

---

## Contaminants of upholstered furniture from China and Malaysia

K.J. Froud<sup>1</sup>, H.G. Pearson<sup>1</sup>, B.J.T. McCarthy<sup>1</sup> and G. Thompson<sup>2</sup>

<sup>1</sup>*Ministry of Agriculture and Forestry, PO Box 2095, Auckland, New Zealand*

<sup>2</sup>*Ministry of Agriculture and Forestry, PO Box 106231, Auckland, New Zealand*  
*Corresponding author: froudk@maf.govt.nz*

---

### Abstract

New Zealand's forestry industry is dependent upon the continuing exclusion of harmful pests and diseases. Wood imported into New Zealand must meet stringent biosecurity requirements to ensure it is free from harmful organisms. Recent interceptions have shown that solid wood furniture from South East Asia, particularly China, poses a biosecurity risk. This led to concern that upholstered furniture may be an important introduction pathway. Ministry of Agriculture and Forestry Biosecurity New Zealand (MAFBNZ) aimed to determine the risk posed by upholstered furniture imported from China and Malaysia. Forty-nine couches were destructively sampled. Quality of construction materials was mostly poor and 39 couches were contaminated with biosecurity risk material. Timber was identified and consisted of several economically and environmentally important plant families. Despite high amounts of risk material, effective intervention by importers reduced the risk. However, without voluntary interventions, importation of upholstered furniture will pose a risk pathway for harmful organisms.

**Keywords:** quarantine, upholstered furniture, woodware, couch, contamination, bark, woodborers, biosecurity, survey.

### Introduction

Forestry is an important industry in New Zealand. Production and export of New Zealand timber products is dependent upon the continuing exclusion of pathogens and wood-boring insects. As such, wood imported into New Zealand must meet stringent biosecurity requirements to prevent introduction of potentially damaging pathogens and pests.

The Ministry of Agriculture and Forestry Biosecurity New Zealand (MAFBNZ) Import Health Standard (IHS) for woodware was introduced to provide a means for managing risk in manufactured woodware imported into New Zealand. Under the IHS, all woodware consignments must be free of regulated pests and have a phytosanitary certificate with the consignment. Mandatory treatment of consignments is not required, however, if a consignment is treated, a treatment or phytosanitary certificate must be supplied as verification of the treatment.

Upon arrival in New Zealand, commercial woodware products that are not accompanied by an appropriate treatment certificate are considered 'untreated' and are subjected to inspection of a minimum of 10% of the consignment (e.g. 10%

---

Surveillance for biosecurity: pre-border to pest management

---

of the wooden items from a consignment would be inspected for evidence of pests, bark or extraneous organic material), or the importer is given the choice of reshipping or destruction by MAFBNZ. Alternatively the importer can choose that they be treated and MAFBNZ will subsequently clear the consignment upon presentation of a treatment certificate.

Recent investigations have shown that wooden furniture from South East Asia and in particular China poses a significant biosecurity risk to New Zealand. Since 1988 there have been 83 detections of exotic organisms associated with imported furniture entering New Zealand. China, Indonesia and Thailand were responsible for 41% of these detections. Over 50% of detections occurred post-border with many of these being detected by members of the public who were unfortunate enough to have purchased contaminated furniture.

The most common contaminants reported are wood-boring insects, many of which would have a detrimental economic effect on the forestry industry if they were to become established in New Zealand. Amphibians, reptiles and fungi were also found in small numbers. Of the 83 organisms detected in association with household furniture, 26 were dead, 51 were alive and the viability of six was unknown.

Each post-border incursion comes at considerable cost to MAFBNZ. All post-border incursions originate from goods that have previously been issued with a Biosecurity Authority Clearance Certificate (BACC). In these circumstances, MAFBNZ's current risk management approach has been to arrange and pay for treatment (e.g. fumigation) in order to manage the risk. On occasion, this has resulted in compensation payments for damaged goods. An alternative approach provided for by the legislation would be to direct the owner of the cleared goods to arrange fumigation in accordance with specifications determined by MAFBNZ using an approved service provider, at their own cost. To date, MAFBNZ's practice has been to use this provision sparingly, particularly in circumstances when the affected party is not at fault (e.g. having purchased the goods in good faith from an importer). In addition, the investigation of contaminated wooden furniture requires significant resources as the whole consignment must normally be traced and treated.

