United States Department of Agriculture

Animal and Plant Health Inspection Service

Plant Protection and Quarantine

New Pest Response Guidelines

Summer Fruit Tortrix Moth (*Adoxophyes orana*)

First Edition Issued 2012

Summer Fruit Tortrix Moth

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Cover Images

Top— Both images of *Adoxophyes orana* were provided courtesy of Jae-Cheon Sohn (UGA5143071, UGA514072), http://www.bugwood.org.

Bottom—Image of *Adoxophyes orana* was provided courtesy of Pest and Diseases Image Library (UGA531008), http://www.bugwood.org.

Chapter 1

Introduction

Contents

Introduction

Use *New Pest Response Guidelines: Summer Fruit Tortrix Moth (*Adoxophyes orana*)*, when designing a program to detect, monitor, control, contain, or eradicate an infestation of this insect in the United States and collaborating territories.

The United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine (USDA–APHIS–PPQ) developed the guidelines through discussion, meeting, or agreement with staff members at the USDA-Agricultural Research Service and advisors at universities.

Any new detection may require the establishment of an Incident Command System to facilitate emergency management. This document contains the necessary information to launch a response to a detection of the summer fruit tortrix moth.

If the summer fruit tortrix moth is detected, PPQ personnel will produce a site-specific action plan based on the guidelines. As the program develops and new information becomes available, the guidelines will be updated.

Users

The guidelines is intended as a reference for the following users who have been assigned responsibilities for a plant health emergency for summer fruit tortrix moth:

- PPQ personnel
- Emergency response coordinators
- State agriculture department personnel
- Others concerned with developing local survey or control programs

Contacts

When an emergency pest response program for summer fruit tortrix moth has been implemented, the success of the program depends on the cooperation, assistance, and understanding of other involved groups. The appropriate liaisons and information officers should distribute news of the program’s progress and developments to interested groups, including the following:

- Academic entities with agricultural interests
- Agricultural interests in other countries
- Commercial interests
- Grower groups such as specific commodity or industry groups
- Land-grant universities and Cooperative Extension Services
- National, State and local news media

- Other Federal, State, county, and municipal agricultural officials
- Public health agencies
- The public
- State and local law enforcement officials
- Tribal governments

Initiating an Emergency Pest Response Program

An emergency pest response program consists of detection and delimitation, and may be followed by programs in regulation, containment, eradication and control. The New Pest Advisory Group (NPAG) will evaluate the pest. After assessing the risk to U.S. plant health, and consulting with experts and regulatory personnel, NPAG will recommend a course of action to PPQ management.

Follow this sequence when initiating an emergency pest response program:

1. A new or reintroduced pest is discovered and reported
2. The pest is examined and pre-identified by regional or area identifier
3. The pest's identity is confirmed by a national taxonomic authority recognized by USDA–APHIS–PPQ-National Identification System
4. Published New Pest Response Guidelines are consulted or a new NPAG is assembled in order to evaluate the pest
5. Depending on the urgency, official notifications are made to the National Plant Board, cooperators, and trading partners
6. A delimiting survey is conducted at the site of detection
7. An Incident Assessment Team may be sent to evaluate the site
8. A recommendation is made, based on the assessment of surveys, other data, and recommendation of the Incident Assessment Team or the NPAG, as follows:
   A. Take no action
   B. Regulate the pest
   C. Contain the pest
   D. Suppress the pest
   E. Eradicate the pest
9. State Departments of Agriculture are consulted
10. If appropriate, a control strategy is selected

11. A PPQ Deputy Administrator authorizes a response
12. A command post is selected and the Incident Command System is implemented
13. State departments of agriculture cooperate with parallel actions using a Unified Command structure
14. Traceback and trace-forward investigations are conducted
15. Field identification procedures are standardized
16. Data reporting is standardized
17. Regulatory actions are taken
18. Environmental Assessments are completed as necessary
19. Treatment is applied for required pest generational time
20. Environmental monitoring is conducted, if appropriate
21. Pest monitoring surveys are conducted to evaluate program success
22. Programs are designed for eradication, containment, or long-term use

Preventing an Infestation

Federal and State regulatory officials must conduct inspections and apply prescribed measures to ensure that pests do not spread within or between properties. Federal and State regulatory officials conducting inspections should follow the sanitation guidelines in the section *Preparation, Sanitization, and Clean-Up* on page 4-2 before entering and upon leaving each property to prevent contamination.

Scope

The guidelines is divided into the following chapters:

8. *Pathways on page 8-1*

The guidelines also includes appendixes, a references section, a glossary, and an index.

The Introduction contains basic information about the guidelines. This chapter includes the guideline's purpose, scope, users, and application; a list of related documents that provide the authority for the guidelines content; directions about how to use the guidelines; and the conventions (unfamiliar or unique symbols and highlighting) that appear throughout the guidelines.

Authorities

The regulatory authority for taking the actions listed in the guidelines is contained in the following authorities:

- Plant Protection Act of 2000 (Statute 7 USC 7701-7758)
- Executive Order 13175, Consultation and Coordination with Indian and Tribal Governments
- Fish and Wildlife Coordination Act
- National Historic Preservation Act of 1966
- Endangered Species Act
- Endangered and Threatened Plants (50 CFR 17.12)
- National Environmental Policy Act

Program Safety

Safety of the public and program personnel is a priority in pre-program planning and training and throughout program operations. Safety officers and supervisors must enforce on-the-job safety procedures.

Support for Program Decisionmaking

USDA–APHIS–PPQ-Center for Plant Health, Science and Technology (CPHST) provides technical support to emergency pest response program directors about risk assessments, survey methods, control strategies, regulatory treatments, and other aspects of pest response programs. PPQ managers meet with State departments of agriculture in developing guidelines and policies for pest response programs.

How to Use the Guidelines

The guidelines is a portable electronic document that is updated periodically. Download the current version from its source, and then use Adobe Reader® to view it on your computer screen. You can print the guidelines for convenience. However, links and navigational tools are only functional when the document is viewed in Adobe Reader®. Remember that printed copies of the guidelines are obsolete once a new version has been issued.

Conventions

Conventions are established by custom and are widely recognized and accepted. Conventions used in the guidelines are listed in this section.

Advisories

Advisories are used throughout the guidelines to bring important information to your attention. Please carefully review each advisory. The definitions have been updated so that they coincide with the America National Standards Institute (ANSI) and are in the format shown below.

EXAMPLE Example provides an example of the topic.

Important Important indicates information that is helpful.

CAUTION

CAUTION indicates that people could possibly be endangered and slightly hurt.

DANGER

DANGEROUS indicates that people could easily be hurt or killed.

NOTICE

NOTICE indicates a possibly dangerous situation where goods might be damaged.

WARNING

WARNING indicates that people could possibly be hurt or killed.

Boldfacing

Boldfaced type is used to highlight negative or important words. These words are: never, not, do not, other than, prohibited.

Lists

Bulleted lists indicate that there is no order to the information being listed. Numbered lists indicate that information will be used in a particular order.

Disclaimers

All disclaimers are located on the unnumbered page that follows the cover.

Table of Contents

Every chapter has a table of contents that lists the heading titles at the beginning to help facilitate finding information.

Control Data

Information placed at the top and bottom of each page helps users keep track of where they are in the guidelines. At the top of the page is the chapter and first-level heading. At the bottom of the page is the month, year, title, and page number. PPQ-Emergency and Domestic Programs-Emergency Programs is the unit responsible for the content of the guidelines.

Change Bar

A vertical black change bar in the left margin is used to indicate a change in the guidelines. Change bars from the previous update are deleted when the chapter or appendix is revised.

Decision Tables

Decision tables are used throughout the guidelines. The first and middle columns in each table represent conditions, and the last column represents the action to take after all conditions listed for that row are considered. Begin with the column headings and move left-to-right, and if the condition does not apply, then continue one row at a time until you find the condition that does apply.

Table 1-1 How to Use Decision Tables

If you:	And if the condition applies:	Then:
Read this column cell and row first	Continue in this cell	TAKE the action listed in this cell
Find the previous condition did not apply, then read this column cell	Continue in this cell	TAKE the action listed in this cell

Footnotes

Footnotes comment on or cite a reference to text and are referenced by number. The footnotes used in the guidelines include general text footnotes, figure footnotes, and table footnotes. General text footnotes are located at the bottom of the page.

When space allows, figure and table footnotes are located directly below the associated figure or table. However, for multi-page tables or tables that cover the length of a page, footnote numbers and footnote text cannot be listed on the same page. If a table or figure continues beyond one page, the associated footnotes will appear on the page following the end of the figure or table.

Heading Levels

Within each chapter and section there can be four heading levels; each heading is green and is located within the middle and right side of the page. The first-level heading is indicated by a horizontal line across the page, and the heading follows directly below. The second-, third-, and fourth-level headings each have a font size smaller than the preceding heading level. The fourth-level heading runs in with the text that follows.

Hypertext Links

Figures, headings, and tables are cross-referenced in the body of the guidelines and are highlighted in boldface type. These appear in blue hypertext in the online guidelines.

Italics

The following items are italicized throughout the guidelines:

- Cross-references to headings and titles
- Names of publications
- Scientific names

Numbering Scheme

A two-level numbering scheme is used in the guidelines for pages, tables, and figures. The first number represents the chapter. The second number represented the page, table, or figure. This numbering scheme allows for identifying and updating. Dashes are used in page numbering to differentiate page numbers from decimal points.

Transmittal Number

The transmittal number contains the month, year, and a consecutively-issued number (beginning with -01 for the first edition and increasing consecutively for each update to the edition). The transmittal number is only changed when the specific chapter sections, appendixes, or glossary, tables, or index is updated. If no changes are made, then the transmittal number remains the unchanged. The transmittal number only changes for the entire guidelines when a new edition is issued or changes are made to the entire guidelines.

Acknowledgements

Writers, editors, reviewers, creators of cover images, and other contributors to the guidelines, are acknowledged in the acknowledgements section. Names, affiliations, and Web site addresses of the creators of photographic images, illustrations, and diagrams, are acknowledged in the caption accompanying the figure.

How to Cite the Guidelines

Cite the guidelines as follows: U.S. Department of Agriculture, Animal Plant Health Inspection Service, Plant Protection and Quarantine. 2011. *New Pest Response Guidelines: Summer Fruit Tortrix Moth (*Adoxophyes orana*).* Washington, D.C.: Government Printing Office. http://www.aphis.usda.gov/import_export/plants/manuals/online_manuals.shtml

How to Find More Information

Contact USDA–APHIS–PPQ–EDP-Emergency Management for more information about the guidelines. Refer to *Resources* on page A-1 for contact information.

Chapter

2

Pest Information

Contents

Introduction

Use *Chapter 2: Pest Information* to learn more about the classification, history, host range, and biology of the summer fruit tortrix moth (SFTM), *Adoxophyes orana* (Fischer von Röslerstamm).

Classification

The summer fruit tortrix moth belongs in the phylum Arthropoda, class Insecta, order Lepidoptera, family Tortricidae, subfamily Tortricinae, tribe Archipini, and species *Adoxophyes orana*. Use *Table 2-1* on page 2-2 as a guide to the classification of the SFTM and the names used to describe it in the guidelines. Several subspecies of *Adoxophyes orana* are known. The most accepted are *Adoxophyes orana orana* (Fischer von Röslerstamm) which is found in Europe, and *Adoxophyes orana fasciata* Walsingham which is found in Japan (Yasuda, 1998).

Table 2-1 Classification of *Adoxophyes orana*

Phylum	Arthropoda
Class	Insecta
Order	Lepidoptera
Family	Tortricidae
Subfamily	Tortricinae
Tribe	Archipini
Genus	*Adoxophyes*
Full Name	*Adoxophyes orana* (Fischer von Röslerstamm)
Preferred Common Name	summer fruit tortrix moth
Synonyms[1]	*minor* Shiraki, 1913; *reticulana* Hübner, 1819 to 1819; *sutschana* Caradja, 1926; *tripsiana* Eversmann, 1844
Subspecies[1]	*beijingensis* Zhou, Qui & Fu, 1997; *fasciata* Walsingham, 1900
Other Common Names	apple peel tortricid, smaller tea tortrix[2]

1 Brown et al., 2005.

2 Tea may not be a host of *Adoxophyes orana*, because of possible taxonomic misidentification. Tea was reported as a host associated with *A. orana* "tea form" which was later named *A. honmai* (Yasuda, 1998). However, according to Barel (1973), the tea strain is a synonym of *A. orana*.

Historical Information

The summer fruit tortrix moth is native to Europe and Asia. It is polyphagous and feeds on many varieties of pome and stone fruits, and on numerous deciduous trees in hedgerows and woods. It is the most important member of a complex of several leafrolling species, and it is the main pest in several European apple-growing regions (Central and Eastern Europe) (Cross, 1994; Dickler, 1991; Kocourek and Stará, 2005).

Economic Impact

Apples in the United States already suffer from a large complex of leaf rollers (Dunley et al., 2006). The summer fruit tortrix moth is considered to be the most damaging leaf roller in Europe (Kocourek and Stará, 2005), and if introduced into the United States, the SFTM could become an economically damaging pest.

Leafrollers attach one or more leaves of the host together with silk to form a shelter; leaves also may be attached to the fruit. The majority of the economic damage occurs when larvae feed directly on fruit (Bradley et al., 1973). The summer fruit tortrix moth feeds on the buds, leaves, and fruit primarily of apple, pear, cherry, and plum (Dickler, 1991). Feeding on the leaves usually does not cause economic damage, but high-density populations of leaf rollers can defoliate trees (Dickler, 1991).

Overwintered larvae of the summer fruit tortrix moth may feed on flowers causing them to fall prior to fruit development (Cross, 1994), though this generation is not considered to be as economically damaging as the summer and fall generations (Kocourek and Stará, 2005). The first generation (summer) of SFTM can feed on the skin of the fruit leaving excavation scars and frass (Cross, 1994). The feeding wounds can heal, leaving a corky area in the fruit (Cross, 1994).

The shoot-feeding by the first generation can result in reduced yield. The second generation (fall) larvae also feed directly on the fruit and leaves, causing pitting or malformed skin on the fruit. This feeding can render fruit unmarketable for the fresh market and for processing (Dickler, 1991). Both generations, summer and fall, cause economic damage by feeding directly on the fruit. The damaged fruit are also much more susceptible to pathogens, resulting in reduced yield and quality (Kocourek and Stará, 2005). Crop losses recorded by this species range up to 20 percent (Whittle, 1985).

Although the summer fruit tortrix moth is polyphagous, the primary hosts are in the Rosaceae family. More specifically, hosts include *Prunus* spp., *Malus* spp., and *Pyrus* spp. (Whittle, 1985). Many of these species are of economic importance. In the United States, apple acreage in 2009 was 347,800 with a fresh market value of more than $2 billion. Two other major fruit tree commodities in the United States that may also be affected by SFTM are peaches (118,830 bearing acres and almost $600 million in utilized production in 2009); and pears (57,000 bearing acres and more than $350 million in utilized production in 2009) (NASS, 2010).

This pest has established populations in geographic areas with climates closely following the USDA Plant Hardiness Zones 4 to 11; this would cover most of the United States.

Ecological Range

The summer fruit tortrix moth occurs throughout Europe including the Netherlands, Italy, Austria, Turkey and Switzerland (*Table 2-2* on page 2-4). It is also a pest in parts of Asia, residing in China, India, Japan and Korea (Dickler, 1991; EPPO, 2007; Meijerman and Ulenberg, 2000) (*Table 2-3* on page 2-5).

Table 2-2 European Countries in Which the Summer Fruit Tortrix Moth is Established

Country	Comments	Reference
Austria	Present and widespread	EPPO, 2007; Whittle, 1985
Belgium	Present	EPPO, 2007; Whittle, 1985
Bulgaria	Present and widespread	EPPO, 2007; Whittle, 1985
Denmark	Present	EPPO, 2007; Meijerman and Ulenberg, 2000; Whittle, 1985
Finland	Present	EPPO, 2007; Whittle, 1985
France	Present	EPPO, 2007; Whittle, 1985
Germany	Present and widespread	EPPO, 2007; Whittle, 1985
Greece	Present	Meijerman and Ulenberg, 2000; Savopoulou-Soultani et al., 1985
Hungary	Present and widespread	EPPO, 2007; Whittle, 1985
Italy	Present, limited distribution	EPPO, 2007; Whittle, 1985
Netherlands	Present, limited distribution	EPPO, 2007; Whittle, 1985
Norway	Present	EPPO, 2007; Meijerman and Ulenberg, 2000; Whittle, 1985
Poland	Present	EPPO, 2007; Whittle, 1985
Romania	Present	EPPO, 2007; Whittle, 1985
Russia	Present, limited distribution	EPPO, 2007; Meijerman and Ulenberg, 2000; Whittle, 1985
Serbia	Present	EPPO, 2007
Spain	Present, limited distribution	EPPO, 2007; Whittle, 1985
Sweden	Present, limited distribution	EPPO, 2007; Meijerman and Ulenberg, 2000
Switzerland	Present and widespread	EPPO, 2007
Turkey	Present	Meijerman and Ulenberg, 2000
Ukraine	Present	EPPO, 2007
United Kingdom	Present, limited distribution	EPPO, 2007
England	Present, limited distribution	EPPO, 2007

Table 2-3 Asian Countries in Which the Summer Fruit Tortrix Moth is Established

Country	Comments	Reference
Armenia	Present	EPPO, 2007
Azerbaijan	Present	EPPO, 2007
Burma	Present, in mountains	Meijerman and Ulenberg, 2000
China	Present, limited distribution	Bradley et al., 1973; EPPO, 2007
Hebei	Present	EPPO, 2007
Sichuan	Present	EPPO, 2007
Georgia	Present	EPPO, 2007
Korea	Present	Meijerman and Ulenberg, 2000
Japan	Present	Bradley et al., 1973; EPPO, 2007
Hokkaido	Present	EPPO, 2007
Honshu	Present	EPPO, 2007
Kyushu	Present	EPPO, 2007
Shikoku	Present	EPPO, 2007
India	Present	Meijerman and Ulenberg, 2000
Russia Far East	Present	EPPO, 2007; Whittle, 1985
Siberia	Present	EPPO, 2007; Whittle, 1985

Potential Distribution

Based on the reported global distribution, it is estimated that the summer fruit tortrix moth can survive in USDA Plant Hardiness Zones 4 to 11, which includes many regions of the United States. The availability of some economically important hosts (e.g., apple, peaches, blackberries, raspberries, pears and cherries) was combined with the climatic suitability to estimate the risk of establishment of the SFTM in the continental United States in *Figure 2-1* on page 2-6. The map was developed by USDA–APHIS using NAPPFAST. Data was collected from the Agricultural Census (USDA–NASS, 2007) for all genera of hosts and 10 years of daily weather data.

Refer to *Distribution of Hosts* on page E-1 for more risk maps of specific host genera (*Malus, Pyrus, Prunus, Ribes, Rubus*, and *Quercus* species)

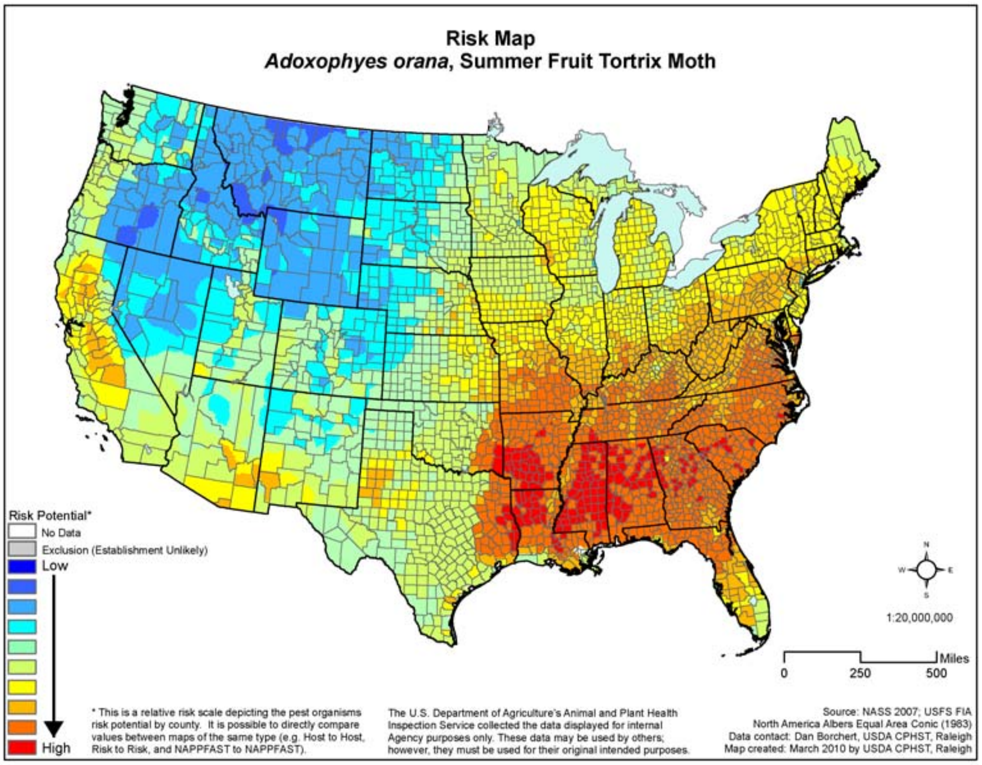


Figure 2-1 Potential Distribution of Summer Fruit Tortrix Moth in the United States

Hosts

The summer fruit tortrix moth is not host specific and reportedly feeds and develops on more than 100 plant species in multiple families (*List of Hosts* on page F-1). Potential host plants, both cultivated and wild, are common in the United States and often occur at high densities. Although the host range includes several forest species, the SFTM is documented as causing economic damage primarily to apples, pears and other rosaceous hosts (Barel, 1973; De Jong et al., 1971; Whittle, 1985).

Life Cycle

The summer fruit tortrix moth undergoes complete metamorphosis from egg to larva, to pupa, to adult.

Eggs

Eggs are flat, oval, and shiny yellow, deposited in clusters of 30 to 50. They are laid on the upper surface of the leaf (Dickler, 1991). Eggs hatch in 7 to 40 days depending on temperature (Cross, 1994). They become transparent just before hatching, making the dark head capsules of larvae visible (CABI, 2010).

Larvae

The larvae are dark brown, yellowish green, olive green, or dark green and up to 18 to 22 mm long. Larvae have a small yellowish pinacula, a yellowish head, a light yellow prothoracic plate, and light brown thoracic legs (Dickler, 1991; Meijerman and Ulenberg, 2000). There are 5 to 6 instars depending on environmental conditions (Milonas and Savopoulou-Soultani, 2000). The larvae are most often located in a silken web attached along the midrib of a leaf or to other leaves or fruit. Early instars may be gregarious, but the later instars are solitary (Bradley et al., 1973).

Pupae

The larvae pupate between leaves or twigs attached with silk, or inside crevices on tree trunks and branches (Bradley et al., 1973). The pupae are dark brown and 8 to 11 mm in length (Dickler, 1991; Meijerman and Ulenberg, 2000).

