1996 Entomology Project Report
Laboratory Services Division
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1996 Survey of Apple Leaf Feeding Pests in Kittitas and Okanogan Counties, Eastern Washington State

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BACKGROUND

The Washington State Department of Agriculture (WSDA) has discovered a number of exotic species of apple tree defoliating moths in Western Washington State in recent years. These pests are new to the state or region and their introduction and presence here may impact both private and commercial production of apple tree stock and tree fruit.

Exotic species of apple leaf feeding pests found in Western Washington since 1985 include the following:

apple tortrix, *Archips fuscocupreanus* Walsingham - Tortricidae
Found in 1995, this exotic pest is native to Japan and Korea, where it is an economic pest of apples and many other trees and shrubs. Spring hatching larvae feed on leaves, flowers, and the surface of developing fruit

green pug moth, *Chloroclystis rectangulata* (L.) - Geometridae
A European pest of apple, pear, cherry and other fruit trees. Larval damage to blossoms causes deformation of fruit.

green budworm, *Hedya nubiferana* (Haworth) - Tortricidae
This European leafroller is also found in the Eastern U.S. and Canada, where it is sometimes abundant in unsprayed orchards. Overwintering larvae feed on leaf and blossom buds, and may also bore into and kill new branch tips.

"Golden tortrix", *Croesia holmiana* (L.) - Tortricidae
A common pest of many fruit trees and ornamental plants in Europe and Asia, where it is considered a minor problem. Spring larval feeding affects only leaves.

Dark fruit tree tortrix, *Pandemis heparana* (Denis & Schiff.) - Tortricidae
Native to Europe and Asia, this leafroller is considered a minor pest of many trees and shrubs, including apple, pear, plum, and some berries. Spring flower and fruit feeding can cause drop or blemishes.

barred fruit tree tortrix, *Pandemis cerasana* (Hübner) - Tortricidae
Another European species of Pandemis, similar in appearance and biology to P. heparana, but considered more of an economic pest. Blossom and fruitlet damage produces blemished fruit of apple, pear, cherry, plum, and other fruit crops in Europe

lesser bud-moth, *Recurvaria nanella* (Hübner) - Gelechiidae
Originally from Europe, where it is a destructive pest, this pest was also introduced into the Northeastern U.S. in the late 1700's. Larvae of this pest feed on leaves and blossoms of apple, plum, and many other fruit trees in early spring.

Swammerdamia pelicaria, *Swammerdamia pelicaria* (Retz., 1783) - Yponomeutidae
Native to Europe and Asia, where it is not considered an important pest, larvae of this small moth feed on the upper surface of apple and hawthorn leaves in early and late summer.

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The discovery of these exotic species in Western Washington prompted a survey of apple trees in Kittitas and Okanogan Counties in Eastern Washington to determine if these species are currently present there. Kittitas and Okanogan Counties represent the geographical areas (pathways) through which natural spread or immigration of exotic species present in Western Washington or the Canadian Okanogan Valley could occur. The major commercial apple producing areas of Eastern Washington are east of the Cascade Mountain range. This Cooperative Agricultural Pest Survey (CAPS) survey project was supervised by the Washington State Department of Agriculture (WSDA) and Washington State University Wenatchee Treefruit Research and Extension Center (WSU TFREC) staff with funds for field staff and survey materials provided by USDA Animal and Plant Health Inspection Service (APHIS).

1996 EASTERN WASHINGTON APPLE DEFOLIATOR SURVEY

In this survey, leaf feeding caterpillars were collected from roadside and backyard (untreated) apple trees in the target counties spring and early summer of 1996, reared to the adult stage, and identified to species.

1996 Project Objectives

1. Determine the presence or absence of several target apple defoliating species, primarily the previously listed exotic pest species recently detected in Western Washington.
2. Identify all apple leaf feeding insects collected to evaluate the presence of non-target species of significance.