To date, most post-border cases associated with woodware have been from solid-wood goods and furniture. On several occasions, investigators have discovered active wood-borer tracks and holes intentionally covered up with wood putty during manufacture of the item. Investigations have also noted that some Chinese furniture manufacturers put good quality (flawless) wood on visible surfaces, and poor quality (insect damaged and bark covered) timber in internal sections of the furniture. This practice has led MAFBNZ to believe that there is a likelihood that concealed internal timber used in the manufacture of upholstered furniture is of poor quality and therefore of higher risk of being contaminated.

## Contaminants of upholstered furniture from China and Malaysia

The risks associated with upholstered furniture are poorly understood, largely because wooden components are obscured by fabric. Over the 5 years prior to this study there was a steady increase in the number of consignments of upholstered furniture entering New Zealand, with importation of couches having a dramatic increase from 16,895 in the year 2000 to 65,456 in 2005, with the majority imported from China and secondly from Malaysia (Table 1).

**Table 1. Increase in imported upholstered furniture over a 5-year period. Data are from Statistics NZ and numbers are individual lounge suites.**

Country	2000	2001	2002	2003	2004	2005
China	962	1884	3614	9023	22376	39308
Malaysia	5377	4060	6056	16166	17942	14758
Thailand	1690	3345	6633	9509	8238	7422
Italy	4766	7384	2524	2285	2534	1547
Australia	2440	896	1642	3260	937	1095
Other	1660	1134	1688	2189	2507	1326
TOTAL	16895	18703	22157	42432	54534	65456

High numbers of imports, coupled with the potential for poor-quality materials led to concern that upholstered furniture was a potentially important pathway for pests and pathogens of forests. In addition the timber types used were largely unknown but indications were that several types could be used in a single item. MAFBNZ believes this may increase the chance that a couch will introduce a pest or pathogen to New Zealand by increasing the range of pests or pathogens associated with different timber types.

A survey was undertaken with the aim of determining the current level of risk posed by couches imported from China and Malaysia. This survey examined the incidence of contamination within wooden-framed, upholstered furniture imported from China and Malaysia and aimed to identify the types of host timber used in the construction of Chinese and Malaysian upholstered furniture so that an assessment could be made of which forestry species and other timber-based industries may be at risk.

## Methods

### Sampling

A total of 37 lounge suites comprised of 49 couches were purchased for destructive sampling. All couches were purchased from retailers with a history of importing couches from China and Malaysia.

Selected from a recent importers list, the study population mostly consisted of Auckland-based retailers that imported three or more consignments over the 5-year period. The remaining retailers were made up from the Yellow Pages listings. Auckland City was divided into five 'regions' of North, South, East, West and

---

Surveillance for biosecurity: pre-border to pest management

---

Central. A minimum of 10 unique retailers in each region was selected to ensure that the same retail chain stores were not visited at different locations.

Procurement of couches was undertaken by two Investigation and Diagnostic Centre (IDC) incursion investigators over a 5-week period from late April to early June 2006. Each region was targeted on a single day, one region per week for 5 weeks. A quota of 10 couch purchases was attempted on each day.

An attempt was made to purchase a single two-seater couch from each retailer, as this was our standard 'sample unit'. However, in several instances it was not possible to purchase a single couch and a 'suite' was purchased instead, usually consisting of one three-seater couch and one two-seater couch. Where no two-seater couches were available but a large (defined as containing a similar amount of wood as a two-seater couch) single-seater or two smaller single-seaters were available, these were purchased and referred to as a single 'sampling unit'. On one occasion, a single-seater and an accompanying upholstered ottoman were used as a single sampling unit.

