**Cooperative Research Centre
for National Plant Biosecurity**

Final Report

CRC10001

Early warning of pre-emergent emergency plant pest threats

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1. Executive Summary

There are hundreds, perhaps thousands, of invasive species that have the potential to arrive and establish in any particular region or country. Identifying which species are more likely than others to invade and establish is extremely difficult, yet the capacity to do so is vitally important to the biosecurity of a nation. Currently, government agencies consult industry stakeholders and technical experts, as well as published data to generate a pest risk assessment for a particular insect pest. While this can be valuable for many reasons, any estimate of risk is ultimately subjective. An alternative is to use a more quantitative modelling approach to generate more objective estimates of risk. One modelling approach is to utilise a Self Organising Map (SOM), which is a type of artificial neural network. The *Early Warning of Pre-Emergent Emergency Plant Pest Threats* (CRC10001) project has investigated the use of the SOMs technique in quantitative risk assessments.

This report provides a detailed overview of the project and the path we have followed in the development of the SOMs approach. Our research has explored the potential to use SOM predictions of high-risk invasive species that could potentially affect Australian plant industries. The report contains our experiences with using SOMs, and presents lists of species ranked in order of their likelihood of establishment in Australia. This information will be used primarily by state and federal government agencies charged with undertaking the identification and assessment of external threats. The species lists we have generated will assist in allocating pre-border and border biosecurity resources, and support the development of pre-emptive approaches to threat mitigation. We also present the results of SOMs analysis we conducted on the United States. These results demonstrate the applicability of the SOMs technique to different countries and regions, and its potential use by international biosecurity agencies.

The research methods we used can be summarised as follows. Presence and absence data for pest species recorded over several hundred global geographic regions is used in this analysis. An artificial neural network algorithm, the SOM, is used to classify geographic areas based on similar pest species composition. Risk lists for regions are extracted from the SOM analysis. These risk lists estimate the likelihood of a species establishing in that region.

The key findings of our research were:

- SOM analysis is an extremely useful and cost effective method of generating establishment probability indices for large numbers of species with minimal computation time

- SOM analysis of world wide data reveals which regions around the world a potential sources of future pests for Australia;

- SOM analysis of Australian data reveals that New South Wales (NSW) and Queensland may already have the majority of pests and diseases present in Australia and few could invade and establish from other states

- Comparing SOM-generated species lists of high-establishment-risk species with those generated by Plant Health Australia reveals significant differences between rankings by the two systems

- SOM methodology can generate robust risk lists resilient to error rates up to 20% in the presence/absence data (Paini et al 2010). (see objectives (ii), (iii) and (vi) below);

- SOM methodology is extremely accurate in its ability to identify which species are able to establish in a region. (see objective (ii) and (iii) below)

- SOM analysis applied to US species assemblages found the greatest threat to US states to be those species present in the US as opposed to those outside, and

- The SOM methodology on its own is unable to incorporate climate change into its risk lists as it requires future species assemblages in response to climate change (see objective (iv) below).

The implications of this report for state and territory biosecurity agencies are that practical tools are available that enable exotic pest species from different taxa to be prioritised on the basis of their probability of becoming established in each region. This information has not been available in the past, which has made resourcing of risk mitigation activities difficult to justify. Based on the assemblages of species throughout the world, regional biosecurity agencies now have access to a method of calculating the likelihood of a particular species or group of species (for instance, those associated with a particular trade pathway) becoming established in their area of influence.

Based on our findings, we have put forward the following recommendations:

1. The development of a communication strategy with Australian and international biosecurity agencies to encourage the uptake of SOMs as an effective risk identification technology

2. An online or PC-based SOM device be developed that is capable of producing country and (where possible) region-based estimates of exotic species potential to establish

3. The results of SOMs analyses that quantitatively express species establishment likelihoods should be incorporated into traditional forms of quantitative risk assessment

4. SOMs analysis can be incorporated in to existing pest risk analysis and import risk analysis methodologies

5. Strategies for the effective communication of risk and uncertainty in emergency plant pest prioritisation and preparedness decisions should form a part of future research proposals

6. Further research should be conducted on the use of SOMs (which identify high-risk species for a particular area) with methods identifying source regions for future invasive species under climate change, and

7. Caution must be exercised when quoting high-establishment-risk lists generated by SOMs using the Australian Plant Pest Database as data for some states and territories contains non-pest species, while for others there is insufficient data recorded.

2. Aims and objectives

There are seven objectives of the research project:

(i) Contrast the similarity approach to threat detection to the existing approached for identifying pre-emergent emergency plant pest (EPP) threat and determine which is the most robust approach to early warning of EPP threats

(ii) Develop a robust early warning capability for threat identification

(iii) Utilise a similarity approach based on that developed by Sue Worner, Lincoln University to improve the capacity to identify pre-emergent EPPs

(iv) Incorporate within this a climate change scenario to determine the potential impact of climate change of pest threats

(v) Data mine interception and Australian Pest and Disease databases; Department of Primary Industry pest and disease records, and literature to identify those EPPs already established in Australia and to identify EPPs that have a history of incursion and identify pathways

(vi) Use a risk analysis approach to rank the threat posed by the pre-emergent EPPs identified

(vii) Compare the pre-emergent EPPs identified through this process to those identified using the PTQ/DTQ approach which follows the Food and Agriculture Organisation (FAO) guidelines for pest prioritisation.

3. Key findings

3.1.   The SOM analysis

Key finding:

SOM analysis is an extremely useful and cost effective method of generating establishment probability indices for large numbers of species with minimal computation time.

Invasive species cause immense environmental and economic damage worldwide (Blackburn et al., 2004; Traveset and Richardson, 2006; LaDeau et al., 2007; Asner et al., 2008). There are currently large numbers of exotic species with the potential to invade and establish within Australia, and of those species clearly identifying which are most likely to become established is extremely difficult. But, from the point of view of policy-makers trying to allocate biosecurity funds and resources to achieve the greatest amount of benefit for society, the capacity to identify species with the highest establishment potential is vitally important. Generally, biosecurity agencies worldwide consult industry stakeholders and technical experts, as well as published data to generate risk assessments for particular species (Pest Risk Analyses (PRA)) or potential entry pathways (Import Risk Analyses (IRA)). Although a valid and often informative practice, the approach of asking individuals their opinion about establishment potential requires species to be evaluated individually, making it extremely time intensive to rank and prioritise large numbers of species. Further, the reliance on expert testimony leaves the process susceptible to framing, context dependence and motivational bias (Burgman, 2005), which may result in misleading prioritisation. This is especially the case given that expert testimony can only reflect upon the knowledge invested in the experts, which is seldom all encompassing. As a consequence, it is difficult to assess all potential invasive pest species, and key threats might be overlooked, particularly those where available knowledge and information is lacking.

In addition, any estimate of establishment risk, though often based on a significant amount of information, is ultimately subjective. Government organisations are, therefore, continually searching for additional methods to prioritise pest lists and generate more objective establishment estimates. One such approach is the use of climate envelope models (Stephens et al., 2007) where the climatic parameters of a pest's native range are used to predict its likely exotic range. However, problems in the accuracy of these predictions have been highlighted by several authors (Hulme, 2003;Sax et al., 2007). Other statistical methods include generalised additive models (Bunnell et al., 2009), boosted regression trees (Jacobs and Macisaac, 2009), maximum entry method (Brown et al., 2008) and mechanistic niche modelling (Kearney and Porter, 2009). But, to rank and prioritise hundreds of species using any of these approaches would again mean evaluating each species individually. With so many species with invasive potential and of quarantine significance to a country like Australia, the time required would be prohibitive and costly.

An alternative is to take a community ecology approach that studies the species assemblage of a region. As such, a large number of species can be analysed simultaneously and ranked according to their 'likelihood' of establishing in a particular region based on species associations (i.e. any species that is commonly found with a particular species assemblage is more likely to establish in a region where that species assemblage is found). This would enable an initial screening of potential pests to a more manageable number that could then be further analysed using any of the modelling methods mentioned above. A self organising map (SOM), which is an unsupervised artificial neural network, can be used to generate values that indicate the strength of association of a species with a species assemblage, which can be used as a risk index.

Worner and Gevrey (2006) utilised invasive insect pest data from the Centre for Agriculture and Biosciences International (CABI) Crop Protection Compendium (CPC) (CABI, 2003) and constructed a SOM to classify and group 459 regions of the world into clusters, based on their insect assemblages drawn from a global pool of 844 known insect pest species. The insect assemblage present in a particular region captures a significant proportion of biological, ecological, and abiotic factors that cannot be measured. Given the assumption that regions with similar assemblages provide similar niches, Worner and Gevrey were able to identify those regions with similar species assemblages to New Zealand and hence those regions that may be of highest risk as a source of invasive insects. In addition they were able to utilise the SOMs neuron weights to generate a quantitative estimate of the risk of establishment in New Zealand for all 844 insect species and we used this same dataset. This technique provides an innovative way of predicting likelihood of establishment of a large number of species, and so adds valuable information to the currently employed methods.

A SOM is an artificial neural network capable of converting high dimensional data into a two dimensional map in which data points that are found close together on the map are more similar than those that are further away. A SOM consists of two layers of artificial neurons (or nodes), the input layer and the output layer. In the SOM, the input layer is essentially the raw data and comprises 844 neurons (i.e. one neuron for each insect species) with each neuron connected to all 459 regions. The output layer is the two dimensional map comprising a suitable number of neurons, laid out in a hexagonal grid. For this data set, a map of 108 neurons with dimensions of 12 rows by nine columns was used (see Worner and Gevrey, 2006).

Each of the 459 regions contained within the CABI CPC data set occupies a particular point in space of 844 dimensions. Each region's position in this space is determined by the 844 element vector that is the presence or absence of all 844 insect pests in that region. The SOM projects its 108 neurons into this space via neuron weight vectors. As with the region vectors, these neuron weight vectors are comprised of 844 elements. In effect, each SOM neuron is occupying a point in the same multidimensional space as the regions, thereby allowing them to 'interact' with the regions (see below for further explanation)[1].

These neuron weight vectors can be initially projected randomly into the multidimensional space, but we use a linear initialisation that distributes the neuron weight vectors corresponding to the first two eigenvalues of a principle component analysis. This linear initialisation distributes the neuron weight vectors in a way that is more representative of the raw data and significantly reduces the time taken to train the network and complete the analysis (Kohonen, 2001).

When the analysis is initiated, each raw data point is assessed and the neuron that is closest to a data point in this multidimensional space is deemed to be the best matching unit (BMU). The neuron weight vector of the BMU is adjusted so that it moves closer to the data point. Because all neurons are connected together similar to a large elastic net, the process of one neuron moving exerts a gravitational force that drags other neurons in the SOM with it. While each data point can be assessed individually, doing so means the learning is highly dependent on the order in which data points are assessed (Worner and

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[1] Further details describing a SOM analysis can be obtained from (Kohonen, 2001;Worner and Gevrey, 2006).

Gevrey, 2006). Assessing data points simultaneously, using a batch algorithm solves this problem, and this is the approach we used in our analysis.

Data points are repeatedly assessed and over time the neurons spread out to occupy approximately the same area that the data points occupy in the multidimensional space. When the analysis is complete each data point or region will have a BMU, which is its closest neuron. Regions that have very similar pest assemblages will be located close together in the multidimensional space and will have the same BMU. Each neuron therefore occupies a point in the multidimensional space, which is described by its neuron weight vector.

In this study the neuron weight vector is composed of 844 elements with each element having a value between 0 and 1. Each element corresponds to one of the 844 insect species and can be interpreted as a risk index or an index of how strongly that species is associated with other species in that neuron and hence the species assemblage of any region associated with that neuron. For Australia, the risk list generated would be the neuron weight of its BMU. The analysis was performed using Matlab (Mathworks, 2007) and the SOM Toolbox (version 2.0) developed by the Laboratory of Information and Computer Science Helsinki University of Technology (http://www.cis.hut.fi/projects/somtoolbox/).

Risk lists can subsequently be generated for Australia, its states and territory, and any other regions in the dataset (see section 3.2).

3.2.   Analysis of world wide data

Key finding:

SOM analysis of world wide data reveals which regions around the world are potential sources of future pests for Australia.

In this section we generate a risk list for Australia using the same global pest dataset as that used by Worner and Gevrey (2006).

The risk list for the top 100 insect pests of threat to Australia generated from the data is shown in Table 1. Australia's BMU (i.e. the neuron to which Australia is closest in the multidimensional space) was the same neuron with which Papua New Guinea (PNG) is associated. In addition, two other neurons were always clustered with Australia's BMU regardless of which clustering algorithm was used (Table 2). Countries associated with these neurons that also happen to be prominent sources of Australian food imports include China, Japan, Singapore, Thailand and Malaysia.

Table 1. Top 100 risk list for insect pests from the SOM analysis. Lines indicate the three risk categories utilised in the data analysis (see Section 3.5). For a full list see Appendix, Table 12.

rank	Insect pest species	risk index	rank	Insect pest species	risk index	rank	Insect pest species	risk index
1	Scirpophaga incertulas	0.7924	35	Schizaphis graminum	0.4895	69	Helopeltis bradyi	0.3634
2	Oryctes rhinoceros	0.7722	36	Aproaerema modicella	0.4841	70	Phyllotreta striolata	0.3604
3	Sesamia inferens	0.7695	37	Xylotrechus quadripes	0.4835	71	Minthea rugicollis	0.36
4	Scrobipalpa heliopa	0.7128	38	Attacus atlas	0.4821	72	Idioscopus niveosparsus	0.3589
5	Marasmia exigua	0.6856	39	Ceratovacuna lanigera	0.4774	73	Scotinophara coarctata	0.3589
6	Diaphorina citri	0.6807	40	Bactrocera latifrons	0.4651	74	Naranga diffusa	0.3445
7	Aleurocanthus woglumi	0.6801	41	Hypothenemus hampei	0.4606	75	Liriomyza trifolii	0.3431
8	Leucinodes orbonalis	0.6748	42	Henosepilachna pusillanima	0.4605	76	Urentius hystricellus	0.342
9	Stephanitis typica	0.6675	43	Idioscopus clypealis	0.4589	77	Megymenum brevicorne	0.3326
10	Xylosandrus compactus	0.6632	44	Sternochetus frigidus	0.4586	78	Elaeidobius kamerunicus	0.3311
11	Pelopidas mathias	0.6446	45	Trichoplusia ni	0.4573	79	Aulacaspis tegalensis	0.3262
12	Dicladispa armigera	0.6378	46	Dialeurodes citri	0.4532	80	Bombyx mori	0.3194
13	Acherontia styx	0.6356	47	Pyrilla perpusilla	0.4499	81	Rhynchophorus vulneratus	0.3189
14	Chilo auricilius	0.6338	48	Chilo sacchariphagus	0.4491	82	Aulacophora foveicollis	0.3156
15	Nephotettix virescens	0.6279	49	Atherigona soccata	0.4395	83	Tessaratoma papillosa	0.3147
16	Planococcus lilacinus	0.594	50	Sinoxylon conigerum	0.4335	84	Statherotis discana	0.3145
17	Batocera rubus	0.5836	51	Cricula trifenestrata	0.4329	85	Cydia leucostoma	0.3132
18	Aulacophora lewisii	0.5702	52	Chilo partellus	0.4206	86	Bactrocera umbrosa	0.3105
19	Toxoptera odinae	0.5694	53	Orthezia insignis	0.4138	87	Pseudococcus jackbeardsleyi	0.3105
20	Orseolia oryzae	0.5676	54	Rhipiphorothrips cruentatus	0.4108	88	Perkinsiella vastatrix	0.3052
21	Odoiporus longicollis	0.5669	55	Batocera rufomaculata	0.41	89	Artona catoxantha	0.3043
22	Chilo infuscatellus	0.5559	56	Omiodes indicata	0.4097	90	Heterobostrychus aequalis	0.3037
23	Zeuzera coffeae	0.551	57	Plocaederus obesus	0.4047	91	Poecilocoris latus	0.3037
24	Helopeltis theivora	0.5425	58	Bactrocera tau	0.4008	92	Opisina arenosella	0.303
25	Hypomeces squamosus	0.5395	59	Adoretus versutus	0.3917	93	Chondracris rosea	0.2994
26	Orgyia postica	0.5343	60	Hieroglyphus banian	0.3888	94	Prays endocarpa	0.2905
27	Pinnaspis strachani	0.529	61	Rastrococcus iceryoides	0.3879	95	Chromatomyia horticola	0.2827
28	Rastrococcus invadens	0.519	62	Fulmekiola serrata	0.3834	96	Medythia suturalis	0.2746
29	Parasa lepida	0.5177	63	Phyllotreta chotanica	0.3803	97	Acherontia lachesis	0.2735
30	Papilio polytes	0.5119	64	Bactrocera zonata	0.3802	98	Aphis fabae	0.2704
31	Bactrocera dorsalis	0.5008	65	Melanagromyza obtusa	0.3747	99	Tetramoera schistaceana	0.2684
32	Hydrellia philippina	0.4957	66	Liriomyza huidobrensis	0.3743	100	Rhynchocoris poseidon	0.2682
33	Omphisa anastomosalis	0.4933	67	Tarophagus colocasiae	0.372			
34	Erionota thrax	0.4931	68	Chilo polychrysus	0.3658			

Table 2. Regions in the same BMU as Australia and its states and territory, and the regions associated with the neurons that were most often clustered with the Australian BMU. For details of the cluster analyses see Appendix, Table 13. For the full list of neurons and associated regions see Appendix, Table 14.

Target region and regions placed in the same BMU	Regions placed in the neurons most often clustered with the target region BMU
1. Australia, Papua New Guinea	Bangladesh, China, Taiwan (China), Indonesia, Java (Indonesia), India, Japan, Sri Lanka, Myanmar, Malaysia, Peninsular Malaysia (Malaysia), Philippines, Pakistan, Singapore, Thailand, Vietnam
2. Western Australia	South Australia, Tasmania (Australia), Victoria (Australia), New Zealand, Azores (Portugal), Saudi Arabia, St Helena
3. Northern Territory (Australia)	Delhi (India), Gujarat (India), Indian Punjab (India), Rajasthan (India), Andhra Pradesh (India), Bihar (India), Maharashtra (India), Madhya Pradesh (India), Orissa (India), Uttar Pradesh (India), Northern Mariana Islands
4. South Australia, Tasmania (Australia), Victoria (Australia), New Zealand, Azores (Portugal)	Western Australia, Saudi Arabia, St Helena
5. New South Wales (Australia), Queensland (Australia), Fiji, New Caledonia, Solomon Islands	Assam (India), Karnataka (India), Kerala (India), Tamil Nadu (India), West Bengal (India), Brunei Darussalam, Guangdong (China), Hong Kong (China), Sumatra (Indonesia), Cambodia, Laos, Sabah (Malaysia), Sarawak (Malaysia)

It should be noted that SOM estimations of establishment likelihood are based on current distributions of species, which is inherently a function of historical pathways. If new trade pathways become established, some species that have a restricted range due to pathway limitation may invade new regions and species assemblages would be altered, thereby altering SOM predictions. However, analyses conducted using simulations in a virtual world of invasive pests indicate that SOM is able to predict even those species with restricted ranges (see section 3.6) and we maintain our confidence in SOMs predictive powers.

Once a species' risk of establishment is determined, further analysis of host availability and distribution as well as possible entry pathways would be appropriate to assess overall risk. That is, a species may have a high likelihood of establishment but if the pathway is absent, then the likelihood of entry is low. In addition, species at the top of the list could be further analysed using climate or niche matching models to identify specific regions within a country at greatest risk from a pest species. Finally, information on economic costs of a particular pest should also be considered. For example, the third highest pest species at risk of establishing in Australia (Table 1) is *Sesamia inferens* (Lepidoptera: Noctuidae), and while this species is a pest of rice, sugarcane, maize, sorghum and wheat, it is considered the least destructive of the stem borer pests (CABI, 2003). An economic analysis might suggest that despite this pest having a high likelihood of establishing in Australia, it may not be considered a serious economic threat.

In contrast, *Chromatomyia horticola* (Diptera, Agromyzidae) is a very serious pest in almost all countries in which it is found, causing serious damage to tomatoes, legumes, lettuce, cruciferous crops and cucurbits, among others (CABI, 2003). Although this pest was only ranked 95th in the top 100 risk list (Table 1) and has a low risk of establishment, its potential to cause significant economic damage may motivate government authorities to treat this pest as a more serious threat than indicated by establishment risk alone.

In addition to the pest rankings there is additional information provided by the SOM analysis that can be utilised by biosecurity agencies. The first is determining which regions have been allocated to the same neuron as the target region. For Australia, the only other region associated with the same neuron is Papua New Guinea (PNG), indicating these two regions have a significant percentage similarity in insect assemblage (48.4%). As such, they may share similar climatic, biological and ecological characteristics and insect pests that are established in PNG may therefore have a high risk of establishing in Australia.

Because this SOM analysis does not give 'crisp edges' to clustered regions of the world, further analysis was performed by a conventional cluster analysis of the neuron weights. As no one clustering algorithm is recommended, we repeated the cluster analysis using a different clustering algorithm each time (single link, nearest neighbour, complete link, furthest neighbour, average link, median sorting, and group average clustering) and compared the results to determine which neurons were consistently clustered together. This analysis was performed using GenStat (2007).

The regions belonging to these neighbouring neurons, though not such a close match to the target region as those regions allocated to its BMU will have similar insect pest assemblages and hence also represent a potential source of insect pests. Most neurons in a SOM will have six neighbouring neurons unless it is on the edge of the map, where it will have only four neighbours, or in the corner of the map, where it will have only three neighbouring neurons (Figure 1). These neurons occupy a point in the multidimensional space and are not necessarily evenly distributed throughout this space. Some neighbouring neurons may therefore be closer than others to a BMU. A conventional cluster analysis can

reveal which of these neighbouring neurons are closest to a BMU and hence which regions are more similar to the target region. Australia's BMU was on the edge of the map and it therefore had only four neighbouring neurons. Of these four neurons, two were consistently clustered with Australia's BMU regardless of the clustering algorithm used (Appendix, Table 13).
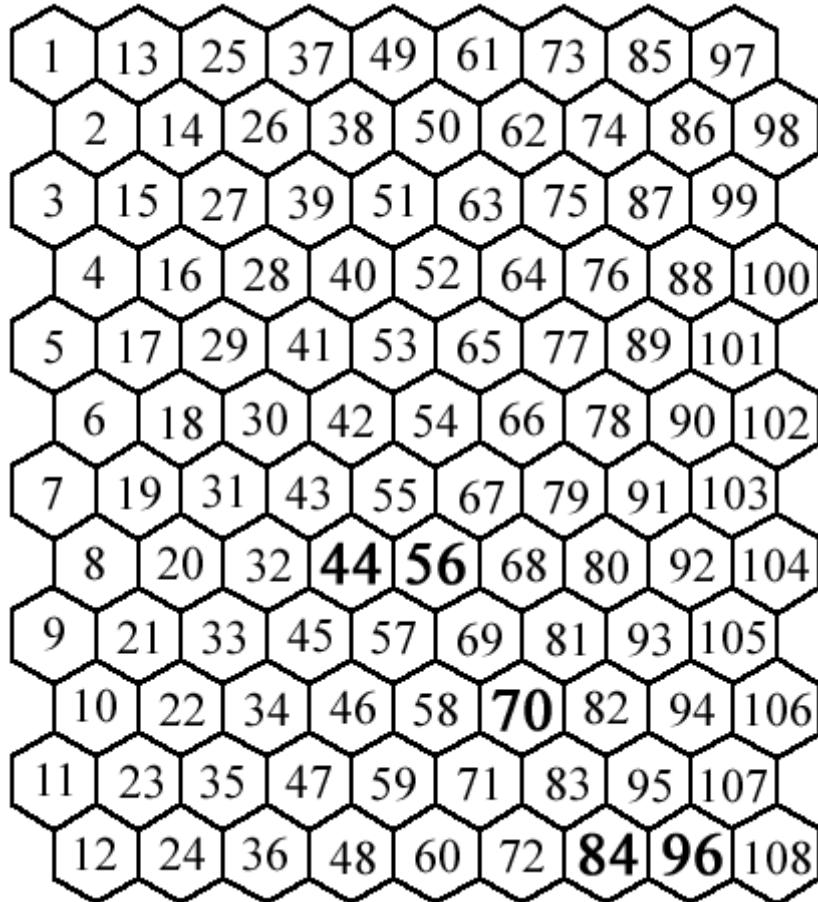
Figure 1. SOM map with numbered neurons. Those neurons in which Australia, or one of its states or territory, are placed are in bold. Refer to Appendix, Table 14 for a full list of neurons and associated regions.

As with PNG, the regions associated with these closely clustered neurons are also possible sources for the species already in the risk list. In addition, because of the significant percentage similarity in insect assemblages (Table 3) and therefore the potential similarities in climatic, biological and ecological conditions, these regions could also be sources for insect pests that have not been included in the database used in this analysis and extra caution should be taken when inspecting imports from these regions. As five of these regions are in the top ten for merchandise imports into Australia (China, Japan, Singapore, Thailand, and Malaysia) (Table 4) entry pathway may not provide a constraint to their arrival.

Table 3. Species similarity indices between Australia and closely clustered regions.

Region	% similarity
Papua New Guinea	48.4
India	24.8
Thailand	22.2
China	22.1
Taiwan (China)	20.0
Sri Lanka	19.0
Indonesia	19.0
Pakistan	18.4
Java (Indonesia)	17.8
Vietnam	17.4
Philippines	17.4
Malaysia	17.2
Japan	16.9
Myanmar	16.9
Bangladesh	15.0
Peninsular Malaysia (Malaysia)	14.6
Singapore	11.2

Table 4. The top 20 countries exporting goods into Australia based on the mean monthly percentage of total imports for 2007 (extracted from ABS, 2008).

Country	mean monthly percentage of total imports
1. China	15.4
2. USA	12.6
3. Japan	9.6
4. Singapore	5.6
5. Germany	5.2
6. United Kingdom	4.3
7. Thailand	4.2
8. Malaysia	3.9
9. New Zealand	3.3
10. Korea, Republic of	3.2
11. Indonesia	2.6
12. Italy	2.6
13. France	2.5
14. Vietnam	2.4
15. Taiwan	2.3
16. Papua New Guinea	1.3
17. Sweden	1.2
18. Ireland	1.1
19. United Arab Emirates	1.1
20. Canada	1.1

For example, the CABI CPC (CABI, 2003) provides distributional data on 21 of 30 (70%) of the world's worst invasive crop and forest insect pests as determined by the International Union for Conservation of Nature (IUCN) (Table 5) (http://www.issg.org/database). One of these species not found in the CPC and hence not included in the analysis is *Aulacaspis yasumatsui* (Hemiptera: Diaspididae), a major pest of cycads. This insect is present in China, Thailand, Singapore and Taiwan (Germain and Hodges, 2007), all countries closely clustered with Australia (Table 2) and all exporting significant quantities of commodities into Australia (Table 4). It follows that this pest, though not included in the database, might present a high risk of establishing in Australia. Further analysis utilising habitat suitability modelling (Kriticos et al., 2003), impact simulation modelling (Cook et al., 2007), and benefit costs analysis (Cook, 2008) may reveal more about the risk this species poses to Australia.

Table 5. List of 58 of the world's most invasive insect pests (Global Invasive Species Database - http://www.issg.org/database) classified as either crop or forest pests or not. Of those that are crop or forest pests, those that were present in the CABI CPC (CABI, 2003) are also indicated.

IUCN Global Invasive Species Database (Insects)	crop/forest pest	present in CABI CPC
1. Acromyrmex octospinosus	Y	Y
2. Adelges piceae	N	N/A
3. Adelges tsugae	Y	Y
4. Aedes albopictus	N	N/A
5. Agrilus planipennis	N	N/A
6. Anopheles quadrimaculatus	N	N/A
7. Anoplolepis gracilipes	N	N/A
8. Anoplophora glabripennis	Y	Y
9. Anthonomus grandis	Y	Y
10. Apis mellifera scutellata	N	N/A
11. Aulacaspis yasumatsui	Y	N
12. Bactrocera tryoni	Y	N
13. Bemisia tabaci	Y	Y
14. Cactoblastis cactorum	N	N/A
15. Calliphora vicina	N	N/A
16. Ceratitis capitata	Y	Y
17. Cinara cupressi	Y	Y
18. Coptotermes formosanus	Y	Y
19. Culex quinquefasciatus	N	N/A
20. Harmonia axyridis	N	N/A
21. Hemiberlesia pitysophila	Y	Y
22. Homalodisca vitripennis	Y	N
23. Hoplochelus marginalis	Y	Y
24. Hyphantria cunea	Y	Y
25. Lasius neglectus	Y	N
26. Linepithema humile	N	N/A
27. Lymantria dispar	Y	Y
28. Monomorium destructor	N	N/A
29. Monomorium pharaonis	N	N/A
30. Myrmica rubra	Y	Y
31. Ochlerotatus japonicus japonicus	N	N/A
32. Oopterus soledadinus	N	N/A
33. Oracella acuta	Y	Y
34. Orthotomicus erosus	Y	Y
35. Oryctes rhinoceros	Y	Y
36. Paratachardina pseudolobata (insect)	N	N/A
37. Paratrechina longicornis	Y	Y
38. Pheidole megacephala	Y	N
39. Philornis downsi	N	N/A
40. Polistes chinensis antennalis	N	N/A
41. Quadrastichus erythrinae	N	N/A
42. Radumeris tasmaniensis	N	N/A
43. Sirex noctilio	Y	Y
44. Solenopsis geminata	Y	N
45. Solenopsis invicta	N	N/A
46. Solenopsis papuana	N	N/A
47. Solenopsis richteri	Y	N
48. Tapinoma melanocephalum	N	N/A
49. Technomyrmex albipes	N	N/A
50. Tetropium fuscum	Y	N
51. Tomicus piniperda	Y	Y
52. Trogoderma granarium	Y	Y
53. Vespula germanica	N	N/A
54. Vespula pensylvanica	N	N/A
55. Vespula vulgaris	N	N/A
56. Wasmannia auropunctata	N	N/A
57. Xylosandrus compactus	Y	Y
58. Xylosandrus mutilatus	Y	N
Total	**30**	**21**

In addition to risk lists for whole countries, the CABI CPC also has data for the states or provinces within many of the larger countries. Countries in this database that have been divided up into states or territories include Australia, Brazil, Canada, China, India, Indonesia, Japan, Malaysia, Russia, and USA. This can give predictions at a finer scale and also reveal which insect pests found in a state also present a high risk of establishment in a neighbouring state. Government agencies could then identify not only those threats from outside the country but also those from within.

Generating more accurate estimates for the risk of establishment of species is vital for informed biosecurity. Government agencies require estimates to allocate resources in such a way that will efficiently prioritise pest detection methods. These quantitative estimates can also feed into economic models used in import risk assessments (e.g. Cook et al., 2007) that can affect policy decisions. Importantly, the use of SOMs can be extended to any taxa, such as weeds, marine pests, or even organisms of threat to natural systems. As long as the worldwide distributional data is available, this methodology can be utilised by any agency or researcher in which prioritisation or prediction of establishment likelihood is required.

3.3.   Analysis of Australian data

Key finding:

SOM analysis of Australian data reveals that NSW and Queensland may already have the majority of pests and diseases present in Australia and few could invade and establish from other states.

Thus far, this report has contained details of analyses conducted using world wide distributional data from the CABI CPC, but other data sources can be used when applying the SOM technique to Australia. To supplement our analyses using CABI data we also analysed species distribution data collected by state and territory departments of agriculture and primary industries for plant insect pests, fungal, bacterial and viral pathogens. This enabled us to generate risk lists for each state and territory, thereby indentifying inter-state invasive threats (i.e. those that could come from another Australian state or territory).

Methods

Distributional data was extracted from the Australian Plant Pest Database (APPD) (http://www.planthealthaustralia.com.au/go/phau/capacity-and-capability/information-support-systems/appd), or directly from the state DPI's or Agriculture Departments.

Insect pests

The APPD requested that only species from those families listed in Table 6 be submitted to its database and of those families, only those insect species identified as plant pests. No species were recorded in the database from the families Liriomyza (Diptera) and Metabelidae (Lepidoptera).

Table 6. List of the insect pest families requested from states and territory to be submitted to the Australian Plant Pest Database.

Order	Family	Order	Family
Coleoptera	Anobiidae	Hemiptera	Pentatomidae
Coleoptera	Bostrichidae	Hemiptera	Psyllidae
Coleoptera	Cerambycidae	Isoptera	Kalotermitidae
Coleoptera	Chrysomelidae	Isoptera	Mastotermitidae
Coleoptera	Coccinelidae	Isoptera	Rhinotermitidae
Coleoptera	Curculionidae	Isoptera	Termitidae
Coleoptera	Dermestidae	Isoptera	Termopsidae
Coleoptera	Elateridae	Lepidoptera	Gelechiidae
Coleoptera	Nitidulidae	Lepidoptera	Gracilariidae
Coleoptera	Scarabaeidae	Lepidoptera	Lymantriidae
Coleoptera	Silvanidae	Lepidoptera	Metabelidae
Coleoptera	Tenebrionidae	Lepidoptera	Noctuidae
Diptera	Agromyzidae	Lepidoptera	Psychidae
Diptera	Liriomyza	Lepidoptera	Pyralidae
Diptera	Tephritidae	Lepidoptera	Tortricidae
Hemiptera	Aleyrodidae	Orthoptera	Acrididae
Hemiptera	Aphididae	Orthoptera	Gryllidae
Hemiptera	Cicadellidae	Orthoptera	Gryllotalpidae
Hemiptera	Coccidae	Orthoptera	Tettigoniidae
Hemiptera	Coreidae	Thysanoptera	Aeolothripidae
Hemiptera	Lygaeidae	Thysanoptera	Thripidae
Hemiptera	Miridae		

As this data is a record of collections as far back as the early 1900s, many represent synonyms of modern species names. It was therefore necessary to obtain synonyms for all species and cross check the list for synonym duplications. Synonym lists were obtained for all families except Curculionidae. As there is no central list of Curculionidae species and their synonyms it would have been necessary to check every entry by searching the taxonomic literature. Unfortunately we did not have sufficient time available to us to complete this task, and therefore Curculionidae are not included in the analysis below.

