MINISTRY OF HEALTH
MANATŪ HAUORA

A Health Impact Assessment Relating to Venomous Spiders Entering New Zealand in Association with Imported Table Grapes

September 2002

Published in September 2002 by the
Ministry of Health
PO Box 5013, Wellington, New Zealand

ISBN: 0-478-25534-9 (book)
ISBN: 0-478-25535-9 (web)

This document is available on the Ministry of Health's website:
http://www.moh.govt.nz

Acknowledgements

Much of the toxicological information in this health risk assessment was contributed by Dr John S Fountain, Medical Toxicologist of the New Zealand National Poisons Centre. Dr Deborah Read, Senior Advisor Environmental Health and Dr Bob Boyd, Chief Technical Officer (Health) peer reviewed the first draft of the document. Mary-Louise Hannah, Senior Advisor (Nutrition/Surveys) provided peer review of the nutritional information in the assessment. Dr Barry Borman, Manager (Epidemiologist) Public Health Intelligence peer reviewed the arguments and advised on appropriate hazard comparisons.

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Executive Summary

In November 2001 the Chief Technical Officer (Conservation) and Chief Technical Officer (Health) advised the Ministry of Agriculture and Forestry that the level of protection for imports of Californian table grapes was not acceptable given the number of post-border detections of live spiders occurring, and trade was suspended.

Decisions regarding the recommencement of importation will take into account this assessment of the public health risk posed by venomous spiders associated with the importation of table grapes into New Zealand, along with the Indigenous Flora and Fauna Group of the Ministry of Agriculture and Forestry's *Pest Risk Assessment: Spiders associated with table grapes from California, Australia, Mexico and Chile* and *Mitigation Measures for the Management of the Risks Posed by Exotic Spiders Entering New Zealand in Association with Imported Table Grapes*.

Of the 58 interceptions / post border detections of spiders, eggs or spiderlings on consignments of table grapes arriving in New Zealand from January 2000 to February 2002, 20 were of species that were considered as possibly of public health significance: four members of the *Latrodectus* genus (*Latrodectus mactans* (Black widow spider), *Latrodectus hesperus* (Western black widow spider), *Latrodectus geometricus* (Brown widow spider) and *Latrodectus hasselti* (Australian redback)); *Phidippus johnsoni* (Johnson jumper); and *Cheiracanthium inclusum* (Yellow sac spider).

This assessment confirms that all but *Phidippus johnsoni* are public health hazards with the potential to cause significant morbidity or mortality. However of those species that represent a public health hazard only the two black widow spiders (*Latrodectus mactans* and *Latrodectus hesperus*) were detected post-border on more than a single occasion. There were 8 post-border detections of live *Latrodectus* spiders in association with table grape imports to New Zealand between January 2000 and November 2001. All these post-border detections were associated with table grape imports from California. Adult female black widow spiders are responsible for most black widow spider bites and 6 of these live post-border detections were of adult female black widow spiders.

Black widow spiders pose a moderate health risk; black widow spider bites in some cases require medical intervention, and in a small number of cases the effects of bites can be severe, but they do not represent the scale of risk that is posed by, for example, insects capable of vectoring infectious human diseases.

Post-border detections of black widow spiders provide for high individual exposure, creating a moderately high public health risk. The public health risk posed by the scenario of black widow spiders becoming established in New Zealand is moderately low.

The impacts on human health and health systems triggered by black widow spiders would be amplified by the public perception of the health risk posed by black widow spiders in a country where venomous creatures are rare.

Potential financial costs associated with post-border detections and the establishment of populations of black widow spiders relate to the treatment of bites, the loss of production

from bites; professional training; professional information dissemination; public information dissemination; the establishment of rapid response taxonomic services, the auditing, establishing and maintenance of antivenom stores, and the contracting of expert advice.

There would also be a social cost associated with any establishment of populations of black widow spiders relating to the behaviour modifications required to minimise the new risk.

No significant health benefits were identified relating to the importation of table grapes into New Zealand.

The Ministry acknowledges that, despite what was seen as an unacceptable number of post-border spider detections related to table grape imports, there have been no reports of black widow spiders biting people in New Zealand to date.

Drafts of this Health Impact Assessment (titled *Towards a Health Impact Assessment Relating to Venomous Spiders Entering New Zealand in Association with Imported Table Grapes: A Discussion Document),* of the *Pest Risk Assessment: Spiders associated with table grapes from California, Australia, Mexico and Chile* and of the *Mitigation Measures for the Management of the Risks Posed by Exotic Spiders Entering New Zealand in Association with Imported Table Grapes*, were released for public consultation on 12 June 2002, with 24 July as the closing date for submissions.

Eighteen submissions were received. On the whole the submissions that commented on the draft Health Impact Assessment accepted the data presented in the assessment, but there was some disagreement with the interpretation of this data and with the process used to arrive at some of the conclusions. Amendments have been made to this Health Impact Assessment as a result of comments in the submissions, mainly to clarify some of the sections, and, therefore, address some of these disagreements. The Ministry of Health, Ministry Agriculture and Forestry, and the Department of Conservation have responded to all submissions in their Review of Submissions (Ministry of Agriculture and Forestry 2002).

Based on this assessment the Chief Technical Officer (Health) has not found that the public health risk posed by spiders entering the country on imported table grapes warrants the continuation of the suspension of Californian imports. She has found that the moderately high individual health risk posed by post-border detections of black widow spiders warrants the imposition of further pre-border measures to maximise as far as possible the likelihood of these spiders being intercepted before crossing the border, and the implementation of post-border measures to mitigate the effects of any future post-border detections of spiders of public health significance on imported table grapes.

Purpose

This report is intended to provide information on the public health risk posed by venomous spiders associated with the importation of *Vitis vinifera* (table grapes) into New Zealand. The importation of table grapes from California was suspended in November 2001 after the Chief Technical Officer (Health) and the Chief Technical Officer (Conservation) advised that the level of protection of the imports was not acceptable given the number of post-border detections of live regulated non-plant pests. Regulated non-plant pests (now categorised as 'regulated pests') are those organisms that, although not pests of plants or plant products, may be associated with plants or plant products in international trade, and may have an effect on human health or biodiversity and may thus fall under the jurisdiction of New Zealand government departments other than the Ministry of Agriculture and Forestry. *Latrodectus mactans* (black widow spider) is an example of one such non-plant or 'hitch-hiker' pest detected on bunches of imported Californian table grapes post-border which could pose a risk to human health. This report was written to assist with decision-making regarding the recommencement of importation of Californian table grapes, and to assist with the assessment of the appropriateness of the measures in place for table grape imports from Australia, Mexico and Chile.

Scope

This health impact assessment comprises a *risk assessment* (including identifying the hazard, identifying the health effects of the hazard and assessing the risk of human exposure to the hazard) a discussion of *risk communication* and options for *risk management*. The hazard identification section has focused on the deleterious effects that the spiders of concern can have on people: for descriptive information regarding the species and their behaviours see the Indigenous Flora and Fauna Group of the Ministry of Agriculture and Forestry's *Pest Risk Assessment: Spiders associated with table grapes from California, Australia, Mexico and Chile* (the IFF PRA).

Most of the determinants of public health lie outside of what we may usually view as the 'health environment'. People and communities are part of their environment and they rely on the quality of their environment for their survival and for the maintenance of their good health and wellbeing: 'there can … be a real reduction in wellbeing for the population at large from biosecurity incursions which damage parts of the environment significant for national or cultural identity' (NZIER 2000). The loss of the perception of a safe and healthy environment and the loss of spiritual wellbeing felt by some with the loss of any native species may impact on human health. While recognising the connection between human health and the environment, it is outside the scope of this assessment to assess the risk to the environment posed by spiders associated with the importation of table grapes (for such an assessment see the IFF PRA). This report, however, acknowledges that negative environmental impacts may also negatively impact on human health.

One of the key determinants of health is access to income, which is related to a country's GDP or economic wellbeing. Issues that threaten our economy will also threaten our health and wellbeing: at the individual level this could be due to loss of income through loss of employment, at the national level this could be through reduced GDP to spend on health. This paper however has not explored the economic benefit to New Zealand of the table grape trade, nor the economic risks to the local grape industry posed by the table grape trade.

