MAF BIOSECURITY PEST RISK ASSESSMENT

Spiders Associated With Table Grapes From United States of America (State of California), Australia, Mexico and Chile

12 June 2002

Indigenous Flora and Fauna Biosecurity Co-ordination

MAF Biosecurity
Ministry of Agriculture and Forestry
Wellington
New Zealand

MAF Biosecurity

MAF BIOSECURITY AUTHORITY

Ministry of Agriculture and Forestry
Te Manatu Ahuwhenua, Ngaherehere
ASB Bank House
101-103 The Terrace
P.O Box 2526
Wellington
New Zealand

Telephone: +64 4 474 4100
Facsimile: +64 4 470 2741
Internet: http://www.maf.govt.nz

Pest Risk Assessment for Spiders
Associated with Table Grapes from
United States (State of California), Australia
Mexico and Chile

12 June 2002

Prepared by the Indigenous Flora and Fauna Team:

Ms. Christine Reed (Project Leader)
National Adviser, Indigenous Flora and Fauna,
Biosecurity Co-ordination
MAF Biosecurity

Mr Sean Newland,
National Adviser, Indigenous Flora and Fauna,
Biosecurity Co-ordination
MAF Biosecurity

With advice from other members of the inter-agency project team:

Mr Justin Downs
National Adviser, International Operations - Imports
MAF Plants Biosecurity

Ms Verity Forbes
New Organisms Officer
Department of Conservation

Ms Sally Gilbert
Chief Technical Officer (Health)
Ministry of Health

Table of Contents Page

1. INTRODUCTION

1.1 GENERAL PROCEDURE

This pest risk assessment has been carried out using the MAF Plants Biosecurity Standard for Pest Risk Assessment (2001) as a guide. Exotic spiders associated with the table grape pathway were categorised up until recently as regulated non-plant pests (now referred to as regulated pests). These spiders have potential but largely unknown impacts on the environment. Some have known adverse effects on human health and this risk is addressed separately by a Ministry of Health assessment.

While a wide range of spiders have been documented as being found in vineyards, only those exotic spiders that have been intercepted on imported table grapes have been included in this assessment.

This is a qualitative assessment that estimates the likelihood of entry, establishment and spread, and associated potential environmental impacts. Uncertainties and gaps in the information identified during the estimation process are documented. The likelihood and consequences assessment for exotic spiders associated with the table grape pathway concludes with a statement describing the risk the organisms pose to New Zealand's environment.

MAF Plants Biosecurity uses the conclusions from pest risk assessments to assist in determining what pest risk management is required and the strength of any phytosanitary measures that may be specified in an Import Health Standard.

1.2 DEFINITIONS

Acceptable level of risk

The level of risk accepted by the importing country (New Zealand) given that zero risk is unattainable. Is applied in this document as the acceptable likelihood of entry of a pest given the application of phytosanitary measures.

Commodity[1]

A type of plant, plant product or other regulated article being moved for trade or other purpose.

Contaminating pest[1]

A pest that is carried by a commodity and in the case of plants, and plant products, does not infest those plants or plant products.

[1] International Standards for Phytosanitary Measures 5; Glossary of Phytosanitary terms
[2] Biosecurity Act (1993) (as amended by the Biosecurity amendment Act (1997)

Entry[1]

Movement of a pest into an area where it is not yet present, or present but not widely distributed and being officially controlled

Environment[2]

Includes:
(a) Ecosystems and their constituent parts, including people and their communities; and
(b) All natural and physical resources;
(c) Amenity values;
(d) The aesthetic, cultural, economic, and social conditions that affect or are affected by any matter referred to in paragraphs (a) to (c) of this definition.

Establishment[1]

Perpetuation, for the foreseeable future, of a pest within an area after entry.

Exotic[1]

Not native to a particular country, ecosystem or ecoarea (applied to organisms intentionally or accidentally introduced as a result of human activities).

Hitch-hiker pest[1]

See Contaminating pest

Interception (of a pest)[1]

The detection of a pest during inspection or testing of an imported consignment

Introduction[1]

The entry of a pest resulting in its establishment

Pest risk analysis[1]

The process of evaluating biological or other scientific and economic evidence to determine whether a pest should be regulated and the strength of any phytosanitary measures to be taken against it.

Pest risk assessment[1]

Determination of whether a pest is a quarantine pest and evaluation of its introduction potential

[1] International Standards for Phytosanitary Measures 5; Glossary of Phytosanitary terms
[2] Biosecurity Act (1993) (as amended by the Biosecurity amendment Act (1997)

Pest risk management[1]

The decision-making process of reducing the risk of introduction of a quarantine pest.

Post-border detection[1]

Detection of a pest after biosecurity clearance has been completed.

Preclearance[1]

Phytosanitary certification and/or clearance in the country of origin, performed by or under the regular supervision of the National Plant Protection Organisation of the country of origin.

Risk

For the purpose of this standard, **Risk** is equal to the potential impact of an event (e.g. a pest establishing in New Zealand) multiplied by the likelihood of the impact being realised (actually occurring) (Risk = Impact x likelihood). The impact, measured in this analysis in environmental terms, can occur at the entry, establishment and/or spread of a pest in an area.

Spread[1]

Expansion of the geographic distribution of a pest within an area.

Technically justified[1]

Justified on the basis of conclusions reached by using an appropriate pest risk analysis or, where applicable, another comparable examination and evaluation of available scientific information.

Transparency[1]

The principle of making available, at the international level, phytosanitary measures and their rationale.

[1] International Standards for Phytosanitary Measures 5; Glossary of Phytosanitary terms
[2] Biosecurity Act (1993) (as amended by the Biosecurity amendment Act (1997)

2. INITIATION OF THE PEST RISK ASSESSMENT PROCESS

2.1 INITIATION EVENT

This pest risk assessment has been undertaken because of the increased number of exotic spider detections in table grape imports from California during the 2000 and 2001 import seasons. The increase raised concern from the Department of Conservation (DoC) in terms of potential environmental risk, and from the Ministry of Health (MoH) in terms of the potential risk to human health from venomous spiders.

2.2 SCOPE

The scope of this assessment does not include all potential pathways by which these spiders may enter New Zealand, but follows the scope agreed by the relevant biosecurity agencies (below). It is assumed that existing phytosanitary measures (Appendix 1) are in place, but the assessment of risk does include a discussion on risk elevation in the absence of measures.

An inter-agency meeting between MAF Biosecurity Authority (MAF BA), DoC and MoH in November 2001 agreed that the scope of this assessment would be to assess:

"The likelihood of the establishment of the exotic spiders associated with the table grape trade in New Zealand"

An inter-agency project team was established in late 2001. In April 2002, the project team agreed to widen the scope of the assessment to include an assessment of environmental consequence.

Appendix 2 lists the detections of spiders associated with table grapes from 1999 until March 2002.

2.3 IMPORT HEALTH STANDARDS RELEVANT TO THIS PEST RISK ASSESSMENT

- Import Requirement Summary Commodity Sub-Class: Fresh fruit/vegetables, Grapes, *Vitis vinifera* from the United States of America (State of California) (June 2001).

- Import Requirement Summary Commodity Sub-Class: Fresh fruit/vegetables, Grapes, *Vitis vinifera* from Australia (December 2000).

- Draft Import Health Standard for Grape, *Vitis vinifera* (Commodity Class: Fresh Fruit/Vegetables) from Mexico (May 1998).

- 152.02 Import Health Standard for Importation and Clearance of Fresh Fruit and Vegetables into New Zealand including additional phytosanitary declaration for Chile.

2.4 OTHER PROCEDURES RELEVANT TO THIS PEST RISK ASSESSMENT

- Phytosanitary Procedures for the Effective Management of Poisonous Spiders Associated with the Importation of Table Grapes (*Vitis vinifera*) from California to New Zealand. 28 May 2001.

- AQIS Systems Operations Manual: Australia - New Zealand Bilateral Quarantine Arrangement (Version 3, issued 31 May 1999), Section 11.

3. PEST INFORMATION: IDENTIFICATION, SIGNIFICANCE AND DISTRIBUTION

There were 10 border interceptions and 47 post-border detections (and one presumed post-border) of spiders, eggs, or spiderlings from table grapes between 2000 and 2002. Of these 58 reports, 11 have been identified to Order only (Araneae), 8 to Family, 14 to Genus and 25 to Species (or near Species) level.

While the assessment covers 58 border interceptions or post-border detections of spider life stages, only 37 of these were confirmed as live or viable animals (Appendix 2).

The 11 intercepts to Order only were:

3 of eggs (unknown if alive or dead on detection);
2 of dead eggs;
3 egg sacs with recently hatched but dead spiderlings;
One of spiderlings (possibly Salticidae);
2 of unknown life stage and viability.

In addition to the 58 interceptions/detections, five other reports cover webbing or exudiae from spiders associated with table grapes. In these cases, a live spider was not detected. And one further report was of an egg sac only with no eggs present (possibly belonging to *Latrodectus* based on laboratory comment).

For pests identified to Family or Genus only, a description of their taxonomic group and their general habits is given. Only those organisms identified to species level are included in the full assessment of the risk of establishment.

Table 1 presents the number of border interceptions/post-border detections identified to the different taxonomic levels for each country of origin for the period 2000-2001. In the following text, discussion relates to exotic spiders of California origin unless otherwise indicated.

Table 1. Border interceptions and post-border detections of exotic spiders identified to the different taxonomic levels for each country of origin

COUNTRY	Location	ORDER	FAMILY	GENUS	SPECIES	TOTAL
Mexico	Border	0	0	0	0	**0**
	Post-border	0	0	0	0	**0**
Chile	Border	0	0	3	0	**3**
	Post-border	0	0	1	0	**1**
Australia	Border	2	0	0	1	**3**
	Post-border	0	0	0	1	**1**
California	Border	1	2	0	1	**4**
	Post-border	7	6	10	22	**45**
	Unknown	1	0	0	0	**1**
TOTAL	**Border**	**3**	**2**	**3**	**2**	**10**
	Post-border	**7**	**6**	**11**	**23**	**47**
	Unknown	**1**	**0**	**0**	**0**	**1**

3.1 SPIDERS IDENTIFIED TO FAMILY LEVEL (eight identifications to six families)

Phylum: Arthropoda
Class: Arachnida
Order: Araneae

Note that the number in brackets following the family name denotes the number of detections in that family.

1. Family: Theridiidae (1)
Common name: Cob-web spiders

The Theridiidae family consist of 73 genera and 2209 species of cob-web spiders world-wide (Platnick 2002). There have been no recent revisions or detailed studies that would provide up to date scientific names for representatives of the family in New Zealand. However, the most common genus of this family in New Zealand is *Achaearana*, commonly found around houses and gardens. This genus also contains species that inhabit forests and scrubland (Forster and Forster 1999). The family includes the native katipo spiders (*Latrodectus katipo* and *L. atritis*) found in coastal habitats. While most theridiids named in the early days of spider classification in New Zealand were placed in the genus *Theridion*, there are actually no native representatives in this group found here (Forster and Forster 1999).

Other notable species of theridiids found in New Zealand are *Steatoda grossa* (house cob-web spider) thought to have originated from Europe (Hann 1994, Forster and Forster 1999) and *S. capensis* (introduced from South Africa) which is considered to out compete the native katipo spider (Hann 1990) after natural (eg. storms) or human-induced (habitat disturbance) events.

The most common theridiids known to be associated with vineyards in California are *Theridion dilutum, T. melanurum* and *Cheiracanthium inclusum* (Costello and Daane 1995, 1997, 1999).

The widow spiders (*Latrodectus* sp.) are also contained in this family and one of these species (*L. hesperus*) has been associated with Californian vineyards (Costello and Daane 1995). Another 2 species of this genus (*L. mactans* and *L. geometricus*) have been intercepted post-border in New Zealand associated with table grapes. These three species will be considered further in the assessment.

The one detection at the border belonging to this family (not identified further taxonomically) was of dead eggs in November 2000 (Appendix 1).

2. **Family:** Clubionidae (1)
Common name: Hopping spiders

The Clubionidae family consists of 15 genera and 526 species of hopping spiders world-wide (Platnick 2002). Most species in New Zealand live in open areas on low tussocks, shrubs or flax but a few species are restricted to the forest (Forster and Forster 1999).

The yellow-sac spider *Cheiracanthium inclusum* was (until recently) included in this family but is now placed in the family Miturgidae. It will be considered in more detail, having been detected post-border on grapes and known to be present in large numbers in Californian vineyards (Costello and Daane 1995, 1997, 1999). Costello and Daane (1995) also found another member of this family, *Trachelas pacificus*, in vineyards of California.

The one detection in this family (not identified further taxonomically) was of dead eggs at the border in November 2001 (Appendix 1).

3. **Family:** Araneidae (3)
Common name: Orb-web spiders

The Araneidae family consist of 167 genera and 2801 species of orb-web spiders world-wide (Platnick 2002). Some sixty species were described from New Zealand in the late nineteenth century (Forster and Forster 1999) but their classification on a phenotypic basis led to many being named a number of times. Forster and Forster (1999) later revised this family to include 15 native and 5 introduced species in New Zealand. The commonest orbweb throughout New Zealand is the Australian *Eriophora pustulosa* found in gardens and moderately open areas. The Araneid *Neoscona oaxacensis* has been found associated with Californian vineyards (Costello and Daane 1995).

The three post-border detections of Araneidae (all from California) were spiderlings (December 2000), eggs and immatures, and an adult female in November 2000.

4. **Family:** Agelenidae (1)
Common name: Funnel weaver or grass spiders

The Agelenidae family consists of 42 genera and 490 species of these spiders world-wide (Platnick 2002). The taxonomy of this family in New Zealand is not well understood (Forster and Forster 1999). The most common Agelenid in New Zealand is the ubiquitous house spider *Tegenaria domestica* originally native to Europe but now world-wide in its distribution (Forster and Forster 1999). Genera within this Family are nocturnal, forest-floor hunting spiders.

The only published record of this family in vineyards is that of *Hololena nedra* in California (Costello and Daane 1995).

The post-border intercept from this family was an adult female in September 2001 from California.

5. **Family:** Gnaphosidae (1)
Common name: Stealthy spiders

The Gnaphosidae family consists of 115 genera and 1942 species of stealthy spiders world-wide (Platnick 2002). Only 10 Gnaphosid genera are known from New Zealand and 4 of these are recently introduced from Australia, with one species in each genera.

Costello and Daane (1995) found one member of this family *Nodocion voluntarius* in Californian vineyards.

The single detection of this family associated with table grapes was an adult female (possibly *Drassodes* sp.) in September 2001 from California.

6. **Phylum:** Arthropoda
Class: Arachnida
Order: Opilones
Family: Phalangiidae (1)
Common name: Harvestmen

The Family Phalangiidae or harvestman are not true spiders but are classified as relatives, belonging to the Order Opilones. Native harvestman are common in New Zealand but the most commonly encountered member of this family is *Phalangium opilio*, the common brown European harvestman (Forster and Forster 1999). No representatives of this order are noted by Costello and Daane (1995) in Californian vineyards.

The only detection of a harvestman was a live adult female in November 2001 of a species from California that is not known in New Zealand.

3.2 PESTS IDENTIFIED TO GENUS (14 identifications to 8 Genera)

1. **Taxonomic Group:** Arachnida**:** Clubionidae
Genus: *Clubiona* (3)

Platnick (2002) lists 424 species in this genus, 44 of which are found in the USA or North America and 11 in Chile. *Clubiona* sp. were thought to be related to *Cheiracanthium* and both have been reported as giving extremely painful bites (review by Bettini and Brignoli 1978 cited in Korszniak et al 1994). *Cheiracanthium* has subsequently been moved to a different family. Costello and Daane (1995) found no representatives of this genus in California vineyards.

Clubionidae (sac spiders) make a resting tube in a rolled leaf, or under bark or stones (Levi and Levi 1968).

One of the three detections of this genus was from Californian grapes in Auckland (December 2000) and the others were from Chilean grapes (at the border January 2002 and post border in

Invercargill February 2002). There are 13 species in this genus in New Zealand (Platnick 2002), all of which are endemic.

2. **Taxonomic Group:** Arachnida**:** Dictynidae
Genus: *Cicurina* (3)
Common name: Hackled silk spider

Platnick (2002) lists 128 species in this genus, the majority of which (109) are found in the USA. Cicurina are small funnel weavers that live in leaf litter and under stones. There are numerous species in North America and some in Europe (Levi and Levi 1968). There has been no reference to this genus being found in Californian vineyards (Costello and Daane 1995, 1997, 1999).

Two adult males and one adult female of this genus have been detected post-border in New Zealand in the period September to December 2001, all originating from California. The genus does not occur in New Zealand.

3. **Taxonomic Group:** Arachnida**:** Dictynidae
Genus: *Dictyna* (1)

Platnick (2002) lists 123 species of this genera, 42 of which occur in the United States.

The single border interception of this genus in January 2002 was from Chilean grapes. Two species are listed as occurring in Chile (Platnick 2002): *Dictyna togata* and *Dictyna trivirgata*. Platnick (2002) lists one species in this genus in New Zealand (*Dictyna urquharti*) but Forster and Forster (1999) do not include *Dictyna* in their list of three genera in this family in New Zealand. This anomaly may not have been addressed in revisions leading to the Forster and Forster publication (Phil Sirvid, pers. comm.). Marples (1959) discussed the New Zealand species as *Dictyna decolora*, with females collected from only two places in NZ and the male is not known at all (Phil Sirvid, pers. comm).

4. **Taxonomic Group:** Arachnida**:** Hexathelidae
Genus: *Hexathele* (1)
Common name: Tunnel-web spider

This genus of trap door spider is endemic to New Zealand, and contains 20 species (Platnick 2002) spread throughout the country (Forster and Forster 1999). As this genus is only present in New Zealand, the spider would have entered the grapes after biosecurity clearance at the border.

5. **Taxonomic Group:** Arachnida**:** Lycosidae
Genus: *Lycosa* (1)
Common name: Wolf spiders

Lycosidae (wolf spiders) are among the most common of spiders. There are 1500 to 2000 species of wolf spiders known world-wide. More than a hundred species occur north of Mexico. They make up a large proportion of the spider population in the Arctic or on high mountains.

Mayse et al (1998a) found Lycosid spiders to be the most common spiders (in a sample of over 1000 specimens) collected in pit-fall traps and canopy shakes from 4 vineyards in San Joaquin valley in the 1997 field season.

Lycosa are large, common wolf spiders. Most are nocturnal. Some hide under objects and others dig burrows (Levi and Levi 1968). Platnick (2002) lists 263 species in this genus world-wide, 10 of which occur in the United States. In New Zealand there are four endemic species represented in this genus (Sirvid, in press). Some are common around gardens but others are found on riverbeds and in alpine areas (Forster and Forster 1999).

Wolf spiders described by Costello et al (1995) in Californian vineyards are from different genera: *Pardosa ramulosa* which is day active, usually found on the ground but occasionally in canopy; and the less common *Schizocosa mccooki* which is conspicuous because of its large size.

The single post-border detection of this genus was an adult male in September 2001 from California.

6. **Taxonomic Group:** Arachnida**:** Salticidae
Genus: *Eris* (1)

Platnick (2002) lists 21 species in this genus and several of these extend into South America. Salticids are for the most part diurnal hunters and have highly evolved eyes, the most important characteristic of the family (Richman and Jackson 1992).

They are generalist hunting spiders, world-wide in their distribution. This genus was not identified in the studies of Costello and Danne in California vineyards, and does not occur in New Zealand.

The single border detection of this spider from Chilean grapes occurred in April 2001.

7. **Taxonomic Group:** Arachnida**:** Salticidae
Genus: *Phidippus* (3)

Platnick (2002) lists 85 species in this genus, the majority of which (50) occur in the United States. A number of other species in this genus are also found in Mexico and South America. *Phidippus* are larger than most other salticid spiders and are capable predators (Vest 2001). The most notable species of this genus is *Phidippus johnsoni*, which has been intercepted on California table grapes and will be assessed in more detail.

All three post-border detections (November and December 2000, January 2001) of this genus were male, one of which was an immature. Identification was not taken to species level. The genus does not occur in New Zealand.

8. **Taxonomic Group:** Arachnida**:** Theridiidae
Genus: *Euryopis* (1)
Common name: Comb-footed spider

Platnick (2002) lists 73 species in this genus world-wide, 17 of which occur in the United States. This genus was not identified in the studies of Costello and Danne in California vineyards. The family to which this spider belongs has been discussed in 3.1 (1). Platnick (2002) lists two species in this genus in New Zealand - *Euryopis nana* and *E. oecobioides,* both of which are endemic.

Euryopis funebris is an ant feeder, living under stones and bark in the eastern United States (Levi and Levi 1968).

The one post-border interception of this genus on California table grapes was an adult female in November 2001.

3.3 SPIDERS IDENTIFIED TO SPECIES (25 identifications to 10 Species)

1. **Taxonomic Group:** Arachnida**:** Araneidae
Name: Gea heptagon
Common name: Orb-web spider (1)

Gea heptagon is found in the south- eastern USA to Costa Rica (Levi and Levi 1968), West Indies, South Pacific Islands and Australia (Levi 1983, Platnick 2002). The genus is thought to have originated in Australia (Levi, 1983).

All members of this genus construct small orbwebs in low-lying vegetation to catch insects. There are several common New Zealand species that occupy the same ecological niche, most notably *Eriophora pustulosa*, also known as the common garden orbweb spider (introduced from Australia).

The single post-border detection of this species was an adult female in November 2001 from California.

