

**Virginia Wine Grower's Association
2007 Project Proposal**

Project Title: Beneficial insectary plants to enhance arthropod natural enemies in vineyards

Term of project: 1 year

Project leader(s):

Dr. Douglas G. Pfeiffer

Professor, Dept. of Entomology,
Virginia Polytechnic Institute & State University
Blacksburg, VA 24061-0319
Ph.; e-mail: @vt.edu

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Dr. Thomas P. Kuhar

Assistant Professor, Dept. of Entomology,
Eastern Shore AREC
33446 Research Drive
Virginia Polytechnic Institute & State University
Painter, VA 23420
Ph: 757-414-0724 ext.14; e-mail: tkuhar@vt.edu

Collaborator(s):

Location:

Funds requested: \$6,620

Beneficial insectary plants to enhance arthropod natural enemies in vineyards

Objective 1:

Background and Rationale:

Arthropod natural enemies such as lady beetles (Coccinellidae), flower flies (Syrphidae), predatory bugs (pentatomids, reduviids, anthocorids, *Geocoris*), lacewings (chrysopids), parasitic wasps (ichneumonids, braconids, *Trichogramma*, and chalcidoids) and parasitic flies (tachinids) play a vital role in reducing many pest populations in agroecosystems (Flint and Dreistadt 1998). Conservation of natural enemies and even enhancement of their populations can improve their efficiency and effectiveness as biological control agents. Establishing flowering plants in and around fields to provide pollen and nectar resources for natural enemies has shown tremendous promise as a strategy to enhance biological control of certain pests (Colley and Luna 2000). Today there are even commercially available beneficial insect habitat seed mixes that growers can plant on their farms (Forehand et al. 2006). We feel that this approach could possibly improve natural insect control in grapes in Virginia.

Our study will record the beneficial arthropods present in three different commercially available beneficial insect habitat seed mixes (Clyde Robin's Border Patrol, Heirloom Seed's Beneficial Insect Mix, and Peaceful Valley's Good Bug Blend) planted around vineyards in Virginia. Identifying what organisms are attracted to the beneficial plants is an important first step in determining the potential impact of the strategy on grape pest management. Potential pests that may be impacted by natural enemies include grape berry moth, aphids, leafhoppers. Seaman et al. (1990) reared several egg parasites from grape berry moth, including one species of *Trichogramma*, *T. pretiosum*. While not always present, it was capable of causing the highest level of parasitization. It would be worthwhile trying to modify the habitat to allow greater levels of *Trichogramma* survival. It is likely that alternative food sources would improve parasite survival. Simser (1994) found greater levels of parasitization of cranberry fruitworm by either endemic or released *T. pretiosum* in neglected sites. Shearer and Atanassov (2004) found that *T. minutum* adults lived longer and produced more offspring when plant nectar sources were available (in this case, peach extrafloral nectaries). *T. dendrolimi* and *T. maidis* attack eggs of the European grape berry moth, *Eupoecilia ambiguella*; in that species, eggs have been shown to be most attractive to parasites when young; once the head capsule develops, eggs are no longer attractive (Remund and Bigler 1986). Egg-parasitic wasps can also be a mortality factor in sharpshooters that transmit Pierce's disease (Al-Wahaibi et al. 2005).

Ground cover plants can have additional roles with pests in vineyards. Japanese beetle feeds on hundreds of plant species. While grapevines are a favored plant, it is possible that other species could be more attractive to feeding adults. There is anecdotal evidence that a variety of plants hinder feeding or survival of Japanese beetle. Some of these have been discredited experimentally, while others have been confirmed (Potter and Held 2002). Some plants cause a paralytic effect in feeding adults (Potter and

Braman 1999). Strip cropping has been shown to reduce incidence of adult Japanese beetle feeding in field crops (Homes and Barrett 1997).

Procedures:

In spring 2007, we will establish plantings (~0.1 acre) of each of three commercial insectary plant mixes in randomized complete blocks with 4 replications at two separate vineyards in Virginia (The Vineyard at Point Breeze, Belle Haven, VA and ??????????). The plant seeds included in each of the commercial mixes are presented in Table 1.

Table 1. Plant species present in three commercial beneficial insect habitat seed mixes (adapted from Forehand et al. 2006)

Product name	Common name	Scientific name
Border Patrol	Evening Primrose	<i>Oenothera argillicola</i> Mackenzie
	Buckwheat	<i>Fagopyrum convolvulis</i> Moench.
	Baby Blue Eyes	<i>Nemophila menziesii</i> Hook. and Arn.
	Bishop's Flower	<i>Ammi majus</i> L.
	Blackeyed Susan	<i>Rudbeckia hirta</i> L.
	Strawflower	<i>Helichrysum</i> ssp. P. Mill.
	Nasturtium	<i>Tropaeolum majus</i> L.
	Angelica	<i>Angelica atropurpurea</i> L.
	Yarrow	<i>Achillea millefolium</i> L.
	Dame's Rocket ^a	<i>Hesperis matronalis</i> L.
Beneficial Insect Mix	Siberian Wallflower ^a	<i>Erysimum hieraciifolium</i> L.
	Sweet Alyssum	<i>Lobularia maritime</i> (L.) Desv.
	Baby Blue Eyes	<i>Nemophila menziesii</i> Hook. and Arn.
	Bishop's Flower	<i>Ammi majus</i> L.
	Blackeyed Susan	<i>Rudbeckia hirta</i> L.
	Candytuft	<i>Iberis sempervirens</i> L.
	Coriander	<i>Coriandrum sativum</i> L.
	Purple Prairie Clover	<i>Dalea purpurea</i> Vent.
	Lance-Leaved Coreopsis	<i>Coreopsis lanceolata</i> L.
	Shasta Daisy	<i>Leucanthemum x superbum</i> (J.W. Ingram) Berg. ex Kent.
Good Bug Blend	Forget-me-not	<i>Myosotis sylvatica</i> Ehrh. ex Hoffmann
	Blanket Flower	<i>Gaillardia</i> spp. Foug.
	Gayfeather	<i>Liatris</i> spp. Gaertn. ex Schreb.
	California Poppy	<i>Eschscholzia californica</i> Cham.
	Dill	<i>Anethum graveolens</i> L.
	Siberian Wallflower	<i>Erysimum hieraciifolium</i> L.
	Alyssum	<i>Lobularia maritime</i> (L.) Desv.
	Caraway	<i>Carum carvi</i> L.
	Carrot	<i>Apiaceae</i>
	Celery	<i>Apium graveolens</i> L.