Destructive sampling was undertaken over 4 days by two four-person MAFBNZ survey teams in June 2006. All sampling was conducted within a contained area. Each sample of furniture was assigned a unique identifying number. Information about the retailer, importer, cost, material type, date of purchase and types of contaminants found were recorded for each item.

Destructive sampling involved a series of stages that were designed to ensure that all contaminants were found and contained. Contaminants found at any stage of the sampling process were placed in sample bags or vials, depending on the type of contaminant. For wood contaminated with bark or borer holes, the entire piece was removed and placed into a sample bag. Small samples (approximately 50 mm) of each type of timber were collected from each item of furniture for wood identification.

The first step was removal of the feet, and then the outer fabric of the couch was removed and a careful inspection was conducted of the foam and the inside of the fabric for contaminants such as insects and seeds. The next step involved the removal of the foam. Once the wooden frame was exposed, it was carefully inspected with particular attention paid to the joints. Photographs were taken before each inspection began, at each stage throughout the inspection process and of any contamination (Figs 1a, 1b & 1c).

Once the item had been sampled, all uncontaminated wooden material was disposed of in waste skips. The outer fabric and foam were sent for recycling. Following the completion of sampling of each item, the work area was swept clean and sanitised before sampling of another furniture item began.



### Contaminants of upholstered furniture from China and Malaysia

---



**Figure 1. (a) Typical couch upholstered, (b) Upholstery removed and (c) Timber frame exposed.**

#### **Identifications**

All wood samples were sent to Lloyd Donaldson at Scion for identification. Wood samples were identified to family where possible. All insect, fungi and plant material were identified by the MAFBNZ Plant Health and Environment Laboratory to species where possible.

#### **Trace back**

All retailers of purchased couches were contacted and asked to provide information regarding the couch. The information sought required confirmation of which country the couch was manufactured in, the manufacturer's name, customs import entry number, consignment number, whether or not the furniture was fumigated, and the quantity of upholstered furniture imported each year.

All retailers responded and gave varying degrees of information that enabled some trace back of treatments.

#### **Analysis**

It was acknowledged that individual units within a suite (two couches) may represent a level of replication of sample units and where possible this was avoided. When analysing the data we have used the total number of units ( $n=49$ ) surveyed in most cases. Where we believe that replication from using two couches from the same suite may have influenced the results we have used the number of

## Surveillance for biosecurity: pre-border to pest management

unique units (n=37) by removing the second couch from each suite from the data set. We have indicated where this has occurred in the text.

Relationships between the presence of bark and other contaminants or of unit price on likelihood of contamination were tested using Chi-square.

## Results and discussion

A total of 49 couches was purchased, with a mean couch price of \$697.94 and a range of \$300.00 – \$1610.00. A total of 39 (or 31 out of 37 unique units) came from China and 10 (or 6 out of 37 unique units) came from Malaysia.

### Contaminants

Of the 49 couches inspected, 39 (79.6%) (30 from China and 9 from Malaysia) were contaminated with some form of biosecurity risk material and 24 couches had more than one type of contaminant. The most common contaminant found was bark, which was present on 30 samples. Insect contaminants were collected from 19 couches. However, thirty-two couches had visible insect damage, mostly in the form of borer holes or bark beetle tracks. Fungal samples were collected from 11 couches and plant material (seed) from one (Table 2).

**Table 2. Number of couches (n= 49) from China and Malaysia with different types of biosecurity risk material (numbers in brackets indicate results for n=37 unique couch units).**

