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Solid Wood Packing Material from China

Initial Pest Risk Assessment on Certain Wood Boring Beetles Known To Be Associated With Cargo Shipments: Asian Longhorned Beetle (*Anoplophora glabripennis*), *Ceresium*, *Monochamus* and *Hesperophanes*.

August 31, 1998

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Executive Summary

We conducted a plant pest risk assessment to examine the risks associated with solid wood packing material (SWPM) imported from China into the United States. Although there are many legitimate quarantine pests associated with SWPM from China, this assessment focuses on four taxa (one species and three genera) that have been intercepted repeatedly with shipments.

Our risk assessment was conducted according to accepted international guidelines for plant pest risk analyses.

After introductory comments, citations of previous assessments and studies, and a discussion of interceptions of these pests, we document the quarantine status of the taxa covered by this assessment. Then for each taxon, we provide a detailed discussion supporting our rating for the likelihood of entry, likelihood of establishment and consequences of establishment for these organisms.

This assessment does not constitute an exhaustive account of the known biology and documented scientific literature on these taxa. However, we present considerable, detailed information on these taxa that demonstrate a obvious pattern of significant risk. The likelihood of entry for these taxa is high; each has been intercepted numerous times, both at ports of entry and postentry in warehouses. The likelihood of establishment for at least one (Asian Longhorned Beetle, ALB) is also apparent as breeding populations of ALB were recently detected in New York and Illinois. We rate the likelihood of establishment for both *Monochamus* and *Hesperophanes* as high due to their wide distributions in temperate regions and wide host ranges which include tree species in the United States. We rate the likelihood of establishment for *Ceresium* as medium because we have little information regarding the exact identity of the pest(s) arriving in the United States.

We rate the consequences of introduction (entry and establishment) for all of these taxa as high. Although the amount of available information on damage caused by these four taxa varies, we present detailed information from the scientific literature on the impacts of these pests in China and other areas of the world. We found that each of these insect genera contains pests of ornamental, orchard and environmentally significant tree groups, and that some of these pests (*e.g.*, ALB) could have devastating impact on our forests and agriculture.

Finally, we rate the overall pest risk potential for each of these four taxa as high. This results from our finding that the risk of introduction is high and that, if introduced to the United States, these pests will have a significant adverse impact.

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I. Introduction.

The Animal and Plant Health Inspection Service (APHIS) of the United States Department of Agriculture (USDA) is responsible for protecting the country's agricultural and forest resources from plant pests. APHIS' regulatory authority in this area derives from 7 U.S.C. 150dd, 150ee, 150ff, 151-167, 450, 2803, and 2809; 21 U.S.C. 136 and 136a; 7 CFR 2.22, 2.80, and 371.2(c). Logs, lumber, and other unmanufactured wood articles imported into the United States pose a significant hazard of introducing plant pests detrimental to agriculture and to natural, cultivated, and urban forest resources. APHIS' regulations in 7 CFR 319.40-1 through 319.40-11 contain provisions to eliminate significant plant pest risks presented by the importation of logs, lumber, and other unmanufactured wood articles.

One of the classes of wood articles that are subject to import restrictions is solid wood packing material (SWPM). The regulations define solid wood packing material in § 319.40-1 as "Wood packing materials other than loose wood packing materials, used or for use with cargo to prevent damage, including, but not limited to, dunnage, crating, pallets, packing blocks, drums, cases, and skids." Most of the wooden pallets, crates, dunnage and similar articles used to assist the movement of commodities in international commerce meet the definition of solid wood packing material and are subject to the regulations. SWPM does not include synthetic or highly processed wood materials used as packing materials, and these articles (e.g., plywood, oriented strand board, corrugated paperboard, plastic, resin composites) are not subject to the requirements for SWPM.

Risks posed by SWPM. The importation of SWPM is regulated because these materials present a number of risks. SWPM are often constructed from raw wood just shortly before they are used, often include bark on some surfaces, and are often made from low quality wood that sometimes may be of low quality due to pest damage. These factors contribute to a high risk of spreading wood pests that exist in from the areas where the wood was obtained or used for SWPM construction. Additionally, the SWPM in transit are in close contact with the commodities (including wood products) they are used to pack, creating an opportunity for pests to move from SWPM to commodity. After commodities arrive in the United States, pests from the SWPM may escape and become established, especially because the SWPM associated with commodities often move large distances throughout the United States, are reused frequently, are often stored outdoors at ports and warehouses, or are discarded. To control these risks, § 319.40-3 of the regulations imposes certain requirements on imported SWPM.

This pest risk assessment was prepared by APHIS to examine plant pest risks associated with the importation of SWPM into the United States from China.

Compliance with International Standards. International plant protection organizations (*e.g.*, North American Plant Protection Organization (NAPPO) and the International Plant Protection Convention (IPPC) of the United Nations Food and Agriculture Organization (FAO)) provide guidance for conducting pest risk analyses. The methods we used to initiate, conduct, and report

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this plant pest risk assessment are consistent with guidelines provided by these organizations. Our use of biological and phytosanitary terms (*e.g.*, introduction, quarantine pest) conforms with the NAPPO Compendium of Phytosanitary Terms (NAPPO 1995) and the Definitions and Abbreviations (Introduction Section) in International Standards for Phytosanitary Measures, Section 1—Import Regulations: Guidelines for Pest Risk Analysis (FAO 1996).

Pest risk assessment is one component of an overall pest risk analysis. The Guidelines for Pest Risk Analysis provided by FAO (1996) describe three stages in pest risk analysis. This document satisfies the requirements of FAO Stages 1 (initiation) and 2 (risk assessment). Stage 3 (risk management) is not addressed herein.

The Food and Agriculture Organization (FAO, 1996) defines "pest risk assessment" as "Determination of whether a pest is a quarantine pest and evaluation of its introduction potential". "Quarantine pest" is defined as "A pest of potential economic importance to the area endangered thereby and not yet present there, or present but not widely distributed and being officially controlled" (FAO 1995, NAPPO 1995). Thus, pest risk assessments should consider both the likelihood and consequences of introduction of quarantine pests. Both issues are addressed in this qualitative pest risk assessment.

