Canadian Food Inspection Agency
Agence canadienne d'inspection des aliments

Pest categorization

Argyrotaenia franciscana Borden

Orange tortrix

Canada

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Background

The purpose of this categorization is to determine whether *Argyrotaenia franciscana* (orange tortrix) has the potential to satisfy the criteria in the definition for a quarantine pest. The method used by the CFIA to initiate and conduct this categorization is consistent with international guidelines set by the International Plant Protection Convention (IPPC). Definitions follow those listed in the IPPC's *Glossary of phytosanitary terms*.

Initiation point: This categorization was identified via a Commodity Risk Assessment on blueberry plants from Canada to the UK for the Jens-Georg Unger Plant Health Fellowship project, funded by the European and Mediterranean Plant Protection Organisation (EPPO). This project was led by a visiting scientist from the UK Department for the Environment, Food and Rural Affairs, utilising the tools and templates of the Canadian Food Inspection Agency and coordinating with experienced Canadian risk assessors.

Identification of the PRA area: The PRA area is all of the UK.

Current regulatory status: *Argyrotaenia franciscana* is not currently regulated as a pest in the UK. However, it is regulated as a quarantine pest in Chile, Argentina, Mexico, Morocco, New Zealand, and Western Australia (AGRIC 2022; EPPO 2022; MPI 2022). The entire *Argyrotaenia* genus is regulated by the United States (APHIS-USDA 2022).

Identity of organism

Name: *Argyrotaenia franciscana* Borden (Lepidoptera: Tortricidae)

Synonyms: *Argyrotaenia citrana* (Fernald), *Argyrotaenia purata* Freeman, *Cacoecia franciscana* Penny, *Eulia citrana* Essig, *Eulia franciscana* Frost, *Tortrix citrana* Fernald, *Lozotaenia franciscana* Walsingham

English common names: Orange tortrix, apple skinworm

French common names: Tordeuse des citrus

1. **Is the organism clearly a single taxonomic entity and can it be adequately distinguished from other entities of the same rank?**

Yes	**Go to 2**
If no	Go to 11

Argyrotaenia franciscana adults are distinguished from other species in the *Argyrotaenia* genus by possessing a triangular second joint on the appendage in the mouth region used for touching or tasting (known as a palpal appendage) (Freeman 1944). *Argyrotaenia franciscana* is a member of the Archipini tribe. Its larvae are difficult to distinguish from many species of this tribe, as they all possess the common features of a brown, unmarked head and prothoracic shield (a plate on the upper surface of the first thorax segment) (Gilligan and Epstein 2014).

In the past, *A. franciscana* and *Argyrotaenia citrana* were thought to be separate species, however with the use of molecular data it was established that they form a single species (Landry *et al.* 1999).

Presence in the PRA area

2. Does the organism occur in the PRA area?

If yes	Go to 3
No	**Go to 5**

3. Is the organism widely distributed in the PRA area?

If yes	Go to 11
If no	Go to 4

Regulatory status

4. Is the organism under official control in the PRA area or is it a potential candidate for official control?

If yes	Go to 5
If no	Go to 11

Potential for establishment and spread in the PRA area

5. Does the PRA area have climatic conditions suitable for establishment and spread of the organism?

Yes	**Go to 6**
If no	Go to 11

6. Does the PRA area have ecological conditions suitable for establishment and spread of the organism?

Yes	**Go to 7**
If no	Go to 11

Argyrotaenia franciscana was first reported in California, United States (U.S.), in the late 1800s, before being reported in Oregon and Washington in the U.S., as well as eastern Canada and Mexico, in subsequent decades (Belton 1988; Brown 2004; Coquillett 1894; Gilligan *et al.* 2020). It is possible that this pest spread naturally, though adult females do not appear to fly distances of 400m or more. They can fly at least 100m to nearby fields (Knight 1986). Larvae can also move between fields by being dispersed on windblown silk threads (OregonBlueberry No date; PNW 2022). However, rare reports have been made of *A. franciscana* further east of its known distribution (GBIF 2022; Heppner 2004; Lotts and Naberhaus 2021; MontanaGov 2022), such as in Montana (see Figure 1). It has been suggested that these outlying reports are a result of host plants and plant products moving long distances for trade (Heppner 2004). No reports of hitchhiking have occurred.