The final list contained 8,096 insect species and a SOM analysis was performed on this data.

Fungal pathogens

The list of fungal species obtained from the APPD included both pathogenic and non-pathogenic species. It was therefore necessary to check every entry for pathogenicity (Holliday 1998) and for synonyms using Index Fungorum (http://www.speciesfungorum.org/Names/Names.asp). The final list of fungal pathogens contained 3,779 species and a SOM analysis was performed on this data.

Bacterial pathogens

This list contained 160 species and a SOM analysis was performed on this data.

Viral pathogens

This list contained 232 species and a SOM analysis was performed on this data.

Results

Insect pests

As the SOM analysis was performed on more than 8,000 insect species, we have only presented the top 200 for each state and territory (Appendix, Table 15-Table 21). The SOM map identifies which states have the most similar species assemblage by grouping them into the same neuron (Figure 2).
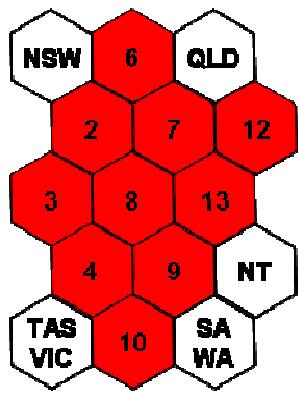
Figure 2. SOM of Australian insect distributional data. Red cells are neurons that do not have a state or territory allocated to them.

Fungal pathogens

The SOM analysis was performed on more than 3,000 fungal species, but we have only presented the top 200 for each state and territory (Appendix, Table 22-Table 28). The SOM map identifies which states have the most similar species assemblage by grouping them into the same neuron (Figure 3)
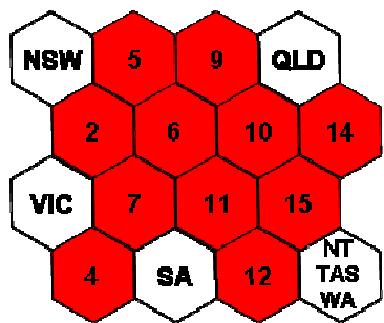
Figure 3. SOM of Australian plant fungal pathogen distributional data. Red cells are neurons that do not have a state or territory allocated to them.

Bacterial pathogens

The rankings of bacterial pathogens are provided for each state and territory (Appendix, Table 29-Table 35) and the SOM map (Figure 4) identifies which states have the most similar species assemblage by grouping them into the same neuron.
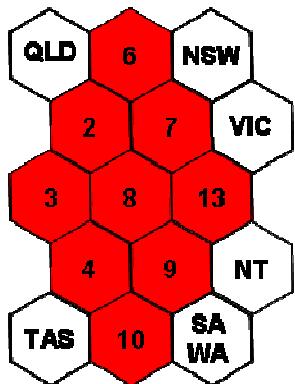
Figure 4. SOM of Australian plant bacterial pathogen distributional data. Red cells are neurons that do not have a state or territory allocated to them.

Viral pathogens

The rankings of bacterial pathogens are provided for each state and territory (Appendix, Table 36‑Table 42) and the SOM map (Figure 5) identifies which states have the most similar species assemblage by grouping them into the same neuron.
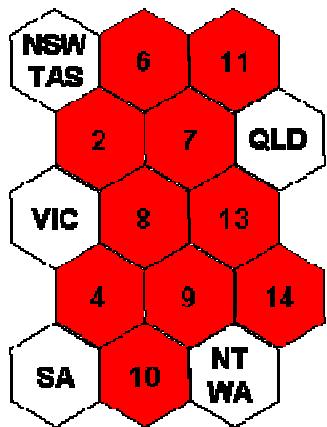
Figure 5. SOM of Australian plant viral pathogen distributional data. Red cells are neurons that do not have a state or territory allocated to them.

Discussion

It is important to recognise that APPD data entries are not limited to plant pests or diseases, but often relate to non-native species that are benign or of low economic, social or environmental significance. It follows that many species captured in the database and subsequently analysed by SOM may not be bona fide pests or diseases. We must therefore stress that government authorities using the lists we have generated as part of this report first filter for those species that are acknowledged plant pests or diseases and modify their prioritisations accordingly. This issue aside, state and territory agencies may be able to incorporate the lists generated here (or the SOM methodology) into their biosecurity practices allowing them to further optimise their priority lists of pests and diseases of threat from other regions within Australia.

It should be noted for some states, the species at the top of the list had very low risk indices (less that 0.2). Queensland had low indices for lists from all four taxa. New South Wales had low indices for insect pests and fungal pathogens, while Tasmania had low indices for bacterial pathogens. For all these states, it is likely that these low indices indicate that those taxa are unlikely to establish and that the species present in Australia that are likely to establish in those states have already done so. As such, it may be more appropriate for biosecurity agencies with these states to focus on potential invasive threats from outside Australia when considering these taxa.

The Northern Territory list of present bacterial and viral pathogens contained only seven and three species (respectively). As can be seen from the work presented in Section 3.6, any list generated for a region which contains so few species initially can be prone to significant levels of inaccuracy in the list rankings. We strongly recommend that these two Northern Territory lists not be used in any biosecurity prioritisation process.

In addition, state and territory biosecurity agencies may wish for this analysis to be repeated incorporating all insect pests and plant pathogens into one data set. This will enable a comparison of establishment likelihood across taxa.

3.4.   *Comparison with expert stakeholder opinion*

Key finding:

Comparing SOM-generated species lists of high-establishment-risk species with those generated by Plant Health Australia reveals significant differences between rankings by the two systems.

An important aspect of the SOM analysis is how it compares to risk assessment techniques that rely on expert and stakeholder consultation. In this section we compare the establishment risk values estimated using the SOM approach with estimates based on expert stakeholder opinion, which is currently used to inform Australian biosecurity policy and resource prioritisation.

Keller et al. (2007) demonstrated that the benefits generated by the adoption of a risk assessment strategy based on expert judgement are potentially large. But, the perceived lack of accuracy of this approach perhaps explains why the vast majority of countries have not mandated risk analysis for non-indigenous species (Keller et al., 2007). On this basis, a SOMs-supplemented method of risk assessment could generate substantial economic gains over time if it produces higher confidence, and therefore greater adoption of pre-import risk assessments as a key instrument of biosecurity policy.

To determine the differences in ranking that can occur between a SOM analysis and the expert or stakeholder consultation currently employed by many biosecurity agencies, we compared the risk estimates obtained in this analysis with those generated by Plant Health Australia (PHA), a national coordinating body addressing the biosecurity of Australia's plant industries. As part of its role, this organisation generates industry biosecurity plans (http://www.planthealthaustralia.com.au/site/Industry_Biosecurity_Plan_Mainpage.asp). Within these plans, the risk of establishment for insect pests has been estimated using a process of qualitative risk assessment, which consults expert opinion. These lists and rankings for each industry are not intended as definitive or actionable lists for the purposes of quarantine arrangements but are compiled for the purpose of determining biosecurity threats for each plant industry. Of the 567 insect pests in our data set that are absent

from Australia, 226 (39.8%) were also evaluated by PHA. The risk of establishment for these 226 insect pests were classified into four categories (high, medium, low, and negligible) making direct comparison with our list relatively simple, if the 'negligible' and 'low' categories are grouped together.

Many of the species (21.9%) had multiple risk categories attributed to them by PHA, depending on which crop was being considered. We counted species agreements if the SOM categorisation agreed with any one of the classifications made by PHA. We also calculated Cohen's kappa statistic (Cohen, 1960), to test the level of agreement between PHA and SOM after taking into account any agreement that could occur by chance. However, the kappa statistic assumes a species is classified into only one category and PHA classified many species into more than one category. For a species with multiple classifications, we determined if one of these classifications matched the SOM classification and if it did, we took that classification. If the classifications did not match we used the highest classification PHA had given that species.

Comparing the groupings obtained by the SOM analysis with those estimated by PHA we found that overall only 22.1% of species had the same risk estimate by the two methods. The category with the lowest level of agreement was the low risk category where only 14.0% of species classified as low by the SOM analysis were also classified as low by PHA. For the medium and high categories there was 53.3% and 50.0% agreement respectively. Further, while the SOM analysis only classified two species as high risk, PHA classified 92 species as high risk and of these 92 species, 73 (79.3%) were classified as low risk by the SOM analysis (Table 7, and Appendix, Table 43). Finally, Cohen's kappa statistic indicated very low agreement in the classification by SOM and PHA. Values for kappa range from -1 (complete disagreement) to 1 (complete agreement). A value close to zero, as reported here, indicates that any agreement between PHA and SOM can only be attributed to chance.

	PHA			
SOM	high	medium	low	**Total**
high	1	1	0	**2**
medium	18	24	3	**45**
low	73	81	25	**179**
Total	**92**	**106**	**28**	**226**

Table 7. A confusion matrix comparing the classification into 3 levels of likelihood of establishment by the SOM analysis and Plant Health Australia (PHA) (http://www.planthealthaustralia.com.au/site/Industry_Biosecurity_Plan_Mainpage.asp).

The large disparity between SOM and expert or stakeholder consultation may indicate the inclination of people, even those with a significant level of biological and ecological knowledge, to be risk averse and classify a species as a high risk when perhaps it is not. These experts or stakeholders also may not have an in depth knowledge of all potential pests and may therefore confuse the risk of establishment for a pest with the potential impact of that pest (Gary Fitt, CSIRO – personal communication). In addition, expert or stakeholder solicitation has often been found susceptible to a range of cognitive biases such as the format of the question(s), past experience, overconfidence, motivational bias, lack of independence, and cultural, political or philosophical context (see Burgman, 2005 for review). Despite this, there are a range of methods a facilitator can utilise to improve any estimates. One of these methods is to give the expert feedback on their estimates and allow them the opportunity to alter them (Burgman, 2005). Any species ranking list

generated by a SOM analysis would not only be independent of the 'human' biases mentioned above, but could be used by a facilitator as additional information that could serve as feedback for the experts to consider in their final estimates.

The placing of a pest species into different categories by PHA can also complicate the pest risk analysis and the second advantage therefore of using a SOM analysis is only one risk estimate is provided and this can be utilised by biosecurity agencies without having to consider the multiple risk categories that could be obtained in an expert or stakeholder consultation process.

Finally, while classification into the three categories is possible in both methodologies, this gives an equal 'value' of risk to all species within the same risk category. The SOM analysis however, gives quantitative estimates of risk, which can allow further prioritisation within each risk group and a more refined list.

One of the important reasons for using expert and stakeholder consultation is to ensure that factors associated with specific production concerns are met. The ability therefore of stakeholders to provide input and be part of the risk assessment procedure will ensure these stakeholders accept a shared responsibility for managing biosecurity concerns. For this reason, the SOM methodology should not replace the process of consultation, but can provide a framework and guide to the consultative process, enabling consultants access to more analytical assessments, which can better inform their recommendations regarding a pest's risk of establishment. Considering the cognitive biases mentioned above that are inherent in any consultative process, the addition of the SOM methodology and the information it provides can only improve the subsequent estimates of likelihood experts and stakeholders will produce.

3.5. SOM sensitivity

Key finding:

SOM methodology can generate robust risk lists resilient to error rates up to 20% in the presence/absence data (Paini et al 2010). (see objectives (ii), (iii) and (vi) section 2, p.8).

To determine the sensitivity of any risk list to errors in the data set, we deliberately altered the data set by increasing amounts to simulate error rates. After the data were altered, a new SOM was generated and a subsequent risk list for Australia extracted.

Once a risk list for Australia was generated, we classified all those species that are recorded as absent from Australia into risk categories similar to the categories utilised by Biosecurity Australia (the Australian government agency that undertakes science-based risk assessment, and provides quarantine policy advice) to obtain a semi-quantified estimate of risk of establishment. However, we condensed the lower four categories of Biosecurity Australia's scheme into one category as making fine grade distinctions between low risk level pests is considered relatively unimportant (Table 8). We also generated a top 100 list.

While these three risk categories (Table 8), which are a function of the risk scores allotted to each species, follow the established Biosecurity Australia model, other agencies might be more interested in a basic ranking of species and identifying, for example, the top 100 threats. This approach has been used by the Global Invasive Species Program (GISP) in a database, which lists 100 of the world's worst invasive alien species (http://www.issg.org/database/species/search.asp?st=100ss). In addition, biosecurity

agencies may wish to filter all the possible invasive species into a more manageable list for which they would seek advice from experts or stakeholders. Generating a top 100 list would be analogous to this filtering process. Such a list would not be directly dependent on a risk value but rather the relative ranking. In line with this we also generated a top 100 list of species posing the highest establishment risk for Australia.

List before the data alteration and after the data alteration were then compared (list fidelity). This list fidelity was assessed by recording the proportion of species present in each of the three risk categories that stayed in those same risk categories after the data were altered. For the top 100 insect pests, the proportion of these insects that stayed in the top 100 was recorded. In addition, to get an assessment of the fidelity of the overall list we performed Spearman's rank correlations on the entire list before and after data alteration.

Table 8. Risk categories used by (a) Biosecurity Australia (Biosecurity Australia, 2001) and (b) the three categories used in this analysis.

(a)		(b)	
Likelihood	Probability range	Likelihood	Probability range
High	0.7 - 1.0	High	0.7 - 1.0
Moderate	0.3 - 0.7	Moderate	0.3 - 0.69
Low	0.05 - 0.3	Low	0 - 0.29
Very Low	0.001 - 0.05		
Extremely Low	0.000001 - 0.001		
Negligible	0 - 0.000001		

We utilised IRAs generated by the Australian Government's Department of Agriculture, Fisheries and Forestry (DAFF) (http://www.daff.gov.au/ba/ira/final-plant) to estimate the error rate in a sample of the CABI data and determine the range of data alteration required. These IRAs assess the risk of importing a particular product from another country and identify the known insect pest species present in the exporting country and associated with that product. These lists of pest species are generated from published sources and are independent of the CABI database. We compared these lists with the CABI database and found error rates for 58 countries ranging from 0% up to 38%, and averaging 8.54% (Table 9). Included in this mean was an estimate for the error rate for Australia, which was calculated by randomly selecting 200 species and comparing the CABI database with the Australian Plant Pest Database (http://www.planthealthaustralia.com.au/our_projects/display_project.asp?category=4&ID =1) and by consulting taxonomy experts in the Australian National Insect Collection (CSIRO ANIC). The error rate for these 200 species was 2.5%.

Table 9. Error rates present in the CABI CPC for 58 countries. Error rates were calculated using data was extracted from Import Risk Assessments generated by the Australian Government's Department of Agriculture, Forestry, and Fisheries (http://www.daff.gov.au/ba/ira/final-plant).

Country	Error rate	Country	Error rate	Country	Error rate
1 Angola	0.00%	21 Grenada	12.50%	41 Pakistan	0.00%
2 Antigua and Barbuda	14.29%	22 Guadeloupe	20.00%	42 Panama	0.00%
3 Argentina	0.00%	23 Guatemala	0.00%	43 Peru	16.67%
4 Australia*	2.50%	24 Guyana	0.00%	44 Phillipines	7.14%
5 Bangladesh	0.00%	25 Haiti	0.00%	45 PNG	0.00%
6 Barbados	0.00%	26 India	6.90%	46 Puerto Rico	0.00%
7 Brazil	7.14%	27 Indonesia	0.00%	47 Saint Kitts and Nevis	0.00%
8 Cameroon	11.11%	28 Jamaica	0.00%	48 Samoa	14.29%
9 Canada	34.38%	29 Japan	15.91%	49 Sierra Leone	0.00%
10 Chile	3.45%	30 Korea	19.15%	50 Singapore	0.00%
11 China	11.11%	31 Laos	16.67%	51 Solomon Islands	0.00%
12 Colombia	25.00%	32 Malaysia	26.32%	52 Sri Lanka	0.00%
13 Congo	0.00%	33 Mauritius	20.00%	53 Surniame	20.00%
14 Costa Rica	14.29%	34 Mexico	11.11%	54 Thailand	10.81%
15 Cote D'Ivoire	14.29%	35 Montserrat	20.00%	55 Tonga	20.00%
16 Cuba	12.50%	36 Mozambique	20.00%	56 Trinidad and Tobago	0.00%
17 Dominican Republic	0.00%	37 Myanmar	0.00%	57 USA	3.57%
18 Ecuador	12.50%	38 New Caledonia	16.67%	58 Venezuela	0.00%
19 Fiji	22.22%	39 New Zealand	10.42%	59 Vietnam	0.00%
20 Ghana	0.00%	40 Nigeria	11.11%	**Mean**	**8.54%**

* The error rate for Australia was calculated using the Australian Plant Pest Database (http://www.planthealthaustralia.com.au/our_projects/display_project.asp?category=4&ID=1) and taxonomy experts in the Australian National Insect Collection (CSIRO ANIC).

Initially, data from all regions (459) was altered by increasing amounts (5%, 10%, 20%, and 30%). To do this, a set percentage of species were randomly selected from each region and their presence/absence score reversed. For example, for 5% alteration, 42 of the 844 species were randomly selected and their presence/absence score reversed (i.e. any species that was present was made absent and vice versa). This was done separately for all regions so that no two regions had exactly the same species data altered.

The error rate in the CABI database varied across countries and we therefore wanted to determine what variation in error rate could be tolerated by the SOM. Because the analysis indicated that an error rate of 20% across all countries could be accommodated (see results) we subsequently separated the 59 countries in Table 2 into two groups; those with an error rate of 20% or less and those above 20%. There were 55 countries (93% of the 59 countries) with error rates equal to or less than 20% and four countries above 20%. The mean error rate for the 55 countries was 7.15%. We assumed that if 93% of countries tested against the IRAs averaged 7.15% then the same proportion of regions in the CABI database (428 regions) would have a similar error rate. To be conservative, however, we set the alteration rate for these regions at the slightly higher value of 10%. The remaining 31 regions were subsequently tested for increasing alteration rate to determine how the list was affected.

When data from all regions were altered there was a marked decrease in the fidelity of species to their original categories after 20% alteration (Figure 6). This was confirmed by the top 100 list, which showed a similar large decrease in fidelity of species after 20% data alteration (Figure 7). However, Spearman's rank correlation showed significant correlations between the original list and lists generated up to 30% alteration (Table 10).
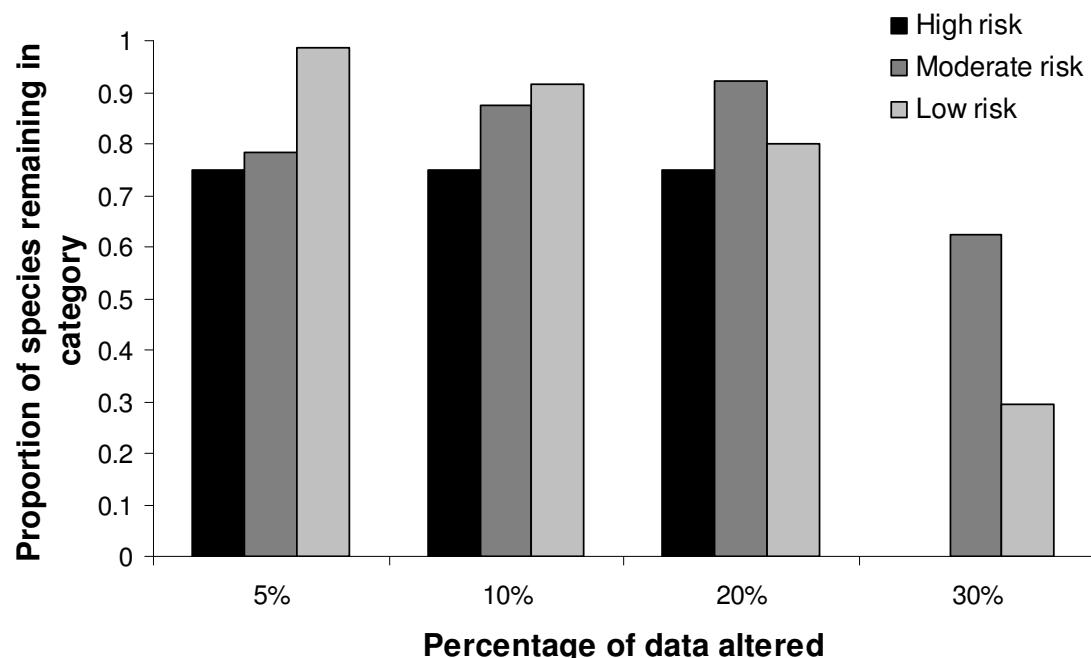
Figure 6. The proportion of species remaining in each risk category in response to an increasing level of data alteration.
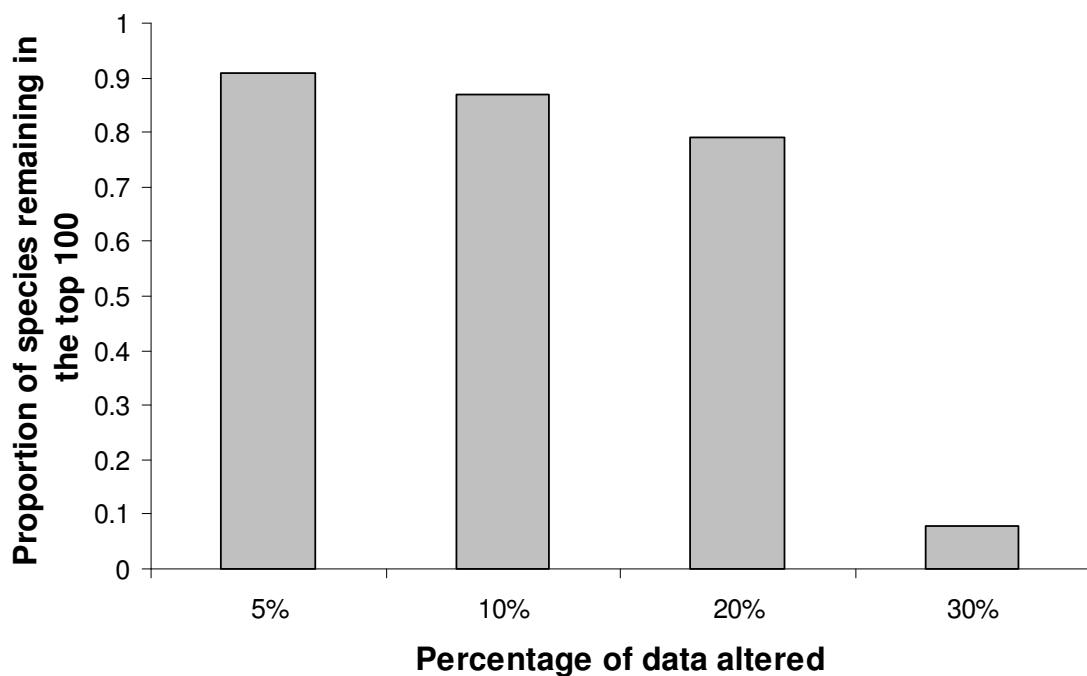
Figure 7. The proportion of species remaining in the top 100 list in response to an increasing level of data alteration.

Table 10. Spearman's rank correlations comparing the original list generated by SOM with lists generated from altered data.

Data alteration	r_s (adjusted for ties)
all regions at 5%	0.87†
all regions at 10%	0.82†
all regions at 20%	0.69†
all regions at 30%	0.44†
all regions at 40%	0.05
31 regions at 0%‡	0.79†
31 regions at 10%‡	0.82†
31 regions at 20%‡	0.79†
31 regions at 30%‡	0.78†
31 regions at 40%‡	0.79†
31 regions at 50%‡	0.68†
31 regions at 60%‡	0.70†
31 regions at 70%‡	0.69†
31 regions at 80%‡	0.81†
31 regions at 90%‡	0.82†
31 regions at 100%‡	0.74†

‡ 428 regions at 10%
† $p < 0.001$

When regions were separated into two groups (the larger group of regions with an alteration rate of 10%) we found that, using the three categories, an alteration rate of 30% in the smaller group of regions maintained category fidelity (Figure 8). Using the top 100 list, this alteration rate could be increased to 40% before significant reductions in fidelity occurred (Figure 9). The Spearman's rank correlation analysis revealed that the alteration rate for the smaller group of regions could be 100% and still maintain a significant correlation over the entire list (Table 10).
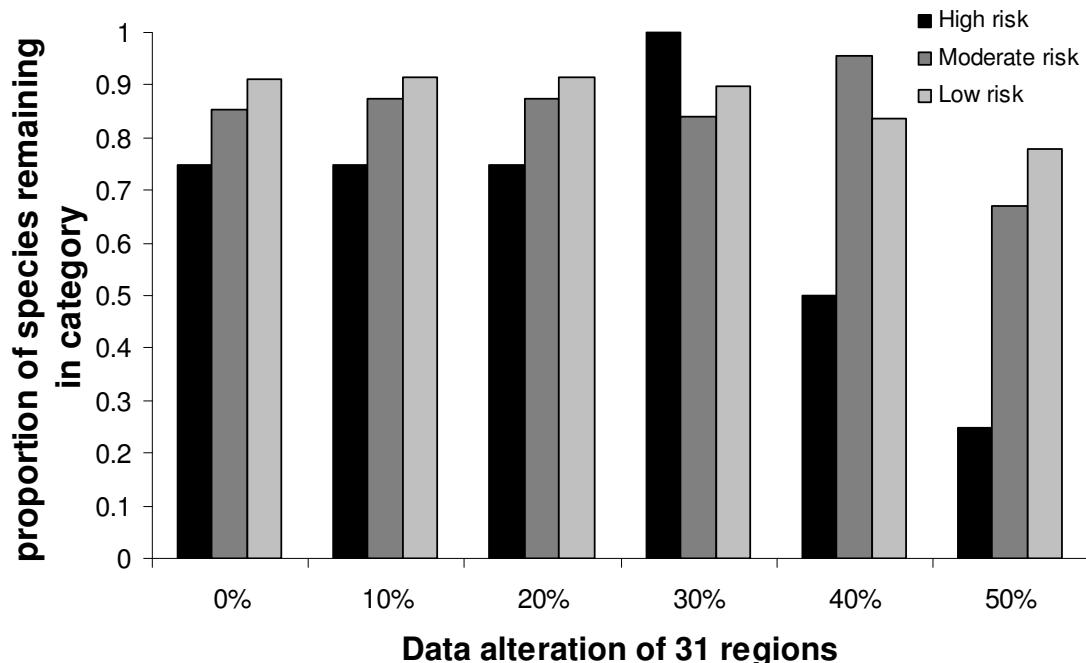
Figure 8. The proportion of species remaining in each risk category in response to an increasing level of data alteration for 31 randomly selected regions. The alteration rate for the remaining regions was maintained at 10%.
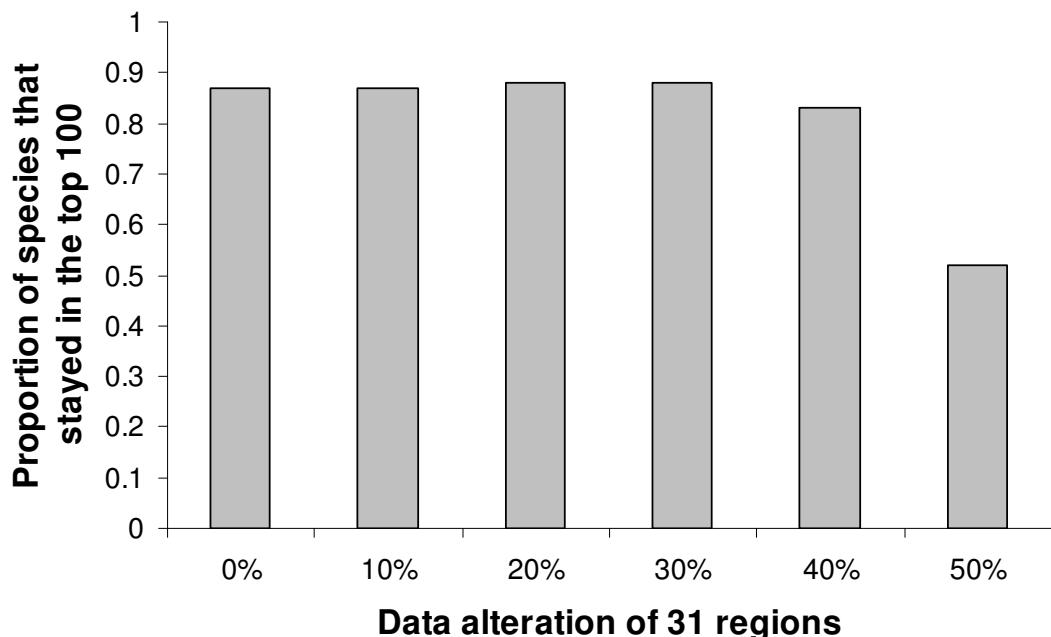
Figure 9. The proportion of species remaining in the top 100 list in response to an increasing level of data alteration for 31 randomly selected regions. The alteration rate for the remaining regions maintained at 10%.

Discussion of results

As current methods for quantifying the risk of establishment of invasive species can be relatively subjective, identifying and evaluating new methods that could help in generating more accurate invasive risk lists is paramount, and Worner and Gevrey (2006) have introduced the novel idea of using a self organising map to generate these risk lists. As with any modelling technique, it is important to obtain high quality data and/or test model sensitivity to data error. We found that an error rate in species distribution lists of up to 20% across all regions will still generate risk lists of relatively high fidelity.

Although an overall error rate of 20% would appear to be adequately handled by any SOM analysis, our estimation of the error rate showed that a small proportion of regions had higher error rates (Table 9). The error rate for these countries averaged 27% and the subsequent analysis that separated the 459 regions into two groups indicated that either a categorical list or a top 100 list could both be insensitive to errors at this level. In addition, rank correlations were maintained at significant levels up to 100% (i.e. all species in this small proportion of countries could be incorrectly classified as present or absent), indicating that, when considering all species, the list still maintained constant rankings.

If a biosecurity agency wished to use SOM as an initial filtering device that would enable a large number of species to be reduced to a smaller manageable number that could be utilised in any expert solicitation, then the Spearman rank correlations indicate that error rates up to 30% could be accommodated. Considering the error rate we found in the CABI CPC data averaged only 8.5%, SOM would appear to be very robust.

Our analysis suggests that SOMs can provide important information for the evaluation and prioritisation of pest lists, with species rankings appearing relatively robust to quite large errors in species distribution data. Given such errors are inevitable, these findings illustrate the practical utility of this approach and the utility of SOMs as a method, which can complement the current approaches used by biosecurity agencies.

3.6.   SOM accuracy

Key finding:

SOM methodology is extremely accurate in its ability to identify which species are able to establish in a region.

While the previous section showed that the SOM method is robust to significant errors in the distributional data, there has never been a test of its predictive powers. There are two possible methods that could be used to achieve this. The first is to use a historical world wide invasive species assemblage, perform an analysis using SOM and compare the SOM predictions to the current distribution of invasive species. One would expect, if the SOM is accurate in its predictions that those species identified by the SOM as having a high likelihood of establishing in a region to have subsequently established. However, if a species identified as a high risk by SOM has not subsequently established it is possible that the SOM was incorrect in its assumptions or the species simply has not had the opportunity to establish (i.e. not arrived to the region via some pathway).

The alternative is to create a virtual world filled with virtual invasive species and test SOM predictions in this arena. The advantage of this alternative is that all the regions in which a species are able to establish are known and it is a relatively simple task to compare the SOM predictions to what is known to be true.

CRCPLANTbiosecurity

We therefore generated an Australian risk list for invasive fungal plant pathogens from data extracted from the CABI CPC (CABI, 2003) and determined the reliability of these predictions by building a virtual world of invasive species of similar size and species distribution.

Methods

Fungal pathogen data and SOM anlaysis

Fungal pathogen data was extracted from the CABI CPC (CABI, 2003). This was the presence/absence data for 486 fungal pathogen species distributed over 459 regions of the world. A 459 x 486 matrix was thus generated in which the presence or absence of each fungal pathogen species was recorded in each region. The SOM analysis was performed and a risk list (top 200) generated for Australia and its states and territories.

Virtual World

We created a virtual world that consisted of the same number of regions as the CABI CPC data set (i.e. 459 regions) and allocated each region with a value or range of values between 1 and 10 that represented its invasibility index (InIx). We then generated the same number of species as the fungal pathogen data set (486 species) and applied a value between 1 and 10 to each species, which represented its invasibility requirements (InRq). If a species' InRq matched a region's InIx, then that species was able to invade and establish in that region. For example, if a region had an InIx range of 3-5, then any species that had an InRq of 3, 4, or 5 was able to establish in that region. While the InRq for species were randomly selected, the InIx for regions were also random, but weighted.

We wanted to simulate a world similar to the real world in which the range of InIx's of the virtual world was similar to that in the real world. However, it is not possible to determine how invasible the world's regions are, as the invasive species of the world have not fully invaded all the regions they are able to. This 'invasion equilibrium' point has not yet been achieved and we therefore used a proxy to determine the ranges of invasibility by examining worldwide species plant diversity (Kier et al 2005).