Scope of This Initial PRA. This document provides information on the pest risk posed by SWPM from China. It rates the likelihood that four groups of exotic insect borers will arrive and establish in the United States, the consequences of introduction (entry and establishment) of these pests, and provides a composit rating (the pest risk potential) for these factors. A separate economic assessment (USDA, APHIS 1998) document will address economic consequences of establishment of these pests.

APHIS prepared this assessment in response to growing urgency to address the risk exemplified by increasing detections of exotic longhorned beetles (Coleoptera: Cerambycidae) in United States commerce and recent Asian longhorned beetle detections in New York (1996) and Illinois (1998). Consequently, we limited the scope of the document to the four beetle taxa of most immediate concern. We describe this document as an initial assessment because APHIS is developing a comprehensive pest risk assessment on SWPM from all sources. When completed, that document will provide a more complete assessment of the risk associated with SWPM from around the world.

II. Risk Assessment

1. Initiating Event: Proposed Action

Although the United States has specific regulations intended to prevent entry of pests associated with SWPM, APHIS has found numerous exotic pests associated with SWPM imported from China, including extremely destructive wood-boring insects of the genera *Anoplophora*, *Ceresium*, *Hesperophanes*, and *Monochamus*. Pests of these genera have moved with SWPM to

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numerous States, including California, Florida, Texas, New York, Illinois, Indiana, Kentucky, Michigan, New Jersey, North Carolina, Tennessee, Washington, and Wisconsin. By the end of fiscal year 1998, State and Federal agencies will have spent approximately $5 million in attempts to eradicate these insects.

2. Previous Risk Assessments

We reviewed the following pest risk assessments related to this work.

- Kucera, D. 1996. Risk assessment - Asian longhorned beetle (ALB). Washington, D.C.: USDA Forest Service, State and Private Forestry. Unpublished report, 11p.

- Tyrrell, M. 1996. The invasion of Brooklyn, New York by *Anoplophora glabripennis*: an ecological risk assessment. Yale University School of Forestry and Environmental Studies, unpublished report, 33p.

- USDA, Forest Service. 1991. Pest risk assessment of the importation of larch from Siberia and the Soviet Far East. Forest Service Misc. Publ. 1495.

We also reviewed the following documents that discussed pest risk pertinent to this work.

- Mastro, V. and J. Cavey. 1996. *Anoplophora glabripennis*, an Asian longhorned beetle, Science Advisory Panel Report, October 25, 1996, for APHIS PPQ. Unpublished agency report. 7p.

- USDA, APHIS. 1996. New Pest Advisory Group Report on *Anoplophora glabripennis* (Motschulsky) (an exotic Asian longhorned beetle), September 25, 1996. Unpublished agency report, 7p.

3. Pest Interceptions

Pest interception records pertinent to this document are listed in Appendix A, Tables 1 and 2. These tables include PPQ interception records from port-of-entry inspections, only. They do not include detection records for inland warehouses, discussed below. During the years 1985 to 1998, 354 insects in the family Cerambycidae were found with wood in commerce from China. This number exceeds the total of all other insect taxa found with wood in cargo from China during the same period.

4. Quarantine Pests

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In this risk assessment, we did not consider the full range of quarantine pests likely to be associated with SWPM. Instead, this assessment focuses on a subset of frequently intercepted insect borers, in the beetle family Cerambycidae (longhorned beetles) and lists quarantine significant cerambycid beetles (Appendix A, Table 1) and other wood boring pests (Appendix A, Table 2) intercepted from these materials by PPQ. The borers assessed herein include a species that has infested trees in New York and Illinois (Asian longhorned beetle, ALB) and taxa (including ALB) that have infested inland United States warehouses by escaping detection at ports-of-entry. These intercepted quarantine pests are:

Anoplophora glabripennis (Motschulsky)
Anoplophora sp.
Ceresium sp.
Hesperophanes sp.
Hesperophanes campestris (Falderman)
Monochamus alternatus
Monochamus sp.
Trichoferus sp.

5. Likelihood of Entry and Establishment, and Consequences of Establishment: Qualitative Assessment

This section considers the eight quarantine pest taxa listed above in four groups, *i.e.*, *Anoplophora glabripennis*, *Monochamus*, *Ceresium*, and *Hesperophanes*. We rate each group for likelihood of pest entry, likelihood of establishment, and consequences of introduction using high, medium, or low as descriptors, and provide an overall rating of pest risk potential.

Because we evaluated only these four pest taxa, we believe the cumulative risk posed by SWPM from China is greater than indicated by this assessment.

Anoplophora glabripennis (Asian Longhorned Beetle).

Factor Summary for *Anoplophora glabripennis*	
Factor	**Rating**
Likelihood of Entry	High

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Likelihood of Establishment	High
Consequences of Introduction	High
Pest Risk Potential	High

PPQ frequently intercepts longhorned beetle larvae in cargo from China, but taxonomists can rarely identify this immature life stage to the species level. Because larvae of most species have not been adequately described in the literature, intercepted larvae are usually identified only to the genus level (*e.g.*, *Anoplophora* sp.), subfamily level (*e.g.*, Lamiinae) or family level (*e.g.*, Cerambycidae). In the case of Asian longhorned beetle (ALB), USDA, Agricultural Research Service (ARS), specialists developed techniques to identify larvae as belonging to the genus *Anoplophora* in 1996.

Quarantine Status. Breeding populations of *Anoplophora glabripennis* exist in the United States on Long Island, New York, and near Chicago, Illinois. APHIS has placed both infestations under official control through quarantines and eradication programs. No other species of the genus, many of which feed on and damage living trees, occur in the United States (Duffy 1968, Poole & Gentili 1996, Wang & Chen 1984, Zhou *et al*. 1981, and see Consequences of Introduction section, below). APHIS considers all *Anoplophora*, including ALB, as quarantine pests.

