Animal and Plant Health Inspection Service
U.S. DEPARTMENT OF AGRICULTURE

Importation of parsley (*Petroselinum crispum*) for consumption from Kenya into the United States and territories

A Qualitative, Pathway-Initiated Pest Risk Assessment

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Executive Summary

The purpose of this report is to assess the pest risks associated with importing commercially produced leaves and shoots of parsley, *Petroselinum crispum* (Mill.) Fuss (Apiaceae), for consumption from Kenya into the United States and territories.

Based on the market access request submitted by Kenya, we considered the pathway to include the following processes and conditions: standard post-harvest culling and washing. The pest risk ratings depend on the application of all conditions of the pathway as described. Parsley leaves and shoots produced under different conditions were not evaluated and may pose a different pest risk.

We used scientific literature, port-of-entry pest interception data, and information from the government of Kenya to develop a list of pests with quarantine significance for the United States and territories. These are pests that occur in Kenya (on any host) and are associated with the commodity plant species (anywhere in the world).

The following organism is a candidate for pest risk management because it has met the threshold for unacceptable consequences of introduction.

Pest type	**Taxonomy**	**Scientific name**	**Likelihood of Introduction overall rating**
Arthropod	Diptera: Agromyzidae	*Chromatomyia horticola* Goureau	Medium
		Liriomyza huidobrensis (Blanchard)	Medium

Detailed examination and choice of appropriate phytosanitary measures to mitigate pest risk are addressed separately from this document.

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1. Introduction

1.1. Background

This document was prepared by analysts of the Plant Epidemiology and Risk Analysis Laboratory (PERAL), United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine (USDA-APHIS-PPQ). The purpose of this report is to assess the pest risk associated with the importation of commercially produced fresh leaves and shoots of parsley (*Petroselinum crispum* (Mill.) Fuss) from Kenya (referred to as the export area) into the United States and territories (referred to as the pest risk analysis or PRA area) for the purpose of consumption.

This is a qualitative risk assessment. The likelihood of pest introduction is expressed as a qualitative rating rather than in numerical terms. This methodology is consistent with guidelines provided by the International Plant Protection Convention (IPPC) in the International Standard for Phytosanitary Measures (ISPM) No. 11, "Pest Risk Analysis for Quarantine Pests" (IPPC, 2017). The use of biological and phytosanitary terms is consistent with ISPM No. 5, "Glossary of Phytosanitary Terms" (IPPC, 2018; 2019).

As defined in ISPM No. 11, this document comprises Stage 1 (Initiation) and Stage 2 (Risk Assessment) of risk analysis. Stage 3 (Risk Management) will be covered in a separate document.

1.2. Initiating event

The importation of fruits and vegetables for consumption into the United States is regulated under Title 7 of the Code of Federal Regulations, Part 319.56-3 (7 CFR §319.56-3, 2019). Under current regulation, the entry of parsley from Kenya into the PRA area is not authorized. This commodity risk assessment was initiated in response to a request by the Kenya Plant Health Inspectorate to change the Federal Regulation to allow such entry (KEPHIS, 2018).

1.3. Determining if a weed risk analysis for the commodity is needed

In some cases, an imported commodity could become invasive in the PRA area. If warranted, we would analyze the commodity for weed risk.

A weed risk analysis is not required if (a) the commodity is already enterable into the PRA area from other countries, (b) the commodity plant species is widely established (native or naturalized) or cultivated in the PRA area, or (c) the imported plant part(s) cannot easily propagate on its own or be propagated. We determined that parsley does not need to be analyzed for its weed risk potential since is already enterable from other countries (USDA, 2020).

1.4. Description of the pathway

A pathway is "any means that allows the entry or spread of a pest" (IPPC, 2018; 2019). In the context of this document, the pathway is the commodity to be imported, together with all the processes the commodity undergoes from production through importation and distribution. The following description of this pathway focuses on the conditions and processes that may have an impact on pest risk. Our assessment is therefore contingent on the application of all components of the pathway as described in this section.

1.4.1. Description of the commodity

The specific pathway of concern is the importation of fresh leaves and shoots of parsley for consumption.

1.4.2. Summary of the production, harvest, post-harvest procedures, shipping and storage conditions being considered

Production, harvesting, and post-harvesting procedures in the export area beyond standard washing and culling were not considered as part of this assessment. Plants will be shipped all year-round (KEPHIS, 2018), but other shipping and storage conditions have not been specified.