Using this dataset, we determined the maximum species diversity in any one ecoregion (10,000 species). We used these values as proxies for the range of invasibility indices applied to any region in the virtual world. If an ecoregion had the maximum 10,000 species that was equivalent to the maximum invasibility range (all InIx values between 1 and 10). If an ecoregion had 9,000 species that was equivalent to an invasibility range of 9 (9 values between 1 and 10), etc. The proportion of ecoregions in each of the ten species diversity categories was used to determine the weighting for the random selection of invasibility indices for regions in the virtual world (Table 11).

Table 11. Weighting for the random selection of invasibility indices for regions in the virtual world.

# species	range	# ecoregions	proportion
1-1,000	1	456	0.527
1,001-2,000	2	182	0.210
2,001-3,000	3	111	0.128
3,001-4,000	4	52	0.060
4,001-5,000	5	24	0.028
5,001-6,000	6	14	0.016
6,001-7,000	7	14	0.016
7,001-8,000	8	6	0.007
8,001-9,000	9	5	0.006
9,001-10,000	10	1	0.001

For example, only one region contained the maximum number of species (9,001 to 10,000), which represents 0.1% of all ecoregions. In the virtual world therefore, the chance of obtaining a region with the maximum range of invasive indices was 0.1%. The largest percentage of regions (52.7%) had the smallest range and so the chance of a region receiving only one invasibility index was 52.7%.

Once both the species' InRq's and the regions' InIn's were allocated it was possible to know exactly how many and which regions any species was able to invade and establish in. This represents the 'invasion equilibrium', referred to above, in which all species have invaded all possible regions. The current real world distribution of invasive pathogens represents some unknown point before this. To test SOM predictions in this virtual world we allocated each species to a pre-determined percentage of all the possible regions a species could invade. For example, if a species was able to invade 200 of the 459 regions in the virtual world, we could randomly allocate that species to 50% of those 200 regions. Repeating this for all species would result in species assemblages for all regions that represented some point in time before 'invasion equilibrium'. This species distribution could then be analysed using SOM and the predictions tested against the known 'invasion equilibrium', which shows where all species will invade.

Initially, we allocated species to 50% of their potential and repeated this 100 times (simulations), each time maintaining the same region InIn's and species InRq's, simply altering the random allocation of species to 50% of their potential ranges. This process generated 100 datasets, each of which was analysed using SOM, and a risk list for each region was generated. Each region's risk list was then compared to the 'invasion equilibrium' list for that region (i.e. the list of species that are known to be able to invade and establish in a region). If SOM is perfect in its predictions it would be expected that all those species which are able to invade that region are ranked above all those species that are unable to invade. For example, if it is known that 100 species are capable of invading a region, and SOM ranked all 100 of those species in the top 100 of its risk list, then SOM's predictions would be 100% correct. For convenience we can refer to the top 100 in this case as the 'top half' and the remaining species as the 'bottom half' (if, in another region only 25 species could invade then the top 25 species of the SOM risk list for that region would be the 'top half'). If only 90 of those 100 species were ranked in the 'top half', then SOM's predictions would be 90% correct. This was calculated for all regions in all 100 simulations to give a total 45,900 estimates of SOM's ability to correctly predict which species will establish in a region. In addition, it is possible to determine how well SOM

predicts any one species in all of the available regions. If a species could establish in 50 of the available 459 regions, then in those 50 regions SOM should have ranked that species in the 'top half', while in the remaining regions, SOM should have ranked that species in the 'bottom half'. This was calculated for all 100 simulations giving a total of 48,600 estimates of SOM's ability to predict species invasibility across regions. We were therefore able to estimate SOM's ability to predict which species should establish in a region and which regions a species should establish in.

We then repeated the above process, but this time allocated species to only 10% of their potential distribution. This enabled us to test the SOM's ability to predict when species distributions (and therefore species associations) are significantly more restricted.

In addition, we also generated multiple virtual worlds to eliminate the possibility of idiosyncracies of a single virtual world biasing results. Had we only used the single virtual world we initially created and just randomly distributed the species into that world, it was possible that the characteristics of that world would be unique. Therefore, the SOMs ability to make predictions could have been reduced or enhanced by these unique characteristics. We subsequently generated 200 virtual worlds in which each region's InIn and species' InRq were randomly selected. Each virtual world was therefore different to all others. For 100 virtual worlds we allocated species to 50% of their potential range and for the remaining 100 virtual worlds we allocated species to 10% of their potential range. We were able to determine if this added level of variation increased the variation in predictive power of SOM.

Results

Plant Pathogen Dataset

Of the 486 plant pest pathogens in the CABI CPC data set, 237 are absent from Australia. These species have been ranked by the SOM analysis and the full list for Australia and its states and territory can be found in Appendix, Table 44-Table 51.

Virtual World Results - 50% Initial distribution

Predicting a species across all regions (100 simulations):

All species were initially distributed to between 27 and 58 regions. We found that the SOM predictions for all these species ranged from 92.8% to 100% correct (Figure 10 (a)) and averaged 98.9%. On average therefore, each species was correctly predicted by SOM as being able or not be able to invade 454 of the 459 regions. Of the 48,600 data points (486 species in 100 simulations), 88% were correctly predicted in 98% of regions (450 regions) (Figure 10(b)).
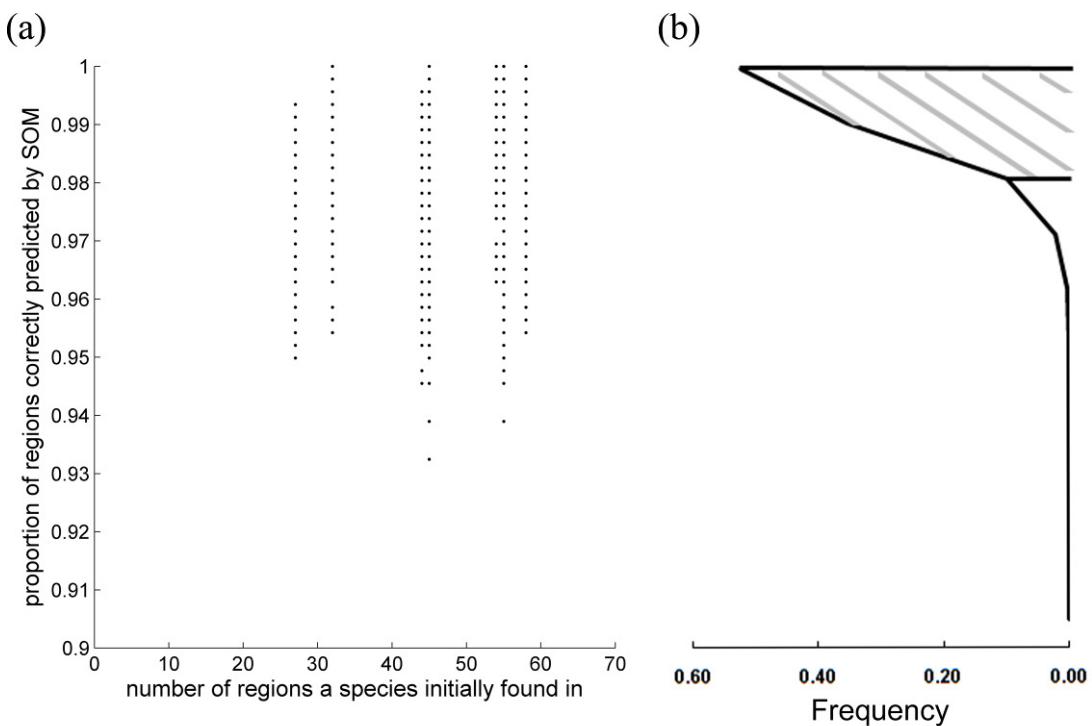
Figure 10. (a) For each species, the proportion of regions correctly predicted by SOM as being able or unable to invade and establish in. Data generated from 100 simulations of the same virtual world and with species initially distributed to 50% of the regions in which they could invade and establish in. (b) Frequency distribution of species. Shaded area = 88% of species.

Predicting a species across all regions (100 virtual worlds):

Though the creation of 100 different virtual worlds increased the variation in number of regions a species was initially found in (19 to 68 regions), the mean success rate for SOM predicting which species would or would not be able to invade and establish in a region is still at an extremely high level (98.9%), ranging from 92.1% up to 100% (Figure 11(a)). In addition, 87% of species were correctly predicted by SOM in at least 98% of regions (Figure 11(b)).
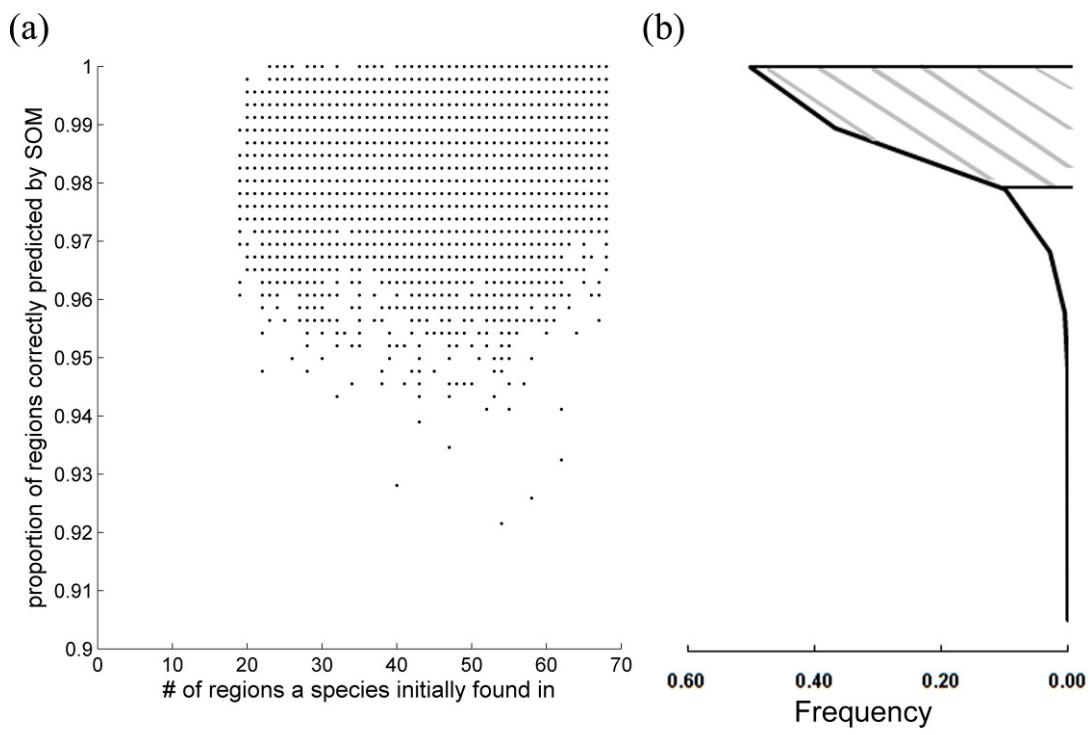
Figure 11. (a) For each species, the proportion of regions correctly predicted by SOM as being able or unable to invade and establish in. Data generated from 100 virtual worlds and with species initially distributed to 50% of the regions in which they could invade and establish in. (b) Frequency distribution of species. Shaded area = 87%.

Predicting species within a region (100 simulations):

For all regions in all simulations (45,900), SOM was able, on average, to correctly predict whether or not 98.7% of the species were able to establish and invade a region. Although there was a wide spread of prediction success (i.e. from as low as 6% up to 100% (Figure 12(a))), for the majority of regions (96%) most species (95%) were correctly predicted by SOM as being able or unable to invade and establish (Figure 12(b)).
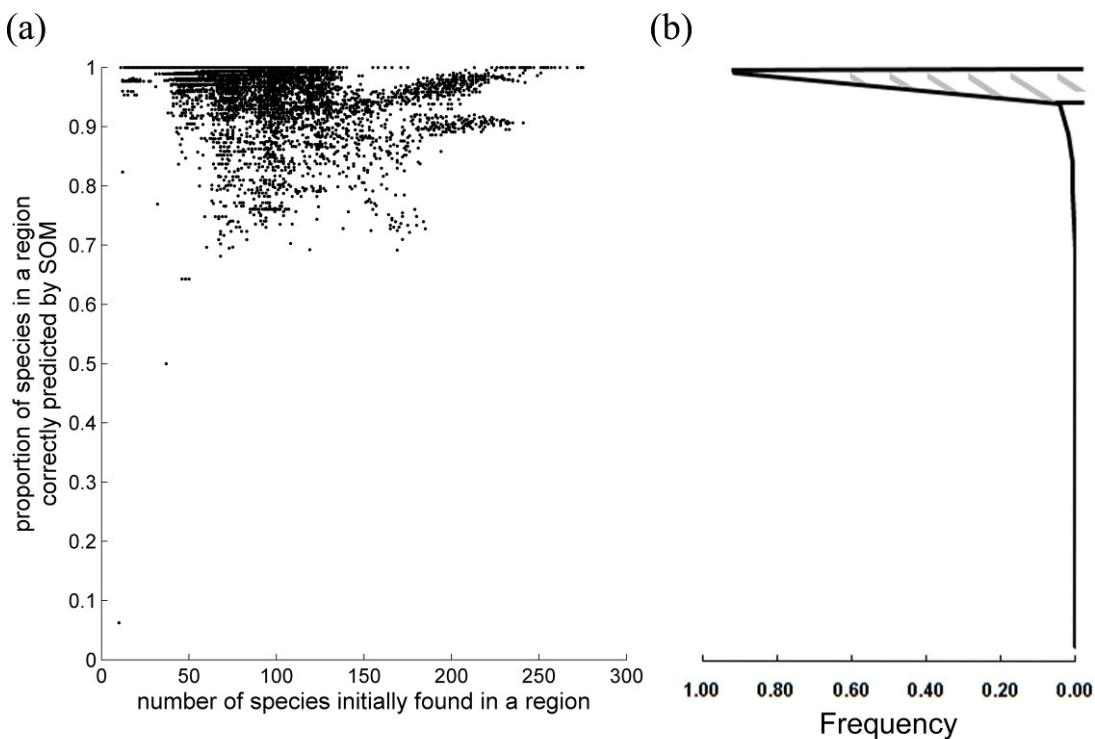
Figure 12. (a) For each region, the proportion of species correctly predicted by SOM as being able or unable to invade and establish in. Data generated from 100 simulations of the same virtual world and with species initially distributed to 50% of the regions in which they could invade and establish in. (b) Frequency distribution of regions. Shaded area = 96%.

Predicting species within a region (100 virtual worlds):

For all regions in all virtual worlds (45,900), SOM was able, on average, to correctly predict whether a not 98.7% of species were able to establish and invade a region. Although the number of species in a region correctly predicted by SOM was as low as 44.9% (Figure 13(a)), the majority of regions (91.6%) had at least 95% of species correctly predicted by SOM as being able or unable to invade and establish (Figure 13(b)).
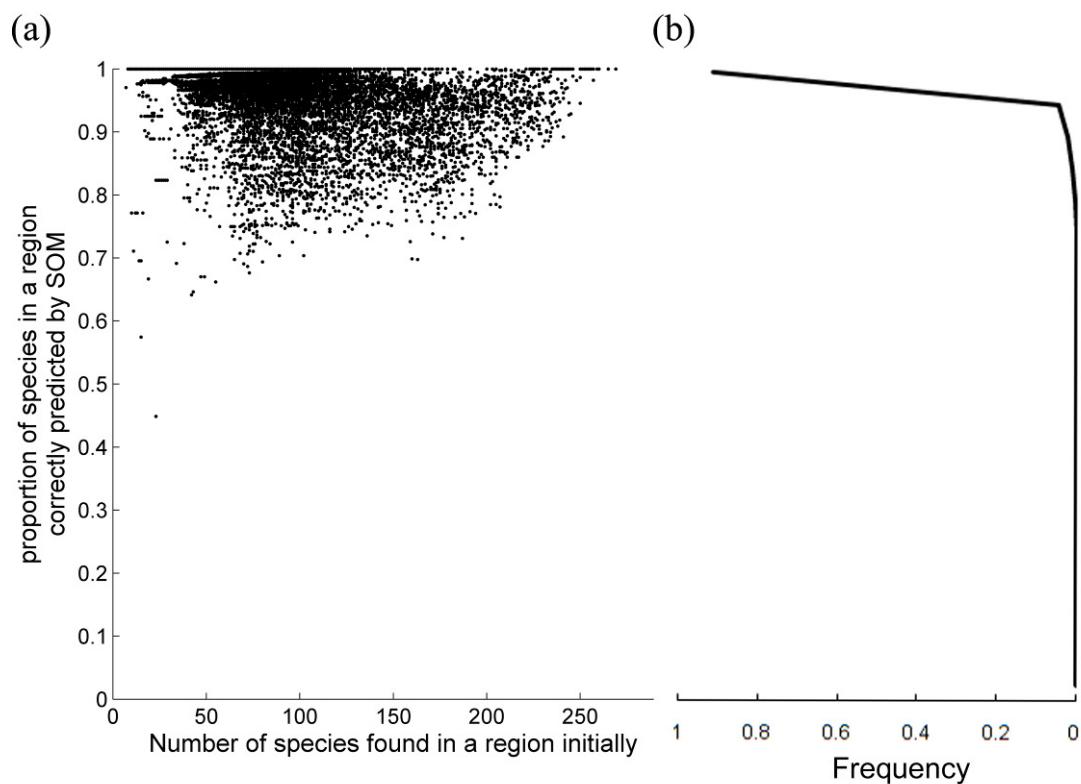
Figure 13. (a) For each region, the proportion of species correctly predicted by SOM as being able or unable to invade and establish in. Data generated from 100 virtual worlds and with species initially distributed to 50% of the regions in which they could invade and establish in. (b) Frequency distribution of regions.

<u>Virtual World Results - 10% Initial distribution</u>

Predicting a species across all regions (100 simulations):

Species were initially distributed to between 5 and 12 regions. The SOM success rate for predicting whether or not a species could establish in a region ranged from 69.2% of regions correct up to 98.9% of regions correct (Figure 14(a)). On average, SOM was able to correctly predict whether or not a species was able to invade 91.5% of regions (420 regions). In addition, 95% of species were correctly predicted in greater than 85% of regions (Figure 14(b)).
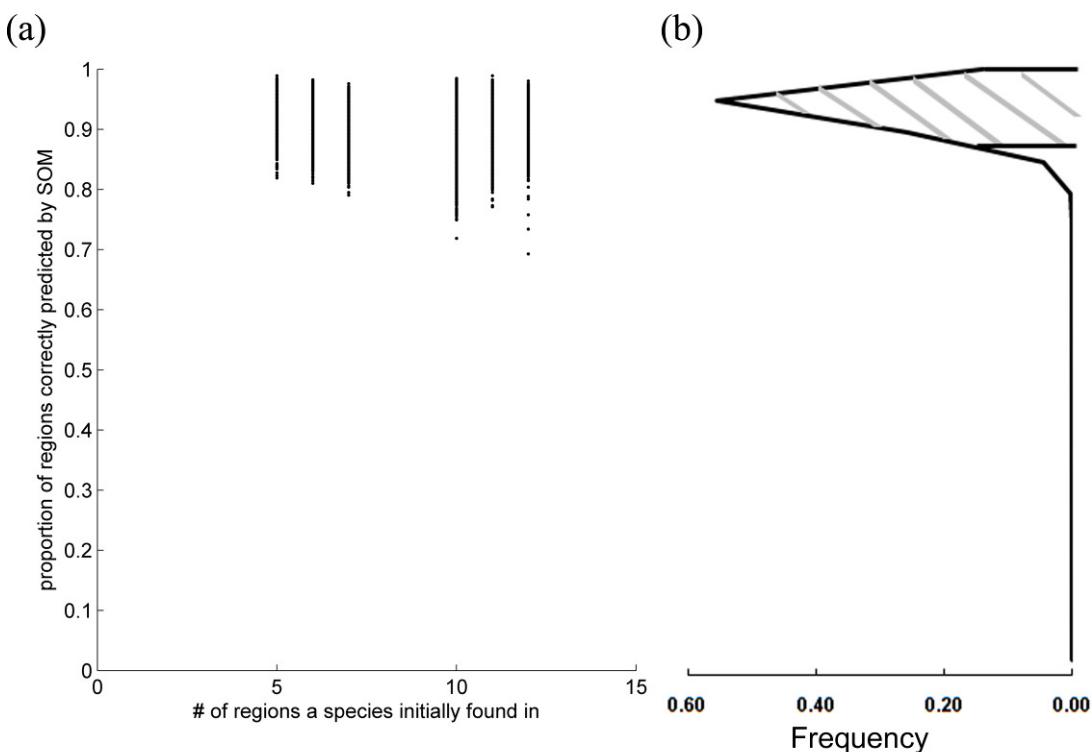
Figure 14. (a) For each species, the proportion of regions correctly predicted by SOM as being able or unable to invade and establish in. Data generated from 100 simulations of the same virtual world and with species initially distributed to 10% of the regions in which they could invade and establish in. (b) Frequency distribution of species. Shaded area = 95%.

Predicting a species across all regions (100 virtual worlds):

Species were initially distributed to between 4 and 14 regions. The SOM success rate for predicting which regions a species was able to establish in ranged from 71.0% up to 99.3% (Figure 15(a)), and averaged 91.7%. In addition, 71% of species were correctly predicted in greater than 90% of regions (Figure 15(b)).
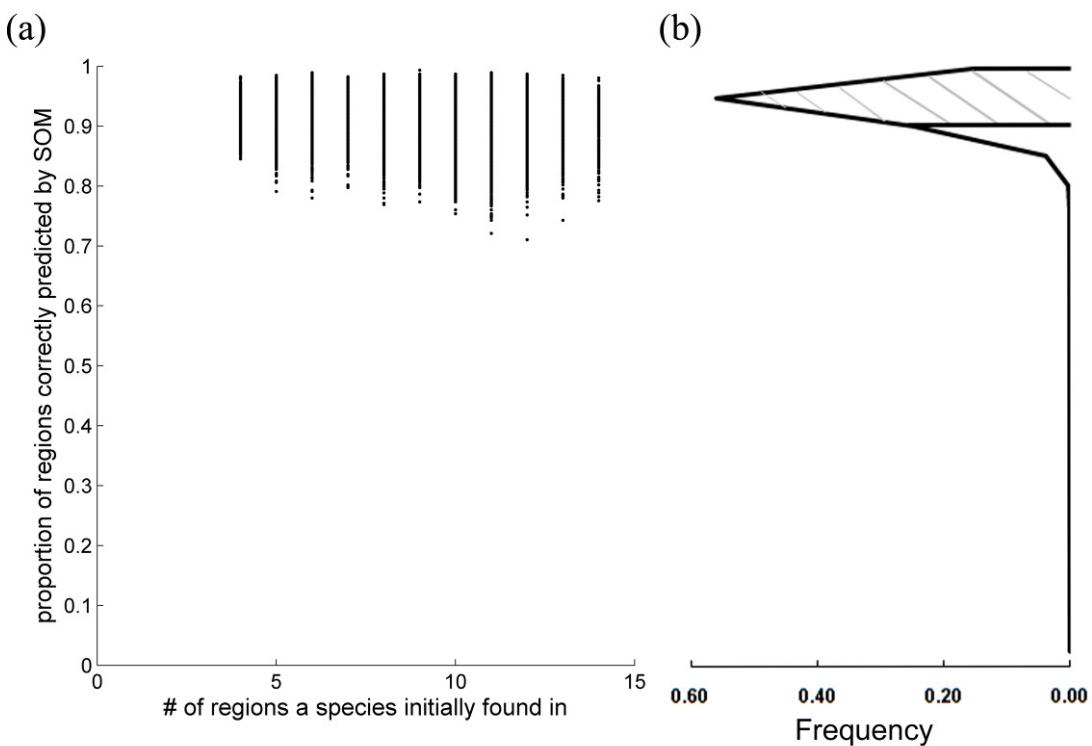
Figure 15. (a) For each species, the proportion of regions correctly predicted by SOM as being able or unable to invade and establish in. Data generated from 100 virtual worlds and with species initially distributed to 10% of the regions in which they could invade and establish in. (b) Frequency distribution of species. Shaded area = 71%.

Predicting species within a region (100 simulations):

For all regions in all simulation (45,900), SOM was able on average to correctly predict whether or not 75% of the species were able to establish and invade a region. For the majority of regions (74%), most species (75%) were correctly predicted by SOM as being able or unable to invade and establish (Figure 16(b)). Regions which initially had between only 1 and 9 species appear to be particularly difficult SOM to predict with success rates that vary from 1.7% up to 100% (Figure 16(a)). Despite this large variation, the average success rate for these regions was 71.4%, with 64% of regions having a 70% correct prediction rate (Figure 17).
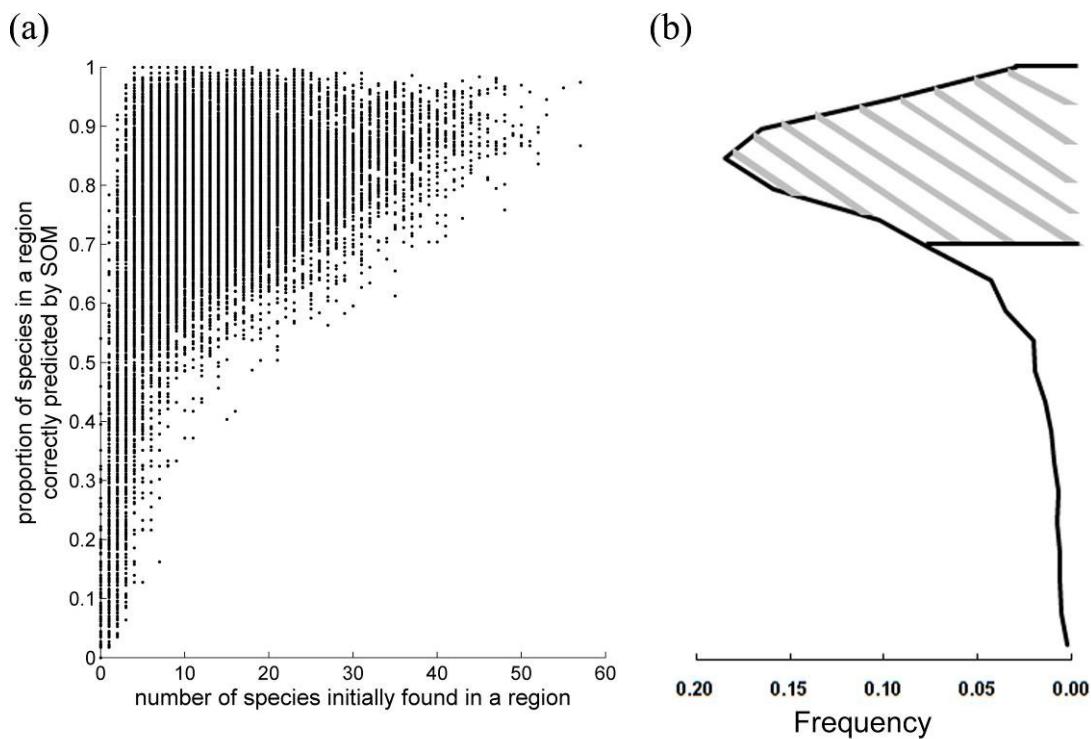
Figure 16. (a) For each region, the proportion of species correctly predicted by SOM as being able or unable to invade and establish in. Data generated from 100 simulations of the same virtual world and with species initially distributed to 10% of the regions in which they could invade and establish in. (b) Frequency distribution of regions. Shaded area = 74%.
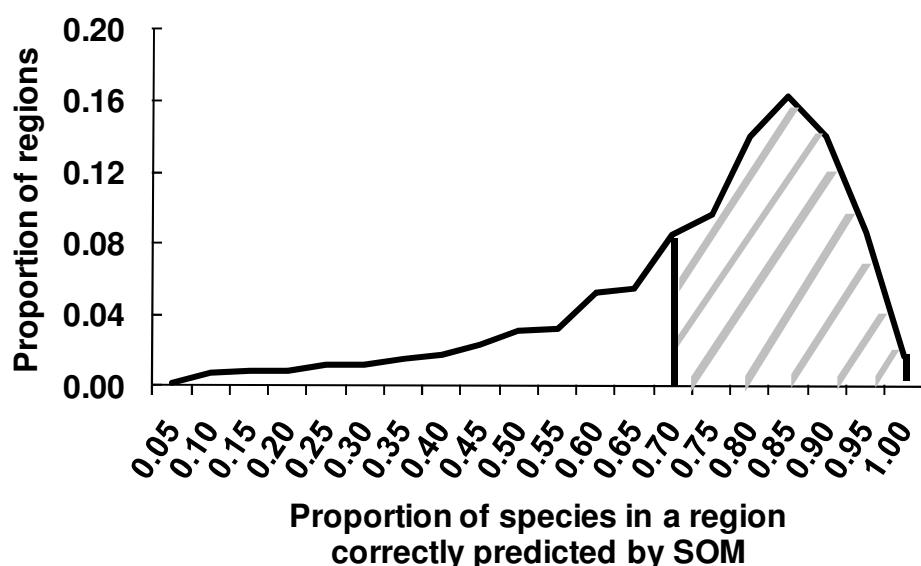
Figure 17. Frequency distribution for regions which only had between 1 and 9 species present initially. Shaded area = 64%. The means that 64% of regions had 70% of species correctly predicted by SOM as being either able or unable to invade and establish.

Predicting species within a region (100 virtual worlds):

For all regions in all virtual worlds (45,900), SOM was able, on average, to correctly predict whether or not 76.0% of the species were able to invade and establish in a region. For the majority of regions (65%), most species (75%) were correctly predicted by SOM as being able or unable to establish (Figure 18(b)). Regions which initially had between only 1 and 9 species (Figure 18(a)), appear to be particularly difficult for SOM to predict, with success rates that vary from 1.5% up to 100%. Despite this large variation, the average success rate for these regions was 73.2% of species, with 69% of regions having a 70% correct prediction rate (Figure 19).
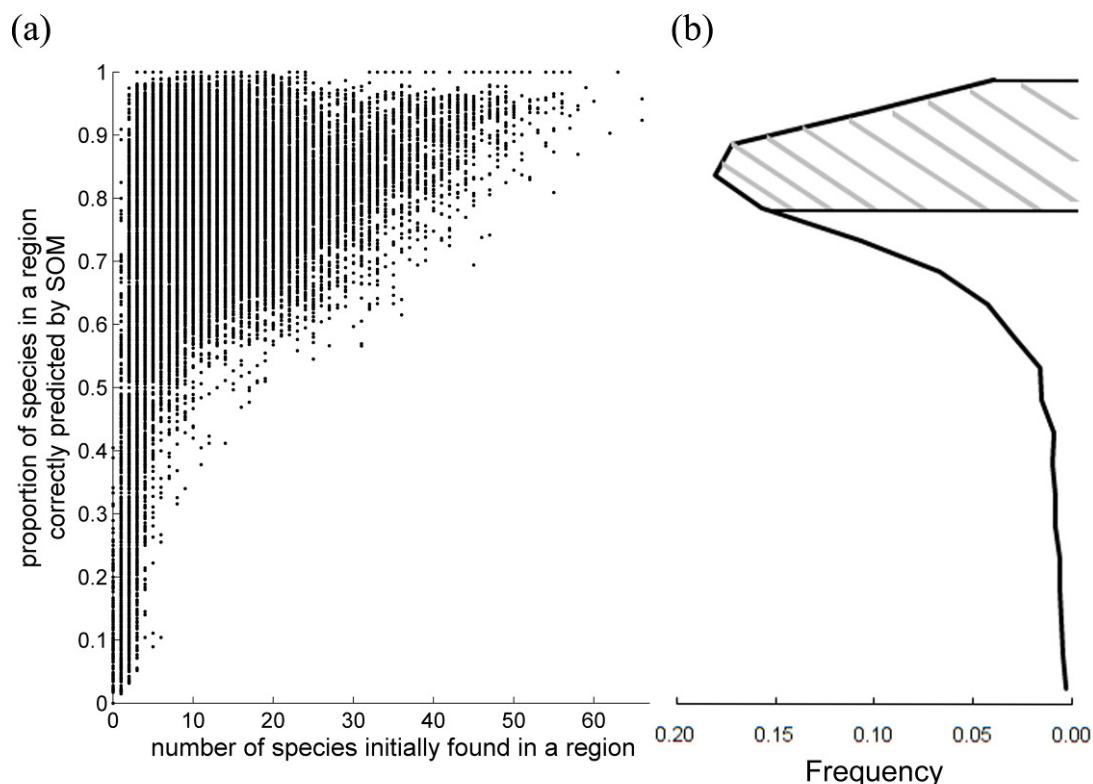
Figure 18. (a) For each region, the proportion of species correctly predicted by SOM as being able or unable to invade and establish in. Data generated from 100 virtual worlds and with species initially distributed to 10% of the regions in which they could invade and establish in. (b) Frequency distribution of species. Shaded area = 65%.
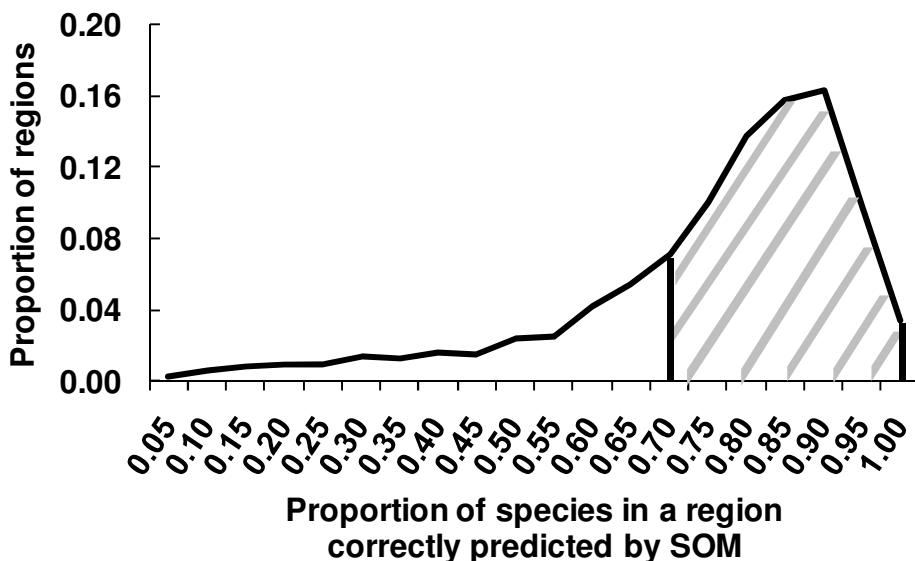
Figure 19. Frequency distribution for regions which only had between 1 and 9 species present initially. Shaded area = 69%. The means that 69% of regions had 70% of species correctly predicted by SOM as being either able or unable to invade and establish.