There has been some discussion in the past whether *Argyrotaenia franciscana* was an invasive species from Europe or some Pacific Islands (Belton 1988; Coquillett 1894), however the current evidence suggests that this species is native to the U.S. at least (Basinger 1938; Gilligan *et al.* 2020; Powell 1964). Unconfirmed reports of this species have also been made from the United Kingdom (UK) (iNaturalist 2022).

In its confirmed distribution (see Figure 1), *Argyrotaenia franciscana* is found primarily in cooler coastal areas and river valleys (Gilligan and Epstein 2014). This can be attributed to their preference for mild

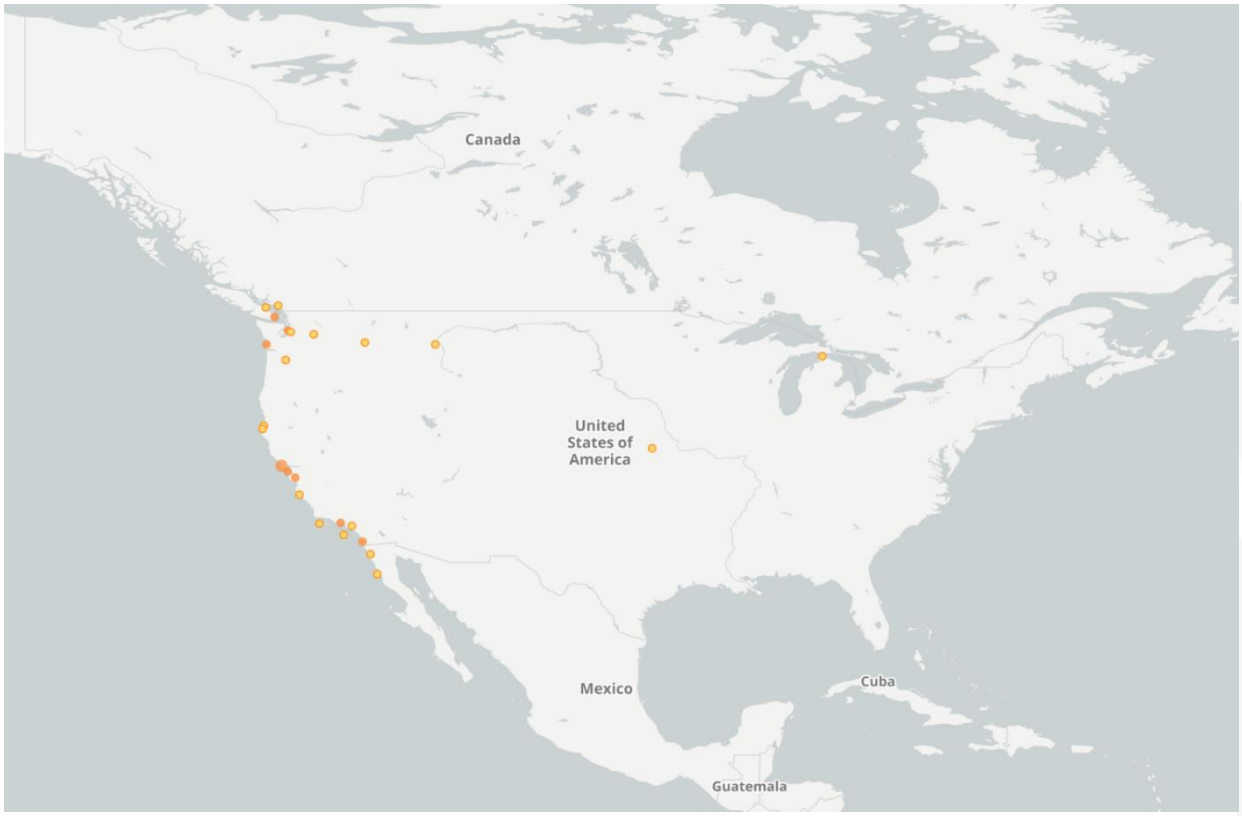

Figure 1: Distribution of *Argyrotaenia franciscana* (GBIF 2022)