Adults

The adult male moths have a wingspan of 15 to 19 mm, and are usually smaller than the females. The forewings are light brown with a dark brown pattern, and the hind wings are gray. Females have a wingspan of 18 to 22 mm (Meijerman and Ulenberg, 2000). The forewings are light grey-brown with dark brown markings, with the pattern less defined than in the male adult; and the hind wings are paler (Dickler, 1991).

Behavior

In Europe, the summer fruit tortrix moth has two to three generations per year depending on the climate (Dickler, 1991; Pepperný, 2007). Three generations of SFTM per year have been reported in Greece (Milonas and Savopoulou-Soultani, 2006). Pheromone traps begin capturing SFTM in early May with a second generation in July and a third in late August spanning into September (Milonas and Savopoulou-Soultani, 2006).

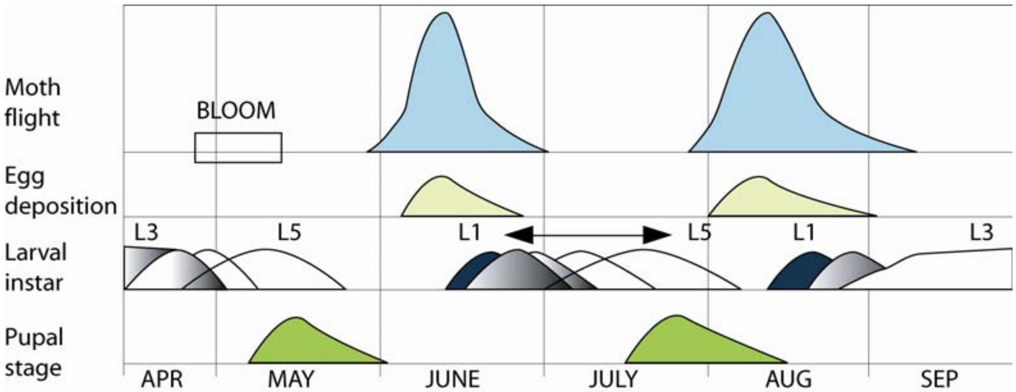
The summer fruit tortrix moth overwinters as a 2nd or 3rd instar larva. The larvae emerge from diapause in the spring at about 67 degree days (DD) with a developmental threshold of 9 to 10°C (Whittle, 1985). After emergence, the larvae feed on young leaves, buds, and flowers beginning in April. In May, they may begin feeding on the developing fruit (De Jong and Beeke, 1976;

Dickler, 1991; Whittle, 1985). The fluctuation of shoot infestation by larvae determines the periods of larval activity corresponding with the life cycle (*Figure 2-2* on page 2-9). By late October, the larval population is comprised mainly of third instar larvae which enter diapause for the winter (Milonas and Savopoulou-Soultani, 2006).

The developmental threshold for summer fruit tortrix moth larva is between 6.2°C and 30°C. The optimal temperature for development is 25°C. SFTM requires 333 to 430 DD to complete development, depending on the population (*Table 2-4* on page 2-9) (Milonas and Savopoulou-Soultani, 2000). During the first generation, the adult female moths lay about 150 eggs per egg mass (Pepperný, 2007). Eggs develop after an accumulation of 90 DD, with a developmental threshold of 10°C (Charmillot and Megevand, 1983). Eggs hatch within a few days (summer generation) depending on temperature (Bradley et al., 1973, de Jong 1980, Cross, 1994).

The first complete generation of larvae feed extensively on the pome fruit and can cause considerable economic damage (Cross, 1994). The larvae complete development on average in 430 DD above a developmental threshold of 7 to 8°C (Charmillot and Megevand, 1983). This generation pupates at the end of July. The peak in adult moth emergence and flight occurs in early August. This results in egg laying in mid-August and the second generation (fall generation) of larvae appearing in late August (*Figure 2-2* on page 2-9) (Cross, 1994). In the United Kingdom, the second generation hatches in early fall (Bradley et al., 1973). These caterpillars also feed on the fruit causing economic damage. To overwinter, the larvae move into the bark crevices or in a hibernaculum spun between leaves and twigs (Bradley et al., 1973) and enter diapause (Cross, 1994).

Diapause is influenced by several factors including photoperiod and the ability of an insect to withstand freezing temperatures (Milonas and Savopoulou-Soultani, 2004). Diapause is induced by a short day length ranging from less than 12 to 16 hours at 20 to 25°C (Barel, 1973; Berlinger and Ankersmit, 1976; Whittle, 1985). The duration of diapause is also influenced by temperature and photoperiod (Milonas and Savopoulou-Soultani, 2004).



Source: Cross, 1994

Figure 2-2 Life Cycle of Summer Fruit Tortrix Moth in the United Kingdom

Table 2-4 Developmental Threshold and Degree Days for the Summer Fruit Tortrix Moth

Stage	Developmental threshold (°C)	Degree Days	References
Egg	15	263	De Jong et al., 1965via Berlinger and Ankersmit, 1976
1st generation (summer)	7 to 8	430	Charmillot and Megevand, 1983
	6	333	Milonas and Savopoulou-Soultani, 2000
Prediapause	15	420	De Jong et al., 1965 via Berlinger and Ankersmit, 1976
Pupa	10	90	Charmillot and Megevand, 1983

Environmental Impact

The summer fruit tortrix moth is polyphagous. More than 120 plants on the Federally Registered Threatened and Endangered Species list are attacked by SFTM (USFWS, 2010). Refer to *Threatened and Endangered Hosts* on page G-1 for further information. Additionally, chemical control programs may be initiated in the event of an introduction of the SFTM in the United States, which may negatively impact non-target pests and the environment.

Chapter 3

Identification

Contents

Introduction

Use *Chapter 3: Identification* as a guide to recognizing the summer fruit tortrix moth (SFTM), *Adoxophyes orana* (Fischer von Röslerstamm). Accurate identification of the pest is pivotal to assessing its potential risk, developing a survey strategy, and determining the level and manner of control.

Authorities

Qualified State, County, or cooperating university personnel may do the preliminary identification and screening of suspect summer fruit tortrix moth. Before survey and control activities are initiated in the United States, an authority recognized by USDA–APHIS–PPQ-National Identification Services must confirm the identity of such pests. Submit specimens to the USDA-National Identification Services (NIS). For further information refer to *How to Submit Insect Specimens* on page C-1 and *Taxonomic Support for Surveys* on page D-1.

For a screening aid for use in field identification of common species in the United States and *Adoxophyes orana*, refer to ***Screening Aids*** on page H-1. Final identification of the summer fruit tortrix moth requires dissection and examination of adult male internal structures (Passoa, 1990; Yasuda, 1998). Molecular identification of tortricids is also possible. For molecular sequencing protocols, refer to ***Tortricidae Molecular Protocols*** on page J-1.

Reporting

Forward reports of positive identifications by national specialists to PPQ-National Identification Service (NIS) in Riverdale, Maryland, according to Agency protocol. NIS will report the identification status of these tentative and confirmed records to PPQ-Emergency and Domestic Programs (EDP). EDP will report the results to all other appropriate parties. For further information refer to *Taxonomic Support for Surveys* on page D-1.

Characteristics

Use the morphological characteristics described in this section to identify *Adoxophyes orana*.

Eggs

The yellowish eggs are deposited in somewhat circular masses in imbricate or shingle-like rows of 30 to 50 eggs. After hatching, the transparent egg shells remain (Brown, 2011; CABI, 2010).

Larvae

The larva was described by Whittle (1985) with the assistance of D.M. Weismen USDA-ARS:

> Length up to 20 mm. Head pale yellow, overlaid with pale brown pattern becoming more evident toward posterior margin; dark pigment in ocellar area; dark pigment at genal juncture extending as bar almost halfway to ocellus 1. Prothoracic shield yellow with a dark patch at posterolateral angles. Thoracic legs yellowish with tarsi slightly darker. Body color pale (dark green in living larvae). Pinaculi and anal shield pale. Spinules slightly darker than body color on dorsum contrasting with pinaculi. Anal fork well developed with 6-8 spines.
>
> Head with ocellus 2 closer to ocellus 3 than to ocellus 1. Prothorax with prespiracular setae almost in line, seta L1 closer to seta L2 than to seta L3. Abdomen with spiracles on segments A1-7 larger than insertion of seta SD1; subventral setal formula on segments 1, 2, 7, 8, and 9 is 3, 3, 3, 2, 2; on segment A9, setae V1 are slightly farther apart than those on A8. Anal shield tapered. Abdominal prolegs with about 40 crochets, biordinal, weaker anteriorly.

Pupae

The pupae of summer fruit tortrix moth are 8 to 11 mm in length. Initially, the pupae are light brown, but turn a darker brown before emergence. Two lateral rows of small spines are located on the posterior margin of abdominal segments two through eight and appear as a narrow line without magnification. The spines on the anterior margin of abdominal segment two are weakly developed. The cremaster is wider than long and bears six pairs of long, distally-hooked spines.

There is a fork of forewing veins seven and eight which is observable in the pupal stage (Brown, 2011; CABI, 2010). Like the pupa of other tortricids, that of summer fruit tortrix moth has two transverse rows of spines on the venter of each abdominal segment 3 to 8, with the spines of the anterior row conspicuously larger (Brown, 2011).

Adults

The summer fruit tortrix moth is a small moth ranging 8 to 12 mm in length. The forewing is brownish with a dark-brown pattern. The median fascia is narrower laterally, becoming larger near the middle. There is a distinctive costal spot is present subapically on the forewing, which is common for members of Archipini (Brown, 2011; CABI, 2010).

The summer fruit tortrix moth adults are sexually dimorphic. The male adults are smaller and have more pronounced wing markings with brighter colors. Females have a bell-shaped silhouette (in resting posture), with the lower tips of the wings pointing out. Males have long scales at the end of the abdomen covering the valve on the ventral side. In females the ovipositor lobes (or papillae anales) can be seen at the end of the abdomen (Brown, 2011; CABI, 2010). Refer to *Taxonomy and Morphology* on page I-1for further information.

Source: Name, http://www.bugwood.org

Source: Name, http://www.bugwood.org

Figure 3-1 Summer Fruit Tortrix Moth Male (left) and Female (right) Forewing

Source: Name, http://www.bugwood.org

Source: Name, http://www.bugwood.org

Figure 3-2 Summer Fruit Tortrix Moth Lateral View (left) and Dorsal View (right) of the Head and Thorax

Similar Species

Archips podana (Scopoli), the fruit tree tortrix, is also a very serious pest of fruit trees. It is native to Europe, but also has a restricted distribution to Whatcom County in Washington State (LaGasa et al., 2003). There has also been documentation of it occurring in British Columbia, Canada since 1988 (Belton, 1988). The fruit tree tortrix (*A. podana*) *Archips oporana* (L.) may also be confused with summer fruit tortrix moth and occurs from Europe to Asia.

The chequered fruit tree tortrix, *Pandemis corylana* (F.), and the dark fruit tree tortrix, *Pandemis heparana* (Den. and Schiff.), are also found throughout Europe and Asia. The latter species (*P. heparana*) is now also in Washington State (LaGasa et al., 2003), and the former (*P. corylana*) has been intercepted in international commerce. North American species of *Pandemis* also may be confused with the summer fruit tortrix moth, but males of native species have a small notch near the base of the antennae that distinguishes them from other Archipini (Brown, 2011).

Common Nearctic species that look most similar to summer fruit tortrix moth include reticulated sparganothis, *Sparganothis reticulatana* (Clem.), four-lined leaf roller, *Argyrotaenia quadrifasciana* Fern., and the oak leaf roller, *A. quercifoliana* (Fitch) (Dombroskie, 2010). Field identification proves especially difficult, and dissection of male genitalia is required for positive identification. Also see: **Appendix I, Taxonomy and Morphology of the Summer Fruit Tortrix Moth**

Chapter

4

Survey Procedures

Contents

Introduction

Use *Chapter 4: Survey Procedures* as a guide when conducting a survey for the summer fruit tortrix moth (SFTM), *Adoxophyes orana* (Fischer von Röslerstamm).

Survey Types

Plant regulatory officials will conduct detection, delimiting, and monitoring surveys for the summer fruit tortrix moth. Conduct a detection survey to ascertain the presence or absence of SFTM in an area where it is not known to occur. After a new U.S. detection, or when detection in a new area is confirmed, conduct a delimiting survey to define the extent of an infestation. Conduct a monitoring survey to determine the success of control or mitigation activities carried against a pest (*Table 4-1* on page 4-2). Pheromone trappings are the recommended survey method for SFTM (CAPS, 2010).

Use detection and delimiting surveys to survey for the presence of summer fruit tortrix moth. Use a monitoring survey to determine the effectiveness of control measures.

Table 4-1 Methods of Surveying for the Summer Fruit Tortrix Moth

If you:	Then use this survey:	And the following tools:
Are unsure the pest is present	Detection	Visual inspection, and/or traps trees to capture specimens. Place traps, sample fruits, and inspect plants. Consult with a SFTM specialist to confirm your identification.
Know the pest is present and you need to define its geographic location	Delimiting	Use traps and fruit sampling at specific locations and densities to capture specimens according to the plan outlined below. Consult with an SFTM moth specialist to confirm your identification.
Have applied a control and need to measure its effectiveness	Monitoring	Use visual inspection, fruit examination and/or traps to capture suspect specimens. Place traps or inspect plants at suspect locations. Consult with an SFTM moth specialist to confirm your identification.

Preparation, Sanitation, and Clean-up

This section provides information that will help personnel prepare to conduct a survey, procedures to follow during a survey, and instructions for proper cleaning and sanitizing of supplies and equipment after the survey is finished.

1. Before starting a survey, determine if there have been recent pesticide applications that would make it unsafe to inspect the nursery, grove, or landscape planting. Contact the property owner or manager and ask if

there is a re-entry period in effect due to pesticide application. Look for posted signs indicating recent pesticide applications, particularly in commercial fields or greenhouses.

2. Conduct surveys at the proper time. The summer fruit tortrix moth is only active from spring until fall. Based upon the pest's reported global distribution, it is estimated that SFTM may establish in USDA Plant Hardiness Zones 4 to 11 (***Figure 2-1*** on page 2-6). General survey efforts should focus on months when the larva can be found feeding on the leaves.
3. Obtain permission from the landowner before entering a property.
4. Determine if quarantines for other pests of apple or other host crops are in effect for the area being surveyed. Comply with any and all quarantine requirements.
5. When visiting the apple orchard, nurseries, or landscape planting to conduct surveys or to take samples, everyone must take strict measures to prevent contamination by the summer fruit tortrix moth or other pests between properties during inspections.
6. Before entering a new property, make certain that clothing and footwear are clean and free of pests and soil to avoid moving soil-borne pests and arthropods from one property to another. Wash hands. Change clothes if clothing is covered with insects.
7. Mark the apple tree or sampled location with flagging whenever possible, and draw a map of the immediate area and indicate reference points so that the areas can be found in the future if necessary. Do not rely totally on the flagging or other markers to re-locate a site as they may be removed. Record the GPS coordinates for each infested host plant location so that the area or plant may be re-sampled if necessary.
8. Survey task forces should consist of an experienced survey specialist or entomologist familiar with the the summer fruit tortrix moth and the symptoms of its presence.

Detection Survey

The purpose of a detection survey is to determine whether a pest is present in a defined area. This can be broad in scope, as when assessing the presence of the pest over large areas or it may be restricted to determining if a specific pest is present in a focused area.

Statistically, a detection survey is not a valid tool to claim that a pest does not exist in an area, even if results are negative. Negative results can be used to provide clues about mode of dispersal, temporal occurrence, or industry practices. Negative results are also important when compared with results from sites that are topographically, spatially, or geographically similar.

Procedure

Use the following tools singly or in any combination to detect the summer fruit tortrix moth:

1. Focus on high risk areas where SFTM is more likely to be found. Refer to ***Targeted Surveys*** on page 4-7 for detailed information.
2. Establish regular sites to inspect along your normal surveying route. Refer to ***Sentinel Sites*** on page 4-7 for detailed information.

Check plants for pest presence and damage. Refer to ***Visual Inspection*** on page 4-7 for detailed information.

Delimiting Survey after Initial U.S. Detection

If the summer fruit tortrix moth is detected in the United States, surveys will be conducted in the area to determine the distribution of the pest. In large areas, locating the source of an infestation could be difficult. The summer fruit tortrix moth primarily moves locally. Adult moths are capable of dispersing by flight, but larva can also be dispersed by wind (Barel, 1973). Any extended survey should be downwind along the direction of the prevailing winds.

Procedure

Use visual inspection of host plants and other nearby plants to determine presence of the summer fruit tortrix moth (*Table 4-2* on page 4-5). Refer to *Visual Inspection* on page 4-7. Once SFTM has been confirmed in an area, additional surveys should continue in nearby areas to determine the full extent of the infestation. SFTM's are capable of flight, and both the larva and adults aided by wind. Inspections should encompass continually larger areas particularly where hosts are known to occur.

Surveys should be most intensive around the known positive detections and any discovered through traceback and trace-forward investigations.

Table 4-2 Delimiting Survey Decision Table for Summer Fruit Tortrix Moth

If:	In an area:	Take this action:	And supplement with:
One or more adults	Within the original infestation site	Set 36 traps per square mile in the core area	Visual survey
	Within a 1-square mile area	Set 36 traps per square mile in 9 square miles around the core area	Visual survey and trapping of 100 hosts per square mile in the 9 square mile area.
One or more (any stage)	Within a 6-square mile area	Set 36 traps per square mile in 25 square miles around the core area	Visual survey and trapping of 100 hosts per square mile in the 25 square mile area.

Use the site of the detection as the focal point. Begin by setting 36 traps per square mile in the core area where the the summer fruit tortrix moth has been detected. Each block represents one square mile. Set out traps at the focal point and in each square mile in the first and second buffer areas in a standard grid array. In tree crops, traps should be suspended from tree limbs within the canopy for the highest number of moth catches (Gut et al., 2009). If traps are placed in wild host, follow these guidelines to determine placement, but try to follow grid spacing as closely as possible.

Once a delimiting survey area has been established, the area beyond the last buffer zone will be trapped at a minimum rate of nine traps per square mile. This trapping should occur for two life cycles where hosts are available, up to 10 miles from the epicenter.

Traceback and Trace-Forward Investigations

Traceback and trace-forward investigations help determine priorities for delimiting survey activities after an initial U.S. detection. Traceback investigations attempt to determine the source of infestation. Trace-forward investigations attempt to define further potential dissemination through means of natural and artificial spread (commercial or private distribution of infested plant material). Once a positive detection is confirmed, investigations are conducted to determine the extent of the infestation or suspect areas in which to conduct further investigations.

Infestations of the summer fruit tortrix moth may go undetected if populations are small and breeding insects are in the tree canopy, or resting on nearby plants. Typically, if a single SFTM is found in an area far removed from a port of entry or host plant, it is likely that it was transported to the site. The same is true for isolated detections during cool seasons. SFTM is inactive at air temperatures lower than 13°C (55°F) (De Jong et al., 1971).

Use wind field maps to plot the possible path of the summer fruit tortrix moth moth. Calculate the estimated day and time of arrival (based on the circumstances at the site and likely air mass movements) and work backward in time and space to construct a logical path. Site circumstances that provide clues to the estimated time of arrival include the following types of detections:

- Associated with the arrival of a weather system
- Adults with no evidence of larval feeding
- Located inland at locations away from obvious ports of entry
- Populations that end abruptly outside a given area
- New generation or stage in the life cycle
- Sudden outbreaks or increases in numbers not associated with local breeding populations

Once the path of the moth is plotted, carry out surveys along the path until the likely introduction site is located. Likely origins include port environs, areas where over-wintering is possible, or agricultural areas where hosts are abundant. Allowing for the imprecision of this method, surveys add weight to conjecture about the origin of an introduction.

Computer generated atmospheric trajectory analyses are available to help identify potential sources of infestation and to trace the probable movement of plant pests with air masses. One such program is the Branching Atmospheric Trajectory. Refer to *Resources* on page A-1 for the address.

For nursery stock, a list of facilities associated with nursery stock infested with the summer fruit tortrix moth will be compiled. These lists will be distributed by the State to the field offices, and are not to be shared with individuals outside USDA–APHIS–PPQ and state regulatory cooperators.

Grower names and field locations on these lists are strictly confidential, and any distribution of lists beyond appropriate regulatory agency contacts is prohibited. Each state is only authorized to see locations within their state and sharing of confidential business information may be restricted between state and federal entities. Check the privacy laws with the State Plant Health Director for each state.

When notifying growers on the list, be sure to identify yourself as a USDA or state regulatory official conducting an investigation of facilities that may have received summer fruit tree moth-infested material. Speak to the growers or farm managers and obtain proper permission before entering private property. Check nursery records to obtain names and addresses for all sales or distribution sites (if any sales or distribution has occurred from infested nursery during the previous 6 months).

Monitoring Surveys

If the summer fruit tortrix moth is detected in the United States, a Technical Working Group will be assembled to provide guidance on using a monitoring survey to measure the effectiveness of applied treatments on the pest population.

Targeted Surveys

Conduct targeted surveys in areas where introduction of the summer fruit tortrix moth may be considered more likely. This may include orchards near ports of entry for fruit and nursery stock. Areas with regular traffic from countries with known infestations that may carry insect hitchhikers should also be targeted for regular surveys.

Sentinel Sites

In the case of the summer fruit tortrix moth introduction, sentinel sites may need to be established to monitor population spread. Cooperators and researchers can survey these areas during times of possible establishment to determine presence or absence of SFTM in an area.

Visual Inspection

This section contains instructions for visual inspecting plants for infestation by the summer fruit tortrix moth. The advantages and disadvantages of visual inspection are as follows:

Advantages	**Disadvantages**
◆Locates pupae, eggs or larvae that would not be detected by other survey methods	◆Labor intensive
◆Inexpensive and simple	◆Time intensive
	◆Search efficiency varies greatly by habitat

1. Inspect apple trees, other potential host plants, and nearby resting places for aggregations of the summer fruit tortrix moth. Refer to *Taxonomy and Morphology* on page I-1 for further information.
2. Collect samples of tortricids while inspecting potential host plants. Review the images in Appendix E. Do not move live insects from survey sites.
3. Follow the instructions described in Processing Samples when preparing specimens. Submit specimens and plant material to the proper authority.
4. If the summer fruit tortrix moth is detected in an area, a Technical Working Group for this pest will be assembled; the group will provide further guidance concerning additional surveys.

What to Look For

Check orchards, fence rows, nearby trees and other habitats for suitable hosts. Be sure to check field edges since hosts favored by the summer fruit tortrix moth may be there, especially brambles. Areas with damaged or poorly growing plants should receive priority in the survey. Look for host fruits, berries, and leaves that are stuck together and/or damaged, and for any evidence of external feeding. Hosts from the core area are normally examined at the site.

Follow a similar sampling pattern for each field or orchard surveyed. Collect samples at least 75 feet from the edge of five different locations (*Figure 4-1* on page 4-8).