Risk Material	China n=39 (30)		Malaysia n=9 (6)		Total n=49 (37)	
	No.	% of total	No.	% of total	No.	% of total
No contaminants	10 (9)	25.6 (30.0)	1 (1)	11.1 (11.1)	11 (10)	22.4 (27.0)
Bark	24 (19)	61.5 (63.3)	6 (3)	66.7 (33.3)	30 (22)	61.2 (59.5)
Insects	15 (10)	38.5 (33.3)	4 (2)	44.4 (22.2)	19 (12)	38.8 (32.4)
Fungi	11 (9)	28.2 (30.0)	0	0	11 (9)	22.4 (24.3)
Plant material	0	0	1 (1)	11.1 (11.1)	1 (1)	2.0 (2.0)
Borer holes	23 (17)	59.0 (56.7)	9 (5)	100 (55.6)	32 (22)	65.3 (59.5)
>1 contaminant	24 (18)	64.5 (60.0)	3 (1)	33.3 (11.1)	27 (19)	55.1 (51.4)

Examples of contaminants are shown in Figures 2a, 2b, 2c, 2d & 2e.

The presence of bark meant that there was a high probability that other contaminants were present (Chi-square 7.46, df 1,  $P < 0.01$ ) (Table 3); couches with bark were commonly contaminated with either fungi or insects or both. The IHS for woodware specifically prohibits the importation of bark, which is covered under a separate IHS, unless the bark has been lacquered or otherwise coated in a permanent covering.