temperatures and low humidity. Laboratory studies have shown that *A. franciscana* requires temperatures of 6-32°C to complete development, with an optimum temperature of 25.6°C (Basinger 1938; Kido *et al.* 1981). In addition, a lower relative humidity was shown to delay development (Basinger 1938). Populations of *A. franciscana* larvae are also strongly influenced by winter conditions, experiencing high mortality in subfreezing temperatures, although cold tolerance is influenced by the precise larval stage (Knight and Croft 1986). Given that the environmental conditions of the UK are usually mild, with an average temperature between 5-13°C (MetOffice 2022), it is likely that the establishment and spread of this pest could occur in the UK.

Argyrotaenia franciscana is one of the most polyphagic species of North American Lepidoptera, and found on hosts in both urban and agricultural areas (Powell 1964). The host plants of this insect have been reported as follows (Basinger 1938; Gilligan and Epstein 2014):

Table 1: Host range of *Argryotaenia franciscana*

Family	**Genus/species**	**Common name**
Anacardiaceae	*Schinus molle* L.	Peruvian peppertree
Apocynaceae	*Nerium oleander* L.	nerium
Aquifoliaceae	*Ilex opaca* Aiton	American holly
Araliaceae	*Aralia* sp.	Spikenard
Araliaceae	*Hedera helix* L.	English ivy
Asteraceae	*Achillea millefolium* L.	common yarrow
Asteraceae	*Artemisia californica* Less.	coastal sagebrush
Asteraceae	*Artemisia douglasiana* Besser	Douglas' sagewort
Asteraceae	*Baccharis pilularis* DC.	coyotebrush
Asteraceae	*Baccharis* L.	baccharis
Asteraceae	*Cineraria* sp.	
Asteraceae	*Cirsium occidentale* (Nutt.) Jeps.	cobwebby thistle
Asteraceae	*Coreopsis gigantea* (Kellogg) H. M. Hall	giant coreopsis
Asteraceae	*Coreopsis* L.	tickseed
Asteraceae	*Corethrogyne* DC.	sandaster
Asteraceae	*Encelia californica* Nutt.	California brittlebush
Asteraceae	*Erigeron glaucus* Ker Gawl.	seaside fleabane
Asteraceae	*Eriophyllum staechadifolium* Lag.	
Asteraceae	*Gnaphalium* L.	cudweed
Asteraceae	*Grindelia camporum* Greene	Great Valley gumweed
Asteraceae	*Grindelia hirsutula* Hook. & Arn.	hairy gumweed
Asteraceae	*Grindelia* Willd.	gumweed
Asteraceae	*Isocoma veneta* (Kunth) Greene	goldenbush
Asteraceae	*Lactuca sativa* L.	lettuce
Asteraceae	*Lessingia* Cham.	lessingia
Asteraceae	*Leucanthemum maximum*	Max chrysanthemum
Asteraceae	*Pericallis hybrida* B. Nord.	common ragwort
Asteraceae	*Pseudognaphalium biolettii* Anderb.	two-color rabbit-tobacco
Asteraceae	*Pseudognaphalium californicum* (DC.) Anderb.	ladies' tobacco