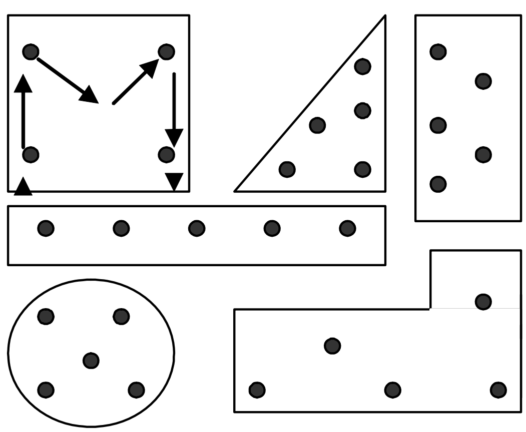


Figure 4-1 Standard Survey Sampling Pattern

At each sample location, inspect at least 10 plants from 3 adjoining rows (or at equally spaced intervals). Note that the summer fruit tortrix moth feeds externally on the fruit, berry, leaves etc. of the host, resulting in many external symptoms. Yet it may be helpful to search for some of the following: plants showing signs of poor growth; rotting or abnormally fallen fruit, or leaves;

holes in fruit; adults hidden in foliage; silk webbing and leaves and/or fruit stuck together.

Visual Symptoms

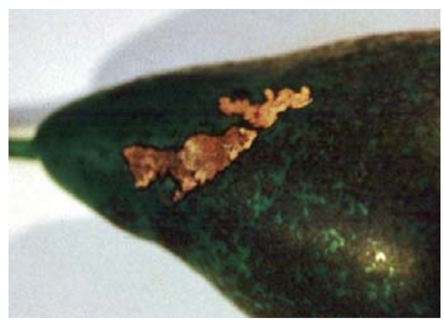
- Adults resting on leaves in the summer and fall (Whittle, 1985)
- Eggs laid on upper surfaces of leaves or fruit during the summer and fall (Bradley et al., 1973)
- Feeding damage by larva consisting of shallow, surface grazing on the fruit (Dickler, 1991)
- White webbing along the midribs of leaves (Whittle, 1985)

During winter pruning, overwintering larvae may be discovered in hibernacula near a flower bud or at the bifurcation of two small branches (CABI, 2010). Overwintering larvae may also may be found in bark cervices and under dry leaves (Bradley et al., 1973).

Feeding damage by the summer fruit tortrix moth on fruit usually appears as several small holes together. Often a leaf sticks to the fruit on the eaten areas. In the process of host examination, the surface of the fruits, berries, twigs, stems, and leaves of the host plants should be examined for eggs and larvae.

Any specimens collected should be held in colony for at least one the summer fruit tortrix moth life cycle. The facility where the samples are held must be secure to prevent any inadvertent release of moths. Security measures must be equal to those established for a quarantine insect rearing facility.

Source: D. Bylemans



Source: D. Bylemans

**Figure 4-2 Left: Shoot Damage by Summer Fruit Tortrix Moth Larvae
Right: Feeding Damage by Summer Fruit Tortrix Moth on Pear**

Sweep-Net Sampling

Sweep-net sampling is effective for sampling of the summer fruit tortrix moth if the host is one of the berries, cotton, alfalfa, beans, hops, nettles, bushes (forsythia), lilacs, or roses listed in *List of Hosts* on page F-1 or any other host discovered during program operations.

Sweeping is a useful method for collecting the summer fruit tortrix moth larvae and adults from the hosts. Look for leaves or fruit that indicate larval feeding. Sweeping at dusk or dawn, in synchrony with larval feeding patterns, will produce the best yield.

Sweep net sampling can be performed in combination with visual inspection. While walking forward, swing the net rapidly from side to side over the tops of the foliage. A typical sample unit is 25 to 100 sweeps (*Figure 4-1* on page 4-8). When performing aerial sweeps for adults, move the net in a horizontal figure-8 path, passing the handle from hand to hand at the body mid-point during the down stroke.

Trapping

Pheromone trapping can be used to determine the presence of the summer fruit tortrix moth. A trap and lure is the method approved by the Cooperative Agriculture Pest Survey (CAPS) for SFTM. The CAPS program recommends a different ratio of a 90:10:10:2 mixture of (Z)-11-Tetradecen-l-ol acetate of high isomeric purity, (Z) -11-Tetradecen-l-ol acetate, (Z)-9-Tertadecen-l-ol, and (Z)-11-Tetracecen-l-ol (CAPS, 2010). A paper delta trap with a rubber septum lure is recommended for the trapping of SFTM. The gray rubber septum dispenser has a 2 to 12 week length of effectiveness depending on the brand and external temperature (Gut et al., 2009).

The advantages and disadvantages of pheromone trapping are as follows:

Advantages	Disadvantages
◆ Very specific attractant	◆ Effectiveness may depend on climatic or wind conditions
◆ Generally low maintenance	◆ May be phase dependant
◆ Active method (lure), but does not require energy input	

CAPS-Approved Method—Trap with lure

Trap Type—Paper delta trap

Trap Abbreviation —paper delta trap, two sticky sides, brown; paper delta trap, two sticky sides, green; paper delta trap, two sticky sides, orange (Jackson, 2010; Sullivan et. al. 2011)

Table 4-3 Summer Fruit Tortrix Moth Lure Information

Lure Compound	Dispenser Type	Lure Abbreviation	Length of Effectiveness
Z,9-14:AC Z,11-14:AC Z,9-14:OH Z,11-14:OH	gray rubber septum	ADOX	12 weeks

Trap and lure abbreviation: As found in the PPQ trap and lure database (Jackson, 2010; Sullivan et al., 2011)

Trap should be used with ends open. Trap color is up to the State and does not affect trap efficacy (CAPS, 2010).

Source: Gemplers, 2010

Figure 4-3 Pherocon II Trap Paper Delta Trap

Processing Samples

This section contains instructions for preparing and shipping insect and plant specimens.

Preparation

Preserve larva in 70 percent isopropyl alcohol and sent for identification and preservation. Adults should be pinned or sent in cotton to not damage identifiable characteristics on the wings.

Shipping

Call the laboratory prior to shipping the samples via overnight delivery service. Instructions and contact information are located in *How to Submit Insect Specimens* on page C-1 and *Taxonomic Support for Surveys* on page D-1.

Data Collection

Recording negative results in surveys is just as important as positive detections since it helps define an area of infestation. A system of data collection should include an efficient tracking system for suspect samples such that their status is known at various stages and laboratories in the confirmation process. If available, use pre-programmed hand-held units with GPS capability.

Data collected during surveys should include the following:

- Date of survey
- Collector’s name and affiliation
- Full name of business, institution, or agency
- Full mailing address including country
- Type of property (commercial nursery, hotel, natural field, residence)
- GPS coordinates of the host plant and property
- Host species and cultivar
- General conditions or any other relevant information
- Positive or negative results from specimen collection

Cooperation with Other Surveys

Other surveyors regularly sent to the field should be trained to recognize infestations of the summer fruit tortrix moth. Large populations may occur on host plants during the spring and summer larval while feeding on host plants.

Chapter 5

Regulatory Procedures

Contents

Introduction

Use *Chapter 5 Regulatory Procedures* as a guide to the procedures that must be followed by regulatory personnel when conducting pest survey and control programs against summer fruit tortrix moth (SFTM), *Adoxophyes orana* (Fischer von Röslerstamm).

Instructions to Officials

Agricultural officials must follow instructions for regulatory treatments or other procedures when authorizing the movement of regulated articles. Understanding the instructions and procedures is essential when explaining procedures to people interested in moving articles affected by the quarantine and regulations. Only authorized treatments can be used in line with labeling restrictions. During all field visits, ensure that proper sanitation procedures are followed as outlined in *Preparation, Sanitization, and Clean-up* on page 4-2.

Regulatory Actions and Authorities

After an initial suspect positive detection, an Emergency Action Notification may be issued to hold articles or facilities, pending positive identification by a USDA–APHIS–PPQ-recognized authority and/or further instruction from the PPQ Deputy Administrator. If necessary, the Deputy Administrator will issue a letter directing PPQ field offices to initiate specific emergency action under the Plant Protection Act until emergency regulations can be published in the *Federal Register.*

The Plant Protection Act of 2000 (Statute 7 USC 7701-7758) provides the authority for emergency quarantine action. This provision is for interstate regulatory action only; intrastate regulatory action is provided under State authority.

State departments of agriculture normally work in conjunction with Federal actions by issuing their own parallel hold orders and quarantines for intrastate movement. However, if the U.S. Secretary of Agriculture determines that an extraordinary emergency exists and that the States measures are inadequate, USDA can take intrastate regulatory action provided that the governor of the State has been consulted and a notice has been published in the Federal Register. If intrastate action cannot or will not be taken by a State, PPQ may find it necessary to quarantine an entire State.

PPQ works in conjunction with State departments of agriculture to conduct surveys, enforce regulations, and take control actions. PPQ employees must have permission of the property owner before entering private property. Under certain situations during a declared extraordinary emergency or if a warrant is obtained, PPQ can enter private property without owner permission. PPQ prefers to work with the State to facilitate access when permission is denied, however each State government has varying authorities regarding entering private property.

A General Memorandum of Understanding (MOU) exists between PPQ and each State that specifies various areas where PPQ and the State department of agriculture cooperate. For clarification, check with your State Plant Health Director (SPHD) or State Plant Regulatory Official (SPRO) in the affected State. Refer to *Resources* on page A-1 for information on identifying SPHD's and SPRO's.

Tribal Governments

USDA–APHIS–PPQ also works with federally-recognized Indian Tribes to conduct surveys, enforce regulations and take control actions. Each Tribe stands as a separate governmental entity (sovereign nation) with powers and authorities similar to State governments. Permission is required to enter and access Tribal lands.

Executive Order 13175, Consultation and Coordination with Indian and Tribal Governments, states that agencies must consult with Indian Tribal governments about actions that may have substantial direct effects on Tribes. Whether an action is substantial and direct is determined by the Tribes. Effects are not limited to Tribal land boundaries (reservations) and may include effects on off-reservation land or resources which Tribes customarily use or even effects on historic or sacred sites in States where Tribes no longer exist.

Consultation is a specialized form of communication and coordination between the Federal and Tribal governments. Consultation must be conducted early in the development of a regulatory action to ensure that Tribes have opportunity to identify resources which may be affected by the action and to recommend the best ways to take actions on Tribal lands or affecting Tribal resources. Communication with Tribal leadership follows special communication protocols. For more information, contact PPQ's Tribal Liaison. Refer to *Table A-1* on page A-1 for information on identifying PPQ's Tribal Liaison.

To determine if there are Federally-recognized Tribes in a State, contact the State Plant Health Director (SPHD). To determine if there are sacred or historic sites in an area, contact the State Historic Preservation Officer (SHPO). For clarification, check with your SPHD or State Plant Regulatory Official (SPRO) in the affected State. Refer to *Resources* on page A-1 for contact information.

Overview of Regulatory Program After Detection

Once an initial U.S. detection is confirmed, holds will be placed on the property by the issuance of an Emergency Action Notification. Immediately put a hold on the property to prevent the removal of any host plants of the pest.

Traceback and trace-forward investigations from the property will determine the need for subsequent holds for testing and/or further regulatory actions. Further delimiting surveys and testing will identify positive properties requiring holds and regulatory measures.

Record-Keeping

Record-keeping and documentation are important for any holds and subsequent actions taken. Rely on receipts, shipping records and information provided by the owners, researchers or manager for information on destination of shipped plant material, movement of plant material within the facility, and any management (cultural or sanitation) practices employed.

Keep a detailed account of the numbers and types of plants held, destroyed, and/or requiring treatments in control actions. Consult a master list of properties, distributed with the lists of suspect nurseries based on traceback and trace-forward investigations, or nurseries within a quarantine area. Draw maps of the facility layout to located suspect plants, and/or other potentially infected areas. When appropriate, take photographs of the symptoms, property layout, and document plant propagation methods, labeling, and any other information that may be useful for further investigations and analysis.

Keep all written records filed with the Emergency Action Notification copies, including copies of sample submission forms, documentation of control activities, and related State issued documents if available.

Issuing an Emergency Action Notification

Issue an Emergency Action Notification to hold all host plant material at facilities that have the suspected plant material directly or indirectly connected to positive confirmations. Once an investigation determines the plant material is not infested, or testing determines there is no risk, the material may be released and the release documented on the EAN.

Regulated Area Requirements Under Regulatory Control

Depending upon decisions made by Federal and State regulatory officials in consultation with a Technical Working Group, quarantine areas may have certain other requirements for commercial or research fields in that area, such as plant removal and destruction, cultural control measures, or plant waste material disposal.

Any regulatory treatments used to control this pest or herbicides used to treat plants will be labeled for that use or exemptions will be in place to allow the use of other materials.

Establishing a Federal Regulatory Area or Action

Regulatory actions undertaken using Emergency Action Notifications continue to be in effect until the prescribed action is carried out and documented by regulatory officials. These may be short-term destruction or disinfestation orders or longer term requirements for growers that include prohibiting the planting of host crops for a period of time. Over the long term, producers, shippers, and processors may be placed under compliance agreements and permits issued to move regulated articles out of a quarantine area or property under an EAN.

Results analyzed from investigations, testing, and risk assessment will determine the area to be designated for a Federal and parallel State regulatory action. Risk factors will take into account positive testing, positive associated, and potentially infested exposed plants. Boundaries drawn may include a buffer area determined based on risk factors and epidemiology.

Regulatory Records

Maintain standardized regulatory records and databases in sufficient detail to carry out an effective, efficient, and responsible regulatory program.

Use of Chemicals

The PPQ *Treatment Manual* and the guidelines identify the authorized chemicals, and describe the methods and rates of application, and any special instructions. For further information refer to *Control Procedures* on page 6-1. Agreement by PPQ is necessary before using any chemical or procedure for regulatory purposes. No chemical can be recommended that is not specifically labeled for this pest.

Chapter 6

Control Procedures

Contents

Introduction

Use *Chapter 6: Control Procedures* as a guide to controlling the summer fruit tortrix moth (SFTM), *Adoxophyes orana* (Fischer von Röslerstamm). Consider the treatment options described within this chapter when taking action to eradicate, contain, or suppress SFTM.

Leaf rollers are a low threshold pest (Cross et al., 1999), requiring a successful management program. A suitable integrated pest management system will consider chemical, biological and cultural techniques to reduce pest populations.

Researchers recommend a variety of insecticide classes to control the summer fruit tortrix moth. These include insect growth regulators, organophosphates and pyrethroids. Biological insecticides, including *Bacillus thuringiensis* Berliner, baculoviruses and spinosad can also be integrated into a management program. Biological control organisms are present in the environment and may also help reduce the SFTM population.

Overview of Emergency Programs

APHIS–PPQ develops and makes control measures available to involved States. United States Environmental Protection Agency-approved treatments will be recommended when available. If the selected treatments are not labeled for use against the pest or in a particular environment, PPQ's FIFRA Coordinator is available to explore the appropriateness in developing an Emergency Exemption under Section 18, or a State Special Local Need under section 24(c) of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act), as amended.

The PPQ FIFRA Coordinator is also available upon request to work with EPA to rush the approval of a product that may not be registered in the United States, or to get labeling for a new use. The PPQ FIFRA Coordinator is available for guidance pertaining to pesticide use and registration. Refer to *Resources* on page A-1 for information on contacting the Coordinator.

Treatment Options

Consider the treatment options described within this chapter when taking action to eradicate, contain, or suppress the summer fruit tortrix moth. There are various chemical control measures available for use against SFTM, although it has been found that many species of leaf rollers are developing resistance to insecticides used in various regions of the world (Dunley et al., 2006; Kehrli et al., 2009; Sial et al., 2010).

All treatments listed in the guidelines should only be used as a reference to assist in the regulatory decision making process. It is the National Program Manager's responsibility to verify that treatments are appropriate and legal for use. Upon detection and when a chemical treatment is selected, the National Program Manager should consult with PPQ's FIFRA Coordinator to ensure that the chemical is approved by EPA for use in the United States prior to application.

Treatments can include any combination of the following options:

- Sanitation
- Application of insecticides
- Other cultural control methods

Eradication

Eradication, the elimination of a pest from an area through phytosanitary measures, is the first priority to consider with the introduction of a new pest. Eradication may be feasible when the following conditions exist:

- Pest population is confined to a small area
- Detection occurs soon after the introduction
- Pest population density is low

If an infestation of the summer fruit tortrix moth is discovered that is apparently limited in distribution, eradication will be attempted (*Table 6-1* on page 6-3). Measures will include, but may not be limited to, removal and destruction of all infested plant material, removal of host material within 2 miles of the find, and treatment of the soil and surrounding vegetation with an approved pesticide after removal of the infested plants.

Table 6-1 Decision Table for Eradication Treatment Area of Summer Fruit Tortrix Moth

If this number SFTM:	Are detected in an area of this size:	Then treatment will commence and extend:
1 to 5 larvae, pupae or gravid females OR 2 to 5 males or virgin females	Less than 6 square miles	200 yards beyond the detection
6 or more of any stage	Greater than 6 square miles	2½ miles beyond the detection

Suppression

Pest management includes steps taken to either contain or suppress a pest population. Damage attributed to the summer fruit tortrix moth is most effectively managed with the chemical, cultural and biological controls described in the sections that follow.

Sanitation

When visiting fields to conduct surveys or take samples, everyone (including regulatory officials) must take strict measures to prevent contamination by the the summer fruit tortrix moth between properties during inspections. Before entering a new property make certain that footwear and clothing are clean and free of soil and insects to avoid moving SFTM from one property to another.

Carry out sanitation in nurseries, gardens, landscapes, fields, and other establishments where hosts are present within the core and buffer areas. Depending on the circumstances and equipment available, use the following techniques:

- Clean cultivation
- Burning of host plants
- Field sanitation

Mulching

Mulching may be used to enhance alternative hosts for parasitoids of the summer fruit tortrix moth and improve the natural control of this leaf roller species. Mulching methods that encourage undergrowth of nectar plants and habitat conditions (vegetation height) for parasitoid habitat should be investigated. Based on such data, vegetation management might be used as a tool to enhance parasitoid efficiency in biological control (Kienzle et al., 1997).

Insecticides

Kocourek and Stará (2005) determined that the flight activity of male the summer fruit tortrix moth is influenced by weather causing dramatic variations in flight activity. Due to the strong relationship with weather, it was difficult for researchers to model activity. It was suggested that insecticide applications follow 7 to 10 days after egg lay. A single application of pesticide per generation was found to be sufficient at controlling SFTM (Kocourek and Stará, 2005).

Many of the chemicals listed in *Table 6-2* on page 6-5 are approved for a wide variety of crops and plants. Since the summer fruit tortrix moth has a large host range, we focused on determining the specific registration of chemicals on the primary hosts, apples and peaches.

Important All treatments listed in the guidelines should only be used as a reference to assist in the regulatory decisionmaking process. It is the National Program Manager's responsibility to verify that treatments are appropriate and legal for use. Upon detection and when a chemical treatment is selected, the National Program Manager should consult with PPQ's FIFRA Coordinator to ensure the chemical is approved by EPA for use in the United States before use. Refer to *Resources* on page A-1 for contact information.

Table 6-2 Insecticides Available for Use in the United States

MOA	Chemical	Pome[1]	Stone[2]	U.S.[3]	Comments	Reference
4A	acetamiprid	Yes	Yes	Yes	Tested on leaf rollers in the U.S.	Dunley et al., 2006
11	*Bacillus thuringiensis*	Yes	Yes	Yes	Tested on leaf rollers in U.S. and SFTM	Brunner et al., 2010; Cross, 1997b; Van der Geest, 1971, 1981
11	*Bacillus thuringiensis aizawai*	Yes	Yes	Yes	Tested on SFTM	Pollini, 2009
11	*Bacillus thuringiensis kurstaki*	Yes	Yes	Yes	Tested on SFTM	Pollini, 2009; Trona et al., 2008
28	chlorantranilip-role	Yes	Yes	Yes	Tested on leaf rollers in U.S. Pre-bloom only	Sial and Brunner, 2010
1B	chlorpyrifos	Yes	Yes	Yes	Tested on leaf rollers in the U.S. Pre-bloom only	Dunley et al., 2006
1B	chlorpyrifos-methyl	No	No	Yes	Tested on SFTM	Charmillot et al., 2006; Kehrli et al., 2009
6	emamectin benzoate	Yes	No	Yes	Tested on leaf rollers in the U.S.	Brunner et al., 2010
7B	fenoxycarb	No	No	Yes	Tested on SFTM. Approved on ornamen-tals and some flow-ers.	Cross, 1997a; Schmid et al., 1978
22A	indoxacarb	Yes	Yes	Yes	Tested on leaf rollers in U.S. and SFTM	Brunner et al., 2010; Charmillot et al., 2006; Dunley et al., 2006; Kehrli et al., 2009
N/A	kaolin clay	Yes	Yes	Yes	Tested on leaf rollers in the U.S.	Brunner et al., 2010

Table 6-2 Insecticides Available for Use in the United States (continued)

MOA	Chemical	Pome[1]	Stone[2]	U.S.[3]	Comments	Reference
18	methoxyfeno-zide	Yes	Yes	Yes	Tested on leaf rollers in U.S. and SFTM	Brunner et al., 2010; Bylemans et al., 2003; Cantoni et al., 2004; Dunley et al., 2006; Hoelscher and Barrett, 2003; Kehrli et al., 2009;
1B	methyl-para-thion	No	No	Yes	Tested on leaf rollers in the U.S.	Dunley et al., 2006
7C	pyriproxyfen	Yes	Yes	Yes	Tested on leaf rollers in the U.S.	Brunner et al., 2010
5	spinetoram	Yes	Yes	Yes	Tested on leaf rollers in the U.S.	Sial and Brunner, 2010

1 Approved on pome fruit.

2 Approved on stone fruit.

3 Approved in the United States.

Oxadiazine

Indoxacarb is effective through both oral and dermal contact; it blocks the sodium channels in the nervous system. As a newly registered insecticide in the United States, it is registered for use on leaf rollers on pome fruit. Brunner et al. (2010) reported that some leaf rollers in the United States are already exhibiting resistance. Additionally, it is also not an effective control of codling moth.

Insect Growth Regulators

An insect growth regulator (IGR) is a chemical that mimics a natural compound that is produced by the insect. IGR’s mimic insect hormones; thereby, interrupting normal biological processes. Applications of these compounds can lead to premature molts and deformities. IGR’s have been tested for efficacy against tortricids and have been found to be effective.

Methoxyfenozide

Methoxyfenozide is a molt-accelerating compound. It is lethal to lepidopteran larva and may have ovicidal properties against the summer fruit tortrix moth. Hoelscher and Barrett (2003) reported that application of this compound disrupts adult communication and female reproduction. These sublethal effects can play an important role in SFTM control.

A single application of methoxyfenozide resulted in good control against spring generations of the summer fruit tortrix moth. It exhibited better control than two season applications of fenoxycarb or fenoxycarb followed by tebufenozide (Bylemans et al., 2003). It had reliable efficacy against larvae of the overwintering and summer generations of SFTM. Applications of methoxyfenozide have resulted in consistent control of overwintering larva due its ability to control all stages of larva. The insecticide persistence is also not affected by adverse environmental conditions (Bylemans et al., 2003; Cantoni et al., 2004). Methoxyfenozide also has low toxicity to bees and natural enemies on pome fruit (Bylemans et al., 2003).