The scope of this report is constricted by insufficient information about a number of important factors in assessing the health impact of exotic spiders in New Zealand:

- we do not have a way of estimating how many spiders entering the country via grape imports are represented by the number of live post-border detections
- although we have some information regarding spider bite incidence in the United States, we do not have the information required to quantify the risk of bites and envenomations in the New Zealand environment and therefore to quantify all the associated social and health system burdens
- we have insufficient information regarding the non-physical effects that incursions of exotic organisms may have on public health, either to quantify the current burden of related anxiety in New Zealand or the potential increase that spider detections and incursions may trigger.

This health impact assessment is a qualitative assessment of the potential impact on public health posed by the presence of venomous spiders in New Zealand caused by the importation of table grapes.

Background

The Ministry of Agriculture and Forestry (MAF) requires phytosanitary measures and procedures for the importation of fresh table grapes to New Zealand. The Indigenous Flora and Fauna Group of the Ministry of Agriculture and Forestry's *Mitigation Measures for the Management of the Risks Posed by Exotic Spiders Entering New Zealand in Association with Imported Table Grapes* (the Mitigation Measures Report) details these measures and procedures, which cover grape-picking practices through to systems auditing (e.g. visual inspection during picking and packing, fumigation with SO2/CO2, export inspection, import inspection and systems auditing).

In February 2001 the importation of table grapes from Mexico was suspended due to concerns about the increased range of *Homalodisca coagulata* (glassy-winged sharpshooter). Glassy-winged sharpshooters are capable of spreading the bacterium *Xylella fastidiosa*, which causes Pierces disease; a disease of grapevines for which there is no effective treatment.

In January 2001 MAF had also suspended the importation of table grapes from California mainly due to concerns over an increase in the population and distribution of glassy-winged sharpshooter in Southern California. However a number of validated post-border detections of live spiders in California table grape shipments late in the 2000 export season added impetus to this suspension. MAF undertook a review of the phytosanitary requirements for the importation of table grapes from California at this time.

Importation from California recommenced in June 2001 with additional phytosanitary measures in place to prevent incursions of glassy-winged sharpshooters and a MAF team travelled to California to audit the implementation of the phytosanitary measures. While this team did find three minor non-conformances (and identified relevant quality improvements) no critical non-conformances were observed (Downs 2001).

However by November 2001 there had been 28 post-border spider detections related to Californian table grapes that year. These 28 spiders included species considered to be of public health significance: *Latrodectus mactans* (black widow spider) (two), *Phiddipus johnsoni* (Johnson jumper) (two), *Latrodectus hesperus* (Western black widow spider) (one confirmed and another probable but not confirmed), *Cheiracanthium inclusum* (Yellow sac spider) (1 found dead).

In November 2001 the Chief Technical Officer (Conservation) and the Chief Technical Officer (Health) advised MAF that the level of protection of the imports of Californian table grapes was not acceptable given the number of post-border detections of live regulated non-plant pests and trade was once again suspended.

The IFF PRA, the Mitigation Measures Report and this health impact assessment will assist with the decision-making regarding the recommencement of the importation of Californian table grape sand with the assessment of the appropriateness of the measures in place for table grape imports from Australia, Mexico and Chile.

Hazard Identification

Spiders as human health risks

Physical

It has been estimated that there are some 170,000 species of spider in the world, 34,000 species of which have been described (Coddington and Levi 1991). Of these only a handful are considered to be dangerous. Spiders play a very important role in ecosystems, often to our benefit in that they catch many annoying and harmful insects, such as flies, mites and aphids.

All spiders, apart from those belonging to a few groups such as *Uloboridae* and *Holoarchaeidae* (Meier and White 1995), use venom to kill their prey and their venom is generally either neurotoxic or cytotoxic. Neurotoxic venom can disrupt the communication between the nervous system and the muscles of the prey (causing paralysis) and cytotoxic venom affects cellular tissue (causing local or widespread tissue destruction). The size of the toxic protein molecules reflects the spiders' prey; most spider venoms have evolved to capture small invertebrates (Forster and Forster 1999) and so spider venom is almost always harmless to humans.

However, there are a few exceptions where the bite of a spider can cause serious harm to humans, especially to young children, the sick and the elderly. In an extremely small number of such cases spider venom proves lethal. Humans can be affected by either neurotoxic or cytotoxic envenomation. The act of biting itself can infect the wound with environmental bacteria.

As the LD50 (the quantity of a lethal dose needed to kill 50 percent of a tested population) of spider venom differs among animals and as tests to determine the LD50 of various spiders has never been performed on humans, it is difficult to quantify how poisonous any given spider venom is for humans compared with other toxic substances.

With this wide diversity of spider venoms the correct identification of spider bites is significant for appropriate treatment, as antivenoms tend to be spider specific. Spider venoms were not moulded by evolution as deterrents; the defensive use of spider venoms is secondary (Vetter and Visscher 1998), therefore serious systemic toxic effects are usually not felt immediately and this 'delayed response' can mean it is hard to determine the spider that caused the bite. There is not a venom detection kit available for spiders as there is for some groups of snakes.

Although most spiders are 'venomous' this adjective usually refers to those spiders capable of inflicting poisonous wounds harmful to humans.

Non-physical

The fear of spiders is very common, varying from mild disgust to a debilitating aversion. People suffering from the fear of spiders (arachnophobia) do not always require the presence of the spider to cause a negative response and, in many cases no negative

associative learning event needs to occur to initiate arachnophobia (Vetter and Visscher 1998), nor does the fear of spiders appear to be associated with higher levels of anxiety trait or an increased disposition to fears in general. It is thought in fact that spider fears are part of a cluster of animal phobias that are an evolutionary adaptive response, probably as a defence against disease, dirt and contagion (rather than a defensive strategy developed in the face of predator pressure). This view is supported by there being no overwhelming consensus among those fearful of spiders on what they find the fearful features of spiders to be (Davey 1992). This does not mean that the effects of such fears are negligible: in a 1995 study carried out in Sydney of a relatively small sample (n=19) of 'spider fearfuls', 26 percent of study subjects claimed that their fear had "significantly interfered with their daily life or activities" (Jones and Menzies 1995).

As well as the generalised fear of spiders there is the more specific fear of venomous spider bites, in relation to oneself, others and companion animals: cats appear particularly sensitive to black widow spider bites (Fitzgerald 2000).

New Zealand spiders

New Zealand is home to approximately 2,500 spider species, 1,300 of which are described (Forster and Forster 1999). Some of these species have been inadvertently imported from other countries. Of the natives, although *Porrhothele antipodiana* (black tunnelweb spider) can deliver a painful bite, only *Latrodectus katipo* (katipo) should be treated with caution (Forster and Forster 1999).

The katipo (which means 'night stinger' in Māori) is the most poisonous native animal in New Zealand and belongs to the *Latrodectus* genus, which is a worldwide genus of over thirty species (Forster and Forster 1999). There are two species of katipo in New Zealand: *Latrodectus katipo* and *Latrodectus atritus* (the black katipo). No poisonous bites have been reported from the latter species (Forster and Forster 1999).

The katipo is ground-dwelling and restricted to warm sandy beaches (Forster and Forster 1999), preferring medium to dense marram clumps (Hann 1990) in which they weave small tangled webs to catch insects.

Katipo are rare in most areas of New Zealand and studies show an increasing overall decline in katipo numbers; over the last decade the species has totally disappeared from many North Island beaches. The reason for this decline is probably due to an introduced South African spider: *Steatoda capensis* (Brown house spider). The katipo spider, although a superior fighter, is not a fast reproducer and is slow to recover from a loss or disturbance of its habitat. *S. capensis* is better at recolonising newly vacant sites (Hann 1990).

The habitat of the katipo, its rarity in most areas, and its increasing rarity in all areas mean few people suffer katipo bites; of the 444 spider enquiries received by the National Poisons Centre since the beginning of 2000, six related to katipo spiders.

Reactions to katipo venom vary from discomfort through to difficulty in breathing and problems with the nervous system, the only two deaths documented as resulting from katipo envenomation date from the nineteenth century (Hutching 1998). *Latrodectus hasselti* (the Australian redback) antivenom is effective for katipo bites; however, national stocks are not managed systematically nor are their locations centrally recorded.