Discussion

Although SOM was tested in two different scenarios, (100 simulations of the same virtual world and 100 different virtual worlds), the results indicate little difference between the two with respect to SOM prediction success. Clearly, SOM is very good at making predictions, specifically at ranking those species most likely of establishing in different regions above those species that are not.

The SOM analysis of fungal pathogens generated a risk list for Australia. Utilising Figure 13(a) we can determine a level of confidence around this list. Australia has approximately 250 fungal pathogen species present. SOM was able to successfully rank approximately 99% of the species in regions with approximately 250 species. This result gives a great deal of confidence in this list. We can also determine, to some degree, the level of confidence in the state lists generated (Appendix, Table 44‑Table 51). New South Wales, and Queensland both have approximately 200 species present. From Figure 13(a) we can see that SOM ranked approximately 93% of species correctly. South Australia, Victoria, Tasmania, and Western Australia all have approximately 100 species and the ranking success for regions with this many species present was 95%. The Northern Territory only has 40 species of fungal pathogens present and from Figure 18(a) we could estimate a success rate of 86%.

SOM generated risk lists can be utilised by government biosecurity agencies around the world wishing to prioritise and rank pest lists. Currently, this process often involves consulting experts, industry stakeholders, and government employees. While the work presented in this section shows that there is significant confidence in a list's resilience to errors in the data, this work shows that there is significant confidence in the accuracy of the ranked predictions generated by SOM.

Present distributions of invasive species are a function of historic trade routes, which have given these species the opportunities to invade the regions they have invaded. One

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criticism levelled at SOM analysis is that it cannot consider the opening of future trade routes and how this might affect future distributions and subsequent SOM predictions. The work presented here in the virtual world shows that the SOM can still make predictions and successfully rank species that will establish above those species that will not establish despite having very little initial distributional data. Trade routes that open up in the future and result in altered invasive species distributional data will no doubt improve the accuracy of the SOM predictions. Despite this, we can still have high levels in confidence of any SOM predictions based on current real world invasive species distributions, regardless of future trade routes that may or may not open up.

3.7.   US case study

Key finding:

SOM analysis applied to US species assemblages found the greatest threat to US states to be those species present in the US as opposed to those outside.

Introduced species are estimated to cost the US economy approximately $120 billion/year (Pimentel et al., 2005). Accordingly, US government agencies maintain active biosecurity infrastructures (http://www.csrees.usda.gov/nea/ag_biosecurity/ag_biosecurity.cfm), backed-up by national and international regulatory institutions and agreements (e.g. GATT, 1994) aimed at preventing introductions. Given the increasingly global nature of transport and trade, together with the fact that there are hundreds or even thousands of potential invasive species in the global species pool, a major challenge for US biosecurity lies in predicting which invasive species are of greatest threat (Hulme, 2003) and from where those species are likely to come (Hulme, 2009). Additionally, for a large country like the US with multiple potential entry points, there is a need to consider not only pre-border incursions, but also post-border spread of exotic species that have already arrived (USDA, 2005;Forrest et al., 2009).

As previously mentioned in this report, the current approach of the US and many other governments around the world to these issues relies heavily on a consultative process in which scientific experts, policy officers, and industry stakeholders are consulted for their opinion on which of the potential invasive species have the highest likelihood of invading (USDA, 2007). However, it is well known that such opinions are susceptible to context dependence and motivational bias potentially resulting in misleading prioritisation (Burgman, 2005), making it difficult to rank and prioritise potentially hundreds of species for different biosecurity contexts (e.g. pre- vs. post-border, state or regional vs. national, agricultural vs. environmental)

In this section we apply SOM analysis to rank, based on establishment likelihood, the threat of a globally distributed set of invasive insect pest species to the US. Our initial analysis was very similar to that presented in section 3.2 which provided a list of high-establishment-risk pests for Australia, only using the US as our point of focus rather than Australia. Hence, we again used world wide insect pest distributional data from the CABI CPC (CABI, 2003) to generate a pest establishment top 100 risk list for the contiguous US as a whole (Appendix, Table 52). This list revealed a key finding: of the top 100 insect species predicted to have the highest chance of establishment in the US, all are currently present somewhere within the contiguous US (and 178 of the top 200 are present).

We then generated a top 100 risk list for each of the 48 contiguous states of the US and determined how many of the top 100 are still absent from a particular state despite the

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presence of a plant host in that state (Figure 20(a)).Note: we obtained plant host lists for every pest species absent from a state and in that state's top 100 list from the CABI CPC (CABI, 2003). Using data from the United States Department of Agriculture (USDA) Plants Database (http://plants.usda.gov/index.html), we determined for each pest if at least one of these host plants was present in the state in which the species concerned was absent. This indicated if a pest species was able to establish in principle in a state.

In contrast to the national risk list, we found that all states had species absent in their top 100, with most states having at least 20 absent species in their top 100 and one state (Vermont) having almost half of the 100 absent (48).

We then asked, of those absent species in a states' top 100, how many are present in another state in the US? In all but one of the 48 contiguous states of the US, every absent species in the top 100 for a state can be found in at least one other state and on average will be found in 27 other states (Figure 20(b)). Moreover, we found the majority of absent species in any states' top 100 can be found in a neighbouring state that shares a border (Figure 20(c)). On average, 84.3% of the absent species will be found in at least one neighbouring state, with 12 states having all absent species in their top 100 present in a neighbouring state (Figure 20(c)). The emergent conclusion from this information is that for any state, the immediate present-day threat from known invasive insect pests is greater from within the US than from foreign sources.
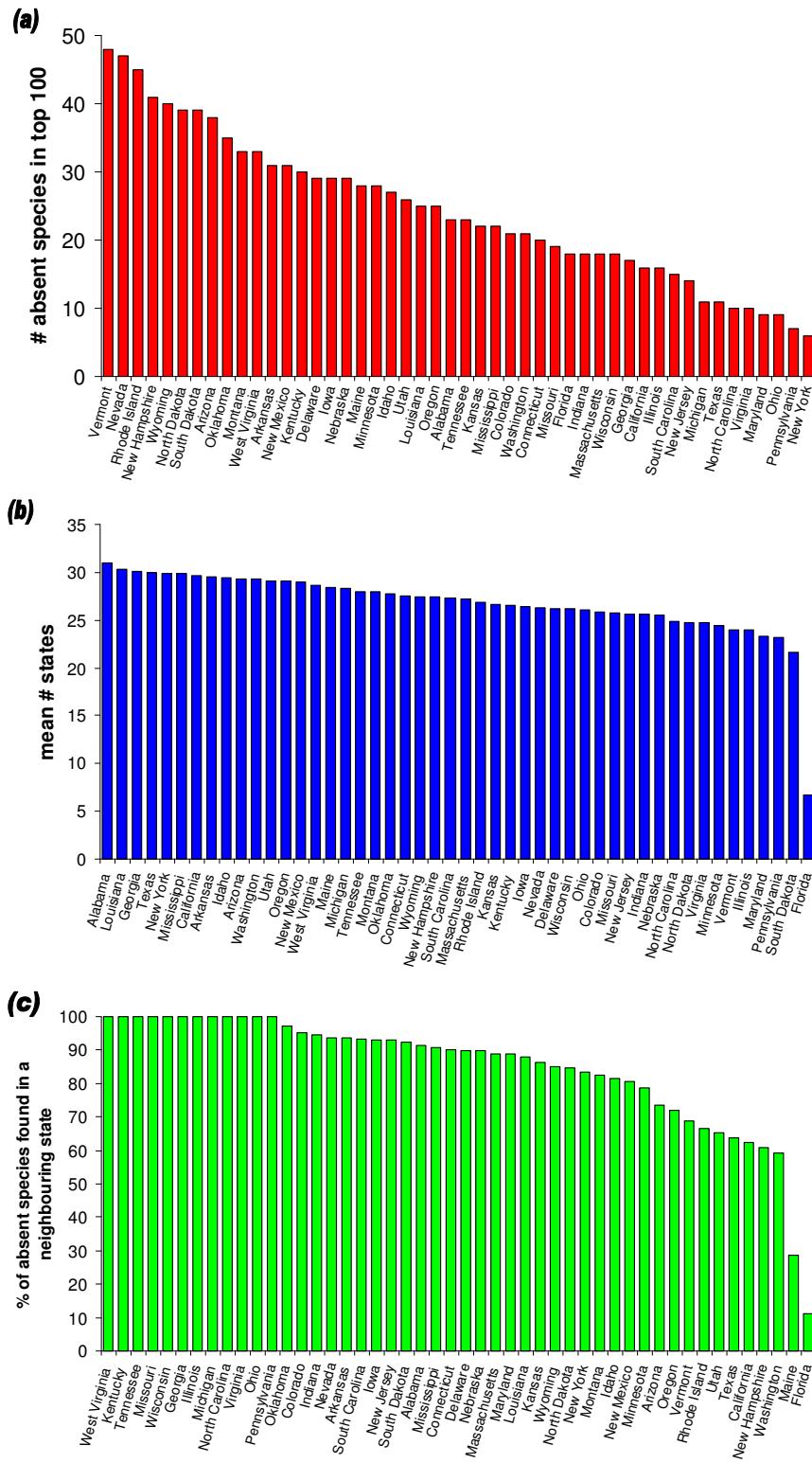
Figure 20. (a) Number of absent species in the top 100 risk list for each state of the contiguous USA, (b) Mean number of other states in the contiguous USA an absent species in the top 100 risk list is found (e.g. for Alabama, the 23 absent species in its top 100 risk list are found, on average, in 31 other states), (c) Percentage of absent species in a state's top 100 risk list found in at least one neighbouring state.

The one partial exception to this conclusion is Florida, for which nine out of the 18 species absent in its top 100 are not found anywhere else in the contiguous USA, and a further three species are only found in one other state. Thus, the immediate threat from outside the US may be proportionately greater for Florida than any other contiguous US state. Interestingly, of all inspection stations at US ports-of-entry (airports, maritime ports, and land border sites), Miami had the greatest percentage (21.8%) of insect interceptions (McCullough et al., 2006) indicating that it receives a significant number of insect pests and may be a 'doorway' to insect pests entering the US.

In determining what factors could predict whether a state has a large number of absent species in the top 100, it might be expected that larger states would accumulate more species than smaller states and therefore have fewer absent species. We obtained state size data from Wikipedia (http://en.wikipedia.org/wiki/List_of_U.S._states_by_area) and used linear regression to determine if there was a significant relationship between the size of the state and the number of absent species in a states' top 100 list. We found no relationship between the number of absent species in a state and state size ($F_{1,46} = 0.06$, p = 0.8). Similarly, species diversity tends to decrease with latitude (Hillebrand, 2004) so it might be expected that southern states would have fewer absent species than northern states. We obtained state latitudinal range from Wikipedia's web page for each individual state. We then took the midpoint in a state's latitudinal range and used linear regression to determine if there was a significant relationship between a state's latitude and the number of absent species in a states' top 100 list. Again there was no significant relationship between the number of absent species in a states' top 100 and the state latitudinal midpoint ($F_{1,46} = 2.45$, p = 0.125).

We also tested inbound domestic passengers and gross state product against the number of absent species in a state's top 100. We obtained domestic passenger data from the US Bureau of Transportation Statistics (http://www.transtats.bts.gov/DL_SelectFields.asp?Table_ID=258), T-100 Domestic Market (US Carriers) database (2007 data). We used asymptotic regression (exponential curve) to determine if there was a significant relationship between the numbers of passengers arriving into a state and the number of absent species in a state's top 100 list. We obtained gross state product (GSP) from Wikipedia (http://en.wikipedia.org/wiki/List_of_U.S._states_by_GDP_(nominal)) and used asymptotic regression (exponential curve) to determine if there was a significant relationship between a state's GSP and the number of absent species in a state's top 100 list.

In contrast to state size or latitude, there was a significant negative relationship with the number of inbound domestic passengers ($F_{2,45} = 12.46$, p < 0.001, $R^2 = 0.328$, Figure 21), and also gross state product ($F_{2,45} = 43.48$, p < 0.001, $R^2 = 0.644$, Figure 22). These measures can be considered surrogates for propagule pressure and ecological disturbance, respectively (Westphal et al., 2008), both of which have been identified as determinants of species invasion in other contexts (Lonsdale, 1999;Dalmazzone, 2000;Kolar and Lodge, 2001;Westphal et al., 2008). Thus, transport ('propagule pressure') and economic activity ('disturbance') appear to be factors in determining the probability of establishment of known invasive crop pests in the US states.
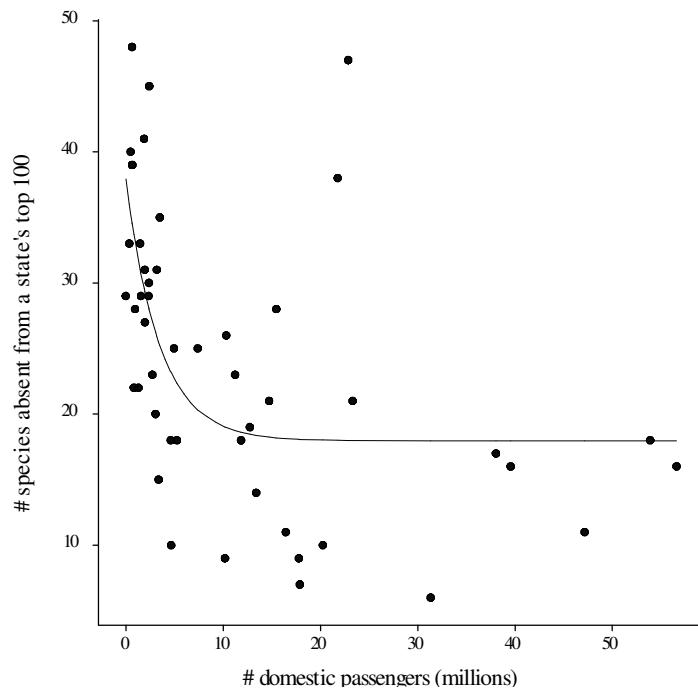
Figure 21. Relationship between the number of incoming domestic flight passengers to a state and the number of absent species in that state's top 100 list (fitted curve: $17.96 + 20.04 \times 0.749^X$).
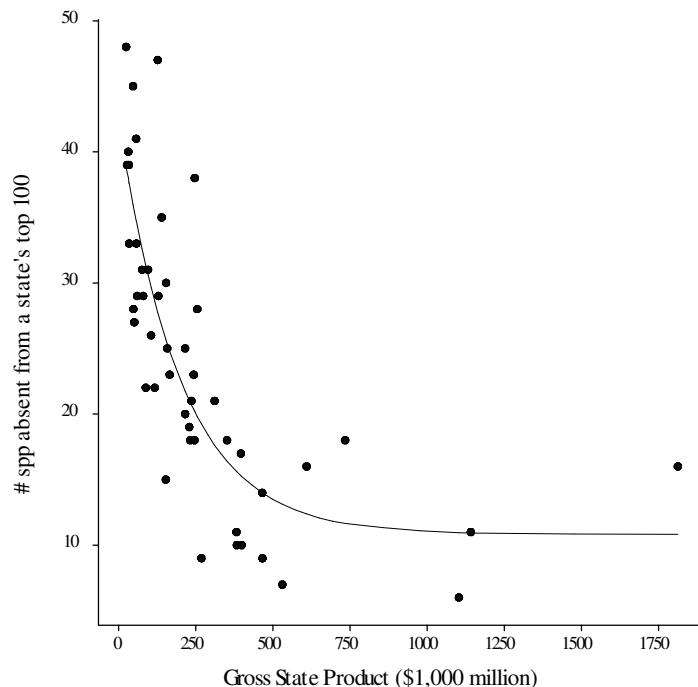
Figure 22. Relationship between the gross state product and the number of absent species in that state's top 100 list (fitted curve: $10.81 + 31.73 \times 0.995^{x}$).

Beyond enabling us to generate risk lists for each of the US states, as mentioned above, those regions that are closest together in a SOM, and in particular that share the same neuron, are most similar to one another. Examining which states have been assigned to the same neuron in the current analysis, therefore, reveals which states have most similar insect pest assemblages (Figure 23). The analysis identifies several clusters of states that do show some similarities with regional ecosystem divisions (http://www.fs.fed.us/land/ecosysmgmt/colorimagemap/ecoreg1_divisions.html). However, the clusters do not simply follow regional groupings of contiguous states, with some states clustering across very broad regions and others clustering with just one, or even no other states. In terms of invasive species risk and possible biosecurity responses, states within the same 'ecological' cluster are the most likely potential sources of high-establishment-risk pests for one another (a conclusion which should apply to pests in general, and not only those species contained within the current pest database) (Worner and Gevrey, 2006; Paini et al., 2010). This doesn't mean that states outside of an immediate cluster cannot act as sources for high risk species, but does provide some insights for informing potential biosecurity/phytosanitary measures between states.

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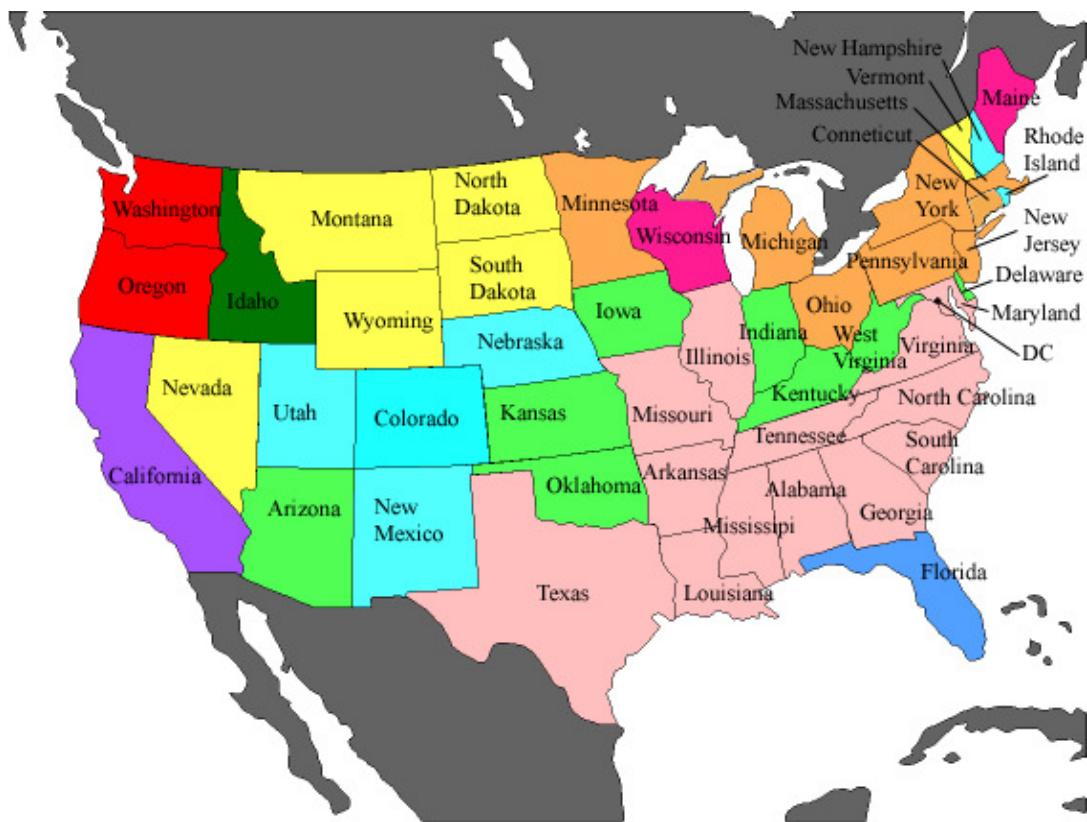
Figure 23. Map of contiguous USA showing those states that were allocated to the same neuron in a SOM analysis (same colour) and hence those states which have the most similar insect pest assemblages.

The SOM is essentially a statistical approach for predicting risk of establishment and identifying the most suitable 'source' locations for pests, but it does not consider the risk of a species actually arriving in a state. Therefore, if the SOM model predicts a high risk of establishment for a species that is currently absent from a state, it is not possible to determine if the species is absent because it has failed to arrive, or if the SOM prediction is simply inaccurate. However, examining the distribution of absent species across risk levels reveals that most absent species from a region occur in the lowest risk values, and of those species with high risk values, most have already established. Thus, the model predictions do not appear confounded by lack of appropriate introduction pathways or time for establishment.

Further validation of the SOM technique can be obtained by comparing our predictions with independent pest distribution data for the US. The National Agricultural Pest Information System (NAPIS) pest tracker website (http://pest.ceris.purdue.edu/pestlist.php) publishes maps for pests of agricultural and forest commodities based on survey data collected by the Cooperative Agricultural Pest Survey (CAPS) and USDA Animal and Plant Health Inspection Service's (APHIS) Plant Protection and Quarantine (PPQ) program. These survey maps show, on a county by county basis, where a pest species has or has not been found. We identified 59 insect pest species present in this online database that were also present in the CABI database and compared their observed distributions with the predicted risk of establishment from the SOM. Although not a categorical threshold, assuming a risk value of 0.5 indicates that the SOM model predicts a species is more likely to be present than

absent, we found 86% agreement between observed (from the NAPIS website) and predicted (from the SOM model) species distribution (Appendix, Table 53).

These validation results, together with analyses demonstrating that the method is resilient to realistic reporting errors in the species presence/absence data (Paini et al., 2010), suggest the SOM approach provides a robust method for exploring invasion risk, and identifying the greatest pest threats plus the likely source sites based on pest assemblage similarity. Our study reveals that, based on a known global list of insect pests, the greatest immediate threats to the US come from within, since the majority of pest species most capable of establishing have already established. This is reflected at the state level where, for the majority of states, those species of highest risk of invading and establishing can be found in another state, and often a neighbouring state. While this does not mean that the US could not be invaded by other recognized pest species, or that new exotic insects can not arrive and attain pest status, in terms of invasive species policy the results suggest the need for increased awareness of state-level post-border biosecurity (http://www.cdfa.ca.gov/phpps/ar/pe_exterior.html), especially amongst ecologically clustered states.

3.8. SOMs and climate change

Key finding:

The SOM methodology on its own is unable to incorporate climate change into its risk lists as it requires future species assemblages in response to climate change.

A SOM analysis alone can not make predictions of invasive species under climate change as the data utilised is the invasion history of species (i.e. where invasive species have invaded and established). There is little to no information on future species invasions under climate change.

Ferrier (2005) has developed the Generalised Dissimilarity Model (GDM) and describes it as a method to determine the level of species diversity dissimilarity between geographical locations. Briefly, GDM estimates the expected dissimilarity in species composition of ecological communities at different locations as a non-linear function of environmental (including climatic) differences between these locations. The predictive maps generated using the GDM technique are of a high spatial resolution, enabling specific area to be examined in relatively fine detail. The predictive maps can therefore identify geographical points that have the lowest level of dissimilarity (i.e. the most similar).

Using GDM it would be possible to generate a dissimilarity map for Australia based on invasive species diversity. A geographical point of interest could be identified and its future dissimilarity score under climate change could then be calculated. Present day geographical points most similar to this geographical point under climate change could then be identified and the SOM predictions for those points could be applied to the original geographical point under climate change. In this way, invasive species predictions under climate change could be made.

Unfortunately, the GDM analysis is conducted at a different scale to the SOM analysis. The SOM analysis was conducted on data from the CABI CPC, in which the geographic unit was country (in some cases for large countries, such as Australia, the country was further divided into states, territories, provinces, etc.). The GDM analysis is conducted at a significantly finer scale, $1km^2$ or $5km^2$ grids. This scale is not available at present for

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invasive species distributions and so it has not been possible to incorporate climate change predictions with invasive species predictions.

4. Implications for stakeholders

As a result of the work presented in this report, there are a number of implications for stakeholders. The first and most important implication is that the SOM methodology is one that is resilient to significant errors in the raw data and that there can be significant confidence in the rankings generated by a SOM analysis. Given this, it is clear that SOMs can be a useful and reliable analytical technique, which can be incorporated into the current species prioritisation processes. These prioritisation processes often involve expert and/or stakeholder solicitation and as such is prone to 'human' error. A SOM analysis could be used initially to 'screen' the potential invasive species down to a more manageable number, for this consultative process. In addition, the SOM rankings of this reduced list can be included in the consultative process and provide extra information to be utilised by those being consulted.

4.1. What have the SOMs told us?

Table 43 gives an indication of how some species previously thought to have a high risk of establishment may not. For example, *Anthonomus grandis* (Cotton Boll Weevil) has been ranked by PHA in their high risk of establishment category. However, according to the SOM analysis of pest species from the CABI CPC this species has an extremely low likelihood of establishment in Australia (risk index = 0). Of course, likelihood of establishment is just one aspect of a risk assessment and it might be decided that despite this low likelihood of establishment, the potential economic impact may warrant continued vigilance for this pest. But, based on global pest assemblage data, the SOM analysis indicates that it's capacity to establish is much lower than previously thought.

This is only one example, but it highlights how SOMs, being a quantitative, objective estimation of likelihood of establishment can be used by biosecurity agencies and industry as a guide to prioritising invasion risk lists. This being the case, what are some of the implications of our research and the SOM analysis in general in terms of how our stakeholders might go about their future business?

4.2. How might the SOMs be used in its current form?

Results for an important supplement to existing IRAs

It is important to note that a SOM analysis is not something that should be solely used in isolation when prioritising potential invasive pests. It can be thought of as providing an important piece of the plant pest invasion jigsaw puzzle, but without the remaining pieces it is largely ineffectual from a policy perspective. However, when combined with these other pieces, such as pathway analysis, habitat suitability modelling and economic impact simulations, it becomes empowering to biosecurity policy-makers who have had no previous access to quantitative establishment risk information.

As highlighted in section 3.4, the information obtained from a SOM analysis (chiefly the species establishment risk indexes) could in future form an important supplement for existing pest prioritisation methods relying on expert opinion. Risk indices provided to experts and stakeholders could potentially form an objective starting point for experts to begin entering their views and opinions based on experiences. In addition, when the number of species requiring expert consultations is prohibitively large, the SOM analysis could be used as an initial screening device to eliminate species with low establishment

risk. SOMs may in fact be used in a similar capacity in future border quarantine activities involving species interceptions and the assessment of interception information. A SOM ranking of potential pests could potentially give border protection officers an indication of the likelihood of any intercepted species to establish within a given region.

Input into predictive models

As with other fields of research, biosecurity economics is becoming increasing quantitative. But, while methods of assessing invasion consequences are advancing rapidly in this area, the provision of supporting data and materials often lags behind. Probability models, and in particular economic impact assessment models like those outlined in Cook (2008), Cook et al. (2007), Cook and Matheson (2008) and Hodda and Cook (2010), require an assessment of establishment likelihood as an input parameter. These studies have highlighted, the sensitivity of results to this parameter is typically large, and there is a great deal of importance on its accurate specification when results are to be used to inform policy decisions. Up until this point in time quantitative estimates of establishment risk that could be used in these assessments have been lacking, and analysts have resorted to using Monte Carlo analyses with high numbers of iterations and broad parameter ranges to demonstrate the possible effects of misspecification. This process of sensitivity testing is set to benefit tremendously from the risk indices produced by SOM analysis for individual species.

The CRC NPB project *Enhanced Risk Analysis Tools* (CRC10010) has explored the design and implementation of quantitative bioeconomic models providing consequence assessments, and we have maintained an on-going dialogue about the future use of SOM outputs into this process. Cook et al. (in press) represents the first attempt to use SOM establishment indices to inform these models.

4.3.   What testing remains to be done?

While the work presented in this report shows that SOM analysis is both resilient to significant errors in the data and accurate in its ability to predict and rank invasive pests, the next logical step is to assess the risk indices generated from the SOM analysis and applied to each species. It would be desirable to be able to inform biosecurity agencies and policy-makers what SOM establishment risk index corresponds to a 95% likelihood of a species establishing in a region. This 'cut off' point can be obtained from the same virtual world presented in this report, by comparing the risk indices given to those species that cannot establish in a region with those that can. A second (and perhaps more desirable) methods of determining this cut off point might involve the use of historical interception data for species that have consistently arrived into a region but failed to establish. Determining the risk index given to these species in a SOM analysis will indicate the range of risk indices that will not result in establishment.

4.4.   How might the SOMs be used in future?

Identifying high-risk species and their likely source

As we have shown throughout this report, a SOM analysis has the ability to identify potential invasive species. A powerful supplement to this approach in future could be the identification of source regions of these species. We have identified GDMs as an existing modelling technique that could be used in conjunction with SOMs to identify potential source regions, and feel that an exploration of the potential to combine the two approaches is warranted. Recall from section 3.8, GDM produces high-resolution predictive

maps comparing regions in different parts of the world to reveal geographical points that have the highest ecological similarity. These similar regions represent areas from which species could be transferred and survive, and therefore those regions that might contain future pest species. When combined with a SOM analysis, analysts would be in a position to identify species with a high risk of establishing within a region (i.e. using SOM) and where that species is likely to come from (i.e. using GDMs). Moreover, GDMs have the advantage of being able to incorporate climate change into its predictions, bringing significantly more power to the predictions of SOM analyses.

Indentifying highly vulnerable species

The work presented here focuses on predicting invasive species, but we believe this analytical technique could also be applied in the biodiversity arena and used to identify vulnerable native species. While the SOM generates risk indices for species that are absent from a region, it also generates risk indices for species that are present. If a SOM analysis was applied to native distributions, examining the lowest risk indices given to those species present in a region will identify those species most vulnerable to extinction in that region.

5. Recommendations

1. **The development of a communication strategy with Australian and international biosecurity agencies to encourage the uptake of SOMs as an effective risk identification technology.**

   Further interactions with Australian and international biosecurity agencies to encourage the uptake of this technology are recommended. SOMs represent a reliable and cost effective method of generating quantitative measures of species arrival likelihoods that equip biosecurity agencies with a pre-invasion early-warning device for risk management planning.

2. **An online or PC-based SOM device be developed that is capable of producing country and (where possible) region-based estimates of exotic species potential to establish.**

   The development of an online or 'off the shelf' product that could be made available to these biosecurity agencies would further enhance the likelihood of uptake and we strongly recommend this focus.

3. **The results of SOMs analyses that quantitatively express species establishment likelihoods should be incorporated into traditional forms of quantitative risk assessment.**

   Given the reliability and cost effectiveness of the SOMs method of generating establishment likelihood indexes for invasive species, the use of SOMs to supplement other predictive decision-support tools is to be encouraged. These include epidemiological models and economic impact assessment models. Establishment likelihood is a critical parameter most often characterised by complete ignorance or profound uncertainty, and is therefore the cause of significant disturbances in

predictive models. The ability of the SOMs method to generate results that can be directly applied in these models will prove of great benefit in this regard.

4. **SOM analysis can be incorporated in to existing pest risk analysis and import risk analysis methodologies.**

SOM methodology potentially has two functions in import risk analysis and pest risk analysis. The first is to use as an initial screening process, which can reduce the list of potential invasive species to a more manageable list for expert and stakeholder solicitation. Secondly, species establishment indices generated by the SOM can be used in the solicitation process as an unbiased and objective assessment of the relative likelihood of establishment for potential invasive pests.

5. **Strategies for the effective communication of risk and uncertainty in emergency plant pest prioritisation and preparedness decisions should form a part of future research proposals.**

As a SOM analysis assesses the likelihood of establishment, there is a significant need to generate similar rankings of the likelihood of a species arriving to Australia. In this way, both aspects of the likelihood equation (arrival and establishment) can be combined to generate an overall estimate of likelihood of an invasion occurring. We recommend funding further research into estimating arrival likelihood and in particular, the use of social network theory to analyse the available data.

6. **Further research should be conducted on the use of SOMs - which identify high-risk species for a particular area) - with methods identifying source regions for future invasive species under climate change.**

There is a strong likelihood that complementarities exist between SOMs and other existing methods of habitat matching. Generalised Dissimilarity Modelling (GDM), for instance, is able to identify high-risk regions related to a given area within Australia. Research is needed to explore the compatibility of results produced by both, which might in future be used as complements to provide comprehensive risk assessments in a timely and cost-effective manner.