Likelihood of Entry. PPQ intercepted organisms recognized as ALB only twice and as "*Anoplophora* sp." 21 times, from 1985-1998 (Appendix A, Table 1). However, for reasons stated above, PPQ probably intercepted this species repeatedly before 1996, but could not recognize larvae to species. Thus, previous interceptions identified as "Lamiinae sp." (*i.e.*, the subfamily containing ALB) or "Cerambycidae sp." may represent unrecognized ALB. The strong similarity between larvae of *Monochamus* and ALB (Cavey *et al.* 1998) suggests that some of the 141 *Monochamus* interception records from China predating 1996 may also represent unrecognized ALB.

But regardless of how many interceptions actually represent ALB, this beetle has entered the United States and is currently infesting trees in two locations on Long Island, New York and three locations near Chicago, Illinois. PPQ recently found ALB adults associated with Chinese cargo in warehouses in Washington, Massachusetts, and North Carolina and larvae identified as "*Anoplophora* sp." in warehouses in California, New Jersey, Michigan, Kentucky, Indiana, Texas, and Pennsylvania. These widespread U.S. detections dictate a high rating for entry potential of ALB. Our high rating agrees with that determined by the USDA Forest Service (Kucera 1996).

Likelihood of Establishment. Asian longhorned beetle occurs in temperate China from 21°N to 43°N (and 100-127°E), suggesting that conditions favorable for ALB establishment could occur in similar climatic areas of North America from southern Mexico to the Great Lakes (Haack *et al.* 1997). ALB feeds on a wide variety of hardwood tree hosts in China and in the United States, including maples, birch, willow, poplar, pear and plum (Gine & Chein 1986, Peng & Liu 1992,

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Haack *et al.* 1997, Kucera 1996, Mastro & Cavey 1996). Larvae can feed on at least 47 tree species that occur in China, including 23 species of poplar (*Populus*) (Yang *et. al* 1995).

Adults are weak flyers capable of flying up to 1200 m distances. Infestations spread slowly, less than 300 m/year in Beijing poplar groves (Thier 1997). They are not attracted to lights (Li & Wu 1993). Like other wood borers, ALB can be transported as eggs, larvae and pupae in logs, tree trimmings, firewood and untreated lumber. The nature and exact location of the Amityville, New York ALB infestation indicates that it possibly resulted from infested tree trimmings transported from ALB-populated areas in Brooklyn by a pruning company (before the quarantine).

ALB currently infests trees in Brooklyn and Amityville, New York and in three locations in and near Chicago, Illinois. Eradication efforts in New York have dramatically reduced but not eliminated local populations in the past two years. ALB's persistence in New York, presence in Illinois, temperate Asian distribution, and wide host range dictate a high rating for establishment potential, agreeing with that determined by the USDA Forest Service (Kucera 1996).

Consequences of Introduction. Literature on ALB's economic and environmental effects in China is either sparse or not readily available. Electronic searches and inquiries through contacts in China have produced references mostly on ALB control research efforts (*e.g.*, Dai & Wang 1988, Lei *et al.* 1993, Liu *et al.* 1992, Qin *et al.* 1985, Sun *et al.* 1990). The variety and number of ALB control projects in China suggest that ALB has significant adverse impact in its native habitat. Other literature including a report that this trunk-boring insect causes severe damage to forests in China (Yan 1985) and a listing of ALB with other forest pests (Gine & Chein 1986), support this conclusion.

Asian researchers have confirmed ALB's pest status in China. Members of the Biological Control Institute of the Chinese Academy of Agricultural Sciences (CAAS) consider ALB as one of the most serious forest pests in China (J. Thaw, PPQ, pers. commun., February 1997). Conversations between B. Wang (PPQ), R. Gao (Chinese Academy of Forestry Research, Institute of Forest Protection) and Y. Luo (Beijing Forestry University, Beijing) included discussion that ALB seriously reduces poplar fiber and wood production. Furthermore, it can affect agricultural crops indirectly by killing trees used as windbreaks around crop fields. We learned that the Chinese government recently ordered the removal and burning of large areas of poplar windbreak belts to help reduce large numbers of ALB in western China. Attempts to grow North American varieties of maple in China for wood and syrup production were recently abandoned because ALB repeatedly killed the trees (V. Mastro, PPQ, pers. commun., August 1998). This is consistent with severe decline and high mortality of many hardwood trees, especially maples, observed at ALB infested areas in New York (Haack *et al.* 1997, Mastro & Cavey 1996). In New York, ALB infests healthy or stressed trees of all sizes, from newly planted saplings to mature plants measuring 1.8 meters in diameter (Haack *et al.* 1997). Apparently, beetles find trees suitable for laying eggs even if declining from previous ALB infestation. This habit renews infestation in already weakened trees, leading to eventual death of the tree.

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These reports suggest that ALB would severely impact U.S. forest resources and related industries, such as timber, nursery, tourist, and maple syrup. ALB's actions in U.S. forests could change the composition of tree species enough to cause significant ecological impact.

Control efforts in New York and Illinois resulted in the destruction of more than 2000 trees, to date. The affected suburban areas lose aesthetic value as mature infested trees are replaced by young, often less desirable ALB resistant trees. Because efficacious control options are presently limited to tree removal, control costs are and will likely remain high (ALB control programs cost approximately $5 million since 1996).

ALB resembles European gypsy moth with respect to certain aspects of introduction to the United States (Tyrrell 1996). Both pests began breeding in urban areas and were not noticed for an estimated 10 years after accidental introduction. Both cause severe damage to numerous tree species, and do not fly great distances. But unlike gypsy moth, ALB is perennially a serious pest in its native land, despite the presence of coevolved natural enemies and varied control efforts over the years.