There is evidence that the katipo has 'existence value' to New Zealanders; katipo words and images are used in logos, trademarks and company names, and public warnings concerning the katipo tend to relate to avoiding them in order to protect the species rather than to protect human health (Christchurch City Council 2000).

Of the 'imported' species already in New Zealand the main risks to humans are from another member of the *Latrodectus* genus *Latrodectus hasselti* (the Australian redback), and from *Lampona cylindrata* (the white-tailed spider).

The female Australian redback bite can cause serious illness, but since redback spiders rarely leave their webs, humans are not likely to be bitten unless a body part such as a hand is put directly into the web. Australian redbacks also have small jaws and often bites are ineffective. Australian redbacks are not geographically widespread in New Zealand; the main population being most likely confined to Central Otago with smaller populations possibly present in New Plymouth (IFF PRA). Because of New Zealand's cooler and damper climate it is unlikely that populations will ever reach the same numbers as in Australia (Forster and Forster 1999). Australian redback venom acts directly on the nerves causing pain, sweating, muscular weakness, nausea and vomiting (Australian Museum 2000a). Australian redback antivenom is available in New Zealand, but as mentioned above an audit is required of current national stocks and their locations.

There is an ongoing debate among toxicologists and spider biologists about the effects and dangers of the bite of the white-tailed spider. Most bites appear to cause little or no effect beyond transient local pain and an itchy bump. However, a few cases do exhibit more extensive symptoms, such as local swelling and tenderness, skin discolouration, headache and nausea. Occasionally, the skin near the bite may ulcerate in a condition known as *necrotising arachnidism*. Evidence from several Australian studies strongly suggests that such skin ulceration is a rare outcome of white-tailed spider bites. Where such skin ulceration does occur there is debate as to the cause, i.e. whether it is the bite itself or bacterial infection contracted at the time of the bite (Australian Museum 2000b). However, there is a public perception, fuelled by high media interest, that white-tailed spiders pose a high risk to human health. Even if this perception is questioned by toxicologists and biologists there is still a demand for consultation and use of medical facilities when members of the public fear they have been bitten by white-tailed spiders.

Although the two syndromes, *latrodectism* (relating to bites from *Latrodectus* spiders) and *necrotising arachnidism*, are both recognised in this country, New Zealand health professionals have little opportunity to gain experience in the diagnosis and treatment of venomous spider bites, given the rarity of bites in New Zealand.

Intercepted spiders considered to be of human health significance

Of the 58 interceptions of spiders, eggs or spiderlings on consignments of table grapes from January 2000 to February 2002, the following species were considered to be possibly of public health significance at the time of the suspension of imports of Californian table grapes in November 2001:

Latrodectus mactans (Black widow spider)
Latrodectus hesperus (Western black widow spider)
Latrodectus geometricus (Brown widow spider)
Latrodectus hasselti (Australian redback)
Phidippus johnsoni (Johnson jumper)
Cheiracanthium inclusum (Yellow sac spider).

Post-border detection history: consignments from Chile, January 2000 – February 2002

There was one post-border detection (live adult female), and one interception at the border, of a spider of the genus *Clubiona* associated with table grape imports from Chile between January 2000 and February 2002. There are 12 species in the genus *Clubiona* and some of these are already established in New Zealand: they can be identified by their habit of hopping randomly in no particular direction while travelling (Forster and Forster 1999). Some species of *Clubiona* are capable of delivering painful bites, but as we do not know which species was detected post-border on Chilean grapes we have not been able to assess the hazard. There was only a single detection of these spiders during the period under review.

Post-border detection history: consignments from Mexico, January 2000 – February 2002

There were no interceptions or post-border detections of spiders associated with table grape imports from Mexico between January 2000 and February 2002. Imports from this country were suspended for part of this period, but 90,000 kilograms (9000 cartons) of grapes were imported from Mexico during 2000.

Post-border detection history: consignments from Australia, January 2000 – February 2002

There was one post-border detection (no information on life stage, life state or gender), and one interception pre-clearance in Australia, of an Australian redback associated with table grape imports from Australia between January 2000 and February 2002. A discussion of the Australian redback has been included under the heading 'New Zealand spiders' above, as the species has already established in New Zealand. The species is further discussed under the heading 'Post-border detections' below, due to the human exposure to the spiders provided by post-border detections.

Post-border detection history: consignments from California, January 2000 – February 2002

The six species that were considered to be of public health significance at the time of the suspension of imports of Californian table grapes represent 20 of the 58 interceptions and post-border detections of spiders, eggs or spiderlings relating to table grape imports from January 2000 – February 2002. Eighteen of these 20 interceptions and post-border detections related to imports from California. These 18 interceptions and post-border detections account for all of the species listed above apart from the Australian redback (relating to imports from Australia).

For description and behaviour of the spider species see the IFF PRA.

Widow spiders (Family: Theridiidae)

Table 1: Post-border detection history: consignments from California Jan. 2000 - Nov. 2001

Black Widow Spider (*Latrodectus mactans*)

Confirmed	2/10/00	Female	Adult	Christchurch	Live
Confirmed	22/08/01	Female	Juvenile	Feilding	Live
Confirmed	12/09/01	Female	Adult	Kaitaia	Live

Western Black Widow Spider (*Latrodectus hesperus*)

Confirmed	10/11/00	Male	Adult	Gore	Live
Confirmed	14/12/00	Female	Adult	Timaru	Live
Confirmed	2/11/01	Female	Adult	Nelson	Live
Suspected	8/12/00	Female	Adult	Hamilton	Live
Suspected	6/10/01	Female	Adult	Pakuranga, Auckland	Live

Brown Widow Spider (*Latrodectus geometricus*)

Confirmed	4/10/00	Unknown	Adult	Tawa, Wellington	Unknown

Biting behaviour

Widow spiders feed primarily on insects and other arthropods but, when disturbed, may bite people or other mammals. All three species readily adapt to human-altered environments. Although they generally tend to build their webs in locations where they will not be disturbed, black widow spiders can bite humans when they accidentally become trapped against human skin (for example when a person reaches under objects where the spider is hiding or when they put on clothing, gloves or shoes containing the spider). It is mainly the females that bite: few bites are reported from immature black widows, whose short fangs may not penetrate the skin, or from males, who likewise have small venom glands and short fangs (Vetter and Visscher 1998). Brown widow spiders have a retiring nature and are not in any way aggressive (Forster and Forster 1999).

Venom

Although the venom of the black widow spider is reported to be 'a more potent neurotoxin than that of [the] pit viper' and that each venom gland contains 0.2 mg venom (Caravati 2000), as mentioned above the lethal dose range is species-dependent and varies with size of prey. The venom is neurotoxic and contains several proteins that cause a massive release of neurotransmitters, changes in ion channels and which inhibit vesicle recycling in the brain (Vetter and Visscher 1998), i.e. brain function and muscle control is inhibited.

Although Bettini describes the brown widow spider as a less toxic species of the *Latrodectus* genus (Bettini 1964), Forster and Forster (1999) report that the venom of the brown widow spider is one of the most lethal of the *Latrodectus* group, but as mentioned above the risk of a person being bitten is minimal.

Signs

A black widow spider bite site may have localised erythema (inflammatory redness) and two fang marks may be seen where the skin was penetrated. A rash may develop after several days (Vetter and Visscher 1998). Diagnosis is usually dependent on symptoms.

Symptoms

The bite is experienced as a 'pin prick' sensation but causes pain within a few minutes. If venom has been injected at the time of the bite, the pain spreads rapidly to arms, legs, chest, back, and abdomen. The symptoms of an envenomating black widow spider bite are systemic, spreading through the lymphatic system and they usually start about 1 to 3 hours after the bite. The most common symptoms are intense pain, rigid stomach muscles, muscle cramping, malaise, local sweating, chills, nausea, oliguria (reduced urine production), vomiting, difficult respiration, partial paralysis, spasms and hypertension (Vetter and Visscher 1998) (Smith 1982).