2. **Taxonomic Group:** Arachnida**:** Desidae
Name: *Badumna* sp nr *longinqua*
Common name: Grey house spider (1)

The Australian grey house spider *Badumna longinqua* (formerly known as *Ixeuticus martius*) was first recorded in New Zealand last century. It is distributed throughout Eastern Australia and the United States (Platnick 2002). *Badumna* occurs commonly throughout the bush and especially under bark and around tree bases where foraging for invertebrates is fruitful. Its venom is toxic and severe necrotic lesions are known from its bite (Robert Raven, pers. comm.).

The adult female detected on table grapes from California in November 2001 was identified as "near" *longinqua* only. This would indicate the specimen resembles most closely the species indicated but may or may not be that species (Alan Flynn, pers. comm.). The record will not be assessed further given the presence of this species in New Zealand.

3. **Taxonomic Group:** Arachnida**:** Gnaphosidae
Name: *Oradrassus assimilis* (1)

This species is endemic to the USA (Platnick and Shadab 1975, Platnick 2002). It is found in the Western United States from Oregon east to New Mexico. It is recorded in many localities throughout California but is also in Arizona, Colorado, Oregon and Utah. Mature males of this species have been found from early May to late November, mature females from early February to mid-November. They have been located at elevations between 5000 and 10,000 feet under rocks and bark in montane forests (Platnick and Shadab 1975).

The detection of this species in New Zealand was a female from California in September 2001.

4. **Taxonomic Group:** Arachnida: Mitigurgidae
Name: *Cheiracanthium inclusum*
Common name: Yellow sac spider (1)

The yellow sac spider has recently been assigned to the Family Miturgidae from Clubionidae although this is not yet universally accepted (Sirvid, pers. comm.). Hence the literature (Costello and Daane 1995, 1997, 1999) records the species under the old family name. Appendix 1 retains the original nomenclature for this species.

New Zealand has 26 species within the family Miturgidae, of which only 2 are described (Sirvid, in press) and belong to a separate genus. Sirvid (in press) adheres to current accepted taxonomic practice and includes *Cheiracanthium* under the family Clubionidae.

Cheiracanthium stratioticum is the only member of this genus in New Zealand and is an adventive species, almost certainly here as a result of inadvertent human introduction (Sirvid, pers. comm.) being also found in Tasmania (Platnick 2002).

Cheiracanthium spp. have been associated with numerous cases of bites to humans but neither severe trauma or deaths have been reported in the United States (Ozane 2002). *C. inclusum* is also known to bite humans (Costello et al 1995). Yellow sac spiders can be found inhabiting wall voids or sacs constructed in the upper corners of rooms, resting during the day and hunting at night (Ozane 2002). The indoor population of *C. inclusum* in California increases significantly in the autumn when the weather cools and outdoor food sources decline (Ozane 2002). The species is nocturnally active and rests diurnally under leaves and in bunches of grapes (Costello et al 1995).

Costello and Daane (1995) found that this species was distributed across most California vineyards studied. It was represented at all sites in both years of their study and made up an average of 22.4% of spiders collected. Vineyard condition, cultural practices and leaf hopper density did not affect abundance. This suggests that it has a more plastic genome and is competitive under a wider range of conditions and prey types than the other spider species collected (Costello and Daane 1995). Similarly *C. inclusum* was the second most abundant spider in a later study (Costello and Daane 1999), with densities low in early season and peaking late in season.

The single post-border detection of this species was a dead adult female with an eggsac (unknown if alive or dead) in Nelson during October 2001.

5. **Taxonomic Group:** Arachnida**:** Salticidae
Name: *Phidippus johnsoni*
Common name: Johnson jumper (or red backed jumping spider) (7)

The distribution of *Phidippus johnsoni* in North America is bounded by Great Plains, Pacific Ocean, northern Mexico and Southern Canada. *Phidippus* is widely distributed west of the Rocky Mountains, is very common in many areas of California, and can be found all the way from beach debris at the seashore to 12,000 feet high in the mountains including coastal dunelands and oak woodlands. They frequently occur around human structures (G. B Edwards, pers. comm.). Adult and large juveniles of P. *johnsoni* are primarily ground dwellers, but the smaller juveniles often venture up into the vegetation (G. B Edwards, pers. comm.). They have been found in fairly dense vegetation but Jackson (1978) could not find any populations in either extensive closed canopy or desert habitats. Adults are one centimetre in length and population densities range between 2 and 30 spiders per 1000 sq.m. (Jackson 1976). Their main prey are flies (Diptera) followed by spiders, Homoptera (aphids mainly), Lepidoptera, Hymenoptera, Opiliones, Coleoptera and Dermaptera. While Diptera numerically constitutes most of their prey; spiders, moths and wasps may be more important in terms of biomass (Jackson 1977).

Johnson jumping spiders are generalist diurnal predators, stalking their prey with a highly developed visual system. They can be maintained in the laboratory on houseflies (*Musca domestica)* and *Drosophila melanogaster* (Jackson 1974).

Individuals are easily located in the field when occupying their nests, and hence they have been studied intensively (Jackson 1974, 1976, 1977, 1978, 1979, 1980; Jackson and Griswold 1979). Their preferred habitats differ in temperature and precipitation patterns. California is suitable for the species despite hot dry summers and wet cold winters. Males are smaller than females. In the laboratory, immatures take 6 to 7 months to reach maturity at 24°C when adequately provisioned with food (Jackson 1978).

There are some reports of people being bitten by this spider in California and some discomfort resulting, but the species is not considered to be dangerous (Jackson, pers. comm.).

Four adult females and one adult of unknown sex were detected post-border in late October/mid November 2000, and another female was detected the following January. Note that the 3 *Phidippus* individuals not identified to species (section 3.2 (7)) were also detected over that period. With the exception of a single female detected in November 2001, 9 of the 10 *Phidippus* finds are thought to have resulted from one consignment traced back to a single facility with a faulty fumigation fan. This facility no longer exports grapes to New Zealand.

6. **Taxonomic Group:** Arachnida**:** Theridiidae
Name: *Latrodectus geometricus*
Common name: Brown widow spider (1)

Latrodectus geometricus is a cosmotropical (including Florida, South America, Spain, Saudi Arabia) species but is most widespread in Africa and is probably native there (Levi 1959). Smithers (1944) however believes it was introduced to Africa. This spider is found on houses and buildings in Florida where it is thought to have been introduced (Levi and Levi 1968). They are found in similar habitats in South Africa where they may be "in a ventilator, behind pipes, under eaves, any corner that affords shelter for the nest and where there is a plentiful supply of insects" (Smithers 1944). It is also found in Australia.

This species is less likely to bite than the black widow but is more venomous (Forster and Forster 1999). It has a tufted and fluffy egg sac (Levi and Levi 1968). Nests and webs of *L. geometricus* are most often in and around buildings, in any corner where shelter and food supply are found. They are also found under the bark of trees and occasionally in thick tufts of grass or bushes.

In New Zealand, specimens have been collected from a fishing boat some years ago, and the species reportedly entered Australia (Forster and Forster 1999) via motor vehicle imports (Sirvid, pers. comm.) and is now established there.

The one specimen intercepted post-border was an adult female (from California) in October 2000. The detection is unusual given the restriction of this species to Florida in the country of import origin, but identification is not thought to be inaccurate (Dave Voice, pers.comms).

7. Taxonomic Group: Arachnida**:** Theridiidae
Name: *Latrodectus hasselti* (2)
Common name: Red-back spider

Latrodectus hasselti or the Australian redback spider is found from Southeast Asia to Australia and in New Zealand (Platnick 2002). Between 1966 and 1978, at least 16 redbacks are known to have been detected in New Zealand on a range of goods either imported from, or via Australia. At least 20 more of these spiders were intercepted from 1978 until 1982.

Three females were discovered in Central Otago in 1981 (Forster 1984) and the species is now accepted as being established in New Zealand. There have been reports of redbacks from Christchurch, Dunedin, Wanaka, Twizel, Te Anau, Greymouth, Auckland and Culverden (Forster 1984, 1985); as well as from Taranaki and the Wairarapa (McCutcheon pers. comm.). The distribution of this spider is not yet widespread geographically, and the main populations are most likely confined to Central Otago and possibly New Plymouth in some of the warmer buildings (e.g. factories). They are not in large numbers in the latter site (Sirvid, pers. comm., McCutcheon, pers. comm.). There are anecdotal but unconfirmed reports of colonies existing in Auckland (Sirvid, pers. comm.).

The redback is larger and more aggressive than New Zealand's native katipo, and is found in both inland and coastal areas of Australia. It prefers areas of human habitation (Forster 1985) and dark gloomy sheds where they can attach webs to metallic surfaces (Softly and Freeth 1970). Solitary females with egg sacs can be found on these webs from September to March (Softly and Freeth 1970). The female has a venomous bite. Before vaccines became available in 1953, an estimated 5% of recorded bites were fatal. Males are not venomous.

The most likely limiting factor for their distribution in New Zealand is their requirement for a period of sustained warm conditions taking 2-3 months of 15-25^{o}C temperatures to reach maturity (Forster 1985). They are capable of surviving cold temperatures in winter, providing that summer conditions allow breeding and growth of spiderlings to maturity.

As this species is present in New Zealand, it will not be assessed further but information on this representative of the Theridiidae family is relevant to the assessment for widow spiders.

8. Taxonomic Group: Arachnida**:** Theridiidae
Name: *Latrodectus hesperus* (5)
Common name: Western black widow spider

The Genus *Lactrodectus* is cosmopolitan. It comprises medium-sized spiders that are the largest of the Family Theridiidae (Kaston 1970). *L hesperus* is the only species in this genus found west of the middle of Texas, Oklahoma, and Kansas to the Canadian provinces (Kaston 1970). Their distribution is listed (Platnick 2002) as Western USA, southern Canada and Mexico, with a single record from Israel. *L. hesperus* does occur in Mexico and *L. curcacaviensis* is known from Chile (Sirvid pers. comm.).

Despite the fact that the black widow is well known, there have been no new distribution studies on the spider since Kaston (1970) (Vetter, pers. comm.). The western black widow exist in good numbers in all kinds of habitats. They are found in coastal regions in San Diego near Mexico, in the hot deserts where temperatures get up to 120 degrees (46^{o} C) and in the mountains which are covered by snow in winter. Populations in mountainous Colorado (which is about 1500 m or higher over the whole state) have no trouble surviving the winter (Vetter, pers.comm). Black widows are not common in wet, cold Seattle but they are very plentiful on the east side of the mountains in the high elevation, desert plains area (Vetter, pers.comm). These spiders are not very common in Oregon and Washington along the wet coastal regions but are very plentiful on the drier, leeway side of the mountain range. The species is common throughout California from the coastal regions to inland deserts and up to the mountains. They are also in Idaho and possibly Montana (Vetter, pers. comm.). Martindale and Newlands (1982) (cited in Kavale 1986) also describe *Latrodectus* as nocturnal and "usually found in dry regions between 50° North and 45° South".

Although *L. hesperus* is often associated with urban development in North America, they have also successfully invaded desert habitats in the Southwest. They are able to survive and compete because of their effective integumental waterproofing, combined with other appropriate physiological and behavioural modifications (Hadley and Quinlan 1989). These comb-footed spiders construct webs to catch insects. The snare is a retreat deep inside vegetation or other substrate upon which the web is built (Kavale 1986). Their normal moisture requirement is derived from prey, generally ground-dwelling insects such as beetles and slaters (McKeown 1952). Wet springs may produce lots of insect prey and hence, good spider survival (Vetter, pers. comm.). They can be exceedingly plentiful and about 40 large females can be collected in an hour in some localities (Vetter, pers. comm.). In one weedy litter-filled lot in Brawley California (Kaston 1970) 100 adults were located in a 120 x 150 foot area.

Female *Latrodectus* are larger (12 mm long) than males (4 mm) but have a body mass many more than three times larger. They have a relatively large abdomen that is high and subglobose. The abdomen of the female is shiny black with both sexes having a red, hourglass shaped mark on the ventral surface (Kaston 1970). The male body is small to medium with a brown background to the abdomen and a light swirl pattern (Costello et al 1995). Most male *L. hesperus* weigh 8 to 18 mg, whereas females weigh 120-400 mg. Gravid females may be 940 mg or more. The venom glands are large and extend back to the cephalothorax. Males are a much smaller size and more brightly coloured, with relatively longer legs, and have a lower and narrower abdomen ellipsoidal in appearance.

Black widows will attack and eat almost anything that comes into their snare. They are nocturnally active, sitting to wait for prey. The females are not inclined to bite humans unless contacted and the male seldom if ever bites (Costello et al 1995). Their prey includes crickets and cockroaches (Costello et al 1995).

9. **Taxonomic Group:** Arachnida**:** Theridiidae
Name: *Latrodectus mactans* (4)
Common name: Black widow spider

Latrodectus mactans is common in the South Eastern states but is found as far north as Southern New York, southern New England, west through southern Ohio, Indiana, Illinois, Missouri, to about central Kansas and through to central Oklahoma and Texas. It has been reported in Louisiana from relatively dry situations (in piles of stones, in culverts, fence corners, under steps, in burrows of animals, human habitations, tobacco barns and corners of rooms and basements).

The species was recorded by Levi (1959) as occurring through most of the mid to lower US, Europe and Mediterranean, southern portions of Africa, Madagascar, Seychelles, India to NZ.

But many of these records have subsequently been described as different species and subspecies, and there has been no subsequent revision of the genera since Levi's work. In the southern USA, the species is found under stones and pieces of wood on the ground, about stumps, in holes and about outbuildings. They are generally distributed in warm areas of all continents including California.

10. **Taxonomic Group:** Arachnida**:** Theridiidae
Name: *Steatoda grossa* (2)
Common name: House cobweb spider

Steatoda grossa is a cosmopolitan member of the Theridiidae family (Levi and Levi 1968, Platnick 2002). Four species of *Steatoda* are present in New Zealand including *S. grossa* and *S. capensis* (both introduced*)* and two endemic species (*S. lepida* and *S. truncata*) described in Hann (1994). *S. grossa* is the largest of the four species, with records in NZ dating back to 1885 (Urquhart 1885 cited in Hann 1994) when it was first described as *Theridium sericum. S. grossa* has a wide geographical distribution including some of New Zealand's outlying islands. It has also been clearly dispersed by human activity and there is no evidence that the species is found in other than commensal locations (Hann 1994).

S. capensis is common in South Africa where it is the commonest species in and around houses. It is found throughout the North Island of NZ from Cape Reinga to Cape Palliser. Most specimens are from the coast, where they are found under logs and in marram, but they are also found around dwellings. There are far fewer records from South Island, but they are found in Nelson, Marlborough, Canterbury and Otago. "*S. capensis* is clearly spread by human activity, and the much larger human population in the North Island would account for its rapid spread throughout this area (Hann 1990)". They feed mainly on common sandhoppers *Talorchestia quoyana* (Amphipoda) and a variety of Coleoptera. *S. capensis* is also found in Australia with records from Perth, Melbourne and Canberra.

The endemic *S. lepida* is distributed on both the North and South Islands of New Zealand, the Chatham Islands and Three Kings Islands. They are found in both mountainous and lowland areas, and (like *S. truncata*) are found under logs on the coast and under rocks in riverbeds. The second of the endemic species, *S. truncata*, is widespread in the South Island but has also been recorded in Wellington, Hawkes Bay, Tongariro and Wairarapa.

As this species is present in New Zealand, it will not be assessed further but information on this representative of the Theridiidae family is relevant to the assessment for widow spiders and will be included in later discussion.

3.4 Summary of Pests for Further Assessment

Three of the 10 species identified from post-border detections (*Badumna sp. nr longinqua, Latrodectus hasselti, Steatoda grossa)* are excluded from the remaining assessment as they are already established in New Zealand.

Life history information on *L. hasselti* is included where it is relevant to discussion of other theridiids being assessed (i.e. *L. hesperus*, *L. mactans* and *L. geometricus*).

The likelihood of entry for the remaining 7 species of spider (*Cheiracanthium inclusum, Gea heptagon, Latrodectus hesperus, L. mactans, L. geometricus, Phidippus johnsoni, Oradrassus assimilis*) will be discussed collectively, detailing literature and current knowledge relevant to each individual species where it exists. Similarly, the likelihood of establishment and spread of these species will be discussed collectively.

4. LIKELIHOOD OF PEST ENTRY WITH TABLE GRAPES

The risk of spiders entering New Zealand in any life cycle stage will depend on the number of spiders present in the area from which the commodity is sourced, an association with the commodity itself (i.e. the grape bunches), the volume of the commodity imported and the phytosanitary measures applied.

4.1 Number of spiders present in the area from which the commodity is sourced

Spider populations in California have been well studied, predominantly from the view of these predators as biological control agents for agricultural pests (Costello and Daane 1995, 1997, 1998, 1999; Costello et al 1995, Roltsch et al 1998). Information on spider life histories from these vineyards is not available however, except for some seasonal abundance measures (Costello and Daane 1995). There is no published information about spider populations from vineyards in Chile, Australia or Mexico.

Costello and Daane (1995) sampled 7 vineyards in the San Joaquin valley in 1992 (Fresno and Madera Counties) and 1993 (Fresno and San Joaquin counties). Factors that can affect the spider fauna in these vineyards included the age of the vineyard, abundance of prey, use of pesticides, and vineyard practices (such as trellis systems, irrigation and ground cover) that change the environmental microclimates. They recorded 27 species of spiders.

In all but one of these vineyards, 8 species constituted more than 80% of specimens. These were:

- *Cheiracanthium inclusum*,
- *Trachelas pacificus*,
- *Theridion dilutum*,
- *Theridion melanurum*,
- *Oxyopes salticus*,
- *Oxyopes scalaris*,
- *Hololena nedra*, and
- *Metaphidippus vitis*.

This study found that three species (*C. inclusum*, *T. dilutum* and *T. melanurum)* made up more than 30% of spiders collected. In three of the vineyards sampled, *Cheiracanthium* and *Theridion* constituted more than 60% of the specimens collected.

The species with the most even distribution was *C. inclusum,* represented at all sites in both years and making up an average of 22.4% of spiders collected. *Theridion* spp. abundance varied greatly among vineyards comprising more than 40% of specimens in some vineyards and less than 1% in others. Distribution of this genus was explained by the presence or absence of understorey vegetation, and was positively correlated with leafhopper density (Costello and Daane 1995). In a further study, *Theridion* were not predominant (Costello and Daane 1998). But Costello and Daane (1999) again found them to be the most abundant spider group, with the highest density in both the early and late season, but equivalent with *C. inclusum* mid-season. *C. inclusum* was the second most abundant spider, with densities low in the early season and peaking late in season. None of the other six species considered in this assessment (including the

Latrodectus) were identified in this study. Similarly, Mayse et al (1998b) found *Theridion* spiders were by far the most common species (using leaf count sampling). *C. inclusum* was a distant second in terms of population density.

Juveniles made up most of the spiders collected by Costello and Daane (1995), and by harvest their numbers had reached population peaks in 7 of the 8 main species (the exception being *H. nedra*). Adult numbers of *T. dilutum*, *M. vitis* and *T. pacificus* also peak just after harvest but the other species (including *C. inclusum*) peak early in the season and then decline as juveniles become more predominant.

In California vineyards, *L. hesperus* have a habitat preference for deep vine trunk crevices or irrigation pipe stands but can be found in canopy and bunches (Costello, pers. comm.). They are extremely uncommon, *L. hesperus* being found in only 1 of the 3 plots sampled by Costello and Daane (1998). They were less than 0.1% of the overall spider species composition.

Roltsch et al (1995) also sampled 11 central California vineyards monthly and found the same species as Costello and Daane (1995) although the 2 species of *Theridion* and 2 species of *Oxyopes* were not described (presumably *Theridion dilutum*, *Theridion melanurum*, *Oxyopes salticus*, *Oxyopes scalaris*). They also recorded 4 salticid species and while *Metaphidippus vitis* is not mentioned, this species was also presumably one of these salticids.

Other researchers have reported that a relatively small proportion of the number of species present in agroecosystems dominate the spider fauna. Three of 41 species collected by Dondale et al (1979) (cited in Costello and Daane 1995) made up from 50 to 76% of the spider community in a Quebec orchard. And 7 out of 97 species collected by Dean et al (1982) (cited in Costello and Daane 1995) made up half the spiders found in east Texas cotton.

In all of these studies, sampling of spiders can be affected by their diel activity rhythms, their life history and their behavioural characteristics. To sample each species reliably, sampling efficiency of each method for each species must be known. Roltsch et al (1998) showed that no sampling method works well for all vineyard spiders. The funnel method can often overestimate spider abundance, while drop cloth and D-vac methods underestimate it. The funnel method was favoured by Costello and Daane (1997) although no single sampling method was best for all spider species. The sampling techniques utilised by these authors dislodged spiders from everywhere on the vine: trunk, cordons, leaves and clusters (Costello, pers. comm.).

During their study of spider populations in vineyards of Fresno County from 1993 to1995, Costello and Daane (1998) found species diversity on ground cover was considerably different from that found on vines above, suggesting that there was little movement between the ground cover and vines..

Spiders are susceptible to many classes of insecticides and pesticides (Roltsch et al 1998). They can be quite abundant in established well balanced vineyard ecosystems but may also reach high densities in non-insecticide treated vineyards during the first leaf growth season (Mayse et al 1998a). They have been shown to be twice as abundant in organic plots compared with conventional plots (Mayse et al 1998b).

Even insecticides applied early in the season have been shown to have a marked season-long negative effect on spider populations found in commercial apple orchards in Massachusetts. The effect may differ depending on the spider species (Wisniewska and Prokopy 1997).

Latrodectus spp. are particularly associated with human habitation and buildings. Therefore the extent to which packing and storage facilities, and packaging itself is kept spider free will also affect the risk of entry.

