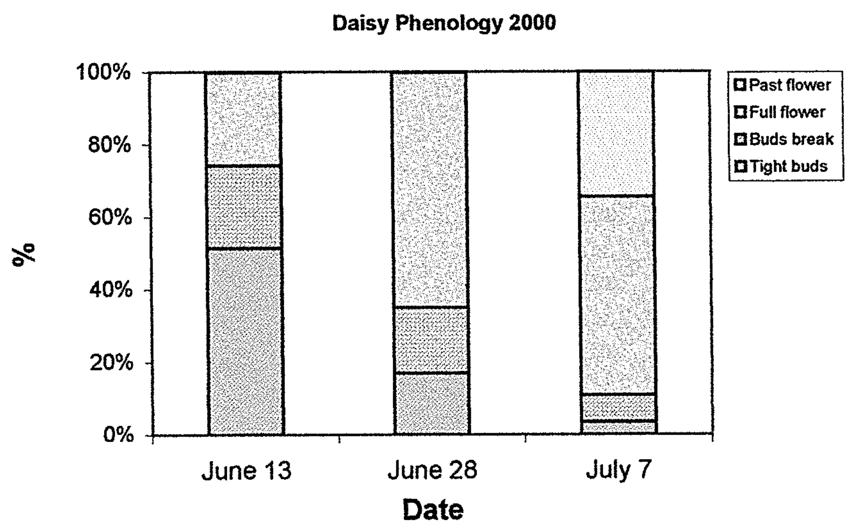


Daisy Phenology 1999
100%
80%
60%
40%
20%
0%
%
June 7
June 14
June 22
July 2
July 7
July 14
Date
Past flower
Full flower
Buds break
Tight buds


Lacebug in Flower Plots 2000
Number per Azalea
Date
May 30
June 5
June 12
June 21
June 27
Nymph
Adults


Lacebug in non-Flower Plots 2000
Number per Azalea
Date
May 30
June 5
June 12
June 21
June 27
Nymph
Adults


Coriander Phenology 2000
100%
80%
60%
40%
20%
0%
%
June 13
June 28
July 7
Date
Past flower
Full flower
Buds break
Tight buds


Daisy Phenology 2000
100%
80%
60%
40%
20%
0%
%
June 13
June 28
July 7
Date
Past flower
Full flower
Buds break
Tight buds

Species diversity by plant species (top 12 species)

Plant Species	Order	Family	Species	Name	# insects
Coriander	Diptera	Syrphidae	S-4		264
Coriander	Diptera		BD-4		254
Coriander	Diptera	Conopidae	C-1		145
Coriander	Diptera	Syrphidae	Syrphus fabricius ?		99
Coriander	Diptera	Syrphidae	Eristalis tenax	Crane fly	34
Coriander	Hymenoptera		Y-10		34
Coriander	Diptera	Conopidae	C-2		16
Coriander	Diptera		BD-3	dark fungus gnat	15
Coriander	Hymenoptera		Y-11		14
Coriander	Immature		I-1		13
Coriander	Homoptera	Cicadellidae	M-6		10
Coriander	Neuroptera	Chrysopidae	Chrysopa carnea	green lacewing	10
Daisy	Hymenoptera	Anthophoridae	Y-1		87
Daisy	Diptera	Syrphidae	Eristalis tenax	Crane fly	68
Daisy	Coleptera	Cantharidae	Chauliognathus pennsylvanica	Solider Beetle	55
Daisy	Diptera	Syrphidae	S-4		37
Daisy	Diptera		BD-4	black fly	36
Daisy	Diptera	Conopidae	C-1		31
Daisy	Hemiptera	Anthocoridae	Orius		22
Daisy	Diptera	Syrphidae	Syrphus fabricius ?		20
Daisy	Diptera	Syrphidae	Mallota Meigen ?		20
Daisy	Diptera		BD-3	dark fungus gnat	19
Daisy	Hymenoptera		Y-9		16
Daisy	Diptera	Sarcophagidae	Sarcophaga Haemorrphoida	Flesh Fly	11
Azalea	Orthoptera		Or-1		78
Azalea	Hemiptera	Tingidae	Stephanitis pyrioides Scott	Azalae Lacebug	31
Azalea	Hemiptera	Reduvidae	H-4		19
Azalea	Coleptera	Scarabidae	Popillia japonica	Japanese Beetle	16
Azalea	Coleptera	Lampyridae	S-1		14
Azalea	Dermaptera		D-3		12
Azalea	Coleptera	Scarabidae	Anomala orientalis	Oriental Beetle	11
Azalea	Coleoptera	Elateridae	Elateridae E-1		10
Azalea	Coleoptera	Curculionidae	Cl-19		8
Azalea	Hemiptera	Nabidae	H-5		8
Azalea	Homoptera	Cicadellidae	M-5		8
Azalea	Coleoptera	Curculionidae	Cl-13		7