2. Pest List and Pest Categorization

The pest list is a compilation of plant pests of quarantine significance to the United States and its territories. This includes pests that are present in Kenya (on any host) and known to be associated with *Petroselinum crispum* (anywhere in the world). Pests are considered to be of quarantine significance if they (a) are not present in the PRA area, (b) are actionable at U.S. ports of entry, (c) are regulated non-quarantine pests, (d) are considered for or under Federal official control, or (e) require evaluation for regulatory action. Consistent with ISPM No. 5, pests that meet any of these definitions are considered "quarantine pests" and are candidates for analysis. Species with a reasonable likelihood of following the pathway into the PRA area are analyzed to determine their pest risk potential.

2.1. Pest list

We developed the pest list based on the scientific literature, port-of-entry pest interception data, and information provided by the government of Kenya. In Table 1, we listed pests that are of quarantine significance to the PRA area. For each pest, we provided evidence of the pest's presence in Kenya and its association with *Petroselinum crispum*. We also indicated the plant parts with which the pest is generally associated and any information about the pest's distribution in the United States. Pests that are likely to remain associated with the harvested commodity in a viable form are indicated by shaded rows and are also listed separately in Table 2.

Table 1. List of quarantine pests associated with *Petroselinum crispum* (in any country) and present in Kenya (on any host)

Pest name	Presence in Kenya	Host association	Plant part(s) [1]	Considered further? [2]
ARTHROPODS				
DIPTERA				
Agromyzidae				

[1] The plant part(s) listed are those for the plant species under analysis. If the information has been extrapolated, such as from plant part association on other plant species, we note that.

[2] "Yes" indicates simply that the pest has a reasonable likelihood of being associated with the harvested commodity; the level of pest prevalence on the harvested commodity (low, medium, or high) is qualitatively assessed as part of the Likelihood of Introduction assessment (section 3).

Pest name	Presence in Kenya	Host association	Plant part(s) [1]	Considered further? [2]
Chromatomyia horticola Goureau	CABI, 2020; Spencer, 1990	Jovicich, 2009; CABI, 2020; Spencer, 1990	Leaves, based on hosts in general (Omkar, 2018; CABI, 2020)	Yes
Liriomyza huidobrensis (Blanchard)	Akutse et al., 2015; CABI, 2020	de Goffau, 1991; Capinera, 2001; Weintraub et al., 2017	Leaves (de Goffau, 1991; Weintraub et al., 2017)	Yes
LEPIDOPTERA				
Noctuidae				
Agrotis segetum Denis & Schiffermüller	CABI, 2020; KEPHIS, 2018	CABI, 2020; KEPHIS, 2018; DAFF, 2000	Leaves, stems (KEPHIS, 2018)	No. Larvae feed on hosts at night and hide in the soil during the day. Therefore, they are absent from the commodity during harvest (Fraval, 2007; DAFF, 2000). Eggs can be laid in the soil or on the underside of leaves singly or in groups (Esbjerg and Sigsgaard, 2019; Esbjerg and Lauritzen, 2010), but because larvae take two or more weeks to develop (Manjula and Kotikal, 2018), they would not be able to complete their cycle before the commodity perishes. See section 2.2.
Helicoverpa armigera (Hübner), syn. *Heliothis armigera* (Hübner)	CABI, 2020; De Prins and De Prins, 2020	Ekman and Tesoriero, 2015; Tellİ and ÜremİŞ, 2010; Authority, 2018	Leaves (Ekman and Tesoriero, 2015)	No. Adults and late instar larvae are large (14 – 40 mm) (Avidov and Harpaz, 1969) and harvesters would easily detect them. Eggs and early instar larvae may go undetected at harvest, but because larvae take two to three weeks to develop (Avidov and Harpaz, 1969), they would not be able to complete their cycle before the commodity perishes. See section 2.2.