Asteraceae	*Senecio jacobaea* L.	stinking willie
Asteraceae	*Solidago simplex* Kunth	Mt. Albert goldenrod
Asteraceae	*Solidago* L.	goldenrod
Begoniaceae	*Begonia* L.	begonia
Berberidaceae	*Mahonia pinnata* (Lag.) Fedde	wavyleaf barberry
Berberidaceae	*Mahonia* Nutt.	barberry
Buddlejaceae	*Buddleja* L.	butterflybush
Brassicaceae	*Brassica* sp.	Cruciferous vegetables
Caprifoliaceae	*Lonicera involucrata* (Richardson) Banks ex Spreng.	twinberry honeysuckle
Caprifoliaceae	*Sambucus nigra* L. ssp. *cerulea* (Raf.) R. Bolli	blue elderberry
Caprifoliaceae	*Symphoricarpos albus* (L.) S. F. Blake	common snowberry
Caryophyllaceae	*Dianthus caryophyllus* L.	carnation
Caryopyllaceae	*Spergularia macrotheca* (Hornem.) Heynh.	sticky sandspurry
Celastraceae	*Euonymus* sp.	spindle tree
Chenopodiaceae	*Chenopodium* L.	goosefoot
Commelinaceae	*Tradescantia fluminensis*	river spiderwort
Commelinaceae	*Tradescantia zebrina* hort. ex Bosse	inchplant
Convolvulaceae	*Calystegia macrostegia* (Greene) Brummitt	island false bindweed
Convolvulaceae	*Convolvulus* L.	bindweed
Crassulaceae	*Dudleya farinosa* (Lindl.) Britt. & Rose	powdery liveforever
Crassulaceae	*Sedum spathulifolium* Hook.	broadleaf stonecrop
Cupressaceae	*Chamaecyparis lawsoniana* (A. Murray) Parl.	Port Orford cedar
Cupressaceae	*Cupressus macrocarpa* Hartw. ex Gord.	Monterey cypress
Cupressaceae	*Sequoia sempervirens* (Lamb. ex D. Don) Endl.	redwood
Cupressaceae	*Thuja plicata* Donn ex D. Don	western redcedar
Dennstaedtiaceae	*Pteridium aquilinum* (L.) Kuhn	western brackenfern
Dryopteridaceae	*Dryopteris arguta* (Kaulf.) Watt	coastal woodfern
Ericaceae	*Arbutus menziesii* Pursh	Pacific madrone
Ericaceae	*Arbutus* L.	madrone
Ericaceae	*Arctostaphylos imbricata* Eastw.	San Bruno Mountain manzanita
Ericaceae	*Vaccinium sp.*	blueberry
Ericaceae	*Vaccinium ovatum* Pursh	California huckleberry
Fabaceae	*Acacia* Mill.	acacia
Fabaceae	*Astragalus miguelensis* Greene	San Miguel milkvetch
Fabaceae	*Cytisus scoparius* (L.) Link	Scotch broom
Fabaceae	*Lotus scoparius* (Nutt.) Ottley	common deerweed
Fabaceae	*Lotus* L.	trefoil
Fabaceae	*Lupinus arboreus* Sims	yellow bush lupine
Fabaceae	*Lupinus chamissonis* Eschsch.	Chamisso bush lupine
Fabaceae	*Lupinus* L.	lupine
Fagaceae	*Quercus agrifolia* Nee	California live oak
Fagaceae	*Quercus douglasii* Hook. & Arn.	blue oak
Fagaceae	*Quercus dumosa* Nutt.	coastal sage scrub oak
Fagaceae	*Quercus* L.	oak