Methods

Beginning in April, apple trees in roadside and yard situations throughout Okanogan and Kittitas Counties were examined for leaf feeding insects, which were collected and returned to the WSU TFREC lab for rearing and cataloging. Trees were selected that appeared or were known (from resident contact) to be untreated for defoliator or fruit pest control. Larvae collected were individually caged in 1 or 3 oz. plastic cups containing modified McNeil's artificial diet and reared at room temperature and normal daylight until pupation and adult eclosion. Emerged adults, shed pupal cases, and any emerged parasitoids present were preserved for identification.

Adult specimens were screened and identified at the WSDA entomology lab if possible, or were prepared, via micro examination mounts, and forwarded to taxonomic specialists.

Methods (Cont.)

Taxonomic specialists providing identifications of material collected in this survey have included:

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Results

Target Exotic Defoliator Species

Only one of the listed target species was detected in either Eastern Washington county surveyed. The lesser bud-moth, *Recurvaria nanella* (Hübner), was found in parts of Kittitas County. The small, dark brown larvae were collected from 34 sites between Easton and Ellensburg. A total of 46 adult lesser bud-moths were reared and identified, with the majority of specimens (34) collected in the Cle Elum area. Spring feeding by lesser bud moth larvae deforms expanding leaf buds and webs together expanding leaves and flower buds, often at branch tips. Both damage and overall larval appearance are very similar to that of the eye-spotted bud moth, *Spilonota ocellana* (Denis. & Schif.), which also was found in many trees sampled in this survey. Eye-spotted bud-moth is widespread and common on apple trees in Washington, but only a single specimen was reared to adult in this survey because it does not readily accept the artificial diet used.

Non-Target Defoliator Species

A total of 374 adult moth specimens, comprised of 47 species in 3 families, were collected and identified in this project. Moth species collected, and a summary of sample numbers and total specimens by species is presented in Table 1.

Table 1. 1996 Eastern Washington Apple Defoliator Survey, Species Collected

Family	Genus species Describer	Common Name	#
Choreutidae	*Choreutis pariana* (Clerck)	apple & thorn skeletonizer	12
Gelechiidae	*Recurvaria nanella* (Denis & Schiff.)	lesser budmoth	46
Gelechiidae	*Chionodes sp.*		2
Geometridae	*Operophtera brumata* (L.)	winter moth	1
Lasiocampidae	*Malacosoma fragilis* (Stretch)	western tent caterpillar	1
Oecophoridae	*Exaeretia ciniflonella* (Leib.&Zel.,1846)		1
Plutellidae	*Ypsolopha falciferella* Walsingham		1
Pyralidae	*Acrobasis tricolorella* Grote		1
Tortricidae	*Acleris ? bowmanana* (McD.)		1
Tortricidae	*Acleris maximana* (Barnes&Busck)		2
Tortricidae	*Archips argyrospilus* (Walker)	fruittree leafroller	24
Tortricidae	*Archips rosanus* (L.)	European leafroller	197
Tortricidae	*Choristoneura rosaceana* (Harris)	obliquebanded leafroller	66
Tortricidae	*Pandemis pyrusana* Kearfort		5
Tortricidae	*Pandemis limitata* (Robinson)		1
Tortricidae	*Spilonota ocellana* (Denis & Schiff.)	eye-spotted bud moth	11
Tortricidae	*Xenotemna pallorana* (Rob.)		1

A complete listing of all individual specimens and associated collection and identification details is also available as an attachment to this report.

Biological Observations

Summary information regarding relative species abundance and phenology observed (under laboratory rearing conditions) are presented in tables 2 and 3.

Table 2. 1996 Eastern Washington Apple Defoliator Survey - Species/Numbers by County