Pest name	Presence in Kenya	Host association	Plant part(s) [1]	Considered further? [2]
Spodoptera littoralis (Boisduval)	Agbodzavu et al., 2018	Ozkan Cakici et al., 2014; Tellİ and ÜremİŞ, 2010	Leaves, based on hosts in general CABI, 2020	No. Larval feeding damage to parsley leaves would be noticeable at harvest. Eggs are laid in obvious masses of 20 – 1000. Late-instar larvae are conspicuous and pupate in soil (CABI, 2020). See section 2.2.
Thysanoplusia orichalcea (F.)	KEPHIS, 2018; De Prins and De Prins, 2020	KEPHIS, 2018; Hill et al., 1987	Leaves (KEPHIS, 2018; Hill et al., 1987)	No. Larvae are external feeders and the pest, damage, and frass are easily detected (CABI, 2020; Hill et al., 1987). Eggs and earlier instar larvae that may go undetected at harvest would not be able to complete development before the commodity perishes. See section 2.2.
NEMATODES				
*Ditylenchus dipsaci (*Kühn,) Filipe's	CABI, 2020, EPPO, 2020	CABI, 2020	Root (CABI, 2020)	No.
Meloidogyne enterolobii Yang & Eisenback	CABI, 2020, EPPO, 2020	EPPO, 2020	Root (CABI, 2020, EPPO, 2020)	No.
VIRUSES				
Alfamovirus alfalfa mosaic virus (AMV)	CABI, 2020	Campbell and Melugin, 1971	Leaves (Campbell and Melugin, 1971)	No. Pathogen is present in Continental US (CABI, 2020) but no records for Hawaii and the U.S. territories. See section 2.2.

2.2. Notes on pests identified in the pest list

In general, moths in the order Noctuidae could follow the pathway into the United States and eggs and larvae have been intercepted at U.S. ports of entry on parsley intended for consumption (PestID 2020). However, we believe that the ability for the insect establish via this pathway is very unlikely given that the commodity would perish within the time necessary for the pest to develop. Further, multiple individuals, both males and females would have to complete development, emerge at roughly the same time, mate, and find hosts to establish. Given that these scenarios would need to occur at the same place and time along with the attrition that

would occur throughout the pathway, we believe that the likelihood of introduction of noctuid moths via this pathway is negligible.

Alfamovirus Alfalfa mosaic virus (AMV) is present in Kenya (Campbell and Melugin, 1971) and found on parsley. It is also present in the continental United States (CABI, 2020), but may still be actionable when destined for Hawaii and the U.S. territories. This virus cannot leave the host on its own, requiring either an insect vector or by mechanical transmission to be transmitted to another host. This is unlikely to occur in parsley shoots or leaves destined for consumption; therefore, we did not analyze this virus further.

2.3. Pests considered but not included on the pest list

Meloidogyne hapla Chitwood, *Meloidogyne incognita* (Kofoid & White) Chitwood and *Pratylenchus penetrans* (Cobb) Filipjev & Schuurmans Stekhoven are all present in Kenya and associated with parsley roots (CABI, 2020). We did not consider root pests as only above-ground portions of parsley were analyzed in this report.

2.3.2. Quarantine pests with insufficient evidence for an association with the commodity or presence in the export area

Aleyrodes proletella (L.) (Hemiptera: Aleyrodidae) has been recorded from Kenya (Mound and Halsey, 1978) and actionable when destined for Hawaii and Guam (PestID, 2020). This species has been associated with *Petroselinum* sp. (Mound and Halsey, 1978), however, we found no direct evidence of host association. Additionally, this species is generally listed as a pest only on *Brassica* spp. hosts (CABI, 2020; Nebreda et al., 2005).

Chrysodeixis chalcites (Esper) (Lepidoptera: Noctuidae) is present in Kenya (CABI, 2020; De Prins and De Prins, 2020) and actionable at U.S. ports of entry (PestID, 2020). This species has been associated with parsley (Robinson et al., 2020), however, we found no direct evidence of host association. Another source had listed *Chrysodeixis* spp. as a pest of carrot, celery and parsley (Ekman and Tesoriero, 2015), but provided no supporting evidence.

2.4. Pests selected for further analysis

We identified two quarantine pests for further analysis (Table 2).

Table 2. Pests selected for further analysis.

Pest type	Taxonomy	Scientific name
Arthropod	Diptera: Agromyzidae	*Chromatomyia horticola* Goureau
		Liriomyza huidobrensis (Blanchard)

3. Assessing Pest Risk Potential

3.1. Introduction

We estimated the overall pest risk potential for each pest we analyzed. Risk is described by the likelihood of an adverse event, the potential consequences, and the uncertainty associated with these parameters. For each pest, we determined if an endangered area exists within the United States and its territories. The endangered area is defined as the portion of the PRA area where

ecological factors favor the pest's establishment and where the pest's presence will likely result in economically important losses. If a pest causes an unacceptable impact (i.e., is a threshold pest), that means it could adversely affect agricultural production by causing 10 percent or greater yield loss, increasing production costs, or impacting an environmentally important host, or international trade. Once we defined the endangered area for a pest, we assessed the pest's overall risk by evaluating the likelihood of its introduction into the endangered area on the imported commodity.