7. **Caution must be exercised when quoting high-establishment-risk lists generated by SOMs using the Australian Plant Pest Database as data for some states and territories contains non-pest species, while for others there is insufficient data recorded.**

APPD data entries are not limited to plant pests or diseases, and often contain species that are harmless or of low economic, social or environmental significance. Hence, when using SOMs output generated from APPD, appropriate filters should be used to isolate those species that are of negligible biosecurity significance.

For some regions there is simply insufficient data in the APPD to make a meaningful comparison of species distributions elsewhere. Of particular concern are the Northern Territory lists of present bacterial and viral pathogens, which currently contained only seven and three species (respectively). As we have shown in Section 3.6, any list generated for a region which contains so few species initially can be prone to significant levels of inaccuracy in the list rankings. We strongly recommend that these two Northern Territory lists not be used in any biosecurity prioritisation process.

6. Abbreviations/glossary

ABBREVIATION	FULL TITLE
APHIS	Animal and Plant Health Inspection Service's
APPD	Australian Plant Pest Database
BMU	Best Matching Unit
CABI	Centre for Agriculture and Biosciences International
CPC	Crop Protection Compendium
CRCNPB	Cooperative Research Centre for National Plant Biosecurity
DAFF	Department of Agriculture, Fisheries and Forestry
EPP	Emergency plant pest
GDM	Generalised Dissimilarity Modelling
InIx	Invasibility Index
InRq	Invasibility Requirements
IRA	Import Risk Analysis
IUCN	International Union for Conservation of Nature
NAPIS	National Agricultural Pest Information System
PHA	Plant Health Australia
PNG	Papua New Guinea
PPQ	Plant Protection and Quarantine
PRA	Pest Risk Analysis
SOM	Self Organising Map
USDA	United States Department of Agriculture

7. Plain English website summary

CRC project no:	CRC10001
Project title:	Early warning of pre-emergent emergency plant pest threats
Project leader:	Dr David Cook
Project team:	Dr David Cook, Dr Dean Paini, Dr Sue Worner
Research outcomes:	Self organising maps (SOM) are a useful tool for ranking species by their likelihood of establishment. We have tested this tool and found it to be both resilient to significant errors in the distributional data (up to 20%) and very reliable in its predictions of which species will and wont invade a region.
Research implications:	SOM would be a valuable tool to integrate into the current biosecurity practices. It could be used initially to screen a large number of potential invasive species down to a more manageable number. The rankings generated by SOM for this

	reduced list could then be included in the consultative process currently used to prioritise pest lists.
Research publications:	1. Paini, D.R., Worner, S.P., Cook, D.C., De Barro, P.J., Thomas, M.B. (2010) Using a self organising map to predict invasive species: sensitivity to data errors and a comparison with expert opinion. Journal of Applied Ecology, in press.
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8. Appendix

Table 12. The full risk list for insect pest species absent from Australia.

Rank	Species names	Risk Index	Rank	Species names	Risk Index	Rank	Species names	Risk Index
1	Scirpophaga incertulas	0.7924	190	Nephotettix cincticeps	0.0971	379	Anthonomus grandis	0
2	Oryctes rhinoceros	0.7722	191	Acrobasis pyrivorella	0.0971	380	Choristoneura conflictana	0
3	Sesamia inferens	0.7695	192	Hadula trifolii	0.0969	381	Choristoneura occidentalis	0
4	Scrobipalpa heliopa	0.7128	193	Lymantria monacha	0.0956	382	Hedya nubiferana	0
5	Marasmia exigua	0.6856	194	Orosius orientalis	0.0954	383	Aspidiella sacchari	0
6	Diaphorina citri	0.6807	195	Acronicta rumicis	0.094	384	Asterolecanium pustulans	0
7	Aleurocanthus woglumi	0.6801	196	Trialeurodes vaporariorum	0.0938	385	Mamestra configurata	0
8	Leucinodes orbonalis	0.6748	197	Bactrocera minax	0.093	386	Blissus leucopterus	0
9	Stephanitis typica	0.6675	198	Euscepes postfasciatus	0.0923	387	Brachycerus muricatus	0
10	Xylosandrus compactus	0.6632	199	Paranthrene tabaniformis	0.0923	388	Archips rosana	0
11	Pelopidas mathias	0.6446	200	Autographa gamma	0.0923	389	Castniomera licus	0
12	Dicladispa armigera	0.6378	201	Jacobiasca lybica	0.0874	390	Caulophilus oryzae	0
13	Acherontia styx	0.6356	202	Zabrotes subfasciatus	0.086	391	Cephus cinctus	0
14	Chilo auricilius	0.6338	203	Schistocerca gregaria	0.0818	392	Cephus pygmeus	0
15	Nephotettix virescens	0.6279	204	Henosepilachna elaterii	0.0778	393	Cerotoma trifurcata	0
16	Planococcus lilacinus	0.594	205	Adoxophyes orana	0.0732	394	Ceroplastes cirripediformis	0
17	Batocera rubus	0.5836	206	Carposina sasakii	0.0717	395	Ceutorhynchus assimilis	0
18	Aulacophora lewisii	0.5702	207	Popillia japonica	0.0716	396	Choristoneura fumiferana	0
19	Toxoptera odinae	0.5694	208	Bactrocera oleae	0.0708	397	Choristoneura pinus	0
20	Orseolia oryzae	0.5676	209	Anoplophora glabripennis	0.0707	398	Choristoneura rosaceana	0
21	Odoiporus longicollis	0.5669	210	Diuraphis noxia	0.0702	399	Cnephasia longana	0
22	Chilo infuscatellus	0.5559	211	Coptotermes formosanus	0.07	400	Colaspis hypochlora	0
23	Zeuzera coffeae	0.551	212	Grapholita inopinata	0.0699	401	Conotrachelus nenuphar	0
24	Helopeltis theivora	0.5425	213	Carpomya pardalina	0.0695	402	Contarinia lycopersici	0
25	Hypomeces squamosus	0.5395	214	Phyllotreta cruciferae	0.0695	403	Corynothrips stenopterus	0
26	Orgyia postica	0.5343	215	Sipha maydis	0.0685	404	Corythuca gossypii	0
27	Pinnaspis strachani	0.529	216	Ceroplastes japonicus	0.068	405	Cerataphis lantaniae	0
28	Rastrococcus invadens	0.519	217	Anoplophora malasiaca	0.0664	406	Corythaica cyathicollis	0
29	Parasa lepida	0.5177	218	Dendrolimus spectabilis	0.0661	407	Curculio elephas	0
30	Papilio polytes	0.5119	219	Oedaleus senegalensis	0.0655	408	Grapholita packardi	0
31	Bactrocera dorsalis	0.5008	220	Selenaspidus articulatus	0.0655	409	Dalbulus maidis	0
32	Hydrellia philippina	0.4957	221	Hyphantria cunea	0.0647	410	Dasineura brassicae	0
33	Omphisa anastomosalis	0.4933	222	Ips cembrae	0.0647	411	Dasineura mali	0
34	Erionota thrax	0.4931	223	Ips typographus	0.0647	412	Dasineura pyri	0

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Table 12 (continued).

Rank	Species names	Risk Index	Rank	Species names	Risk Index	Rank	Species names	Risk Index
35	Schizaphis graminum	0.4895	224	Sitodiplosis mosellana	0.0647	413	Dendroctonus brevicomis	0
36	Aproaerema modicella	0.4841	225	Delia floralis	0.0646	414	Dendroctonus frontalis	0
37	Xylotrechus quadripes	0.4835	226	Malacosoma neustria	0.0646	415	Dendroctonus ponderosae	0
38	Attacus atlas	0.4821	227	Caryedon serratus	0.0645	416	Dendroctonus pseudotsugae	0
39	Ceratovacuna lanigera	0.4774	228	Atherigona biseta	0.0633	417	Dendroctonus rufipennis	0
40	Bactrocera latifrons	0.4651	229	Contarinia tritici	0.0633	418	Diabrotica balteata	0
41	Hypothenemus hampei	0.4606	230	Anthonomus pomorum	0.0631	419	Diabrotica barberi	0
42	Henosepilachna pusillanima	0.4605	231	Gilpinia hercyniae	0.0631	420	Diabrotica speciosa	0
43	Idioscopus clypealis	0.4589	232	Ips sexdentatus	0.0631	421	Diabrotica undecimpunctata	0
44	Sternochetus frigidus	0.4586	233	Cacopsylla pyrisuga	0.063	422	Diabrotica virgifera virgifera	0
45	Trichoplusia ni	0.4573	234	Sitona hispidulus	0.063	423	Diaspis boisduvalii	0
46	Dialeurodes citri	0.4532	235	Metamasius hemipterus	0.0627	424	Diatraea centrella	0
47	Pyrilla perpusilla	0.4499	236	Melolontha melolontha	0.0617	425	Diatraea grandiosella	0
48	Chilo sacchariphagus	0.4491	237	Aeolesthes sarta	0.0616	426	Diatraea lineolata	0
49	Atherigona soccata	0.4395	238	Dendroctonus micans	0.0616	427	Diatraea saccharalis	0
50	Sinoxylon conigerum	0.4335	239	Eulecanium tiliae	0.0616	428	Diprion pini	0
51	Cricula trifenestrata	0.4329	240	Pegomya hyoscyami	0.0616	429	Diaphania nitidalis	0
52	Chilo partellus	0.4206	241	Stephanitis pyrioides	0.0616	430	Diaprepes abbreviatus	0
53	Orthezia insignis	0.4138	242	Zeuzera pyrina	0.0616	431	Diaprepes famelicus	0
54	Rhipiphorothrips cruentatus	0.4108	243	Cryptomyzus ribis	0.0615	432	Dryocoetes confusus	0
55	Batocera rufomaculata	0.41	244	Hylobius abietis	0.0615	433	Dysdercus andreae	0
56	Omiodes indicata	0.4097	245	Grapholita funebrana	0.0615	434	Dyspessa ulula	0
57	Plocaederus obesus	0.4047	246	Monochamus saltuarius	0.0615	435	Edessa meditabunda	0
58	Bactrocera tau	0.4008	247	Pandemis heparana	0.0615	436	Epidiaspis leperii	0
59	Adoretus versutus	0.3917	248	Sphaerolecanium prunastri	0.0615	437	Crocidosema aporema	0
60	Hieroglyphus banian	0.3888	249	Opogona sacchari	0.059	438	Epitrix cucumeris	0
61	Rastrococcus iceryoides	0.3879	250	Protopulvinaria mangiferae	0.0392	439	Epitrix hirtipennis	0
62	Fulmekiola serrata	0.3834	251	Neoaliturus tenellus	0.0382	440	Epitrix tuberis	0
63	Phyllotreta chotanica	0.3803	252	Chelonus insularis	0.0376	441	Erinnyis alope	0
64	Bactrocera zonata	0.3802	253	Pissodes nemorensis	0.0376	442	Erinnyis ello	0
65	Melanagromyza obtusa	0.3747	254	Cacoecimorpha pronubana	0.0376	443	Saturnia pavonia	0
66	Liriomyza huidobrensis	0.3743	255	Anthonomus bisignifer	0.0356	444	Eutinobothrus brasiliensis	0
67	Tarophagus colocasiae	0.372	256	Athalia rosae	0.0356	445	Feltia subterranea	0
68	Chilo polychrysus	0.3658	257	Lobesia botrana	0.0345	446	Frankliniella fusca	0

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Table 12 (continued).

Rank	Species names	Risk Index	Rank	Species names	Risk Index	Rank	Species names	Risk Index
69	Helopeltis bradyi	0.3634	258	Byturus tomentosus	0.0339	447	Frankliniella insularis	0
70	Phyllotreta striolata	0.3604	259	Euproctis chrysorrhoea	0.0339	448	Frankliniella melanommatus	0
71	Minthea rugicollis	0.36	260	Characoma stictigrapta	0.033	449	Frankliniella tritici	0
72	Idioscopus niveosparsus	0.3589	261	Phorodon humuli	0.0329	450	Fundella pellucens	0
73	Scotinophara coarctata	0.3589	262	Dendrolimus sibiricus	0.0324	451	Gnathotrichus sulcatus	0
74	Naranga diffusa	0.3445	263	Operophtera brumata	0.0324	452	Keiferia lycopersicella	0
75	Liriomyza trifolii	0.3431	264	Epilachna varivestis	0.0323	453	Heliothis virescens	0
76	Urentius hystricellus	0.342	265	Ips duplicatus	0.0323	454	Helicoverpa zea	0
77	Megymenum brevicorne	0.3326	266	Philaenus spumarius	0.0323	455	Agrius cingulatus	0
78	Elaeidobius kamerunicus	0.3311	267	Cacopsylla pyricola	0.0323	456	Heterotermes tenuis	0
79	Aulacaspis tegalensis	0.3262	268	Taeniothrips inconsequens	0.0323	457	Hellula phidilealis	0
80	Bombyx mori	0.3194	269	Mythimna unipuncta	0.0317	458	Homalodisca coagulata	0
81	Rhynchophorus vulneratus	0.3189	270	Hypera zoilus	0.0313	459	Horcias nobilellus	0
82	Aulacophora foveicollis	0.3156	271	Acrolepiopsis assectella	0.0308	460	Hortensia similis	0
83	Tessaratoma papillosa	0.3147	272	Amphimallon solstitiale	0.0308	461	Howardia biclavis	0
84	Statherotis discana	0.3145	273	Bothynoderes punctiventris	0.0308	462	Hypothenemus obscurus	0
85	Cydia leucostoma	0.3132	274	Coleophora laricella	0.0308	463	Herpetogramma bipunctalis	0
86	Bactrocera umbrosa	0.3105	275	Dysmicoccus boninsis	0.0308	464	Hylurgopinus rufipes	0
87	Pseudococcus jackbeardsleyi	0.3105	276	Elasmopalpus lignosellus	0.0308	465	Ips amitinus	0
88	Perkinsiella vastatrix	0.3052	277	Empoasca fabae	0.0308	466	Ips confusus	0
89	Artona catoxantha	0.3043	278	Epirrita autumnata	0.0308	467	Ips pini	0
90	Heterobostrychus aequalis	0.3037	279	Eurygaster integriceps	0.0308	468	Ischnaspis longirostris	0
91	Poecilocoris latus	0.3037	280	Rhyacionia buoliana	0.0308	469	Spodoptera frugiperda	0
92	Opisina arenosella	0.303	281	Haplothrips tritici	0.0308	470	Grapholita prunivora	0
93	Chondracris rosea	0.2994	282	Hydraecia micacea	0.0308	471	Leptinotarsa decemlineata	0
94	Prays endocarpa	0.2905	283	Delia radicum	0.0308	472	Lagocheirus araneiformis	0
95	Chromatomyia horticola	0.2827	284	Delia coarctata	0.0308	473	Ligyrus cuniculus	0
96	Medythia suturalis	0.2746	285	Hypsipyla grandella	0.0308	474	Lixus juncii	0
97	Acherontia lachesis	0.2735	286	Ips calligraphus	0.0308	475	Lygus lineolaris	0
98	Aphis fabae	0.2704	287	Cydia splendana	0.0308	476	Macrosiphoniella sanborni	0
99	Tetramoera schistaceana	0.2684	288	Oulema melanopus	0.0308	477	Macrosteles quadrilineatus	0
100	Rhynchocoris poseidon	0.2682	289	Leucoptera malifoliella	0.0308	478	Malacosoma americanum	0
101	Acanthocoris scabrator	0.2649	290	Leucoma salicis	0.0308	479	Malacosoma disstria	0
102	Eurydema pulchrum	0.2647	291	Loxostege sticticalis	0.0308	480	Mayetiola destructor	0

Table 12 (continued).

Rank	Species names	Risk Index	Rank	Species names	Risk Index	Rank	Species names	Risk Index
103	Stauropus alternus	0.2642	292	Meromyza saltatrix	0.0308	481	Mycetaspis personata	0
104	Frankliniella intonsa	0.2636	293	Monochamus sutor	0.0308	482	Megachile rotundata	0
105	Nipaecoccus nipae	0.2619	294	Orgyia antiqua	0.0308	483	Megastes grandalis	0
106	Promecotheca cumingii	0.2598	295	Pandemis cerasana	0.0308	484	Megastigmus spermotrophus	0
107	Clanis bilineata	0.2594	296	Psila rosae	0.0308	485	Meligethes aeneus	0
108	Pieris brassicae	0.2576	297	Cacopsylla pyri	0.0308	486	Cydia latiferreana	0
109	Indarbela quadrinotata	0.2559	298	Scolytus rugulosus	0.0308	487	Melanoplus bivittatus	0
110	Adoretus sinicus	0.2547	299	Scolytus scolytus	0.0308	488	Melanoplus sanguinipes	0
111	Amsacta lactinea	0.2544	300	Tuta absoluta	0.0308	489	Mocis latipes	0
112	Hyblaea puera	0.2541	301	Sitona cylindricollis	0.0308	490	Monochamus carolinensis	0
113	Deporaus marginatus	0.2532	302	Tomicus piniperda	0.0308	491	Monochamus galloprovincialis	0
114	Chlumetia transversa	0.253	303	Spodoptera littoralis	0.0304	492	Monochamus scutellatus	0
115	Lepidiota stigma	0.2529	304	Cryptophlebia leucotreta	0.03	493	Metcalfa pruinosa	0
116	Bactrocera papayae	0.249	305	Sesamia calamistis	0.03	494	Mythimna latiuscula	0
117	Setora nitens	0.2427	306	Earias biplaga	0.0286	495	Nasonovia ribisnigri	0
118	Lopholeucaspis japonica	0.2419	307	Oryctes monoceros	0.0286	496	Neodiprion sertifer	0
119	Parnara guttatus	0.2413	308	Oryctes boas	0.0285	497	Acrosternum hilare	0
120	Mimegralla coeruleifrons	0.2404	309	Nomadacris septemfasciata	0.0283	498	Neoaliturus haematoceps	0
121	Holotrichia serrata	0.2382	310	Clavigralla elongata	0.0268	499	Nasutitermes costalis	0
122	Trialeurodes ricini	0.2376	311	Trioza erytreae	0.0266	500	Orgyia pseudotsugata	0
123	Plocaederus ruficornis	0.2359	312	Phenacoccus manihoti	0.0222	501	Orthezia praelonga	0
124	Caloptilia theivora	0.235	313	Clavigralla tomentosicollis	0.0221	502	Orthosia cerasi	0
125	Laodelphax striatellus	0.2348	314	Eldana saccharina	0.0221	503	Otiorhynchus armadillo	0
126	Amsacta moorei	0.2331	315	Megalurothrips sjostedti	0.022	504	Otiorhynchus singularis	0
127	Bactrocera carambolae	0.229	316	Ceratitis cosyra	0.0209	505	Paracoccus marginatus	0
128	Melanaspis glomerata	0.2269	317	Heteronychus licas	0.0208	506	Acleris variana	0
129	Brachycaudus helichrysi	0.2237	318	Dysdercus fasciatus	0.0205	507	Phyllonorycter blancardella	0
130	Acrocercops syngramma	0.2233	319	Ceratitis rosa	0.0203	508	Phyllonorycter crataegella	0
131	Oxya chinensis	0.2226	320	Scirtothrips aurantii	0.0196	509	Phthia picta	0
132	Empoasca vitis	0.2201	321	Trichispa sericea	0.0191	510	Scrobipalpa ocellatella	0
133	Pseudococcus comstocki	0.2102	322	Zonocerus elegans	0.0184	511	Piezodorus guildinii	0
134	Hysteroneura setariae	0.2096	323	Busseola fusca	0.0153	512	Chionaspis minor	0
135	Sesamia cretica	0.2093	324	Ootheca mutabilis	0.0144	513	Pissodes castaneus	0
136	Sitobion avenae	0.2092	325	Cylas puncticollis	0.0142	514	Pissodes strobi	0

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Table 12 (continued).

Rank	Species names	Risk Index	Rank	Species names	Risk Index	Rank	Species names	Risk Index
137	Amritodus atkinsoni	0.2068	326	Alcidodes dentipes	0.0133	515	Pissodes terminalis	0
138	Citripestis sagittiferella	0.2051	327	Rhynchophorus phoenicis	0.0132	516	Pityogenes chalcographus	0
139	Darna diducta	0.2051	328	Monochamus leuconotus	0.0131	517	Platynota stultana	0
140	Xyleborus ferrugineus	0.2044	329	Antestiopsis orbitalis	0.0126	518	Amblyptilia pica	0
141	Deilephila elpenor	0.2029	330	Mesoplatys cincta	0.0126	519	Platypus parallelus	0
142	Callosobruchus analis	0.2005	331	Mesoplatys ochroptera	0.0126	520	Prays oleae	0
143	Trogoderma granarium	0.1894	332	Ceratitis punctata	0.012	521	Spodoptera eridania	0
144	Atherigona pulla	0.1853	333	Apomecyna binubila	0.0115	522	Manduca sexta	0
145	Parabemisia myricae	0.1823	334	Coelaenomenodera elaeidis	0.011	523	Psylliodes chrysocephala	0
146	Biston suppressaria	0.1793	335	Sahlbergella singularis	0.0105	524	Ostrinia nubilalis	0
147	Ampelophaga rubiginosa	0.1792	336	Eulophonotus myrmeleon	0.0104	525	Rhagoletis cerasi	0
148	Dioryctria abietella	0.1771	337	Cacyreus marshalli	0.008	526	Rhagoletis cingulata	0
149	Liriomyza sativae	0.1733	338	Helopeltis schoutedeni	0.0077	527	Rhagoletis completa	0
150	Pseudodendrothrips mori	0.166	339	Leucoptera caffeina	0.007	528	Rhagoletis fausta	0
151	Aonidomytilus albus	0.1657	340	Perileucoptera coffeella	0.007	529	Rhagoletis indifferens	0
152	Erosomyia mangiferae	0.1655	341	Diabolocatantops axillaris	0.0068	530	Rhagoletis mendax	0
153	Oryzaephilus mercator	0.1636	342	Phenacoccus madeirensis	0.0054	531	Rhagoletis pomonella	0
154	Dacus ciliatus	0.1614	343	Zonocerus variegatus	0.0054	532	Rhagoletis ribicola	0
155	Chrysodeixis chalcites	0.1606	344	Planococcus kenyae	0.0053	533	Rhyacionia frustrana	0
156	Agromyza oryzae	0.157	345	Mussidia nigrivenella	0.005	534	Rhynchophorus palmarum	0
157	Mamestra brassicae	0.156	346	Antestiopsis intricata	0.0047	535	Rhinostomus barbirostris	0
158	Ahasverus advena	0.1555	347	Orseolia oryzivora	0.0047	536	Rupela albinella	0
159	Ceroplastes rusci	0.1533	348	Acraea acerata	0.0046	537	Scaphoideus titanus	0
160	Cossus cossus	0.1518	349	Diparopsis watersi	0.0045	538	Saccharosydne saccharivora	0
161	Clavigralla scutellaris	0.1499	350	Apate monachus	0.0043	539	Schistocerca pallens	0
162	Monochamus alternatus	0.1492	351	Bathycoelia thalassina	0.0042	540	Silba chalybea	0
163	Prostephanus truncatus	0.1476	352	Bixadus sierricola	0.0038	541	Sipha flava	0
164	Acanthiophilus helianthi	0.1459	353	Sesamia nonagrioides	0.0037	542	Sitona humeralis	0
165	Chaetocnema confinis	0.1458	354	Pimelephila ghesquierei	0.0034	543	Sitona lepidus	0
166	Parlatoria oleae	0.1453	355	Helopeltis bergrothi	0.0033	544	Spilonota ocellana	0
167	Cryptoblabes gnidiella	0.1442	356	Planococcoides njalensis	0.0032	545	Spodoptera dolichos	0
168	Liriomyza bryoniae	0.1406	357	Archips podana	0.0015	546	Spodoptera latifascia	0
169	Autographa nigrisigna	0.1369	358	Metopolophium festucae	0.0006	547	Ceresa alta	0
170	Delia antiqua	0.1347	359	Acalymma vittatum	0	548	Stenoma catenifer	0

Table 12 (continued).

Rank	Species names	Risk Index	Rank	Species names	Risk Index	Rank	Species names	Risk Index
171	Aleurothrixus floccosus	0.1345	360	Acleris gloverana	0	549	Steirastoma breve	0
172	Eupoecilia ambiguella	0.1332	361	Agromyza frontella	0	550	Saturnia pyri	0
173	Grapholita delineana	0.1314	362	Agriotes lineatus	0	551	Symmetrischema capsicum	0
174	Anarsia lineatella	0.1299	363	Agriotes obscurus	0	552	Anthonomus quadrigibbus	0
175	Dialeurodes citrifolii	0.1299	364	Agrotis exclamationis	0	553	Tagosodes orizicolus	0
176	Lymantria dispar	0.1284	365	Alabama argillacea	0	554	Tecia solanivora	0
177	Lissorhoptrus oryzophilus	0.1279	366	Aulocara elliotti	0	555	Thaumetopoea pityocampa	0
178	Bactrocera tsuneonis	0.1249	367	Aleurodicus cocois	0	556	Thecla basilides	0
179	Haplothrips aculeatus	0.1248	368	Aleurodicus pulvinatus	0	557	Anticarsia gemmatalis	0
180	Pterochloroides persicae	0.1238	369	Amphimallon majalis	0	558	Thrips angusticeps	0
181	Peridroma saucia	0.1231	370	Ancylostomia stercorea	0	559	Tibraca limbativentris	0
182	Aphis pomi	0.123	371	Anastrepha fraterculus	0	560	Tipula paludosa	0
183	Cicadulina mbila	0.1204	372	Anastrepha grandis	0	561	Tortrix viridana	0
184	Promecotheca caerulipennis	0.1122	373	Anastrepha manihoti	0	562	Toxotrypana curvicauda	0
185	Indarbela dea	0.1108	374	Anastrepha obliqua	0	563	Trialeurodes abutiloneus	0
186	Acrida cinerea	0.1077	375	Anastrepha serpentina	0	564	Vatiga illudens	0
187	Anoplophora chinensis	0.1067	376	Anastrepha striata	0	565	Vinsonia stellifera	0
188	Unaspis yanonensis	0.1047	377	Anthonomus signatus	0	566	Xyleborus dispar	0
189	Dysaphis plantaginea	0.099	378	Anthonomus eugenii	0			

Table 13. The neurons clustered with Australia and its states and territory in cluster analyses using seven different clustering algorithms. For a full list of the regions associated with these neurons see Appendix, Table 14.

Australian regions	Australia	Western Australia	Northern Territory	South Australia, Tasmania, Victoria	New South Wales, Queensland
Neuron number (BMU)	96	56	70	44	84
Cluster analysis algorithm					
1. average linkage	107, 108	44, 45, 57	69, 81, 82, 93	45, 56, 57	83, 94, 95, 106
2. complete link	107, 108	44, 45, 57	69, 81, 82, 93	45, 56, 57	83, 94, 95, 106
3. furthest neighbour	107, 108	44, 45, 57	69, 81, 82, 93	45, 56, 57	83, 94, 95, 106
4. group average	107, 108	44, 45, 57	69, 81, 82, 93	45, 56, 57	83, 69, 70, 81, 82, 93
5. median sorting	107, 108	44, 45, 57	69, 81, 82, 93	45, 56, 57	83, 69, 70, 81, 82, 93
6. nearest neighbour	107, 108	44, 45, 57	69, 83	45, 56, 57	94, 95, 106
7. single link	107, 108	44, 45, 57	69, 83	45, 56, 57	94, 95, 106
Most frequently clustered neurons	107, 108	44, 45, 57	69, 81, 82, 93	45, 56, 57	83, 94, 95, 106

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Table 14. Full list of neurons and associated regions.

Neuron #	Allocated regions
1	Alabama (USA), Arkansas (USA), Georgia (USA), Illinois (USA), Louisiana (USA), Maryland (USA), Missouri (USA), Mississippi (USA), North Carolina (USA), South Carolina (USA), Tennessee (USA), Texas (USA), Virginia (USA)
2	Connecticut (USA), Massachusetts (USA), Michigan (USA), New Jersey (USA), New York (USA), Ohio (USA), Pennsylvania (USA)
3	Canada, Ontario (Canada), California (USA)
4	
5	Austria, Belgium, Bulgaria, Switzerland, Czechoslovakia (former -), Germany, Denmark, Finland, United Kingdom, Hungary, Netherlands, Poland, Romania, Sweden
6	Russian Federation
7	Spain, France, Greece, Italy, Portugal, Turkey
8	Algeria, Egypt, Israel, Iran, Morocco
9	Chile, USA
10	Argentina, Brazil, Sao Paulo (Brazil), Colombia, Mexico, Peru, Florida (USA), Hawaii (USA)
11	Cuba, Jamaica, Puerto Rico, Venezuela
12	Antigua and Barbuda, Barbados, Dominica, Dominican Republic, Grenada, Guadeloupe, Guyana, Saint Kitts and Nevis, Saint Lucia, Martinique, Montserrat, Trinidad and Tobago, Saint Vincent and the Grenadines
13	Arizona (USA), Delaware (USA), Iowa (USA), Indiana (USA), Kansas (USA), Kentucky (USA), Oklahoma (USA), West Virginia (USA)
14	Maine (USA), Wisconsin (USA)
15	British Columbia (Canada), Nova Scotia (Canada), Quebec (Canada), Oregon (USA), Washington (USA)
16	
17	Norway, Ukraine, Former Yugoslavia
18	Yugoslavia
19	
20	Cyprus, Canary Islands (Spain), Iraq, Lebanon, Libya, Malta, Syria, Tunisia
21	
22	Bermuda, Bolivia, Rio Grande do Sul (Brazil), Ecuador, Uruguay
23	

Table 14 (continued).

Neuron #	Allocated regions
24	Bahamas, Costa Rica, French Guiana, Guatemala, Honduras, Haiti, Nicaragua, Panama, Suriname
25	Colorado (USA), Minnesota (USA), Nebraska (USA), New Hampshire (USA), New Mexico (USA), Rhode Island (USA), Utah (USA)
26	Manitoba (Canada), New Brunswick (Canada), Idaho (USA)
27	
28	Latvia
29	Czech Republic, Ireland, Lithuania, Russua (Europe)
30	Azerbaijan, Georgia (Republic)
31	Corsica (France)
32	Sicily (Italy), Jordan, Madeira (Portugal)
33	
34	Parana (Brazil), Santa Catarina (Brazil)
35	Bahia (Brazil), Minas Gerais (Brazil), Pará (Brazil), Rio de Janeiro (Brazil), Belize, Paraguay, El Salvador, United States Virgin Islands
36	
37	Alberta (Canada), Saskatchewan (Canada), Montana (USA), North Dakota (USA), Nevada (USA), South Dakota (USA), Vermont (USA), Wyoming (USA)
38	Prince Edward Island (Canada)
39	
40	Belarus, Estonia, England and Wales (United Kingdom), Luxembourg, Siberia (Russia), Slovenia
41	Albania, Armenia, Croatia, Kazakhstan, Moldova, Central Russia (Russia), Russian Far East (Russia), Slovakia
42	Tajikistan, Turkmenistan, Uzbekistan
43	Sardinia (Italy)
44	South Australia (Australia), Tasmania (Australia), New Zealand, Azores (Portugal)
45	
46	Burundi, Cape Verde
47	
48	Côte d'Ivoire
49	Newfoundland (Canada), Alaska (USA)
50	Channel Islands (United Kingdom), Scotland (United Kingdom)

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Table 14 (continued).

Neuron #	Allocated regions
51	Bosnia and Herzegovina
52	Macedonia, Mongolia, Western Siberia (Russia)
53	Kyrgyzstan, Southern Russia
54	
55	Afghanistan, Balearic Islands (Spain)
56	Western Australia (Australia)
57	Saudi Arabia, Saint Helena
58	Burkina Faso, French Guiana, Niger, Réunion, Seychelles, Yemen
59	Benin, Congo, Guinea, Mali, Rwanda, Somalia, Togo
60	Angola, Cameroon, Ethiopia, Ghana, Kenya, Malawi, Mozambique, Nigeria, Sudan, Senegal, Tanzania, Uganda, Zambia, Congo Democratic Republic, Zimbabwe
61	Northwest Territories (Canada), Yukon Territory (Canada), Faroe Islands, Iceland
62	Andorra, Ningxia (China), Qinghai (China), Monaco, San Marino, Former USSR
63	Gansu (China), Gibraltar, Liechtenstein, Eastern Siberia (Russia), Northern Russia
64	Crete (Greece)
65	Xinjiang (China)
66	Heilongjiang (China), Jilin (China), Liaoning (China), Nei Menggu (China), Shanxi (China), Shaanxi (China), Xizhang (China)
67	Jammu and Kashmir (India), Hokkaido (Japan)
68	
69	
70	Northern Territory (Australia)
71	
72	Madagascar, Mauritius, South Africa
73	Northern Island (United Kingdom), Greenland, Arunachal Pradesh (India), Chandigarh (India), Damman (India), Dadra and Nagar Haveli (India), Diu (India), Goa (India), Lakshadweep (India), Mizoram (India), Nagaland (India), Russia (Asia), Serbia (Yugoslavia)
74	Gaza, Tokelau
75	Bahrain, Djibouti, Western Sahara, Kuwait, Qatar

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Table 14 (continued).