The victim usually recovers in 3 to 5 days; however, without the use of antivenom about 5 percent of all black widow attacks are fatal, with the use of antivenom the fatality rate drops to 0.2 percent (Bettini 1964). Those at greatest risk are children, the sick, and the elderly, particularly those with high blood pressure or heart disease. According to the *2000 Annual report of the American Association of Poison Control Centres: Toxic Exposure Surveillance System* 2.17 million calls were received (from a population of 270.6 million) that year, of these 2,422 (0.112 percent) related to black widow spiders. Of these 2,422 calls 804 were referred on for treatment in a health care facility. Outcomes were recorded for 1,200 of the calls, of these 11.8 percent (142) had no further symptoms; 56.75 percent (681) suffered minor symptoms; 29.7 percent (356) suffered moderate symptoms; 1.75 percent (21) suffered major symptoms; and there were no deaths.

Treatment

Although there are antivenoms for black widow spider bites it has been argued that they should be avoided because of the chance of allergenic reaction (Vetter and Visscher 1998). It is argued that other therapeutic measures can be used to counter symptoms and that not

all bite victims need treatment as, in some cases, the spider injects no venom. These arguments, however, are based on the use of the black widow antivenom used in the United States, which is a not particularly pure (horse serum) product and which can cause a number of adverse reactions. Fortunately, Australian redback antivenom, which is considered efficacious without the same rate of adverse effects and which is available in New Zealand, can be used for the treatment of black widow spider bites (as the toxins are the same) and for moderate to severe envenomations the National Poisons Centre recommends the use of Australian redback antivenom. If antivenom is not immediately available, use of calcium gluconate can be considered for short-term amelioration of symptoms until treatment with antivenom is possible.

Information on appropriate behaviour for the public if a bite is suspected is provided below under the heading of 'Risk Communication'.

Johnson jumper – *Phidippus johnsoni* (Family: Salticidae)

Table 2: Post-border detection history: consignments from California Jan. 2000 – Nov. 2001

Confirmed	7/11/00	Female	Adult	Christchurch	Live
Confirmed	7/11/00	Female	Adult	Hawkes Bay	Live
Confirmed	20/11/00	Female	Adult	Alexandra	Live
Confirmed	21/11/00	Female	Adult	Gore	Live
Confirmed	11/01/01	Female	Adult	Auckland	Live
Confirmed	7/11/01	Female	Adult	Tauranga	Live
Confirmed	31/10/00	Unknown	Unknown	Unknown	Unknown
Suspected	14/11/00	Male	Immature	Gore	Live
Suspected	20/12/00	Male	Adult	Hawkes Bay	Live
Suspected	26/01/01	Male	Adult	Porirua	Live

Biting behaviour

Jumping spiders mainly prey on flies but they also prey heavily on other spiders. They have been described as stalking and pouncing on their prey with 'catlike' patience and precision. Most jumping spiders do not build webs, but spin silk for draglines and many may live in well-lit places, so on bright days they can often be found perched on tree bark, blades of grass and other well-lit places. In cloudy or rainy weather they may withdraw inside silken retreats (Buddle and Shorthouse 2000) (Professor Robert R Jackson, pers. comm. July 2002).

Bites

Jumping spiders may bite people if disturbed and Johnson jumpers may give a painful, but not usually serious, bite.

Symptoms

Bites from the Johnson jumper have not been reported as causing more than pain, erythema and local swelling. However, bites from other members of the genus *Phidippus* have been recognised as occasionally leading to necrotic lesions.

Treatment

Wash the bite area with a mild soap and water. Apply an ice pack over the area to help relieve pain and swelling if they occur.

Yellow sac spider – *Cheiracanthium inclusum* (Family: Clubionidae – Family: Miturgidae)

Table 3: Post-border detection history: consignments from California Jan. 2000 – Nov. 2001

Confirmed	3/10/01	Female	Adult and eggs	Nelson	Adult: Dead Eggs: Unknown

Biting behaviour

Yellow sac spiders are commonly found outdoors in shrubbery, making silken retreats in curled leaves during the day. However, they are nocturnal and at night are often found in homes; they spin silken sac webs in the corners of ceilings and walls, and behind shelves and pictures. They can be seen running on walls and ceilings at night and quickly drop to the floor to escape if they are disturbed. Bites usually occur when the spiders encounter sleeping humans and become trapped against a person's skin in clothing or bedding (Vetter and Visscher 1998; UCIPM 2001).

Venom

Some species of the genus *Cheiracanthium* (estimated as responsible for more bites on people than any other spider (UCIPM 2001)) are recognised as producing cytotoxic venom. Yellow sac spiders are one of these species and they can give nasty bites that may cause necrotic lesions in those bitten.

Signs

Many yellow sac spider bites can produce small blisters or slightly necrotic wounds, which usually heal over a period of several weeks without severe scarring. The bites are not very painful in the early stages, but later may lead to a necrotic lesion (Newlands and Atkinson 1990).

Symptoms

Consequences of bites from *Cheiracanthium* species vary and if effects do occur they are either described as initially painful with a red weal, or initially symptomless with only slight pain, erythema and swelling occurring after a period of 6 to 8 hours. In both cases

self-limiting necrotic lesions may occur, with healing occurring from 10 days to a month later (though bruise-like lesions may reappear). Systemic features, including headache and fever, have been occasionally reported (Wong et al 1987; Newlands and Atkinson 1990).

Treatment

Bites should be washed with a mild soap and water then an ice pack applied over the area to help relieve pain and swelling if they occur. If signs of infection develop (for example redness, swelling, tenderness) medical attention should be sought. If the wound appears necrotic there should be a thorough investigation for causes of dermal necrosis other than the spider bite. If other causes are reliably ruled out, the area of the bite should be kept clean. Antibiotics should be used if infection is identified. A surgeon should be consulted if necrosis does appear to be worsening.

Antivenom has not been developed for yellow sac spider venom.

Non-physical health

Introduction of harmful organisms into an environment

According to Dr John Mumford of the T H Huxley School of Environment, Earth Sciences and Engineering in the United Kingdom (Mumford 1999) there is a moral argument to be made against the disruption of nature by allowing harmful new organisms into an environment. He argues that the preservation of the natural environment in its original state may have an intrinsic value to many people, even if they cannot see any outward difference, and that people may wish, or even feel it a moral duty, to pass on their natural environment in its original state to future generations.

It is difficult to quantify such intrinsic value. Putting a dollar value on the physical impacts on human health may be calculated from factors such as cost of treatment, cost of targeted health promotion activities, cost of storing antivenoms, cost of illness monitoring systems, loss of income, or insurance payments for death or illness. Similar calculations can be made for the loss of domestic animals, and even, in a more arbitrary way, for the loss of wildlife (assigning token values to individuals of key species) (NZIER 2000). But even these figures do not capture such factors as the economic and social cost of loss of productivity due to the anxiety experienced when a potential harm is introduced into an environment, or when native species suffer depredations from invasive species.

The environmental impact of the spiders associated with importation of table grapes is being assessed as part of the IFF PRA; it should be noted that such effects may also impact on the health of New Zealanders. Apart from the intangible damage that may be felt by New Zealanders when a new invasive species establishes in New Zealand, such establishments may have tangible costs as well: we have a ‘naïve’ population that needs to be versed in the behaviours required to avoid novel poisonous insects. Therefore, the introduction of harmful new organisms into the New Zealand environment has a social cost in required behaviour modifications to minimise the new risk as well as a financial cost relating to awareness programmes.

Public perception

There has been high media interest in post-border detections of black widow spiders; environmental lobby groups have consistently called for the cessation of Californian grape importations due to the risk of black widow spiders establishing in New Zealand. Sectors of the New Zealand public cite black widow spider detections as examples of the ineffectiveness of New Zealand's biosecurity processes. Even if it is arguable that individual detections of spiders demonstrate such ineffectiveness (i.e. that even the most effective system cannot guarantee 100 percent exclusion of organisms) the Ministry of Health has to acknowledge the potential impact on health services of media coverage of black widow detections or evidence of populations of black widows establishing in areas of New Zealand. Anecdotally, the media coverage of the post-border black widow spider detections in 2001 led to a number of concerned calls to public health services.