Geraniaceae	*Erodium* L'Her. ex Aiton	stork's bill
Geraniaceae	*Geranium* L.	cranebills
Geraniaceae	*Pelargonium* L'Her. ex Aiton	geranium
Grossulariaceae	*Ribes amarum* McClatchie	bitter gooseberry
Grossulariaceae	*Ribes malvaceum* Sm.	chaparral currant
Grossulariaceae	*Ribes menziesii* Pursh	canyon gooseberry
Grossulariaceae	*Ribes sanguineum* Pursh	redflower currant
Grossulariaceae	*Ribes* L.	currant
Hippocastanaceae	*Aesculus californica* (Spach) Nutt.	California buckeye
Hydrophyllaceae	*Eriodictyon californicum* (Hook. & Arn.) Torr.	California yerba santa
Hydrophyllaceae	*Phacelia malvifolia* Cham.	stinging phacelia
Juglandaceae	*Juglans regia* L.	English walnut
Juglandaceae	*Juglans* L.	walnut
Lamiaceae	*Lavandula angustifolia* Mill.	English lavender
Lamiaceae	*Monardella villosa* Benth.	coyote mint
Lamiaceae	*Monardella* Benth.	monardella
Lamiaceae	*Stachys bullata* Benth.	California hedgenettle
Lamiaceae	*Stachys* L.	hedgenettle
Lauraceae	*Persea americana* Mill.	avocado
Lauraceae	*Umbellularia californica* (Hook. & Arn.) Nutt.	California laurel
Liliaceae	*Asparagus* L.	asparagus
Liliaceae	*Calochortus catalinae* S. Watson	Santa Catalina mariposa lily
Liliaceae	*Calochortus* Pursh	mariposa lily
Malvaceae	*Malva* sp.	mallow
Malvaceae	*Sphaeralcea ambigua* A. Gray	desert globemallow
Myricaceae	*Morella californica* (Cham.) Wilbur	California wax myrtle
Myrtaceae	*Eucalyptus* L'Her.	gum
Onagraceae	*Epilobium canum* (Greene) P.H. Raven ssp. Canum	hummingbird trumpet
Onagraceae	*Epilobium* L.	willowherb
Onagraceae	*Oenothera* L.	evening primrose
Pinaceae	*Abies* Mill.	fir
Pinaceae	*Cedrus deodara* (Roxb.) G. Don f.	Deodar cedar
Pinaceae	*Picea* A. Dietr.	spruce
Pinaceae	*Picea pungens* Engelm.	blue spruce
Pinaceae	*Pinus radiata* D. Don	Monterey pine
Pinaceae	*Pinus* L.	pine
Pinaceae	*Pseudotsuga menziesii* (Mirb.) Franco	Douglas-fir
Pinaceae	*Pseudostuga* Carriere	Douglas-fir
Pinaceae	*Tsuga canadensis* (L.) Carriere	eastern hemlock
Pinaceae	*Tsuga Carriere*	hemlock
Pittosporaceae	*Pittosporum eugenioides*	lemonwood
Poaceae	*Coix lacryma-jobi* L.	Job's tears
Polygonaceae	*Eriogonum latifolium* Sm.	seaside buckwheat
Polygonaceae	*Eriogonum parvifolium* Sm.	seacliff buckwheat
Proteaceae	*Macadamia* F. Muell.	macadamia
Ranunculaceae	*Aquilegia* L.	columbine
Rhamnaceae	*Ceanothus arboreus* Greene	feltleaf ceanothus
Rhamnaceae	*Ceanothus oliganthus* Nutt.	hairy ceanothus

Rhamnaceae	*Ceanothus sorediatus* Hook. & Arn.	jimbrush
Rhamnaceae	*Ceanothus thyrsiflorus* Eschsch.	blueblossom
Rhamnaceae	*Ceanothus* L.	ceanothus
Rhamnaceae	*Frangula californica* (Eschsch.) A. Gray	California buckthorn
Rosaceae	*Adenostoma* Hook. & Arn.	chamise
Rosaceae	*Crataegus* L.	hawthorn
Rosaceae	*Eriobotrya japonica* (Thunb.) Lindl.	loquat
Rosaceae	*Fragaria* sp.	strawberry
Rosaceae	*Heteromeles arbutifolia* (Lindl.) M. Roem.	toyon
Rosaceae	*Heteromeles arbutifolia* (Lindl.) M. Roem. var. *arbutifolia*	toyon
Rosaceae	*Horkelia californica* Cham. & Schltdl.	California horkelia
Rosaceae	*Lyonothamnus floribundus* A. Gray ssp. *aspleniifolius* (Greene) P. H. Raven	fern-leaf Catalina ironwood
Rosaceae	*Malus pumila* Mill.	paradise apple
Rosaceae	*Malus sylvestris* (L.) Mill.	European crab apple
Rosaceae	*Malus* Mill.	apple
Rosaceae	*Potentilla* L.	cinquefoil
Rosaceae	*Prunus armeniaca* L.	apricot
Rosaceae	*Prunus avium* (L.) L.	sweet cherry
Rosaceae	*Prunus domestica* L.	European plum
Rosaceae	*Prunus dulcis* (Mill.) D. A. Webb	sweet almond
Rosaceae	*Prunus persica* (L.) Batsch	peach
Rosaceae	*Prunus* L.	
Rosaceae	*Pyracantha* M. Roem.	firethorn
Rosaceae	*Pyrus* L.	pear
Rosaceae	*Rosa* L.	rose
Rosaceae	*Rubus idaeus* L.	raspberry
Rosaceae	*Rubus parviflorus* Nutt.	thimbleberry
Rosaceae	*Rubus ursinus* Cham. & Schltdl.	California blackberry
Rosaceae	*Rubus vitifolius* Cham. & Schltdl.	Pacific dewberry
Rosaceae	*Rubus* L.	caneberry
Rubiaceae	*Pentas* sp.	
Rutaceae	*Citrus* L.	citrus
Salicaceae	*Salix lasiolepis* Benth.	arroyo willow
Salicaceae	*Salix* L.	willow
Sapindaceae	*Filicium decipiens* Thwaites	
Scrophulariaceae	*Castilleja affinis* Hook. & Arn.	coast Indian paintbrush
Scrophulariaceae	*Castilleja exserta* (A. Heller) T.I. Chuang & Heckard ssp. *exserta*	exserted Indian paintbrush
Scrophulariaceae	*Castilleja* Mutis ex L. f.	Indian paintbrush
Scrophulariaceae	*Diplacus aurantiacus* (W. Curtis) Jeps. ssp. *aurantiacus*	orange bush monkeyflower
Scrophulariaceae	*Scrophularia californica* Cham. & Schltdl.	California figwort
Scrophulariaceae	*Scrophularia* L.	figwort
Scrophulariaceae	*Veronica* L.	speedwell
Solanaceae	*Solanum douglasii* Dunal	greenspot nightshade
Solanaceae	*Solanum pseudocapsicum* L.	Jerusalem cherry