In Washington State, methoxyfenozide is commonly applied to apple trees against leaf rollers. Recommendations for applications are in the spring, from bloom to two weeks before petal fall. A single application can be effective against low leaf roller densities, but a second may be required during periods of high populations (Brunner et al., 2010).

Resistance to Methoxyfenozide: Insecticides containing methoxyfenozide are approved for use in the United States. In Washington state, resistance of leaf rollers to methoxyfenozide has been reported (Dunley et al., 2006). Cross-resistance between methoxyfenozide and diflubenzuron was reported in codling moth (Bylemans et al., 2003). Similar results may be exhibited in the summer fruit tortrix moth; therefore, research to control resistance development should be a priority.

Tebufenozide

This product is a specific anti-lepidopteran insecticide which is successful in controlling spring populations of the summer fruit tortrix moth. Applications of tebufenozide on summer populations, beginning at egg hatch, are also effective at controlling SFTM. It is selective primarily to lepidopteran pests and is harmless to bees; however, it has been documented as being toxic to Colpoclypeus florus Walker, a parasitoid of SFTM (Dhadialla et al., 1998). There have also been reports of tebufenozide resistance developing in Europe (see below) (Cross, 1997b).

Tebufenozide is a compound used on leaf rollers in Washington state. Brunner et al. (2010) reported that it is not as effective on leaf rollers as methoxyfenozide. It also may require two applications to control higher densities of leaf rollers.

Fenoxycarb

Fenoxycarb is a juvenile hormone mimic that causes premature and deformed molting to occur. It has been used in Europe to control the summer fruit tortrix moth and coddling moth on fruit trees since the 1980s (Cross, 1997a). It was first used on SFTM in the 1970s in the Netherlands (Schmid et al., 1978). To control SFTM, Schmid et al. (1978) suggested that the JH mimic be applied in the spring to the fifth instar larva before pupation. This application will help reduce the population buildup of summer adults.

Fenoxycarb was found to be highly effective with two applications pre and post blossom resulting in complete control of the summer fruit tortrix moth (Cross, 1997a, 1997b). However, due to its broad selectivity, this insecticide can also have deleterious effects to natural enemies (Dhadialla et al., 1998). In the United States, fenoxycarb has not been approved for use to tortricids in apples and pears. If SFTM is introduced to the United States, fenoxycarb may be approved for a Section 18. Nevertheless, fenoxycarb is approved for use on ornamentals, flowers, and non-bearing citrus, fruit and nut trees.

Organophosphate Resistance Management

The use of broad-spectrum organophosphates is being phased out of use in tree fruits (Sial and Brunner, 2010). A primary reason for the phase-out is because resistance and cross resistance to organophosphates has been documented in leaf rollers (Dunley et al., 2006; Sial and Brunner, 2010; Sial et al., 2010). Resistance to the organophosphates, azinphosmethyl, was found in some populations of the leaf rollers *Choristoneura rosaceana* (Harris) and *Pandemis pyrusana* Kearfott in Washington State. Dunley et al. (2006) reported that these tortricids exhibited cross-resistance to the organophosphate, azinphosmethyl, and to the IGR's, tebufenozide and methoxyfenozide. However, there was no cross resistance documented to a different organophosphate, chlorpyrifos. In the U.K., common insecticides like chlorpyrifos and tebufenozide are not reliable for reducing the summer fruit tortrix moth populations. This may also be due to insecticide resistance development (Cross, 1997b). Researchers recommend that an appropriate cross resistance program would consist of not applying insecticides of the same class against two consecutive generations.

Other Resistance Concerns

Chamillot et al. (2006) reported that the summer fruit tortrix moth has developed a resistance to the benzoylureas (hexaflumuron and lufenuron) and the benzhydrazides (tebufenozide and methoxyfenozide) in Switzerland. SFTM was not resistant to the insecticides indoxacarb, spinosad and chlorpyrifos-methyl. However in 2009, Kehrli et al., reported resistance is building in SFTM populations to chlorpyrifos-methyl and fenoxycarb in Switzerland.

Biological Insecticides

Spinosad

Spinosad is a selective broad-spectrum insecticide that has also been found to be effective against the summer fruit tortrix moth, particularly on the overwintered and summer generations (Bylemans and Schoonejans, 2000). Bylemans and Schoonejans (2000) reported that it is equally as effective on overwintered caterpillars as the IGR, tebufenozide, and the pyrethroid, deltamethrin (Bylemans and Schoonejans, 2000). Research at Washington State University indicated that spinosad was effective on leaf rollers, but not codling moth (Brunner et al., 2010). Sial et al. (2010) and Sial and Brunner (2010) documented that there is cross resistance between spinosad and spinetoram for the obliquebanded leaf roller Choristoneura rosaceana (Harris). In Switzerland, resistance to spinosad has not been documented for SFTM and it still very effective against the leaf roller (Charmillot et al., 2006). Spinosad was found not to be harmful to predatory mites and bugs (Anthocoridae) (Bylemans and Schoonejans, 2000).

Bacillus thuringiensis

Bacillus thuringiensis Berliner (Bt) is a naturally occurring bacterium that is considered to be an effective insecticide against Lepidoptera (Van der Geest, 1971, 1981). There have been mixed results documented of Bt efficacy on leaf rollers. Van der Geest (1971) reported better efficacy on spring and summer generations of the summer fruit tortrix moth than the fall generation. Conversely, Undorf and Huber (1986) completed a bioassay on SFTM and determined that it was not an effective control method. Research performed at Washington State University determined that Bt is currently effective against leaf rollers in the United States (Brunner et al., 2010).

Two forms of Bt, *Bacillus thuringiensis aizawai* (Bta) and *Bacillus thuringiensis kurstaki* (Btk), have been tested on the summer fruit tortrix moth (Pollini, 2009). Both Bt formulations have been approved for use on leaf rollers in the United States. Trona et al. (2008) determined that Btk and the granulovirus, AdorGV, are effective forms of control for SFTM. When used in appropriate IPM settings, they can be as effective as the IGR flufenoxuron.

Viruses

Baculovirus appear to have good efficacy in field and laboratory trials against the summer fruit tortrix moth. A granulovirus and a nucleopolyhedrovirus have been sequenced for control of SFTM (Dickler, 1991; Huber and Hassan, 1991).

Granuloviruses

The the summer fruit tortrix moth granulovirus AdorGV is effective against the summer fruit tortrix moth. It is highly specific and has no impact on other tortricids, parasites or any other insects (Huber and Hassan, 1991). Pepperný (2007) recorded that larvae infected with the virus during the first instar would usually die during the fifth instar. Additionally, pupae that were infected as a larva also had almost 100 percent mortality.

Hilton and Winstanley (2008) tested the lethal dose (LD) of AdorGV on the the summer fruit tortrix moth larva. They reported that the infected larvae did not exhibit symptoms of the infection until the last instar. The infected caterpillars remain in a prolonged fifth instar in which they release a large amount of the virus. During laboratory studies, the majority of the larvae died as a larval-pupal intermediate stage. If the larva survived into the pupal stage, the infected pupa emerged 20 days later than normal and as a deformed adult (Hilton and Winstanley, 2008). The principal disadvantage to the application of AdorGV is that the infected larvae continue to feed; thereby, causing damage until their death in the last instar (Huber and Hassan, 1991). However, in comparison to the IGR, application of flufenoxuron resulted in lower fruit damage than AdorGV in field trials (Kocourek et al., 2007)

Research of AdorGV in the Czech Republic determined that appropriate applications of the virus will effectively reduce the second generation in the first year (Kocourek et al., 2007). The applications of the virus should coincide with the young larvae to effectively reduce the summer fruit tortrix moth in the second generation during the first year. The first suggested application is during early spring, at the beginning of larval activity. Since infected larvae will not die until the last instar, applications against the young overwintered larvae will reduce fruit damage during the rest of the season. Applications against the summer and fall generations will not be effective at reducing damage by these generations, but the population density of the following generations will be reduced. This will result in a reduction in feeding damage the following year. By the second year, the population could be maintained below economic threshold (Kocourek et al., 2007). AdorGV (Capex 2, ProAgro, Abenberg, Germany) is commercially available in parts of Europe.

Nucleopolyhedrovirus

The nucleopolyhedrovirus isolated from *Adoxophyes honmai* (Yasuda), AdhoNPV, is also infectious to the summer fruit tortrix moth (Huber and Hassan, 1991). The infected SFTM larvae experience a slow death in the final instar. As a control agent, AdhoNPV kills the hosts more quickly than AdorGV (17.3 days vs 26.7 days, after inoculation of 90 percent of the lethal dose), and may contribute to further reduction of the crop damage (Ishii et al., 2003). However, the nucleopolyhedrovirus isolated from SFTM, AdorNPV, is fast acting. Infection of this virus results in a quick death during the first two instars (Hilton and Winstanley, 2008). Hilton and Winstanley (2008) reported that the higher the rate of AdorNPV, the quicker the larvae die.

Sterile Insect Technique

Sterile insect technique (SIT) is an effective tool in certain eradication and suppression programs. SIT employs radiation to sterilize large numbers of male insects. When released, the sterilized insects effectively compete with the viable males. This is usually most effective when the targeted female mates only once in her lifetime. Upon mating with a sterile male, the female will lay sterile eggs; thereby, reducing the reproductive success of the pest. Many factors determine if a particular insect is a good candidate for SIT, including its competitiveness after irradiation, ability to be reared in large numbers, F1 sterility, and the development of a pheromone for monitoring (Dyck et al., 2005).

Sterile insect technique was attempted for the summer fruit tortrix moth from 1969 to 1980 in the Netherlands (Ankersmit et al., 1977). This method of control was found not to be cost effective, and never reduced moth populations (Huber and Hassan, 1991). At present, there are no stocks of sterile SFTM adults available. Currently, there is ongoing recent research on improving SIT for lepidopterans (Simmons et al., 2010; Vreysen et al., 2010), but to date, there has been no effective SIT program developed for SFTM. However, there is a successful SIT program for codling moth in British Columbia, and for pink bollworm in San Joaquin Valley, CA (Bloem et al., 2005).

Pheromones

Mate-find and reproduction is a chemically-mediated process. The summer fruit tortrix moth has more than one compound in its sex pheromone (Meijer et al., 1972).

The lures approved by the Cooperative Agricultural Pest Survey (CAPS, 2010) include the following:

- Z,9-14:AC
- Z,11-14:AC
- Z,9-14:OH
- Z,11-14:OH

Pheromone lures are commonly used in detection, but may also be used in mating disruption by interfering with the ability of the male to find the female and disrupt the reproductive success of the the summer fruit tortrix moth. Large concentrations of the pheromones would be required to confuse the adults. Sex pheromone may also be used for control (attract and kill) or monitoring (Cross, 1996; Kirsch et al., 2001).

Mating Disruption

One of the first sex pheromone for the summer fruit tortrix moth was determined to be Z9-tetradecenyl acetate and Z11-tetradecenyl acetate (Meijer et al., 1972; Tamaki et al., 1971). Currently, this compound is being successfully implemented in Japan for mating disruption of *Adoxophyes orana fasciata* Walsingham (Okazaki et al., 2001). However, during periods of very high populations, Baric and Ciglar (2005) reported that mating disruption for SFTM in apple orchards in Croatia was unsuccessful and uneconomical. The use of the other documented pheromones in different locations may achieve better results.

In California pear orchards, there has been a successful transition from broad-spectrum insecticides to mating disruption for the control of codling moth (Varela and Elkins, 2008). Researchers discovered that by the third year of a mating disruption program, growers were saving up to $500 annually compared with the cost of conventional insecticides. This control method also reduced the use of organophosphates in the orchards. Judd and Gardiner (2008) determined that the use of Isomate®--CM/LR was successful for disrupting mating and control of codling moth and leaf rollers *Choristoneura rosaceana* and *Pandemis limitata* in British Columbia, Canada. It reduced mating and up to 98 percent of damage. It is feasible that a future mating disruption program may help in monitoring and control of other leaf roller species.

Attract and Kill

The attract and kill method is a valuable IPM technique that combines the use of pheromones and insecticides. This technique is used to reduce populations, but does not substitute for survey trapping (Kirsch et al., 2001). To implement this method, both pheromones and insecticides are applied in droplet form to the upper canopy of an orchard. The pheromones attract the male moths to the orchard where they are confused by the amount of pheromones and killed by the insecticide anon.

Somsai et al. (2009) applied sex pheromone, Z9-tetradecenyl acetate and Z11-tetradecenyl acetate, to the top of fruit trees, followed by an application of a pyrethroid at a ratio of 9:1 to control the summer fruit tortrix moth. This method was found to be effective at reducing populations, particularly during periods of low densities (Jakab et al., 2009). Oltean et al. (2009) claimed that if used properly, the pheromone alone could decrease fruit damage by 77 percent, however, the amalgamation of the insecticide offered an additional 15 percent of control. Compared to an IGR (novaluron), Somsai et al. (2009) reported that the attract and kill method was more effective at reducing damage by SFTM.

This technology has been used on codling moth in Washington. It was reported as an effective form of IPM that is less disruptive to predatory insects and mites (Knight, 2010). With any IPM method, insecticides need to be applied in conjunction with the appropriate stage during their biological cycle (Knight, 2010).

Biological Control

Biological control organisms help suppress and control pest populations, but they do not eradicate them. These organisms can be effective when used in combination with other IPM techniques. They are characterized as predators, parasites, parasitoids, or pathogens. There are many parasitoids documented for the summer fruit tortrix moth (*Table 6-3* on page 6-15).

Larval Parasitoids

In Europe, there are multiple species of parasitoids (*Table 6-3* on page 6-15) (Milonas and Savopoulou-Soultani, 2006; Pluciennik and Olszak, 2010). Milonas and Savopoulou-Soultani (2006) conducted a survey of parasitoids of the summer fruit tortrix moth in Greece. The most common (90 percent) larval parasitoid was *Colpoclypeus florus*. Additionally, research in the Netherlands also determined that *C. florus* was the most common larval parasitoid followed by *Teleutaea striata* (Gravenhorst) (Blommers et al., 1987). In Poland, the most common larval parasitoid of SFTM was *Meteorus ictericus* (Nees). However, the overall parasitism of SFTM was low. In general, more parasitism of leaf rollers was found in orchards that were not commercially sprayed (Pluciennik and Olszak, 2010). Higher percentages of parasitism was found in the summer than the spring populations (Kienzle et al., 1997)

Research in Poland recorded parasitoids of leaf rollers (including the summer fruit tortrix moth) (Pluciennik and Olszak, 2010). On average, 9 percent of all leaf roller species were parasitized (a range of 2 to 32 percent). A similar percent parasitism was recorded in Greece for SFTM (Milonas and Savopoulou-Soultani, 2006).

Pupal Parasitoids

There are fewer listed species of pupal than larval parasitoids (*Table 6-3* on page 6-15). Kienzle et al. (1997) recorded only two species as pupal parasitoids for the summer fruit tortrix moth. These included *Itoplectis maculator* F. and *Pimpla turionella* L.

Egg Parasitoids

Trichogrammatidae is the only family of Hymenoptera that parasitizes tortricid eggs (Cross et al., 1999). In field studies, Hassan, 1992, 1994 reported that the release of a combination of two species *Trichogramma dendrolini* Mats. and *T. embryophagum* Htg. increase parasitism efficacy by 10 to 14 percent than *T. dendrolimi* alone. Parasitism of the summer fruit tortrix moth eggs by the parasitoid mixture resulted in greater than 60 percent parasitism and reduced damage by 40 to 85 percent.

The rearing and release of these organisms has been successfully used for control of lepidopteran pests (Hassan, 1992; Li, 1994). A mass rearing program of *Trichogramma* egg parasites was completed by Hassan (1993). However, the cost of egg parasitoid mass rearing is too expensive when compared to insecticides. *Trichogramma* rearing programs have been successful worldwide to reduce populations of the European corn borer *Ostrinia nubilalis* (Hb.) (Hassan, 1993; Smith, 1996).

Table 6-3 Biological Control Agents Active Against the Summer Fruit Tortrix Moth

Parasitoid Type	Family	Species	Reference
Egg	Trichogrammatidae	*Trichogramma embryophagum* Htg.	Hassan, 1992, 1994
Egg	Trichogrammatidae	*Trichogramma dendrolimi* Mats.	CABI, 2010; Hassan, 1992, 1994; Meijerman and Ulenberg, 2000
Larval	Braconidae	*Apanteles ater* (Ratz.)	Pluciennik and Olszak, 2010
Larval	Braconidae	*Apanteles xanthostigma* (Hal.)	CABI, 2010
Larval	Braconidae	*Ascogaster rufidens* Wesm.	Kienzle et al., 1997
Larval	Braconidae	*Bracon hebetor* Say	Milonas and Savopoulou-Soultani, 2006; Milonas and Savopoulou-Soultani, 1999a; Milonas and Savopoulou-Soultani, 1999b
Larval	Ichneumonidae	*Campoplex mutabilis* (Holmgr.)	Pluciennik and Olszak, 2010
Larval	Eulophidae	*Colpoclypeus florus* (Walker)	CABI, 2010; Kienzle et al., 1997; Meijerman and Ulenberg, 2000; Milonas and Savopoulou-Soultani, 2006
Larval	Braconidae	*Cotesia ater* Ratz	Kienzle et al., 1997
Larval	Braconidae	*Cotesia longicauda* Aesm	Kienzle et al., 1997
Larval	Braconidae	*Cotesia xanthostigma* Hal.	Kienzle et al., 1997
Larval	Ichneumonidae	*Diadegma armillata* Grav.	Kienzle et al., 1997
Larval	Ichneumonidae	*Glypta ingrina* Desv	Kienzle et al., 1997
Larval	Braconidae	*Macrocentrus linearis* (Nees.)	Kienzle et al., 1997
Larval	Braconidae	*Macrocentrus thoracicus* (Nees)	Kienzle et al., 1997; Pluciennik and Olszak, 2010
Larval	Braconidae	*Meteorus gyrator* Thunb.	Kienzle et al., 1997
Larval	Braconidae	*Meteorus ictericus* (Nees)	CABI, 2010; Kienzle et al., 1997; Meijerman and Ulenberg, 2000; Pluciennik and Olszak, 2010
Larval	Braconidae	*Oncophanes laevigatus* Ratz	Kienzle et al., 1997
Larval	Tachinidae	*Pseudoperichaeta nigrolineata* Wlk.	Kienzle et al., 1997; Meijerman and Ulenberg, 2000
Larval	Ichneumonidae	*Scambus brevicornis* (Grav.)	CABI, 2010

Table 6-3 Biological Control Agents Active Against the Summer Fruit Tortrix Moth (continued)

Parasitoid Type	Family	Species	Reference
Larval	Ichneumonidae	*Teleutaea striata* (Grav.)	CABI, 2010; Kienzle et al., 1997; Pluciennik and Olszak, 2010
Larval	Ichneumonidae	*Tranosema rostralis* Brisch	Kienzle et al., 1997
Larval[1]-pupal[2]	Ichneumonidae	*Itoplectis maculator* (F.)	[2]Kienzle et al., 1997; Pluciennik and Olszak, 2010[1]
Larval[1]-pupal[2]	Ichneumonidae	*Pimpla turionellae* (L.)	[2]Kienzle et al., 1997; Pluciennik and Olszak, 2010[1]
Larval-pupal	Chalcididae	*Brachymeria rugulosa* (Först.)	Milonas and Savopoulou-Soultani, 2006
Pupal	Ichneumonidae	*Phaeogenes planifrons* Aesm	Kienzle et al., 1997
Pupal	Chalcididae	*Brachymeria obscurata* (Walker)	Meijerman and Ulenberg, 2000

Summary

The most effective control program for suppression of the the summer fruit tortrix moth likely incorporates the use of cultural control measures (e.g. removing and destroying infested plants) and chemical control of the residual population. If an established population is found in an apple production area, a science advisory panel will be asked to determine the best course of action. If eradication is not possible, as determined by the science advisory panel, it will be the responsibility of university extension services to determine the best management practices.

Chapter

7

Environmental Compliance

Contents

Introduction

Use *Chapter 7 Environmental Compliance* as a guide to the summer fruit tortrix moth (SFTM), *Adoxophyes orana* (Fischer von Röslerstamm).

Overview

Program managers of Federal emergency response or domestic pest control programs must ensure that their programs comply with all Federal Acts and Executive Orders pertaining to the environment, as applicable. Two primary Federal Acts, the National Environmental Policy Act (NEPA) and the Endangered Species Act (ESA), often require the development of significant documentation before program actions may begin.

Program managers should also seek guidance and advice as needed from Environmental and Risk Analysis Services (ERAS), a unit of APHIS' Policy and Program Development (PPD) staff. ERAS is available to give guidance and advice to program managers and prepare drafts of applicable environmental documentation.

In preparing draft NEPA documentation ERAS may also perform and incorporate assessments that pertain to other acts and executive orders described below, as part of the NEPA process. The Environmental Compliance Team (ECT), a part of PPQ's Emergency Domestic Programs (EDP), will assist ERAS in the development of documents, and will implement any environmental monitoring.

Leaders of programs are strongly advised to meet with ERAS and/or ECT early in the development of a program in order to conduct a preliminary review of applicable environmental statutes and to ensure timely compliance. Environmental monitoring of APHIS pest control activities may be required as part of compliance with environmental statutes, as requested by program managers, or as suggested to address concerns with controversial activities. Monitoring may be conducted with regards to worker exposure, pesticide quality assurance and control, off-site chemical deposition, or program efficacy. Different tools and techniques are used depending on the monitoring goals and control techniques used in the program. Staff from ECT will work with the program manager to develop an environmental monitoring plan, conduct training to carry out the plan, give day-to-day guidance on monitoring, and provide an interpretive report of monitoring activities.

National Environmental Policy Act

The National Environmental Policy Act (NEPA) requires all Federal agencies to examine whether their actions may significantly affect the quality of the human environment. The purpose of NEPA is to inform the decisionmaker before taking action, and to tell the public of the decision. Actions that are excluded from this examination, that normally require an Environmental Assessment, and that normally require Environmental Impact Statements, are codified in APHIS' NEPA Implementing Procedures located in 7 CFR 372.5.

The three types of NEPA documentation are Categorical Exclusions, Environmental Assessments, and Environmental Impact Statements.

Categorical Exclusion

Categorical Exclusions (CE) are classes of actions that do not have a significant effect on the quality of the human environment and for which neither an Environmental Assessment (EA) nor an environmental impact statement (EIS) is required. Generally, the means through which adverse environmental impacts may be avoided or minimized have been built into the actions themselves (7 CFR 372.5(c)).

Environmental Assessment

An Environmental Assessment (EA) is a public document that succinctly presents information and analysis for the decisionmaker of the proposed action. An EA can lead to the preparation of an environmental impact statement (EIS), a finding of no significant impact (FONSI), or the abandonment of a proposed action.

Environmental Impact Statement

If a major Federal action may significantly affect the quality of the human environment (adverse or beneficial) or the proposed action may result in public controversy, then prepare an Environmental Impact Statement (EIS).