The Ministry has experience of public anxiety levels rising with the announcement of detections or incursions of exotic pests: media statements regarding the identification of exotic species of public health significance are always followed by anxious calls to the Ministry's biosecurity staff from members of the public, sometimes geographically remote from where the identified specimen of spider, ant, wasp, mosquito etc was found. For example, the recent announcement of two larvae of *Ochlerotatus camptorhynchus* (southern saltmarsh mosquito) found at Whitford, south-east of Auckland, resulted in over 100 calls being received at the time of writing this report and from as far away from Whitford as Christchurch. These calls were only those received by the Ministry: the public is advised to call their nearest public health service if they believe they have encountered exotic mosquitoes so the total is probably a lot higher. Similarly, calls to the National Poisons Centre relating to white-tailed spiders always swell after media coverage of the spiders (Dr John Fountain, National Poisons Centre, pers. comm. April 2002).

Disease burden of anxiety

Although not intending to exaggerate the level of anxiety that may accompany post-border detections or evidence of establishment of exotic spiders of public health concern in New Zealand, the Ministry of Health must consider anxiety as an aspect of the harm represented by these spiders. As well as anxiety caused by intangibles, such as the failure of guardianship responsibilities for the environment and the loss of the perception of a safe environment, incursions of venomous spiders associated with the importation of table grapes have the potential to cause anxiety stemming from a perception of personal harm and from the perception of harm to others both human and non-human.

As discussed above under the non-physical aspect of spiders as human health risks, the fear of spiders is very common, can be debilitating and does not always require a negative associative learning event to trigger it. Therefore, the relative lack of poisonous spiders in New Zealand does not mean that New Zealanders are less prone to arachnophobia. Further, as people suffering from the fear of spiders do not always require the presence of a spider to cause a negative response, the mere reporting of a detection or incursion of 'notorious' spiders such as black widows could cause higher levels of anxiety. For many

sufferers of phobic conditions, the running of 'what if' scenarios is enough to bring on anxiety attacks.

We have insufficient information to be able to quantify either the current burden of related anxiety in New Zealand or the potential increase that spider detections or incursions may trigger. We do know however that there are significant economic and social costs associated with anxiety. Mental disorders are associated with significant physical and social disability and increased mortality. The World Health Organization definition of health is "a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity". A World Health Organization analysis of the global disease burden shows that mental disorders make up 5 of the 10 leading causes of disability worldwide and that the proportion of the global disease burden attributable to mental disorder is likely to increase to 50 percent between now and 2020 (New Zealand Guidelines Group 1998). New Zealand is no exception: in the Ministry of Health report on *The Burden of Disease and Injury in New Zealand* disability-adjusted life year (DALY) equals the loss of one year of healthy life. In 1996, 25.5 percent of the burden of non-fatal health outcomes were attributable to mental disorders (depression = 20,497 year lost to disability (YLD), anxiety disorders = 17,930 YLD). In the same year mental disorders were responsible for 12 percent of the DALY measure of the loss of healthy life years (Public Health Intelligence 2001).

Discussion

Of the six spider species considered to be of public health significance at the time of the suspension of imports of Californian table grapes in November 2001, the four species of the species of the *Latrodectus* genus: *Latrodectus mactans* (black widow spider), *Latrodectus hesperus* (western black widow spider), *Latrodectus geometricus* (brown widow spider) and *Latrodectus hasselti* (Australian redback), are hazards of potential significant morbidity (requiring medical attention) or mortality.

Brown widow spiders are a minimal bite risk and there was only one post-border detection of a single specimen of this species (gender and life state unknown) during the review period.

There was only one post-border detection of a single specimen of an Australian redback (gender, life stage and life state unknown) during the review period.

The yellow sac spider is a hazard of potential significant morbidity or mortality but there was only one post-border detection of a single specimen of this species during the review period, and that was of a dead individual.

Based on the low level of post-border detection of these species (and the possibility that no live specimens of any of these species were detected on grapes post-border) it would appear that current pre-border mitigation methods are sufficient for these species. The level of hazard would indicate post-border mitigation methods such as public health information dissemination would be appropriate if live specimens of these species were detected on grapes post-border. And they should remain in the group of spiders of public health significance known to be associated with table grape imports.

Johnson jumpers are of little medical concern (although as discussed above with white-tailed spiders, spiders considered of little medical concern can be perceived as being of medical concern by the general public, despite advice to the contrary).

The discussion for the rest of this report relates primarily to *Latrodectus mactans* and *L. hesperus* (black widow spiders).

Black widow spiders produce neurotoxic venom; the bite of adult female spiders can lead to a range of symptoms from minor to major and, in very rare cases, in the absence of antivenom, to death. The variables that determine the presence and severity of symptoms are the amount of venom (if any) that enters the system, the depth of the bite and the health status of the individual who is bitten. Those at most risk of suffering more severe symptoms when bitten are young children, the sick and the elderly. There is no LD50 (the quantity of a lethal dose needed to kill 50 percent of a tested population) measure for widow spider venom in humans with which to compare the toxicity of black widow spider venom with other toxic substances.

The wide diversity in spider venoms means the correct identification of spider bites is important for appropriate treatment. Even in the place of origin of the spiders of concern (California) health professionals have problems with accurate diagnosis. In one study of 600 suspected 'spider bite cases' in southern California, 80 percent were in fact caused by other arthropods, mostly ticks and reduviid bugs (assassin bugs) (Vetter and Visscher 1998). Problems with identifying the correct spider, or of recognising when symptoms relate to spiders at all, can lead to serious consequences given that there are sometimes unpleasant and dangerous reactions to antivenoms.

An added dimension to the picture of the 'black widow spider hazard' is provided by the potential non-physical health effects associated with their presence. It could be argued that any such effects could be heightened with black widow spider detections and incursions due to the existing negative public perception of these spiders.

From the *2000 Annual report of the American Association of Poison Control Centres: Toxic Exposure Surveillance System* quoted above it can be seen that about a third of those people who rang poison centres that year concerned about black widow bites were advised to seek further professional medical advice; of those for whom outcome information was recorded, although 88 percent suffered symptoms beyond the initial discomfort of a bite, slightly less than a third would have required the administration of antivenom in a facility with full support facilities, according to the recommendations of the New Zealand National Poisons Centre (refer to 'Widow spiders: Treatment' above). With the presence of safe, effective antivenom in New Zealand this represents a relatively low level hazard.

However, if it is estimated that 5 percent of all black widow attacks are fatal without antivenom, it could be argued that the lack of preparedness in New Zealand to respond rapidly and appropriately to venomous spider bites raises the level of the hazard from low to moderate. The impact on health services of heightened public awareness and anxiety relating to black widow spiders would also support the hazard being rated moderate rather than low.

Possible Health Benefits

Spiders

Spiders play a very important role in ecosystems, often to our benefit, in that they catch many annoying and harmful insects; however, there are approximately 2,500 species of spider already present in the New Zealand environment.

Grapes

Grapes contain vitamin C, niacin, pyridoxine, pantothenic acid, thiamin, riboflavin, biotin and folic acid: all at too low a level, however, to be considered as a serious dietary source (Robinson 1999). Grapes do contain large amounts of Vitamin P (a bioflavonoid) although there seems to be a dispute in the literature as to whether this is a true vitamin (however it may still be of benefit to health, even if not a vitamin).

Glucose and fructose accumulate in grapes, resulting from the sucrose photosynthesised in the leaves being moved via the phloem tubes into the grape berries during ripening. This occurs at the same time as water is accumulating in the berry, yet sugar concentration increases as well as liquid volume, i.e. sugar increases at a proportionately greater rate than water, giving grapes high sugar content (Robinson 1999).

There has been some research into the 'functional food' (providing health benefits beyond basic nutrition) value of grapes: resveratrol is a phenolic compound produced in the skins of grapes in response to fungal attack and has antioxidant properties. As the compound is produced in the skins of grapes and the maceration process used to produce red wine encourages the extraction of these compounds (Robinson 1999), resveratrol is the source of the reported cardiovascular benefits of drinking red wine (Gehm et al. 1997). Resveratrol has been reported to reduce serum platelet aggregation, cholesterol levels (Gehm et al. 1997), liver lipids, and, in the laboratory, appears to protect cells from cancerous change (Lu and Serrero 1999). However, the literature consulted discusses these benefits in the context of pharmacological agents based on extractions of this compound or from drinking red wine, so grape consumption would not be the only source of the benefit.