Thymelaeaceae	*Dirca occidentalis* A. Gray	western leatherwood
Urticaceae	*Urtica* L.	nettle
Verbenaceae	*Lantana* L.	lantana
Vitaceae	*Vitis vinifera* L.	wine grape

A considerable number of hosts (apples, plums, cherries, strawberries, raspberries, blueberries, blackcurrants, brassica vegetables, lettuce, roses, geraniums, begonias) are grown commercially in the UK (Defra 2022). In addition, oak, willow, hawthorn, spruce, Douglas fir and pine are all principal trees in the woodlands of Great Britain (ForestResearch 2021). Finally, weed species such as bindweed and nettle grow wild in a wide range of habitats in the UK, including open scrub, rough or short grassland, gardens, roadsides, rubbish tips, railway banks, cultivated and waste ground (PlantAtlas 2022). Therefore, the presence of these hosts could enable the establishment and spread of the orange tortrix in the UK. It is also likely that, in the event of *Argryotaenia franciscana* reaching the UK, new hosts would be recorded, given its highly polyphagic nature.

Several natural enemies control the population of *Argyrotaenia franciscana* in its native range. Over 24 parasites attack *A. franciscana*, including *Apanteles aristoteliae*, *Diadegma* sp., *Enytus eureka*, *Exochus nigripalpis subobscurus, Meteorus argyrotaenia*, *Oncophanes americanus* and *Phytodietus vulgaris* (Basinger 1938; Coop 1982; Kido *et al.* 1981). Total parasitism of an *A. franciscana* population can vary from 16-66%. Given that the populations with higher parasitism levels were consistently smaller, these parasites appear to play a significant role in suppressing the numbers of this pest (Coop 1982; Kido *et al.* 1981). Notably, in one study, over 80% of the difference in total parasitism between high- and low-density populations was due to only three parasites: *Apanteles aristoteliae*, *M. argyrotaeniae*, and *O. americanus* (Coop 1982). Only *O. americanus* is present in Canada (GBIF 2022), so insecticides are necessary for the control of this pest (Belton 1988). None of these parasites are believed to be present in the UK (GBIF 2022).

Finally, predation of larvae by certain spiders, *Chrysopidae* spp. (green lacewing) and *Hemerobius pacificus* (brown lacewing) insects has been reported (Kido *et al.* 1971; PNW 2022; UCANR 2012; UCANR 2014). *Chrysopidae* spp. insects are present in the UK (GBIF 2022), however, predators appear less effective than parasites at suppressing tortricid populations (Walker and Welter 2004). Therefore, it is likely that this pest could establish and spread in the UK without much suppression from natural enemies.