The likelihood of introduction is based on the likelihoods of entry and establishment. We qualitatively assess risk using the ratings: Low, Medium, and High. The risk factors comprising the likelihood of introduction are interdependent; therefore, the model is multiplicative rather than additive. We define the risk categories as follows:

> **High**: This outcome is highly likely to occur.
> **Medium**: This outcome is possible; but for that to happen, the exact combination of required events needs to occur.
> **Low**: This outcome is unlikely to occur because one or more of the required events are unlikely to happen, or because the full combination of required events is unlikely to align properly in time and space.

Uncertainty is addressed within the assessment as follows:

> **Negligible:** Additional or better evidence is very unlikely to change the rating.
> **Low:** Additional or better evidence probably will not change rating.
> **Moderate:** Additional or better evidence may or may not change rating.
> **High:** Reliable evidence is not available.

3.2. Assessment

3.2.1. *Chromatomyia horticola* (Diptera: Agromyzidae)

Chromatomyia horticola is a polyphagous leaf-mining fly that is widespread in the Eastern Hemisphere (CABI, 2020; Griffiths, 1967). Larvae mine through the leaves of host plants and pupate within the leaves at the ends of the mines (Pitkin et al., 2019). Although adults do not disperse over long distances on their own, they can be transported via wind (CABI, 2020) and have been reported to spread naturally across temperate areas of Africa, and from India throughout eastern Asia (Spencer, 1990).

Defining the endangered area for *Chromatomyia horticola* within the United States and territories

Climatic suitability	*Chromatomyia horticola* is present across Europe, Africa, and Asia (Capinera, 2008). Based on this distribution, we estimated establishment is possible in Plant Hardiness Zones 6 through 13 (Takeuchi et al., 2018). Parts of the United States and territories fall within these Zones.
Hosts in PRA area	*Chromatomyia horticola* is a polyphagous species that feeds on wild and cultivated hosts. Some hosts include: **Asteraceae**: *Helianthus annuus* (common sunflower) (Gençer, 2009), *Lactuca sativa* (lettuce) (Anderson et al., 2008), and *Lapsana communis* (common nipplewort) (Gençer,

	2009); **Amaranthaceae**: *Beta vulgaris* (common beet) (Gençer, 2009); **Amaryllidaceae**: *Allium cepa* (onion) (Anderson et al., 2008); **Brassicaceae**: *Brassica juncea* (Indian mustard) (Tran, 2009), *Brassica oleracea* (cabbage) (Gençer, 2009), *Lepidium draba* (whitetop) (Gençer, 2009; Cripps et al., 2006) and *Raphanus sativus* (radish) (Gençer, 2009); **Cucurbitaceae**: *Cucumis sativus* (cucumber) (Gençer, 2009); **Fabaceae**: *Lens esculenta* (lentil) (Erskine et al., 2009), *Melilotus officinalis* (sweet clover) (Gençer, 2009), and *Pisum sativum* Authority, (Gençer, 2009; Anderson et al., 2008); **Papaveraceae**: *Papaver somniferum* (opium poppy) (Gençer, 2009); **Plantaginaceae**: *Antirrhinum majus* (snapdragon) (Gençer, 2009); and **Solanaceae**: *Solanum lycopersicum* (tomato) (Tran, 2009).
Economically important hosts at risk[a]	Economically important hosts at risk include cabbage, cucumber, lentil, lettuce, onion, pea, and tomato.
Pest potential on economically important hosts at risk	*Chromatomyia horticola* is likely to cause unacceptable consequences because it is a leaf miner that forms galleries in the foliage of ornamental and crop plants (Alford, 2012; Capinera, 2008). High-density populations reduce crop yields as well as the aesthetic value of ornamental crops (Bhat and Bhagat, 2009).
Endangered Area	The endangered area includes the regions in Plant Hardiness Zones 6 through 13 where suitable hosts occur within the continental United States, Hawaii and the territories.

[a] As defined by ISPM No. 11, supplement 2, "economically" important hosts refers to both commercial and non-market (environmental) plants (IPPC, 2017).