Endangered Species Act

The Endangered Species Act (ESA) is a statute requiring that programs consider their potential effects on federally-protected species. The ESA requires programs to identify protected species and their habitat in or near program areas, and document how adverse effects to these species will be avoided. The documentation may require review and approval by the U.S. Fish and Wildlife Service and the National Marine Fisheries Service before program activities can begin. Knowingly violating this law can lead to criminal charges against individual staff members and program managers.

Migratory Bird Treaty Act

The statute requires that programs avoid harm to over 800 endemic bird species, eggs, and their nests. In some cases, permits may be available to capture birds, which require coordination with the U.S. Fish and Wildlife Service.

Clean Water Act

The statute requires various permits for work in wetlands and for potential discharges of program chemicals into water. This may require coordination with the Environmental Protection Agency, individual States, and the Army Corps of Engineers. Such permits would be needed even if the pesticide label allows for direct application to water.

Tribal Consultation

The Executive Order requires formal government-to-government communication and interaction if a program might have substantial direct effects on any federally-recognized Indian Nation. This process is often incorrectly included as part of the NEPA process, but must be completed before general public involvement under NEPA. Staff should be cognizant of the conflict that could arise when proposed Federal actions intersect with Tribal sovereignty. Tribal consultation is designed to identify and avoid such potential conflict.

National Historic Preservation Act

The statute requires programs to consider potential impacts on historic properties (such as buildings and archaeological sites) and requires coordination with local State Historic Preservation Offices. Documentation under this act involves preparing an inventory of the project area for historic properties and determining what effects, if any, the project may have on historic properties. This process may need public involvement and comment before the start of program activities.

Coastal Zone Management Act

The statute requires coordination with States where programs may impact Coastal Zone Management Plans. Federal activities that may affect coastal resources are evaluated through a process called Federal consistency. This process allows the public, local governments, Tribes, and State agencies an opportunity to review the Federal action. The Federal consistency process is administered individually by states with Coastal Zone Management Plans.

Environmental Justice

The Executive Order requires consideration of program impacts on minority and economically disadvantaged populations. Compliance is usually achieved within the NEPA documentation for a project. Programs are required to consider if the actions might impact minority or economically disadvantaged populations and if so, how such impact will be avoided.

Protection of Children

The Executive Order requires Federal agencies to identify, assess, and address environmental health risks and safety risks that may affect children. If such a risk is identified, then measures must be described and carried out to minimize such risks.

Chapter

8

Pathways

Contents

Introduction

Use *Chapter 8: Pathways* as a source of information on the pathways of introduction of the summer fruit tortrix moth (SFTM), *Adoxophyes orana* (Fischer von Röslerstamm) into the United States.

Natural Movement

The known range of the summer fruit tortrix moth in Europe and Asia means that this pest cannot get to the United States on its own through migratory patterns or other natural means of spread. In addition, SFTM has a poor capacity for dispersal (Barel, 1973).

Commerce

Officers with USDA-APHIS and the Department of Homeland Security reported only one interception of the summer fruit tortrix moth at U.S. ports of entry from 1985 to 2004 (USDA, 2005). The interception of SFTM was on a shipment of crabapples (*Malus sylvestris* (L.) Mill.) from France. The specimen was intercepted in France as part of a pre-clearance program (USDA, 2005).

Movement of the summer fruit tortrix moth larvae in commerce has been noted previously (reviewed in Barel, 1973), and introductions of tortricid larvae on trees and shrubs can be problematic. Arrivals of tortricids into the United States were noted as early as 1952 on lilacs from the Netherlands. (Davis et al., 2005). However, the USDA has recorded only a single documented interception of SFTM into the United States since 1985. The low interceptions and the known dispersal capacity indicate that SFTM would indicate that the summer fruit tortrix moth has a low risk of establishment in the United States. However, since the pest is a leaf roller, it does have a risk of being transported with nursery stock or on leaves still attached to imported fruit.

Risk of Establishment

1. The cargo usually consists of fruit only. Since the summer fruit tortrix moth is a surface pest on fruit, processing usually takes care of any specimens. Introductions of larvae on trees and shrubs would be more problematic.
2. Inspections usually would pick up anything other than fruit. Leaves, especially rolled leaves would not be expected to be in the shipment and if they were, would be likely to be eliminated through processing or spotted through inspections.
3. The majority of the U.S. has a climate that would support the summer fruit tortrix moth. The primary hosts, are common in climatically suitable areas. Therefore, the chance of SFTM establishment if introduced into the United States is high (Davis et al., 2005).
4. The known dispersal capacity would indicate that the summer fruit tortrix moth could be quickly eradicated if found within a reasonable period of time in the United States, especially if found in commercial hosts.

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Variegated Golden Tortrix

Use *References* to learn more about the publications, Web sites, and other resources that were consulted during the production of the guidelines.

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Variegated Golden Tortrix

Glossary

Use this glossary to find the meaning of specialized words, abbreviations, acronyms, and terms used by PPQ–EDP. To locate where in the manual a given definition, term, or abbreviation is mentioned, refer to the index.

Definitions, Terms, and Abbreviations

APHIS. USDA-Animal and Plant Health Inspection Service
ARS. USDA-Agricultural Research Service
CAPS. Cooperative Agricultural Pest Survey
CPB. U.S. Department of Homeland Security-Customs and Border Protection
CPHST. PPQ-Center for Plant Health Science and Technology
delimiting survey. survey conducted after the initial first detection in an area to define the geographic range of the infection/infestation
evaluation survey. survey conducted at a site where a pest was found and where an eradication program is being performed; also known as monitoring survey
detection survey. survey conducted over a large area to discover new potential infestations or infections in areas where the pest is not known to occur
EDP. PPQ-Emergency and Domestic Programs
EM. PPQ-Emergency Management
FIFRA. Federal Insecticide, Fungicide, and Rodenticide Act
GIS. geographic information systems, a computer system capable of capturing, storing, analyzing, and displaying geographically referenced information
GPS. global positioning system, a radio navigation system
hibernaculum. simple, off-whitish, shapeless sac, completely covering the pupa
host. plant which is invaded by a parasite or pathogen and from which it obtains its nutrients
ICS. Incident Command System
identification authority. authority to confirm the presence of a particular pest contractible issued by the APHIS-National Identification Services to diagnosticians that have demonstrated proficiency in identifying incident command system
IPM. integrated pest management
MOA. mode of action
monitoring survey. survey conducted at a site where a disease was found and where an eradication program is being performed; also known as evaluation survey
NAPPFAST. North Carolina State University APHIS Plant Pest Forecasting System
NASS. USDA-National Agricultural Statistics Service

NEPA. National Environmental Policy Act
NIS. PPQ-National Identification Service
NPAG. PPQ New Pest Advisory Group
NPRG. New Pest Response Guidelines
non-native. immigrant
PASS. potentially actionable suspect sample; a presumptive positive sample diagnosed or identified by provisionally approved laboratory or diagnostician with identification authority that would require confirmatory testing by an official APHIS laboratory due to the nature of the plant sampled and the necessity for Federal confirmation
PERAL. Plant Epidemiology and Risk Analysis Laboratory
pest. includes insects, weeds, plant disease agents, and microorganisms
polyphagous. feeding on a wide range of hosts
PPQ. APHIS-Plant Protection and Quarantine
SEL. USDA–ARS-Systematic Entomology Laboratory
SPHD. State Plant Health Director
SPRO. State Plant Regulatory Official
suspect positive. result that may require confirmatory testing if the sample is a PASS sample
symptom. external and internal reactions or alterations of a plant as the result of a disease
targeted survey. choosing an area, usually residential, on which to concentrate surveys based on known pathway information with ZIP Code-based demographic information or other scientific information; also known as hot zone survey or demographic survey
traceback survey. investigation of the origin of infested plants from initial detection location back through intermediate steps in commercial distribution channels to the origin
trace-forward survey. investigation to determine where infected plants may have been distributed from a known infestation through steps in commercial distribution channels or wholesale or retail procurement
TWG. Technical Working Group
USDA. United States Department of Agriculture

Appendix

A

Resources

Use *Appendix A Resources* to find the Web site addresses, street addresses, and telephone numbers of resources mentioned in the guidelines. To locate where in the guidelines a topic is mentioned, refer to the index.

Table A-1 Resources for the Summer Fruit Tortrix Moth

Resource	Contact Information
Center for Plant Health, Science, and Technology (USDA–APHIS–PPQ–CPHST)	http://www.aphis.usda.gov/plant_health/cphst/index.shtml
Emergency and Domestic Programs, Emergency Management (USDA–APHIS–PPQ–EDP–EM)	http://www.aphis.usda.gov/plant_health/plant_pest_info/index.shtml
PPQ *Manual for Agricultural Clearance*	http://www.aphis.usda.gov/import_export/plants/manuals/online_manuals.shtml
PPQ *Treatment Manual*	http://www.aphis.usda.gov/import_export/plants/manuals/online_manuals.shtml
Host or Risk Maps	http://www.nappfast.org/caps_pests/CAPs_Top_50.htm
Plant, Organism, and Soil Permits (APHIS–PPQ	http://www.aphis.usda.gov/plant_health/permits/index.shtml
National Program Manager for Native American Program Delivery and Tribal Liaison (USDA–APHIS–PPQ)	14082 S. Poston Place Tucson, AZ 85736 Telephone: (520) 822-544
Biological Control Coordinator (USDA–APHIS–CPHST)	http://www.aphis.usda.gov/plant_health/cphst/projects/arthropod-pests.shtml
FIFRA Coordinator (USDA–APHIS–PPQ-EDP)	4700 River Road Riverdale, MD 20737 Telephone: (301) 734-5861
Environmental Compliance Coordinator (USDA–APHIS–PPQ-EDP)	4700 River Road Riverdale, MD 20737 Telephone: (301) 734-7175
PPQ Form 391	http://www.aphis.usda.gov/library/forms/
List of State Plant Health Directors (SPHD)	http://www.aphis.usda.gov/services/report_pest_disease/report_pest_disease.shtml
List of State Plant Regulatory Officials (SPRO)	http://nationalplantboard.org/member/index.html
National Climatic Center, Data Base Administration, Box 34, Federal Building, Asheville, North Carolina 28801	http://www.ncdc.noaa.gov/oa/ncdc.html

Appendix

B

Forms

Use *Appendix B Forms* to learn how to complete the forms mentioned in the guidelines. To locate where in the guidelines a form is mentioned, refer to the index.

Contents

PPQ Form 391 Specimens For Determination

This report is authorized by law (7 U.S.C. 147a). While you are not required to respond your cooperation is needed to make an accurate record of plant pest conditions.

See reverse for additional OMB information.

FORM APPROVED
OMB NO. 0579-0010

U.S. DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE

SPECIMENS FOR DETERMINATION

Instructions: Type or print information requested. Press hard and print legibly when handwritten. Item 1 - assign number for each collection beginning with year, followed by collector's initials and collector's number. Example (collector, John J. Dingle): 83-JJD-001.
Pest Data Section – Complete Items 14, 15 and 16 or 19 or 20 and 21 as applicable. Complete Items 17 and 18 if a trap was used.

FOR IIBIII USE
LOT NO.
PRIORITY

1. COLLECTION NUMBER

2. DATE

MO	DA	YR

3. SUBMITTING AGENCY
☐ State Cooperator ☐ PPQ ☐ Other ______

SENDER AND ORIGIN

4. NAME OF SENDER

6. ADDRESS OF SENDER

ZIP

INTERCEPTION SITE

5. TYPE OF PROPERTY *(Farm, Feedmill, Nursery, etc.)*

7. NAME AND ADDRESS OF PROPERTY OR OWNER

COUNTRY/
COUNTY

PURPOSE

8. REASON FOR IDENTIFICATION *("x" ALL Applicable Items)*

A. ☐ Biological Control (Target Pest Name)
B. ☐ Damaging Crops/Plants
C. ☐ Suspected Pest of Regulatory Concern *(Explain in* REMARKS)
D. ☐ Stored Product Pest
E. ☐ Livestock, Domestic Animal Pest
F. ☐ Possible Immigrant *(Explain in* REMARKS)
G. ☐ Survey *(Explain in* REMARKS)
H. ☐ Other *(Explain in* REMARKS)

9. IF PROMPT OR URGENT IDENTIFICATION IS REQUESTED, PLEASE PROVIDE A BRIEF EXPLANATION UNDER "REMARKS".

HOST DATA

10. HOST INFORMATION
NAME OF HOST *(Scientific name when possible)*

11. QUANTITY OF HOST
NUMBER OF ACRES/PLANTS
PLANTS AFFECTED *(Insert figure and indicate* ☐ Number ☐ Percent*):*

12. PLANT DISTRIBUTION
☐ LIMITED
☐ SCATTERED
☐ WIDESPREAD

13. PLANT PARTS AFFECTED
☐ Leaves, Upper Surface ☐ Trunk/Bark ☐ Bulbs, Tubers, Corms ☐ Seeds
☐ Leaves, Lower Surface ☐ Branches ☐ Buds
☐ Petiole ☐ Growing Tips ☐ Flowers
☐ Stem ☐ Roots ☐ Fruits or Nuts

PEST DATA

14. PEST DISTRIBUTION
☐ FEW
☐ COMMON
☐ ABUNDANT
☐ EXTREME

15. ☐ INSECTS ☐ NEMATODES ☐ MOLLUSKS

NUMBER SUBMITTED	LARVAE	PUPAE	ADULTS	CAST SKINS	EGGS	NYMPHS	JUVS.	CYSTS
ALIVE								
DEAD								

16. SAMPLING METHOD

17. TYPE OF TRAP AND LURE

18. TRAP NUMBER

19. PLANT PATHOLOGY – PLANT SYMPTOMS *("X" one and describe symptoms)*
☐ ISOLATED ☐ GENERAL

20. WEED DENSITY
☐ FEW ☐ SPOTTY ☐ GENERAL

21. WEED GROWTH STAGE
☐ SEEDLING ☐ VEGETATIVE ☐ FLOWERING/FRUITING ☐ MATURE

22. REMARKS

23. TENTATIVE DETERMINATION

24. DETERMINATION AND NOTES *(Not for Field Use)*

SIGNATURE

DATE

FOR IIBIII USE
DATE RECEIVED
NO.
LABEL
SORTED
PREPARED
DATE ACCEPTED
RR

PPQ FORM 391
(AUG 02)
Previous editions are obsolete.

This is a 6-Part form. Copies must be disseminated as follows:
☐ PART 1 – PPQ ☐ PART 2 – RETURN TO SUBMITTER AFTER IDENTIFICATION ☐ PART 3 – IIBIII OR FINAL IDENTIFIER
☐ PART 4 – INTERMEDIATE IDENTIFIER ☐ PART 5 – INTERMEDIATE IDENTIFIER ☐ PART 6 – RETAINED BY SUBMITTER

Figure B-1 Example of PPQ Form 391 Specimens For Determination, side 1

OMB Information
According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0579-0010. The time required to complete this information collection is estimated to average .25 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

Instructions
Use PPQ Form 391, Specimens for Determination, for domestic collections (warehouse inspections, local and individual collecting, special survey programs, export certification).

BLOCK	INSTRUCTIONS
1	1. Assign a number for each collection beginning the year, followed by the collector's initials and collector's number **EXAMPLE** In 2001, Brian K. Long collected his first specimen for determination of the year. His first collection number is 01-BLK-001 2. Enter the collection number
2	Enter date
3	Check block to indicate Agency submitting specimens for identification
4	Enter name of sender
5	Enter type of property specimen obtained from (farm, nursery, feedmill, etc.)
6	Enter address
7	Enter name and address of property owner
8A-8L	Check all appropriate blocks
9	Leave Blank
10	Enter scientific name of host, if possible
11	Enter quantity of host and plants affected
12	Check block to indicate distribution of plant
13	Check appropriate blocks to indicate plant parts affected
14	Check block to indicate pest distribution
15	• Check appropriate block to indicate type of specimen • Enter number specimens submitted under appropriate column
16	Enter sampling method
17	Enter type of trap and lure
18	Enter trap number
19	Enter X in block to indicate isolated or general plant symptoms
20	Enter X in appropriate block for weed density
21	Enter X in appropriate block for weed growth stage
22	Provide a brief explanation if Prompt or URGENT identification is requested
23	Enter a tentative determination if you made one
24	Leave blank

Distribution of PPQ Form 391
Distribute PPQ Form 391 as follows:
1. Send Original along with the sample to your Area Identifier.
2. Retain and file a copy for your records.

Figure B-2 Example of PPQ Form 391 Specimens For Determination, side 2

Purpose

Submit PPQ Form 391, Specimens for Determination, along with specimens sent for positive or negative identification.

Instructions

Follow the instructions in *Table B-1* on page B-5. Inspectors must provide all relevant collection information with samples. This information should be shared within a State and with the regional office program contact. If a sample tracking database is available at the time of the detection, please enter collection information in the system as soon as possible.

Distribution

Distribute PPQ Form 391 as follows:

1. Send the original along with the sample to your area identifier
2. Keep and file a copy for your records

Table B-1 Instructions for Completing PPQ Form 391, Specimens for Determination

Block	Description	Instructions
1	COLLECTION NUMBER	1. ASSIGN a collection number for each collection as follows: 2-letter State code–5-digit sample number (Survey Identification Number in Parentheses) Example: PA-1234 (04202010001) 2. CONTINUE consecutive numbering for each subsequent collection 3. ENTER the collection number
2	DATE	ENTER the date of the collection
3	SUBMITTING AGENCY	PLACE an X in the PPQ block
4	NAME OF SENDER	ENTER the sender's or collector's name
5	TYPE OF PROPERTY	ENTER the type of property where the specimen was collected (farm, feed mill, nursery, etc.)
6	ADDRESS OF SENDER	ENTER the sender's or collector's address
7	NAME AND ADDRESS OF PROPERTY OR OWNER	ENTER the name and address of the property where the specimen was collected
8A-8H	REASONS FOR IDENTIFICATION	PLACE an X in the correct block
9	IF PROMPT OR URGENT IDENTIFICATION IS REQUESTED, PLEASE GIVE A BRIEF EXPLANATION UNDER "REMARKS"	LEAVE blank; ENTER remarks in *Block 22*
10	HOST INFORMATION NAME OF HOST	If known, ENTER the scientific name of the host
11	QUANTITY OF HOST	If applicable, ENTER the number of acres planted with the host
12	PLANT DISTRIBUTION	PLACE an X in the applicable box
13	PLANT PARTS AFFECTED	PLACE an X in the applicable box
14	PEST DISTRIBUTION FEW/COMMON/ ABUNDANT/EXTREME	PLACE an X in the appropriate block
15	INSECTS/NEMATODES/ MOLLUSKS	PLACE an X in the applicable box to indicate type of specimen
	NUMBER SUBMITTED	ENTER the number of specimens submitted as ALIVE or DEAD under the appropriate stage
16	SAMPLING METHOD	ENTER the type of sample
17	TYPE OF TRAP AND LURE	ENTER the type of sample
18	TRAP NUMBER	ENTER the sample numbers
19	PLANT PATHOLOGY- PLANT SYMPTOMS	If applicable, check the appropriate box; otherwise LEAVE blank
20	WEED DENSITY	If applicable, check the appropriate box; otherwise LEAVE blank

Table B-1 Instructions for Completing PPQ Form 391, Specimens for Determination (continued)

Block	Description	Instructions
21	WEED GROWTH STAGE	If applicable, check the appropriate box; otherwise LEAVE blank
22	REMARKS	ENTER the name of the office or diagnostic laboratory forwarding the sample; include a contact name, email address, phone number of the contact; also include the date forwarded to the State diagnostic laboratory or USDA–APHIS–NIS
23	TENTATIVE DETERMINATION	ENTER the preliminary diagnosis
24	DETERMINATION AND NOTES (**Not** for Field Use)	LEAVE blank; will be completed by the official identifier

PPQ 523 Emergency Action Notification

FORM APPROVED - OMB NO. 0579-0102

U.S. DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
PLANT PROTECTION AND QUARANTINE

EMERGENCY ACTION NOTIFICATION

SERIAL NO.

1. PPQ LOCATION
2. DATE ISSUED
3. NAME AND QUANTITY OF ARTICLE(S)
4. LOCATION OF ARTICLES
5. DESTINATION OF ARTICLES
6. SHIPPER
7. NAME OF CARRIER
8. SHIPMENT ID NO.(S)
9. OWNER/CONSIGNEE OF ARTICLES

Name:

Address:

PHONE NO. FAX NO.

SS NO. TAX ID NO.

10. PORT OF LADING
11. DATE OF ARRIVAL
12. ID OF PEST(S), NOXIOUS WEEDS, OR ARTICLE(S)

12a. PEST ID NO.

12b. DATE INTERCEPTED

13. COUNTRY OF ORIGIN
14. GROWER NO.
15. FOREIGN CERTIFICATE NO.

15a. PLACE ISSUED

15b. DATE

Under Sections 411, 412, and 414 of the Plant Protection Act (7 USC 7711, 7712, and 7714) and Sections 10404 through 10407 of the Animal Health Protection Act (7 USC 8303 through 8306), you are hereby notified, as owner or agent of the owner of said carrier, premises, and/or articles, to apply remedial measures for the pest(s), noxious weeds, and or article(s) specified in Item 12, in a manner satisfactory to and under the supervision of an Agriculture Officer. Remedial measures shall be in accordance with the action specified in Item 16 and shall be completed within the time specified in Item 17.

AFTER RECEIPT OF THIS NOTIFICATION, ARTICLES AND/OR CARRIERS HEREIN DESIGNATED MUST NOT BE MOVED EXCEPT AS DIRECTED BY AN AGRICULTURE OFFICER. THE LOCAL OFFICER MAY BE CONTACTED AT:

16. ACTION REQUIRED

☐ TREATMENT:

☐ RE-EXPORTATION:

☐ DESTRUCTION:

☐ OTHER:

Should the owner or owner's agent fail to comply with this order within the time specified below, USDA is authorized to recover from the owner or agent cost of any care, handling, application of remedial measures, disposal, or other action incurred in connection with the remedial action, destruction, or removal.

17. AFTER RECEIPT OF THIS NOTIFICATION COMPLETE SPECIFIED ACTION WITHIN (Specify No. Hours or No. Days):
18. SIGNATURE OF OFFICER:

ACKNOWLEDGMENT OF RECEIPT OF EMERGENCY ACTION NOTIFICATION

I hereby acknowledge receipt of the foregoing notification.

SIGNATURE AND TITLE: DATE AND TIME:

19. REVOCATION OF NOTIFICATION

ACTION TAKEN:

SIGNATURE OF OFFICER: DATE:

PPQ FORM 523 (JULY 2002) Previous editions are obsolete.

Figure B-3 Example of PPQ 523 Emergency Action Notification

Purpose

Issue a PPQ 523, Emergency Action Notification (EAN), to hold all host plant material at facilities that have the suspected plant material directly or indirectly connected to positive confirmations. Once an investigation determines the plant material is not infested, or testing determines there is no risk, the material may be released and the release documented on the EAN.