Summary

Spiders of predominantly eight species are common in Californian vineyards with at least four of these species known to associate with grape clusters. While there is no information from Australia, Mexico or Chile, it is very likely that species with similar habitat requirements are also present in these vineyards. From the interception/detection information presented in Section 3.3, the species most commonly intercepted on table grapes in New Zealand have been *L. hesperus*, *L. mactans*, and *P. johnsoni* which are not those most common in vineyards. Apart from the multiple records post-border of these 3 species in this commodity, and two reports each of *L. hasselti* and *S. grossa,* all other intercepts are of single occurrences of a species. This pattern does not reflect the spider populations known from Californian vineyards, where species such as *Theridion* and *C. inclusum* predominate but are not detected post-border in New Zealand (with the exception of one dead adult female *C. inclusum* attached to her egg sac). *Latrodectus* and *Phidippus* are both very uncommon in vineyards (Daane, pers. comm., Costello, pers. comm.) and are generally associated with human dwellings (although found in other habitats as well).

The possible reasons for the discrepancy between vineyard populations and post-border detections may be:

a) under-representation of some species in the sampling methods of Costello and Daane, and other authors. This is unlikely but their studies did not take place in Kern or Tulare Counties where grape imports to New Zealand are sourced, and where there are higher populations of *Latrodectus* (Costello, pers. comm.);

b) infiltration of the spiders into the commodity post-harvest;

c) fumigation efficiency may be higher for the more common vineyard species;

d) a higher public profile for the spiders of human health concern (and therefore over representation in reporting).

The number of spiders associated with vineyards may have increased in recent years with the move to minimise pesticide use.

4.2 Volume of grapes imported

In 1997, New Zealand imported approximately 20.23 million bunches of grapes from California (MAF Biosecurity Authority estimate) but this volume declined to between 4.45 million (1998) and 9.5 million bunches (2000) in more recent years. Trade volumes are presented in Table 2 for California (1993 - 2001) and Australia (1998 - 2001).

Table 2. Trade volume (metric tonnes) from California and Australia to New Zealand

Year	California*[1]	Australia*[2]
1993	2971	
1994	3484	
1995	3660	
1996	3988	
1997	4985	
1998	2467	3904
1999	2922	3395
2000	3217	2883
2001	2527*[2]	2032

*[1] USDA data
*[2] MAF Biosecurity Authority

Table grape imports from Mexico between 1998 and 2000 totalled 360 tonnes before the trade was suspended due to concerns about the spread of Glassy-winged sharpshooter (*Homalodisca coagulata*). Between 1998 and 2000, 2400 tonnes of grapes were imported from Chile.

4.3 Association with the commodity

4.3.1 Adults

There have been 31 live adult spiders found on table grapes in the past 3 seasons.

Adults from eight main species have been reported in the literature as being associated with vineyards in California (Section 4.1) and four of these have an association with the grape clusters on the vines. These spiders include *Theridion dilutum* and *T. melanurum* that are day active and wait for prey in leaf undersides or grape bunches, and *Cheiracanthium inclusum and T. pacificus* that are also commonly encountered in grape clusters. Only one of these four species (*C. inclusum*) has been found associated with the commodity during the export process to New Zealand.

C. inclusum lay egg sacs primarily in the spring and early summer (May-June), and are not seen in the clusters until later in the season (Costello pers. comm.). These spiders overwinter under the bark of the vine trunk in life stages that span from half-grown juveniles to adults. They are long lived and have overlapping age structures (Costello and Daane 1995). The spiders begin the season established in the vineyard and in late developmental stages. It is also semiparous, dying soon after the spiderlings have hatched. A single female was intercepted in October.

While *L. hesperus* is not one of the eight most abundant species found in studies of California vineyards (and is in fact rare in that habitat), this species has also been seen associated with grape bunches (Costello, pers. comm., and Appendix 1).

Latrodectus are rare in vineyards, being found in only 1 of the 3 study plots of Costello and Daane (1998) where they comprised less than 1% of total species composition. The mean longevity (emergence to death) in this species is 146 days for males and 481 days for females and so both will be present during the grape picking season as adults. The main period for locating males is March to October, with the majority in August and September (Kaston 1970).

Latrodectus mactans (although not reported from the vines and fruit) are found throughout the year, but they are inactive in regions during cold winters. Mature females may be found at any time as they live longer than one year. Males have a shorter life span and mature males are mainly found during the warmer months.

In total, 12 adult *Latrodectus* spiders have been intercepted from California, the majority of which are females (i.e. seven of the eight animals of known sex). These females have been detected in all months from October to December. The only male detected was found in November.

Two adult redback spiders (*L. hasselti*) have been found as adults on grapes from Australia. One of these was intercepted before leaving Australia.

P. johnsoni is also known to inhabit vineyards but is not common (Costello et al 1995). Active *P. johnsoni* are found in all months of the year in beach and coastal range populations, but are also probably inactive for much of the year in alpine populations. The species probably has a fairly short breeding season in grape growing areas and reproduce in the spring before the rains end. Adults may be scarce in summer, with small juveniles on vines during that period, but probably rarely seen (Jackson pers. comm.).

There have been six (possibly seven) adults of this species intercepted on grapes. Three further adults have been detected or intercepted belonging to the *Phidippus* genus. All of the six known-sex spiders identified to species were female. The three *Phidippus* sp. animals were all male (2 adults and a single juvenile). As discussed in 3.3 (5), 9 of the 10 detections of *Phidippus* are likely to have resulted from one non-compliant consignment.

There is no information on the lifestages of *O. assimilis* or *G. heptagon.* One adult of *O. assimilis* was intercepted in September and one (presumably adult) *G. heptagon* detected in from California in November.

4.3.2 Eggs

Most *Latrodectus* build their webs close to the ground. Webs of *L. hesperus* have been reported from holes formed by ground dwelling mammals or uneven ground, and along roadsides. They are also found in trash and sheds, sometimes six or more feet above the ground. Other favoured sites are along the outside of houses close to ground level. *Latrodectus* egg sacs are ordinarily suspended in the web, in or near the retreat if one is built. There is no evidence of widow spiders laying egg sacs in grapes, but given the rare occurrence of these spiders in bunches, egg sacs are likely to be even rarer (Costello pers. comm.). A post-border detection of a female *L. hesperus* in November 2001 was associated with webbing in a bunch of grapes.

One post-border detection of a non-viable egg sac (November 2001) is described as aged and had probably served its purpose before harvest but the possibility that this was not a widow egg sac could not be excluded. The texture was similar to that seen by the laboratory technician in California vineyards (Dave Voice, MAF Operations, pers. comm.).

P. johnsoni construct conspicuous silken nests (retreats) under rocks and wood on the ground and similar locations. Moulting, oviposition, and sometimes courtship and mating occur in these nests.

Redback spiders (*L. hasselti*) have not been reported to lay eggs in grape clusters. There is no information on *G. heptagon* or *O. assimilis* association of eggsacs with the commodity.

Nine egg sacs have been detected post-border in grapes from California although these have been identified to Order only in six cases and to Family level in the remainder.

4.3.3 Spiderlings

Spiderlings associated with table grapes have been found three times in the past two years. In November 2000, eggs and immature spiders of the family Araneidae were detected. As they were frozen before being sent to the laboratory, it is not known if they were alive or dead on detection. A second detection of spiderlings (Araneae indeterminate) recently hatched from an egg sac was recorded in December 2000. Two live (and a number that were dead) spiderlings were detected in October 2001, and these spiders were possibly salticids.

4.4 Effect of grape variety

Of the 21 interceptions or detections for which the grape variety is known, the majority (19) involve 'Red Globe". The other 2 varieties reported were "Flame" and "Ribier". However, only 52% of reports specified the grape variety.

Figures are not available for 2001, but 41 percent of the total boxes shipped to New Zealand in 1999 and 31 percent of boxes in 2000 were Red Globes (Kathleen Nave, California Table Grape Commission, pers. comm.). This variety appears to be reported associated with spider detections more often than expected given the overall percentage of this grape variety imported. There are a number of possible reasons for this including a lack of reporting follow-up for other varieties. But the most likely explanation is the loose nature of grapes within this variety that either provides more retreats in which spiders can hide, or better visibility and therefore an increased likelihood of visual detection. Another possibility may be that this grape variety is favoured more by *Phidippus* and *Latrodectus* spiders (as these genera are reported in 12 of the 19 reports involving this grape variety) than by other spider species present in vineyards and packing houses.

Eight of the 19 reports from Red Globe grapes (all *Phidippus* spiders) relate to the non-compliant consignment unpacked in New Zealand from October 2000 to January 2001.

No conclusions can be drawn without further investigation or research.

4.5 Survival post-harvest

Table grapes from California are visually inspected on picking, and directly packed into boxes before fumigation with a mixture of 1% SO_2 and 6% CO_2 (at a minimum fruit pulp temperature of 16 ^{o}C for 30 minutes). Grapes from Mexico and Chile are not required to be fumigated before export because venomous spiders have not been found to be associated with this pathway. The Import Health Standard for grapes from Australia requires SO_2/CO_2 fumigation for redback spiders.

The efficacy of SO_2/CO_2 treatment for widow spiders under the above fumigation regime is 92% under best conditions (Shorey and Wood 1992, unpublished report). This validation was based on female widow spiders and is likely to be lower for males (Shorey and Wood 1992, unpublished report). The efficacy does lower significantly if the concentration of the gases is lowered. The efficacy of this treatment on eggsacs and juveniles is unknown.

A 2001 research project commissioned to replicate Shorey's research had similar results, with the exception of the SO_2/CO_2 treatment on grapes packed into "corrugated" shipping boxes (Ross Jones, California Table Grape Commission, pers. comm.). The treatment conducted on corrugated boxes resulted in an efficacy level for black widow spiders below the industry's requirement. The industry immediately and voluntarily pulled that box type from the NZ protocol (Ross Jones, California Table Grape Commission, pers. comm.). This report however, was not available for review in preparation of this assessment.

After picking, packing and fumigation, table grapes from California are stored at $1^{o}C$ for one to 30 days. The produce is then shipped at $1^{o}C$ taking a minimum of 21 days to reach New Zealand. On arrival, the grapes may be stored at $1^{o}C$ for between one and 60 days. The minimum storage time at $1^{o}C$ would be 23 days and the maximum is 111 days. In reality these temperatures may be higher for at least part of the shipping process.

Grapes from Australia are air-freighted in the first two months of the season (January and February) at a temperature of 2-$3^{o}C$, taking approximately one day to reach New Zealand. From March to May when there are higher volumes, they are freighted by sea at a similar temperature, taking four to five days. Grapes from Mexico and Chile take approximately 18 days to reach New Zealand by sea. They are also stored at 2-3 ^{o}C.

In California, 920 grape bunches per consignment are visually inspected by the United States Department of Agriculture, Animal ahd Plant Health Inspection Service (USDA APHIS) before export. NZ MAF inspects a similar sample from each consignment. In the 2000 season, a total of 84,000 bunches were inspected from California and 5400 bunches from Mexico. Mexico, Australia and Chile have an inspection rate of 600 bunches per consignment. The rate is higher for California grapes because of the confidence needed to detect Glassy-winged sharpshooter (*Homalodisca coagulata*), rather than being a measure specifically for the detection of venomous spiders.

The period of transport probably has little effect on adult *Latrodectus* spiders. *L. hesperus* can generally endure long periods of fasting. Of 37 females kept without food from the first day of moulting to maturity, only one died (after 36 days) and the longest survived 193 days. Eleven lived over 100 days and their mean longevity was 89.3 days (Kaston 1970).

The optimal temperature for egg development in most *Latrodectus* species is $25^{o}C$ (Downes 1985, 1987). Downes (1987) found that chilling eggs and nymphs for 3 months resulted in no further development of eggs, and that chilling arrested growth in nymphs. Subadult females held at 10 ^{o}C survived 165 days. At lower temperatures, metabolism is lowered by cold and by starvation, thus limiting their ability to catch prey and recover. Spiders recovered well when fed after prolonged periods of food deprivation even if near death. Even consumption of one or two flies is enough to double their "starvation" life expectancy (Downes 1987).

Food deprivation tests indicate that most sub-adult and adult female *L. hasselti* would be able to endure long periods of starvation if incarcerated in cargo (Forster 1984, Forster and Kavale 1989). Sub-adults can survive up to 160 days, and some adults for more than 300. Even after 2-3 months without food, most spiders recover. Forster (1984) held 25 *L. hasselti* spiderlings outdoors where they were subjected to variable winter conditions including 63 frost days in 5.5 months. There was high survival of spiderlings but those not fed all died without moulting (surviving only 35 days). Egg sacs held at 9^{o}C for 45 days failed to hatch on return to room temperature. Spiderlings in sacs, and adults of various ages survived periods of 56 days at a temperature of 7-9^{o}C. They thrived when returned to room temperature. Eggs will also survive 63 hours immersed in water but spiderlings will not (Softly and Freeth 1970).

Phidippus johnsoni is able to survive at altitudes of 3000 m in the Sierra Nevada and the Rocky Mountains where they spend most of their lives under snow. Under stones in the snow, they can survive without feeding for 6 months or more. They could also survive the post-harvest cool storage. Adult females and immatures survive the winter in alpine habitats but not males. Immatures can survive several months without food when exposed to cold temperatures (Jackson 1978).

There is no information on the ability of *C. inclusum*, *G. heptagon* or *O. assimilis* to survive fumigation treatment and periods of fasting with cool temperatures. But the survival of at least one individual of each of the latter 2 species to post-border, indicates that this is possible (but very rare). The only interception of *C. inclusum* was of a dead adult.

4.6 Summary of risk of entry

California

The overall likelihood of entry through the table grape pathway is **low** (even though import volumes are high) for the 7 exotic spiders assessed given;

a) their relatively low abundance in vineyards (compared with other spiders);
b) the known association of only a small number of these species with grape bunches;
c) a 92% efficacy of fumigation treatment (if used to specified standards: note that while this level of efficacy is demonstrated for widow spiders, efficacy on other spiders is unknown but assumed to be similar);
d) some mortality (although not quantified) of egg sacs and spiderlings during cold storage;
e) a visual inspection of 920 bunches per consignment for all quarantine pests.

C. inclusum is an exception to the first 2 points, being abundant in vineyards and also known to be associated with grape bunches. It is not clear why the detection rate for this species is almost nil compared with *Latrodectus* and *Phidippus* (the latter two being rare in vineyards and grape bunches). *Phidippus* records may be over-represented generally however, as they are likely to have originated from one area in late 2000.

Information is not available however, as to the potential for these spiders to enter the pathway after picking. Further research is needed to test the assumption that infestation is occurring before placement of grape bunches into cartons.

Given the phytosanitary measures contained within the Import Health Standard, there have been 23 interceptions of live juvenile or adults on the 2527 tonnes of table grapes imported from California in 2001 (until trade was suspended in November). This equates to approximately one exotic spider per 281,000 bunches of grapes, or one widow spider per 1.62 million bunches. While risk of entry is low, the most probable life stages to survive are adults and egg masses. Eggsacs surviving the fumigation process would require a period of storage that was not prolonged, and a rise in ambient temperature to 25^{o}C for 2-3 weeks for hatching to occur.

Chile

The likelihood of entry of spiders from Chile through the table grape pathway is **low-moderate** given:

a) the low volume of grapes imported from this country (2400 tonnes in the past 3 years);
b) the low detection rate in visual inspections (equating to approximately one spider intercept per 1.5 million bunches calculated over a 3 year period); and
c) a moderate risk of survival during transport (with no pre-export fumigation).

Mexico

The likelihood of entry of spiders from Mexico through the table grape pathway is **low** given:

a) the very low volume of grapes imported from this country (360 tonnes in 3 years); and
b) the absence of spider detections to date on this pathway.

Currently the likelihood of entry is **nil** from Mexico given the suspension of trade.

Australia

The likelihood of entry from Australia (even though volumes are high) is **low** given:

a) that there has only been one post-border detection (and a single border interception) of red-backed spiders in the past 2 seasons (in a trade volume of 4915 tonnes). This species is already established in New Zealand. No other exotic spiders have been associated with this pathway to date. This detection rate equates to approximately one spider per 3.1 million bunches of grapes calculated over a 2 year period;

b) pre-export fumigation for red-backed spiders. While efficacy of this treatment for this species is not known, it is assumed that it is similar to that demonstrated for *L. hesperus* (belonging to the same genus).

5. LIKELIHOOD OF PEST ESTABLISHMENT

5.1 Historical establishment of spiders in New Zealand

New Zealand has a history of spider introductions, particularly by species from Australia. Five new spider families have been introduced to New Zealand, adding to the 50 endemic families originally present. These 5 new families include 2 species of white-tailed spider *Lampona cylindrata* (Forster 1975) and *L. murina* (Family Lamponidae) from Australia; the six-eyed *Dysera crocota* (Dysderidae) from the United Kingdom; the now-common daddy-long legs *Pholcus* sp. (Pholcidae); the fast moving wasp mimic *Supunna picta* (Corinnidae) which is native to Australia; and the Avondale spider *Delena cancerides* (Sparassidae) introduced from Australia 40 to 50 years ago. One sub-family (Erigoninae - tiny money spiders) of the Linyphiidae Family have also become well established. This sub-Family have been the most successful in terms of numbers and species, being so small that they are unlikely to be detected.

Other newly introduced species of spiders from Families already resident in New Zealand include *Eriophora pustuloa* (Araneidae), *Hemicloea rogenhoferi* (Gnaphosidae) (Forster 1975), *Badumna longiqua* (Desidae) (Forster 1975 called this *Ixeuticus martius*), *Helpis minitabunda* (Salticidae) and *Latrodectus hasselti* (Theridiidae) from Australia. Introduction of redbacks to NZ "clearly involved sea and air transport since they were found in their dozens in containers during the early 1980s" (Forster 1984). Live females of *Oecobius* have been located in a house near Auckland, and live female *Scytodes* on a schoolhouse wall in Matamata (Forster and Forster 1999). The brightly coloured Australian orb-web spider *Poecilopachys australasiae* was first recorded in NZ summer of 1971 (May and Gardiner 1995).

However, some visitors do fail to establish such as the banana spider *Heteropoda venatoria* (Sparassidae) (Forster and Forster 1999). This is presumably because they favour warmer or drier climatic conditions than that occurring at the point of entry, or because the point of entry does not provide for their ecological or behavioural needs.

There is a decline in numbers (although not population density) of genera and species of New Zealand spiders from the South to the North. This strongly suggests that our fauna is cold adapted. Spiders introduced from Australia (*Ixeuticus*, *Lampona*, *Hemicloea*, *Araneus*) are not able to colonise native forest (probably because these habitats do not cater for their behavioural or ecological needs), and without the environmental change brought about by man would probably not have become established (Forster 1975).

Surveys of pastoral land have confirmed that the fauna of these areas is composed mainly of introduced species originating from the Northern Hemisphere (Forster 1975). In recent years, further ground spiders such as the Australian ctenid *Horioctenoides* and the clubionid *Supunna* have become established and seem to be rapidly spreading throughout the pastoral country of the North Island and the northern portion of the South Island (Forster 1975). Surveys of the fauna of planted pine forest show these areas are populated in the main by introduced spiders and that very few indigenous species have colonised these habitats (Forster 1975).

In summary, spiders have a long history of establishment in New Zealand, predominantly from Australia. They have mainly colonised human environments and modified landscapes. While native spiders show a trend in numbers and species that increases from North to South, spider introductions from warmer climates are more likely to establish readily in the North Island or top of the South Island.

5.2 Other *Latrodectus* in New Zealand

Three *Latrodectus* species are found in New Zealand; the native katipos (*L. katipo, L. atritis)* and the introduced Australian redbacked spider (*L. hasselti*). The native katipo spiders are restricted to coastal habitats. *L katipo* is more common and is found throughout the country except the southern portion of the South Island (Hann 1990). *L. atritis* is restricted to the northern half of the North Island. Katipo are occasionally found as far as five km from the sea where sand dunes extend inland, but are usually restricted to the narrow belt within a few hundred metres of the high tide level. Egg sacs can be maintained at temperatures between 15 and 25^{o}C (Forster and Kingsford 1983).

Latrodectus hasselti has an optimal developmental rate of 25^{o}C. They still mature when temperatures fluctuate between 10 ^{o}C and 20 ^{o}C although their time to maturity is substantially greater (Forster 1984). While the species is currently established in Central Otago and possibly other sites such as Taranaki, Canterbury and the Wairarapa, these conditions could be matched or improved upon in summer in many areas of New Zealand. Forster (1984) concludes that the species could become more widely distributed in NZ where these summer parameters permit maturation. Spiderlings can assume a state of quiescence during other parts of season.

Most *Latrodectus* prefer habitats of low relative humidity. *L. hasselti* can control water loss from their bodies, supporting the view that they can survive in low humidity. The high success rate in rearing *L. hasselti* without water also leads to the conclusion that these spiders prefer xerophytic environments and that relative humidity may be a limiting factor in their distribution. Suitable breeding temperatures greater than 15^{o}C (Downes 1987) and low relative humidity requirements clearly limit the suitability of areas where this member of the *Latrodectus* genus can become established. Differences between ambient climate and microhabitat conditions may be considerable, so selection of appropriate sites within an area may greatly enhance survival. While red back spiders have been reported from wetter areas of New Zealand (eg. Dunedin, Greymouth), the extent of establishment (if any) of the species at these sites and their microhabitat choice is unknown.