Assessing the likelihood of introduction of *Chromatomyia horticola* into the endangered area via parsley imported from Kenya

Risk Element	Risk Rating	Uncertainty Rating	Evidence for rating (and other notes as necessary)
Likelihood of Entry			
Pest prevalence on the harvested commodity	Low	Medium	*Chromatomyia horticola* lays eggs, feeds, and pupates in leaves of its hosts (Omkar, 2018; CABI, 2020), indicating a chance that this pest could be with the harvested portion of the commodity. We found evidence that parsley is a host for *C. horticola* (Jovicich, 2009; CABI, 2020; Spencer, 1990) but no evidence that it is a major host. Therefore, pest prevalence may be low in the field. Additionally, mines created by the larvae are noticeable (Pitkin et al., 2019).

Risk Element	Risk Rating	Uncertainty Rating	Evidence for rating (and other notes as necessary)
Likelihood of surviving post-harvest processing before shipment	Low	Medium	Other than minimal culling at the time of harvest, we did not consider production, harvest, or post-harvest procedures in the exporting area as part of this assessment. Because the insect lays eggs within the leaves, we do not believe that culling would detect all individuals that are present; consequently, the risk rating did not change.
Likelihood of surviving transport and storage conditions of the consignment	Low	Medium	Transport and storage procedures in the exporting area were not considered as part of this assessment. We did not change the previous risk rating.
Overall Likelihood of Entry	Low		
Likelihood of Establishment	Medium	Medium	*Chromatomyia horticola* has a wide range of hosts; suitable host plants are widely distributed in the endangered area (USDA-NRCS, 2020), however, its eggs, larvae, or pupae would have to complete their development into the adult stage on a perishable commodity and then, find a mate to reproduce. Based on this evidence, we rated this risk element as Medium.
Likelihood of Introduction (combined likelihoods of entry and establishment)	Medium		

3.2.2. *Liriomyza huidobrensis* (Diptera: Agromyzidae)

Liriomyza huidobrensis is a polyphagous species that has established in many parts of the world and is a serious pest. Eggs are inserted into leaves and larvae develop within the leaf, forming "mines." Pupation occurs in the soil and adults can fly. It completes its life cycle in 30 to 60 days, resulting in five to six generations per year (Capinera, 2001). Although adults do not disperse over long distances on their own, they can be transported via wind or propagative

material (CABI, 2020; Parrella, 1987). Their ability to spread on leaves has caused phytosanitary concerns in European countries (CABI, 2020).

Defining the endangered area for *Liriomyza huidobrensis* within the United States and Territories

Climatic suitability	*Liriomyza huidobrensis* is native to Central and South America and has been introduced throughout Europe, Asia, and parts of Africa (CABI, 2020). Based on this distribution, we estimated establishment is possible in Plant Hardiness Zones 6-13 (Takeuchi et al., 2018). Parts of the United States and its territories fall within these Zones.
Hosts in PRA area	*Liriomyza huidobrensis* feeds on ornamental plants and vegetable crops in 14 plant families (Spencer, 1990; Wei et al., 2000). Some hosts include: **Amaryllidaceae**: *Allium cepa* (onion) and *A. sativum* (garlic); **Apiaceae**: *Apium graveolens* (celery), *Coriandrum sativum* (coriander), *Daucus carota* var. *sativus* (carrot), and *Petroselinum crispum* (parsley); **Asteraceae**: *Chrysanthemum morifolium* (florists' chrysanthemum), *Glebionis coronari*a (syn.: *Chrysanthemum coronarium*) (chrysanthemum), and *Lactuca sativa* (lettuce); **Brassicaceae**: *Brassica napus* (rape) and *Brassica rapa* subsp. *pekinensis* (Chinese cabbage); **Caryophyllaceae**: *Gypsophila paniculata* (baby's breath) and *Stellaria media* (chickweed); **Cucurbitaceae**: *Cucumis melo* (melon); **Fabaceae**: *Phaseolus vulgaris* (common bean), *Pisum sativum* (garden pea), *Vicia faba* (fava bean), and *Vigna unguiculata* (cowpea); and **Solanaceae**: *Capsicum annuum* (pepper) and *Solanum tuberosum* (potato) (CABI, 2020; Wei et al., 2000; Weintraub et al., 2017). These hosts occur within climatically suitable areas in the PRA area (Kartesz, 2015; USDA-NRCS, 2020).
Economically important hosts at risk[a]	Economically important hosts include onion, garlic, pepper, potato, melon, lettuce, common bean, garden pea, fava bean, and cowpea.
Pest potential on economically important hosts at risk	*Liriomyza huidobrensis* is likely to cause unacceptable consequences because it reduces yield in vegetable crops as well as the aesthetic value of ornamental plants (Weintraub et al., 2017; Wei et al., 2000; Shepard and Braun, 1998).
Endangered Area	Based on the global distribution of *L. huidobrensis* and U.S. host availability, we predict this leaf miner could potentially establish and become a plant pest in Plant Hardiness Zones 6 to 13 in the United States. This area includes Hawaii and parts of Puerto Rico, and other territories, most of the contiguous United States except for areas around the Rocky Mountains, some northern plain states, and areas of the northeast (Takeuchi et al., 2018).