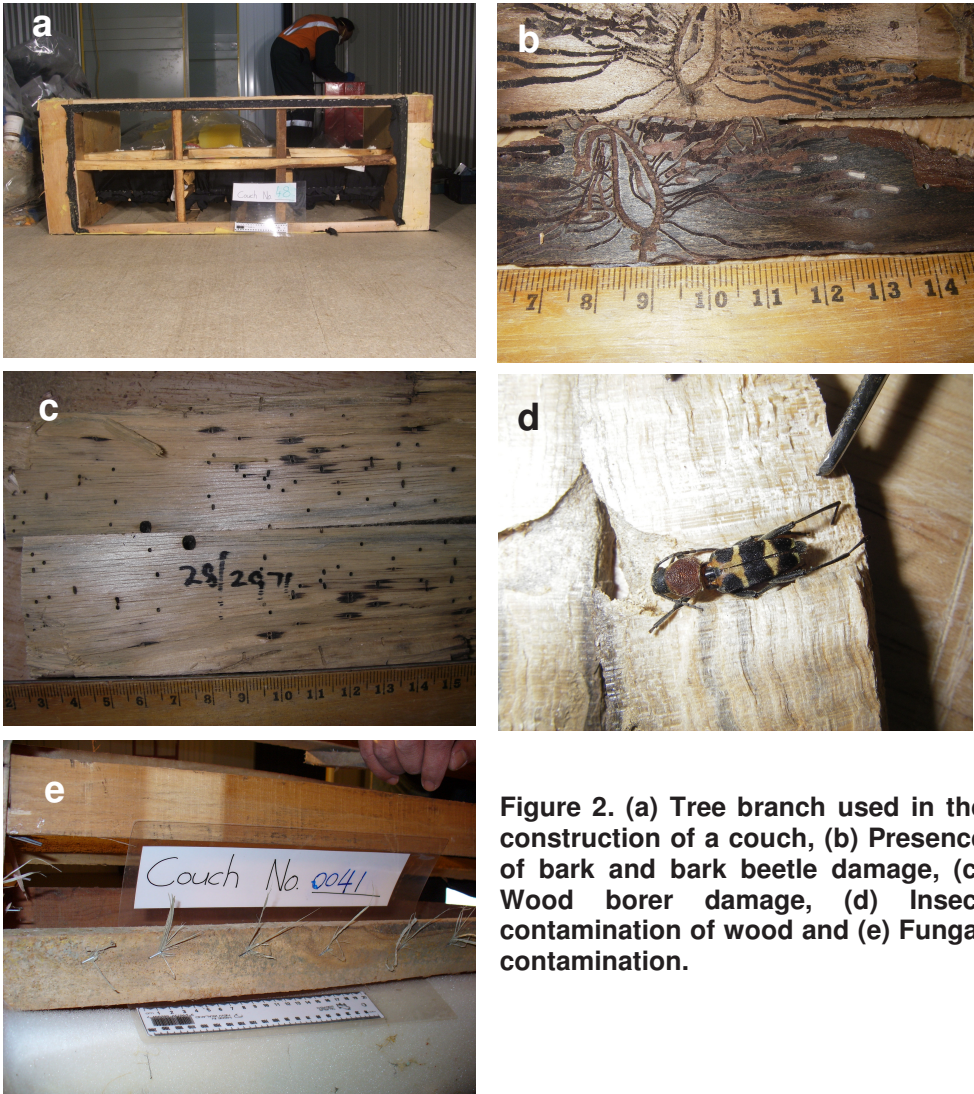


Figure 2. (a) Tree branch used in the construction of a couch, (b) Presence of bark and bark beetle damage, (c) Wood borer damage, (d) Insect contamination of wood and (e) Fungal contamination.

Table 3. Relationship between the number of items with bark and the presence or absence of other contaminants.

	Bark present	Bark absent
Contamination present	24	9
Contamination absent	6	12

---

Surveillance for biosecurity: pre-border to pest management

---

This study demonstrates that bark does provide a vector for contaminants, and the presence of bark in upholstered furniture needs to be monitored by MAFBNZ to ensure greater compliance at the border as allowed for in the existing Import Health Standard for woodware.

There was no statistical difference ( $P>0.05$ ) in the mean price of non-contaminated and contaminated couches.

In many cases the quality of construction materials used in the surveyed couches was sub-standard. Some couches were constructed from low quality plywood, and a number from undressed and dirty timber. In one case a partially dressed branch was used in the construction of the couch (Fig. 2a). In addition, some couches were heavily contaminated with borer holes and bark. The low quality of construction suggests that, as suspected, upholstered furniture represents a potential pathway for pests and diseases to enter New Zealand.

Thirty-eight specimens of insects were identified from the 19 couches that had insect contaminants. One Hemipteran, *Cardiastethus* sp., was found alive. This genus is known to be present in New Zealand and the individual found may have been a local contaminant from the retail store. All other insects were dead.

The arthropod specimens collected in this survey included taxa directly associated with the wood and bark used to construct the couch, together with various other taxa not usually associated with wood. Some of these may have been local contaminants. Most of the insects directly associated with wood were adults or larvae of the wood-boring beetle families and subfamilies (Brentidae, Scolytinae, Cerambycidae and Platypodinae). Termites (Isoptera) and carpenter ants (*Camponotus* sp.) were also found. Several of these groups contain species that are potential economic or environmental pests and descriptions of these are detailed below.

#### **Brentidae (straight-snouted weevils)**

One beetle was found from the wood-boring family Brentidae. Brentidae females lay eggs in living, dying and recently felled hardwood trees. The larvae feed on the wood and on fungal mycelia (Arnett et al. 2002). Adults remain associated with wood and can often be found beneath bark. Because they primarily attack dying and felled trees, Brentidae are considered to be of little or no economic importance (Wood 1982).

#### **Curculionidae Subfamily Scolytinae (bark beetles)**

There were 13 scolytine beetles found. The subfamily Scolytinae includes species that feed directly on wood as larvae, and species that feed on ambrosia fungus associated with the wood (Arnett et al. 2002). Scolytine beetles go through a single generation on a tree; adults disperse soon after emerging from pupae (Arnett et al. 2002). The adults are known to congregate on a single tree and by attacking “en-masse” they overwhelm the tree’s ability to react to predation. This beetle group contains many species that are significant forest pests around the world.



---

Contaminants of upholstered furniture from China and Malaysia

---

Two specimens of this subfamily were identified to species; *Xyleborinus saxeseni*, which is an exotic species already established in New Zealand, and *Xylosandrus crassiusculus*, which is not established in New Zealand. The remaining specimens could not be identified beyond genus because of a lack of literature on Chinese scolytines. These genera include species found in both New Zealand and China.