Red-back spiders are primarily ground-dwelling and require shelter from wind and rain, adequate warmth for breeding and plentiful supply of suitable food. It has denser populations in warm areas but in Australia can tolerate wide climatic conditions from below freezing to above 41^{o}C. In NZ, snow lies on Mt Roy (near Wanaka) for short intervals in winter but redbacks hiding under rocks or logs are buffered from the cold in this area. Temperature has been shown to influence growth rate in the laboratory - males mature at 28 to 45 days, females take 45 to 74 days when kept at 25C and a light regime of 12 hours daylight and 12 hours darkness (Forster 1984).

In New Zealand, the closely related theridiid *Steatoda capensis* has adults and juveniles that may be found throughout the year. Females produce egg sacs all year round but they lay mainly from December to March. Most specimens are from the coast, where they are found under logs and in marram, but they are also found around dwellings.

5.3 Factors affecting establishment

Spiders are generalist predators and while some are associated with vegetation for cover and construction of webs, they do not rely on transfer to a host for their establishment. Suitability of climate at the time of entry, and availability of habitat close to entry sites are likely to be key factors. The number of founder individuals will also be important in establishment, as will natural mortality after entry to New Zealand. Handling of the grape bunches once in New Zealand will also affect whether spiders entering on this pathway can escape detection and survive to establish. Finally the presence of any natural enemies and competition from other spiders will have an influence on survival.

5.3.1 Suitability of climate

General

For 6 of the 7 species identified in Section 3.4, the risk of establishment may be moderate for spiders from California given the similarity of climate to New Zealand. *L. hesp*erus and *L. mactans* have a wide temperature tolerance. Establishment risk will be highest in regions of low humidity where sustained temperatures of 25^{o}C can be maintained for several weeks. In wetter and colder areas, the risk of establishment may be low. *L. geometricus* is unlikely to establish other than in the Northern part of New Zealand given its circumtropical distribution, being found in warmer areas of North America and Europe.

The areas where *Latrodectus* are likely to establish and survive include the East Coast region of the North Island (East Cape to Hawkes Bay), Canterbury, Otago and possibly Nelson, Marlborough and the Wairarapa regions (C. McGuinness, personal communication, 2002). Localised areas with drier micro-climates such as Spirits Bay and Karikari Peninsula in the Far North may also be suitable. These are the drier more arid areas of the country and are also areas where droughts are increasingly likely with climate change (C. Green, personal communication, 2002). It is difficult to be specific in the absence of published information on what constitutes a 'dry' area for these spiders or of any preferred value for relative humidity. In New Zealand, mean relative humidity is often between 65 and 85 percent. However, much lower values (from 30 percent down to 5 percent) occur at times in the lee of the Southern Alps, where the föhn wind (the Canterbury nor-wester) is often very marked. Cool southwesterlies are also at times very dry when they reach eastern districts[3]. Climatic change will also be important in predicting habitats where *Latrodectus* are likely to survive.

The yellow sac spider *C. inclusum* is competitive under a wide range of conditions and prey types (Costello & Daane 1995). This species could establish in New Zealand. A sister species, *C. stratioticum*, is already present in New Zealand (an exotic from Australia). It occurs in tussock and grassland habitats and is common in the North Island, and is not seen much farther south than Canterbury (V. Forbes, pers. comm.).

Survival of life stages in relation to climate and time of arrival

Egg batches and juveniles arriving other than in mid to late summer could potentially have poor survival in Southern locations. *L. hasselti* (as an example of *Latrodectus)* require 2-3 weeks of temperatures above 25^{o}C to complete development.

The California trade season normally extends from July to December, imports from Australia arrive between February and June, Chile from January to May, and Mexico during May and June. Once landed in New Zealand, table grapes are distributed for consumption throughout New Zealand.

Salticid egg masses arriving in October have hatched in Auckland. Egg masses from other Araneae have hatched during January in Winton (Central Otago) and Auckland, and during

[3] NZ Metservice website www.metservice.co.nz/learning/weather_climate_of_nz.asp#humidity 19/4/02

December in the Bay of Plenty (Appendix 2).

Adults of *L. mactans*, *L. hesperus*, and *P. johnsoni* are likely to survive even if entry is in the cooler months, but establishment would probably be limited by a preference for low humidity sites.

G. heptagon has a very wide distribution across the United States (Levi 1983) and presumably could survive reasonably well in the New Zealand climate. The distribution of *C. inclusum* has not been published and therefore information on its climatic tolerance range is not known.

L. hasselti has also established itself in Osaka, Japan where it seems to thrive (even through the winter) in the large pipes (sewage/drainage) that run through the city and which are always warmer than the ambient temps (Raven and Gallon 2002). They have also survived introduction to Belgium despite the cold, wet climate (Raven. pers. comm.). The critical factor for this species seems to be that it can colonise a place in which, for sometime during the day, it gets some heat (Robert Raven, pers. comm.). This species has also been introduced to Tristan da Cunha, probably through satellite tracking equipment. The equipment was moved from New South Wales to Hawaii by air, then direct to Miami where it stayed for 3 weeks before being sent by sea to Tristan da Cunha in the South Atlantic (Wace 1968).

Summary

Egg masses surviving pre-entry fumigation (where applied) could survive if introduced to warmer regions of New Zealand during late spring and summer, or during mid-summer months further south. Adults are capable of sustaining prolonged periods of fasting and can "overwinter" in cooler temperatures. Eggsacs would require a period of warm temperatures and appropriate humidity for several weeks to hatch. Spiderlings would have relatively high mortality unless temperatures were mild to warm and they were able to obtain at least some prey during transport. Local microhabitat conditions may influence adult survival; for example, survival may be enhanced during cooler months by the availability of heated buildings or warm pipes in which to shelter.

5.3.2 Availability of habitat

Although hunting methods may vary amongst these spiders, their requirement for invertebrate prey should not be a limiting factor in their ability to establish in New Zealand. Six of the 7 species (no information available for *O. assimilis*) included in this assessment are associated predominantly with human habitation (homes and gardens). Therefore there should be no limitations in areas available for cover, web-building, prey capture and reproduction. Prey availability will be lowest in the coolest months and particularly in southern areas, but these spiders (*Latrodectus* in particular) are able to survive long periods of fasting.

5.3.3 Number of founder individuals

While the founder population size needed for establishment is not known, a single mated or gravid female is capable of producing a large number of eggs providing that conditions are suitable.

Successful establishment of these spiders is most likely when a founder population of a number of individuals is located at the same site. For single (and in the case of females, unmated) adults, the risk of establishment would be very low given the geographic spread of the commodity post-border and the very low number of individuals. Gravid females or egg sacs may enter New Zealand and survive.

Female *L. hesperus* are capable of producing up to 10 egg sacs with a mean of 196 eggs in each (Kaston 1970). Kaston found the largest number of eggs per sac was 598 with a few sacs over 300, and commonly there were 160-225. One sac had a single egg, five others had less than 10 eggs. The greatest productivity was 3024 eggs for a total of 12 sacs. Hatching takes place after 14.6 days on average.

A female and egg sac of *L. hesperus* were introduced to Maine among household goods transported from Phoenix Arizona (Jennings and McDaniel 1988). A total of 292 spiderlings emerged from the egg sac and could have formed the nucleus of a breeding population (surviving in the 10^{o}C of the attic overwinter).

The brown, papery egg sac of *L. mactans* can contain 255 eggs on average (Levi and Levi 1968). The interval between copulation and egg-laying is 16 to 22 days (and therefore mated females may not produce eggs for two to three weeks). This species had a maximum of 2132 eggs in nine sacs. The largest number of eggs per sac was 919, but only a few sacs contained over 300 eggs. The most common range was 215 to 237 eggs per sac. One sac had a single egg and five had fewer than 100 eggs.

L. geometricus sacs can contain 80 to100 eggs and females may produce up to 10 sacs under laboratory conditions and are known to produce a maximum of eight in field conditions (Smithers 1944). Bouillon (1957) (cited in Kaston 1970) reports that females are capable of making up to 29 egg sacs and that a maximum of 5761 eggs was laid by a single female.

Fertile female redback spiders (*L. hasselti*) lay one to five batches of eggs (mean 3.1), laying 68 to 355 eggs in total (the mean being 208 eggs). Eggs hatch 3 weeks after oviposition and first spiderlings disperse from nest after 3 weeks. In the laboratory, female redback spiders can produce 10 egg sacs in 16 weeks, with up to 2500 spiderlings). Mean fertility of eggs has been demonstrated to be around 71% on average, but this can range between 1 and 100%. The species in the wild can suffer a mortality rate as high as 98% in the first few weeks of life. The sex ratio of *L. hasseltii* spiderlings can be 1 male to 5 females (Softly and Freeth 1970).

In *Phidippus johnsoni* (as in probably most spiders), iteroparity (i.e. deposition of eggs in successive batches rather than single batch) occurs. This behavioural trait is predicted where risk of failure of batches is high from predation, dessication, or when adult survival is high compared to immatures, as it is with this species (Jackson 1978).

Amalin et al (2001) maintained egg sacs of *C. inclusum* at 27^{o}C and 80% RH with a 12:12 photoperiod. The species was reared from egg to maturity on citrus leafminer (*Phyllocnistis citrella*) alone which indicates that they do not require a varied diet.

Summary

While adult spiders are most the most common live stage detected post-border, there is a very low risk of finding another individual with which to mate in this pathway. It is possible that gravid females or eggsacs could enter New Zealand but they would require suitable temperature and humidity conditions in which to establish a founder population. Survival of spiderlings to maturity would also require these conditions.

5.3.4 Survival of life stages

The mean longevity (emergence to death) for *L. mactans* is 90 days for males and 369 for females but there is high variance in this estimate (Kaston 1970). For *L. hesperus*, lifespans are shorter: 90 days for males and 369 days for females (Kaston 1970) but again with high variance.

In New Zealand, *Latrodectus* males have a very short life span (2-5 weeks in *L. katipo*) which means that few survive long enough to mate with sibling females from the same egg sac. But Forster (1984) suggested that this may not be the case in *L. hasselti.*

P. johnsoni generally moult into 7 instars and a subadult, with males undergoing fewer moults to maturity than females. The proportion of laboratory reared spiders surviving each instar varied little and was relatively high in a study by Jackson (1978). Only 4 of 30 spiderlings failed to reach maturity when provided with continual food and moisture. Females tend to survive 126 days compared with 94 days for males (reported as mean lifespans). There is also evidence from nature that males are shorter lived.

There is no information on the survival of *G. heptagon, O. assimilis* or *C. inclusum* life stages.

For the Theridiids at least, lifespan of females under optimum conditions can be over a year. But there is a shorter period over summer months when males are available for mating.

5.3.5 Handling after entry

Most bunches of grapes are taken from cool storage at supermarkets and placed onto the shelf for customers. The majority of post-border detections have taken place at this point, as the spiders body temperature rises to ambient and they become more mobile. A small proportion of grapes will not reach the shelf and there is probably a small risk that these are disposed of into general refuse.

Once purchased, grape bunches may be stored in the home fridge or at room temperature for a short period. Intensive handling of the product (picking individual grapes from the bunch for consumption) has a high chance of detecting any spiders present. A small proportion may not be consumed and become discarded in refuse.

5.3.6 Natural predators

Parasites of *Latrodectus* eggs include *Pseudogaurax signata,* but the impact of this parasite is minimal. The hymenopterous parasitoid for which most is known is the scelionid *Baeus* *latrodecti* reported by Pierce (1942) (cited in Kaston 1970) from egg sacs *of L. hesperus* in California. These 2 species of parasite are not known to be present in New Zealand (Scott and Emberson 1999).

Pierce (1942) and Branch (1943) report *S. grossa* eating *L. hesperus* and Archer (1947) found the same for *L. mactans* (these three references cited in Kaston 1970). It is possible that this Theridiid may compete with, or directly prey on *Latrodectus* as *S. capensis* does with the native *Latrodectus*.

Archer noted that the pirate spider *Mimetus* sp. attacked *L. mactans* and Kaston (1970) noted *Mimetus* feeding on *L. hesperus*. There are currently New Zealand representatives in the genus *Mimetus*, although they are awaiting taxonomic revision. Forster and Forster (1999) suggest that the New Zealand *Mimetus* may have similar spider hunting behaviour as other Theridiids.

Probably the most effective and widespread predator of *Latrodectus* is the blue mud-daubing wasp *Chalybion californicum*. Rau (1935) (cited in Kaston 1970) observed in Missouri that this wasp preferentially provisions its mud cells with *L. mactans* rather than other spiders. D'Armour et al (1936) (cited in Kaston 1970) noted the same for *L. hesperus* in Colorado, and Kaston observed this in *L. mactans* in Georgia (Kaston 1970). This wasp is also not in New Zealand (Scott and Emberson 1999). The mason wasp (*Pison spinolae*) is known to specialise on one group of orb-web spiders in New Zealand, but its effect on these exotic spiders is unknown.

Cannibalism has been demonstrated in at least one member of the *Latrodectus* genus. *L. hasselti* spiderlings emerge within 12 hours of each other but 10 % of these may stay in the egg sac for 2 to 5 days. The later emergents do not usually disperse early emergent spiderlings. Cannibalism can occur in these spiderlings. Forster suggests that this is a growth strategy for females who can grow faster and reach maturity earlier than non-cannibalistic siblings (Forster 1995).

In the laboratory, *L. hasselti* females may prey on courting males, particularly when the latter were outside nests rather than inside them. Cannibalism is otherwise rare (Jackson 1980).

Various gnaphosids are known to be frequent nest associates with *P. johnsonii* and acrocerids are known parasitoids on these and other spiders (Jackson and Griswold 1979). Observations suggest that large gnaphosid prey on this species in its nest. Jackson (1976) observed *Herpyllus hesperolus* prey on *P. johnsoni* and vice versa. *H. hesperolus* is not present in New Zealand (Scott and Emberson 1999).

5.4 Summary of establishment risk

The risk of establishment for these spiders in New Zealand is low to moderate. While at least some parts of New Zealand will be suitable for establishment for most of these species, the propagule size and time of entry will have the greatest impact on risk of establishment. Under optimal conditions, where a gravid female or live eggsac enters warm dry areas and escapes the intensity of public inspection before grapes are individually consumed, the risk may be moderate. Where single unmated adults enter New Zealand or where eggsacs/gravid females arrive outside of optimal breeding conditions, the risk will be low.

6. LIKELIHOOD OF SPREAD

Spiders are not as mobile as other species of insect predators because they lack wings to facilitate colonisation of new areas. Some species disperse by use of silken threads to "balloon" through the air. This method of dispersal is most common in immatures of many spider species and the adults of smaller species. Most ballooning species are one to two mm long but larger individuals may also use this mode of dispersal (Roltsch et al 1998).

It is highly likely that *L. hasselti* spiderlings are dispersed by wind (Forster 1995). Establishment of this *Latrodectus* species at least, was and would be (in new areas) aided by wind dispersal. Native *Latrodectus* however, do not use this method, and it would be disadvantageous given that onshore winds would carry them inland away from preferred habitat, and off-shore winds would take them out to sea.

Climatic conditions and human activity are likely to be the biggest influences on dispersal once established. The limited distribution of *L. hasselti* in New Zealand would indicate climatic barriers to widespread dispersal. *P. johnsoni* is a possible exception, being found in diverse conditions from sea level to the alpine zone.

There is no information on the dispersal mechanisms and potential for spread of *G. heptagon*, *O. assimilis* or *C. inclusum* life stages. *G. heptagon* is widespread in North America, and of Australian origin and therefore assumed to have a strong colonising ability.

Redback spiders are very common in the suburbs of Brisbane, Adelaide, Perth and Alice Springs. They have dramatically increased in population range over the 1970's and 1980's (Rob Raven pers. comm.). Brisbane suburbs that were free of redbacks until 1972 were over-run by 1986. They were found in stormwater drains, gutters, playgrounds, and commonly around fences and houses in many streets of the suburbs. During that period, Brisbane had been through an intensive housing and business expansion. Arachnologists reported similar increases in redback numbers in suburbs of Sydney and Hobart during housing expansions (Rob Raven, pers. comm.). Distribution was limited to human habitation and did not extend into natural areas.

Human activity would probably aid spread of these species. In particular, the relocation of dwellings, vehicles and household effects between areas of similar climatic suitability may assist spread. *Latrodectus* would most likely utilise disturbed habitats (e.g. agricultural plots, paddocks, gardens) and the same is likely for *P. johnsoni* (Jackson, pers. comm.). As *P. johnsoni* is not an especially fast breeder, it is unlikely that it would become established from only a few individuals entering New Zealand from time to time (eg. on the grape pathway) (Jackson, pers. comm.).

The Department of Conservation estimate that the Theridiids would be unlikely to be found in mature forest, preferring the more open scrub habitats on poor or sandy soils (C. McGuinness & C. Green, personal communication, 2002).

Overall, the risk of spread once established is moderate, with distribution dependent on climatic limiting factors and habitat preference.

7. ENVIRONMENTAL CONSEQUENCES OF ESTABLISHMENT

Potential environmental consequences of the establishment of the spiders assessed include predation and competition with native invertebrates for both food and habitat. Potential consequences of the competition impact could be displacement of the native species resulting in a reduction in population numbers. This could potentially lead to local extinction and fragmentation of a species' range. Potential consequences of predation are reductions in numbers, although this is likely to have a minimal effect on the population (apart from *Phidippus* impact on grassland moths with flightless females, see below). Spider introductions would be an added introduced pressure on the native species (C. McGuinness, personal communication, 2002).

New Zealand's xerophytic habitats where these spiders are most likely to establish contain a number of specialised endemic species. An example is the threatened species of *Notoreas* (a day flying moth) that has a highly fragmented, localised distribution in coastal habitats. There are a number of local endemics within this genus, all which have a high degree of host specificity with the *Pimelea* plant species. The Cromwell chafer beetle also has a very localised distribution and is likely to be preyed upon by Theridiids in the event a species became established in the area (C. McGuinness, personal communication, 2002).

There is some evidence that introduced Theridiids may compete with native spiders. The native katipo appears to have declined in some lower North Island regions in the last 10 to15 years (Hann 1990). Their decline has been attributed to the introduction of *S. capensis* which is now associated with houses and is present along the coast in Nelson, Blenheim, Wellington and New Plymouth (Hann 1990). *S. capensis* is also known to be common in Auckland and East Cape. The species overlaps in habitat with the katipo spider, particularly along the coast from Wellington to New Plymouth.

Experimental introduction of *S. capensis* into an area where *L. katipo* were present (but scarce) resulted in no *S. capensis* being found after 3 weeks (Hann 1990). Conversely, introducing *L. katipo* to areas where *L. capensis* were scarce resulted in 75% survival in that period, and it is likely that they also reproduced. In predation experiments, katipo killed *S. capensis* in 19 trials, whereas *S. capensis* killed katipo in only 9. Adult female katipo were more likely to win antagonistic interactions with adult female *S. capensis*.

However, *S. capensis* egg sacs contain almost 3 times the number of eggs as katipo sacs. Even though *S. capensis* spiderlings have much higher mortality than katipo and a smaller number of eggsacs in summer, their reproductive output in winter is much higher than katipo. The number of reproductive *Steatoda* outnumbered katipo reproductive individuals by 5 to 1.

Hann (1990) suggests that competitive release of *S. capensis* following natural or accidental human-related reduction of katipo habitat, is the most likely explanation for colonisation of these habitats by *Steatoda* rather than direct competition. Katipo numbers probably declined after natural (e.g. storms) or human induced events (eg. collection of driftwood from the beach, used for shelter by katipo). As *Steatoda* have the competitive advantage reproductively, this species was then at an advantage.

Impacts on native species directly by way of hybridisation are also possible (although unlikely). Among *Latrodectus*, this has been demonstrated in a laboratory setting (Kavale 1986) but has not yet been reported in the wild. When katipo males were introduced to redback spider webs, the resident redback female always attacked the katipo male, probably because the katipo is twice the size of the redback male and his heavy presence on the web may be more like prey. However, redback males readily mated with female katipo (Forster 1984). Unidirectional mating (i.e. one sex only preferring a different species) was also noted for *Phidippus* (Edwards 1980, cited in Forster 1995). Interspecific matings between *L. hasselti* and *L. katipo* produced viable first generation (F1) hybrids, from which second generations (F2) were bred (Kavale 1986). Fertility was very low in the F1 generation (3%) but improved (83%) in the F2.

If hybridisation of the two *Latrodectus* species (*L. hasselti* and *L. katipo*) is only possible because of common origins during the Gondwana era (Forster 1995), the likelihood of North American species hybridising with native spiders will be very low (if at all possible).

Without detailed ecological information on these spider species it is impossible to predict the direct or indirect ecological impact of these taxa on vertebrates. Spiders are an important source of food for many small passerine bird species, for *Mystacina* (short-tailed bat) and for native herpetofauna. *Petroica* (robins) occur in many natural habits including some relatively xerophytic habitats that could be colonised by *Lactrodectus* (B. Lloyd, personal communication, 2002).

McKeown (1952) shows a mouse caught and hoisted in the web of a redback and reports a skink (*Lygosoma* sp.) also taken by a redback. Raven (1990) reports two cases of redback predation noted from museum collections. A female built her web in the fold of a blanket hung on a clothes line. Two wall skinks (*Cryptobelpharus virgatus)* were found dead and partially consumed in the web. In a second case, a females web that was close to the ground caught a Verreauxs skink. Wolf spiders (*Lycosa lapidosa*) have also been seen taking a young frog (Raven 1990).

Frogs injected with a minimum lethal dose of toxin from a *L. mactans* were shown by Maroli et al (1973) to undergo paralysis of the limbs from one hour onward. Death occurred after 24 hours. These authors found birds to be much less susceptible to the toxin. There are no reports in the literature however of *Latrodectus* killing frogs or birds.