[a] As defined by ISPM No. 11, supplement 2, "economically" important hosts refers to both commercial and non-market (environmental) plants ().

Assessing the likelihood of introduction of *Liriomyza huidobrensis* into the endangered area via parsley imported from Kenya

Risk Element	Risk Rating	Uncertainty Rating	Evidence for rating (and other notes as necessary)
Likelihood of Entry			
Pest prevalence on the harvested commodity	Low	Medium	*Liriomyza huidobrensis* lays eggs and feed within leaves of its hosts (CABI, 2020), indicating a chance that this pest could be with the harvested portion of the plant. Furthermore, we found evidence that parsley is a host for *L. huidobrensis* (Weintraub et al., 2017; Capinera, 2001) but no evidence that it is a major host. Therefore, pest prevalence may be low in the field. Additionally, mines created by the larvae (particularly late instar) are noticeable, therefore, workers are unlikely to harvest infested stems. Based on this evidence, we rated this risk element as Low.
Likelihood of surviving post-harvest processing before shipment	Low	Medium	Other than minimal culling at the time of harvest, we did not consider production, harvest, or post-harvest procedures in the exporting area as part of this assessment. Since the insect lays eggs within the leaves, we do not believe that culling would detect all individuals that may be present; therefore, the risk rating did not change.
Likelihood of surviving transport and storage conditions of the consignment	Low	Medium	Transport and storage procedures in the exporting area were not considered as part of this assessment. We did not change the previous risk rating.
Overall Likelihood of Entry	Low		

Risk Element	Risk Rating	Uncertainty Rating	Evidence for rating (and other notes as necessary)
Likelihood of Establishment	Medium	Medium	*Liriomyza huidobrensis* is highly polyphagous (CABI, 2020) with host species distributed throughout the endangered area (USDA-NRCS, 2020). This species is highly fecund with a short generation time (CABI, 2020), which may lead to a large population in a short time. However, this species pupates in the soil (CABI, 2020), which may mean that some individuals will not be able to complete their development on the harvested commodity. Little information is available on the natural dispersal of *L. huidobrensis*. Adult *Liriomyza* spp., however, are poor fliers and remain in close proximity to their host plants *(*CABI, 2020), though wind could move them further (Parrella, 1987). Based on this evidence, we rated this risk element as Medium.
Likelihood of Introduction (combined likelihoods of entry and establishment)	Medium		

4. Summary

Of the organisms associated with parsley, worldwide, and present in the export area, we identified two organisms that are quarantine pests for the PRA area. These pests are likely to meet the threshold for unacceptable consequences in the PRA area and have a reasonable likelihood of following the commodity pathway (Table 3). Thus, these pests are candidates for risk management. These results represent a baseline estimate of the risks associated with the import commodity pathway as described in section 1.4.

Table 3. The following pests were selected for further evaluation and determined to be candidates for risk management. These pests have met the threshold for unacceptable consequences of introduction and have a reasonable likelihood of following the commodity pathway.

Pest type	Scientific name	Likelihood of Introduction overall rating
Arthropod	*Chromatomyia horticola* Goureau	Medium
	Liriomyza horticola (Blanchard)	Medium

Our assessment of risk is contingent on the application of all components of the pathway as described in section 1.4. The choice of appropriate phytosanitary measures to mitigate pest risk is not addressed in this document.

5. Literature Cited

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6. Appendix: Pests with non-quarantine status

We found some evidence of the organisms, listed below, to be associated with parsley and present in Kenya. Because these organisms are not of quarantine significance for the United States and territories (PestID, 2020; or as defined by ISPM 5, IPPC, 2018; 2019), we did not list them in Table 1 of this risk assessment. Also, we did not do an extensive evaluation of their association with parsley or their presence in Kenya. Therefore, we considered the following pests to have only "potential" association with the commodity and its presence in Kenya.