The EAN may also be issued to hold plant material in fields pending positive identification of suspect samples. When a decision to destroy plants is made, or in the case of submitted samples, once positive confirmation is received, the same EAN which placed plants on hold also is used to document any actions taken, such as destruction and disinfection. More action may be warranted in the case of other fields testing positive for this pest.

Instructions

If plant lots or shipments are held as separate units, issue separate EAN’s for each unit of suspected plant material and associated material held. EAN’s are issued under the authority of the Plant Protection Act of 2000 (statute 7 USC 7701-7758). States are advised to issue their own hold orders parallel to the EAN to ensure that plant material cannot move intrastate.

When using EAN’s to hold articles, it is most important that the EAN language clearly specify actions to be taken. An EAN issued for positive testing and positive-associated plant material must clearly state that the material must be disposed of, or destroyed, and areas disinfected. Include language that these actions will take place at the owner’s expense and will be supervised by a regulatory official. If the EAN is used to issue a hold order for further investigations and testing of potentially infested material, then document on the same EAN, any disposal, destruction, and disinfection orders resulting from investigations or testing.

Find more instructions for completing, using, and distributing this form in the PPQ *Manual for Agricultural Clearance*.

Appendix

C

How to Submit Insect Specimens

Contents

Insects and Mites

Taxonomic support for insect surveys requires that samples be competently and consistently sorted, stored, screened in most cases, and submitted to the identifier. The following are submission requirements for insects.

1. Sorting Trap Samples

   Trapping initiative is most commonly associated with a pest survey program, such as Wood Boring and Bark Beetles (WBBB), see Bark Beetle Submission Protocol from the PPQ Eastern Region CAPS program for detailed procedures. As such, it is important to sort out the debris and non-target insect orders from the trap material. The taxonomic level of sorting will depend on the expertise available on hand and can be confirmed with the identifier.

2. Screening Trap Samples

   Consult the screening aids on the CAPS website for screening aids for particular groups. The use of these aids should be coupled with training from identifiers and/or experienced screeners before their use. These can be found at: http://pest.ceris.purdue.edu/caps/screening.php

3. Storing Samples

   Where appropriate, samples can be stored indefinitely in alcohol, however samples of dried insects such as those in sticky traps may decompose over time if not kept in a cool location such as a refrigerator or freezer. If insect samples have decomposed, do not submit them for identification.

4. Packaging and Shipping

   Ensure specimens are dead before shipping. This can be accomplished by placing them in a vial of alcohol or putting the dry specimens in the freezer for at least 1day. The following are a few tips on sorting, packaging and shipping liquids, sticky traps and dry samples.

Liquids

Factors such as arthropod group, their life-stage and the means they were collected determine the way the specimens are handled, preserved and shipped to the identifier. In general mites, insect larvae, soft-bodied and hard-bodied adult insects can be transferred to vials of 75-90 percent Ethanol (ETOH), or an equivalent such as isopropyl alcohol. At times, Lingren funnel trap samples may have rainwater in them. To prevent later decay, drain off all the liquid and replace with alcohol. Vials used to ship samples should contain samples from a single trap and a printed or hand-written label with the associated collection number that is also found in the top right corner of form 391. Please make sure to use a writing utensil that isn't alcohol soluble, such as a micron pen or a pencil. It is important not to mix samples from multiple traps in a single vial so as to preserve the locality association data. Vials can be returned to field personnel upon request.

If sending specimens in alcohol is an issue with the mail or freight forwarder, the majority of liquid can be decanted off from the vial and then sealed tightly in the container just before shipping. Tell the identifier that the vials will need to have alcohol added back to them as soon as they are received. During the brief time of shipping, the specimens should not dry out if the vial is properly sealed.

Sticky Trap Samples

Adult Lepidoptera, because of their fragile appendages, scales on wings, etc. require special handling and shipping techniques. Lepidoptera specimens in traps should not be manipulated or removed for preliminary screening unless expertise is available. Traps can be folded, with stickum-glue on the inside, but only without the sticky surfaces touching, and secured loosely with a rubber band for shipping. Inserting a few styrofoam peanuts on trap surfaces without insects will cushion and prevent the two sticky surfaces from sticking during shipment to taxonomists. Also DO NOT simply fold traps flat or cover traps with transparent wrap (or other material), as this will guarantee specimens will be seriously damaged or pulled apart – making identification difficult or impossible.

An alternative to this method is to cut out the area of the trap with the suspect pest and pin it securely to the foam bottom of a tray with a lid. Make sure there is some room around the specimen for pinning and future manipulation. For larger numbers of traps, placing several foam peanuts between sticky surfaces (arranged around suspect specimens) can prevent sticky surfaces from making contact when packing multiple folded-traps for shipment. DO NOT simply fold traps flat or cover traps with transparent wrap (or other material), as this will guarantee specimens will be seriously damaged or pulled apart – making identification difficult or impossible.

Dry Specimens

Some collecting methods produce dry material that is fragile. Dry samples can be shipped in vials or glassine envelopes, such as the ones that can be purchased here: http://www.bioquip.com/Search/default.asp. As with the alcohol samples, make sure the collection label is associated with the sample at all times. This method is usually used for larger insects and its downside is the higher chance of breakage during shipping. Additionally, dry samples are often covered in debris and sometimes difficult to identify.

Be sure that the samples are adequately packed for shipment to ensure safe transit to the identifier. If a soft envelope is used, wrap it in shipping bubble sheets; if a rigid cardboard box is used, pack it in such a way that the samples are restricted from moving in the container. Please include the accompanying documentation and tell the identifier before shipping. Remember to tell the identifier that samples are on the way, giving the approximate number and to include your contact information.

Documentation

Each trap sample/vial should have accompanying documentation along with it in the form of a completed PPQ form 391, Specimens for Determination. The form is fillable electronically and can be found here:

http://cals-cf.calsnet.arizona.edu/azpdn/labs/submission/PPQ_Form_391.pdf

It is good practice to keep a partially filled electronic copy of this form on your computer with your address and other information filled out in the interest of saving time. Indicate the name of the person making any tentative identification before sending to an identifier. Please make sure all fields that apply are filled out and the bottom field (block 24: Determination and Notes) is left blank to be completed by the identifier. Include the trap type, lure used, and trap number on the form. Also, include the phone number and/or e-mail address of the submitter. Other documentation in the form of notes, images, etc. can be sent along with this if it useful to the determination. It is important that there be a way to cross-reference the sample/vial with the accompanying form. This can be done with a label with the “Collection Number” in the vial or written on the envelope, etc.

Appendix

D Taxonomic Support for Surveys

Contents

Background

The National Identification Services (NIS) coordinates the identification of plant pests in support of USDA's regulatory programs. Accurate and timely identifications are the foundation of quarantine action decisions and are essential in the effort to safeguard the nation's agricultural and natural resources.

NIS employs and collaborates with scientists who specialize in various plant pest groups, including weeds, insects, mites, mollusks and plant diseases. These scientists are stationed at a variety of institutions around the country, including federal research laboratories, plant inspection stations, land-grant universities, and natural history museums. Additionally, the NIS Molecular Diagnostics Laboratory is responsible for providing biochemical testing services in support of the agency's pest monitoring programs.

On June 13, 2007, the PPQ Deputy Administrator issued PPQ Policy No. PPQ-DA-2007-02 which established the role of PPQ NIS as the point of contact for all domestically- detected, introduced plant pest confirmations and communications. A Domestic Diagnostics Coordinator (DDS) position was established to administer the policy and coordinate domestic diagnostic needs for NIS. This position was filled in October of 2007 by Joel Floyd (USDA, APHIS, PPQ-PSPI,NIS 4700 River Rd., Unit 52, Riverdale, MD 20737, phone (301) 734-4396, fax (301) 734-5276, e-mail: joel.p.floyd@aphis.usda.gov).

Taxonomic Support and Survey Activity

Taxonomic support for pest surveillance is basic to conducting quality surveys. A misidentification or incorrectly screened target pest can mean a missed opportunity for early detection when control strategies would be more viable and cost effective. The importance of good sorting, screening, and identifications in our domestic survey activity cannot be overemphasized.

Fortunately most states have, or have access to, good taxonomic support within their states. Taxonomic support should be accounted for in cooperative agreements as another cost of conducting surveys. Taxonomists and laboratories within the State often may require supplies, develop training materials, or need to hire technicians to meet the needs of screening and identification. As well, when considering whether to survey for a particular pest a given year, consider the challenges of taxonomic support.

Sorting and Screening

For survey activity, samples that are properly sorted and screened before being examined by an identifier will result in quicker turn around times for identification.

Sorting

Sorting is the first level of activity that assures samples submitted are of the correct target group of pests being surveyed, that is, after removal of debris, ensure that the correct order, or in some cases family, of insects is submitted; or for plant disease survey samples, select those that are symptomatic if appropriate. There should be a minimum level of sorting expected of surveyors depending on the target group, training, experience, or demonstrated ability.

Screening

Screening is a higher level of discrimination of samples such that the suspect target pests are separated from the known non-target, or native species of similar taxa. For example, only the suspect target species or those that appear similar to the target species are forwarded to an identifier for confirmation. There can be first level screening and second level depending on the difficulty and complexity of the group. Again, the degree of screening appropriate is dependent on the target group, training, experience, and demonstrated ability of the screener.

Check individual survey protocols to determine if samples should be sorted, screened or sent entire (raw) before submitting for identification. If not specified in the protocol, assume that samples should be sorted at some level.

Resources for Sorting, Screening, and Identification

Sorting, screening, and identification resources and aids useful to CAPS and PPQ surveys are best developed by taxonomists who are knowledgeable of the taxa that includes the target pests and the established or native organisms in the same group that are likely to be in samples and can be confused with the target. Many times these aids can be regionally based. They can be in the form of dichotomous keys, picture guides, or reference collections. NIS encourages the development of these resources, and when aids are complete, post them in the CAPS Web site so others can benefit. If local screening aids are developed, please notify Joel Floyd, the Domestic Diagnostics Coordinator, as to their availability. Please see the following for some screening aids available: http://pest.ceris.purdue.edu/caps/screening.php

Other Entities for Taxonomic Assistance in Surveys

When taxonomic support within a state is not adequate for a particular survey, in some cases other entities may assist including PPQ identifiers, universities and state departments of agriculture in other states, and independent institutions. Check with the PPQ regional CAPS coordinators about the availability of taxonomic assistance.

Universities and State Departments of Agriculture

Depending on the taxonomic group, there are a few cases where these two entities are interested in receiving samples from other states. Arrangements for payment, if required for these taxonomic services, can be made through cooperative agreements. The National Plant Diagnostic Network (NPDN) also has five hubs that can provide service identifications of plant diseases in their respective regions.

Independent Institutions

The Eastern Region PPQ office has set up multi-state arrangements for Carnegie Museum of Natural History to identify insects from trap samples. They prefer to receive unscreened material and work on a fee basis per sample.

PPQ Port Identifiers

There are over 70 identifiers in PPQ that are stationed at ports of entry who primarily identify pests encountered in international commerce including conveyances, imported cargo, passenger baggage, and propagative material. In some cases, these identifiers process survey samples generated in PPQ conducted surveys, and occasionally from CAPS surveys. They can also enter into our Pest ID database the PPQ form 391 for suspect CAPS target or other suspect new pests, prior to being forwarded for confirmation by an NIS recognized authority.

PPQ Domestic Identifiers

PPQ also has a limited number of domestic identifiers (three entomologists and two plant pathologists) normally stationed at universities who are primarily responsible for survey samples. Domestic identifiers can be used to handle unscreened, or partially screened samples, with prior arrangement through the PPQ regional survey coordinator. They can also as an intermediary alternative to sending an unknown suspect to, for example, the ARS Systematic Entomology Lab (SEL), depending on their specialty and area of coverage.

They can also enter into our Pest ID database the PPQ form 391 for suspect CAPS target or other suspect new pests, prior to being forwarded for confirmation by an NIS recognized authority.

PPQ Domestic Identifiers
Bobby Brown
Domestic Entomology Identifier
Specialty: forest pests (coleopteran, hymenoptera)
Area of coverage: primarily Eastern Region

USDA, APHIS, PPQ
901 W. State Street
Smith Hall, Purdue University
Lafayette, IN 47907-2089
Phone: 765-496-9673
Fax: 765-494-0420
e-mail: robert.c.brown@aphis.usda.gov

Julieta Brambila
Domestic Entomology Identifier
Specialty: adult Lepidoptera, Hemiptera
Area of Coverage: primarily Eastern Region
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Final Confirmations

If identifiers or laboratories at the state, university, or institution level suspect they have detected a CAPS target, a plant pest new to the United States, or a quarantine pest of limited distribution in a new state, the specimens should be forwarded to an NIS recognized taxonomic authority for final confirmation. State cooperator and university taxonomists can go through a PPQ area identifier or the appropriate domestic identifier that covers their area to get the specimen in the PPQ system (for those identifiers, see table G-1-1 in the Agriculture Clearance Manual, Appendix G link below). They will then send it to the NIS recognized authority for that taxonomic group.

State level taxonomists, who are reasonably sure they have a new United States. record, CAPS target, or new federal quarantine pest, can send the specimen directly to the NIS recognized authority, but must notify their State Survey Coordinator (SSC), PPQ Pest Survey Specialist (PSS), State Plant Health Director (SPHD), and State Plant Regulatory Official (SPRO).

Before forwarding these suspect specimens to identifiers or for confirmation by the NIS recognized authority, please complete a PPQ form 391 with the tentative determination. Also fax a copy of the completed PPQ Form 391 to

"Attention: Domestic Diagnostics Coordinator" at 301-734-5276, or send a PDF file in an e-mail to mailto:nis.urgents@aphis.usda.govwith the overnight carrier tracking number.

The addresses of NIS recognized authorities of where suspect specimens are to be sent can be found in The Agriculture Clearance Manual, Appendix G, tables G-1-4 and G-1-5: http://www.aphis.usda.gov/import_export/plants/manuals/ports/downloads/mac_pdf/g_app_identifiers.pdf

Only use Table G-1-4, the "Urgent" listings, for suspected new United States records, or state record of a significant pest, and Table G-1-5, the "Prompt" listings, for all others.

When the specimen is being forwarded to a specialist for NIS confirmation, use an overnight carrier, insure it is properly and securely packaged, and include the hard copy of the PPQ form 391 marked "Urgent" if it is a suspect new pest, or "Prompt" as above.

Please contact Joel Floyd, the Domestic Diagnostics Coordinator if you have questions about a particular sample routing, at phone number: 301-734-5276, or e-mail: joel.p.floyd@aphis.usda.gov

Digital Images for Confirmation of Domestic Detections

For the above confirmations, do not send digital images for confirmation. Send specimens in these instances. For entry into NAPIS, digital imaging confirmations can be used for new county records for widespread pests by state taxonomists or identifiers if they approve it first. They always have the prerogative to request the specimens be sent.

Communications of Results

If no suspect CAPS target, program pests, or new detections are found, communication of these identification results can be made by domestic identifiers or taxonomists at other institutions directly back to the submitter. They can be in spread sheet form, on hard copy PPQ form 391's, or other informal means with the species found, or "no CAPS target or new suspect pest species found". Good record keeping by the intermediate taxonomists performing these identifications is essential.

All confirmations received from NIS recognized authorities, positive or negative, are communicated by NIS to the PPQ Emergency and Domestic Programs (EDP) staff in PPQ headquarters. EDP then notifies the appropriate PPQ program managers and the SPHD and SPRO simultaneously. One of these contacts should forward the results to the originating laboratory, diagnostician, or identifier.

Data Entry

Cooperative Agricultural Pest Survey (CAPS)

For survey data entered into NAPIS, new country and state records should be confirmed by an NIS recognized authority, while for others that are more widespread, use the identifications from PPQ identifiers or state taxonomists.

Appendix

E

Distribution of Hosts

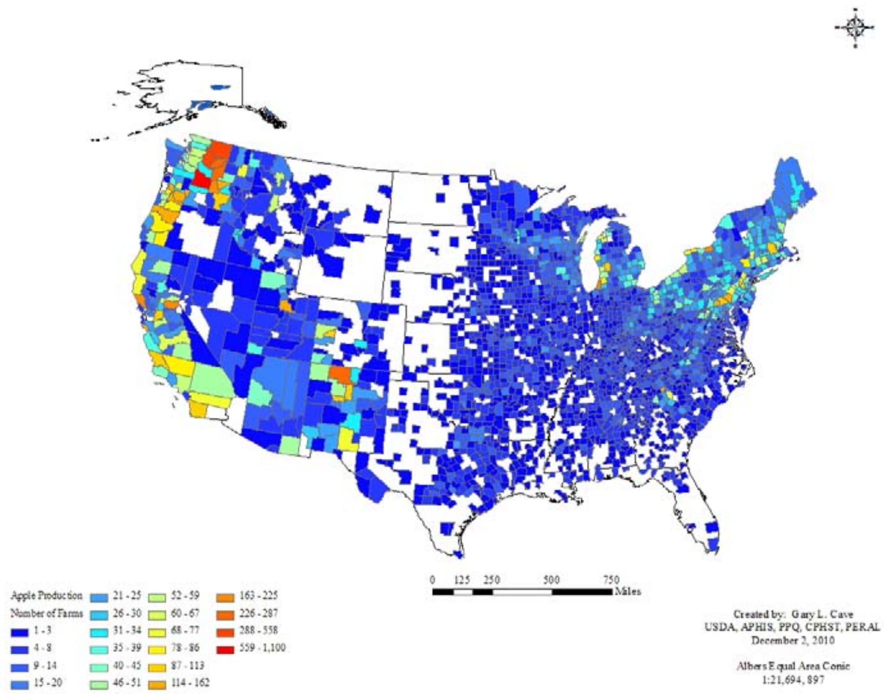

Figure E-1 Counties in the United States Containing Commercial Apple Farms (NASS, 2007)

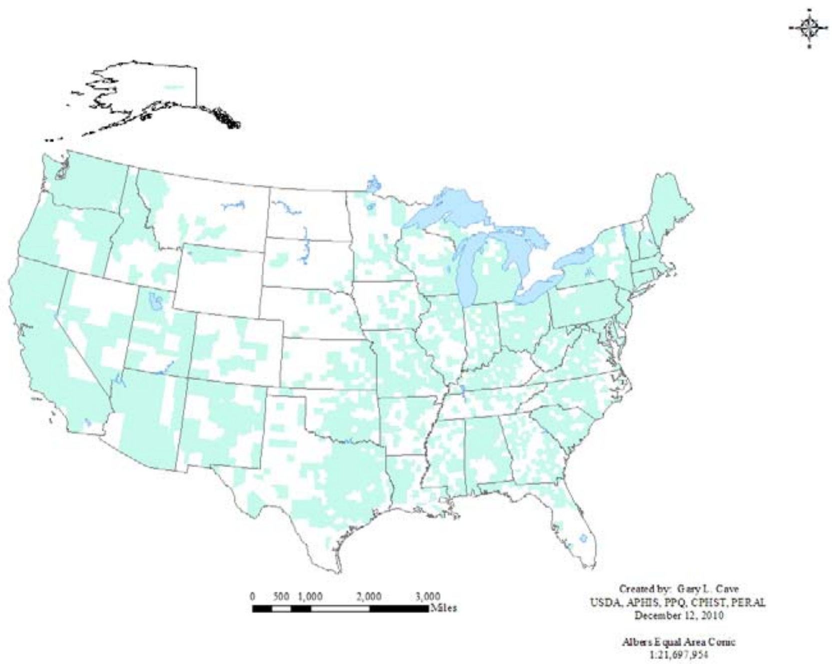

Figure E-2 Counties in the United States Containing Commercial Farms with *Pyrus* spp. (NASS, 2007)

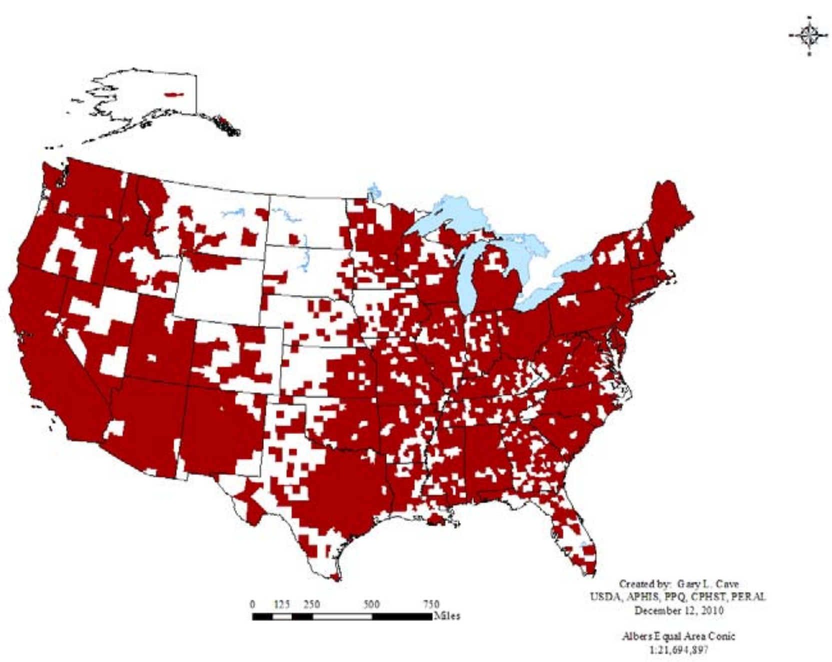

Figure E-3 Counties Containing *Prunus* spp. in the United States (USDA PLANTS database)

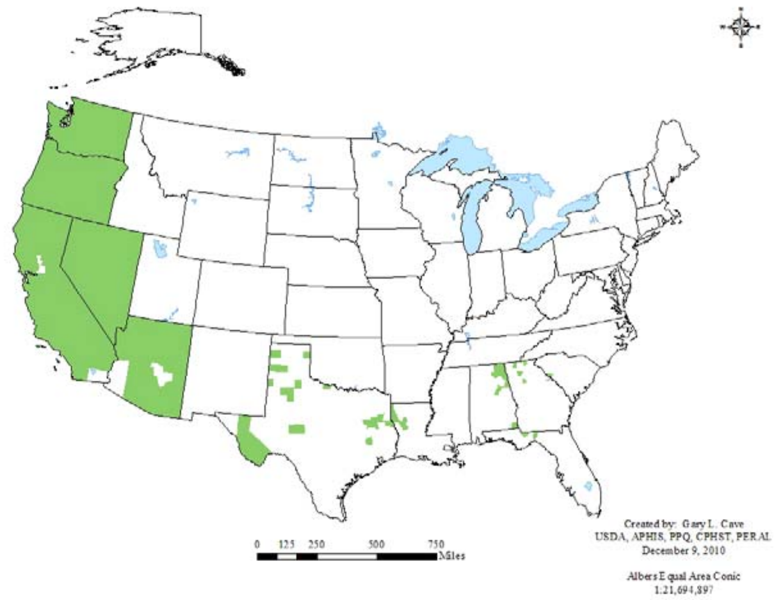

Figure E-4 Counties in the United States Containing Commercial *Ribes* spp. Farms (NASS, 2007)

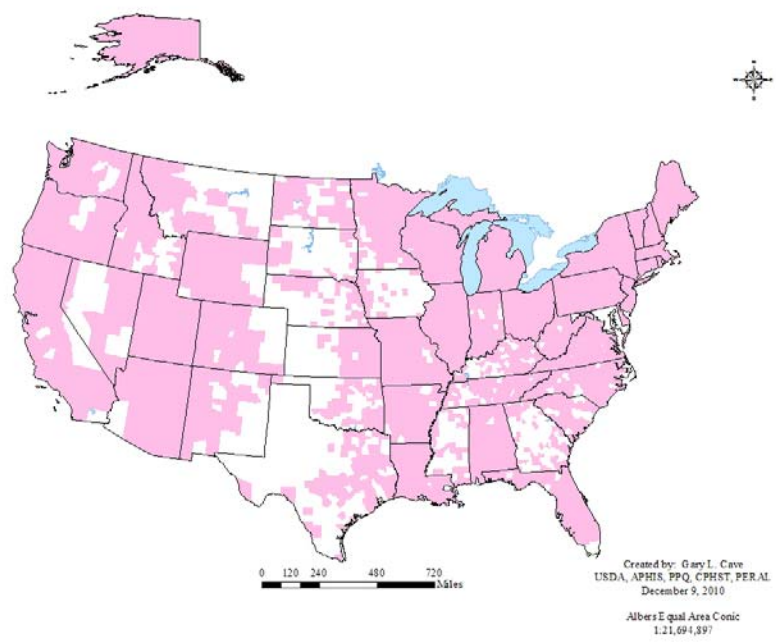

Figure E-5 Counties in the United States Containing *Rubus* spp. (USDA PLANTS database) Counties containing Rubus spp. in the United States.