Whether the spiders' venom proved toxic to native birds or herpetofauna would have to be tested. Katipo, however, do not appear to pose a problem for New Zealand vertebrates that share the same environment, hence from this we could speculate that the exotic *Lactrodectus* should not pose a significant direct threat either (D. Newman, personal communication, 2002).

New Zealand's native and diverse spider fauna is a treasure that contributes significantly to New Zealand's overall biodiversity (B. Lloyd, personal communication, 2002). In the event one of the competitive spider species established in an area where a specialised endemic occurred (e.g. *Notoreas* moths, katipo spiders), localised effects could be significant (C. McGuinness & C. Green, personal communication, 2002).

<u>*Latrodectus* species – environmental consequence level estimate</u>: **low to moderate**

L. hesperus has the potential to impact on katipo and other dune inhabiting invertebrates such as the carabid *Brullea antarctica*. These dune species have already undergone fragmentation of habitat and in the case of katipo competitive pressure from *Steatoda. L. hesperus* is also likely to establish in tussock grassland areas (C. McGuinness, personal communication, 2002).

L. geometricus is classed as cosmotropical and could possibly establish in Northland (P. Sirvid personal communication, 2002).

All the *Latrodectus* species are likely to have a habitat overlap with the already established *Steatoda* species. *Steatoda* may outcompete the *Latrodectus* via their greater fecundity, however, there need to be trials to confirm whether this is the case or not (P. Sirvid personal communication, 2002).

Cheiracanthium inclusum – environmental consequence level estimate: **moderate**

The wide habitat tolerance and competitive nature of *C. inclusum* indicates there is potential for impact on native invertebrates. Most clubionids in New Zealand live in open areas on low shrubs. *C. inclusum* may well be suited to open country including tussock grasslands and shrublands, which are the habitats of a wide range of native invertebrate species. Potential impacts are predation and competition for habitat and food (C. McGuinness, personal communication, 2002).

Phidippus johnsoni – environmental consequence level estimate: **high**

As *Phidippus* prey heavily on other spiders (Jackson 1977) and are larger than most Salticids (Vest 2001) they are potentially a threat to native species where there are habitat overlaps. The potential threat is likely to be greatest where species are already rare for other reasons (eg. the threatened status of their host plants). The likelihood and degree of these impacts are unknown.

P. johnsoni is a large jumping spider that has a wide habitat tolerance and may impact on dune system invertebrates which are already under pressure or scarce (e.g. katipo). It has been found in coastal dunelands and may occupy these habitats in New Zealand, especially if driftwood is present for shelter. However *P. johnsoni* appears to prefer sheltering under stones and as most dune systems are not stony these habitats may not be preferable. Tussock grasslands in Nelson/Marlborough, Otago and Canterbury would be more suitable habitat for this species. Areas of Otago are also very similar to California in both appearance and climate (R. Jackson personal communication, 2002).

Lepidoptera larvae and other soft bodied invertebrates form a major component of this spider's diet (R. Jackson, personal communication, 2002). If this spider was to establish in a grassland system a number of grassland specialist endemic moths may suffer. In particular those that have flightless females (e.g. *Metacrias* tiger moths, *Orocrambus* grass moths and some geometrid moths). The effects of predation on these moth species could potentially make some locally extinct (B. Patrick, personal communication, 2002). Of potential concern in urban environments is the impact of *P. johnsoni* on the native jumping spider *Trite auricoma*, which is also an urban spider (R. Jackson, personal communication, 2002). *P. johnsoni* preys upon spiders and this could result in a reduction of katipo numbers in coastal areas (C. McGuinness & C. Green, personal communication, 2002).

Orodrassus assimilis and *Gea heptagon* – environmental consequence level estimate: **moderate**

Taking into account the elevations mentioned by Platnick & Shadab (1975) as indicative of *Orodrassus assimilis* range, this species could establish in sub-alpine to alpine zones (C. McGuinness, personal communication, 2002). Given the environmental impact of these species is largely unknown, a conservative estimate of consequence would be moderate.

Summary

With the exception of *O. assimilis* for which no information is available, the spiders considered in this assessment are most likely to inhabit human or modified environments. Some particular habitat types such as coastal or alpine sites may be more likely areas of overlap with native species. The consequences of this overlap to native species (through direct predation, hybridisation or indirectly through competition) are not known. There is some limited evidence from the literature that there is an effect of *Latrodectus* on other members of that genus but the effects may be localised. In the case of threatened species with localised distributions (eg. katipo spiders, *Notoreas* moths), this may be significant.

8. SUMMARY OF RISK

While volumes of this commodity from California and from Australia are high, the overall risk from this pathway is low for these countries. In the case of Australia, only one species of spider has been detected in table grapes (*L. hasselti*) and this species is already in New Zealand. Environmental consequence of entry of this spider would therefore be negligible.

The low risk is based on the presence of phytosanitary measures that limit the risk of entry to low rates for spiders. The likelihood of establishment will depend on the time and location of entry, and on founder population size but is considered to be low to moderate.

The overall risk for specific spiders from Mexico and Chile could not be assessed because of an absence of taxonomic information to species level (in the case of Chile) and the absence of spider detections from Mexico. Given the biogeographic similarity between Chile and New Zealand, the likelihood of establishment and spread of the low number of spiders detected on this pathway would be similar to that for Australia and California, being dependant on the same limiting factors identified within this document. For a thorough assessment of risk, these spiders would need to be identified to species level. Imports from Mexico (before trade was suspended) occurred in May and June. The risk of spider establishment at this time of year would be expected to be lower than imports into New Zealand in summer.

The point at which pest entry is made to the commodity would require further research if this level of risk were to be lowered further.

Table 3. Summary of Risk

Country of origin	Likelihood of entry	Likelihood of establishment	Likelihood of spread	Consequence	Overall risk
USA	Low	Low-moderate	Moderate	Low-high	Low
Australia	Low	Low-moderate	Moderate	Negligible	Low
Mexico	Low	Not assessed	Not assessed	Not assessed	Not assessed
Chile	Low-moderate	Not assessed	Not assessed	Not assessed	Not assessed

Without current phytosanitary measures, the likelihood of entry would be "moderate to high" for Australia and California (with high volumes of commodity imported), with a subsequent rise in likelihood of establishment to "moderate to high". This elevation in risk assumes an increased potential for a larger founder population size, and an increase in likelihood of sufficient propagules being dispersed to geographically suitable sites for establishment.

Should *Latrodectus* and particularly *Phidippus* establish in New Zealand, there are potential but largely unknown impacts on native spiders and possibly other invertebrates (eg. endemic moths and beetles). While consequence of spider establishment is moderate to high in most species assessed, the risk to the environment from this pathway is considered low overall. This overall assessment is based on the presence of phytosanitary measures (Appendix 1), the low risk of entry and requirement for sufficient propagule size and climatic factors for establishment.

9. SUMMARY OF INFORMATION GAPS

- point of entry of exotic spiders into the commodity
- populations of spiders established in and around buildings, in stacking areas for pellets, at picking and packing locations
- biological and ecological information on *Gea heptagon*, *Oradrassus assimlis*, Cheiracanthium inclusum in particular
- humidity and temperature tolerances/preferences for *Latrodectus* and other spiders assessed
- definitive information on limiting climatic factors in New Zealand for all species
- definitive information on how native species will be impacted
- efficacy of SO2/CO2 on spiders other than the *Latrodectus* examined by Shorey and Wood (1992) (the report does not give a species name)
- replication of Shorey and Wood (1992) to improve confidence of efficacy of treatment according to chamber conditions/packing conditions
- reasons for the predominance of red globe variety in post-border reports

10. CONTACTS AND EXPERTISE

Michael Costello, California Polytechnic State University	Spiders in California vineyards
Kent Daane, University of California, Kearney	Spiders in California vineyards
G.B. Edwards**,** FDACS, Florida	*Phidippus* and other Spiders
Alan Flynn, National Pest Plant Laboratory	Post-border identification
Chris Green, Department of Conservation	Entomologist
Sean Hann, Wellington.	*Latrodectus* in New Zealand
Robert Jackson, University of Canterbury	*Phidippus*
Ross Jones, Research Director, California Table Grape Commission.	Research on Table grapes
Brian Lloyd, Department of Conservation	Scientific Officer
Eddie McCutcheon, New Plymouth	*Latrodectus* and *Steatoda*
Carl; McGuiness, Department of Conservation	Entomologist
Don Newman, Department of Conservation	Science Manager, Species
Tom Prentice, UC Riverside	California spiders
Rob Raven, Queensland Museum	*Latrodectus hasselti*

Phil Servid**,** Te Papa Museum.	New Zealand spiders
Rick Vetter, Univ California Riverside	Poisonous spiders
Dave Voice, National Pest Plant Laboratory	Post-border identification
Cor Vink, AgResearch	New Zealand spiders

11. REFERENCES

Amalin, D.M., Reiskind, J., Pen, J.E., and R. McSorley. 2001. Predatory behaviour of three species of sac spiders attacking citrus leafminer. J. Arachnol. 29: 72-81.

Costello, M.J., and K.M. Daane. 1995. Spider species composition and seasonal abundance in San Joaquin Valley grape vineyards. Environ. Entomol. 24(4): 823-831.

Costello, M.J., and K.M. Daane. 1997. Comparison of sampling methods used to estimate spider (Araneae) species abundance and composition in grape vineyards. Environmental entomology 26: 142-149.

Costello, M.J., and K.M. Daane. 1998. Influence of ground cover on spider populations in a table grape vineyard. Ecological Entomology 23: 33-40.

Costello, M.J., and K.M. Daane. 1999. Abundance of spiders and insect predators on grapes in Central California. J. Arachnology 27: 531-538.

Costello, M.J., Mayse, M.A., Daane, K.M., O'Keefe, W.A., Sisk, C.B. 1995. Spiders in San Jaoquin valley grape vineyards. University Califonia DANR leaflet 2153, CATI publication #951003.

Downes, M.F. 1985. Fecundity and fertility in *Latrodectus hasselti* (Araneae: Theridiidae). Aust J Ecol 10: 261-264.

Downes, M.F. 1987. Post-embryonic development of *Latrodectus hasselti* Thorell (Araneae: Theridiidae). J. Arach. 14(3): 293-301.

Forster, L.M. 1984. The Australian redback spider (*Latrodectus hasselti*): its introduction and potential for establishment and distribution in New Zealand. In Laird, M (ed) Commerce and the spread of pests and disease vectors. Praeger, New York.

Forster, L.M. 1985. Is the redback spider here to stay? NZJ Agric. 150(6): 58-9.

Forster, L.M. 1995. The behavioural ecology of *Latrodectus hasselti* (Thorell), the Australian redback spider (Araneae:Theridiidae): a review. Records West Aust. Mus. Suppl. 52: 13-24.

Forster, L.M., and J. Kavale. 1989. Effects of food deprivation on *Latrodectus hasselti* Thorell (Araneae:Theridiidae), the Australian redback spider. NZJ Zoology 16: 401-408.

Forster, L.M., and S. Kingsford. 1983. A preliminary study of development in two *Latrodectus* species (Araneae: Theridiidae). NZ Entomologist 7(4): 431-439.

Forster, R.R. 1975. The spiders and harvestman. In: Biogeography and Ecology in NewZealand. Ed. G. Kuschel and Dr W. Junk. B.V. Publishers, The Hague, pp. 493-505.

Forster, R.R., and L.M. Forster 1999. Spiders of New Zealand and their Worldwide Kin.University of Otago Press, Dunedin.

Hadley, N.F., and M.C. Quinlan. 1989. Cuticular permeability of the black widow spider *Latrodectus hesperus*. J. Comp. Physiol. B. 159:243-248.

Hann, S.W. 1990. Evidence for the displacement of an endemic New Zealand spider, *Latrodectus katipo* Powell by the South African species *Steatoda capensis* Hann (Araneae: Theridiidae). NZJ Zoology 17: 295-307.

Hann, S.W. 1994. Descriptions of four *Steatoda* species (Araneae, Theridiidae) found in New Zealand. NZJ Zoology 21: 225-238.

Jackson, R. R. 1974. Rearing methods for spiders. J Arachnol. 2: 53-56.

Jackson, R.R. 1976. Predation as a selection factor in the mating strategy of the jumping spider *Phidippus johnsoni* (Salticidae, Araneae). Psyche 83 (3-4): 243-255.

Jackson, R.R. 1977. Prey of the jumping spider *Phidippus johnsoni* (Araneae: Salticidae). J. Arachnol. 5: 145-149.

Jackson, R.R. 1978. Life History of *Phidippus johnsoni* (Araneae, Salticidae) J. Arachnol. 6: 1-29.

Jackson, R.R. 1979. Nests of *Phidippus johnsoni* (Araneae: Salticidae): Characteristics, pattern of occupation and function. J. Arachnol. 7:47-58.

Jackson, R.R. 1980. Cannibalism as a factor in the mating strategy of the jumping spider *Phidippus johnsoni* (Araneae, Salticidae). Bull. Br. Arachnol. Soc. 5(3): 129-133

Jackson, R.R., and C.E. Griswold. 1979. Nest associates of *Phidippus johnsoni* (Araneae, Salticidae). J. Arachnol. 7:59-67.

Jennings, D.T., and I.N. McDaniel. 1988. *Latrodectus hesperus* (Araneae: Theridiidae) in Maine. Ent. News 99(1): 37-40.

Kaston, B.J. 1970. Comparative Biology of American Black Widow spiders. Transactions of the San Diego Soc. Nat. History 16(3). 82 pp.

Kavale, J. 1986. The comparative biology of two *Latrodectus* species. MSc thesis, Univ. Otago.

Korszniak, N., McPhee, C., and D. Story. 1994. Australian spiders: is their publicity worse than their bite? Victorian Naturalist 111(2): 70-71.

Levi, H.W. 1959. The spider genus Lactrodectus (Araneae, Theridiidae). Transactions of the American Microscopical Society 78: 7-43.

Levi, H.W. 1983. The orb-weaver genera *Argiope, Gea and Neogea* from the western Pacific region (Araneae: Araneidae, Argiopinae). Bulletin of the Museum of Comparative Zoology 150 (5): 247-338.

Levi, H.W., and L.R. Levi. 1968. A Guide To Spiders And Their Kin. Golden Press, New York. Western Publishing Coy, Inc.

Maroli, M., Bettini, S., and B. Panfili. 1973. Toxicity of *Latrodectus mactans tredecimguttatus* venom on frog and birds. Toxicon 11:203-206.

Marples, R.R. 1959. The Dictynid spiders of New Zealand. Trans. Royal Soc. NZ, 87: 333-61.

May, B.M., and D.I. Gardiner. 1995. Observations of the Australian "two-spined" Spider *Poecilopachys australasia* in an Auckland garden. The Weta 18: 1-5.

Mayse, M.A., Harper, J., and J. Stock. 1998a. Arthropod community dynamics in new varietal vineyards. Viticulture and Enology Research Center, CATI publication 981003.

Mayse, M.A., Witharana, S., Striegler, R.K., and D. Dexter-Mendez. 1998b. Abundance and diversity of arthropods associated with conventional and organic vineyard practices. Viticulture and Enology Research Center, CATI publication 981002.

McKeown, K.C. 1952. Australian spiders. Their lives and habits. 2nd edition, Angus and Robertson, Sydney.

Ozane 2002. Termite and Pest Control www.ozane.com

Platnick, N.I., and M.U. Shadab. 1975. A revision of the spider genera *Haplodrassus* and *Orodrassus* (Araneae, Gnaphosidae) in North America. American Museum Nat. Hist. 2583, 40 pp.

Platnick, N.I. 2002. The World Spider Catalog, Version 2.5. http://research.amnh.org/users/reddy/platnick/BIBLIO.html

Raven, R.J. 1990. Spider predators of reptiles and amphibia. Memoirs of the Queensland Museum: 448.

Raven, R.J., and J. Gallon. 2002. The redback spider http://www.uq.edu.au/~xxrraven/redback.html

Richman, D.B., and R.R. Jackson. 1992. A review of the ethology of jumping spiders (Araneae:Salticidae). Bull. Br. Arachnol. Soc. 9 (2): 33-37.

Roltsch, W., Hanna, R., Zalom, F., Shorey, H., and M. Mayse. 1998. Spider and vineyardrelationships in California. pp. 311-338 In Enhancing biological control: habitat management to promote natural enemies of agricultural pests. Eds. C.H. Pickett and R.L. Bugg, The Regents of California Press.

Scott, R.R. and R.M. Emberson. 1999. Handbook of New Zealand insect names - common and scientific names for insects and allied organisms. Bulletin of the Entomol. Soc. NZ: 4.

Shorey, H.H., and D.L. Wood. 1992. Control of black widow spiders in table grapes. Unpubl. Report to the California table grape Commission.

Sirvid, P.J. (in press). Order Araneae in Gordon, D.P. (Ed.) The New Zealand Inventory of Biodiversity: A Species 2000 Symposium Review. Canterbury University Press, Christchurch.

Softly, A., and G.E. Freeth. 1970. The laboratory maintenance of *Latrodectus mactans.* J. Inst. Animal Technicians 21(4): 117-126.

Smithers, R.H.N. 1944. Contributions to our knowledge of the Genus Latrodectus (Araneae) in South Africa. Pp 263 - 313.

Vest, D.K. 2001. The Hobo spider web-site. http://hobospider.org

Wace, N.M. 1968. Australian red-backed spiders on Tristan da Cunha. Aust. J. Sci 31(5): 189-190.

Wisniewska, J., and R.J. Prokopy. 1997. Pesticide effect on faunal composition, abundance, and body length of spiders (Araneae) in apple orchards. Environ. Entomol. 26(4): 763-776.

APPENDIX 1.

PHYTOSANITARY MEASURES FOR TABLE GRAPES FROM UNITED STATES OF AMERICA (STATE OF CALIFORNIA), AUSTRALIA, CHILE AND MEXICO.

Import Requirement SummaryCommodity Sub-class: Fresh Fruit/Vegetables Grapes, *Vitis vinifera* from the United States of America (State of California)

ISSUED 25 June 2001

Scope

This import requirement summary is produced for the purpose of communicating the phytosanitary requirements for the importation of fresh grapes (*Vitis vinifera*) fruit from the United States of America (State of California) into New Zealand. These phytosanitary requirements are taken from the import health standard entitled *MAF Biosecurity Authority Standard 152.02: Importation and Clearance of Fresh Fruit and Vegetables into New Zealand* that has been issued in accordance with Section 22(1) of the Biosecurity Act 1993.

For details of the actions which must be undertaken to ensure compliance with these phytosanitary requirements please refer to the following documents:

- *MAF Biosecurity Authority Standard 152.02 - Importation and Clearance of Fresh Fruit and Vegetables into New Zealand;*
- the Workplan between the New Zealand Ministry of Agriculture and Forestry and the United States of America Department of Agriculture, Animal and Plant Health Inspection Service;
- *Agreed Phytosanitary Procedures for the Effective Management of Quarantine Risk Group 2 Pests Associated with the Importation of Fresh Table Grapes* (*Vitis vinifera*) *from California to New Zealand;*
- *Agreed Procedures for the Effective Management of Latrodectus geometricus, Latrodectus mactans and Phidippus johnsoni Associated with the Importation of Fresh Table Grapes (Vitis vinifera) from California to New Zealand.*

In all cases, the phytosanitary requirements as described in *MAF Biosecurity Authority Standard 152.0: Importation and Clearance of Fresh Fruit and Vegetables into New Zealand* are those which must be meet before product will given biosecurity clearance in New Zealand.

1 NEW ZEALAND NATIONAL PLANT PROTECTION ORGANISATION

The New Zealand national plant protection organisation is the Ministry of Agriculture and Forestry and as such, all communication should be addressed to:

Director, Plants Biosecurity
Ministry of Agriculture and Forestry
PO Box 2526
Wellington
NEW ZEALAND
Fax: 64-4-474 4240
E-mail: plantimports@maf.govt.nz
http://www.maf.govt.nz

2 SPECIFIC CONDITIONS FOR TABLE GRAPES FROM CALIFORNIA

The import requirement summary covers the requirements for the entry of table grapes, commodity sub-class: fresh fruit/vegetables from the United States of America (State of California) only.

2.1 PRE-EXPORT REQUIREMENTS

2.1.1 Inspection of the consignment

The New Zealand Ministry of Agriculture and Forestry requires that the United States of America national plant protection organisation sample and inspect the consignment according to official procedures for all visually detectable regulated pests (as specified by the New Zealand Ministry of Agriculture and Forestry). For quarantine risk group 2 pests, leaf material and trash, sample rates must achieve a 99% confidence level that not more than 0.5% of the units (for grapes, a unit is one **bunch**) in the consignment are infested (this equates to an acceptance level of zero units infested in a 920 unit sample). For quarantine risk group 1 pests, sample rates must achieve a 95%confidence level that not more than 0.5% of the units in the consignment are infested (this equates to an acceptance level of one infested unit in a sample size of 920 units).

2.1.2 Testing of the consignment

Testing of the consignment prior to export to New Zealand for quarantine pathogens which are not visually detectable is not generally required for fresh grapes from the United States of America (State of California).

2.1.3 Documentation

Bilateral quarantine arrangement/Workplan: Required
Table grapes, commodity sub-class: fresh fruit/vegetables, may only be imported into New Zealand from the United States of America (State of California) under the terms of the Workplan.

Agreed procedures for quarantine risk group 2 pests (and equivalent): Required.

Phytosanitary certificate: Required.

Import permit/Authorisation to import: Exempt under Gazette Notice: No. AG12, 13 July 1995.