We listed these organisms along with the references that support their potential association with parsley in Kenya, and their presence in the United States and its territories. If any of the organisms listed in the table are **not** present in the United States or its territories, we provided justification for their non-quarantine status. Unless otherwise noted, these organisms are non-actionable at U.S. ports of entry.

Organism	In Kenya	In U.S.	Host Association	Notes
ARTHROPODS				
Diptera: Agromyzidae				
Liriomyza trifolii Burgess	Webb, 2017	CONUS (Webb, 2017), Hawaii, Guam, Puerto Rico, Northern Mariana Islands, U.S. Virgin Islands (CABI, 2020)	Webb, 2017	
Hemiptera: Aleyrodidae				
Trialeurodes vaporariorum Westwood	KEPHIS, 2018	CONUS (Webb, 2017), Puerto Rico (CABI, 2020)	KEPHIS, 2018	
Hemiptera: Aphididae				
Aphis gossypii Glover	Webb, 2017	CONUS (Webb, 2017), Guam, Puerto Rico, Northern Mariana Islands (CABI, 2020)	Webb, 2017	
Myzus ornatus Laing	Millar, 1994	CONUS (Miller and Stoetzel, 1997)	Millar, 1994	
Myzus persicae Sulzer	KEPHIS, 2018	CONUS, Hawaii, Puerto Rico, Northern Mariana Islands (CABI, 2020)	KEPHIS, 2018	
Lepidoptera: Noctuidae				

Agrotis ipsilon (Hufnagel)	CABI, 2020	CONUS, Hawaii (CABI, 2020)	Webb, 2017
Spodoptera exigua (Hübner)	Webb, 2017	CONUS, Hawaii (Webb, 2017)	Webb, 2017
Trichoplusia ni (Hübner)	CABI, 2020	CONUS, Hawaii, Puerto Rico, U.S. Virgin Islands (CABI, 2020)	Webb, 2017
Thysanoptera: Thripidae			
Frankliniella occidentalis (Pergande)	KEPHIS, 2018	CONUS, Hawaii, Puerto Rico (CABI, 2020; Webb, 2017)	KEPHIS, 2018; Ekman and Tesoriero, 2015
Frankliniella schultzei (Trybom)	CABI, 2020	CONUS, Guam, Hawaii, Puerto Rico (CABI, 2020)	Ekman and Tesoriero, 2015
Thrips tabaci Lindeman	CABI, 2020	CONUS, Hawaii, Puerto Rico (CABI, 2020), U.S. Virgin Islands (Crossman and Palada, 1998)	Ekman and Tesoriero, 2015; Capinera, 2001
Prostigmata: Tetranycidae			
Tetranychus urticae Koch	CABI, 2020	CONUS, Hawaii (CABI, 2020), Puerto Rico (Migeon and Dorkeld, 2020), Guam, Northern Mariana Islands (Sararit and Auamcharoen, 2020)	Webb, 2017
NEMATODES			
Meloidogyne javanica (Treub) Chitwood	CABI, 2020	CABI, 2020	Ferris, 2013
FUNGI & CHROMISTA			
Alternaria alternata (Fr.) Keissl., syn.: *Alternaria tenuissima* (Nees & T. Nees : Fr.) Wiltshire; *Alternaria tenuis* Nees.	Farr and Rossman, 2020; Caretta et al., 1999	Farr and Rossman, 2020; CABI, 2020	Farr and Rossman, 2020; Dingley et al., 1981