Potential for economic and environmental consequences in the PRA area

7. Is the organism a known pest in its area of current distribution?

Yes	**Go to 9**
If no	Go to 8

8. Does the organism have intrinsic attributes that indicate that it could cause significant harm to plants?

If yes	Go to 9
If no	Go to 11

9. With specific reference to the plants or habitats which occur in the PRA area, could the organism by itself, or acting as a vector, cause significant damage or loss to plants leading to negative economic, environmental, societal or export market impacts?

Yes	**Go to 10**
If no	Go to 11

Larvae feed on developing buds, blossoms, stems and leaves of hosts, as well as fruits. This can cause leaf injury, girdling of the stems, as well as undesirable branching and loss of fruit quality and yield (Ebeling and Pence 1957; Gilligan and Epstein 2014; PNW 2022). Feeding also enables the entry of bacterial and fungal pathogens, such as *Botryis cinerea*, that causes fruit rot disease (Bettiga 2013; Lange 1936; PNW 2022). *Argyrotaenia franciscana* larvae can also contaminate the fruit during harvesting, by rolling up leaves together or to fruits for shelter while feeding (PNW 2022).

Few reports of damage by this pest to forestry species could be found. *Argyrotaenia franciscana* is an occasional feeder of conifer trees (Powell and De Benedictis 1995), and although reported to cause significant damage to coniferous trees, such as pine, only few trees are attacked overall (Lange 1936). The reasons for this are unknown. It could be due to the host preferences or the uncontrolled numbers of natural enemies in the wild. The latter theory seems more likely given that nearly all hosts of *A. franciscana* are alien plants or native plants growing in domesticated habitats (Powell 1964). This pest is also reported to be only a minor problem in cherries and pears (UCANR 2012; UCANR 2015).

Argyrotaenia franciscana has been listed as a species of economically important Lepidoptera (EPPO 2016; Zhang 1994). The economic impacts of this pest is primarily important on fruit (van der Geest

and Evenhuis 1991), causing damage to citrus (UCANR 2017), apricot and peach (Belton 1988), as well as described as a major pest of grapes (Kreiter 2018; UCANR 2014), raspberry, blackberry, and blueberry (Kido *et al.* 1981; Knight and Croft 1986). Growers have been known to lose their entire raspberry crop to this pest, after being rejected by processors, causing a loss of around $150,000 in one county alone in 1947 (Breakey and Batchelor 1948). This sum is equivalent to just over $2 million in today's prices (Webster 2022). Significant crop losses have also been reported in oranges (of up to 40%), avocados (damage up to 50%), and apples (each larva found on plant corresponds to roughly 1% of fruit damage) (Basinger 1938; Ebeling and Pence 1957; Gilligan and Epstein 2014; Walker and Welter 2001; Zalom and Pickel 1988). However, heavy pest infestations have been sporadic (Basinger 1938) and no social or environmental damage has been identified.

Apples, plums, cherries, strawberries, raspberries, blueberries, blackcurrants, brassica vegetables and lettuce are all commercially produced in the UK and are at risk from this pest. Particular hosts have significant economic value in the UK horticultural industry, for example, in 2021, the UK production of dessert and culinary apples was valued at £198 million, of strawberries valued at £352 million, and raspberries valued at £148 million. Roses, geraniums and begonias are also significant in the ornamental sector (Defra 2022).

Conclusion

10. This organism has the potential to satisfy the definition of a quarantine pest.

11. This organism does not fulfill all of the criteria for a quarantine pest.

Argyrotaenia franciscana is believed to be absent from the UK. It appears to have expanded its geographical range in the past to spread further in the U.S, as well as potentially invade parts of Mexico and Canada. It has a highly polyphagic nature and appears capable of establishment and spread in the UK. Finally, it causes significant economic damage to fruit crops in its native range. Therefore, this organism has the potential to satisfy the definition of a quarantine pest and a Pest Risk Analysis is recommended.

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