We rate ALB high for consequences of introduction, primarily because it is a major forest pest in China and, in New York and Illinois, has demonstrated formidable potential for harming many tree species in the United States. We rate the total pest risk potential for ALB as high.

Monochamus. Under this heading, we treat the following taxa listed above: *Monochamus* sp. and *Monochamus alternatus*.

Factor Summary for *Monochamus*

Factor	Rating
Likelihood of Entry	High
Likelihood of Establishment	High
Consequences of Introduction	High
Pest Risk Potential	High

Quarantine Status. Some members of the genus *Monochamus* occur in the United States, but many species, including, *M. alternatus* and other species from China, listed below, are exotic (Peng & Liu 1992, Cherepanov 1990, Duffy 1968, Poole & Gentili 1996). Many species in this genus cause feeding damage and transmit harmful pathogenic organisms to living trees (see Consequences of Introduction section, below). APHIS considers species in this genus as quarantine pests, unless they occur in the United States.

Likelihood of Entry. From 1985 to 1998, PPQ lists 141 interception records identified as "*Monochamus* sp.", 11 as *M. alternatus*, and one as *M. teserula* White from China (Appendix A,

Table 1). More of these insects than any other longhorned beetle taxon were intercepted from China. Additionally, some interceptions identified as "Lamiinae sp." or "Cerambycidae sp." may represent unrecognized *Monochamus*. PPQ found "*Monochamus* sp." and *M. alternatus* that escaped detection at ports-of-entry in warehouses, including locations in New York, Kentucky, and Massachusetts.

Although, as discussed above, some identifications of "*Monochamus* sp." could actually represent Asian longhorned beetle, the frequency of *Monochamus* interceptions warrants a high rating for entry potential.

Likelihood of Establishment. Species of *Monochamus* are distributed throughout temperate regions of the Old World (Cherepanov 1990, Duffy 1968) and occur in North America (Poole & Gentili 1996). Many *Monochamus* species occur in China, including *M. alternatus* Hope, *M. bimaculatus* Gahan, *M. gravidus* Pascoe, *M. guerryi* Pic, *M. guttatus* Blessig, *M. impluviatus* Motschulsky, *M. saltuarius* Gebler, *M. sparsutus* Fairmaire, *M. sutor* (L.), and *M. urusovi* (Fischer) (Anon. 1992, Cherepanov 1990, Duffy 1968). None of these species occur in the United States (Poole & Gentili 1996). Many of these species feed on a variety of host trees (Cherepanov 1990, USDA Forest Service 1991, Wang 1988). Some are known to attack only coniferous hosts (*e.g.*, *M. urusovi*: USDA Forest Service 1991), or deciduous hosts (*e.g.*, *M. bimaculatus*: Wang 1988), and others attack both (*e.g.*, *M. alternatus*: Wang 1988). Hosts for *M. alternatus* — a species we have identified from Chinese cargo — include pines, fir, cedar, and larch (Duffy 1968). Suitable host material in these plant groups exists throughout the United States.

Sympatric (species occurring together) *Monochamus* species in Europe attack different parts of the same tree (Hellrigl 1971). This habit suggests that newly introduced *Monochamus* species could co-exist here without competition from North American species, in cases where feeding niches differ.

USDA Forest Service (1991) estimates that *Monochamus* species can probably fly several kilometers per year. Like all cerambycids considered in this assessment, beetles are likely to be transported as eggs, larvae and pupae in logs, tree trimmings, firewood and untreated lumber.

We rate *Monochamus* high for establishment potential because of its wide distribution, wide host range, and feeding habits noted above.

Consequences of Introduction. *Monochamus* populations can periodically attain large numbers in Asia. In spring, adults feeding on bark of young coniferous shoots often wither the shoots and significantly reduce canopy foliage in heavily infested trees (Cherepanov 1990, USDA Forest Service 1991). Larval tunneling in tree trunks seriously reduces or eliminates timber value.

In addition to damage caused directly by the beetle, *Monochamus* species are known to carry plant parasitic nematodes and fungi, including members of a pine wood nematode species complex (*Bursaphelenchus* spp.) that can kill healthy trees (USDA Forest Service 1991). Four types of insect vector (*M. alternatus*)/nematode interactions involved in pine wilt were found in

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China, and *M. alternatus* was identified as the primary vector of the disease (Lai *et al.* 1996). *Monochamus urusovi* is associated with species of *Ceratocystis*, an often pathogenic fungus (USDA Forest Service 1991). Pathogens transmitted by the insects could increase the damage to trees beyond that caused by insect feeding alone. This also suggests that introductions of exotic *Monochamus* species could facilitate spread of plant diseases in two ways, by potentially (1) introducing exotic plant pathogens carried by colonizing beetles and (2) spreading existing diseases in North America more efficiently than present vectors.

Because *Monochamus* species that locally co-occur together in Europe are known to compliment one another by attacking different parts of the tree (Hellrigl 1971), the actions of new exotic species that may become established in the United States, in combination with actions of native *Monochamus*, could have a synergistic (more than additive) adverse effect on infested trees.

We rate the consequences of introduction high for *Monochamus* because species in this genus — including species that occur in China — damage living trees and vector plant pathogens capable of killing trees. We rate the total pest risk potential for *Monochamus* as high.

Ceresium.

Factor Summary for *Ceresium*	
Factor	**Rating**
Likelihood of Entry	High
Likelihood of Establishment	Medium
Consequences of Introduction	High
Pest Risk Potential	High

Quarantine Status. No species in the genus *Ceresium* occur in the United States (Poole & Gentili 1996) and, at least some species feed on and damage living trees (see Consequences of Introduction section, below). APHIS considers organisms recognized as species of this genus as quarantine pests.