Alternaria crassa (Sacc.) Rands, syn.: *Alternaria capsici* E.G. Simmons	Nattrass, 1961	Farr and Rossman, 2020	Bessadat et al., 2020
Alternaria dauci (J.G. Kühn) J.W. Groves & Skolko	CABI, 2020; KEPHIS, 2018	Farr and Rossman, 2020; Poudel and Zhang, 2018	Farr and Rossman, 2020
Boeremia exigua var. *exigua* (Desm.) Aveskamp, Gruyter & Verkley, syn.: *Phoma exigua* var. *exigua* Desm.; *Phoma linicola* Bubák	Farr and Rossman, 2020; Nattrass, 1961	Farr and Rossman, 2020	Mułenko et al., 2008
Botrytis cinerea Pers.: Fr., syn.: *Botryotinia fuckeliana* (de Bary) Whetzel, *Botrytis vulgaris* Link: Fr.	Farr and Rossman, 2020	Farr and Rossman, 2020; CABI, 2020	Minchinton et al., 2006
Cercospora apii Fresen., syn.: *Cercospora molucellae* Bremer & Petr.	Farr and Rossman, 2020; Siboe et al., 2000	Farr and Rossman, 2020	Braun, 1999
Erysiphe orontii Castagne, syn.: *Golovinomyces orontii* (Castagne) Heluta	Nattrass, 1961	Koike et al., 2013	Koike et al., 2013
Erysiphe polygoni DC.	Farr and Rossman, 2020	Farr and Rossman, 2020; CABI, 2020	Farr and Rossman, 2020; Foister, 1961
Fusarium oxysporum Schltdl.	KEPHIS, 2018	Farr and Rossman, 2020	KEPHIS, 2018
Gibberella avenacea R. J. Cook, syn.: *Fusarium avenaceum* (Corda: Fr.) Sacc.	Farr and Rossman, 2020	Farr and Rossman, 2020	Farr and Rossman, 2020; Nowicki, 1997
Leveillula taurica (Lév.) G. Arnaud, syn.: *Oidiopsis taurica* (Lév.) E.S. Salmon; *Erysiphe taurica* Lév.	Farr and Rossman, 2020; CABI, 2020	Farr and Rossman, 2020; CABI, 2020	Reis et al., 2004
Neocosmospora solani (Mart.) L. Lombard & Crous, syn.: *Fusarium solani* (Mart.) Sacc.	Farr and Rossman, 2020	Farr and Rossman, 2020	Farr and Rossman, 2020; Nowicki, 1997
Penicillium italicum Stoll	CABI, 2020	CABI, 2020	CABI, 2020

Phoma anethi (Pers.) Sacc., syn.: *Fusoidiella anethi* (Pers.) Videira & Crous; *Cercospora petroselini* Sacc; *Passalora punctum* (Delacr.) S. Petzoldt	Farr and Rossman, 2020	Farr and Rossman, 2020; Mułenko et al., 2008	Mułenko et al., 2008
Phytophthora nicotianae Breda de Haan, syn.: *Phytophthora parasitica* Dastur; *Phytophthora terrestris* Shreb.	Farr and Rossman, 2020	Farr and Rossman, 2020; CABI, 2020	Elena and Grigoriou, 2008
Pythium aphanidermatum (Edson) Fitzp., syn. *Nematosporangium aphanidermatum* (Edson) Fitzp.; *Pythium butleri* L. Subram.	Farr and Rossman, 2020; CABI, 2020	Farr and Rossman, 2020; CABI, 2020	Gull et al., 2004
Pythium ultimum var. *ultimum* Trow, syn.: *Globisporangium ultimum* (Trow) Uzuhashi, Tojo & Kakish; *Pythium ultimum* Trow	Farr and Rossman, 2020	CABI, 2020	Petkowski et al., 2013
Sclerotinia minor Jagger	Farr and Rossman, 2020	Farr and Rossman, 2020	Farr and Rossman, 2020; Sampson and Walker, 1982
Sclerotinia sclerotiorum (Lib.) de Bary, syn.: *Sclerotinia libertiana* Fuckel	Farr and Rossman, 2020; CABI, 2020	Farr and Rossman, 2020; CABI, 2020	Kurt et al., 2017
Septoria apiicola Speg., syn.: *S. petroselini* Desm; *S. apii* Chester; *S. apii-graveolentis* Dorogin	CABI, 2020; KEPHIS, 2018	CABI, 2020	Marthe et al., 2016; Kurt, 2003
Stemphylium vesicarium (Wallr.) E.G. Simmons	CABI, 2020	CABI, 2020	Koike et al., 2013
Thanatephorus cucumeris (A.B. Frank) Donk, syn.: *Rhizoctonia solani* J.G. Kühn; *Corticium solani* (Prill. & Delacr.) Bourdot & Galzin	Farr and Rossman, 2020; CABI, 2020	Farr and Rossman, 2020; CABI, 2020	Farr and Rossman, 2020
BACTERIA			
Pseudomonas marginalis pv. *marginalis* (Brown) Stevens, syn.: *Pseudomonas intybi* (Swingle) Stapp	CABI, 2020	CABI, 2020	Osada, 1994

Pseudomonas viridiflava (Burkholder) Dowson	CABI, 2020	CABI, 2020	CABI, 2020
Rhizobium radiobacter (Beijerinck & van Delden) Young et al.	CABI, 2020	CABI, 2020	CABI, 2020
VIRUSES			
Cucumovirus cucumber mosaic virus	CABI, 2020	CABI, 2020	Sevik and Akcucura, 2011