Appendix

F

List of Hosts

Use *List of Hosts* to learn more about the host records of the summer fruit tortrix moth that have been reported. Many may be merely incidental records of the summer fruit tortrix moth resting or hitchhiking on various plants.

Table F-1 Reports of Summer Fruit Tortrix Moth on Various Host Plants[1]

Family	Latin Name	Common Name	References
Aceraceae	*Acer campestre* L.	Common maple	Barel (1973), CABI (2010), Janssen (1958), Meijerman and Ulenberg (2000), Whittle (1985)
Aceraceae	*Acer* spp.	Maple	De Jong et al. (1971)
Anacardiaceae	*Pistacia lentiscus* L.	Mastic tree[2]	Barel (1973), CABI (2010), Janssen (1958), Meijerman and Ulenberg (2000), Savopoulou-Soultani et al. (1985), Whittle (1985)
Anacardiaceae	*Pistacia* spp.	Pistachio	Savopoulou-Soultani et al. (1985)
Anacardiaceae	*Populus* spp.	Poplars	Barel (1973), CABI (2010), De Jong et al. (1971), Janssen (1958), Meijerman and Ulenberg (2000), Savopoulou-Soultani et al. (1985), Whittle (1985)
Betulaceae	*Alnus* spp.	Alder	Barel (1973), CABI (2010), De Jong et al. (1971), Janssen (1958), Meijerman and Ulenberg (2000), Whittle (1985)
Betulaceae	*Betula* spp.	Birch	Barel (1973), CABI (2010), De Jong et al. (1971), Janssen (1958), Meijerman and Ulenberg (2000), Savopoulou-Soultani et al. (1985), Whittle (1985)
Betulaceae	*Carpinus betulus* L.	European hornbeam	Barel (1973), CABI (2010), Janssen (1958), Whittle (1985)
Betulaceae	*Carpinus* spp.	Hornbeam	De Jong et al. (1971)
Betulaceae	*Corylus* spp.	Filbert, Hazelnut	Meijerman and Ulenberg (2000), Whittle (1985)
Cannabaceae	*Humulus* spp.	Hops	Barel (1973), CABI (2010), Janssen (1958), Meijerman and Ulenberg (2000), Whittle (1985)

Table F-1 Reports of Summer Fruit Tortrix Moth on Various Host Plants[1]

Family	Latin Name	Common Name	References
Caprifoliaceae	*Lonicera caprifolium* L.	Italian woodbine	Barel (1973), Janssen (1958), Meijerman and Ulenberg (2000), Whittle (1985)
Caprifoliaceae	*Lonicera* spp.	Honeysuckle	De Jong et al. (1971), Savopoulou-Soultani et al. (1985)
Caprifoliaceae	*Lonicera xylosteum* L.	Fly honeysuckle, Dwarf honeysuckle	Barel (1973), CABI (2010), Janssen (1958), Meijerman and Ulenberg (2000), Whittle (1985)
Caprifoliaceae	*Symphoricarpos albus* (L.) S.F. Blake	Common snowberry	CABI (2010), Janssen (1958), Whittle (1985)
Chenopodiaceae	*Chenopodium album* L.	Lambsquarters	Barel (1973)
Convolvulaceae	*Convolvulus arvensis* L.	Field bindweed	Barel (1973)
Ericaceae	*Vaccinium* spp.	Blueberries	Barel (1973), CABI (2010), Janssen (1958), Meijerman and Ulenberg (2000), Savopoulou-Soultani et al. (1985), Whittle (1985)
Fabaceae	*Laburnum anagyroides* Medik.	Golden chain tree	CABI (2010), Janssen (1958)
Fabaceae	*Laburnum* spp.	Golden chain tree	Barel (1973), De Jong et al. (1971), Meijerman and Ulenberg (2000), Whittle (1985)
Fabaceae	*Medicago* spp.	Alfalfa	Barel (1973), CABI (2010), Janssen (1958), Meijerman and Ulenberg (2000), Whittle (1985)
Fabaceae	*Vicia faba* L.	Horsebean	Barel (1973)
Fagaceae	*Fagus sylvatica* L.	European beech	Barel (1973), CABI (2010), Janssen (1958), Meijerman and Ulenberg (2000), Whittle (1985)
Fagaceae	*Quercus acutissima* Carruthers	Saw-tooth oak	Meijerman and Ulenberg (2000)
Fagaceae	*Quercus* spp.	Oaks	Barel (1973), Janssen (1958), Savopoulou-Soultani et al. (1985), Whittle (1985)
Grossulariaceae	*Ribes* spp.	No data	Savopoulou-Soultani et al. (1985)
Grossulariaceae	*Ribes glandulosum* Grauer ex Weber	White currant	De Jong et al. (1971), Whittle (1985)

Table F-1 Reports of Summer Fruit Tortrix Moth on Various Host Plants[1]

Family	Latin Name	Common Name	References
Grossulariaceae	*Ribes grossularia* L.	European gooseberry[2]	Meijerman and Ulenberg (2000)
Grossulariaceae	*Ribes nigrum* L.	Black currant	Barel (1973), CABI (2010), De Jong et al. (1971), Janssen (1958), Meijerman and Ulenberg (2000), Whittle (1985)
Grossulariaceae	*Ribes rubrum* L.	Red currant	Barel (1973), CABI (2010), De Jong et al. (1971), Janssen (1958), Meijerman and Ulenberg (2000), Whittle (1985)
Grossulariaceae	*Ribes uva-crispa* L.	English gooseberry	CABI (2010), Whittle (1985)
Grossulariaceae	*Ribes uva-crispa* L. var. *sativum* DC	English gooseberry	Barel (1973), Janssen (1958)
Hamamelidaceae	*Parrotia* spp.	Ironwood[2]	Barel (1973), Janssen (1958), Meijerman and Ulenberg (2000), Savopoulou-Soultani et al. (1985), Whittle (1985)
Malvaceae	*Gossypium herbaceum* L.	Arabian cotton	Barel (1973), CABI (2010), Janssen (1958), Whittle (1985)
Malvaceae	*Gossypium herbaceum* L. var. *hirsutum* (L.) Mast.	Levant cotton	CABI (2010), Meijerman and Ulenberg (2000), Whittle (1985)
Malvaceae	*Gossypium hirsutum* L.	Upland cotton	Whittle (1985)
Malvaceae	*Gossypium* spp.	Cotton	De Jong et al. (1971), Savopoulou-Soultani et al. (1985)
Menyanthaceae	*Menyanthes trifoliata* L.	Buckbean	Barel (1973), Janssen (1958), Whittle (1985)
Oleaceae	*Forsythia suspensa* (Thunb.) Vahl	Weeping forsythia	Barel (1973), CABI (2010), Janssen (1958), Meijerman and Ulenberg (2000), Whittle (1985)
Oleaceae	*Fraxinus* spp.	Ash	De Jong et al. (1971), Whittle (1985)
Oleaceae	*Ligustrum* spp.	Privet	Barel (1973), CABI (2010), De Jong et al. (1971), Janssen (1958), Meijerman and Ulenberg (2000), Savopoulou-Soultani et al. (1985), Whittle (1985)

Table F-1 Reports of Summer Fruit Tortrix Moth on Various Host Plants[1]

Family	Latin Name	Common Name	References
Oleaceae	*Syringa* spp.	Lilac	De Jong et al. (1971), Savopoulou-Soultani et al. (1985)
Oleaceae	*Syringa vulgaris* L.	Common lilac	Barel (1973), CABI (2010), Janssen (1958), Meijerman and Ulenberg (2000), Whittle (1985)
Polygonaceae	*Rumex* spp.	Dock	Barel (1973)
Rosaceae	*Pyrus* spp.	Pear	Savopoulou-Soultani et al. (1985)
Rosaceae	*Cotoneaster dielsianus* E. Pritz.	Diel's cotoneaster	Barel (1973), Janssen (1958), Whittle (1985)
Rosaceae	*Crataegus* spp.	Hawthorn	Barel (1973), CABI (2010), De Jong et al. (1971), Janssen (1958), Savopoulou-Soultani et al. (1985), Whittle (1985)
Rosaceae	*Cydonia oblonga* Mill.	Quince	Barel (1973), CABI (2010), De Jong et al. (1971), Janssen (1958), Meijerman and Ulenberg (2000), Savopoulou-Soultani et al. (1985), Whittle (1985)
Rosaceae	*Fragaria* spp.	Strawberry	De Jong et al. (1971), Whittle (1985)
Rosaceae	*Malus baccata* (L.) Borkh.	Siberian crabapple	Barel (1973), CABI (2010), Janssen (1958), Meijerman and Ulenberg (2000), Whittle (1985)
Rosaceae	*Malus domestica* Borkh.	Apple	Barel (1973), Blommers et al. (1987), CABI (2010), Charmillot and Brunner (1990), Cross et al. (1999), De Jong (1980), De Jong et al. (1971), De Jong and Minks (1981), Kienzle et al. (1997), Meijerman and Ulenberg (2000), Milonas and Savopoulou-Soultani (1999a), Milonas and Savopoulou-Soultani (2000), Savopoulou-Soultani et al. (1985)
Rosaceae	*Malus pumila* Mill.	Paradise apple	Barel (1973), CABI (2010), Janssen (1958), Meijerman and Ulenberg (2000)
Rosaceae	*Malus sylvestris* (L.) Mill	European crabapple	Whittle (1985)

Table F-1 Reports of Summer Fruit Tortrix Moth on Various Host Plants[1]

Family	Latin Name	Common Name	References
Rosaceae	*Potentilla* spp.	Cinquefoil	Barel (1973)
Rosaceae	*Prunus armeniaca* L.	Apricot	Barel (1973), CABI (2010), Janssen (1958), Meijerman and Ulenberg (2000), Whittle (1985)
Rosaceae	*Prunus avium* (L.) L.	Sweet cherry	Barel (1973), CABI (2010), Janssen (1958), Meijerman and Ulenberg (2000), Whittle (1985)
Rosaceae	*Prunus cerasus* L.	Sour cherry	Barel (1973), Janssen (1958), Meijerman and Ulenberg (2000), Whittle (1985)
Rosaceae	*Prunus domestica* L.	Plum	Barel (1973), CABI (2010), Janssen (1958), Meijerman and Ulenberg (2000), Whittle (1985)
Rosaceae	*Prunus domestica* L. *syriaca* (Borkh.) Janch. ex Mansf.	Yellow plum[2]	Barel (1973), Janssen (1958), Meijerman and Ulenberg (2000)
Rosaceae	*Prunus domestica* L. var. *insititia* (L.) Fiori & Paoletti	European plum	Barel (1973), Janssen (1958), Whittle (1985)
Rosaceae	*Prunus padus* L.	European bird cherry	Barel (1973), CABI (2010), Janssen (1958), Meijerman and Ulenberg (2000), Whittle (1985)
Rosaceae	*Prunus persica* (L.) Batsch	Peach	Barel (1973), CABI (2010), Charmillot and Brunner (1989), Hrudova (2003), Janssen (1958), Meijerman and Ulenberg (2000), Milonas and Savopoulou-Soultani (1999a), Milonas and Savopoulou-Soultani (2000), Milonas and Savopoulou-Soultani (2004), Savopoulou-Soultani et al. (1985), Whittle (1985)
Rosaceae	*Prunus salicina* Lindl.	Japanese plum	CABI (2010)
Rosaceae	*Prunus* spp.	Plum	De Jong et al. (1971), De Jong and Minks (1981), Hrudova (2003), Savopoulou-Soultani et al. (1985)

Table F-1 Reports of Summer Fruit Tortrix Moth on Various Host Plants[1]

Family	Latin Name	Common Name	References
Rosaceae	*Prunus triloba* Lindl.	Flowering plum, Flowering almond	Barel (1973), CABI (2010), Janssen (1958), Meijerman and Ulenberg (2000), Whittle (1985)
Rosaceae	*Pyrus communis* L.	Pear	Barel (1973), CABI (2010), Charmillot and Brunner (1989), Charmillot and Brunner (1990), Cross et al. (1999), De Jong (1980), De Jong et al. (1971), De Jong and Minks (1981), Janssen (1958), Meijerman and Ulenberg (2000), Milonas and Savopoulou-Soultani (2000), Savopoulou-Soultani et al. (1985), Whittle (1985)
Rosaceae	*Pyrus ussuriensis* var. *simoni* Maxim.	Apricot plum[2]	Meijerman and Ulenberg (2000)
Rosaceae	*Rosa canina* L.	Dog rose	Barel (1973), CABI (2010), Janssen (1958), Meijerman and Ulenberg (2000), Whittle (1985)
Rosaceae	*Rosa* spp.	Roses	Barel (1973), CABI (2010), De Jong et al. (1971), De Jong and Minks (1981), Janssen (1958), Meijerman and Ulenberg (2000), Savopoulou-Soultani et al. (1985)
Rosaceae	*Rubus fruticosus* L.	Blackberry, Shrubby blackberry[2]	Barel (1973), CABI (2010), Janssen (1958), Meijerman and Ulenberg (2000), Whittle (1985)
Rosaceae	*Rubus idaeus* L.	Red raspberry	Barel (1973), CABI (2010), De Jong et al. (1971), Janssen (1958), Meijerman and Ulenberg (2000), Whittle (1985)
Rosaceae	*Rubus* spp.	No data	Savopoulou-Soultani et al. (1985)
Salicaceae	*Salix caprea* L.	Pussy willow, Goat willow	CABI (2010), Meijerman and Ulenberg (2000), Whittle (1985)
Salicaceae	*Salix schwerinii* E. Wolf	Willow [2]	CABI (2010)
Salicaceae	*Salix* spp.	Willow	De Jong et al. (1971), Savopoulou-Soultani et al. (1985)

Table F-1 Reports of Summer Fruit Tortrix Moth on Various Host Plants[1]

Family	Latin Name	Common Name	References
Salicaceae	*Salix viminalis* L.	Basket willow, Buckbean	Barel (1973), CABI (2010), Janssen (1958), Meijerman and Ulenberg (2000), Whittle (1985)
Solanaceae	*Physalis peruviana* L.	Peruvian ground-cherry	Whittle (1985)
Solanaceae	*Solanum dulcamara* L.	Climbing night-shade	Janssen (1958), Meijerman and Ulenberg (2000), Whittle (1985)
Solanaceae	*Solanum* spp.	Nightshade	Savopoulou-Soultani et al. (1985)
Theaceae	*Camellia sinensis* (L.) Kuntze	Tea[3]	Whittle (1985)
Theaceae	*Camellia* spp.	Tea[3]	Barel (1973), De Jong et al. (1971)
Tiliaceae	*Tilia* spp.	Basswood	Barel (1973), CABI (2010), De Jong et al. (1971), Janssen (1958), Meijerman and Ulenberg (2000), Savopoulou-Soultani et al. (1985), Whittle (1985)
Ulmaceae	*Ulmus campestris* Linn.	English elm, Wych elm	Janssen (1958)
Ulmaceae	*Ulmus minor* (=*procera* (=*campestris*) Salisb	English elm	CABI (2010), Meijerman and Ulenberg (2000)
Ulmaceae	*Ulmus minor* Mill.	European field elm	CABI (2010)
Ulmaceae	*Ulmus* spp.	Elms	De Jong et al. (1971), Savopoulou-Soultani et al. (1985), Whittle (1985)
Urticaceae	*Urtica dioica* L.	Stinging nettle	De Jong et al. (1971)
Urticaceae	*Urtica* spp.	Nettle	Janssen (1958), Whittle (1985)
Vitaceae	*Vitis vinifera* L.	Grapevine	Savopoulou-Soultani et al. (1985)

1 The true host status of these reports has not been tested or verified.

2 Host not known to occur in the United States.

3 Tea may not be a host of summer fruit tortrix moth because of possible taxonomic misidentification. Tea was reported as a host associated with *Adoxophyes orana* "tea form" which was later named *A. honmai* (Yasuda (1998). However (according to Barel (1973) the “tea strain” is a synonym of *Adoxophyes orana*.

Appendix G

Threatened and Endangered Hosts

Use *Threatened and Endangered Hosts* to identify the threatened and endangered possible hosts for summer fruit tortrix moth if this insect if introduced into the United States.

Table G-1 Threatened Species That May be Hosts of Summer Fruit Tortrix Moth

Family	Species	Common Name	Range
Betulaceae	*Betula uber* (Ashe) Fernald	Virginia round-leaf birch	VA
Convolvulaceae	*Bonamia grandiflora* (A. Gray) Hallier f.	Florida bonamia	FL
Fabaceae	*Aeschynomene virginica* (L.) Britton, Sterns & Poggenb.	Sensitive joint-vetch	DE, MD, NC, NJ, PA, VA
Fabaceae	*Apios priceana* B.L. Rob.	Price's potato-bean	AL, IL, KY, MS, TN
Fabaceae	*Astragalaus magdalenae* Greene var. *peirsonii* (Munz & McBurney) Barneby	Peirson's milk-vetch	CA
Fabaceae	*Astragalus desereticus* Barneby	Deseret milk-vetch	UT
Fabaceae	*Astragalus lentiginosus* Douglas ex Hook var. *piscinensis* Barnaby	Fish Slough milk-vetch	CA
Fabaceae	*Astragalus montii* Barnaby	Heliotrope milk-vetch	UT
Fabaceae	*Astragalus phoenix* Barnaby	Ash Meadows milk-vetch	NV
Fabaceae	*Clitoria fragrans* Small	Pigeon wings	FL
Fabaceae	*Lespedeza leptostachya* Engelm	Prairie bush-clover	IA, IL, MN, WI
Fabaceae	*Lupinus oreganus* A. Heller var. *kincaidii* C.P. Sm.	Kincaid's lupine	OR, WA
Fabaceae	*Oxytropis campestris* (L.) DC. var. *chartacea* (Fassett) Barneby	Fassett's locoweed	WI
Fabaceae	*Stahlia monosperma* (Tul.) Urb.	Cóbana negra	PR, DR[1]
Fagaceae	*Quercus hinckleyi* C.H. Mull.	Hinckley's oak	TX
Malvaceae	*Sidalcea nelsoniana* Piper	Nelson's checker-mallow	OR, WA

Table G-1 Threatened Species That May be Hosts of Summer Fruit Tortrix Moth

Family	Species	Common Name	Range
Polygonaceae	*Chorizanthe pungens* Benth. var. *pungens*	Monterey Spineflower	CA
Polygonaceae	*Eriogonum gypsophilum* Woot. & Standl.	Gypsum wild-buckwheat	NM
Polygonaceae	*Eriogonum kennedyi* Porter ex S. Watson var. *austromonta-num* Munz & I.M. Johnst.	Southern mountain wild-buckwheat	CA
Polygonaceae	*Eriogonum longifolium* Nutt. var. *gnaphalifolium* Gandog.	Scrub buckwheat	FL
Rosaceae	*Ivesia kingii* S. Watson var. *eremica* (Coville) Ertter	Ash Meadows ivesia	NV
Rosaceae	*Spiraea virginiana* Britton	Virginia spiraea	GA, KY, NC, OH, PA, TN, VA, WV

1 Dominican Republic.

Table G-2 Endangered Species That May be Hosts of Summer Fruit Tortrix Moth

Family	Species	Common Name	Range
Anacardiaceae	*Rhus michauxii* Sarg.	Michaux's sumac	GA, NC, SC, VA
Chenopodiaceae	*Atriplex coronata* S. Watson var. *notatior* Jeps.	San Jacinto Valley crown-scale	CA
Chenopodiaceae	*Suaeda californica* S. Watson	Seablite, California	CA
Convolvulaceae	*Bonamia menziesii* A. Gray	None	HI
Convolvulaceae	*Calystegia stebbinsii* Brummitt	Stebbins' morning-glory	CA
Convolvulaceae	*Jacquemontia reclinata* House	Beach jacquemontia	FL
Fabaceae	*Amorpha crenulata* Walter var. *crenulata* (Rydb.) Isely	Crenulate lead-plant	FL
Fabaceae	*Astragalus albens* Greene	Cushenbury milk-vetch	CA
Fabaceae	*Astragalus ampullarioides* Sheldon	Shivwits milk-vetch	UT
Fabaceae	*Astragalus applegatei* M. Peck	Applegate's milk-vetch	OR
Fabaceae	*Astragalus bibullatus* Barneby & Bridges	Guthrie's (=Pyne's) ground-plum	TN
Fabaceae	*Astragalus brauntonii* Parish	Braunton's milk-vetch	CA
Fabaceae	*Astragalus clarianus* Jeps.	Clara Hunt's milk-vetch	CA
Fabaceae	*Astragalus cremnophylax* Bar-neby var. *cremnophylax*	Sentry milk-vetch	AZ