Likelihood of Entry. PPQ identified 94 interception records of larvae as "*Ceresium* sp." from China (Appendix A, Table 1) (although some early records may have been *Hesperophanes* mistaken for the similar *Ceresium*). These interception records occurred from 1996 to 1998. Some previous interceptions identified as "Cerambycidae sp." or "Cerambycinae sp." may represent unrecognized *Ceresium*. *Ceresium* larvae that escaped detection at ports-of-entry were found by PPQ in Chinese cargo delivered to five warehouses in New Jersey. Consequently, we estimate the entry potential for *Ceresium* as high.

Likelihood of Establishment. Although we do not know which species these intercepted larvae represent, we can use information from the literature to estimate the likelihood that *Ceresium*

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could become established in the United States. Numerous species of this genus exist in temperate Asian countries, including *Ceresium longicorne* in Japan and Korea (Kusigemati 1985, Lee 1981), *C. holophaeum* in Japan (Mikami 1993), *C. sinicum ornaticolle* , *C. s. sinicum* White and *C. flavipes* (F.) in China (Anonymous 1994, Duffy 1968, Liu 1991), *C. declaratum* in India (Holzschuh 1990), and several other species in Korea (Lee 1987). Certain *Ceresium* can develop in temperate host trees, *e.g.*, *C. longicorne* on *Prunus salicina* (Kusigemati 1985). We could find no data on dispersal ability of *Ceresium*. However, like other cerambycid wood borers, *Ceresium* should disperse readily in wood carried by man.

Because we intercept *Ceresium* as larvae, we do not know which species infest imported Chinese cargo and cannot accurately determine their potential for establishing in the United States. However, because the genus occurs widely in temperate Asia, intercepted larvae infest cargo also infested with other temperate taxa such as *Monochamus*, and at least some species feed on temperate Asian trees, we estimate establishment potential as medium.

Consequences of Introduction. Species of *Ceresium* are pests of living trees. *Ceresium longicorne* caused serious damage to *Prunus salicina* fruit trees in Kyushu, Japan (Kusigemati 1985). *Ceresium nilgiriense* is a pest of tea and shade trees (The India Tea Research Association. 1984). *Ceresium sinicum* attacks citrus and mulberry (Duffy 1968) and causes serious damage to many useful trees in Hubei Province, China (Liao & Takagawa 1984). *Ceresium flavipes* (=*simplex* Gyllenhal) damages citrus, *Casuarina*, and others (Duffy 1968).

As noted above, both *C. sinicum* and *C. flavipes* occur in China. Although PPQ has not intercepted *Ceresium* adults and consequently, could not identify the species we find, the Canadian Forest Service has reared adults of *C. flavipes* from Chinese SWPM (L. Humble, Canadian Forest Service, pers. commun., October 1997).

We rate *Ceresium* as high for consequences of introduction because species of this genus — including two species that occur in China — are known to be pests of fruit and/or ornamental and other useful trees. We rate the total pest risk potential for *Ceresium* as high.

Hesperophanes. Under this heading, we treat the following taxa listed above:
Hesperophanes sp., *Hesperophanes campestris* (Falderman), and *Trichoferus* sp.

Factor summary for *Hesperophanes*

Factor	Rating
Likelihood of Entry	High
Likelihood of Establishment	High
Consequences of Introduction	High
Pest Risk Potential	High

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Quarantine Status. Some members of the genus *Hesperophanes* occur in the United States, but many species, including *H. campestris*, are exotic (Peng & Liu 1992, Cherepanov 1988, Poole & Gentili 1996). At least some species in the genus, including *H. campestris*, feed on and damage living trees (see Consequences of Introduction section, below). APHIS considers members of this genus as quarantine pests unless recognized as species occurring in the United States.

Likelihood of Entry. Taxonomists now consider the genus name *Trichoferus* as a junior synonym of *Hesperophanes* (pers. commun., Steven Lingafelter, USDA, ARS, Systematic Entomology Laboratory, May 1998). ARS scientists discovered this synonymy after identifying a few larvae found in Chinese cargo stored in warehouses as *Trichoferus*. Therefore, PPQ data recorded as *Trichoferus* actually represent interceptions of *Hesperophanes*.

From 1985 to 1998, PPQ intercepted six larvae identified as "*Hesperophanes* sp." and one "*Trichoferus* sp.". But because larvae of *Ceresium* are very similar to *Hesperophanes* and because PPQ often detects adult *Hesperophanes* but never adult *Ceresium* in Chinese cargo, many early interceptions identified as *Ceresium* (*i.e.*, some of the 94 interceptions in Appendix A, Table 1) may represent unrecognized *Hesperophanes*. Additionally, some interceptions identified as "Cerambycidae sp." or "Cerambycinae sp." (*i.e.*, 16 and 17 interception records, respectively, in Appendix A, Table 1) may represent unrecognized *Hesperophanes*.

Most intercepted larvae identified as "*Hesperophanes* sp." are probably *H. campestris*. Major works on Asian cerambycids list *H. campestris* from throughout Asia and as the only species occurring in China (Peng & Liu 1992, Cherepanov 1988). One reference notes a new distribution record for *H. heydeni* and describes a new species in the genus from China, *H.* (*Trichoferus*) *maculatus* (Pu 1991). But, the larvae commonly infesting wood packing materials in commerce are less likely to belong to the more obscure *H. heydeni* than to the widespread pest *H. campestris* and not likely to belong to a species just recently discovered. Furthermore, all PPQ interceptions of *Hesperophanes* adults that were identified to species from Chinese cargo and from infested warehouses have been *H. campestris*.

PPQ frequently intercepts adult *H. campestris* from warehouses storing imported Chinese cargo. In one warehouse near Houston, PPQ repeatedly captured adults, presumably emerging from stored Chinese cargo, in black light traps. PPQ inspectors found dead *H. campestris* adults near windows in other warehouses containing Chinese cargo.

Primarily because of repeated findings of *H. campestris* in multiple distribution warehouses, these records suggest a high rating for the entry potential of *Hesperophanes*.