2.1.4 Phytosanitary certification

A completed phytosanitary certificate issued by the United States of America national plant protection organisation must accompany all table grapes, commodity sub-class: fresh fruit/vegetables exported to New Zealand.

Before an export phytosanitary certificate is to be issued, the United States of America national plant protection organisation must be satisfied that the following activities [or agreed equivalent activities] required by the New Zealand Ministry of Agriculture and Forestry have been undertaken.

The table grapes have:

(i) been inspected in accordance with appropriate official procedures and found to be free of visually detectable quarantine pests specified by the New Zealand Ministry of Agriculture and Forestry.

(ii) undergone or initiated appropriate pest control activities that are effective against those quarantine risk group 2 pests specified by NZ MAF.

(iii) been sourced from an area free (verified by an official detection survey) or undergone appropriate pest control activities that are effective against *Maconellicoccus hirsutus* (pink hibiscus mealybug).

(iv) undergone an agreed treatment that is effective against species in quarantine risk group 3.

2.1.5 Effective pest control activities

Pest control activities for the effective management of *Homalodisca coagulata* (glassy-winged sharpshooter), *Xylella fastidiosa* (Pierce's disease) and regulated spiders have been summarised in an appended table.

Note: for specific details of the agreed procedures refer to the documents entitled:

Agreed Phytosanitary Procedures for the Effective Management of Quarantine Risk Group 2Pests Associated with the Importation of Fresh Table Grapes (*Vitis vinifera*) *from California to New Zealand.*

2.1.6 Additional declarations to the phytosanitary certificate

If satisfied that the pre-export activities have been undertaken, the United States of America national plant protection organisation must confirm this by providing the following additional declarations to the phytosanitary certificate as appropriate:

Note: additional declarations marked with an * are mandatory.

"The table grapes in this consignment have:

(i)* been inspected in accordance with appropriate official procedures and found to be free of any visually detectable quarantine pests specified by NZ MAF".

AND

(ii)* **Either (for pre-export treatments)**

undergone agreed pest control activities that are effective against those quarantine risk group 2 pests specified by NZ MAF".

Or (for in-transit treatments)

initiated agreed pest control activities that are effective against those quarantine risk group 2 pests specified by NZ MAF".

AND

(iii)* been sourced from an area free (verified by an official detection survey) from *Maconellicoccus hirsutus* (pink hibiscus mealybug)".

Or

undergone agreed pest control activities that are effective against *Maconellicoccus hirsutus* (pink hibiscus mealybug)".

AND

(iv)* treated in accordance with Appendix 1(b) of the Workplan between NZ MAF and USDA APHIS".

2.2 TRANSIT REQUIREMENTS

The table grapes must be packed and shipped in a manner to prevent contamination by regulated pests.

The package should not be opened in transit. However, where a consignment is either stored, split up or has its packaging changed while in another country (or countries) *en route* to New Zealand, a "Re-export Certificate" is required. Where a consignment is held under bond, as a result of the need to change conveyances, and it is kept in the original shipping container, a "Re-export Certificate" is not required.

2.3 INSPECTION ON ARRIVAL

The New Zealand Ministry of Agriculture and Forestry will check the accompanying documentation on arrival to confirm that it reconciles with the actual consignment.
The New Zealand Ministry of Agriculture and Forestry requires that the United States of America national plant protection organisation sample and inspect the consignment according to official procedures for all visually detectable regulated pests (as specified by the New Zealand Ministry of Agriculture and Forestry). For quarantine risk group 2 pests, leaf material and trash, sample rates must achieve a 99% confidence level that not more than 0.5% of the units (for table grapes, a unit is one **bunch**) in the consignment are infested (this equates to an acceptance level of zero units infested in a 920 unit sample). For quarantine risk group 1 pests, sample rates must achieve a 95%confidence level that not more than 0.5% of the units in the consignment are infested (this equates to an acceptance level of one infested unit in a sample size of 920 units).

2.4 BIOSECURITY/QUARANTINE DIRECTIVE

The commodity may be directed to a facility for further treatment if required.

2.5 TESTING FOR REGULATED PESTS

The New Zealand Ministry of Agriculture and Forestry may, on the specific request of the Director, Plants Biosecurity, test table grapes (commodity subclass: fresh fruit/vegetables) from the United States of America (State of California) for quarantine pests.

2.6 ACTIONS UNDERTAKEN ON THE INTERCEPTION/DETECTION OF ORGANISMS/CONTAMINANTS

If regulated pests are intercepted/detected on the commodity, or associated packaging, the following actions will be undertaken as appropriate:

2.6.1 Quarantine: Risk group 1 pests

If a risk group 1 pest is intercepted, the importer will be given the option of:-

- treatment (where possible) of the consignment at the importer's risk,
- re-sorting (specific conditions apply) of the consignment,
- reshipment of the consignment,
- destruction of the consignment.

2.6.2 Quarantine: Risk group 2 pests

If a risk group 2 pest is intercepted, the importer will be given the option of:-

- treatment (where possible) at the discretion of the Director, Plants Biosecurity, and immediate feedback to the national plant protection organisation of the exporting country with a request for corrective action,
- reshipment of the consignment,
- destruction of the consignment.

Note: For interceptions of live regulated spiders the above RG2 contingencies will apply at the discretion of the Director, Animal Biosecurity and/or Ministry of Health.

2.6.3 Quarantine: Risk group 3 pests

Actions for the interception of risk group 3 pests will include:-

- reshipment of the consignment OR destruction of the consignment,

  AND

- the suspension of trade, until the cause of the non-compliance is investigated, identified and rectified. The appropriate actions may be audited by the New Zealand Ministry of Agriculture and Forestry. Once the requirements of the New Zealand Ministry of Agriculture and Forestry have been met to the satisfaction of the Director, Plants Biosecurity, and supporting evidence is provided and verified by the United States of America national plant protection organisation, the trade suspension will be lifted.

2.6.4 Regulated non-quarantine pests

Actions for the interception/detection of regulated non-quarantine pests will be in accordance with the contingencies implemented for that pest if detected in New Zealand.

2.6.5 Regulated non plant pests/unwanted organisms

Actions for the interception/detection of regulated non-plant pests/unwanted organisms will be in accordance with the actions required by the relevant government department.

2.6.6 Non-regulated non-quarantine pests

No action is undertaken on the interception of non-regulated non-quarantine pests.

2.6.7 Non-regulated non plant pests/organisms

No action is undertaken on the interception of non-regulated non plant pests/organisms.

2.6.8 Contaminants

Lots with more than 25 grams of soil and/or any leaf material/trash per 920 unit sample shall be treated, reshipped or destroyed.

2.7 BIOSECURITY CLEARANCE

If regulated pests are not detected, or are successfully treated following interception/detection biosecurity clearance will be given.

2.8 FEEDBACK ON NON-COMPLIANCE

The United States of America national plant protection organisation will be informed by the New Zealand Ministry of Agriculture and Forestry's Director, Plants Biosecurity, of the interception (and treatment) of any quarantine pests and/or "unlisted" organisms, or non-compliance with other phytosanitary requirements.

3 CONTINGENCIES FOLLOWING BIOSECURITY CLEARANCE

Should a regulated pest be detected subsequent to biosecurity clearance, the New Zealand Ministry of Agriculture and Forestry may implement a management programme (official control programme) in accordance with Part V of the Biosecurity Act 1993 and Part 5 of the Biosecurity Amendment Act 1997.

Pest List
Commodity Sub-class: Fresh Fruit/Vegetables
Grape, *Vitis vinifera*
from the United States of America - State of California

REGULATED PESTS (actionable)

Quarantine: Risk group 3 pests

None

Quarantine: Risk group 2 pests

Insect	
Insecta	
Homoptera	
Cicadellidae	
Homalodisca coagulata [vect.]	glassy-winged sharpshooter
Pseudococcidae	
Maconellicoccus hirsutus	pink hibiscus mealybug

Bacterium	
-	
-	
Bacterium family unknown	
Xylella fastidiosa [VO]	Pierce's disease

Quarantine: Risk group 1 pests

Insect	
Insecta	
Coleoptera	
Cerambycidae	
Cerasphorus albofasciatus	grape trunk borer
Chrysomelidae	
Altica ampelophaga	flea beetle
Altica chalybaea	grape flea beetle
Altica gravida	metallic flea beetle
Altica torquata	grapevine flea beetle
Colaspis brunnea	grape colaspis
Fidia viticida	grape root worm
Curculionidae	
Ampeloglypter ater	grape cane girdler
Ampeloglypter sesostris	grape cane gallmaker
Craponius inaequalis	grape curculio
Otiorhynchus cribricollis	cribrate weevil
Diptera	

Cecidomyiidae	
Contarinia spp.	grape flower midges
Lasioptera vitis	grape tomato gall midge
Hemiptera	
Coreidae	
Anasa tristis	squash bug
Pentatomidae	
Euschistus conspersus	stink bug
Homoptera	
Aleyrodidae	
Trialeurodes vittata	grape whitefly
Cicadellidae	
Carneocephala fulgida [vect.]	red-headed sharpshooter
Draeculacephala minerva [vect.]	green sharpshooter
Erythroneura comes	eastern grape leafhopper
Erythroneura elegantula	western grape leafhopper
Erythroneura variabilis	variegated grape leafhopper
Erythroneura vinealis	leafhopper
Erythroneura ziczac	-
Graphocephala atropunctata [vect.]	blue-green sharpshooter
Coccidae	
Parthenolecanium persicae	European peach scale
Phylloxeridae	
Viteus vitifoliae [strain]	grape phylloxera
Pseudococcidae	
Planococcus ficus	fig mealybug
Pseudococcus maritimus	grape mealybug
Hymenoptera	
Eurytomidae	
Evoxysoma vitis	grape seed chalcid
Tenthredinidae	
Erythraspides vitis	grape sawfly
Lepidoptera	
Arctiidae	
Estigmene acrea	saltmarsh caterpillar
Geometridae	
Lygris diversilineata	grapevine looper
Pyralidae	
Amyelois transitella	navel orangeworm
Desmia funeralis	grape leaf-folder
Paramyelois transitella	navel orangeworm
Sesiidae	
Vitacea polistiformis	grape root borer
Sphingidae	
Eumorpha achemon	achemon sphinx
Eumorpha satellitia	Pandora sphinx moth
Eumorpha vitis	grapevine sphinx moth
Tortricidae	
Argyrotaenia citrana	orange tortrix
Paralobesia viteana	grape berry moth
Platynota stultana	omnivorous leafroller

Zygaenidae	
Harrisina americana	grapeleaf skeletonizer
Harrisina brillians	western grapeleaf skeletonizer
Thysanoptera	
Thripidae	
Caliothrips fasciatus	bean thrip
Drepanothrips reuteri	grape thrips
Frankliniella minuta	minute flower thrips
Frankliniella occidentalis [pesticide resistant strain]	western flower thrips
Scirtothrips citri	citrus thrips
Mite	
Arachnida	
Acarina	
Eriophyidae	
Colomerus vitis [leaf curling strain]	grape erineum mite
Tenuipalpidae	
Brevipalpus lewisi	bunch mite
Tetranychidae	
Eotetranychus carpini	tetranychid mite
Eotetranychus willamettei	hazel mite
Tetranychus pacificus	Pacific spider mite
Fungus	
Ascomycota	
Dothideales	
Mycosphaerellaceae	
Mycosphaerella angulata (anamorph *Cercospora brachypus*)	angular leaf spot
Leotiales	
Dermateaceae	
Pseudopezicula tetraspora	angular leaf scorch
Sclerotiniaceae	
Grovesinia pyramidalis (anamorph *Cristulariella moricola*)	target spot
Mitosporic Fungi (Coelomycetes)	
Sphaeropsidales	
Sphaerioidaceae	
Ascochyta ampelina	leaf spot
Ascochyta chlorospora	-
Coniella diplodiella	white rot
Phoma vitis	-
Pyrenochaeta vitis	leaf spot
Septoria ampelina	septoria leaf spot
Mitosporic Fungi (Hyphomycetes)	
Hyphomycetales	
Dematiaceae	
Alternaria vitis	leaf disease
Moniliaceae	
Penicillium sp.	rot
Unknown Hyphomycetes	

Unknown Hyphomycetes

Briosia ampelophaga	leaf blotch

Weed
Angiospermae
Asterales
Asteraceae

Baccharis halimifolia [contaminant]	baccharis
Chondrilla juncea [contaminant]	skeleton weed
Gnaphalium spp. (except *G. americanum, G. audax, G. calviceps, G. coarctatum, G. delicatum, G. ensifer, G. gymnocephalum, G. involucratum, G. laterale, G. limosum, G. mackayi, G. nitidulum, G. paludosum, G. pensylvanicum, G. polylepis, G. purpureum, G. ruahinicum, G. simplicicaule, G. sphaericum, G. subfalcatum, G. traversii*) [contaminant]	cudweed
Lactuca spp. (except *L. sativa, L. serriola, L. virosa*) [contaminant]	lettuce
Sonchus spp. (except *S. arvensis, S. asper, S. oleraceus, S. kirkii*) [contaminant]	sowthistle
Xanthium spp. (except *X. spinosum*) [contaminant]	bur

Geraniales
Zygophyllaceae

Tribulus spp. [contaminant]	caltrop
Tribulus terrestris [contaminant]	caltrop

Poales
Poaceae

Cenchrus spp. (except *C. ciliaris*) [contaminant]	grass
Digitaria spp. (except *D. aequiglumis, D. ciliaris, D. ischaemum, D. sanguinalis, D. setigera, D. violascens*) [contaminant]	grass
Echinochloa spp. (except *E. crus-galli, E. crus-pavonis, E. esculenta, E. telmatophila*) [contaminant]	grasses
Eragrostis curvula [contaminant]	African love grass
Panicum spp. (except *P. capillare, P. dichotomiflorum, P. huachucae, P. maximum* var. *trichoglume, P. miliaceum, P. schinzii, P. sphaerocarpon*) [contaminant]	-
Pennisetum alopecuroides [contaminant]	Chinese pennisetum
Pennisetum polystachion [contaminant]	mission grass
Phragmites spp. [contaminant]	grass
Poa spp. (except 52 specified species in NZ) [contaminant]	-
Sorghum halepense [contaminant]	Johnson grass
Sorghum x almum [contaminant]	Columbus grass

Solanales
Solanaceae

Lycium spp. (except *L. barbarum, L. ferocissimum*) [contaminant]	boxthorn

Solanum elaeagnifolium [contaminant]	silverleaf nightshade

Regulated non-quarantine pests

None

Regulated non plant pests

Spider	
Arachnida	
Araneae	
Salticidae	
Phidippus johnsoni	red backed jumping spider
Theridiidae	
Latrodectus geometricus	brown widow spider
Latrodectus mactans	black widow spider

NON-REGULATED PESTS (non-actionable)

Non-regulated non-quarantine pests

Insect	
Insecta	
Homoptera	
Pseudococcidae	
Pseudococcus calceolariae	citrophilus mealybug
Pseudococcus longispinus	longtailed mealybug
Pseudococcus viburni	obscure mealybug
Mite	
Arachnida	
Acarina	
Eriophyidae	
Colomerus vitis [bud strain]	grape erineum mite
Colomerus vitis [erineum strain]	grape erineum mite
Tenuipalpidae	
Brevipalpus californicus	bunch mite
Tetranychidae	
Calepitrimerus vitis	grapeleaf rust mite
Tetranychus urticae	twospotted spider mite
Fungus	
Ascomycota	
Dothideales	
Botryosphaeriaceae	
Botryosphaeria dothidea (anamorph *Fusicoccum aesculi*)	canker
Mycosphaerellaceae	
Mycosphaerella personata (anamorph *Pseudocercospora vitis*)	isariopsis blight
Mycosphaerella tassiana (anamorph *Cladosporium herbarum*)	black leaf spot
Pleosporaceae	
Pleospora tarda (anamorph *Stemphylium botryosum*)	black mould
Erysiphales	
Erysiphaceae	
Uncinula necator (anamorph *Oidium tuckeri*)	powdery mildew
Leotiales	
Sclerotiniaceae	
Botryotinia fuckeliana (anamorph *Botrytis cinerea*)	grey mould
Phyllachorales	
Phyllachoraceae	
Glomerella cingulata (anamorph *Colletotrichum gloeosporioides*)	anthracnose
Mitosporic Fungi (Coelomycetes)	

Unknown Coelomycetes	
Unknown Coelomycetes	
Greeneria uvicola	bitter rot
Mitosporic Fungi (Hyphomycetes)	
Hyphomycetales	
Dematiaceae	
Alternaria alternata	black stalk rot
Moniliaceae	
Aspergillus aculeatus	aspergillus rot
Aspergillus niger	aspergillus rot
Zygomycota: Zygomycetes	
Mucorales	
Mucoraceae	
Rhizopus arrhizus	wet rot
Rhizopus stolonifer	rhizopus soft rot

Weed	
Angiospermae	
Asterales	
Asteraceae	
Gnaphalium americanum [contaminant]	cudweed
Gnaphalium audax [contaminant]	creeping cudweed
Gnaphalium calviceps [contaminant]	silky cudweed
Gnaphalium coarctatum [contaminant]	purple cudweed
Gnaphalium delicatum [contaminant]	creeping cudweed
Gnaphalium ensifer [contaminant]	creeping cudweed
Gnaphalium gymnocephalum [contaminant]	creeping cudweed
Gnaphalium involucratum [contaminant]	creeping cudweed
Gnaphalium laterale [contaminant]	cudweed
Gnaphalium limosum [contaminant]	creeping cudweed
Gnaphalium mackayi [contaminant]	cudweed
Gnaphalium nitidulum [contaminant]	cudweed
Gnaphalium paludosum [contaminant]	cudweed
Gnaphalium pensylvanicum [contaminant]	cudweed
Gnaphalium polylepis [contaminant]	cudweed
Gnaphalium purpureum [contaminant]	cudweed
Gnaphalium ruahinicum [contaminant]	creeping cudweed
Gnaphalium simplicicaule [contaminant]	cudweed
Gnaphalium sphaericum [contaminant]	Japanese cudweed
Gnaphalium subfalcatum [contaminant]	silky cudweed
Gnaphalium traversii [contaminant]	cudweed
Lactuca saligna [contaminant]	wild lettuce
Lactuca sativa [contaminant]	lettuce
Lactuca serriola [contaminant]	prickly lettuce
Lactuca virosa [contaminant]	acrid lettuce
Poa acicularifolia subsp. *ophitalis* [contaminant]	-
Pseudognaphalium luteoalbum [contaminant]	Jersey cudweed
Sonchus arvensis [contaminant]	perennial sow thistle
Sonchus asper [contaminant]	prickly sow thistle
Sonchus kirkii [contaminant]	-
Sonchus oleraceus [contaminant]	puha

Xanthium spinosum [contaminant]	bur

Poales

Poaceae

Cenchrus ciliaris [contaminant]	buffel grass
Digitaria aequiglumis [contaminant]	-
Digitaria ciliaris [contaminant]	summer grass
Digitaria ischaemum [contaminant]	summer grass
Digitaria sanguinalis [contaminant]	crab grass
Digitaria setigera [contaminant]	-
Digitaria violascens [contaminant]	-
Echinochloa crus-galli [contaminant]	barn grass
Echinochloa crus-pavonis [contaminant]	gulf barnyard grass
Echinochloa esculenta [contaminant]	Japanese millet
Echinochloa telmatophila [contaminant]	-
Panicum capillare [contaminant]	witchgrass
Panicum dichotomiflorum [contaminant]	smooth witchgrass
Panicum huachucae [contaminant]	-
Panicum maximum var. *trichoglume* [contaminant]	green panic
Panicum miliaceum [contaminant]	broomcorn millet
Panicum schinzii [contaminant]	swamp panicum
Panicum sphaerocarpon [contaminant]	-
Pennisetum macrourum [contaminant]	African feather grass
Poa acicularifolia subsp. *acicularifolia* [contaminant]	-
Poa anceps subsp. *anceps* [contaminant]	-
Poa anceps subsp. *polyphylla* [contaminant]	-
Poa annua [contaminant]	annual poa
Poa antipoda [contaminant]	-
Poa astonii [contaminant]	-
Poa aucklandica subsp. *aucklandica* [contaminant]	-
Poa aucklandica subsp. *campbellensis* [contaminant]	-
Poa aucklandica subsp. *rakiura* [contaminant]	-
Poa breviglumis [contaminant]	-
Poa buchananii [contaminant]	-
Poa bulbosa [contaminant]	bulbous poa
Poa celsa [contaminant]	-
Poa chathamica [contaminant]	-
Poa cita [contaminant]	silver tussock
Poa cockayneana [contaminant]	avalanche grass
Poa colensoi [contaminant]	blue tussock
Poa compressa [contaminant]	-
Poa cookii [contaminant]	-
Poa dipsacea [contaminant]	-
Poa foliosa [contaminant]	-
Poa hesperia [contaminant]	-
Poa imbecilla [contaminant]	-
Poa incrassata [contaminant]	-
Poa infirma [contaminant]	-
Poa intrusa [contaminant]	-
Poa kirkii [contaminant]	-
Poa labillardierei [contaminant]	-

Poa lindsayi [contaminant]	-
Poa litorosa [contaminant]	-
Poa maia [contaminant]	-
Poa maniototo [contaminant]	desert poa
Poa matthewsii [contaminant]	-
Poa nemoralis [contaminant]	-
Poa novae-zelandiae [contaminant]	-
Poa palustris [contaminant]	-
Poa pratensis [contaminant]	Kentucky bluegrass
Poa pusilla [contaminant]	-
Poa pygmaea [contaminant]	-
Poa ramosissima [contaminant]	-
Poa schistacea [contaminant]	-
Poa senex [contaminant]	-
Poa sieberiana [contaminant]	rough poa tussock
Poa spania [contaminant]	-
Poa sublimis [contaminant]	-
Poa subvestita [contaminant]	-
Poa sudicola [contaminant]	-
Poa tennantiana [contaminant]	-
Poa tonsa [contaminant]	-
Poa trivialis [contaminant]	rough-stalked meadow grass
Poa xenica [contaminant]	-
Solanales	
Solanaceae	
Lycium barbarum [contaminant]	boxthorn
Lycium ferocissimum [contaminant]	boxthorn

Non-regulated non plant pests

None

APPENDIX 1. (cont.)