Neuron #	Allocated regions
76	United Arab Emirates, Botswana, Central African Republic, Gabon, Equatorial Guinea, Guinea-Bissau, Liberia, Lesotho, Mauritania, Namibia, Swaziland, Chad
77	Eritrea
78	Meghalaya (India), Manipur (India)
79	Anhui (China), Hebei (China), Henan (China), Shandong (China)
80	Himachal Pradesh (India), Haryana (India), Korea - DPR
81	Delhi (India), Gujarat (India), Indian Punjab (India), Rajasthan (India)
82	Andhra Pradesh (India), Bihar (India), Maharashtra (India), Madya Pradesh (India), Orissa (India), Uttar Pradesh (India)
83	
84	New South Wales (Australia), Queensland (Australia), Fiji, New Caledonia, Solomon Islands
85	Lord Howe Island (Australia), Aruba, Bonaire, Acre (Brazil), Amapa (Brazil), Fernando de Noronha (Brazil), Roraima (Brazil), Beijing (China), Shanghai (China), Falkland Islands, Carriacou (Grenada), Isle of Man, Line Islands (Kiribati), Kanton and Enderbury (Kiribati), St. Martin, Kermadec Islands (New Zealand), Marquesas (French Polynesia), Bismarck Archipeligo (Papua New Guinea), Bougainville (Papua New Guinea), Saint Pierre and Miquelon, Severo-Osetinskaya Respublika (Russia), Aldabra (Seychelles), Saba, Turks and Caicos Islands, East Timor, Krymskaya Oblast (Ukraine), Former USSR-in-Europe, Former USSR-in-Asia, US Minor Outlying Islands, Midway Islands (US Minor Outlying Islands), Wake Islands (US Minor Outlying Islands), Socotra (Yemen), Mayotte
86	Macau (China), Nauru, Ascension (Saint Helena)
87	Pitcairn Islands
88	Tripura (India)
89	
90	Kalimantan (Indonesia), Moluccas (Indonesia), Andaman and Nicobar Islands (India)
91	Guizhou (China), Jiangsu (China)
92	Bhutan, Hubei (China), Sikkim (India), Shikoku (Japan)
93	Northern Mariana Islands
94	Assam (India), Kerala (India)
95	Karnataka (India), Tamil Nadu (India), West Bengal (India)
96	Australia, Papua New Guinea

Table 14 (continued).

Neuron #	Allocated regions
97	Anguilla, Rondonia (Brazil), Sergipe (Brazil), Curaçao, Galapagos Islands, Bonin Island (Japan), District of Columbia (USA)
98	Netherlands Antilles, Alagoas (Brazil), Amazonas (Brazil), Ceara (Brazil), Espirito Santo (Brazil), Goias (Brazil), Maranhao (Brazil), Matto Grosso do Sul (Brazil), Matto Grosso (Brazil), Paraiba (Brazil), Pernambuco (Brazil), Piauí (Brazil), Rio Grande do Norte (Brazil), Cayman Islands
99	Easter Island, British Indian Ocean Territory, Rodriquez Island (Mauritius), Johnston Island (US Minor Outlying Islands)
100	Cocos Islands, Christmas Island, Comoros, Norfolk Island, Oman, Sao Tome and Principe, Tuvalu, Zanzibar (Tanzania), British Virgin Islands
101	Kiribati, Marshall Islands, Maldives, Wallis and Futuna
102	American Samoa, Cook Islands, Federated states of Micronesia, Caroline Islands (Federated states of Micronesia), Guam, Irian Jaya (Indonesia), Northern Mariana Islands, Niue, French Polynesia, Belau, Tonga, Vanuatu, Samoa
103	Nusa Tenggara (Indonesia), Sulawesi (Indonesia)
104	Fujian (China), Guangxi (China), Hainan (China), Hunan (China), Jiangsu (China), Sichuan (China), Yunnan (China), Zhejiang (China), Ryukyu Archipelago (Japan)
105	Honshu (Japan), Kyushu (Japan), Korea-Republic of,
106	Brunei Darussalam, Guangdong (China), Hong Kong (China), Sumatra (Indonesia), Cambodia, Laos, Sabah (Malaysia), Sarawak (Malaysia)
107	Peninsular Malaysia (Malaysia), Singapore
108	Bangladesh, China, Taiwan (China), Indonesia, Java (Indonesia), India, Japan, Sri Lanka, Myanmar, Malaysia, Philippines, Pakistan, Thailand, Vietnam

Table 15. NSW insect pest top 200 risk list generated from SOM analysis of Australian distributional data. . * Species with the same risk index were ranked in alphabetical order.

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
1	Oxycarenus luctuosus	0.1247	34	Lyctus linearis	0.1209	67	Conoeca guildingi	0.1206
2	Carpophilus maculatus	0.1244	35	Lyctus planicollis	0.1209	68	Coracanthella geophila	0.1206
3	Dysaphis aucupariae	0.1234	36	Nacoleia rhoeoalis	0.1209	69	Cryptocephalus cyanipennis	0.1206
4	Brachycaudus rumexicolens	0.1231	37	Nocar depressiusculus	0.1209	70	Csiro subparallela	0.1206
5	Conoderus basalis	0.1231	38	Odontothripiella compta	0.1209	71	Culladia cuneiferellus	0.1206
6	Euander lacertosus	0.1231	39	Palaeotoma styphelana	0.1209	72	Cyrtorhinus lividipennis	0.1206
7	Hesthesis plorator	0.1231	40	Palorus ratzeburgi	0.1209	73	Dicranosterna aeraria	0.1206
8	Hyalopterus pruni	0.1231	41	Piesarthrius laminosus	0.1209	74	Dumbletoniella pittospori	0.1206
9	Metopolophium dirhodum	0.1231	42	Pimelopus nothus	0.1209	75	Eboo exilis	0.1206
10	Aeolothrips fasciatus	0.1228	43	Proagapete carissima	0.1209	76	Empoasca smithi	0.1206
11	Agetinus abjectus	0.1228	44	Spectrotrota fimbrialis	0.1209	77	Endotricha pyrosalis	0.1206
12	Aporocera tasmanica	0.1228	45	Thrips nigropilosus	0.1209	78	Faveria laiasalis	0.1206
13	Enchoptera apicalis	0.1228	46	Acyphas chionitis	0.1206	79	Frankliniella williamsi	0.1206
14	Enneaphyllus aeneipennis	0.1228	47	Agrypnus mammillatus	0.1206	80	Frenchella hirticollis	0.1206
15	Ocirrhoe westwoodi	0.1228	48	Anarsia dryinopa	0.1206	81	Glaucocharis ochracealis	0.1206
16	Pytheus erosus	0.1228	49	Aporocera casta	0.1206	82	Glypheus villosulus	0.1206
17	Sejanus vividus	0.1228	50	Aporocera melanocephala	0.1206	83	Heteronyx macleayi	0.1206
18	Zanessa rubrovariegata	0.1228	51	Aristotelia furtiva	0.1206	84	Homotrysis planicollis	0.1206
19	Graptostethus servus	0.1222	52	Aspidomorpha denticulata	0.1206	85	Hypogomphus bufo	0.1206
20	Aleurodicus destructor	0.1219	53	Austronevra bimaculata	0.1206	86	Isochorista helota	0.1206
21	Onthophagus glabratus	0.1219	54	Bleszynskia malacelloides	0.1206	87	Lilioceris bakewelli	0.1206
22	Arotrophora arcuatalis	0.1212	55	Bolbophanes rugatus	0.1206	88	Meritastis polygraphana	0.1206
23	Capitophorus hippophaes	0.1212	56	Brachypeplus binotatus	0.1206	89	Metriolagria affinis	0.1206
24	Dieuches notatus	0.1212	57	Brachytria gulosa	0.1206	90	Microtragus luctuosus	0.1206
25	Altica pagana	0.1209	58	Cadmus klugii	0.1206	91	Musotima acrias	0.1206
26	Anaphothrips cecili	0.1209	59	Cadmus australis	0.1206	92	Neboisselater australicus	0.1206
27	Anomala antiqua	0.1209	60	Calomela macleayi	0.1206	93	Neoheteronyx brevicollis	0.1206
28	Antitrogus burmeisteri	0.1209	61	Chalcopteroides colossus	0.1206	94	Niptus hololeucus	0.1206
29	Essigella californica	0.1209	62	Chalcopteroides confusus	0.1206	95	Notobrachypterus crassiusculis	0.1206
30	Hednota grammellus	0.1209	63	Cheiroplatys solidus	0.1206	96	Nyctozoilus laevipennis	0.1206
31	Helea squamosa	0.1209	64	Cletus bipunctatus	0.1206	97	Ocirrhoe wilsoni	0.1206
32	Heteronyx piceus	0.1209	65	Colpochila dubia	0.1206	98	Oenogenes fugalis	0.1206
33	Lanelater mastersii	0.1209	66	Conocephalus semivittatus	0.1206	99	Onthophagus anisocerus	0.1206

Table 15 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
100	Onthophagus ferox	0.1206	133	Acroelytrum muricatum	0.1201	166	Aleurodicus dispersus	0.1198
101	Onthophagus squalidus	0.1206	134	Agrotis interjectionis	0.1201	167	Amyotea erythromelas	0.1198
102	Palorus depressus	0.1206	135	Amblypelta lutescens	0.1201	168	Andrallus spinidens	0.1198
103	Paracardiophorus divisus	0.1206	136	Bactrocera decurtans	0.1201	169	Anoplognathus brevicollis	0.1198
104	Paropsis morio	0.1206	137	Bactrocera frauenfeldi	0.1201	170	Antineda princeps	0.1198
105	Paropsis pictipennis	0.1206	138	Bactrocera mayi	0.1201	171	Assara quadriguttella	0.1198
106	Paropsis sexpustulata	0.1206	139	Campyloma austrinum	0.1201	172	Ataenius walkeri	0.1198
107	Paropsisterna semivittata	0.1206	140	Colpochila deceptor	0.1201	173	Australitermes perlevis	0.1198
108	Phalota obscura	0.1206	141	Cryptoblabes adoceta	0.1201	174	Ayyaria chaetophora	0.1198
109	Piesarthrius brevicornis	0.1206	142	Dendrothripoides innoxius	0.1201	175	Bactrocera diospyri	0.1198
110	Polysoma eumetalla	0.1206	143	Hemipharis insularis	0.1201	176	Bactrocera melanothoracica	0.1198
111	Priasus bilunulatus	0.1206	144	Lepidiota delicatula	0.1201	177	Bactrocera signatifera	0.1198
112	Proagapete auricoma	0.1206	145	Lepidiota perkinsi	0.1201	178	Bemisia afer	0.1198
113	Promethis opaca	0.1206	146	Lepidiota rothei	0.1201	179	Calguia deltophora	0.1198
114	Pseudanaphothrips uniformis	0.1206	147	Lipaleyrodes euphorbiae	0.1201	180	Callistomyia horni	0.1198
115	Rhyzobius discolor	0.1206	148	Microcerotermes nervosus	0.1201	181	Calloodes grayianus	0.1198
116	Scrobipalpa pyrrhanthes	0.1206	149	Nasutitermes longipennis	0.1201	182	Callosobruchus phaseoli	0.1198
117	Serangium mysticum	0.1206	150	Oncocoris coelebs	0.1201	183	Cephaloplatus darwini	0.1198
118	Sinomegoura citricola	0.1206	151	Oncocoris favillaceus	0.1201	184	Chilocorus flavidus	0.1198
119	Stylogeocoris capricornutus	0.1206	152	Onthophagus symbioticus	0.1201	185	Cicadella spectra	0.1198
120	Tarachota mersana	0.1206	153	Platyomopsis pedicornis	0.1201	186	Clavigralla horrens	0.1198
121	Tessaromma sericans	0.1206	154	Rhyparida didyma	0.1201	187	Clavigralloides spinosus	0.1198
122	Thalycrodes mixtum	0.1206	155	Scirpophaga innotata	0.1201	188	Cnaphalocrocis poeyalis	0.1198
123	Toxicum insigne	0.1206	156	Stenocatantops angustifrons	0.1201	189	Cofana perkinsi	0.1198
124	Tracholena sulfurosa	0.1206	157	Stenocatantops vitripennis	0.1201	190	Colasposoma sellatum	0.1198
125	Trachymela pustulosa	0.1206	158	Teleogryllus oceanicus	0.1201	191	Collessomyia setiger	0.1198
126	Udeocoris nigroaeneus	0.1206	159	Thrips unispinus	0.1201	192	Colpochila griffithi	0.1198
127	Yarranum crenicolle	0.1206	160	Tirathaba rufivena	0.1201	193	Colpochila iota	0.1198
128	Zaletta nereias	0.1206	161	Adisura marginalis	0.1198	194	Colpochila paula	0.1198
129	Bactrocera tenuifascia	0.1204	162	Adoxophyes templana	0.1198	195	Colpochila scutalis	0.1198
130	Dacus axanus	0.1204	163	Adrama biseta	0.1198	196	Colpochila secreta	0.1198
131	Pectinophora gossypiella	0.1204	164	Agrotera amathealis	0.1198	197	Colpochila setosa	0.1198
132	Thrips palmi	0.1204	165	Aleurocanthus spiniferus	0.1198	198	Conoguinula coeruleopennis	0.1198

Table 15 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
199	Creontiades pacificus	0.1198	234	Monolepta palmerstoni	0.1198	269	Phaenognatha erichsoni	0.1198
200	Cryptodus foveatus	0.1198	235	Monoplistes occidentalis	0.1198	270	Philophylla quadrata	0.1198
201	Cryptotermes secundus	0.1198	236	Montrouzieriellus turneri	0.1198	271	Phrynocaria astrolabiana	0.1198
202	Dacus hardyi	0.1198	237	Nagia linteola	0.1198	272	Prooedema inscisalis	0.1198
203	Dappula tertius	0.1198	238	Nasutitermes eucalypti	0.1198	273	Pygospila tyres	0.1198
204	Deraeocoris signatus	0.1198	239	Nasutitermes triodiae	0.1198	274	Rectitropis australis	0.1198
205	Drepanotermes daliensis	0.1198	240	Neomaskellia bergii	0.1198	275	Rhyparida tenuis	0.1198
206	Drepanotermes rubriceps	0.1198	241	Nephotettix malayanus	0.1198	276	Rhyssemus inscitus	0.1198
207	Dudua aprobola	0.1198	242	Nephotettix nigropictus	0.1198	277	Rodolia limbata	0.1198
208	Dysallacta negatalis	0.1198	243	Olene mendosa	0.1198	278	Rupilia ruficollis	0.1198
209	Ephelotermes melachoma	0.1198	244	Oncocoris detersus	0.1198	279	Sameodes cancellalis	0.1198
210	Euclasta maceratalis	0.1198	245	Onthophagus bicavicollis	0.1198	280	Schedorhinotermes breinli	0.1198
211	Eysarcoris fuscus	0.1198	246	Onthophagus bicornis	0.1198	281	Scirtothrips dobroskyi	0.1198
212	Geloptera inaequalis	0.1198	247	Onthophagus capitosus	0.1198	282	Scirtothrips tenor	0.1198
213	Geocoris lubra	0.1198	248	Onthophagus comperei	0.1198	283	Scymnus mitior	0.1198
214	Gesonula mundata	0.1198	249	Onthophagus cruciger	0.1198	284	Silvanolomus crenicollis	0.1198
215	Giffardia dolichocephala	0.1198	250	Onthophagus demarzi	0.1198	285	Silvanolomus goughi	0.1198
216	Gnathmocerodes euplectra	0.1198	251	Onthophagus discolor	0.1198	286	Stegasta variana	0.1198
217	Gonocephalum carpentariae	0.1198	252	Onthophagus fabricii	0.1198	287	Synodita melanocephala	0.1198
218	Gralliclava australiensis	0.1198	253	Onthophagus fissiceps	0.1198	288	Synona seminigra	0.1198
219	Graptostethus cardinalis	0.1198	254	Onthophagus latro	0.1198	289	Temnoplectron rotundum	0.1198
220	Haploscapanes barbarossa	0.1198	255	Onthophagus nodulifer	0.1198	290	Termitorioxa exleyae	0.1198
221	Heliocheilus melibaphes	0.1198	256	Onthophagus ocelliger	0.1198	291	Termitorioxa laurae	0.1198
222	Heterotermes venustus	0.1198	257	Onthophagus parvus	0.1198	292	Termitorioxa termitoxena	0.1198
223	Idioscopus nitidulus	0.1198	258	Onthophagus quadripustulati	0.1198	293	Thrips coloratus	0.1198
224	Ipoides melaleucae	0.1198	259	Onthophagus queenslandicus	0.1198	294	Thrips extensicornis	0.1198
225	Lagria cyanea	0.1198	260	Onthophagus sagittarius	0.1198	295	Thrips orientalis	0.1198
226	Lepidiota arnhemensis	0.1198	261	Onthophagus sloanei	0.1198	296	Thyas miniacea	0.1198
227	Lepidiota sticta	0.1198	262	Onthophagus vilis	0.1198	297	Tortor pulchra	0.1198
228	Leucinodes orbonalis	0.1198	263	Onthophagus yeyeko	0.1198	298	Tumulitermes hastilis	0.1198
229	Liparetrus minor	0.1198	264	Ophiorrhabda phaeosigma	0.1198	299	Tumulitermes pastinator	0.1198
230	Lophotermes quadratus	0.1198	265	Parapoynx crisonalis	0.1198	300	Turrana abnormis	0.1198
231	Macrognathotermes errator	0.1198	266	Parapoynx stagnalis	0.1198	301	Ubida holomochla	0.1198
232	Micraspis aphidectoides	0.1198	267	Pedioscopus disjunctus	0.1198			
233	Microcerotermes nanus	0.1198	268	Pedioscopus philenor	0.1198			

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Table 16. VIC insect pest top 200 risk list generated from SOM analysis of Australian distributional data. . * Species with the same risk index were ranked in alphabetical order.

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
1	Stethorus histrio	0.5659	34	Arotrophora arcuatalis	0.5517	67	Chasmina pulchra	0.4941
2	Stethorus vagans	0.5659	35	Euoniticellus fulvus	0.5516	68	Mataeomera dubia	0.4941
3	Carpophilus dimidiatus	0.5659	36	Sinoxylon anale	0.5072	69	Pantydia sparsa	0.4941
4	Alphitobius laevigatus	0.5659	37	Palorus subdepressus	0.5072	70	Faveria tritalis	0.4941
5	Lipaphis erysimi	0.5659	38	Aproaerema simplexella	0.5072	71	Hygraula nitens	0.4941
6	Sitotroga cerealella	0.5659	39	Ephestia cautella	0.507	72	Meyriccia latro	0.4941
7	Agrotis ipsilon	0.5659	40	Acheta domesticus	0.507	73	Musotima ochropteralis	0.4941
8	Achroia grisella	0.5659	41	Graptostethus servus	0.5061	74	Salma pyrastis	0.4941
9	Hellula hydralis	0.5659	42	Tragocerus spencei	0.4941	75	Cryptoptila immersana	0.4941
10	Sceliodes cordalis	0.5659	43	Altica corusca	0.4941	76	Epiphyas xylodes	0.4941
11	Merophyas divulsana	0.5659	44	Altica gravida	0.4941	77	Holocola triangulana	0.4941
12	Gastrimargus musicus	0.5659	45	Cassida mera	0.4941	78	Cryptobothrus chrysophorus	0.4941
13	Xylobosca bispinosus	0.5528	46	Paropsisterna nigerrima	0.4941	79	Goniaea australasiae	0.4941
14	Chrysophtharta variicollis	0.5528	47	Phyllotreta undulata	0.4941	80	Lepidogryllus parvulus	0.4941
15	Anthrenus museorum	0.5528	48	Adalia bipunctata	0.4941	81	Andrewarthaia kellyana	0.4941
16	Idiopterus nephrelepidis	0.5528	49	Dicteniophorus ramifer	0.4941	82	Desmothrips obsoletus	0.4941
17	Cryptes baccatus	0.5528	50	Colpochila obesa	0.4941	83	Toxeutes arcuatus	0.4939
18	Parthenolecanium persicae	0.5528	51	Glycyphana stolata	0.4941	84	Zygocera canosa	0.4939
19	Athetis tenuis	0.5528	52	Heteronyx aequalis	0.4941	85	Dermestes peruvianus	0.4939
20	Cadra cautella	0.5528	53	Onthophagus binodis	0.4941	86	Trogoderma sternale	0.4939
21	Ephestia kuehniella	0.5528	54	Semanopterus solidus	0.4941	87	Carpophilus aterrimus	0.4939
22	Isotenes miserana	0.5528	55	Gnatocerus cornutus	0.4941	88	Heteronyx dimidiata	0.4939
23	Austroicetes pusilla	0.5528	56	Cinara juniperi	0.4941	89	Rhotidoides montana	0.4939
24	Macrotona australis	0.5528	57	Pulvinaria mesembryanthemi	0.4941	90	Rhotidoides punctivena	0.4939
25	Gryllotalpa australis	0.5528	58	Amorbus rubiginosus	0.4941	91	Uloprora risdonensis	0.4939
26	Caedicia otivacea	0.5528	59	Anaxilaus vesiculosus	0.4941	92	Pamerapa thoracica	0.4939
27	Symmetrischema tangolias	0.5527	60	Dictyotus inconspicuus	0.4941	93	Coridromius variegatus	0.4939
28	Persectania dyscrita	0.5527	61	Dictyotus roei	0.4941	94	Omyta centrolineata	0.4939
29	Strepsicrates macropetana	0.5527	62	Diemenia rubromarginata	0.4941	95	Armactica conchidia	0.4939
30	Austroicetes frater	0.5527	63	Paramenestheus terricolor	0.4941	96	Earias paralella	0.4939
31	Austroicetes vulgaris	0.5527	64	Poecilometis strigatus	0.4941	97	Ectopatria mundoides	0.4939
32	Limothrips angulicornis	0.5527	65	Tholosanus proximus	0.4941	98	Eudesmeola lawsoni	0.4939
33	Dieuches notatus	0.5517	66	Aedia leucomelas	0.4941	99	Neumichtis nigerrima	0.4939

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Table 16 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
100	Altica pagana	0.493	133	Cardiaspina squamula	0.4928	166	Phyllocharis cyanicornis	0.4353
101	Pimelopus nothus	0.493	134	Cryptoneossa vulgaris	0.4928	167	Rhyparida commutabilis	0.4353
102	Nocar depressiusculus	0.493	135	Platyobria maddeni	0.4928	168	Epilachna guttatopustulata	0.4353
103	Palorus ratzeburgi	0.493	136	Scrobipalpa heliopa	0.4928	169	Rhyzobius forestieri	0.4353
104	Hednota grammellus	0.493	137	Ectopatria paurogramma	0.4928	170	Idaethina pilistriata	0.4353
105	Nacoleia rhoeoalis	0.493	138	Proteuxoa amaurodes	0.4928	171	Thalycrodes pulchrum	0.4353
106	Spectrotrota fimbrialis	0.493	139	Proteuxoa atrisquamata	0.4928	172	Phyllotocus ruficollis	0.4353
107	Palaeotoma styphelana	0.493	140	Proteuxoa oxygona	0.4928	173	Scitala aureorufa	0.4353
108	Anaphothrips cecili	0.493	141	Paralipsa gularis	0.4928	174	Sericesthis consanguinea	0.4353
109	Odontothripiella compta	0.493	142	Exarna includens	0.4928	175	Ishidaella angustata	0.4353
110	Macrones purpureipes	0.4928	143	Minyacris manum	0.4928	176	Pascoepus nymphias	0.4353
111	Phlyctaenodes pustulosus	0.4928	144	Peakesia brunnea	0.4928	177	Rosopaella evansi	0.4353
112	Arsipoda kingensis	0.4928	145	Urnisa rugosa	0.4928	178	Amorbus obscuricornis	0.4353
113	Chrysophtharta bimaculata	0.4928	146	Buangina diminuens	0.4928	179	Felisacus elegantulus	0.4353
114	Chrysophtharta nobilitata	0.4928	147	Apterothrips secticornis	0.4928	180	Lygaeoscytus cimicoides	0.4353
115	Ellopidia pedestris	0.4928	148	Callosobruchus maculatus	0.4484	181	Diaphyta fulvescens	0.4353
116	Paropsis tasmanica	0.4928	149	Carpophilus obsoletus	0.4484	182	Diaphyta pulchra	0.4353
117	Carpophilus frivolus	0.4928	150	Taylorilygus pallidulus	0.4472	183	Monteithiella humeralis	0.4353
118	Aphodius suberosus	0.4928	151	Xylobosca elongatula	0.4353	184	Notius consputus	0.4353
119	Colpochilodes peregrina	0.4928	152	Amphirhoe decora	0.4353	185	Ocirrhoe australis	0.4353
120	Heteronyx glabrata	0.4928	153	Illaena exilis	0.4353	186	Ocirrhoe lutescens	0.4353
121	Heteronyx obesus	0.4928	154	Mecynopus cothurnatus	0.4353	187	Poecilotoma grandicornis	0.4353
122	Heteronyx praecox	0.4928	155	Paratesta dorsalis	0.4353	188	Ardozyga mesochra	0.4353
123	Onthophagus taurus	0.4928	156	Phoracantha longipennis	0.4353	189	Scrobipalpa aptatella	0.4353
124	Pachygastra tasmanica	0.4928	157	Rhinophthalmus nusutus	0.4353	190	Prometopus inassueta	0.4353
125	Silvanus lateritius	0.4928	158	Syllitus microps	0.4353	191	Proteuxoa flexirena	0.4353
126	Jacksonia papillata	0.4928	159	Zoedia triangularis	0.4353	192	Metura elongatus	0.4353
127	Anacephaleus minutus	0.4928	160	Adoxia femoralis	0.4353	193	Callionyma sarcodes	0.4353
128	Ishidaella naomiae	0.4928	161	Arsipoda bifrons	0.4353	194	Corynophora lativittalis	0.4353
129	Parthenolecanium corni	0.4928	162	Chrysophtharta decolorata	0.4353	195	Crocydopora cinigerella	0.4353
130	Anoeconeossa assimilis	0.4928	163	Chrysophtharta hectica	0.4353	196	Endotricha ignealis	0.4353
131	Anoeconeossa copidiformis	0.4928	164	Monochirus multispinosus	0.4353	197	Hednota bivittella	0.4353
132	Blastopsylla moorei	0.4928	165	Paropsis charybids	0.4353	198	Hednota pleniferellus	0.4353

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Table 16 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
199	Heteromicta pachytera	0.4353	245	Paropsisterna nucea	0.4352	291	Acrocercops laciniella	0.4352
200	Musotima nitidalis	0.4353	246	Paropsisterna rufipes	0.4352	292	Phyllonorycter messaniella	0.4352
201	Orthaga thyrisalis	0.4353	247	Rhyzobius hirtellus	0.4352	293	Agaristodes feisthamelii	0.4352
202	Ptochostola microphaeellus	0.4353	248	Neoanthrenus ocellifer	0.4352	294	Agrotis radians	0.4352
203	Salma ebenina	0.4353	249	Trogoderma longius	0.4352	295	Artigisa lignicolaria	0.4352
204	Salma recurvalis	0.4353	250	Trogoderma morio	0.4352	296	Eremochroa alphitias	0.4352
205	Stericta carbonalis	0.4353	251	Conoderus cordieri	0.4352	297	Leucania exarans	0.4352
206	Tipanaea patulella	0.4353	252	Glyphochilus lucidus	0.4352	298	Leucania obumbrata	0.4352
207	Acropolitis excelsa	0.4353	253	Brachypeplus basalis	0.4352	299	Leucania obusta	0.4352
208	Acropolitis magnana	0.4353	254	Brachypeplus blandus	0.4352	300	Meyrickella ruptellus	0.4352
209	Bathrotoma constrictana	0.4353	255	Brachypeplus planus	0.4352	301	Neumichtis sepultrix	0.4352
210	Epiphyas ashworthana	0.4353	256	Epuraea meyricki	0.4352	302	Praxis edwardsii	0.4352
211	Holocola perspectana	0.4353	257	Soronia superba	0.4352	303	Praxis porphyretica	0.4352
212	Brachyexarna lobipennis	0.4353	258	Comophorina testaceipennis	0.4352	304	Proteuxoa cyanoloma	0.4352
213	Cirphula pyrrhocnemis	0.4353	259	Heteronyx comans	0.4352	305	Proteuxoa florescens	0.4352
214	Pteronemobius regulus	0.4353	260	Heteronyx excisus	0.4352	306	Proteuxoa hydraecioides	0.4352
215	Thrips setipennis	0.4353	261	Heteronyx fumata	0.4352	307	Proteuxoa hypochalchis	0.4352
216	Dryophilodes subcylindricus	0.4352	262	Heteronyx ovatus	0.4352	308	Rhapsa suscitatalis	0.4352
217	Mezium affine	0.4352	263	Heteronyx tasmanicus	0.4352	309	Sandava scitisignata	0.4352
218	Priobium multimaculatus	0.4352	264	Heteronyx unicolor	0.4352	310	Sandava xylistis	0.4352
219	Ambeodontus tristis	0.4352	265	Liparetrus vestitus	0.4352	311	Tathorhynchus fallax	0.4352
220	Dorcadida bilocularis	0.4352	266	Microvalgus lapeyrousei	0.4352	312	Cebysa leucotelus	0.4352
221	Gracilia minuta	0.4352	267	Neodasygnathus corynophylloi	0.4352	313	Clania lewinii	0.4352
222	Homaemota tricolor	0.4352	268	Onthophagus tabellifer	0.4352	314	Gauna aegusalis	0.4352
223	Pentacosmia scoparia	0.4352	269	Phyllotocus nigripennis	0.4352	315	Hednota megalarcha	0.4352
224	Stenoderus concolor	0.4352	270	Uleiota australis	0.4352	316	Hednota opulentellus	0.4352
225	Syllitus deustus	0.4352	271	Zophophilus convexiusculus	0.4352	317	Hednota panselenella	0.4352
226	Uracanthus pallens	0.4352	272	Eriosoma lanuginosum	0.4352	318	Mimaglossa habitalis	0.4352
227	Uracanthus pertenuis	0.4352	273	Myzaphis rosarum	0.4352	319	Patagoniodes farinaria	0.4352
228	Aporocera erosa	0.4352	274	Myzus ascalonicus	0.4352	320	Salma marmorea	0.4352
229	Aporocera rufescens	0.4352	275	Austroagalloides obliquus	0.4352	321	Scoparia meyrickii	0.4352
230	Cadmus apicalis	0.4352	276	Euacanthella palustris	0.4352	322	Acropolitis ergophora	0.4352
231	Cadmus pacificus	0.4352	277	Hackeriana glauca	0.4352	323	Arotrophora siniocosma	0.4352
232	Chaetocnema erichsoni	0.4352	278	Paracephaleus montanus	0.4352	324	Capua intractana	0.4352
233	Chalcolampra aenea	0.4352	279	Putoniessa nigrella	0.4352	325	Conchylis subfurcatana	0.4352
234	Chalcolampra thoracica	0.4352	280	Rosopaella crofta	0.4352	326	Dichelia sobriana	0.4352
235	Chrysophtharta agricola	0.4352	281	Rosopaella cuprea	0.4352	327	Epiphyas caryotis	0.4352
236	Chrysophtharta laesa	0.4352	282	Rubria brevifrons	0.4352	328	Epitymbia alaudana	0.4352
237	Chrysophtharta obovata	0.4352	283	Taslopa montana	0.4352	329	Epitymbia isoscelana	0.4352
238	Ditropidus lentulus	0.4352	284	Tenuitartessus blundellensis	0.4352	330	Ericodesma concordana	0.4352
239	Ditropidus ruficollis	0.4352	285	Spilostethus pacificus	0.4352	331	Glyphidoptera insignana	0.4352
240	Elaphodes cervinus	0.4352	286	Melanotrichus australianus	0.4352	332	Meritastis lythrodana	0.4352
241	Idiocephala albilinea	0.4352	287	Orthotylus sidnicus	0.4352	333	Thrincophora lignigerana	0.4352
242	Loxopleurus ater	0.4352	288	Mycoolona atricornis	0.4352	334	Balamara albovittata	0.4352
243	Monolepta ordinaria	0.4352	289	Paradictyotus fuscus	0.4352			
244	Monolepta subsuturalis	0.4352	290	Cardiaspina spinifera	0.4352			

Table 17**.** TAS insect pest top 200 risk list generated from SOM analysis of Australian distributional data. . * Species with the same risk index were ranked in alphabetical order.