According to the 1997 National Nutrition Survey (Ministry of Health 1999) almost half of the New Zealand adult (15+ years) population met the New Zealand Nutrition Taskforce (1991) guideline of at least two servings of fruit per day. Overall, grape consumption had increased by 5 percent between 1989 and 1997. When grapes were available, 30 percent of the population chose to consume grapes at least once per week. Individuals in that 30 percent were more likely to be from the New Zealand Deprivation Index (NZDep) 1996 quartile one (least deprived) areas than those from quartile 4 (most deprived and at greater risk of inadequate diet) areas.

'Eat plenty of vegetables and fruit' is one of the key population health messages that form part of the Ministry of Health's *Healthy Action – Healthy Eating* strategy document

(Ministry of Health 2002). Ensuring a range of fruits and vegetables are available through all seasons would contribute to the successful uptake of this message.

Table grapes are imported into New Zealand from a range of countries to cover all the seasons:

Table 4: Volume of grape imports by country of origin

Country	Season	Metric tonnes imported 1998-2001	Notes
Australia	early January to early June	12,214	
Chile	early January to end of May	2,400	
Mexico	late May to early July	360	Prior to suspension due to concerns about the spread of Glassy-wing sharpshooter
California	late June to early December	11,133	

Season information provided by Justin Downs, MAF Biosecurity, pers. comm. March 2002

The very small New Zealand table grape industry produces high quality table grapes almost exclusively destined for the Japanese hospitality market; these exports represent only 30 tonnes of grapes per year (Ian Turk, New Zealand Fruitgrowers Federation, pers. comm. March 2002).

Grape consumption could contribute to the benefit of having off-season access to fresh fruit, but such access would not significantly contribute to the Ministry's nutrition strategy referred to above, which calls for special recognition of the particular needs of Māori and population groups at high risk, such as Pacific peoples, as individuals in these groups are less likely to choose grapes when they are available.

Exposure Assessment

A hazard becomes a public health risk when there is human exposure to the hazard. The level of risk is commensurate to the level of hazard only when all other factors, exposures and the people subject to them in particular, are equal. This is rarely the case. A very 'high' hazard can pose a low risk if human exposure to the hazard is negligible (e.g.

cholera entering the marine environment from ballast water discharges) and, conversely, high exposure to a negligible risk can create a high risk (e.g. airborne flour dust in a bakery leading to occupational asthma).

The exposure levels for black widow spiders in the two scenarios, that of population establishments and that of post-border detections, will be assessed separately.

Establishment

Ongoing exposure to black widow spiders would result for sections of the general public from the establishment of black widow spiders in New Zealand as the spiders readily adapt to human-altered environments.

We can attempt a comparison of *Latrodectus* spider bites reported for one year (2000) by national poisons centres in New Zealand and the United States:

> The United States has more that 70 times the population of New Zealand (270.6 million / 3.8 million). The United States national poison centres received 112 times the number of calls that the New Zealand National Poisons Centre received (2.17 million / 19,304), however there were 400 times the number of calls relating to *Latrodectus* spiders (US statistics are only for black widow spider bites (2,422); the New Zealand National Poisons Centre received six calls related to *Latrodectus* species that year: four for katipo, two for Australian redbacks). This equates to one call for every 112,000 people in the United States and one call for every 633,000 New Zealanders. During 2000 six times as many people in the United States called a poisons centre about black widow spiders as New Zealanders rang a poisons centre about katipo or Australian redbacks.

These figures for the United States may in fact be low due to the observation that the incidence of *latrodectism* does not always image the geographical distribution of the spiders; statistics gathered 1826–1926 in the United States show that two-thirds of all the cases of *latrodectism* reported were from California whereas black widows are present throughout North America (Bettini 1964). This means that the 2,422 calls relating to *Latrodectus* species received may have come from a smaller population base than that of the entire United States.

In addition, New Zealanders enjoy a relatively hazard-free natural environment and they are not versed in the behaviours required to avoid poisonous insects: many New Zealanders clear out yards and garages bare-footed, bare-limbed and bare-handed; and they sleep without first checking what might fall from the ceiling. Black widow spider-avoidance behaviours recommended by the *University of California Pest Management Guidelines* (UCIPM 2001) include:

- sweeping, mopping, hosing, or vacuuming webs and spiders off buildings regularly
- regularly vacuuming or sweeping windows, corners of rooms, storage areas, basements, and other seldom-used areas to remove spiders and their webs

- vacuuming spiders and removing spiders from indoor areas by placing a jar over them and slipping a piece of paper under the jar that then seals off the opening of the jar when it is lifted up
- sealing cracks in the foundation and other parts of the structure and gaps around windows and doors
- wearing shoes and gloves when working outdoors and in outbuildings
- cleaning up clutter in garages, sheds, basements, and other storage areas
- placing boxes off the floor and away from walls of indoor storage areas
- sealing boxes with tape to prevent spiders from taking up residence within
- keeping the area next to the house foundations free of rubbish, leaf litter, heavy vegetation, and other accumulations of materials
- trimming plant growth away from the house and other structures
- keeping lighting fixtures off structures and away from windows and doorways.

Some New Zealanders may already practise some or all of these behaviours, others may not; a lack of spider-avoidance behaviours could increase exposure to black widow spiders if they established in that area.

Black widow spiders, therefore, could potentially (based only on one year's data) pose greater than six times the risk of New Zealanders being bitten by venomous spiders than at present if the new venomous spiders were to establish and occupy populated areas in the same manner as they do in the United States. However, the total number of calls relating to spiders in 2000 represents only 0.8 percent of all calls to the National Poison Centre that year (173/19304), *Latrodectus*-related calls represent 0.03 percent of total calls that year (6/19304), so it could be argued that the result of such an increase in exposure is still only a moderate level of exposure compared to the level of exposure to other types of toxic substances (although still a higher exposure compared to exposure to other venomous spiders).

This comparison would be valid only if black widow spiders were to fill the same ecological niche in relation to that of human populations that they do in the United States. For an assessment of the likelihood of entry, establishment and spread of black widow spiders see the IFF PRA. In summary, the IFF PRA regards the likelihood of entry of black widow spiders to be low, the likelihood of establishment of black widow spiders to be low to moderate, and the likelihood of spread of black widow spiders in New Zealand to be moderate. It regards the overall risk of establishment, therefore, to be low.

Exposure to the hazard of the establishment of black widow spiders could be seen as moderate; however, if the likelihood of establishment is low the likelihood of exposure would similarly be low. Also the importation of table grapes is not the only pathway of entry for black widow spiders, which means that the adoption of further measures relating to table grapes in order to lower even further the risk of establishment from this pathway will not necessarily alter the risk of public exposure to the hazard.

Post-border detections

Of the 12 identifications of *Latrodectus* spiders in association with table grape imports to New Zealand January 2000 to November 2001, 10 were post-border detections. Of these

10 post-border detections 8 were of live spiders (the other two were of unknown life state). Of these 8 live spiders one was a juvenile female, one a male, and 6 were post-border detection of adult females; the spiders capable of inflicting venomous bites.

All post-border detections were in uncontrolled environments and were made by members of the public or industry workers after MAF officials had cleared the grapes. It is probable that not all live spiders were detected; the shape of bunches of grapes means that other live spiders may have stayed hidden until grapes are grasped for plucking off the stalk. Black widow spiders may bite when they come into contact with skin.

Therefore, the nature of the commodity: a product delivered unprocessed to retail outlets and eaten unprocessed by hand, means post-border detections provide a high individual exposure to the hazard (please note it is post-border detections that provide the high level of exposure for individuals, not grape consumption, as most bunches of grapes do not conceal spiders). It is of particular concern that grapes are seen as a luxury gift to deliver to the sick and to people in hospital and rest homes; the people most vulnerable to spider venom are the sick, the elderly and young children**.**

The remaining two post-border detections of *Latrodectus* spiders were one of *Latrodectus geometricus* (brown widow spider) (gender and life state unknown) associated with Californian grapes and a single post-border detection of *Latrodectus hasselti* (Australian redback) (gender, life stage and life state unknown) associated with table grapes imported from Australia.

Brown widow spiders have a retiring nature and are not in any way aggressive (Forster and Forster 1999) and Australian redbacks have small jaws and their bites are often ineffective. However, bites most frequently occur when a body part such as a hand comes into contact with spiders and therefore the level of exposure provided by brown widows and Australian redbacks being discovered on a commodity would be the same as that for black widow spiders being detected on the same commodity.