MAF-RA-PL-20/9

Country IHS **ISSUED**

Import Health Standard
Commodity Sub-class: Fresh Fruit/Vegetables
Grape, *Vitis vinifera*
from Australia

ISSUED

Issued pursuant to Section 22 of the Biosecurity Act 1993

Date Issued: 20 December 2000

Commodity Class: Fresh Fruit/Vegetables
Grape, *Vitis vinifera*
from Australia

The attached import health standard has been prepared using PAQIS and is therefore consistent in content and format with other similar import health standards.

Initials and Date

THE ATTACHED IMPORT HEALTH STANDARD HAS BEEN PREPARED IN ACCORDANCE WITH MAF-RA-PL-20 AND IS RECOMMENDED FOR ISSUE.

Signature of the National Adviser responsible
For this Commodity Class (or their representative)

Date

The attached import health standard is approved and issued in accordance with Section 22(1) of the Biosecurity Act 1993.

Signature of the CTO (acting under delegated authority)	Date

The WTO has been notified: YES / NO

The 60 day WTO notification period is from:

Date	to	Date

1 NEW ZEALAND NATIONAL PLANT PROTECTION ORGANISATION

The New Zealand national plant protection organisation is the Ministry of Agriculture and Forestry and as such, all communication should be addressed to:

Director, Plants Biosecurity
Ministry of Agriculture and Forestry
PO Box 2526
Wellington
NEW ZEALAND

Fax: 64-4-498 9888
E-mail: plantihs@maf.govt.nz
http://www.maf.govt.nz

2 GENERAL CONDITIONS FOR ALL PLANT PRODUCTS

All plants and plant products are **PROHIBITED** entry into New Zealand, unless an import health standard has been issued in accordance with Section 22 of the Biosecurity Act 1993. Should prohibited plants or plant products be intercepted by the New Zealand Ministry of

Agriculture and Forestry, the importer will be offered the option of reshipment or destruction of the consignment.

The national plant protection organisation of the exporting country is requested to inform the New Zealand Ministry of Agriculture and Forestry of any change in its address.

The national plant protection organisation of the exporting country is required to inform the New Zealand Ministry of Agriculture and Forestry of any newly recorded organisms which may infest/infect any commodity approved for export to New Zealand.

Pursuant to the Hazardous Substances and New Organisms Act 1996, proposals for the deliberate introduction of new organisms (including genetically modified organisms) as defined by the Act should be referred to:

Manager, Operations
Environment Risk Management Authority
PO Box 131
Wellington
NEW ZEALAND

Also note:
In order to meet the Environmental Risk Management Authority's requirements the scientific name (i.e. genus and species) of the commodity must be included in the phytosanitary certificate.

3 EXPLANATION OF PEST CATEGORIES

The New Zealand Ministry of Agriculture and Forestry has categorised organisms associated with plants and plant products into regulated and non-regulated organisms as described below. Organisms (including weeds) associated with each commodity will appear on a separate pest list which will be attached to each import health standard as an Appendix. Weeds may be in the form of seeds or other plant parts.

3.1 REGULATED ORGANISMS

Regulated organisms are those organisms for which phytosanitary actions would be undertaken if they were intercepted/detected. These will include new organisms as defined by the Hazardous Substances and New Organisms Act 1996. Regulated organisms are sub-divided into the following groups:

3.1.1 Quarantine: Risk group 1 pests

Risk group 1 pests are those regulated pests (FAO Glossary of Phytosanitary Terms, 1996) which on introduction into New Zealand could cause unacceptable economic impacts on the production of a commodity/commodities and/or the environment.

3.1.2 Quarantine: Risk group 2 pests

Risk group 2 pests are those regulated pests which on introduction into New Zealand could cause a major disruption to market access (some importing countries require specific pre-export phytosanitary treatments) and/or significant economic impacts on the production of a particular commodity/commodities and/or the environment.

3.1.3 Quarantine: Risk group 3 pests

Risk group 3 pests (e.g. economically significant species of fruit flies) are those regulated pests which on entry into New Zealand would cause a major disruption to market access for a wide range of New Zealand commodities and/or have significant economic impacts on their production and/or the environment (some importing countries prohibit the entry of the host commodity). An official surveillance system is required for such pests in New Zealand.

3.1.4 Regulated non-quarantine pests

A regulated non-quarantine pest (denoted by "reg." on the pest list) is a pest whose presence in a consignment of plants for planting, affects the intended use of those plants with an economically unacceptable impact and is therefore regulated within the territory of the importing contracting party (Revised IPPC definition, Rome 1997). These pests would be under official control by the use of a Government operated or audited certification scheme.

3.1.5 Regulated non plant pests

Regulated non plant pests are those organisms which, although not pests of plants or plant products, may be associated with plants or plant products in international trade, and may have an affect on human or animal health (eg. black widow spider) and thus fall under the jurisdiction of other New Zealand government departments. The categorisation of these organisms and their associated import restrictions will be applied in accordance with the requirements of the relevant departments.

3.1.6 Vectors of associated quarantine pests

In the context of this import health standard, vectors are those organisms which are able to transmit regulated pests into New Zealand. To prevent the transmission of vectored quarantine organisms to susceptible commodities in New Zealand, it is necessary to prevent the entry of their vectors. Vectors (denoted by "vect." on the pest list) will be categorised as risk group 1 even if they are present in New Zealand, unless they are risk group 2 pests in their own right. If the vectored organism is not present in the exporting country then the associated vector(s), if present in New Zealand, will be categorised as a non-regulated non-quarantine pest(s).

3.1.7 Vectored organisms

Vectored organisms (denoted by "VO" on the pest list) are those regulated pests that are able to enter New Zealand via a vector associated with the imported commodity.

3.1.8 Strains of pests

Where there is documented evidence that a pest associated with the imported commodity has a different host range, different pesticide resistance, vectors a different range of organisms, or is more virulent than that of the same species present in New Zealand, then the different strain (denoted by "strain" on the pest list) of that pest will be categorised accordingly as a risk group 1 or 2 regulated pest.

3.1.9 Unidentifiable organisms

Should identification of an organism not be possible within the required time frame, the organism will be categorised as a regulated pest (either risk groups 1, 2, or 3) until such time as shown otherwise.

3.1.10 Unlisted organisms

Should an organism be intercepted that is not included on the pest list for that commodity, it will be categorised into the appropriate risk group and action taken accordingly.

3.2 NON-REGULATED ORGANISMS

Non-regulated organisms are those organisms for which phytosanitary actions would not be undertaken if they were intercepted/detected. These would include new organisms which could not establish in New Zealand. Non-regulated organisms are sub-divided into the following groups:

3.2.1 Non-regulated non-quarantine pests

Non-regulated non-quarantine pests are either already present in New Zealand and are not under official control or, could not establish in New Zealand.

3.2.2 Non-regulated non plant pests

Non-regulated non plant pests are not pests of plants and are not of concern to the Ministry of Agriculture and Forestry or any other New Zealand government department.

3.3 CONTAMINANTS (INCLUDING SOIL)

Consignments contaminated with soil, or other potential carriers of regulated pests (eg. leaf litter) will not be permitted entry if the level of contamination is above the acceptable tolerance.

4 APPLICATION OF PHYTOSANITARY MEASURES

A number of different phytosanitary measures may be applied to pests in each risk group, depending on the commodity and the type of pest. These measures include:

4.1 QUARANTINE: RISK GROUP 1 PESTS

Phytosanitary measures required for risk group 1 pests may include:

- inspection and phytosanitary certification of the consignment according to appropriate procedures by the national plant protection organisation of the exporting country,
- testing prior to export for regulated pests which cannot be readily detected by inspection (eg. viruses on propagating material from accredited facilities), and verified by an additional declaration, to that given on the phytosanitary certificate,

- inspection/testing of the consignment by the New Zealand Ministry of Agriculture and Forestry prior to biosecurity clearance, to ensure the specified pest tolerance has not been exceeded.

4.2 QUARANTINE: RISK GROUP 2 PESTS

Phytosanitary measures required for risk group 2 pests may include all the requirements for risk group 1 pests and may also require pre-export pest control activities to be undertaken by the contracting party, and confirmed by additional declarations to the phytosanitary certificate.

4.3 QUARANTINE: RISK GROUP 3 PESTS

Phytosanitary measures applied to risk group 3 pests may include all the requirements for risk group 1 pests plus:

- the application of a pre-export treatment which has been developed in accordance with an approved New Zealand Ministry of Agriculture and Forestry standard,
- an official bilateral quarantine arrangement between the New Zealand Ministry of Agriculture and Forestry and Australia national plant protection organisation which includes descriptions of each approved treatment system(s),
- specific additional declarations on the phytosanitary certificate.

4.4 REGULATED NON-QUARANTINE PESTS

Phytosanitary measures applied to regulated non-quarantine pests will generally be the same as for risk group 1 pests, or according to the contingencies implemented for that pest if detected in New Zealand.

4.5 NON-REGULATED NON-QUARANTINE PESTS

No phytosanitary measures are applied to non-regulated non-quarantine pests.

5 GENERAL CONDITIONS FOR FRESH FRUIT/VEGETABLES

Commodity sub-class: fresh fruit/vegetables includes fresh fruit and vegetables for consumption.

Only inert/synthetic material may be used for the protection, packaging and shipping materials of fresh fruit/vegetables.

All host material (fruit/vegetables) of fruit fly species (Diptera: Tephritidae) of economic significance shall only be imported under the terms of a bilateral quarantine arrangement (e.g. agreement, workplan) between the New Zealand Ministry of Agriculture and Forestry's Director, Plants Biosecurity and the head of the supply country's national plant protection organisation.

6 SPECIFIC CONDITIONS FOR GRAPES FROM AUSTRALIA

This import health standard covers the requirements for the entry of grapes, commodity sub-class: fresh fruit/vegetables from Australia only.

6.1 PRE-EXPORT REQUIREMENTS

6.1.1 Inspection of the consignment

The New Zealand Ministry of Agriculture and Forestry requires that the Australia national plant protection organisation sample and inspect the consignment according to official procedures for all visually detectable regulated pests (as specified by the New Zealand Ministry of Agriculture and Forestry), with a 95% confidence level, that not more than 0.5% of the units in the consignment are infested (this equates to an acceptance level of zero units infested by quarantine pests in a sample size of 600 units).

6.1.2 Testing of the consignment

Testing of the consignment prior to export to New Zealand for quarantine pathogens which are not visually detectable is not generally required for fresh grapes from Australia.

6.1.3 Documentation

Bilateral quarantine arrangement: Required

Grapes, commodity sub-class: fresh fruit/vegetables, may only be imported into New Zealand from Australia under the terms of the bilateral quarantine arrangement.

Phytosanitary certificate: Required.

Import permit/Authorisation to import: Exempt under Gazette Notice: No. AG12, 13 July 1995.

6.1.4 Phytosanitary certification

A completed phytosanitary certificate issued by the Australia national plant protection organisation must accompany all grapes, commodity sub-class: fresh fruit/vegetables exported to New Zealand.

Before an export phytosanitary certificate is to be issued, the Australia national plant protection organisation must be satisfied that the following activities required by the New Zealand Ministry of Agriculture and Forestry have been undertaken.

The grapes have:

- been inspected in accordance with appropriate official procedures and found to be free of visually detectable regulated pests specified by the New Zealand Ministry of Agriculture and Forestry.

  AND
- undergone an agreed treatment that is effective against species in Quarantine: Risk group 3.

AND

- undergone appropriate pest control activities that are effective against:

  Conogethes punctiferalis
  Latrodectus hasselti
  Maconellicoccus hirsutus

  OR

  been sourced from an area free (verified by an official detection survey) from the following:

  Conogethes punctiferalis
  Maconellicoccus hirsutus

Note: Combinations of treatments and area freedom are permissible for the aforementioned risk group 2 regulated pests.

6.1.5 Additional declarations to the phytosanitary certificate

If satisfied that the pre-export activities have been undertaken, the Australia national plant protection organisation must confirm this by providing the following additional declarations to the phytosanitary certificate:

"The grapes in this consignment have:

- been inspected in accordance with appropriate official procedures and found to be free of any visually detectable regulated pests specified by the New Zealand Ministry of Agriculture and Forestry.

  AND

- been treated in accordance with Appendix 2 or 5 of the Arrangement between the New Zealand Ministry of Agriculture and Forestry and the Australia national plant protection organisation concerning the access of host material of fruit fly species of economic significance into New Zealand from Australia.

  AND

- undergone appropriate pest control activities that are effective against:

  Conogethes punctiferalis
  Latrodectus hasselti
  Maconellicoccus hirsutus

  OR
  been sourced from an area free (verified by an official detection survey) from the following:

Conogethes punctiferalis
Maconellicoccus hirsutus."

Note: For *Latrodectus hasselti,* either an additional declaration is required whereby *Latrodectus hasselti* is treated using forced air fumigation with a mixture of sulphur dioxide (1%) and carbon dioxide (6%) for 30 minutes OR the treatment specification for *Latrodectus hasselti* is detailed in the treatment section of the Phytosanitary Certificate.

6.2 TRANSIT REQUIREMENTS

The grapes must be packed and shipped in a manner to prevent contamination by regulated pests.

The package should not be opened in transit. However, where a consignment is either stored, split up or has its packaging changed while in another country (or countries) *en route* to New Zealand, a "Re-export Certificate" is required. Where a consignment is held under bond, as a result of the need to change conveyances, and it is kept in the original shipping container, a "Re-export Certificate" is not required.

6.3 INSPECTION ON ARRIVAL

The New Zealand Ministry of Agriculture and Forestry will check the accompanying documentation on arrival to confirm that it reconciles with the actual consignment.

The New Zealand Ministry of Agriculture and Forestry requires, with 95% confidence, that not more than 0.5% of the units (for grapes, a unit is one bunch) in a consignment are infested with visually detectable regulated pests. To achieve this, the New Zealand Ministry of Agriculture and Forestry will sample and inspect 600 units with an acceptance level of zero infested units (or equivalent), from the (homogeneous) lot.

6.4 BIOSECURITY/QUARANTINE DIRECTIVE

The commodity may be directed to a facility for further treatment if required.

6.5 TESTING FOR REGULATED PESTS

The New Zealand Ministry of Agriculture and Forestry may, on the specific request of the Director, Plants Biosecurity, test grapes (commodity subclass: fresh fruit/vegetables) from Australia for regulated pests.

6.6 ACTIONS UNDERTAKEN ON THE INTERCEPTION/DETECTION OF ORGANISMS/CONTAMINANTS

If regulated pests are intercepted/detected on the commodity, or associated packaging, the following actions will be undertaken as appropriate:

6.6.1 Quarantine: Risk group 1 pests

If a risk group 1 pest is intercepted, the importer will be given the option of:-

- treatment (where possible) of the consignment at the importer's risk,
- re-sorting (specific conditions apply) of the consignment,
- reshipment of the consignment,
- destruction of the consignment.

6.6.2 Quarantine: Risk group 2 pests

If a risk group 2 pest is intercepted, the importer will be given the option of:-

- treatment (where possible) at the discretion of the Director, Plants Biosecurity and immediate feedback to the national plant protection organisation of the exporting country with a request for corrective action,
- reshipment of the consignment,
- destruction of the consignment.

6.6.3 Quarantine: Risk group 3 pests

Actions for the interception of risk group 3 pests will include:-

- reshipment of the consignment OR destruction of the consignment,

  AND

- the suspension of trade, until the cause of the non-compliance is investigated, identified and rectified. The appropriate actions may be audited by the New Zealand Ministry of Agriculture and Forestry. Once the requirements of the New Zealand Ministry of Agriculture and Forestry have been met to the satisfaction of the Director, Plants Biosecurity, and supporting evidence is provided and verified by the Australia national plant protection organisation, the trade suspension will be lifted.

6.6.4 Regulated non-quarantine pests

Actions for the interception/detection of regulated non-quarantine pests will be in accordance with the contingencies implemented for that pest if detected in New Zealand.

6.6.5 Regulated non plant pests

Actions for the interception/detection of regulated non plant pests will be in accordance with the actions required by the relevant government department.

6.6.6 Non-regulated non-quarantine pests

No action is undertaken on the interception of non-regulated non-quarantine pests.

6.6.7 Non-regulated non plant pests

No action is undertaken on the interception of non-regulated non plant pests.

6.6.8 Contaminants

Lots with more than 25 grams of soil per 600 unit sample shall be treated, reshipped or destroyed.

Interception of extraneous plant material (e.g. leaves, twigs) in the 600 unit sample will result in the lot being held until an assessment has been made in comparison with the risk of importing the part(s) of the plant species concerned.

6.7 BIOSECURITY CLEARANCE

If regulated pests are not detected, or are successfully treated following interception/detection biosecurity clearance will be given.

6.8 FEEDBACK ON NON-COMPLIANCE

The Australia national plant protection organisation will be informed by the New Zealand Ministry of Agriculture and Forestry's Director, Plants Biosecurity of the interception (and treatment) of any regulated pests, "unlisted" organisms, or non-compliance with other phytosanitary requirements.

7 CONTINGENCIES FOLLOWING BIOSECURITY CLEARANCE

Should a regulated pest be detected subsequent to biosecurity clearance, the New Zealand Ministry of Agriculture and Forestry may implement a management programme (official control programme) in accordance with Part V of the Biosecurity Act 1993 and Part 5 of the Biosecurity Amendment Act 1997.

Pest List

Commodity Sub-class: Fresh Fruit/Vegetables
Grape, *Vitis vinifera*
from Australia

REGULATED PESTS (actionable)

Quarantine: Risk group 3 pests

Insect	
Insecta	
Diptera	
Tephritidae	
Bactrocera neohumeralis	lesser Queensland fruit fly
Bactrocera tryoni	Queensland fruit fly
Ceratitis capitata	Mediterranean fruit fly

Quarantine: Risk group 2 pests

Insect	
Insecta	
Homoptera	
Pseudococcidae	
Maconellicoccus hirsutus	pink hibiscus mealybug
Lepidoptera	
Pyralidae	
Conogethes punctiferalis	yellow peach moth

Quarantine: Risk group 1 pests

Insect	
Insecta	
Coleoptera	
Cerambycidae	
Dihammus vastator	fig longhorn
Chrysomelidae	
Altica gravida	metallic flea beetle
Monolepta australis	red-shouldered leaf beetle
Monolepta divisa	small monolepta beetle
Curculionidae	
Orthorhinus cylindrirostris	elephant weevil
Orthorhinus klugi	immigrant acacia weevil
Otiorhynchus cribricollis	cribrate weevil
Nitidulidae	
Carpophilus maculatus	dried fruit beetle
Scarabaeidae	
Dilochrosis atripennis	flower chafer
Diphucephala sp.	green scarab beetles

Diptera	
Drosophilidae	
Drosophila spp.	vinegar flies
Hemiptera	
Coreidae	
Fabrictilis australis	squash bug
Mictis profana	crusader bug
Lygaeidae	
Nysius vinitor	Rutherglen bug
Oxycarenus arctatus	coon bug
Pentatomidae	
Plautia affinis	green stink bug
Pyrrhocoridae	
Dysdercus sidae	pale cotton stainer
Scutelleridae	
Scutiphora pedicellata	metallic shield bug
Homoptera	
Aleyrodidae	
Aleurocanthus spiniferus	orange spiny whitefly
Margarodidae	
Icerya seychellarum	Seychelles scale
Pseudococcidae	
Ferrisia virgata	striped mealybug
Lepidoptera	
Lymantriidae	
Porthesia paradoxa	tussock moth
Noctuidae	
Agrotis munda	brown cutworm
Eudocima fullonia	fruit-piercing moth
Psychidae	
Hyalarcta huebneri	leaf case moth
Sphingidae	
Hippotion celerio	grapevine hawk moth
Theretra oldenlandiae	vine hawk moth
Tortricidae	
Epiphyas spp. (except *E. postvittana*)	leafrollers
Orthoptera	
Acrididae	
Austracris guttulosa	spur-throated locust
Valanga irregularis	giant grasshopper
Thysanoptera	
Phlaeothripidae	
Haplothrips froggatti	black plague thrips
Thripidae	
Scirtothrips dorsalis	chilli thrips
Mite	
Arachnida	
Acarina	
Tenuipalpidae	