Rank* Species	risk index	Rank* Species	risk index	Rank* Species	risk index
1 Bostrychopsis jesuita	0.5659	34 Cardiaspina albitextura	0.5527	67 Coptocercus aberrans	0.4941
2 Phoracantha recurva	0.5659	35 Dialectica scalariella	0.5527	68 Coptocercus biguttatus	0.4941
3 Aulacophora hilaris	0.5659	36 Hednota crypsichroa	0.5527	69 Corrhenes picta	0.4941
4 Cryptolaemus montrouzieri	0.5659	37 Hednota panteucha	0.5527	70 Distichocera thomsonella	0.4941
5 Carpophilus humeralis	0.5659	38 Capitophorus hippophaes	0.5517	71 Neostenus saudersii	0.4941
6 Oryzaephilus mercator	0.5659	39 Rhopalosiphum insertum	0.5516	72 Obrida fascialis	0.4941
7 Dacus newmani	0.5659	40 Dinoderus minutus	0.5072	73 Oebarina ceresioides	0.4941
8 Bemisia tabaci	0.5659	41 Minthea rugicollis	0.5072	74 Pachydissus sericus	0.4941
9 Nysius clevelandensis	0.5659	42 Tristaria grouvellei	0.5072	75 Phoracantha frenchi	0.4941
10 Campylomma liebknechti	0.5659	43 Xylobosca vidua	0.5072	76 Phoracantha tricuspis	0.4941
11 Coptotermes acinaciformis	0.5659	44 Micraspis lineola	0.5072	77 Rhagiomorpha lepturoides	0.4941
12 Earias huegeliana	0.5659	45 Chlorobapta frontalis	0.5072	78 Strongylurus cretifer	0.4941
13 Scolothrips sexmaculatus	0.5659	46 Metanastes vulgivagus	0.5072	79 Uracanthus acutus	0.4941
14 Thrips hawaiiensis	0.5659	47 Neodon pecuarius	0.5072	80 Arsipoda chrysis	0.4941
15 Siphoninus phillyreae	0.5658	48 Onthophagus gazella	0.5072	81 Augomela hypochalcea	0.4941
16 Oxycarenus arctatus	0.5647	49 Bactrocera tryoni	0.5072	82 Calomela ioptera	0.4941
17 Phoracantha semipunctata	0.5528	50 Austroagallia torrida	0.5072	83 Ditropidus concolor	0.4941
18 Carpophilus marginellus	0.5528	51 Melanerythrus mactans	0.5072	84 Lamprolina aeneipennis	0.4941
19 Heteronychus arator	0.5528	52 Spilostethus hospes	0.5072	85 Paropsisterna beata	0.4941
20 Ceratitis capitata	0.5528	53 Plautia affinis	0.5072	86 Attagenus unicolor	0.4941
21 Dirioxa pornia	0.5528	54 Neotermes insularis	0.5072	87 Dermestes haemorrhoidalis	0.4941
22 Parasaissetia nigra	0.5528	55 Microcerotermes distinctus	0.5072	88 Anilicus xanthomus	0.4941
23 Pseudapines geminata	0.5528	56 Acrida conica	0.5072	89 Lingana illita	0.4941
24 Coptotermes frenchi	0.5528	57 Austracris guttulosa	0.5072	90 Pseudotetralobus australasiae	0.4941
25 Heterotermes ferox	0.5528	58 Ephippitytha trigintiduoguttata	0.5072	91 Carpophilus davidsoni	0.4941
26 Nasutitermes exitiosus	0.5528	59 Austroasca merredinensis	0.507	92 Epuraea imperialis	0.4941
27 Spodoptera exigua	0.5528	60 Anoplognathus macleayi	0.5059	93 Anoplognathus chloropyrus	0.4941
28 Hednota longipalpella	0.5528	61 Xylothrips flavipes	0.4941	94 Anoplognathus hirsutus	0.4941
29 Chortoicetes terminifera	0.5528	62 Xylotillus lindi	0.4941	95 Anoplognathus montanus	0.4941
30 Pezothrips kellyanus	0.5528	63 Acalolepta argentatus	0.4941	96 Anoplognathus pallidicollis	0.4941
31 Hylotrupes bajulus	0.5527	64 Ancita australis	0.4941	97 Anoplognathus porosus	0.4941
32 Pulvinaria maskelli	0.5527	65 Aridaeus thoracicus	0.4941	98 Colpochila punctulata	0.4941
33 Engytatus nicotianae	0.5527	66 Atesta angasii	0.4941	99 Cryptodus paradoxus	0.4941

Table 17. (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
100	Dasygnathus trituberculatus	0.4941	133	Coptotermes lacteus	0.4941	166	Eriosoma pyricola	0.4939
101	Diaphonia dorsalis	0.4941	134	Schedorhinotermes reticulatus	0.4941	167	Batracomorphus angustatus	0.4939
102	Liparetrus ater	0.4941	135	Nasutitermes fumigatus	0.4941	168	Eurymelops rubrovittata	0.4939
103	Liparetrus fulvohirtus	0.4941	136	Stolotermes victoriensis	0.4941	169	Cardiococcus foraminifer	0.4939
104	Onthophagus pentacanthus	0.4941	137	Comocrus behri	0.4941	170	Paralecanium frenchii	0.4939
105	Phyllotocus australis	0.4941	138	Cruria donowani	0.4941	171	Pulvinaria floccifera	0.4939
106	Phyllotocus kingii	0.4941	139	Heliothis punctifera	0.4941	172	Lyctus linearis	0.493
107	Repsimus aeneus	0.4941	140	Cactoblastis cactorum	0.4941	173	Lyctus planicollis	0.493
108	Rhopaea heterodactyla	0.4941	141	Arorathrips mexicanus	0.4941	174	Piesarthrius laminosus	0.493
109	Semanopterus subcostatus	0.4941	142	Hercinothrips bicinctus	0.4941	175	Proagapete carissima	0.493
110	Sericesthis geminata	0.4941	143	Athemistus puncticollis	0.4939	176	Lanelater mastersii	0.493
111	Sericesthis harti	0.4941	144	Bimia bicolor	0.4939	177	Anomala antiqua	0.493
112	Sericesthis suturalis	0.4941	145	Cnemoplites blackburni	0.4939	178	Antitrogus burmeisteri	0.493
113	Adelium angulicolle	0.4941	146	Cnemoplites edulis	0.4939	179	Heteronyx piceus	0.493
114	Ecnolagria grandis	0.4941	147	Rhytiphora decipiens	0.4939	180	Helea squamosa	0.493
115	Gonocephalum misellum	0.4941	148	Scolecobrothus variegatus	0.4939	181	Essigella californica	0.493
116	Promethis nigra	0.4941	149	Cadmus litigiosus	0.4939	182	Thrips nigropilosus	0.493
117	Prophanes simplex	0.4941	150	Chrysolina hyperici	0.4939	183	Uracanthus albatus	0.4928
118	Pterohelaeus guerini	0.4941	151	Dermestes carnivorus	0.4939	184	Paropsis intacta	0.4928
119	Pterohelaeus piceus	0.4941	152	Liparetrus phoenicopterus	0.4939	185	Peltoschema orphana	0.4928
120	Pterohelaeus striatopunctatus	0.4941	153	Onthophagus blackwoodensis	0.4939	186	Colpochila gagatina	0.4928
121	Bactrocera cacuminata	0.4941	154	Onthophagus geelongensis	0.4939	187	Eupoecila inscripta	0.4928
122	Bactrocera musae	0.4941	155	Onthophagus mniszechi	0.4939	188	Hemichnoodes mniszechi	0.4928
123	Bactrocera neohumeralis	0.4941	156	Schizognathus burmeisteri	0.4939	189	Heteronyx flavus	0.4928
124	Dacus absonifacies	0.4941	157	Adelium alpicola	0.4939	190	Heteronyx normalis	0.4928
125	Spathulina acroleuca	0.4941	158	Anaxo cylindricus	0.4939	191	Heteronyx pustulosus	0.4928
126	Trupanea glauca	0.4941	159	Euomma lateralis	0.4939	192	Liparetrus bituberculatus	0.4928
127	Edwardsiana froggatti	0.4941	160	Otrintus behri	0.4939	193	Metallesthes metallescens	0.4928
128	Orosius canberrensis	0.4941	161	Pterohelaeus planus	0.4939	194	Anaxo brevicornis	0.4928
129	Trocnada dorsigera	0.4941	162	Seirotrana parallela	0.4939	195	Cillibus blackburni	0.4928
130	Biprorulus bibax	0.4941	163	Seirotrana proxima	0.4939	196	Helea castor	0.4928
131	Poecilometis apicalis	0.4941	164	Bactrocera cucurbitae	0.4939	197	Helea modica	0.4928
132	Poecilometis australasiae	0.4941	165	Cinara cupressi	0.4939	198	Metistete omophloides	0.4928

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Table 17. (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
199	Pterohelaeus dispersus	0.4928	207	Coelophora inaequalis	0.4484	215	Creiis lituratus	0.4484
200	Pterohelaeus nitidissimus	0.4928	208	Coptodactyla glabricollis	0.4484	216	Cryptotermes domesticus	0.4484
201	Saragus latus	0.4928	209	Onthophagus laminatus	0.4484	217	Nomophila corticalis	0.4484
202	Tetraneura nigriabdominalis	0.4928	210	Brunotartessus fulvus	0.4484	218	Anthrenus flavipes	0.4483
203	Cuspicona obesula	0.4928	211	Exitianus nanus	0.4484	219	Onthophagus glabratus	0.4473
204	Aporocera parenthetica	0.4484	212	Nesoclutha pallida	0.4484	220	Aleurodicus destructor	0.4473
205	Hispellinus multispinosus	0.4484	213	Recilia hospes	0.4484			
206	Paropsis variolosa	0.4484	214	Soractellus nigrominutus	0.4484			

Table 18. QLD insect pest top 200 risk list generated from SOM analysis of Australian distributional data. . * Species with the same risk index were ranked in alphabetical order.

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
1	Latheticus oryzae	0.1461	34	Hylotrupes bajulus	0.1201	67	Aphodius fimetarius	0.1182
2	Siphoninus phillyreae	0.1459	35	Pulvinaria maskelli	0.1201	68	Aphodius granarius	0.1182
3	Ophiomyia phaseoli	0.1456	36	Engytatus nicotianae	0.1201	69	Diphucephala colaspidoides	0.1182
4	Piezodorus hybneri	0.1456	37	Cardiaspina albitextura	0.1201	70	Adelium similatum	0.1182
5	Mythimna separata	0.1456	38	Symmetrischema tangolias	0.1201	71	Isopteron aversum	0.1182
6	Lyctus brunneus	0.144	39	Dialectica scalariella	0.1201	72	Promethis angulata	0.1182
7	Austroasca merredinensis	0.1437	40	Persectania dyscrita	0.1201	73	Saragus costatus	0.1182
8	Ephestia cautella	0.1437	41	Hednota crypsichroa	0.1201	74	Myzus cerasi	0.1182
9	Acheta domesticus	0.1437	42	Hednota panteucha	0.1201	75	Ovatus crataegarius	0.1182
10	Ceratitella loranthi	0.1435	43	Strepsicrates macropetana	0.1201	76	Rhodobium porosum	0.1182
11	Minchamia hubbardae	0.1435	44	Austroicetes frater	0.1201	77	Pulvinaria hydrangeae	0.1182
12	Penicillaria jocosatrix	0.1435	45	Austroicetes vulgaris	0.1201	78	Dictyotus conspicuus	0.1182
13	Anthrenus flavipes	0.1416	46	Limothrips angulicornis	0.1201	79	Bathytricha truncata	0.1182
14	Lyctus africanus	0.1413	47	Cadmus excrementarius	0.1198	80	Dasygaster padockina	0.1182
15	Onthophagus bindaree	0.1413	48	Chrysolina quadrigemina	0.1198	81	Diarsia intermixta	0.1182
16	Onthophagus erichsoni	0.1413	49	Trogoderma variabile	0.1198	82	Eutrichopidia latinus	0.1182
17	Tropicomyia polyphyta	0.1413	50	Euoniticellus africanus	0.1198	83	Neumichtis saliaris	0.1182
18	Cicadulina bipunctatus	0.1413	51	Euoniticellus pallipes	0.1198	84	Phalaenoides tristifica	0.1182
19	Ipoides honiala	0.1413	52	Anomalaphis comperei	0.1198	85	Anaphothrips varii	0.1182
20	Katipo pallescens	0.1413	53	Coccus pseudomagnoliarum	0.1198	86	Athemistus puncticollis	0.118
21	Brithys crini	0.1413	54	Pulvinaria flavicans	0.1198	87	Bimia bicolor	0.118
22	Ernobius mollis	0.1204	55	Earias vittella	0.1198	88	Cnemoplites blackburni	0.118
23	Heteronyx elongatus	0.1204	56	Leucania stenographa	0.1198	89	Cnemoplites edulis	0.118
24	Isopteron punctatissimus	0.1204	57	Xanthodes congenita	0.1198	90	Rhytiphora decipiens	0.118
25	Chaetosiphon tetrarhodum	0.1204	58	Catamola thyrisalis	0.1198	91	Scolecobrothus variegatus	0.118
26	Uroleucon sonchi	0.1204	59	Megabregmus australiensis	0.1182	92	Toxeutes arcuatus	0.118
27	Parthenolecanium pruinosum	0.1204	60	Phoracantha lata	0.1182	93	Zygocera canosa	0.118
28	Ctenarytaina eucalypti	0.1204	61	Dermestes lardarius	0.1182	94	Cadmus litigiosus	0.118
29	Acyphas semiochrea	0.1204	62	Agrypnus caliginosus	0.1182	95	Chrysolina hyperici	0.118
30	Persectania ewingii	0.1204	63	Crepidomenus decoratus	0.1182	96	Dermestes carnivorus	0.118
31	Hednota pedionoma	0.1204	64	Elatichrosis trisulcatus	0.1182	97	Dermestes peruvianus	0.118
32	Apterothrips apteris	0.1204	65	Acrossidius tasmaniae	0.1182	98	Trogoderma sternale	0.118
33	Odontothripiella australis	0.1204	66	Anoplognathus rugosus	0.1182	99	Carpophilus aterrimus	0.118

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Table 18. (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
100	Heteronyx dimidiata	0.118	133	Bardistus cibarius	0.1177	166	Blaps polychresta	0.1177
101	Liparetrus phoenicopterus	0.118	134	Neoclytus acuminatus	0.1177	167	Brises acuticornis	0.1177
102	Onthophagus blackwoodensis	0.118	135	Omotes erosicollis	0.1177	168	Celibe costatus	0.1177
103	Onthophagus geelongensis	0.118	136	Phoracantha gigas	0.1177	169	Celibe emarginata	0.1177
104	Onthophagus mniszechi	0.118	137	Phoracantha impavida	0.1177	170	Celibe interrupta	0.1177
105	Schizognathus burmeisteri	0.118	138	Rhytiphora saundersii	0.1177	171	Lyphia australis	0.1177
106	Adelium alpicola	0.118	139	Symphyletes nigrovirens	0.1177	172	Mesomorphus darlingensis	0.1177
107	Anaxo cylindricus	0.118	140	Xystoena vittata	0.1177	173	Pterohelaeus tristis	0.1177
108	Euomma lateralis	0.118	141	Aporocera haematodes	0.1177	174	Cerodontha australis	0.1177
109	Otrintus behri	0.118	142	Chaetocnema concinna	0.1177	175	Melanagromyza apii	0.1177
110	Pterohelaeus planus	0.118	143	Chaetocnema olliffi	0.1177	176	Bactrocera dorsalis	0.1177
111	Seirotrana parallela	0.118	144	Chaetocnema propinqua	0.1177	177	Bactrocera kirki	0.1177
112	Seirotrana proxima	0.118	145	Leucispa odewahni	0.1177	178	Bactrocera melanota	0.1177
113	Bactrocera cucurbitae	0.118	146	Cyrema nigellum	0.1177	179	Bactrocera passiflorae	0.1177
114	Cinara cupressi	0.118	147	Trogoderma granarium	0.1177	180	Bactrocera psidii	0.1177
115	Eriosoma pyricola	0.118	148	Trogoderma inclusum	0.1177	181	Xenaleyrodes eucalypti	0.1177
116	Batracomorphus angustatus	0.118	149	Trogoderma irroratum	0.1177	182	Acyrthosiphon pelargonii	0.1177
117	Eurymelops rubrovittata	0.118	150	Australaethina froggatti	0.1177	183	Tinocallis ulmiparvifoliae	0.1177
118	Rhotidoides montana	0.118	151	Epuraea lindensis	0.1177	184	Eurymela rubrolimbata	0.1177
119	Rhotidoides punctivena	0.118	152	Anoplognathus narmarus	0.1177	185	Austrolichtensia hakearum	0.1177
120	Uloprora risdonensis	0.118	153	Corynophyllus fortnumi	0.1177	186	Cardiococcus fossilis	0.1177
121	Cardiococcus foraminifer	0.118	154	Frenchella iridescens	0.1177	187	Ctenochiton eucalypti	0.1177
122	Paralecanium frenchii	0.118	155	Heteronyx granum	0.1177	188	Symonicoccus australis	0.1177
123	Pulvinaria floccifera	0.118	156	Liparetrus nigrinus	0.1177	189	Symonicoccus ovalis	0.1177
124	Pamerapa thoracica	0.118	157	Liparetrus xanthotrichus	0.1177	190	Nysius huttoni	0.1177
125	Coridromius variegatus	0.118	158	Micropoecila cincta	0.1177	191	Eumecopus australasiae	0.1177
126	Omyta centrolineata	0.118	159	Phyllotocus basalis	0.1177	192	Oncocoris desertus	0.1177
127	Armactica conchidia	0.118	160	Phyllotocus moestus	0.1177	193	Aconopsylla sterculiae	0.1177
128	Earias paralella	0.118	161	Popillia japonica	0.1177	194	Cardiaspina fiscella	0.1177
129	Ectopatria mundoides	0.118	162	Sericesthis nemoralis	0.1177	195	Eucalyptolyma maideni	0.1177
130	Eudesmeola lawsoni	0.118	163	Sericesthis tetrica	0.1177	196	Glycaspis brimblecombei	0.1177
131	Neumichtis nigerrima	0.118	164	Telura petiolata	0.1177	197	Phyllolyma rufa	0.1177
132	Xyloperthella crinitarsis	0.1177	165	Adelium rotundum	0.1177	198	Incisitermes minor	0.1177

Table 18. (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
199	Coptotermes havilandi	0.1177	225	Ambeodontus pilosus	0.1161	251	Dendrophagus australis	0.1161
200	Ephysteris subdiminutella	0.1177	226	Atesta tasmanica	0.1161	252	Uleiota militaris	0.1161
201	Acrocercops plebeia	0.1177	227	Callidiopis praecox	0.1161	253	Atoichus bicolor	0.1161
202	Acontia nivipicta	0.1177	228	Callidiopis scutellaris	0.1161	254	Caediomorpha heteromera	0.1161
203	Anomis sabulifera	0.1177	229	Phlyctaenodes pustulatus	0.1161	255	Isopteron triviale	0.1161
204	Armactica columbina	0.1177	230	Phoracantha acanthocera	0.1161	256	Kaszaba corvina	0.1161
205	Earias chlorodes	0.1177	231	Zoedia divisa	0.1161	257	Lepispilus stygianus	0.1161
206	Eublemma amoena	0.1177	232	Aporocera viridipennis	0.1161	258	Neocistela ovalis	0.1161
207	Proteuxoa tibiata	0.1177	233	Cadmus braccatus	0.1161	259	Platydema tetraspilotum	0.1161
208	Ectomyelois ceratoniae	0.1177	234	Chloroplisma viridis	0.1161	260	Cerodontha milleri	0.1161
209	Cydia molesta	0.1177	235	Hispellinus fimbriatus	0.1161	261	Aulacorthum circumflexum	0.1161
210	Acrida turrita	0.1177	236	Monolepta minima	0.1161	262	Myzocallis coryli	0.1161
211	Belpessia dispar	0.1177	237	Paropsis porosa	0.1161	263	Shinjia orientalis	0.1161
212	Histrioacrida roseopennis	0.1177	238	Platycolaspis australis	0.1161	264	Microlopa minuta	0.1161
213	Kosciuskola usitatus	0.1177	239	Rhyzobius pulcher	0.1161	265	Ribautiana ulmi	0.1161
214	Macrolopholia ayersii	0.1177	240	Crepidomenus fulgidus	0.1161	266	Rosopaella kirkaldyi	0.1161
215	Percassa rugifrons	0.1177	241	Wynarka sylvestre	0.1161	267	Rosopaella swani	0.1161
216	Perloccia evittata	0.1177	242	Carpophilus terminalis	0.1161	268	Xestocephalus tasmaniensis	0.1161
217	Qualetta maculata	0.1177	243	Cryptarcha australis	0.1161	269	Niastama obscuritarsis	0.1161
218	Urnisiella rubropunctata	0.1177	244	Epuraea victoriensis	0.1161	270	Kalotermes atratus	0.1161
219	Bobilla bivittata	0.1177	245	Diphucephala pulchella	0.1161	271	Kalotermes convexus	0.1161
220	Pseudorhynchus mimeticus	0.1177	246	Heteronyx crinitus	0.1161	272	Hecatesia fenestrata	0.1161
221	Lamprothrips miltoni	0.1177	247	Onthophagus mutatus	0.1161	273	Hypoperigea tonsa	0.1161
222	Leucothrips nigripennis	0.1177	248	Pimelopus dubius	0.1161	274	Proteuxoa capularis	0.1161
223	Ptinus cupreoniger	0.1161	249	Pimelopus porcellus	0.1161	275	Proteuxoa tortisigna	0.1161
224	Ptinus tectus	0.1161	250	Telura alta	0.1161	276	Aptinothrips rufus	0.1161

Table 19. NT insect pest top 200 risk list generated from SOM analysis of Australian distributional data. . * Species with the same risk index were ranked in alphabetical order.

Rank* Species	risk index	Rank* Species	risk index	Rank* Species	risk index
1 Coleocoptus senio	0.5662	34 Rhopalosiphum rufiabdominalis	0.5662	67 Xylobosca bispinosus	0.5531
2 Coptocercus rubripes	0.5662	35 Sitobion miscanthi	0.5662	68 Phoracantha semipunctata	0.5531
3 Phaolus metallicus	0.5662	36 Therioaphis trifolii	0.5662	69 Chrysophtharta variicollis	0.5531
4 Scolecobrothus westwoodi	0.5662	37 Toxoptera aurantii	0.5662	70 Anthrenus museorum	0.5531
5 Uracanthus triangularis	0.5662	38 Toxoptera citricida	0.5662	71 Carpophilus marginellus	0.5531
6 Cadmus crucicollis	0.5662	39 Tuberculatus annulatus	0.5662	72 Heteronychus arator	0.5531
7 Paropsis atomaria	0.5662	40 Zygina zealandica	0.5662	73 Heteronyx elongatus	0.5531
8 Harmonia conformis	0.5662	41 Coccus hesperidum	0.5662	74 Isopteron punctatissimus	0.5531
9 Hippodamia variegata	0.5662	42 Saissetia coffeae	0.5662	75 Ceratitis capitata	0.5531
10 Rodolia cardinalis	0.5662	43 Saissetia oleae	0.5662	76 Dirioxa pornia	0.5531
11 Anthrenocerus australis	0.5662	44 Cermatulus nasalis	0.5662	77 Chaetosiphon tetrarhodum	0.5531
12 Australaphodius frenchi	0.5662	45 Dictyotus caenosus	0.5662	78 Idiopterus nephrelepidis	0.5531
13 Adelium brevicorne	0.5662	46 Phthorimaea operculella	0.5662	79 Uroleucon sonchi	0.5531
14 Tenebrio molitor	0.5662	47 Agrotis infusa	0.5662	80 Cryptes baccatus	0.5531
15 Chromatomyia syngenesiae	0.5662	48 Apina callisto	0.5662	81 Parasaissetia nigra	0.5531
16 Orchamoplatus citri	0.5662	49 Australothis rubrescens	0.5662	82 Parthenolecanium persicae	0.5531
17 Acyrthosiphon pisum	0.5662	50 Cosmodes elegans	0.5662	83 Parthenolecanium pruinosum	0.5531
18 Aphis spiraecola	0.5662	51 Mythimna convecta	0.5662	84 Pseudapines geminata	0.5531
19 Aulacorthum solani	0.5662	52 Phalaenoides glycinae	0.5662	85 Ctenarytaina eucalypti	0.5531
20 Brachycaudus helichrysi	0.5662	53 Uraba lugens	0.5662	86 Coptotermes frenchi	0.5531
21 Brachycaudus persicae	0.5662	54 Clania ignobilis	0.5662	87 Heterotermes ferox	0.5531
22 Capitophorus elaeagni	0.5662	55 Achyra affinitalis	0.5662	88 Nasutitermes exitiosus	0.5531
23 Cavariella aegopodii	0.5662	56 Uresiphita ornithopteralis	0.5662	89 Acyphas semiochrea	0.5531
24 Chaetosiphon fragaefolii	0.5662	57 Phaulacridium vittatum	0.5662	90 Athetis tenuis	0.5531
25 Cinara tujafilina	0.5662	58 Teleogryllus commodus	0.5662	91 Persectania ewingii	0.5531
26 Dysaphis foeniculus	0.5662	59 Desmothrips propinquus	0.5662	92 Spodoptera exigua	0.5531
27 Dysaphis tulipae	0.5662	60 Desmothrips tenuicornis	0.5662	93 Cadra cautella	0.5531
28 Hyadaphis foeniculi	0.5662	61 Chirothrips manicatus	0.5662	94 Ephestia kuehniella	0.5531
29 Hyperomyzus lactucae	0.5662	62 Frankliniella occidentalis	0.5662	95 Hednota longipalpella	0.5531
30 Macrosiphoniella sanborni	0.5662	63 Limothrips cerealium	0.5662	96 Hednota pedionoma	0.5531
31 Macrosiphum rosae	0.5662	64 Thrips australis	0.5662	97 Isotenes miserana	0.5531
32 Myzus ornatus	0.5662	65 Dysaphis aucupariae	0.5655	98 Austroicetes pusilla	0.5531
33 Rhopalosiphum padi	0.5662	66 Ernobius mollis	0.5531	99 Chortoicetes terminifera	0.5531

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Table 19 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
100	Macrotona australis	0.5531	133	Dialectica scalariella	0.54	166	Xanthodes congenita	0.5269
101	Gryllotalpa australis	0.5531	134	Persectania dyscrita	0.54	167	Catamola thyrisalis	0.5269
102	Caedicia otivacea	0.5531	135	Hyalarcta huebneri	0.54	168	Chrysolina geminata	0.5262
103	Apterothrips apteris	0.5531	136	Hednota crypsichroa	0.54	169	Longitarsus echii	0.5262
104	Odontothripiella australis	0.5531	137	Hednota panteucha	0.54	170	Phyllotocus ustulatus	0.5262
105	Pezothrips kellyanus	0.5531	138	Hellula undalis	0.54	171	Edwardsiana crataegi	0.5262
106	Acyrthosiphon malvae	0.5524	139	Strepsicrates macropetana	0.54	172	Cranothrips poultoni	0.5262
107	Capitophorus hippophaes	0.5524	140	Aiolopus thalassinus	0.54	173	Cranothrips vesper	0.5262
108	Nasonovia ribisnigri	0.5524	141	Austroicetes cruciata	0.54	174	Dorythrips wallacei	0.5262
109	Neotoxoptera formosana	0.5524	142	Austroicetes frater	0.54	175	Frankliniella insularis	0.5262
110	Rhopalosiphoninus latysiphon	0.5524	143	Austroicetes vulgaris	0.54	176	Odontothripiella andrewarthae	0.5262
111	Dieuches notatus	0.5524	144	Desmothrips australis	0.54	177	Odontothripiella concolorata	0.5262
112	Arotrophora arcuatalis	0.5524	145	Desmothrips reedi	0.54	178	Odontothripiella fasciatipennis	0.5262
113	Cacodacnus planicollis	0.54	146	Limothrips angulicornis	0.54	179	Odontothripiella hopei	0.5262
114	Hylotrupes bajulus	0.54	147	Chrysophtharta amoena	0.5393	180	Odontothripiella passalaina	0.5262
115	Phoracantha solida	0.54	148	Euoniticellus fulvus	0.5393	181	Anobium punctatum	0.3031
116	Stenocentrus suturalis	0.54	149	Aleyrodes proletella	0.5393	182	Mesoxylion collaris	0.3031
117	Scymnodes lividigaster	0.54	150	Hyperomyzus carduellinus	0.5393	183	Mesoxylion cylindricus	0.3031
118	Carpophilus planatus	0.54	151	Rhopalosiphum insertum	0.5393	184	Xylodeleis obsipa	0.3031
119	Euoniticellus intermedius	0.54	152	Orgyia australis	0.5393	185	Ancita crocogaster	0.3031
120	Glycyphana brunnipes	0.54	153	Peakesia straminea	0.5393	186	Ancita marginicollis	0.3031
121	Ceronema banksiae	0.54	154	Gryllotalpa africana	0.5393	187	Bethelium signiferum	0.3031
122	Ceroplastes destructor	0.54	155	Desmothrips steeleae	0.5393	188	Earinis mimula	0.3031
123	Ceroplastes rubens	0.54	156	Cadmus excrementarius	0.5269	189	Epithora dorsalis	0.3031
124	Ceroplastes sinensis	0.54	157	Chrysolina quadrigemina	0.5269	190	Hesthesis cingulata	0.3031
125	Coccus longulus	0.54	158	Trogoderma variabile	0.5269	191	Phacodes obscurus	0.3031
126	Eucalymnatus tessellatus	0.54	159	Euoniticellus africanus	0.5269	192	Phoracantha mastersi	0.3031
127	Pulvinaria maskelli	0.54	160	Euoniticellus pallipes	0.5269	193	Phoracantha punctata	0.3031
128	Leptoglossus gonagra	0.54	161	Anomalaphis comperei	0.5269	194	Syllitus grammicus	0.3031
129	Engytatus nicotianae	0.54	162	Coccus pseudomagnoliarum	0.5269	195	Syllitus rectus	0.3031
130	Kapunda troughtoni	0.54	163	Pulvinaria flavicans	0.5269	196	Tessaromma undatum	0.3031
131	Cardiaspina albitextura	0.54	164	Earias vittella	0.5269	197	Uracanthus bivitta	0.3031
132	Symmetrischema tangolias	0.54	165	Leucania stenographa	0.5269	198	Xystrocera virescens	0.3031

Table 19 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
199	Zygocera lugubris	0.3031	223	Phyllotocus macleayi	0.3031	247	Notius depressus	0.3031
200	Brachycaulus ferrugineus	0.3031	224	Phyllotocus rufipennis	0.3031	248	Creiis corniculatus	0.3031
201	Calomela curtisi	0.3031	225	Saulostomus villosus	0.3031	249	Bifiditermes improbus	0.3031
202	Calomela maculicollis	0.3031	226	Scitala sericans	0.3031	250	Porotermes adamsoni	0.3031
203	Monolepta divisa	0.3031	227	Sericesthis nigrolineata	0.3031	251	Teia anartoides	0.3031
204	Paropsisterna morio	0.3031	228	Telura vitticollis	0.3031	252	Agrotis porphyricollis	0.3031
205	Cleobora mellyi	0.3031	229	Cryptamorpha desjardinsi	0.3031	253	Dasypodia selenophora	0.3031
206	Micraspis frenata	0.3031	230	Chalcopteroides columbinus	0.3031	254	Ephestia elutella	0.3031
207	Parapriasus australasiae	0.3031	231	Meneristes australis	0.3031	255	Hednota relatalis	0.3031
208	Rhyzobius ventralis	0.3031	232	Tenebrio obscurus	0.3031	256	Pyralis farinalis	0.3031
209	Dermestes frischii	0.3031	233	Liriomyza brassicae	0.3031	257	Acropolitis rudisana	0.3031
210	Agrypnus variabilis	0.3031	234	Tephritis poenia	0.3031	258	Grapholita molesta	0.3031
211	Hapatesus hirtus	0.3031	235	Cinara fresai	0.3031	259	Oedaleus australis	0.3031
212	Adoryphorus coulonii	0.3031	236	Coloradoa rufomaculata	0.3031	260	Schizobothrus flavovittatus	0.3031
213	Anoplognathus suturalis	0.3031	237	Dysaphis apiifolia	0.3031	261	Acripeza reticulata	0.3031
214	Anoplognathus velutinus	0.3031	238	Myzocallis castanicola	0.3031	262	Anaphothrips obscurus	0.3031
215	Anoplognathus viriditarsis	0.3031	239	Neotoxoptera oliveri	0.3031	263	Parthenothrips dracaenae	0.3031
216	Automolius depressus	0.3031	240	Limotettix incertus	0.3031	264	Tenothrips frici	0.3031
217	Cheiroplatys latipes	0.3031	241	Stenocotis depressa	0.3031	265	Hesthesis plorator	0.3024
218	Cryptodus tasmannianus	0.3031	242	Chaetedus longiceps	0.3031	266	Conoderus basalis	0.3024
219	Eupoecila australasiae	0.3031	243	Sejanus albisignatus	0.3031	267	Brachycaudus rumexicolens	0.3024
220	Liparetrus discipennis	0.3031	244	Sidnia kinbergi	0.3031	268	Hyalopterus pruni	0.3024
221	Onthophagus auritus	0.3031	245	Agonoscelis rutila	0.3031	269	Metopolophium dirhodum	0.3024
222	Onthophagus australis	0.3031	246	Cuspicona simplex	0.3031	270	Euander lacertosus	0.3024

Table 20. SA insect pest top 200 risk list generated from SOM analysis of Australian distributional data. . * Species with the same risk index were ranked in alphabetical order.