The genera identified have a wide host range, being polyphagous on either broadleaf trees or conifers. One genus, *Xyleborinus*, has a haplo-diploid genetic system similar to that of Hymenoptera where an unmated female can produce male offspring with which she can then mate to produce female offspring (Wood 1982). This is of particular concern, as it means that only a single female beetle need establish for a viable population.

### **Curculionidae Subfamily Platypodinae (Ambrosia beetles)**

There were nine Platypodinae beetles found. Subfamily Platypodinae of the family Curculionidae contains many species that are significant pests of wood and forestry. Platypodines can bore deeply into the wood causing considerable damage (Arnett et al. 2002). Sap-staining caused by secondary fungal infection adds to the physical damage from tunnelling caused by these beetles (May 1993).

Three genera of Platypodinae could be identified: *Euplatypus*, *Crossotarsus* and *Treptoplatypus*. Of these, *Crossotarsus*, and *Treptoplatypus* each include a single species established in New Zealand, but there are no *Euplatypus* spp. established. These genera are of economic and potentially environmental significance because they attack living trees, causing extensive physical damage.

### **Cerambycidae (longhorn beetles)**

There were four Cerambycidae beetles found. Cerambycid females lay eggs in cracks in wood or in bark. The larvae feed directly on the wood and may take several years to develop into an adult. Cerambycidae includes a number of serious pest species, and are of economic and potentially environmental significance. One specimen was identified to species (*Xylotrechus magnicollis*). This species is not present in New Zealand.

### **Formicidae (ants)**

A single nest of carpenter ants (*Camponotus* sp.) was found that contained 35 workers. Some carpenter ant species excavate wood when constructing nests. Wood-nesting *Camponotus* spp. can cause structural damage, and as generalist predators and scavengers, these ants are potentially of both economic and environmental significance. No species of the genus *Camponotus* are known to be established in New Zealand.

### **Isoptera (termites)**

One specimen of *Macrotermes* was found. *Macrotermes* spp. is a fungus-growing termite. Rather than feeding directly on wood, they collect cellulose debris on which the termites grow fungi as food. *Macrotermes* spp. is a pest of crops such as corn

---

Surveillance for biosecurity: pre-border to pest management

---

and maize in Africa but do not usually attack wooden structures. They are considered to be potentially both economically and environmentally significant pests. This genus is not present New Zealand.

### **Other insects**

Several other insects were found including carpet beetles (*Anthrenus verbasci*), silverfish (Thysanura: Lepismatidae), cockroaches (Blattodea: Blattidae), flies (Diptera), flower beetles (*Sphaeroderma bayli*) and pirate bugs (Hemiptera: Anthocoridae). In most cases identification to species was not possible due to the condition of the specimen or to lack of literature. These specimens are possibly hitchhikers that have come with the couches, but may also be local contamination.

### **Fungi**

Overall, eleven couches were infested with fungi. These couches were all imported from China. From these, fourteen specimens of viable fungi were identified from the wood samples and all were common saprophytes known to already be present in New Zealand. Thirteen specimens were from the class Ascomycetes while one species (*Mucor* sp.) was from the class Zygomycetes. The Ascomycetes, *Paecilomyces variotii* and *Penicillium* spp. were the most abundant species of fungi. The species *Aspergillus niger*, *Chaetomium cochliodes*, *Cladosporium sphaerospermum*, *Paecilomyces variotii*, *Trichoderma viride* and *Trichoderma koningii* are already present in New Zealand.

Ten couches were infested with more than one species of fungi. Three couches had five fungal species, while two couches had six and one had seven fungal species.