Brevipalpus lewisi	bunch mite
Tetranychidae	
Calepitrimerus vitis	grapeleaf rust mite
Eutetranychus orientalis	pear leaf blister mite
Mollusc	
Gastropoda	
Stylommatophora	
Bradybaenidae	
Bradybaena similaris	snail
Fungus	
Mitosporic Fungi (Coelomycetes)	
Sphaeropsidales	
Sphaerioidaceae	
Ascochyta ampelina	leaf spot
Ascochyta chlorospora	-
Coniella diplodiella	white rot
Mitosporic Fungi (Hyphomycetes)	
Hyphomycetales	
Dematiaceae	
Alternaria vitis	leaf disease
Cladosporium viticola	cladosporium leaf spot
Weed	
Angiospermae	
Asterales	
Asteraceae	
Baccharis halimifolia [contaminant]	baccharis
Chondrilla juncea [contaminant]	skeleton weed
Sonchus spp. (except *S. arvensis, S. asper, S. oleraceus, S. kirkii*) [contaminant]	sowthistle
Xanthium spp. (except *X. spinosum*) [contaminant]	bur
Geraniales	
Zygophyllaceae	
Tribulus terrestris [contaminant]	caltrop
Poales	
Poaceae	
Cenchrus spp. (except *C. ciliaris*) [contaminant]	grass
Digitaria spp. (except *D. aequiglumis, D. ciliaris, D. ischaemum, D. sanguinalis, D. setigera, D. violascens*) [contaminant]	grass
Echinochloa spp. (except *E. crus-galli, E. crus-pavonis, E. esculenta, E. telmatophila*) [contaminant]	grasses
Eragrostis curvula [contaminant]	African love grass
Pennisetum alopecuroides [contaminant]	Chinese pennisetum
Pennisetum polystachion [contaminant]	mission grass
Phragmites spp. [contaminant]	grass
Sorghum halepense [contaminant]	Johnson grass

Sorghum x almum [contaminant]	Columbus grass
Solanales	
Solanaceae	
Lycium spp. (except *L. barbarum, L. ferocissimum*) [contaminant]	boxthorn
Solanum elaeagnifolium [contaminant]	silverleaf nightshade

Regulated non-quarantine pests

None

Regulated non plant pests

Spider	
Arachnida	
Araneae	
Theridiidae	
Latrodectus hasselti	Australian red-back spider

NON-REGULATED PESTS (non-actionable)

Non-regulated non-quarantine pests

Insect	
Insecta	
Coleoptera	
Curculionidae	
Otiorhynchus sulcatus	black vine weevil
Nitidulidae	
Carpophilus dimidiatus	corn sap beetle
Carpophilus hemipterus	dried fruit beetle
Urophorus humeralis	dried fruit beetle
Scarabaeidae	
Heteronychus arator	black beetle
Hemiptera	
Pentatomidae	
Nezara viridula	green vegetable bug
Homoptera	
Aleyrodidae	
Trialeurodes vaporariorum	greenhouse whitefly
Aphididae	
Aphis craccivora	cowpea aphid
Aphis gossypii	cotton aphid
Aphis spiraecola	spirea aphid
Macrosiphum euphorbiae	potato aphid
Coccidae	
Coccus persicae	grapevine scale
Parasaissetia nigra	nigra scale
Parthenolecanium corni	European fruit scale
Diaspididae	
Aspidiotus nerii	oleander scale
Quadraspidiotus perniciosus	San Jose scale
Phylloxeridae	
Viteus vitifoliae	grape phylloxera
Pseudococcidae	
Planococcus citri	citrus mealybug
Pseudococcus calceolariae	citrophilus mealybug
Pseudococcus longispinus	longtailed mealybug
Pseudococcus viburni	obscure mealybug
Lepidoptera	
Agaristidae	
Phalaenoides glycinae	grapevine moth
Noctuidae	
Spodoptera litura	cluster caterpillar
Tortricidae	
Cydia molesta	oriental fruit moth
Epiphyas postvittana	light brown apple moth
Thysanoptera	

Thripidae	
Frankliniella occidentalis	western flower thrips
Heliothrips haemorrhoidalis	greenhouse thrips
Thrips imaginis	plague thrips
Thrips tabaci	onion thrips

Mite
Arachnida

Acarina	
Tarsonemidae	
Polyphagotarsonemus latus	broad mite
Tenuipalpidae	
Brevipalpus californicus	bunch mite
Tetranychidae	
Panonychus ulmi	European red mite
Tetranychus urticae	twospotted spider mite

Mollusc
Gastropoda

Stylommatophora	
Helicidae	
Helix aspersa	common garden snail

Fungus
Ascomycota

Diatrypales	
Diatrypaceae	
Eutypa armeniacae	eutypa dieback
Eutypa lata	eutypa dieback
Dothideales	
Botryosphaeriaceae	
Botryosphaeria dothidea (anamorph *Fusicoccum aesculi*)	canker
Elsinoaceae	
Elsinoe ampelina (anamorph *Sphaceloma ampelinum*)	anthracnose
Mycosphaerellaceae	
Mycosphaerella personata (anamorph *Pseudocercospora vitis*)	isariopsis blight
Mycosphaerella tassiana (anamorph *Cladosporium herbarum*)	black leaf spot
Erysiphales	
Erysiphaceae	
Uncinula necator (anamorph *Oidium tuckeri*)	powdery mildew
Leotiales	
Sclerotiniaceae	
Botryotinia fuckeliana (anamorph *Botrytis cinerea*)	grey mould
Sclerotinia sclerotiorum	cottony rot
Phyllachorales	
Phyllachoraceae	

Glomerella cingulata (anamorph *Colletotrichum gloeosporioides*)	bitter rot
Mitosporic Fungi (Coelomycetes)	
Sphaeropsidales	
Sphaerioidaceae	
Fusicoccum luteum	bunch rot
Macrophomina phaseolina	ashy stem blight
Phoma pomorum	phoma fruit and leaf spot
Phomopsis viticola	dead arm fungus
Unknown Coelomycetes	
Unknown Coelomycetes	
Greeneria uvicola	bitter rot
Mitosporic Fungi (Hyphomycetes)	
Hyphomycetales	
Moniliaceae	
Aspergillus niger	aspergillus rot
Oomycota	
Peronosporales	
Peronosporaceae	
Plasmopara viticola	downy mildew
Zygomycota: Zygomycetes	
Mucorales	
Mucoraceae	
Rhizopus arrhizus	wet rot
Rhizopus stolonifer	rhizopus soft rot
Weed	
Angiospermae	
Asterales	
Asteraceae	
Sonchus arvensis [contaminant]	perennial sow thistle
Sonchus asper [contaminant]	prickly sow thistle
Sonchus kirkii [contaminant]	-
Sonchus oleraceus [contaminant]	puha
Xanthium spinosum [contaminant]	bur
Poales	
Poaceae	
Cenchrus ciliaris [contaminant]	buffel grass
Digitaria aequiglumis [contaminant]	-
Digitaria ciliaris [contaminant]	summer grass
Digitaria ischaemum [contaminant]	summer grass
Digitaria sanguinalis [contaminant]	crab grass
Digitaria setigera [contaminant]	-
Digitaria violascens [contaminant]	-
Echinochloa crus-galli [contaminant]	barn grass
Echinochloa crus-pavonis [contaminant]	gulf barnyard grass
Echinochloa esculenta [contaminant]	Japanese millet
Echinochloa telmatophila [contaminant]	-
Pennisetum macrourum [contaminant]	African feather grass
Solanales	

Solanaceae

Lycium barbarum [contaminant]	boxthorn
Lycium ferocissimum [contaminant]	boxthorn

Non-regulated non plant pests

None

APPENDIX 1. (CONT.)

(Note that this document should be read in conjunction with the relevant documents referred to in the declaration)

Country: Chile

Scientific Name: *Vitis vinifera*

Common Name: Grape

PHYTOSANITARY CERTIFICATE - ADDITIONAL DECLARATIONS

The grapes in this consignment have:

RG1 Pests: been inspected in accordance with appropriate official procedures and found to be free from any visually detectable quarantine pests, specified by the New Zealand Ministry of Agriculture and Forestry.

RG2 Pests: Nil.

RG3 Pests: treated in accordance with Appendix 1 of the Arrangement between the New Zealand Ministry of Agriculture and Forestry and the Chile Servicio Agricola y Ganadero concerning the access of host material of fruit fly species of economic significance into New Zealand from Chile.

OTHER INFORMATION:

Phytosanitary inspection of Chilean grapes shall be aided by at least 10 X magnification or use of a Maggi lamp (i.e. a 10 X magnifying glass lit by a fluorescent tube which is held up from the basal satge). This inspection technique will assist in the detection of very small pests (e.g. *Brevipalpus chilensis* - false spider mite) that are often not visible to the naked eye.

APPENDIX 1. (CONT.)

(Note that this document should be read in conjunction with the relevant Import Health Standard identified under "Other`information" below)

Country: Mexico

Scientific Name: *Vitis vinifera*

Common Name: Grape

PHYTOSANITARY CERTIFICATE - ADDITIONAL DECLARATIONS

The grapes in this consignment have:

RG1 Pests: been inspected in accordance with appropriate official procedures and found to be free from any visually detectable quarantine pests, specified by the New Zealand Ministry of Agriculture and Forestry.

RG2 Pests: Nil.

RG3 Pests: treated in accordance with the Appendix 6 of the Arrangement between the New Zealand Ministry of Agriculture and Forestry and the Mexico Secretaria de Agricultura Ganaderia y Desarrollo Rural, concerning the access of host material of fruit fly species of economic significance into New Zealand from Mexico.

OTHER INFORMATION:

Specific **draft** IHS (PAQIS Version) approved on 28 May 1998.

APPENDIX 2:
Spider detections on table grapes from Chile, Australia, USA, and Mexico.

Organism	Common name	Family	Livestate	Grape variety	Date	Sex	Age	Location	Origin	Re
Araneae indet			unk	unk	09/11/2001	Unknown	Eggs	Upper Hutt	USA	03/
Araneae indet	hackled silk spider?	Agelenidae?	prob alive	red globe	02/01/2002	Unknown	egg sac and spiderlings	Winton	USA	03/
Araneae indet			live	red grapes	07/01/2002	Unknown	egg sac and spiderlings	Whangarei	USA	03/
Araneae indet			unk.	red globe	10/11/2000	Unknown	Eggs	Palmerston North	USA	03/
Araneae indet			dead	unk	27/11/2000	Unknown	eggs	border	USA	C2
Araneae indet			unk.	red globe	15/11/2001	Unknown	Eggs	Tawa, Wellington	USA	03/
Araneae indet			unk, frozen	red globe	28/11/2001	Unknown	Eggs	Napier	USA	03/
Araneae indet			dead	unk	30/10/2001	Unknown	eggs/spiderlings		USA	09/
Araneae indet			no life	unk	14/09/2001	Unknown	webbing	Papatoetoe	USA	09/
Araneae indet			no life	unk	08/12/2000	Unknown	webbing/exuviae	Auckland	USA	09/
Araneae indet			no life	unk	04/10/2001	Unknown	webbing/exuviae	Whangarei	USA	09/
Araneae indet			no life	unk	09/10/2001	Unknown	webbing/exuviae	Avondale	USA	09/
Badumna sp nr longinqua	grey house spider	Desidae	live	unk	26/11/2001	Female	Adult	Manurewa	USA	09/
Cheiracanthium inclusum	yellow sac spider	Clubionidae	dead adult and unk eggs	unk	03/10/2001	Female	Adult and eggs	Nelson	USA	09/
Cicurina sp.	hackled silk spider	Dictynidae	live	unk	28/09/2001	Male	Adult	Oamaru	USA	03/
Cicurina sp.	hackled silk spider	Dictynidae	live	red globe	03/10/2001	Male	Adult	Auckland	USA	09/
Cicurina sp.	hackled silk spider	Dictynidae	live	red grapes	04/12/2001	Female	Adult	Roxburgh	USA	03/
Clubiona sp.	vagrant spider	Clubionidae	no info	unk	08/12/2000	Female	Adult	Auckland	USA	9-0
Clubiona sp.	vagrant spider	Clubionidae	live	unk	19/02/2002	Female	Adult	Invercargill	Chile	03/
Clubiona sp.	vagrant spider	Clubionidae	no info	unk	28/01/2002	no info	no info	Border	Chile	03/
Dictyna sp.		Dictynidae	no info	unk	28/01/2002	no info	no info	Border	Chile	03/
Eris sp.		Saltidae	no info	unk	10/04/2001	Unknown	Adult	Auckland (border)	Chile	C2
Euryopis sp.	comb-footed spider	Theridiidae	live	red globe	14/11/2001	Female	Adult	Hokitika	USA	03/
Gea heptagon	orbweb spiders	Araneidae	live	unk	21/11/2001	Female	Adult	Rotorua	USA	03/
Hexathele sp.	tunnel web spider	hexathelidae	no info	unk	24/10/2001	Unknown		Dargaville	USA	09/
Indet	funnel weavers/grass spiders	Agelenidae	live	flames	04/09/2001	Female	Adult	Mt Albert	USA	09/
Indet		Poss. salticidae	2 live, rest dead	unk	04/10/2001	Female/male	juveniles	Auckland	USA	09/

Indet	orb-web spiders	Araneidae	live	unk	07/12/2000	Unknown	spiderlings	Bay of Plenty	USA	9-0
Indet indet	sac spider	Gnaphosidae	live	unk	27/09/2001	female	Adult	Tauranga	USA	03/
Indet indet	orb web spider	Araneidae	live	unk	01/11/2001	Female	Adult	Alexandra	USA	03/
Indet indet	long legged harvestmen	Phalangiidae	live	unk	22/11/2001	Female	Adult	Masterton	USA	03/
Indet indet		Theridiidae	dead eggs	unk	13/11/2000	Unknown	dead eggs	border	USA	C2
Indet indet			unk	unk	23/10/2001	Unknown	dead eggs	Auckland	USA	09/
Indet indet		Clubionidae	dead eggs	unk		Unknown	dead eggs	border	USA	C2
Indet indet	orb-web spiders	Araneidae	unk	red globe	29/11/2000	female/male	eggs/immat	Christchurch	USA	03/
Indet indet			unk	unk	03/04/2001	Unknown	no info	border	AUS	C2
Indet indet			unk	unk	16/04/2001	Unknown	no info	border	AUS	C2
Latrodectus geometricus	brown widow spider	Theridiidae	no info	unk	04/10/2000	no info	adult	Tawa, Wellington	USA	
Latrodectus hasselti	red-backed spider	Theridiidae	no info	unk	24/01/2001	no info	no info	pre-clearance-Australia	AUST	
Latrodectus hasselti	red-backed spider	Theridiidae	no info	unk	23/06/2001	no info	no info	Gore	AUST	
Latrodectus hesperus	western black widow	Theridiidae	live	red globe	10/11/2000	Male	Adult	Gore	USA	03/
Latrodectus hesperus	western black widow	Theridiidae	live	ribier	14/12/2000	Female	Adult	Timaru	USA	03/
Latrodectus hesperus	western black widow	Theridiidae	live	red globe	02/11/2001	Female	Adult	Nelson	USA	03/
Latrodectus mactans	black widow	Theridiidae	live	unk	02/10/2000	Female	Adult	Christchurch	USA	03/
Latrodectus mactans	black widow	Theridiidae	live	unk	12/09/2001	Female	Adult	Kaitaia	USA	09/
Latrodectus mactans	black widow	Theridiidae	live	unk	22/08/2001	Female	Juvenile	Feilding	USA	03/
Latrodectus mactans	black widow	Theridiidae	live	unk	19/09/2000	Unknown	unk	preclearance-USA	USA	
Latrodectus sp. nr hesperus	western black widow?	Theridiidae	live	red globe	08/12/2000	Female	Adult	Hamilton	USA	03/
Latrodectus sp. nr hesperus	western black widow?	Theridiidae	live	red globe	06/10/2001	Female	Adult	Pakuranga	USA	09/
Lycosa sp.	wolf spider	Lycosidae	live	unk	14/09/2001	Male	Adult	Hawkes Bay	USA	03/
Oradrassus assimilis		Gnaphosidae	live	unk	28/09/2001	Female	Adult	Petone	USA	03/
Phidippus johnsoni	Johnson jumper	Salticidae	live	red globe	07/11/2000	Female	Adult	Hawkes Bay	USA	03/
Phidippus johnsoni	Johnson jumper	Salticidae	live	red globe	07/11/2000	Female	Adult	Christchurch	USA	03/
Phidippus johnsoni	Johnson jumper	Salticidae	live	red globe	20/11/2000	Female	Adult	Alexandra	USA	03/
Phidippus johnsoni	Johnson jumper	Salticidae	live	red globe	21/11/2000	Female	Adult	Gore	USA	03/
Phidippus johnsoni	Johnson jumper	Salticidae	live	red globe	11/01/2001	Female	Adult	Auckland	USA	9-0
Phidippus johnsoni	Johnson jumper	Salticidae	live	unk	07/11/2001	Female	Adult	Tauranga	USA	03/
Phidippus johnsoni	Johnson jumper	Salticidae	no info	unk	31/10/2000	no info	no info	no info	USA	03/
Phidippus sp.		Salticidae	live	red globe	14/11/2000	Immat male	Adult	Gore	USA	03/
Phidippus sp.		Salticidae	live	red globe	19/12/2000	Male	Adult	Hawkes Bay	USA	03/
Phidippus sp.		Salticidae	live	red globe	22/01/2001	Male	Adult	Porirua	USA	03/
Steatoda grossa	house cobweb spider	Theridiidae	live	red	13/09/2001	Female	Adult	Christchurch	USA	03/
Steatoda grossa	house cobweb spider	Theridiidae	live	red	04/02/2002	Female	Adult	Hamilton	USA	03/
Webbing indet.			no life	unk	08/12/2000		webbing/exuviae	Auckland	USA	9-0

APPENDIX 3:

Spiders known to be associated with table grapes from California (commodity and vineyards).

IDENTIFICATION	REFERENCE	NOTES
Agelenidae *Hololena nedra*	 Costello and Daane 1995, CATI 1995, Costello and Daane 1997, Costello and Daane 1999, Costello and Daane 1998, Roltsch et al 1995	
Anyphaenidae *Anyphaena pacifica* *Aysha incursa*	 Costello and Daane 1995, Costello and Daane 1997, Costello and Daane 1998 Costello and Daane 1995, Costello and Daane 1998	
Araneidae *Neoscona oaxacensis* *Gea heptagon*	 Costello and Daane 1995, CATI 1995, Costello and Daane 1998 NPPRL	
Clubionidae *Cheiracanthium inclusum* *Clubiona*	 Costello and Daane 1995, CATI 1995, Costello and Daane 1997 NPPRL, Costello and Daane 1999, Costello and Daane 1998, Roltsch et al 1998 NPPRL	
Corinnidae *Trachelas pacificus*	 CATI 1995, Costello and Daane 1995, Costello and Daane 1997, Costello and Daane 1999, Costello and Daane 1998, Roltsch et al 1998	
Desidae *Badumna sp nr longinqua*	 NPPRL	 Present in NZ
Dictynidae *Dictyna calcarata* *Cicurina*	 Costello and Daane 1995, Costello and Daane 1998 NPPRL	
Gnaphosidae *Nodocion voluntarius* *Oradrassus assimilis*	 Costello and Daane 1995, Costello and Daane 1998 NPPRL	
Hexathelidae *Hexathele*	 NPPRL	 NZ endemic
Linyphiidae *Erigone dentosa*	 Costello and Daane 1995, CATI 1995, Costello and Daane 1997, Costello and Daane 1999, Costello and Daane 1998	

Lycosidae *Pardosa ramulosa* *Schizocosa mccooki* *Lycosa* sp.	 Costello and Daane 1995, CATI 1995, Costello and Daane 1998 Costello and Daane 1995, Costello and Daane 1998 NPPRL	
Mimetidae *Mimetus hesperus*	 Costello and Daane 1995, Costello and Daane 1998	
Oxypidae *Oxyopes scalaris* *Oxyopes salticus*	 Costello and Daane 1995, CATI 1995, Costello and Daane 1999, Roltsch et al 1998 Costello and Daane 1995, CATI 1995, Costello and Daane 1999, Roltsch et al 1998	
Philodromidae *Tibellus chamberlini*	 Costello and Daane 1995	
Salticidae *Metaphidippus vitis* *Platycrypttus californicus* *Phidippus johnsoni* *Phidippus clarus* *Thiodina sp.* *Metacyrba taeniola* *Phidippus* sp. *Habronattus* sp.	 Costello and Daane 1995, CATI 1995, Costello and Daane 1997 Costello and Daane 1999, Costello and Daane 1998 Costello and Daane 1995, NPPRL, CATI 1995, Costello and Daane 1998 Costello and Daane 1998, Costello and Daane 1995a Costello and Daane 1995, Costello and Daane 1998 Costello and Daane 1995, Costello and Daane 1998 Costello and Daane 1998 NPPRL Costello and Daane 1998	
Mitigurgidae *Cheiracanthium inclusum*	 Costello and Daane 1995, NPPRL	
Theridiidae *Theridion dilutum* *Theridion melanurum* *Latrodectus hesperus* *Latrodectus mactans* *Latrodectus geometricus* *Steatoda grossa* *Euryopis sp.*	 Costello and Daane 1995, Costello and Daane 1997, Costello and Daane 1999, Roltsch et al 1998 Costello and Daane 1995, Costello and Daane 1997, Costello and Daane 1999, Roltsch et al 1998 Costello and Daane 1995, NPPRL, CATI 1995, Costello and Daane 1998 NPPRL NPPRL NPPRL NPPRL	 Present in NZ
Thomisidae *Xysticus loculipes* *Coriaraches utahensis* *Misumenops sp.*	 Costello and Daane 1995, CATI 1995 Costello and Daane 1995, CATI 1995 Costello and Daane 1995, CATI 1995	

Appendix 3. (cont.)

Spiders known to be associated with Table grapes from Chile (commodity)

IDENTIFICATION	REFERENCE
Salticidae *Eris* sp.	NPPRL
Dictynidae *Dictyna* sp.	NPPRL
Clubionidae *Clubiona* sp.	NPPRL

Spiders known to be associated with Table grapes from Australia (commodity)

IDENTIFICATION	REFERENCE	NOTES
Theridiidae *Latrodectus hasselti*	NPPRL	Present in NZ