Chervil	<i>Anthriscus cerefolium</i> (L.) Hoffmann
Clovers and Alfalfa	<i>Trifolium</i> spp. L. and <i>Medicago sativa</i> L.
Coriander	<i>Coriandrum sativum</i> L.
Daikon/Radish	<i>Raphanus sativus</i> L.
Dill	<i>Anethum graveolens</i> L.
Fennel	<i>Foeniculum foeniculum</i> (L.) Karst.
Gypsophila	<i>Gypsophila</i> spp. L.
Nasturtium	<i>Tropaeolum majus</i> L.
Yarrow	<i>Achillea</i> spp. L.

^a Species not advertised as component of seed mixture.

When plants begin flowering in summer, we will begin weekly sampling of plots. Arthropods will be sampled using two strategies: 1) by “vacuuming” plants (10 sec sample) using a leaf blower-vacuum fitted with a mesh bag on the intake tube (Stivers et al. 2001), and 2) by sweeping vegetation with a standard 15 inch diameter canvas sweep net (20 pendulum sweeps per sample date), and dumping the contents into 1-gal plastic bags. After each sample, bags will be removed, sealed, and placed in a freezer for later analysis of natural enemy fauna and numbers. All insects collected will be identified to family and assigned to feeding groups. Cumulative insect diversity will be analyzed for each feeding group using Species Richness, Simpson’s Index and Shannon-Wiener’s Index procedures. Relative abundance of beneficial insects will be analyzed using ANOVA Procedures for a randomized complete block design. Eggs of grape berry moth and sharpshoots will be sampled to determine parasitization.

References:

- Al-Wahaibi, A. K., J. G. Morse and A. K. Owen, A. K. 2005. Description and behavioural biology of two *Ufens* species (Hymenoptera: Trichogrammatidae), egg parasitoids of *Homalodisca* species (Hemiptera: Cicadellidae) in southern California. *Bull. Entomol. Res.* 95: 275-288.
- Colley, M. R. and J. M. Luna. Relative attractiveness of potential beneficial insectary plants to aphidophagous hoverflies (Diptera: Syrphidae). *Environ. Entomol.* 29: 1054-1059.
- Flint, M. L. and S. H. Dreistadt. 1998. *Natural Enemies Handbook: The Illustrated Guide to Biological Pest Control*. Statewide Integrated Pest Management Project. Univ. Calif. Pub. No. 3386. 154 pp.
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- Potter, D. A. and S. K. Braman. 1999. Absence of food-aversion learning by a polyphagous scarab, *Popillia japonica*, following intoxication by geranium, *Pelargonium x hortorum*. Entomol. Exp. Applic. 91: 83-88.
- Potter, D. A. and D. W. Held. 2002. Biology and management of the Japanese beetle. Annu. Rev. Entomol. 47: 175-205.
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- Seaman, A. J., J. P. Nyrop and T. F. Dennehy. 1990. Egg and larval parasitism of the grape berry moth (Lepidoptera: Tortricidae) in three grape habitats in New York. Environ. Entomol. 19: 764-770.
- Shearer, P. W. and A. Atanassov. 2004. Impact of peach extrafloral nectar on key biological characteristics of *Trichogramma minutum* (Hymenoptera: Trichogrammatidae). J. Econ. Entomol. 97: 789-792.
- Simser, D. 1994. Parasitism of cranberry fruitworm (*Acrobasis vaccinii*; Lepidoptera: Pyralidae) by endemic or released *Trichogramma pretiosum* (Hymenoptera: Trichogrammatidae). Great Lakes Entomol. 27: 189-196.
- Stivers, L. J., T. P. Kuhar, A. G. Taylor, and M. P. Hoffmann. 2001. Potato leafhopper trials in snap beans, 2000. Arthropod Management Tests. 26: E9.

Total Budget:

Labor: Technical help (2 individuals summer wages @ \$4,000 + fringe 8.5%)
\$8,680

Materials & Supplies:

Beneficial Plant mixes: \$300
 Motor pool gasoline: \$2,000

Travel:

Weekly sample visits to vineyards: \$2,000

Total: \$12,980



Virginia Polytechnic Institute and State University Proposal Cover Sheet

PROPOSAL INFORMATION

Virginia Vineyards Association

Sponsor

Solicitation No.

Beneficial insectary plants to enhance arthropod natural enemies in vineyards

Proposal Title

\$12,980.00

7/31/07

6/30/08

New or

Renewal of _____

Amount

Begin Date

End Date

PRINCIPAL INVESTIGATOR(S)

Douglas G. Pfeiffer

Thomas P. Kuhar

Principal Investigator

Co-Principal Investigator

Co-Principal Investigator

Signature

Signature

Signature

540-231-4183

757-414-0724

Phone

Phone

Phone

dgpfeiff@vt.edu

tkuhar@vt.edu

Email

Email

Email

Professor

Asst. Professor

PI Title

Co-PI Title

Co-PI Title

Entomology

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