Genus	species	Okanogan Co. # Sites for sp.	Okanogan Co. # Specimens	% of Total in County	Kittitas Co. # Sites for sp.	Kittitas Co. # Specimens	% of Total in County
Acrobasis	tricolorella	1	1	2.70%			0.00%
Acleris	? bowmanana			0.00%	1	1	0.59%
Acleris	maximana			0.00%	2	2	0.59%
Archips	argyrospilus	4	8	21.62%	5	16	4.75%
Archips	rosanus	3	9	24.32%	60	189	56.08%
Chionodes	sp.	1	1	2.70%	1	1	0.30%
Choreutis	pariana			0.00%	6	12	3.56%
Choristoneura	rosaceana	6	14	37.84%	28	52	15.43%
Exaeretia	ciniflonella			0.00%	1	1	0.30%
Malacosoma	fragilis			0.00%	1	1	0.30%
Operophtera	brumata			0.00%	1	1	0.30%
Pandemis	limitata	1	1	2.70%	2	3	0.89%
Pandemis	pyrusana	1	2	5.41%			0.00%
Recurvaria	nanella			0.00%	34	46	13.65%
Spilonota	ocellana			0.00%	8	11	3.26%
Ypsolopha	falciferella			0.00%	1	1	0.30%
Xenotemna	pallorana	1	1	2.70%			0.00%
Totals Spp.:	17	14	37			337	

Table 3. 1996 Eastern Washington Apple Defoliator Survey - Species Phenology*

Genus	Species	County (Location)	Ave. Collection Date	Ave. Pupation Date	# Pupa Date Records	Ave. Eclosion Date	# Adult Date Records
Acrobasis	*tricolorella*	Okanogan	6-May	2-Jun	1	16-Jun	1
Acleris	*? bowmanana*	Kittitas	8-May	9-Jun	1	2-Jul	1
Acleris	*maximana*	Kittitas	30-Jun	14-Jul	2	12-Aug	2
Archips	*argyrospilus*	Okanogan	29-May	9-Jun	8	16-Jun	8 **
Archips	*argyrospilus*	Kittitas	3-May	17-Jun	9	23-Jun	16
Archips	*rosanus*	Okanogan	2-Jun	11-Jun	6	21-Jun	6
		Kittitas	22-Jun	24-Jun	108	4-Jul	187
		Kitt. (Ellensburg)	27-May	6-Jun	10	14-Jun	10
		Kitt. (Thorp)	8-May	6-Jun	1	17-Jun	2
		Kitt. (Cle Elum)	24-Jun	26-Jun	36	4-Jul	91
		Kitt. (Roslyn)	18-Jun	22-Jun	41	3-Jul	53
		Kitt. (Easton)	1-Jun	4-Jul	20	13-Jul	31
Chionodes	*sp.*	Okanogan	4-Jun	16-Jun	1	2-Jul	1
		Kittitas	9-Jun	23-Jun	1	14-Jun	1
Choreutis	*pariana (1st. gen.?)*	Kittitas (Ellensburg)	3-Jun	9-Jun	1	16-Jun	
	pariana (1st. gen.?)	Kittitas (Cle Elum)	28-Jun			9-Jul	3
	pariana (2nd. gen.?)	Kittitas	19-Aug	26-Aug	8	5-Sep	8
Choristoneura	*rosaceana*	Kittitas	13-Jun	19-Jun	33	30-Jun	44
		Okanogan	29-May	9-Jun	10	17-Jun	10
Exaeretia	*ciniflonella*	Kittitas	9-Jun	27-Jun	1	11-Jul	1
Malacosoma	*fragilis*	Kittitas	5-Jun	9-Jun	1	20-Jun	1
Pandemis	*pyrusana*	Kittitas	26-May	13-Jun	3	29-Jun	3
Recurvaria	*nanella*	Kittitas	20-May	5-Jun	46	23-Jun	46
		Kittitas (Ellensburg)	14-May	31-May	4	21-Jun	4
		Kittitas (Cle Elum)	19-May	4-Jun	31	21-Jun	31
		Kittitas (Easton)	27-May	10-Jun	9	27-Jun	8
Spilonota	*ocellana*	Kittitas		10-Jun	11		
Ypsolopha	*falciferella*	Kittitas	4-Jun	11-Jun	1	23-Jul	1

** Phenology dates shown are for field collected specimens reared in constant temperature laboratory conditions (pupation and eclosion).*
*** A. argyrospilus phenology dates show wide range (? Multivoltine)*

Pertinent Literature

LaGasa, E., S. Passoa, and M. Hardwick. 1996. A Survey of Apple Tree Defoliators in Whatcom County, Northwestern Washington State, 1994-1995. 1994/1995 Entomology Project Report - Washington State Department of Agriculture. August 16, 1996

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