Likelihood of Establishment. Members of the genus *Hesperophanes* are distributed throughout temperate portions of the Old World (Bense 1995, Miroshinikov 1990) and occur in North America (Poole & Gentili 1996). *Hesperophanes campestris* occurs throughout northern Asia (Cherepanov 1988). Depending on the species, *Hesperophanes* beetles may utilize several coniferous or deciduous hosts (Abdulagatov 1977, Benfatto & Longo 1987, Coffin 1986, Soria & Vives 1995, Yagdyev 1987).

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Hesperophanes campestris displays high resistance to dryness in host wood (Iwata & Yamada 1990). This ability may significantly augment the beetle's development and survival in the rough-processed crating and pallets used for shipping.

Except to note that some species have wide distributions in the Old World (*e.g.*, *H. griseus* and *H. campestris*), we could find little data on dispersal ability of *Hesperophanes*. Like other wood borers, *Hesperophanes* are likely to be transported as eggs, larvae and pupae in logs, tree trimmings, firewood and untreated lumber.

For reasons stated above, we suspect that most interceptions of *Hesperophanes* from Chinese cargo represent *H. campestris*. At this time, we lack detailed knowledge of the biology of this species. However, we know that *H. campestris* occurs widely in temperate regions, feeds on ornamental deciduous trees (Yagdyev 1987), flies, and may survive well and transport readily in raw and semi-processed wood. We rate establishment potential for *Hesperophanes*, and especially *H. campestris*, as high.

Consequences of Introduction. This genus contains a number of serious plant pests. In Mediterranean Europe, a related species, *H.* (*Trichoferus*) *griseus*, requires integrated control programs to reduce its impact on citrus trees (Benfatto & Longo 1987) and develops in *Prunus mahaleb* (Coffin 1986). This species also infests fig and kills grape vines (Abdulagatov 1977). Spain considers *H.* (*Trichoferus*) *fasciculatus* a pest of fir trees (Soria & Vives 1995). *Hesperophanes campestris* is recorded as a pest of deciduous ornamental trees in the former Soviet Union (Yagdyev 1987) and a pest of apple, Chinese date, and orange in China (Anonymous 1994). Cherepanov (1988) notes that *T. campestris* (= *H. campestris*) inhabits broad-leaved and mixed vegetation, and colonizes birch and *Micromeles alnifolia*.

We rate *Hesperophanes* as high for consequences of introduction because members of this genus — including *H. campestris* that occurs in China — are known to be pests of fruit and other trees. We rate the total pest risk potential for *Hesperophanes* as high.

III. Literature Cited.

Abdulagatov, A. Z. 1977 (abstract). The fig longhorn beetle - a pest of grape vine. Zashchita Rastenii (No. 8): 41.

Anonymous. 1994. Harmful pests of China fruit trees (second edition). China Agriculture Science Institute. China Agriculture Press. (Translation by USDA, APHIS) 1063p.

Benfatto, D. and S. Longo. 1987 (abstract). Beetle pests living on citrus in Italy, pp.165-172. *In* Cavalloro, R. and E. Dimartino (ed.). Integrated pest control in Citrus-groves; experts' meeting, Acireale, Italy, March 26-29, 1985. Xii+600p. A. A. Balkema, Rotterdam, Netherlands; Boston, Massachusetts, USA.

Image Maker Demo

Bense, U. 1995 (abstract). Longhorn beetles: illustrated key to the Cerambycidae and Vesperidae of Europe. Margraf Verlag, Weikersheim. 512p.

Cavey, J. F., E. R. Hoebeke, S. Passoa and S. W. Lingafelter. 1998. A new exotic threat to North American hardwood forests: an Asian longhorned beetle, *Anoplophora glabripennis* Motschulsky) Coleoptera: Cerambycidae: I. Larval description and diagnosis. Proceedings of the Entomological Society of Washington 100 (2):373-381.

Cherepanov, A.I. 1988. Cerambycidae of Northern Asia. Volume 2, Part 1: Cerambycinae. Oxonian Press Pvt. Ltd., New Delhi, India. 292p.

Cherepanov, A.I. 1990. Cerambycidae of Northern Asia. Volume 3, Part 1: Lamiinae. Amerind Publishing Co. Pvt. Ltd., New Delhi, India. 300p.

Coffin, J. 1986 (abstract). *Prunus mahaleb* L., host tree for the larvae of *Hesperophanes* (*Trichoferus*) *griseus* Fabricius (Coleoptera, Cerambycidae). Entomologiste 42(6): 366.

Dai, L. and X. Wang. 1988 (abstract). A new subspecies of *Bacillus thuringiensis*. Microbiologica Sinica 28: 4, 301-306.

Duffy, E.A.J. 1968. A monograph of the immature stages of oriental timber beetles (Cerambycidae). Trustees of the British Museum (Natural History). London, United Kingdom. 434p.

EPPO. 1994. European and Mediterranean Plant Protection Organization (EPPO) Plant Quarantine Retrieval (PQR) System, version 3.0, computerized data base. Information in the data base originates from: Smith, I. M. 1992. Quarantine Pests for Europe. Oxon, UK: CAB International, Paris: Published in association with the European and Mediterranean Plant Protection Organization.

FAO. 1996. International Standards for Phytosanitary Measures. Part 1 - Import Regulations: Guidelines for Pest Risk Analysis (Draft Standard). Secretariate of the International Plant Protection Convention, Food and Agriculture Organization of the United Nations. Rome, Italy.

Gine, W. and M. Chein, *in* Forest Diseases and Insect Prevention, First Edition. 1986 (from an in-house translation by Millie Yang, CPA, USDA - OIG and provided by Dan Kucera, USDA FS, Radnor, PA).

Haack, R.A., K.R. Law, V.C. Mastro, H.S.Ossenbruggen, and B.J. Raimo. 1997. New York's battle with the Asian long-horned beetle. Journal of Forestry 95(12): 11-15.