Similarly post-border detections of live yellow sac spiders would provide high individual exposure to these spiders.

Risk Characterisation

Risk characterisation is achieved by combining the information obtained from the hazard identification, the health effects of the hazard, and exposure assessment in order to estimate the risk associated with each exposure scenario considered, and to present information on uncertainties in the analysis to risk managers (Public Health Commission 1995).

It is not possible in this assessment to quantify the risk of bites and envenomations and the associated social and health system burdens: statistics from the country of origin could be understated for comparative purposes due to the population being used to spider avoidance behaviour, or may be overstated due to the diagnostic problems discussed above. Also we do not have a way to extrapolate the actual number of spiders of public health concern that enter the country from the number actually intercepted. The following is an attempt to take all relevant information into account in order to arrive at a non-quantitative risk characterisation.

Grapes from Chile

There is a low public health risk posed by the importation of table grapes from Chile based on an analysis of those spiders detected post-border and associated with table grape imports from Chile between January 2000 and February 2002: one post-border detection (live adult female) of a spider of the genus *Clubiona* (not identified to species).

Grapes from Mexico

There was no public health risk posed by the importation of table grapes from Mexico based on post-border detections of spiders and associated with table grape imports from Mexico between January 2000 and February 2002.

Grapes from Australia

There is a low public health risk posed by the importation of table grapes from Australia based on post-border detections of spiders and associated with table grape imports from Australia between January 2000 and February 2002: one Australian redback; gender, life stage and life state unknown.

Grapes from California

There is a moderately high individual health risk posed by the importation of table grapes from California based on post-border detections of spiders associated with table grape imports from California between January 2000 and February 2002 (the hazard is moderate, individual exposure is high). As we do not know the number of black widow spiders that enter the country on Californian table grapes in order to quantify the possible number of individual exposures, we can only refer to the rate of detection at the time of the suspension of trade; one post-border detection each month for the four months prior to the suspension.

There is a moderately low public health risk posed by the importation of table grapes from California where exposure would be provided by established populations of black widow spiders (the hazard is moderate, the level of exposure low). Also of relevance is the fact that imported grapes are not the only pathway of entry for these spiders.

Potential burden on public health and the public health system from post-border detections or establishment of spiders of public health significance:

- suffering and treatment of bites and their sequelae
- anxiety related to publicity about post-border detections of spiders or the presence of venomous spiders
- professional education campaigns
- accessing expert advice (medical and taxonomic)
- public awareness campaigns
- establishment and maintenance of antivenom stores.
- establishment of response plans.

Factors exacerbating risk:

- lack of relevant experience of health professionals in the identification of spider bites for appropriate treatment
- lack of systems in New Zealand for the rapid identification of exotic spiders.
- lack of local learned avoidance behaviours increasing the risk of exposure and of bites.

It is acknowledged that there have been no reported bites from exotic spiders detected as a result of the importation of grapes to date.

In trying to characterise the public health risk posed by black widow spiders generally, a possible comparison is with another exotic insect that is considered to be of sufficient public health concern that millions of dollars are being spent to contain, control and eradicate the species from New Zealand: *Ochlerotatus camptorhynchus* (southern saltmarsh mosquito). Southern saltmarsh mosquitoes are considered a high public health hazard due to their competency as a vector for various arboviral disease-causing viruses, Ross River Virus in particular. Ross River virus affects people differently according to their health status: it is uncommon in children, case numbers peak among young and middle-aged adults and, although not a lethal disease, at least 20 percent of infected individuals develop an acute disease (polyarthritic symptoms lasting a few days to 5 to 6 weeks) and about 10 percent of patients suffer a chronic fatigue-type syndrome (Ministry of Health 2001). The presence of the mosquitoes themselves does not present the risk; the Ross River virus would also have to be present. Apart from their nuisance biting behaviour non-viraemic mosquitoes are merely capable of carrying a health hazard.

The black widow spider hazard is more direct. The spiders themselves are naturally venomous; they are not vectors for another hazard. On a consequences comparison the defensive bite of a black widow spider has much more serious potential consequences than the aggressive bites of non-viraemic southern saltmarsh mosquitoes. When detected post-border black widow spiders are not confined geographically, but southern saltmarsh mosquitoes are dependent on a saltmarsh habitat.

The factors that make the mosquitoes such a high risk are the presence of suitable southern saltmarsh mosquito habitat close to human populations, the likelihood of entry of the virus (deemed to be inevitable due to the high movement of people to and from countries where Ross River virus is endemic and widespread), the non-immune status of the New Zealand population (leading to the elevated disease incidence rates of a 'virgin soil' epidemic) and the aggressive biting nature of the mosquitoes. Once the virus is present in the mosquito and human populations it has been predicted that there will be around three epidemics per decade, plus endemic cases in intervening years (Ministry of Health 2001).

The black widow spider hazard does not involve the self-perpetuating health risk of an infectious disease. Once Ross River virus becomes established in the mosquito population, on a consequences comparison, thousands of aggressive bites of viraemic mosquitoes have much more serious inevitable consequences than the potential consequences of a defensive black widow spider bite.

Risk Communication

Given the high media interest in widow spider detections government agencies would have to be proactive with communication strategies relating to any further widow spider detections, including media statements, provision of public information, etc.

There is an opportunity for risk communications to be associated with the commodity at point of sale; some retailers have expressed interest in the concept of self-managed programmes to assist with identification and reporting of exotic organisms associated with fresh produce. The Ministry of Health recommends the provision of information on first aid interventions to supermarket staff and other fresh produce retailers.

Supermarkets and other fresh produce outlets could also be an ideal location for more general biosecurity messages, explaining the inevitability of insects arriving in association with imported fresh fruit and vegetables and asking for the public's help, via the MAF 0800 number, with the detection of such organisms.

The concerns of environmental lobby groups on the subject of widow spiders foreshadow that sectors of the New Zealand public would find the establishment of widow spider populations an example of a failure of New Zealand's biosecurity processes. Government agencies would have to be prepared to react quickly to disseminate avoidance and health information should a population of black widow spiders become established in a populated area; such information would have to be sensitive to the perception that government agencies view the benefits of the table grape trade as outweighing the environmental and health risks associated with the commodity. Information on spider, avoidance behaviour around the home could be modelled on examples from California, as under *Establishment* above.

The most important information for any scenario concerns appropriate behaviour for the public if a bite is suspected. Along with information presented about black widow spider detections there has been the advice that if anyone suspects that a black widow spider may

have bitten them, they should place ice on the bite and seek urgent medical attention. Further information regarding cleaning the wound with antiseptic or warm soapy water, not applying pressure to the wound and not taking sedatives or consuming alcohol after having been bitten by a black widow spider, should be added to this advice.

Advice should also be given that, if the spider can be captured without endangering anybody, it should be caught to confirm its identification and the local public health service advised. In order to do this the spider should be approached with caution and fly spray used to stun the spider prior to killing it and/or placing it in a sealed jar.

Risk Management

Antivenom stores

While antivenom specifically for the black widow spider does exist in the United States, it carries a high rate of adverse reaction, and the currently available Australian redback antivenom is considered efficacious without the same rate of adverse effects. It is therefore reasonable to maintain adequate stocks of Australian redback antivenom rather than arrange supply of black widow antivenom. Australian redback antivenom has a shelf life of one year and costs $205 per vial (each treatment requires 1 to 2 vials).

All antivenoms have the potential to cause adverse reactions, notably anaphylaxis and serum sickness. Fortunately, these reactions are relatively uncommon with the Australian redback product; however, due to the possibility of anaphylaxis, full support facilities **must** be available whenever spider antivenoms are used.

The most cost-effective risk management strategy relating to the minimising of risks from spider envenomations by ensuring the availability of antivenoms would take a conservative view of potential incursions, formally reviewing antivenom stocks and supplies, developing systems for their maintenance and delivery, and considering the appropriateness of holding other existing antivenoms.

Estimated cost of antivenom management system: $56,250 (incl. GST), $28,125 (incl. GST) annual maintenance.

Development and management of professional training

The correct identification of spider bites is significant for appropriate treatment: there is a potential problem in New Zealand with health professionals recognising when symptoms definitely relate to spider bites (differential diagnosis).