Table G-2 Endangered Species That May be Hosts of Summer Fruit Tortrix Moth

Family	Species	Common Name	Range
Fabaceae	*Astragalus holmgreniorum* Barneby	Holmgren milk-vetch	UT, AZ
Fabaceae	*Astragalus humillimus* A. Gray	Mancos milk-vetch	CO, NM
Fabaceae	*Astragalus jaegerianus* Munz	Lane Mountain milk-vetch	CA
Fabaceae	*Astragalus lentiginosus* Douglas ex Hook. var. *coachellae* Barneby ex Shreve & Wiggins	Coachella Valley milk-vetch	CA
Fabaceae	*Astragalus osterhoutii* M.E. Jones	Osterhout milk-vetch	CO
Fabaceae	*Astragalus pycnostachyus* A. Gray var. *lanosissimus* (Rydb.) Munz & McBurney	Ventura Marsh milk-vetch	CA
Fabaceae	*Astragalus robbinsii* (Oakes) A. Gray var. *jesupii* Eggl. & Sheldon	Jesup's milk-vetch	NH, VT
Fabaceae	*Astragalus tener* A. Gray var. *titi* (Eastw.) Barneby	Coastal dunes milk-vetch	CA
Fabaceae	*Astragalus tricarinatus* A. Gray	Triple-ribbed milk-vetch	CA
Fabaceae	*Baptisia arachnifera* Duncan	Hairy rattleweed	GA
Fabaceae	*Caesalpinia kavaiense* Mann	Uhiuhi	HI
Fabaceae	*Canavalia molokaiensis* O. Deg., I. Deg. & Sauer	Awikiwiki	HI
Fabaceae	*Canavalia napaliensis* H. St. John	Awikiwiki	HI
Fabaceae	*Chamaecrista glandulosa* (L.) Greene var. *mirabilis* (Pollard) Irwin & Barneby	None	PR
Fabaceae	*Crotalaria avonensis* DeLaney & Wunderlin	Avon Park harebells	FL
Fabaceae	*Dalea foliosa* (A. Gray) Barneby	Leafy prairie-clover	AL, IL, TN
Fabaceae	*Galactia smallii* H.J. Rogers ex Herndon	Small's milkpea	FL
Fabaceae	*Hoffmannseggia tenella* Tharp & L.O. Williams	Slender rush-pea	TX
Fabaceae	*Kanaloa kahoolawensis* D.H. Lorence & K.R. Wood	Kohe malama malama o kanaloa	HI
Fabaceae	*Lotus dendroideus* (Greene) Greene var. *traskiae* (Eastw. ex Noddin) Isely	San Clemente Island broom	CA
Fabaceae	*Lupinus nipomensis* Eastw.	Nipomo Mesa lupine	CA
Fabaceae	*Lupinus tidestromii* Greene	Clover lupine	CA

Table G-2 Endangered Species That May be Hosts of Summer Fruit Tortrix Moth

Family	Species	Common Name	Range
Fabaceae	*Lupinus westianus* Small var. *aridorum* (McFarlin ex Beckner) Isely	Scrub lupine	FL
Fabaceae	*Serianthes nelsonii* Merr.	Hayun lagu (Guam), Tronkon guafi (Rota)	WPO[1]-GU, MP-Rota
Fabaceae	*Sesbania tomentosa* Hook. & Arn.	Ohai	HI
Fabaceae	*Trifolium amoenum* Greene	Showy Indian clover	CA
Fabaceae	*Trifolium stoloniferum* Muhl. ex Eaton	Running buffalo clover	AR, IL, IN, KS, KY, MO, OH, WV
Fabaceae	*Trifolium trichocalyx* A. Heller	Monterey clover	CA
Fabaceae	*Vicia menziesii* Spreng.	Hawaiian vetch	HI
Fabaceae	*Vigna o-wahuensis* Vogel	None	HI
Fagaceae	*Quercus hinckleyi* C.H. Mull.	Hinckley's oak	TX
Malvaceae	*Abutilon eremitopetalum* Caum	None	HI
Malvaceae	*Abutilon menziesii* Seem.	Koʻoloaʻula	HI
Malvaceae	*Abutilon sandwicense* (O. Deg.) Christoph	None	HI
Malvaceae	*Callirhoe scabriuscula* B.L. Rob.	Texas poppy-mallow	TX
Malvaceae	*Eremalche parryi* (Greene) Greene ssp. *kernensis* (C.B. Wolf) D.M. Bates	Kern mallow	CA
Malvaceae	*Hibiscadelphus distans* Bishop & D.R. Herbst	Kauai hau kuahiwi	HI
Malvaceae	*Hibiscadelphus giffardianus* Rock	Hau kuahiwi	HI
Malvaceae	*Hibiscadelphus hualalaiensis* Rock	Hau kuahiwi	HI
Malvaceae	*Hibiscadelphus woodii* D.H. Lorence & W.L. Wagner	Hau kuahiwi	HI
Malvaceae	*Hibiscus arnottianus* A. Gray ssp. *immaculatus* (Roe) D.M. Bates	Kokio keokeo	HI
Malvaceae	*Hibiscus brackenridgei* A. Gray	Mao hau hele	HI
Malvaceae	*Hibiscus clayi* O. Deg. & I. Deg.	Clay's hibiscus	HI
Malvaceae	*Hibiscus waimeae* A. Heller ssp. *hannerae* (O. Deg. & I. Deg.) D.M. Bates	Kokio keokeo	HI
Malvaceae	*Iliamna corei* Sherff	Peter's Mountain mallow	VA

Table G-2 Endangered Species That May be Hosts of Summer Fruit Tortrix Moth

Family	Species	Common Name	Range
Malvaceae	*Kokia cookie* O. Deg.	Cooke's kokiʻo	HI
Malvaceae	*Kokia drynarioides* (Seem.) Lewt.	Kokiʻo	HI
Malvaceae	*Kokia kauaiensis* (Rock) O. Deg. & Duvel	Kokiʻo	HI
Malvaceae	*Malacothamnus clementinus* (Munz & I.M. Johnst.) Kearney	San Clemente Island bush-mallow	CA
Malvaceae	*Malacothamnus fasciculatus* (Nutt. ex Torr. & A. Gray) Greene var. *nesioticus*	Santa Cruz Island bush-mallow	CA
Malvaceae	*Sidalcea keckii* Wiggins	Keck's checkermallow	CA
Malvaceae	*Sidalcea oregana* (Nutt. ex Torr. & A. Gray) A. Gray ssp. *oregana* var. *calva* C.L. Hitchc.	Wenatchee Mountains checker-mallow	WA
Malvaceae	*Sidalcea oregana* (Nutt. ex Torr. & A. Gray) A. Gray ssp. *valida* (Greene) C.L. Hitchc.	Kenwood Marsh checker-mallow	CA
Malvaceae	*Sidalcea pedata* A. Gray	Pedate checker-mallow	CA
Polygalaceae	*Polygala lewtonii* Small	Lewton's polygala	FL
Polygalaceae	*Polygala smallii* R.R. Sm. & Ward	Tiny polygala	FL
Polygonaceae	*Chorizanthe howellii* Goodman	Howell's spineflower	CA
Polygonaceae	*Chorizanthe orcuttiana* Parry	Orcutt's spineflower	CA
Polygonaceae	*Chorizanthe pungens* Benth. var. *hartwegiana* Reveal & Hardham	Ben Lomond spineflower	CA
Polygonaceae	*Chorizanthe robusta* Parry var. *hartwegii* (Benth.) Reveal & R. Morgan	Scotts Valley spineflower	CA
Polygonaceae	*Chorizanthe robusta* Parry var. *robusta*	Robust Spineflower	CA
Polygonaceae	*Chorizanthe valida* S. Watson	Sonoma spineflower	CA
Polygonaceae	*Dodecahema leptoceras* (A. Gray ex Benth.) Reveal & Hardham	Slender-horned spine-flower	CA
Polygonaceae	*Eriogonum apricum* J.T. How-ell var. *prostratum* Myatt	Ione (incl. Irish Hill) buck-wheat	CA
Polygonaceae	*Eriogonum ovalifolium* Nutt. var. *vineum* (Small) Jeps	Cushenbury buckwheat	CA
Polygonaceae	*Eriogonum ovalifolium* Nutt. var. *williamsiae* Reveal	Steamboat buckwheat	NV

Table G-2 Endangered Species That May be Hosts of Summer Fruit Tortrix Moth

Family	Species	Common Name	Range
Polygonaceae	*Eriogonum pelinophilum* Reveal	Clay-loving wild-buck-wheat	CO
Polygonaceae	*Oxytheca parishii* Parry var. *goodmaniana* Ertter	Cushenbury oxytheca	CA
Polygonaceae	*Polygonella basiramia* (Small) G.L. Nesom & V.M. Bates	Wireweed	FL
Polygonaceae	*Polygonella myriophylla* (Small) Horton	Sandlace	FL
Polygonaceae	*Polygonum hickmanii* H. Hinds & R. Morgan	Scotts Valley polygonum	CA
Rosaceae	*Acaena exigua* A. Gray	Liliwai	HI
Rosaceae	*Cercocarpus traskiae* Eastw.	Catalina Island mountain-mahogany	CA
Rosaceae	*Geum radiatum* Michx.	Spreading avens	NC, TN
Rosaceae	*Potentilla hickmanii* Eastw.	Hickman's potentilla	CA
Rosaceae	*Prunus geniculata* Harper	Scrub plum	FL
Rosaceae	*Purshia subintegra* (Kearney) Henrickson	Arizona cliffrose	AZ
Solanaceae	*Goetzea elegans* Wydler	Beautiful goetzea or matabuey	PR
Solanaceae	*Nothocestrum breviflorum* A. Gray	Aiea	HI
Solanaceae	*Nothocestrum peltatum* Skottsb.	Aiea	HI
Solanaceae	*Solanum drymophilum* O.E. Schulz	Erubia	PR
Solanaceae	*Solanum incompletum* Dunal	Popolo ku mai	HI
Solanaceae	*Solanum sandwicense* Hook. & Arn	Aiakeakua, popolo	HI
Urticaceae	*Neraudia angulata* Cowan	None	HI
Urticaceae	*Neraudia ovate* Gaudich	None	HI
Urticaceae	*Neraudia sericea* Gaudich	None	HI
Urticaceae	*Urera kaalae* Wawra	Opuhe	HI

1 Western Pacific Ocean.

Appendix H

Screening Aids

Use *Appendix H Screening Aids* to screen or identify the summer fruit tortrix moth.

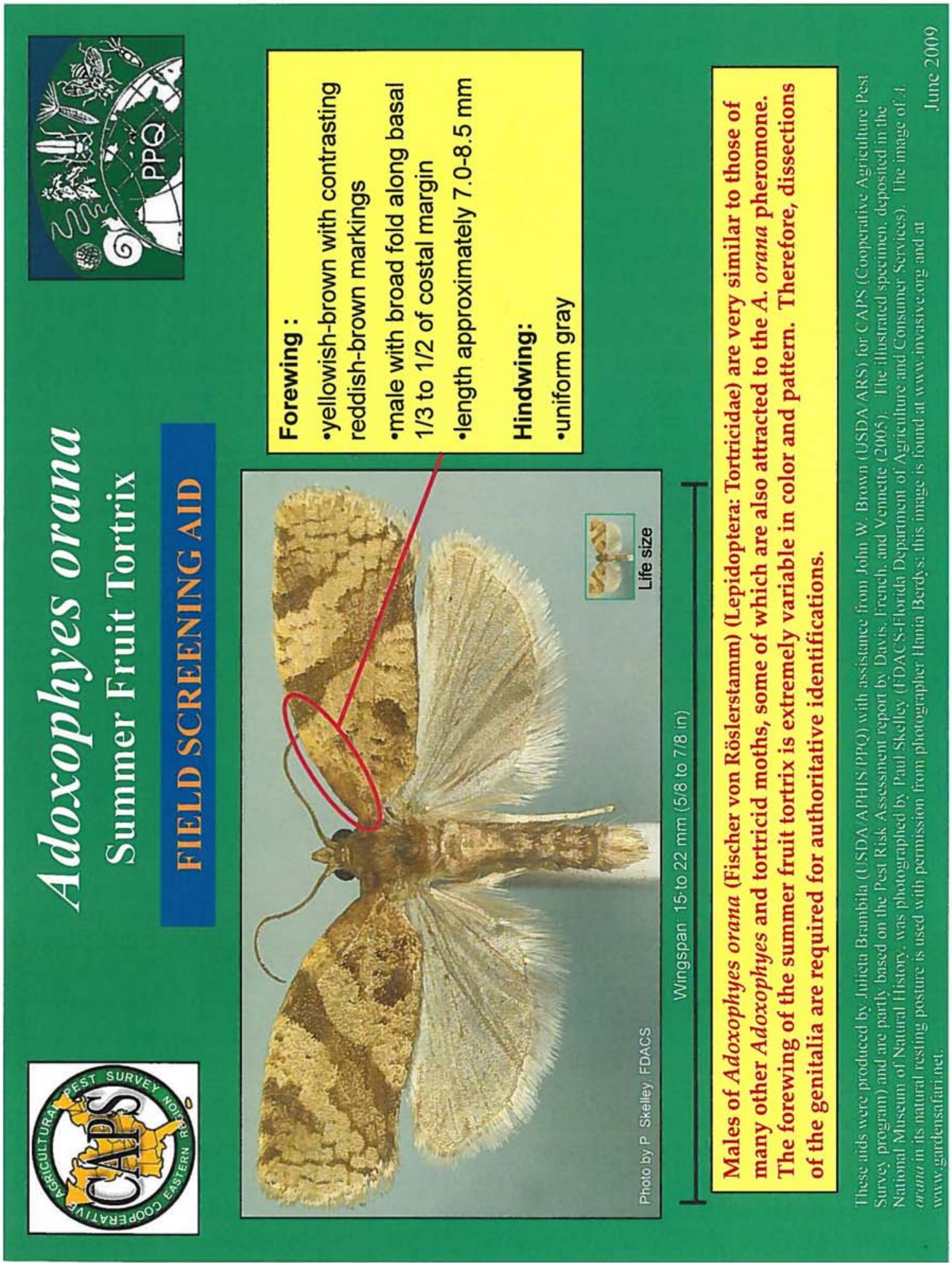

Figure H-1 Field Screening Aid for Summer Fruit Tortrix Moth

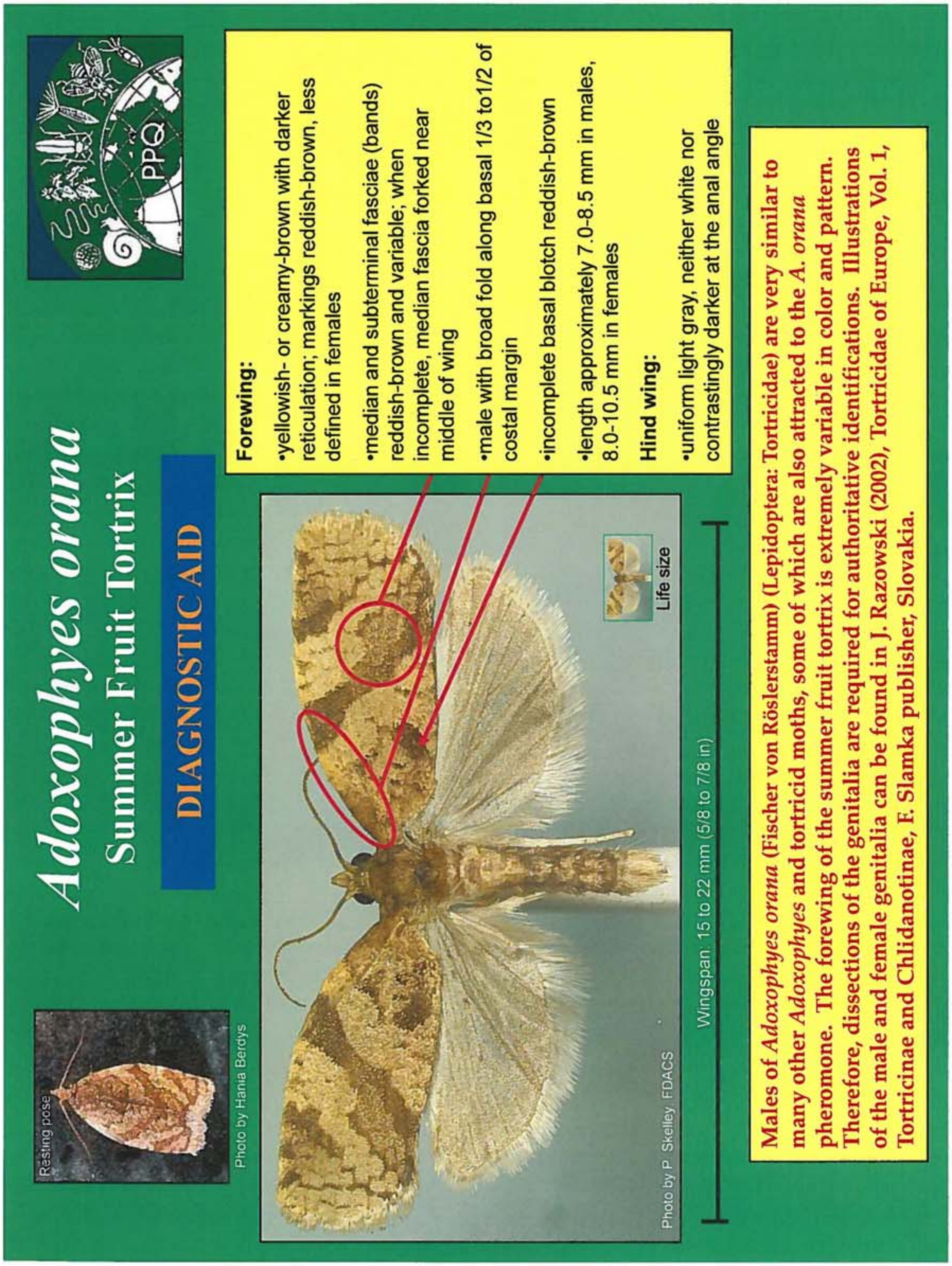

Figure H-2 Diagnostic Aid for Summer Fruit Tortrix Moth

Appendix

I

Taxonomy and Morphology

Refer to the following Web site for images of tortricids found throughout North America.

http://mothphotographersgroup.msstate.edu/

Refer to the following Web site for protocols for molecular identifications of tortricids.

http://www.tortricid.net

The genus *Adoxophyes* was originally described by Meyrick (1882). Yasuda (1998) reexamined the genus and described adults differences among species based on the morphology of the genitalia. In the review of the genus, Yasuda (1998) included species and subspecies that occur in Japan: *A. orana*, *A. orana orana*, *A. orana fasciata*, *A honmai*, and *A. dubia*. Taxonomy of the immature stages of *Adoxophyes* was originally studied by Honma (1970; 1972) and recently revised by Sakamaki and Hayakawa (2004).

Various life stages of *A. orana* have been described by Yasuda (1998), Dickler (1991), and others (CABI, 2010; Whittle, 1985). Sakamaki and Hayakawa (2004) describe larval and pupal characters of *A. orana fasciata*, *A. honmai*, and *A. dubia*.

The species *A. fasciata* is technically a subspecies of *A. orana*.

> The subspecies has so far been generally known from continental Europe (Yasuda, 1998).

Adoxophyes fasciata is considered a synonym of *A. orana*. *Adoxophyes orana fasciata* Walsingham has the following synonyms:

Adoxophyes fasciata Walsingham, 1900

Adoxophyes orana fasciata

Adoxophyes orana

> FL. Male 10.0-11.0 mm, Female 11.0-13.0 mm. The forewing of the female is rather dull grayish brown, while in the male the coloration is brighter and is a yellowish brown. The male has a fold that extends about ½ of the length of the costa, and the fold is lined with whitish small glandular scales" (Yasuda, 1998).

♂15-19 mm, ♀18-22 mm. Sexual dimorphism pronounced; antenna of male shortly ciliate, forewing with broad costal fold from base to about one-third, markings usually conspicuous, contrasting with paler ground colour; female usually larger, antenna minutely ciliate, forewing without costal fold, with darker general coloration and less contrasting markings" (Bradley et al., 1973).

S. Passoa (1990) from unpublished USDA
Quarterly Report, Reynoldsburg, Ohio. 1 page

EXOTIC PHEROMONE TRAPPING RESULTS FOR REYNOLDSBURG LABORATORY

In the following summary, the number of trap bottoms for each state is given in parenthesis and the abundance of each species is based on the trap catches.

Results for summer fruit tortrix moth, Adoxophyes orana. Traps collected in 1988.

States surveyed: Ohio
Number of trap bottoms: 10
Number of target specimens found: 0
Non-target species identified:
Adoxophyes furcatana (a tortricid moth) - frequently present
Parargyractis bifascialis (an aquatic pyralid) - rare
Munroe (1972) recorded this species from Nova Scotia to Ontario and south to West Virginia and Texas. The Ohio record is unreported, but within the expected distribution of the species.

A. orana can be readily confused with our native Adoxophyes spp. The following key will separate them.

1. Uncus spatulate and "transtillar lobes" armed with stout setae (Adoxophes spp.).....................................2
1'. Uncus not spatulate, transtilla variable..a non-target species

2. Cornuti absent............................Adoxophyes heteroidana
2'. Cornuti present...3

3. Uncus almost as long as broad............Adoxophyes furcatana
3'. Uncus approximately 3 times longer than broad...Adoxophyes orana

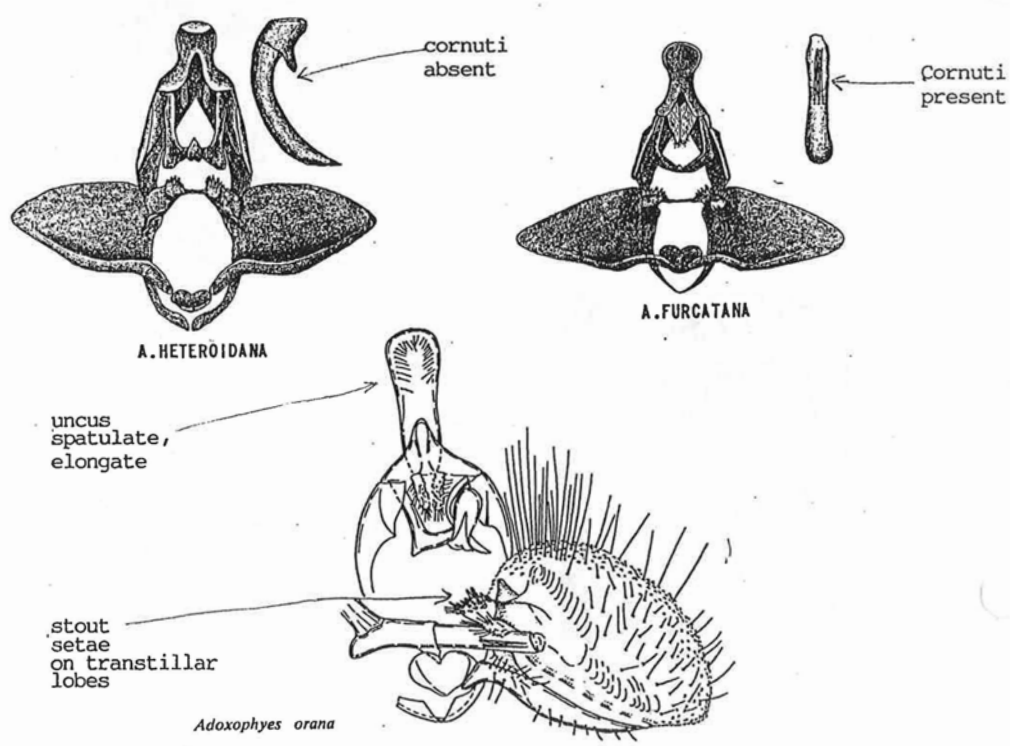

Figure I-1 Key (Passoa 1990)

Appendix J

Tortricidae Molecular Protocols

Contents

Summer Fruit Tortrix Moth

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