Hellrigl, K.G. 1971 (abstract). The bionomics of the European *Monochamus* species (Coleoptera: Cerambycidae) and their significance for forestry and the wood industry. Redia 52: 367-509.

Image Maker Demo

Holzschuh, C. 1990 (abstract). Description of new longhorn beetles of the Himalayan Region. Insecta. Berichte des Naturwissenschaftlich-Medizinischen Vereins in Innsbruck 77(0): 185-198.

India Tea Research Association. 1984(?) (abstract). Tocklai Experimental Station, Jorhat 785008, Assam, India. Annual Scientific Report, Tea Research Association, India, vol. 1983/84: 72-83.

Iwata, R. and F. Yamada. 1990 (abstract). Notes on the biology of *Hesperophanes campestris* Faldermann (Coleoptera: Cerambycidae), a drywood borer in Japan. Mater. Oorg. (Berl.) 25(4): 305-314.

Kucera, D. 1996. Risk assessment - Asian longhorned beetle (ALB). Washington, D.C.: USDA Forest Service, State and Private Forestry. Unpublished report, 11p.

Kusigemati, K. 1985 (abstract). A new ichneumonid parasite of the cerambycid beetle *Ceresium longicorne* in Japan (Hymenoptera). Memoirs of the Faculty of Agriculture Kagoshima University 21(30): 199-202.

Lai, Y.X., S.Y. Zhang, H.Z. Huang, Z.T. Lu, and Y.Y. Shi. 1996 (abstract). *Monochamus alternatus* withered pine. Journal of the Zhejiang Forestry College. 13(1) : 75-81.

Lee, S.M. 1981 (abstract). Eleven unrecorded longicorn beetles of Korea. Korean Journal of Entomology 11(2): 47-50.

Lee, S. 1987 (abstract). The longicorn beetles of Korean Peninsula. National Science Museum, Seoul. 287p.

Lei, Y. S. Yin, and X. Zhang. 1993 (abstract). Integrated management of poplar longicorns. Forest Research 6 (Mem.): 41.

Li, G.W., G.Y. Shao, and B.N. Yu. 1986 (abstract). Preliminary observation on *Monochamus alternatus*. Insect-Knowledge 23: 4, 169-170.

Li, W. and C. Wu. 1993 (abstract). Integrated management of longhorn beetles damaging poplar trees. Beijing, China Forest Press, 290p.

Liao, D. X., and T. Tachikawa. 1984 (abstract). Description of *Paracerchysius ceresii* Liao et Tachikawa, gen. et sp. nov. from China (Hymenoptera: Chalcidoidea: Encyrtidae). Transactions of the Shikoku Entomological Society 16(4):19-24.

Liu, L. 1991 (abstract). Bionomics of *Ceresium sinicum ornaticolle* Pic and its control. Entomological Knowledge 28(2): 100-102.

Liu, S.R., C.X. Zhu, and X.P. Lu. 1992 (abstract). Field trials of controlling several cerambycid larvae with entomopathogenic nematodes. Chinese Journal of Biological Control 8: 4, 176.

Image Maker Demo

Mastro, V. and J. Cavey. 1996. *Anoplophora glabripennis*, an Asian longhorned beetle, Science Advisory Panel Report, October 25, 1996, for APHIS PPQ. Unpublished agency report. 7p.

Mikami, R. 1993 (abstract). Observation on the hosts of three longicorn beetles in western seashore of Aomori Prefecture. Nature and Insects 28(5): 18-24.

Miroshnikov, A. 1990 (abstract). Data on longhorn beetles (Coleoptera: Cerambycidae) of the Caucasus USSR. Entomol. Obozr. 69(1): 84-92.

NAPPO. 1995. NAPPO Compendium of Phytosanitary Terms, B.E. Hopper, NAPPO Secretariat, ed. North American Plant Protection Organization (NAPPO), Nepean, Ontario, Canada.

Peng, J. and Y. Liu. 1992. Iconography of forest insects of Hunan China. Hunan Department of Zoology, Institute of Forestry Science. Academia Sinica. (ISBN 7-5357-1068-9.) 1473p.

Poole, R.W. and P. Gentili (eds.) 1996. Nomina Insecta Nearctica, a check list of the insects of North America. Volume 1, Coleoptera, Strepsiptera. Entomology Information Services, Rockville, Maryland. 827p.

Pu, F. 1991 (abstract). New genus and species of Cerambycinae, with new records of longicorn beetles from China (Coleoptera: Cerambycidae). Sinozoologia 8: 247-252.

Qin, X., R. Gao, J. Li, W. Hao, and K. Liu. 1985 (abstract). Preliminary investigation on the resistance of different clones of poplars to *Anoplophora glabripennis* (Motsch.). Scientia Silvae Sinicae 21(3): 310-314.

Soria, S. and E. Vives. 1995 (abstract). Damage by *Trichoferus fasciculatus* (Falderman, 1837) (Col. Cerambycidae) on firs (Abies sp.) in the central region of Spain. Boletin de Sanidad Vegetal, Plagas 21(2):177-184.

Sun, J.Z., Z.Y. Zhao, T.Q. Ru, Z.G. Qian, and X.J. Song. 1990 (abstract). Control of *Anoplophora glabripennis* by using cultural methods Forest Pest and Disease. No. 2: 10-12.

Thier, R.W. 1997. USDA, Forest Service Boise, Idaho letter, 29 May 1997, describing information from pers. commun. with Zhou Jian Sheng, Director of Anhui Province Forest Biological Control Center, China. 2p.

Tyrrell, M. 1996. The invasion of Brooklyn, New York by *Anoplophora glabripennis*: an ecological risk assessment. Yale University School of Forestry and Environmental Studies, unpublished report, 33p.

USDA, APHIS. 1994. Importation of logs, lumber, and other unmanufactured wood articles. Draft environmental impact statement, February 1994. 85p., 4 appendices.