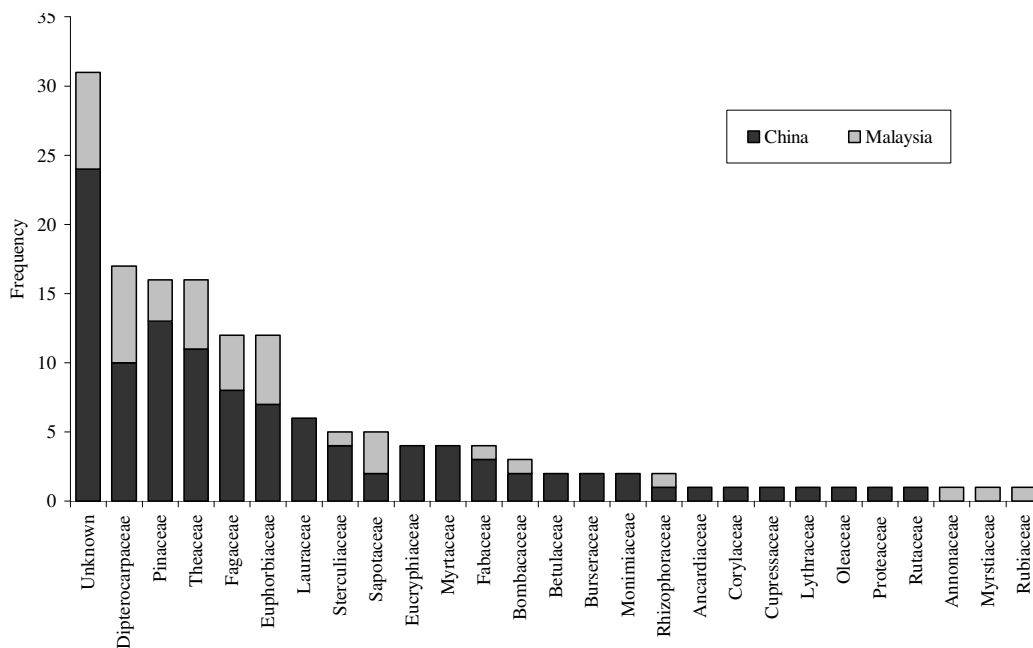
### **Wood identification**

The majority of couches had more than one timber type used in their construction. The median number of timber types was three. Nine couches had small amounts of plywood or particle board. One couch was made entirely out of plywood. In three cases, more than six types of timber were used.

When totalled across all couches, there were at least 65 different types of wood used in construction. Timber samples from 25 families were collected during the survey (Table 4). Both softwoods and hardwoods of temperate and tropical origin were used in the construction of couches. The predominant wood types in couches from China were softwoods from the families Pinaceae and Theaceae. The next most common wood type used in couches from China, and also the most commonly used wood type in couches from Malaysia, was hardwood from the tropical family Dipterocarpaceae (Fig. 3). Thirty-two samples of wood could not be identified with the available keys.

### Contaminants of upholstered furniture from China and Malaysia

Most of the wood types (all except Dipterocarpaceae and Burseraceae) have representative species present in New Zealand (Table 4). Four types of wood were identified from Pinaceae. Two of these, *Pinus* sp. and *Larix* sp., are considered economically important forest trees of New Zealand. Members of the citrus family (Rutaceae), which are also an economically important family to New Zealand, were also found. Eleven types of wood were identified from families that have native members present in New Zealand (Table 3). For example, the Fagaceae family has four species of endemic beech trees (*Nothofagus* spp.). Furthermore, the Myrtaceae has native species that include pohutakawa (*Metrosideros excelsa*) and manuka (*Leptospermum scoparium*).



**Figure 3. Frequency of timber types (identified to family) found in couches (n=49) from China and Malaysia.**

Eleven complete lounge suites were purchased for this study. Inspection of a single couch from a lounge suite was a good indicator of whether contamination was present or absent from other couches in the suite. Eight lounge suites were contaminated with some form of biological material. Each couch from the eight contaminated suites had similar levels and types of contamination as the others within the suite. This suggests that when couches are inspected and contaminants are found on a single unit then it is likely the remaining units would be contaminated.

Retailers that sold contaminated couches were contacted and asked if their couches had been fumigated. All retailers that were contacted indicated either verbally or by providing documentation that the couches had been fumigated.