Another area of expertise missing in New Zealand is that required to correctly and rapidly identify venomous spiders, and other venomous creatures, in order to ensure appropriate treatment in the event of envenomations (Dr John Fountain, National Poisons Centre, pers. comm. March 2002). Work is required to address this problem, which is complex given

the range of possible intruders, the rarity of instances where the service would be required, and the need for speed and accuracy.

Rather than specific training of health professionals in the management of spider bite victims, a more cost-effective approach would be the facilitation of ready access to appropriate identification and medical management information. Health professionals would be made aware of where reliable information can readily and easily be obtained when required, and those tasked with providing the information would receive the intensive training.

Possible routes for the dissemination of information to health professionals about a central information source would be: articles in *New Zealand Public Health Report*, items on the Ministry of Health discussion databases, articles on the Ministry of Health website (the cost of all of which would be accommodated within existing budgets) and announcements at appropriate conferences and fora.

There is already an organisation in New Zealand capable of becoming the central information source: the National Poisons Centre. A professional training strategy would include the training of personnel in the National Poisons Centre to recognise and provide appropriate management advice regarding spider bites, and the development by the National Poisons Centre staff of first-aid and medical management recommendations.

This model would depend on rapid, reliable, real time information and, increasingly, the provision of such information is being achieved via the Internet. The National Poison Centre has developed an Internet-based TOXINZ poisons management database. The Ministry of Health recommends that all public health services should have access to this database.

To ensure a successful information strategy regarding venomous spiders the TOXINZ database should be appropriately expanded and made widely available (to hospitals, public health services, occupational health workers, general practitioners, etc.). TOXINZ has the ability to display images for bite and spider identification purposes (although this alone would not address the lack of experts who can determine spider species referred to above). TOXINZ could also provide access to first-aid recommendations for the public via the TOXINZ public access first-aid site.

While cost effective, this strategy would still require investment for professional training, resource development (including the development of a formal liaison with a specialist toxicologist able to provide clinical advice as required), and the costs of further developing and maintaining TOXINZ and managing wide access to it.

In addition, there would be costs to address the lack of rapid response taxonomic services.

Estimated cost of expanding TOXINZ: $67,500 (incl. GST), $11,250 (incl. GST) annual retainer for expert advice.

Public health awareness campaigns

Public health awareness campaigns need to be tailored to the situation being addressed; inappropriate emphasis on risk avoidance can in itself create unnecessary anxiety. First aid information should be made available to workers in 'at risk' occupations proactively, and first aid messages should be repeated as part of reactive strategies.

In the unlikely event of spiders of public health significance becoming established in New Zealand as a result of table grape imports, information about spider avoidance behaviour should be made available to residents in the area while the spiders are present (suggestions for message content are provided above under the heading of 'Risk communication'). Campaigns within areas could also target at-risk groups; for example, gardeners or children.

The following are indicative costs of possible education strategies to inform the public about venomous spiders.

A national poster campaign focusing on risk areas to advise the public of spider avoidance behaviours would cost between $11,250 (incl. GST) and $13,500 (incl. GST) depending on the number of posters.

A pamphlet campaign for the whole country would cost $109,350 (incl. GST); for the Auckland area $43,425 (incl. GST); for a smaller centre $27,675 (incl. GST) (these costings do not include distribution, the costs of which would vary with the range of the campaign and the distribution method chosen; for example, one quote for a mailout of one pamphlet was $4461.75 (incl. GST) per 10,000 households).

The addition of advertising would cost $56,250 (incl. GST) for two weeks' worth of advertisements in national and community newspapers.

Conclusion

Of the species of spiders detected post-border multiple times from January 2000 to November 2001 and considered to be of potential public health significance, the two black widow spiders (*Latrodectus mactans*, black widow spider and *Latrodectus hesperus*, Western black widow spider) were found to be a public health hazard with the potential to cause significant morbidity or mortality.

Johnson jumpers were found to be of little medical concern. The other two *Latrodectus* spiders (brown widow spider and Australian redback) and the yellow sac spider were found to be of public health significance, but based on the low level of post-border detection of these species (and the possibility that no live specimens of any of these species were detected on grapes post-border during the review period) it would appear that current pre-border mitigation methods are sufficient for these species.

All post-border detections of the two black widow species were associated with table grape imports from California. The impacts of these spiders range from painful bites through to neurotoxic envenomations. Not all bite victims suffer symptoms beyond the initial bite and victims who do suffer further symptoms usually recover in 3 to 5 days. There is safe and effective antivenom available for black widow spider bites, and due to the presence of the native *Latrodectus*, the katipo, and *Latrodectus hasselti* (the Australian redback) in New Zealand, *latrodectism* is a medical syndrome recognised in this country.

However, children, the sick, the elderly, and those with high blood pressure or heart disease can be much more seriously affected by black widow spider bites. Even in the place of origin of these spiders, California, health professionals have problems with accurate identification of the spiders, and with recognising when symptoms relate to spider bites at all. New Zealand does not have 'rapid response' taxonomic services and the misidentification of spider bites can have serious consequences given that there are sometimes unpleasant and dangerous reactions to antivenoms.

Black widow spiders pose a moderate health risk; black widow spider bites would in some cases require medical intervention, and in a small number of cases the effects of bites could be severe, but they do not represent the scale of risk that is posed by, for example, insects capable of vectoring infectious human diseases.

Bunches of grapes provide good spider hiding places. All eight post-border detections of black widow spiders between January 2000 and November 2001 were in uncontrolled environments and these spiders are known to sometimes bite humans when they accidentally come into contact with human skin. Grapes are delivered unprocessed to supermarkets and carried and eaten unprocessed by hand. Therefore, post-border detections of black widow spiders provide for high individual exposure, creating a moderately high public health risk.

Black widow spiders are capable of exploiting human-altered environments and not all New Zealanders practise the spider avoidance behaviours promoted in countries where the black widow spiders are established. If black widow spiders became established in New Zealand in the same geographic relationship to human populations as they are in the

United States, New Zealanders could (based on ones year's data) experience more than six times the level of exposure to *Latrodectus* spiders than they currently do. However the IFF PRA found the risk of black widow spiders establishing in New Zealand to be low. Therefore, the public health risk posed by the importation of table grapes from California, where the exposure would be provided by black widow spiders becoming established in New Zealand is moderately low. Imported grapes are not the only, or necessarily the most effective pathway of entry for black widow spiders becoming established here.

The impacts on human health and health systems triggered by black widow spiders would be amplified by associated non-physical impacts and the public perception of the health risk posed by black widow spiders.

Potential financial costs associated with post-border detections and the establishment of populations of black widow spiders relate to the treatment of bites, the loss of production from bites; professional training; professional information dissemination; public information dissemination; the establishment of rapid response taxonomic services, the auditing, establishing and maintenance of antivenom stores, and the contracting of expert advice.

Also there would be a social cost relating to the behaviour modifications required to minimise the new risk.

There are no significant health benefits arising from the importation of table grapes into New Zealand.

It is acknowledged that, despite what was seen as an unacceptable number of post-border spider detections related to table grape imports, there have been no bites from black widow spiders reported in New Zealand to date.

Based on this assessment the Chief Technical Officer (Health) has not found that the public health risk posed by spiders entering the country on imported table grapes warrants the continuation of the suspension of Californian imports. She has found that the moderately high individual health risk posed by post-border detections of black widow spiders warrants the imposition of further pre-border measures to maximise as far as possible the likelihood of these spiders being intercepted before crossing the border, and the implementation of post-border measures to mitigate the effects of any future post-border detections of spiders of public health significance on imported table grapes.

Glossary

Commodity[1]

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

Effects

Include any positive or adverse effect; any temporary or permanent effect; any past, present or future effect; any cumulative effect that arises over time or in combination with other effects – regardless of the scale, intensity, duration of frequency of the effect, and also includes any potential effect of high probability, and any potential effect of low probability which has a high potential impact.

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.

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).

Hazard

The potential to cause harm.

Health impact assessment

A systematic process to assess the actual or potential effects of policies, objectives, programmes, plans, consents, or activities on the health of individuals, groups or communities. It is an assessment of risks to people either directly or indirectly as a result of environmental conditions or hazards.

Hitch-hiker 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.

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 assessment[1]

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

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

Risk is the probability and magnitude of the occurrence of specified adverse effects: the likelihood of harm.

Spread[1]

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

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