Image Maker Demo

USDA, APHIS. 1996. New Pest Advisory Group Report on *Anoplophora glabripennis* (Motschulsky (an exotic Asian longhorned beetle), September 25, 1996. Unpublished report, 7p.

USDA, APHIS. 1997. Importation of logs, lumber, and other unmanufactured wood articles. Draft supplement to the environmental impact statement, December 1997. 88p., 6 appendices.

USDA, APHIS. 1998 (in prep.). Preliminary regulatory impact analysis of the interim rule on solid wood packing materials from China. August 1998. Unpublished report.

USDA, Forest Service. 1991. Pest risk assessment of the importation of larch from Siberia and the Soviet Far East. Forest Service Misc. Publ. 1495.

Wang, Q. 1988 (abstract). The biogeography of *Monochamus* Guer. (Coleoptera: Cerambycidae). Scientia-Silvae-Sinicae 24(3): 297-304.

Wang, T.Z. and D.P. Chen. 1984 (abstract). Notes on the damage done by *Anoplophora chinensis* to *Cryptomeria japonica*. Res. Inst. For. Sci., Jiangsu, China. No. 6: 26-27.

Xiao, G. (ed.) 1980. Forest insects of China. Forest Research Institute, Chinese Academy of Forestry, Beijing, China. 1107 p.

Yagdyev, A. 1987 (abstract). Pests of ornamental plants in towns of the Turkmen SSR USSR. Izv. Akad. Nauk. Turkm. SSR Ser. Biol. Nauk. 0(1): 47-50.

Yan, J. J. 1985. Research on distribution of basicostal white-spotted longicorn in east China. Journal of the North Eastern Forestry College 13(1): 62-69.

Yang, X., J. Zhou, F. Wang, and M. Cui. 1995 (abstract). A study on the feeding habits of the larvae of two species of longicorn (*Anoplophora*) to different tree species. J. Northwest For. College 10(2):1-6.

Zhou, J.X., M.T. Liu, Y.Z. Lu, and X.G.Yang. 1981. A preliminary study on *Anoplophora nobilis* Ganglbauer (Coleoptera: Cerambycidae). Scientia Silvae Sinicae. 17: 4, 413-418.

Zhou, J., Y. Sun, and H. Tang. 1988 (abstract). Economic insect fauna of Shaanxi: Coleoptera, Cerambycidae. Shaanxi Kexue Jishu Chuban She, Xian, China. 1988: 1-9, 1-136

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IV. Preparation, Consultation and Review

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Appendix A. Tables of Insect Pests Intercepted by PPQ with Wood in Commerce from China

Table 1. PPQ Interception Records of Cerambycidae (longhorned beetles) Found With Wood in Commerce from China 1985 - 1998

Port Information Network database, 24August1998

Pest	No.
Anoplophora glabripennis Motschulsky	2
Anoplophora sp.	21
Apriona sp.	1
Asemum sp.	2
Batocera sp.	2
Callidiellum sp.	1
Callidium sp.	1
Cerambycidae, sp. of	16
Cerambycinae, sp. of	17
Ceresium	94
Chlorophorus sp.	1
Dere thoracia White	1
Elaphidion sp.	1
Glenea sp.	1
Hesperophanes sp.	6
Lamiinae, sp. of	9
Monochamus alternatus Hope	11
Monochamus sp.	141
Monochamus teserula White	1
Phymatodes sp.	1
Plagionotus christophi Kraatz	1
Pterolophia sp.	1
Purpuricenus sp.	1
Stromatium barbatum (F.)	1
Stromatium longicorne (Newman)	1
Trichoferus sp.	1
Xylotrechus grayi (White)	1
Xylotrechus magnicollis Fairmaire	2
Xylotrechus sp.	15
Sum	**354**

Table 2. PPQ Interception Records of Insects, Other Than Cerambycidae,

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Found With Wood in Cargo from China 1985-1998

Port Information Network database, 24 August 1998

Pest	No.
Buprestidae, sp. of	2
Buprestis sp. (Buprestidae)	1
Chalcophora sp. (Buprestidae)	1
Chrysobothris sp. (Buprestidae)	2
Coleoptera, sp. of	2
Coptotermes sp. (Rhinotermitidae)	1
Cryphalus sp. (Scolytidae)	10
Cryptorhynchinae, sp. of (Curculionidae)	2
Cryptorhynchus sp. (Curculionidae)	2
Cryptotermes sp. (Kalotermitidae)	1
Curculionidae, sp. of	7
Curculionoidea, sp. of	3
Cyrtogenius sp. (Scolytidae)	2
Dryocoetes sp. (Scolytidae)	40
Euwallacea validus (Scolytidae)	1
Hylobius sp. (Curculionidae)	1
Hypocryphalus sp. (Scolytidae)	3
Hypothenemus sp. (Scolytidae)	5
Ips acuminatus (Gyllenhall) (Scolytidae)	1
Ips cembrae (Heer) (Scolytidae)	2
Ips erosus (Wollaston) (Scolytidae)	25
Ips sp. (Scolytidae)	3
Ips typographus (L.) (Scolytidae)	2
Niphades sp. (Curculinidae)	4
Orthotomicus sp. (Scolytidae)	13
Phloeosinus sp. (Scolytidae)	2
Pissodes sp. (Curculionidae)	3
Pityogenes chalcographus (L.) (Scolytidae)	1
Platypodidae, sp. of	1
Platypus sp. (Platypodidae)	1
Polygraphus poligraphus (L.) (Scolytidae)	1
Polygraphus sp. (Scolytidae)	3
Reticulitermes sp. (Rhinotermitidae)	1
Scolytidae, sp. of	55
Scolytus sp. (Scolytidae)	12
Shirahoshizo sp. (Curculionidae)	14
Sipalinus sp. (Curculionidae)	2
Siricidae, sp. of	3
Xyleborinus sp. (Scolytidae)	1
Xyleborus sp. (Scolytidae)	7
Xyleborus validus Eichoff (Scolytidae)	2
Sum	**245**