Surveillance for biosecurity: pre-border to pest management

**Table 4. Representation of wood families used in the construction of Chinese and Malaysian couches imported into New Zealand. Grey highlighted families are not present in New Zealand (Donaldson 2006).**

Family	Native	Fruit/ nut	Forestry/ crop	Ornamental
Ancardiaceae	-	Present	-	Present
Annonaceae	-	Present	-	-
Betulaceae	-	-	-	Present
Bombacaceae	-	-	-	Present
Burseraceae	-	-	-	-
Corylaceae	-	-	-	Present
Cupressaceae	-	-	-	-
Dipterocarpaceae	-	-	-	-
Eucryphiaceae	-	-	-	Present
Euphorbiaceae	Present	-	-	Present
Fabaceae	Present	-	Present	Present
Fagaceae	Present	-	-	Present
Lauraceae	Present	Present	-	Present
Lythraceae	-	-	-	Present
Myristiaceae	-	-	-	-
Monimiaceae	Present	-	-	-
Myrtaceae	Present	-	Present	Present
Oleaceae	Present	-	Present	Present
Pinaceae	-	-	Present	Present
Proteaceae	Present	-	-	Present
Rhizophoraceae	-	-	-	-
Rubiaceae	Present	-	-	Present
Rutaceae	Present	Present	-	Present
Sapotaceae	Present	-	-	-
Sterculiaceae	-	-	-	Present
Theaceae	-	-	-	Present

The observed risk on this pathway was low due to effective intervention by importers. However, the low-grade materials utilised in the manufacture of couches suggests that in the absence of these voluntary interventions, the importation of upholstered furniture poses a risk of introducing forestry pests and pathogens. There were numerous types of wood used in the manufacture of couches, and couches with more types of wood were more likely to harbour insects. In addition, the presence of bark was a good predictor of other types of contaminants.

The rapid increase in the number of couches entering New Zealand over the last 6 years suggests that the residual risk on this pathway is likely to increase without the initiation of an increase in intervention practices. Future management of this pathway should focus on maintaining communication with industry to ensure ongoing voluntary compliance and ongoing inspection at the border.



---

Contaminants of upholstered furniture from China and Malaysia

---

Because of the difficulty in inspecting consignments of couches without damaging them, it may be possible to have couches arrive with no base cover to facilitate easier access to the internal cavity and wooden structure. The base covers could be easily added once the inspection is completed at very little cost.

Since this survey MAFBNZ has investigated five notifications of live insects associated with recently imported couches and has found that three out of the five notifications were positive for live exotic wood boring beetles.

MAF BNZ will be considering if further changes to the IHS and inspection processes can be accommodated.

### **Acknowledgements**

Thanks to the MAFBNZ survey team for their enthusiastic destructive sampling and specimen collection. Thank you to Lloyd Donaldson from Scion for wood identification and analysis of New Zealand wood families, and to Wellcome Ho for fungal identifications. Thanks also to the staff at Storage King in St Johns who were very helpful and accommodating in providing storage and destruction facilities for us during the survey. Thanks also to the retailers who responded to our requests for further information.

### **References**

- Arnett RH, Thomas MC, Skelley PE, Frank JH ed. 2002. American Beetles. Polyphaga: Scarabaeoidea through Curculionoidea,. CRC Press, New York. 861 pp.
- Donaldson L. 2006. Report on timber species from Chinese couches. Scion report prepared for the Ministry of Agriculture and Forestry. 6 pp.
- May BM. 1993. Larvae of Curculionidea (Insecta: Coleoptera): a systematic overview. Fauna of New Zealand #28. Manaaki Whenua Press, Lincoln, New Zealand. 226 pp.
- Thompson G, Froud K, Pearson H, Tohovaka S, Whyte C, McCarthy B 2006. Contaminants of upholstered furniture from China and Malaysia, June 2006, Biosecurity New Zealand, BMG 06-07/04.
- Wood SL 1982. The Bark and Ambrosia Beetles of North and Central America (Coleoptera: Scolytidae), a Taxonomic monograph. Great Basin Naturalist Memoirs. Brigham Young University, Provo, Utah. 1359 pp.