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
1	Xylopsocus gibbicollis	0.6528	34	Antigastra catalaunalis	0.5588	67	Penicillaria jocosatrix	0.5579
2	Trialeurodes vaporariorum	0.6528	35	Cnaphalocrocis medinalis	0.5588	68	Bactrocera mendosa	0.5578
3	Xylobosca vidua	0.6058	36	Corcyra cephalonica	0.5588	69	Dacus pallidus	0.5578
4	Micraspis lineola	0.6058	37	Diaphania indica	0.5588	70	Graptostethus diffusus	0.5578
5	Plautia affinis	0.6058	38	Herpetogramma licarsisalis	0.5588	71	Helopeltis pernicialis	0.5578
6	Microcerotermes distinctus	0.6058	39	Omiodes diemenalis	0.5588	72	Microcerotermes boreus	0.5578
7	Aproaerema simplexella	0.6058	40	Spoladea recurvalis	0.5588	73	Leptocneria binotata	0.5578
8	Austracris guttulosa	0.6058	41	Cryptophlebia ombrodelta	0.5588	74	Orgyia papuana	0.5578
9	Graptostethus servus	0.6057	42	Heteropternis obscurella	0.5588	75	Nanaguna breviuscula	0.5578
10	Austroasca merredinensis	0.6049	43	Australothrips bicolor	0.5588	76	Austracris basalis	0.5578
11	Anoplognathus macleayi	0.6048	44	Scirtothrips dorsalis	0.5588	77	Retithrips javanicus	0.5578
12	Acalolepta mixtus	0.5588	45	Selenothrips rubrocinctus	0.5588	78	Xylodeleis obsipa	0.4422
13	Apomecyna histrio	0.5588	46	Thrips florum	0.5588	79	Uracanthus bivitta	0.4422
14	Zygrita diva	0.5588	47	Thrips parvispinus	0.5588	80	Rhyzobius ventralis	0.4422
15	Aulacophora abdominalis	0.5588	48	Platyomopsis pedicornis	0.5587	81	Liriomyza brassicae	0.4422
16	Oulema rufotincta	0.5588	49	Rhyparida didyma	0.5587	82	Dysaphis apiifolia	0.4422
17	Harmonia octomaculata	0.5588	50	Hemipharis insularis	0.5587	83	Limotettix incertus	0.4422
18	Carpophilus mutilatus	0.5588	51	Lepidiota delicatula	0.5587	84	Sejanus albisignatus	0.4422
19	Dialeuropora decempuncta	0.5588	52	Lepidiota perkinsi	0.5587	85	Sidnia kinbergi	0.4422
20	Amrasca terraereginae	0.5588	53	Bactrocera decurtans	0.5587	86	Agrotis porphyricollis	0.4422
21	Austroasca alfalfae	0.5588	54	Lipaleyrodes euphorbiae	0.5587	87	Anaphothrips obscurus	0.4422
22	Balclutha incisa	0.5588	55	Acroelytrum muricatum	0.5587	88	Parthenothrips dracaenae	0.4422
23	Eysarcoris trimaculatus	0.5588	56	Amblypelta lutescens	0.5587	89	Tenothrips frici	0.4422
24	Anomis flava	0.5588	57	Campylomma austrinum	0.5587	90	Brachycaudus rumexicolens	0.4421
25	Helicoverpa assulta	0.5588	58	Oncocoris coelebs	0.5587	91	Ovatus crataegarius	0.4413
26	Mocis alterna	0.5588	59	Microcerotermes nervosus	0.5587	92	Rhodobium porosum	0.4413
27	Mocis frugalis	0.5588	60	Cryptoblabes adoceta	0.5587	93	Anaphothrips varii	0.4413
28	Ophiusa coronata	0.5588	61	Scirpophaga innotata	0.5587	94	Rhopalosiphoninus staphyleae	0.4412
29	Ophiusa tirhaca	0.5588	62	Stenocatantops angustifrons	0.5587	95	Smynthurodes betae	0.4412
30	Pericyma cruegeri	0.5588	63	Stenocatantops vitripennis	0.5587	96	Phoracantha frenchi	0.3952
31	Spodoptera exempta	0.5588	64	Teleogryllus oceanicus	0.5587	97	Adalia bipunctata	0.3952
32	Spodoptera litura	0.5588	65	Dendrothripoides innoxius	0.5587	98	Carpophilus davidsoni	0.3952
33	Spodoptera mauritia	0.5588	66	Thrips unispinus	0.5587	99	Glycyphana stolata	0.3952

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Table 20 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
100	Orosius canberrensis	0.3952	133	Coccus viridis	0.3482	166	Xenaleyrodes eucalypti	0.3473
101	Trocnada dorsigera	0.3952	134	Pulvinaria psidii	0.3482	167	Tinocallis ulmiparvifoliae	0.3473
102	Schedorhinotermes reticulatus	0.3952	135	Pulvinaria urbicola	0.3482	168	Cardiaspina fiscella	0.3473
103	Faveria tritalis	0.3952	136	Ardozyga stratifera	0.3482	169	Acrocercops plebeia	0.3473
104	Hygraula nitens	0.3952	137	Helicoverpa prepodes	0.3482	170	Anomis sabulifera	0.3473
105	Cryptoptila immersana	0.3952	138	Calamotropha leptogrammellu	0.3482	171	Eublemma amoena	0.3473
106	Epiphyas xylodes	0.3952	139	Ostrinia furnacalis	0.3482	172	Lamprothrips miltoni	0.3473
107	Andrewarthaia kellyana	0.3952	140	Epiphyas sobrina	0.3482	173	Leucothrips nigripennis	0.3473
108	Desmothrips obsoletus	0.3952	141	Valanga irregularis	0.3482	174	Xylopsocus rubidus	0.3472
109	Arorathrips mexicanus	0.3952	142	Gryllodes supplicans	0.3482	175	Atesta patula	0.3472
110	Hercinothrips bicinctus	0.3952	143	Franklinothrips variegatus	0.3482	176	Atesta sita	0.3472
111	Anomala antiqua	0.3951	144	Thrips safrus	0.3482	177	Pachydissus boops	0.3472
112	Essigella californica	0.3951	145	Algarobius prosopis	0.3481	178	Phoracantha odewahni	0.3472
113	Batracomorphus angustatus	0.3943	146	Gonocephalum walkeri	0.3481	179	Phoracantha punctipennis	0.3472
114	Neumichtis nigerrima	0.3943	147	Cicadulina bimaculata	0.3481	180	Sceleocantha pilosicollis	0.3472
115	Chrysophtharta nobilitata	0.3942	148	Saissetia miranda	0.3481	181	Algarobius bottimeri	0.3472
116	Carpophilus frivolus	0.3942	149	Oncocoris hackeri	0.3481	182	Aporocera bynoei	0.3472
117	Heteronyx pustulosus	0.3942	150	Ctenarytaina longicauda	0.3481	183	Cadmus breweri	0.3472
118	Tetraneura nigriabdominalis	0.3942	151	Heterotermes paradoxus	0.3481	184	Cadmus nothus	0.3472
119	Anacephaleus minutus	0.3942	152	Agrotis emboloma	0.3481	185	Chrysophtharta mentatrix	0.3472
120	Cardiaspina squamula	0.3942	153	Agrotis poliotis	0.3481	186	Monolepta haemorrhoidalis	0.3472
121	Xylothrips religiosus	0.3482	154	Bermiella acuta	0.3481	187	Paropsis yilgarnensis	0.3472
122	Tryphocaria acanthrophora	0.3482	155	Craspedothrips minor	0.3481	188	Paropsisterna picta	0.3472
123	Paropsis geographica	0.3482	156	Dendrothrips diaspora	0.3481	189	Penthobruchus germanini	0.3472
124	Trachymela tincticollis	0.3482	157	Hercinothrips femoralis	0.3481	190	Rhyparida alcyone	0.3472
125	Halmus chalybeus	0.3482	158	Hydatothrips haschemi	0.3481	191	Rhyparida vittata	0.3472
126	Dilochrosis atripennis	0.3482	159	Megalurothrips typicus	0.3481	192	Terrillus suturalis	0.3472
127	Ophiomyia lantanae	0.3482	160	Neohydatothrips samayunkur	0.3481	193	Chilocorus bipustulatus	0.3472
128	Dumbletoniella eucalypti	0.3482	161	Panchaetothrips timonii	0.3481	194	Macroura deceptor	0.3472
129	Orchamoplatus mammaeferus	0.3482	162	Rhamphothrips pandens	0.3481	195	Colymbomorpha lineata	0.3472
130	Austrogallia torrida	0.3482	163	Scirtothrips australiae	0.3481	196	Diphucephala edwardsii	0.3472
131	Balclutha viridinervis	0.3482	164	Stenchaetothrips biformis	0.3481	197	Heteronyx exectus	0.3472
132	Ceroplastes ceriferus	0.3482	165	Phoracantha impavida	0.3473	198	Heteronyx proxima	0.3472

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Table 20 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
199	Lepidiota alticalceus	0.3472	232	Gilippsus hostilis	0.3472	265	Desmothrips marilynae	0.3472
200	Lepidiota amitina	0.3472	233	Oncocoris ovalis	0.3472	266	Desmothrips mendozai	0.3472
201	Lepidiota gilesi	0.3472	234	Tectocoris diophthalmus	0.3472	267	Dorythrips jenkinsi	0.3472
202	Liparetrus jenkinsi	0.3472	235	Blastopsylla nigricollaris	0.3472	268	Liothrips atratus	0.3472
203	Liparetrus similis	0.3472	236	Blastopsylla occidentalis	0.3472	269	Rhipidothrips brunneus	0.3472
204	Gonocephalum elderi	0.3472	237	Cardiaspina jerramungae	0.3472	270	Anaphothrips newmani	0.3472
205	Delia platura	0.3472	238	Cardiaspina tetragonae	0.3472	271	Anaphothrips occidentalis	0.3472
206	Hylemya urbana	0.3472	239	Cardiaspina tetrodontae	0.3472	272	Anascirtothrips arorai	0.3472
207	Phytoliriomyza pittosporphylli	0.3472	240	Creiis periculosus	0.3472	273	Caliothrips graminicola	0.3472
208	Aleurotrachelus dryandrae	0.3472	241	Coptotermes michaelseni	0.3472	274	Cerathrips frici	0.3472
209	Dialeurodes dryandrae	0.3472	242	Neotermes insularis	0.3472	275	Frankliniella lantanae	0.3472
210	Synaleurodicus hakeae	0.3472	243	Xerometra crocina	0.3472	276	Hercothrips bifasciipennis	0.3472
211	Synaleurodicus serratus	0.3472	244	Teia athlophora	0.3472	277	Isochaetothrips ignobilis	0.3472
212	Tetraleurodes pluto	0.3472	245	Agrotis poliophaea	0.3472	278	Isochaetothrips uniformis	0.3472
213	Apomatalis rufictus	0.3472	246	Anomis planalis	0.3472	279	Karphothrips dugdalei	0.3472
214	Ceriferella dossuaria	0.3472	247	Chlorodea obsoleta	0.3472	280	Odontothripiella bispinosa	0.3472
215	Dysaphis lappae	0.3472	248	Earias luteolaria	0.3472	281	Odontothripiella magna	0.3472
216	Meringosiphon paradisicum	0.3472	249	Helicoverpa hardwicki	0.3472	282	Odontothripiella moundi	0.3472
217	Reticulaphis distylii	0.3472	250	Apomyelois ceratoniae	0.3472	283	Odontothripiella unidentata	0.3472
218	Rhopalosiphum conni	0.3472	251	Cadra elutella	0.3472	284	Pseudodendrothrips mori	0.3472
219	Rhopalosiphum rufomaculata	0.3472	252	Niphadoses palleucus	0.3472	285	Rhamphiskothrips rhipistos	0.3472
220	Sitobion ragariae	0.3472	253	Arotrophora diadela	0.3472	286	Scirtothrips astibos	0.3472
221	Austroasca bancrofti	0.3472	254	Cryptophlebia gilva	0.3472	287	Scirtothrips eremicus	0.3472
222	Austroasca terraereginae	0.3472	255	Epiphyas liadelpha	0.3472	288	Scirtothrips moneres	0.3472
223	Stogatella furcifera	0.3472	256	Epiphyas pulla	0.3472	289	Scirtothrips pilbara	0.3472
224	Alecanopsis mirus	0.3472	257	Peraglyphis idiogenes	0.3472	290	Scirtothrips quadriseta	0.3472
225	Ceronema dryandrae	0.3472	258	Phaulacridium crassum	0.3472	291	Scirtothrips solus	0.3472
226	Coccus synapheae	0.3472	259	Aritella leengila	0.3472	292	Thrips seticollis	0.3472
227	Odonaspis ruthae	0.3472	260	Madsumma planiceps	0.3472	293	Thrips subnudula	0.3472
228	Leptocorisa acuta	0.3472	261	Gryllotalpa pluvialis	0.3472	294	Acanthoscelides obtectus	0.3056
229	Leptoglossus bidentatus	0.3472	262	Cranothrips kartus	0.3472	295	Altica ignea	0.3056
230	Campylomma kununurraensis	0.3472	263	Cranothrips ravidus	0.3472			
231	Nesidiocoris tenuis	0.3472	264	Cycadothrips emmaliami	0.3472			

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Table 21. WA insect pest top 200 risk list generated from SOM analysis of Australian distributional data. . * Species with the same risk index were ranked in alphabetical order.

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
1	Altica cyanea	0.6528	34	Neagenor spinosus	0.5588	67	Bethelium signiferum	0.4422
2	Diomus notescens	0.6528	35	Phyllocnistis citrella	0.5588	68	Earinis mimula	0.4422
3	Dermestes ater	0.6528	36	Donuca orbigera	0.5588	69	Epithora dorsalis	0.4422
4	Heteronyx australis	0.6528	37	Eudocima salaminia	0.5588	70	Hesthesis cingulata	0.4422
5	Cydia pomonella	0.6528	38	Pandesma submurina	0.5588	71	Phacodes obscurus	0.4422
6	Carpophilus maculatus	0.6527	39	Pycnostictus seriatus	0.5588	72	Phoracantha mastersi	0.4422
7	Lyctus brunneus	0.6519	40	Sphingonotus erythropterus	0.5588	73	Phoracantha punctata	0.4422
8	Dinoderus minutus	0.6058	41	Chaetanaphothrips signipennis	0.5588	74	Syllitus grammicus	0.4422
9	Minthea rugicollis	0.6058	42	Chirothrips atricorpus	0.5588	75	Syllitus rectus	0.4422
10	Sinoxylon anale	0.6058	43	Colpochila deceptor	0.5587	76	Tessaromma undatum	0.4422
11	Tristaria grouvellei	0.6058	44	Lepidiota rothei	0.5587	77	Xystrocera virescens	0.4422
12	Chlorobapta frontalis	0.6058	45	Onthophagus symbioticus	0.5587	78	Zygocera lugubris	0.4422
13	Metanastes vulgivagus	0.6058	46	Bactrocera frauenfeldi	0.5587	79	Brachycaulus ferrugineus	0.4422
14	Neodon pecuarius	0.6058	47	Bactrocera mayi	0.5587	80	Calomela curtisi	0.4422
15	Onthophagus gazella	0.6058	48	Oncocoris favillaceus	0.5587	81	Calomela maculicollis	0.4422
16	Palorus subdepressus	0.6058	49	Nasutitermes longipennis	0.5587	82	Monolepta divisa	0.4422
17	Bactrocera tryoni	0.6058	50	Agrotis interjectionis	0.5587	83	Paropsisterna morio	0.4422
18	Austroagallia torrida	0.6058	51	Tirathaba rufivena	0.5587	84	Cleobora mellyi	0.4422
19	Melanerythrus mactans	0.6058	52	Ceratitella loranthi	0.5579	85	Micraspis frenata	0.4422
20	Spilostethus hospes	0.6058	53	Minchamia hubbardae	0.5579	86	Parapriasus australasiae	0.4422
21	Neotermes insularis	0.6058	54	Rosenbergia megalocephala	0.5578	87	Dermestes frischii	0.4422
22	Acrida conica	0.6058	55	Anoplostethus roseus	0.5578	88	Agrypnus variabilis	0.4422
23	Ephippitytha trigintiduoguttata	0.6058	56	Apogonia destructor	0.5578	89	Hapatesus hirtus	0.4422
24	Ephestia cautella	0.6049	57	Ischiopsopha yorkiana	0.5578	90	Adoryphorus coulonii	0.4422
25	Acheta domesticus	0.6049	58	Pterohelaeus costatus	0.5578	91	Anoplognathus suturalis	0.4422
26	Heterobostrychus aequalis	0.5588	59	Elasmolomus sordidus	0.5578	92	Anoplognathus velutinus	0.4422
27	Eurynassa australis	0.5588	60	Pseudopachybrachius guttus	0.5578	93	Anoplognathus viriditarsis	0.4422
28	Penthea pardalis	0.5588	61	Syllepte derogata	0.5578	94	Automolius depressus	0.4422
29	Aspidomorpha deusta	0.5588	62	Anobium punctatum	0.4422	95	Cheiroplatys latipes	0.4422
30	Onitis alexis	0.5588	63	Mesoxylion collaris	0.4422	96	Cryptodus tasmannianus	0.4422
31	Onthophagus consentaneus	0.5588	64	Mesoxylion cylindricus	0.4422	97	Eupoecila australasiae	0.4422
32	Xylotrupes gideon	0.5588	65	Ancita crocogaster	0.4422	98	Liparetrus discipennis	0.4422
33	Caedius sphaeroides	0.5588	66	Ancita marginicollis	0.4422	99	Onthophagus auritus	0.4422

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Table 21 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
100	Onthophagus australis	0.4422	133	Acripeza reticulata	0.4422	166	Onthophagus posticus	0.4412
101	Phyllotocus macleayi	0.4422	134	Hesthesis plorator	0.4421	167	Podotenus victoriae	0.4412
102	Phyllotocus rufipennis	0.4422	135	Conoderus basalis	0.4421	168	Alphitophagus bifasciatus	0.4412
103	Saulostomus villosus	0.4422	136	Hyalopterus pruni	0.4421	169	Myzus cymbalariae	0.4412
104	Scitala sericans	0.4422	137	Metopolophium dirhodum	0.4421	170	Xylothrips flavipes	0.3952
105	Sericesthis nigrolineata	0.4422	138	Euander lacertosus	0.4421	171	Xylotillus lindi	0.3952
106	Telura vitticollis	0.4422	139	Megabregmus australiensis	0.4413	172	Acalolepta argentatus	0.3952
107	Cryptamorpha desjardinsi	0.4422	140	Phoracantha lata	0.4413	173	Ancita australis	0.3952
108	Chalcopteroides columbinus	0.4422	141	Dermestes lardarius	0.4413	174	Aridaeus thoracicus	0.3952
109	Meneristes australis	0.4422	142	Agrypnus caliginosus	0.4413	175	Atesta angasii	0.3952
110	Tenebrio obscurus	0.4422	143	Crepidomenus decoratus	0.4413	176	Coptocercus aberrans	0.3952
111	Tephritis poenia	0.4422	144	Elatichrosis trisulcatus	0.4413	177	Coptocercus biguttatus	0.3952
112	Cinara fresai	0.4422	145	Acrossidius tasmaniae	0.4413	178	Corrhenes picta	0.3952
113	Coloradoa rufomaculata	0.4422	146	Anoplognathus rugosus	0.4413	179	Distichocera thomsonella	0.3952
114	Myzocallis castanicola	0.4422	147	Aphodius fimetarius	0.4413	180	Neostenus saudersii	0.3952
115	Neotoxoptera oliveri	0.4422	148	Aphodius granarius	0.4413	181	Obrida fascialis	0.3952
116	Stenocotis depressa	0.4422	149	Diphucephala colaspidoides	0.4413	182	Oebarina ceresioides	0.3952
117	Chaetedus longiceps	0.4422	150	Adelium similatum	0.4413	183	Pachydissus sericus	0.3952
118	Agonoscelis rutila	0.4422	151	Isopteron aversum	0.4413	184	Phoracantha tricuspis	0.3952
119	Cuspicona simplex	0.4422	152	Promethis angulata	0.4413	185	Rhagiomorpha lepturoides	0.3952
120	Notius depressus	0.4422	153	Saragus costatus	0.4413	186	Strongylurus cretifer	0.3952
121	Creiis corniculatus	0.4422	154	Myzus cerasi	0.4413	187	Tragocerus spencei	0.3952
122	Bifiditermes improbus	0.4422	155	Pulvinaria hydrangeae	0.4413	188	Uracanthus acutus	0.3952
123	Porotermes adamsoni	0.4422	156	Dictyotus conspicuus	0.4413	189	Altica corusca	0.3952
124	Teia anartoides	0.4422	157	Bathytricha truncata	0.4413	190	Altica gravida	0.3952
125	Dasypodia selenophora	0.4422	158	Dasygaster padockina	0.4413	191	Arsipoda chrysis	0.3952
126	Ephestia elutella	0.4422	159	Diarsia intermixta	0.4413	192	Augomela hypochalcea	0.3952
127	Hednota relatalis	0.4422	160	Eutrichopidia latinus	0.4413	193	Calomela ioptera	0.3952
128	Pyralis farinalis	0.4422	161	Neumichtis saliaris	0.4413	194	Cassida mera	0.3952
129	Acropolitis rudisana	0.4422	162	Phalaenoides tristifica	0.4413	195	Ditropidus concolor	0.3952
130	Grapholita molesta	0.4422	163	Ancita sparsa	0.4412	196	Lamprolina aeneipennis	0.3952
131	Oedaleus australis	0.4422	164	Stenoderus suturalis	0.4412	197	Paropsisterna beata	0.3952
132	Schizobothrus flavovittatus	0.4422	165	Conoderus australasiae	0.4412	198	Paropsisterna nigerrima	0.3952

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Table 21 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
199	Phyllotreta undulata	0.3952	232	Ecnolagria grandis	0.3952	265	Comocrus behri	0.3952
200	Attagenus unicolor	0.3952	233	Gnatocerus cornutus	0.3952	266	Cruria donowani	0.3952
201	Dermestes haemorrhoidalis	0.3952	234	Gonocephalum misellum	0.3952	267	Heliothis punctifera	0.3952
202	Anilicus xanthomus	0.3952	235	Promethis nigra	0.3952	268	Mataeomera dubia	0.3952
203	Dicteniophorus ramifer	0.3952	236	Prophanes simplex	0.3952	269	Pantydia sparsa	0.3952
204	Lingana illita	0.3952	237	Pterohelaeus guerini	0.3952	270	Cactoblastis cactorum	0.3952
205	Pseudotetralobus australasiae	0.3952	238	Pterohelaeus piceus	0.3952	271	Meyriccia latro	0.3952
206	Epuraea imperialis	0.3952	239	Pterohelaeus striatopunctatus	0.3952	272	Musotima ochropteralis	0.3952
207	Anoplognathus chloropyrus	0.3952	240	Bactrocera cacuminata	0.3952	273	Salma pyrastis	0.3952
208	Anoplognathus hirsutus	0.3952	241	Bactrocera musae	0.3952	274	Holocola triangulana	0.3952
209	Anoplognathus montanus	0.3952	242	Bactrocera neohumeralis	0.3952	275	Cryptobothrus chrysophorus	0.3952
210	Anoplognathus pallidicollis	0.3952	243	Dacus absonifacies	0.3952	276	Goniaea australasiae	0.3952
211	Anoplognathus porosus	0.3952	244	Spathulina acroleuca	0.3952	277	Lepidogryllus parvulus	0.3952
212	Colpochila obesa	0.3952	245	Trupanea glauca	0.3952	278	Lyctus linearis	0.3951
213	Colpochila punctulata	0.3952	246	Cinara juniperi	0.3952	279	Lyctus planicollis	0.3951
214	Cryptodus paradoxus	0.3952	247	Edwardsiana froggatti	0.3952	280	Piesarthrius laminosus	0.3951
215	Dasygnathus trituberculatus	0.3952	248	Pulvinaria mesembryanthemi	0.3952	281	Proagapete carissima	0.3951
216	Diaphonia dorsalis	0.3952	249	Amorbus rubiginosus	0.3952	282	Altica pagana	0.3951
217	Heteronyx aequalis	0.3952	250	Anaxilaus vesiculosus	0.3952	283	Lanelater mastersii	0.3951
218	Liparetrus ater	0.3952	251	Biprorulus bibax	0.3952	284	Antitrogus burmeisteri	0.3951
219	Liparetrus fulvohirtus	0.3952	252	Dictyotus inconspicuus	0.3952	285	Heteronyx piceus	0.3951
220	Onthophagus binodis	0.3952	253	Dictyotus roei	0.3952	286	Pimelopus nothus	0.3951
221	Onthophagus pentacanthus	0.3952	254	Diemenia rubromarginata	0.3952	287	Helea squamosa	0.3951
222	Phyllotocus australis	0.3952	255	Paramenestheus terricolor	0.3952	288	Nocar depressiusculus	0.3951
223	Phyllotocus kingii	0.3952	256	Poecilometis apicalis	0.3952	289	Palorus ratzeburgi	0.3951
224	Repsimus aeneus	0.3952	257	Poecilometis australasiae	0.3952	290	Hednota grammellus	0.3951
225	Rhopaea heterodactyla	0.3952	258	Poecilometis strigatus	0.3952	291	Nacoleia rhoeoalis	0.3951
226	Semanopterus solidus	0.3952	259	Tholosanus proximus	0.3952	292	Spectrotrota fimbrialis	0.3951
227	Semanopterus subcostatus	0.3952	260	Coptotermes lacteus	0.3952	293	Palaeotoma styphelana	0.3951
228	Sericesthis geminata	0.3952	261	Nasutitermes fumigatus	0.3952	294	Anaphothrips cecili	0.3951
229	Sericesthis harti	0.3952	262	Stolotermes victoriensis	0.3952	295	Odontothripiella compta	0.3951
230	Sericesthis suturalis	0.3952	263	Aedia leucomelas	0.3952	296	Thrips nigropilosus	0.3951
231	Adelium angulicolle	0.3952	264	Chasmina pulchra	0.3952			

Table 22. NSW fungal pathogens top 200 risk list generated from SOM analysis of Australian distributional data. . * Species with the same risk index were ranked in alphabetical order.

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
1	Monilinia fructicola	0.1971	34	Cercospora nasturtii	0.1881	67	Laetisaria fuciformis	0.1881
2	Monilinia laxa	0.1971	35	Cercospora solanacea	0.1881	68	Lembosiopsis australiensis	0.1881
3	Penicillium digitatum	0.1971	36	Cercospora zonata	0.1881	69	Leptostroma acaciae	0.1881
4	Penicillium expansum	0.1971	37	Chondrostereum purpureum	0.1881	70	Macrohyporia dictyopora	0.1881
5	Sclerotinia sclerotiorum	0.1971	38	Cintractia distichlidis	0.1881	71	Massarina microcarpa	0.1881
6	Uromyces scaevolae	0.1971	39	Cladosporium epiphyllum	0.1881	72	Moreaua muelleriana	0.1881
7	Cercosporella pastinacae	0.197	40	Claviceps phalaridis	0.1881	73	Mycosphaerella cerasella	0.1881
8	Cintractia spinificis	0.197	41	Coccodiella banksiae	0.1881	74	Mycosphaerella recutita	0.1881
9	Coma circularis	0.197	42	Coniothyrium acaciae	0.1881	75	Mycosphaerella swartii	0.1881
10	Erysiphe alphitoides	0.197	43	Coryneum microstictum	0.1881	76	Ophiodothella longispora	0.1881
11	Ovulinia azaleae	0.197	44	Curvularia robusta	0.1881	77	Ovularia obliqua	0.1881
12	Peronospora farinosa	0.197	45	Curvularia senegalensis	0.1881	78	Passalora clematidis	0.1881
13	Phoma exigua	0.197	46	Cylindrocladiella parva	0.1881	79	Peronospora knautiae	0.1881
14	Pseudopeziza medicaginis	0.197	47	Diplodia destruens	0.1881	80	Peronospora rumicis	0.1881
15	Pseudopeziza trifolii	0.197	48	Diplodia phyllodiorum	0.1881	81	Phaeoacremonium parasiticum	0.1881
16	Sclerotinia minor	0.197	49	Diplodina gaubae	0.1881	82	Phellinus gilvus	0.1881
17	Uromycladium simplex	0.197	50	Drepanopeziza sphaerioides	0.1881	83	Phellinus robustus	0.1881
18	Armillaria luteobubalina	0.1882	51	Elsinoe eucalypti	0.1881	84	Phellinus setulosus	0.1881
19	Macrophomina phaseolina	0.1882	52	Elsinoe leucospermi	0.1881	85	Phoma narcissi	0.1881
20	Rhizopus stolonifer	0.1882	53	Embellisia chlamydospora	0.1881	86	Phomopsis asparagi	0.1881
21	Schizophyllum commune	0.1882	54	Erysiphe biocellata	0.1881	87	Phyllachora schoenicola	0.1881
22	Abortiporus biennis	0.1881	55	Erysiphe izuensis	0.1881	88	Phyllachora callistemonis subsp. langdonii	0.1881
23	Aecidium disseminatum	0.1881	56	Eurotium herbariorum	0.1881	89	Phyllosticta phyllodiorum	0.1881
24	Aecidium oleariae	0.1881	57	Fusarium anthophilum	0.1881	90	Podosphaera aphanis	0.1881
25	Alternaria dichondrae	0.1881	58	Fusicladium pyrorum	0.1881	91	Podosporiella verticillata	0.1881
26	Apiospora montagnei	0.1881	59	Ganoderma applanatum	0.1881	92	Protostegia eucalypti	0.1881
27	Arthrinium phaeospermum	0.1881	60	Gloeosporium acaciae	0.1881	93	Pseudopeziza eucalypti	0.1881
28	Ascochyta corticola	0.1881	61	Gloeotinia granigena	0.1881	94	Pteroconium pterospermum	0.1881
29	Ascochyta syringae	0.1881	62	Golovinomyces orontii	0.1881	95	Puccinia asparagi	0.1881
30	Banksiamyces toomansis	0.1881	63	Harknessia fumaginea	0.1881	96	Puccinia brachycomes	0.1881
31	Camarosporium atriplicis	0.1881	64	Harknessia uromycoides	0.1881	97	Puccinia calcitrapae	0.1881
32	Ceratocystis paradoxa	0.1881	65	Isothea rhytismoides	0.1881	98	Puccinia epilobii-tetragoni	0.1881
33	Ceratocystis ips	0.1881	66	Laetiporus portentosus	0.1881	99	Puccinia hibbertiae	0.1881

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Table 22 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
100	Puccinia hypochaeridis	0.1881	127	Stromatinia gladioli	0.1881	154	Moreaua lepidospermatis	0.1792
101	Puccinia morrisonii	0.1881	128	Suttoniella gaubae	0.1881	155	Phytophthora inundata	0.1792
102	Puccinia muhlenbeckiae	0.1881	129	Tandonella oleariae	0.1881	156	Puccinia longispora	0.1792
103	Puccinia operculariae	0.1881	130	Tilletia ehrhartae	0.1881	157	Pycnoporus cinnabarinus	0.1792
104	Puccinia punctiformis	0.1881	131	Uromyces betae	0.1881	158	Pyrenochaeta lycopersici	0.1792
105	Puccinia subnitens	0.1881	132	Uromyces trifolii	0.1881	159	Pyrenopeziza brassicae	0.1792
106	Puccinia tepperi	0.1881	133	Uromycladium robinsonii	0.1881	160	Pyrenophora chaetomioides	0.1792
107	Puccinia tetragoniae	0.1881	134	Ustilago tepperi	0.1881	161	Schizopora paradoxa	0.1792
108	Puccinia thuemenii	0.1881	135	Vermisporium eucalypti	0.1881	162	Sclerotinia trifoliorum	0.1792
109	Puccinia violae	0.1881	136	Verticillium albo-atrum	0.1881	163	Septoria antirrhini	0.1792
110	Puccinia vittadiniae	0.1881	137	Thelephora terrestris	0.1793	164	Septoria martiniae	0.1792
111	Puccinia xanthosiae	0.1881	138	Acremonium recifei	0.1792	165	Serpula lacrymans	0.1792
112	Pycnoporus coccineus	0.1881	139	Aecidium soleniiforme	0.1792	166	Sphaeropsis sapinea	0.1792
113	Pyrenochaeta terrestris	0.1881	140	Armillaria fumosa	0.1792	167	Sphaerotheca fusca	0.1792
114	Pyrenophora lolii	0.1881	141	Armillaria hinnulea	0.1792	168	Sphaerotheca pannosa	0.1792
115	Pythium mastophorum	0.1881	142	Armillaria novae-zelandiae	0.1792	169	Thaptospora atrobrunnea	0.1792
116	Sclerotinia homoeocarpa	0.1881	143	Athelia fuciformis	0.1792	170	Thielaviopsis basicola	0.1792
117	Seimatosporium eucalypti	0.1881	144	Botryotinia fuckeliana	0.1792	171	Tilletia inolens	0.1792
118	Septoria chrysanthemella	0.1881	145	Chalara australis	0.1792	172	Uredo bossiaeae	0.1792
119	Septoria ixodiae	0.1881	146	Davidiella macrospora	0.1792	173	Uromyces asperulae	0.1792
120	Septoria lepidii	0.1881	147	Ganoderma australe	0.1792	174	Uromyces caryophyllinus	0.1792
121	Septoria martiniana	0.1881	148	Gelasinospora retispora	0.1792	175	Uromyces minor	0.1792
122	Septoria nodorum	0.1881	149	Gongronella butleri	0.1792	176	Uromyces otakou	0.1792
123	Septoria phyllodiorum	0.1881	150	Harknessia eucalypti	0.1792	177	Uromycladium bisporum	0.1792
124	Septoria socia	0.1881	151	Leptosphaeria maculans	0.1792	178	Verticillium lecanii	0.1792
125	Sporisorium destruens	0.1881	152	Meliola oleariae	0.1792	179	Wojnowicia hirta	0.1792
126	Stagonospora elegans	0.1881	153	Microsphaeropsis hellebori	0.1792			

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Table 23. VIC fungal pathogens top 200 risk list generated from SOM analysis of Australian distributional data. . * Species with the same risk index were ranked in alphabetical order.

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
1	Glomerella cingulata	0.3119	34	Paraphaeosphaeria michotii	0.3088	67	Lophodermium arundinaceum	0.3071
2	Alternaria citri	0.3109	35	Periconia circinata	0.3088	68	Oculimacula yallundae	0.3071
3	Alternaria cucumerina	0.3109	36	Phyllosticta confusa	0.3088	69	Phaeosphaeria herpotrichoides	0.3071
4	Cochliobolus sativus	0.3109	37	Puccinia bassiae	0.3088	70	Phloeospora crescentium	0.3071
5	Cochliobolus spicifer	0.3109	38	Puccinia calotidis	0.3088	71	Phloeospora myopori	0.3071
6	Colletotrichum orbiculare	0.3109	39	Puccinia semibarbatae	0.3088	72	Phomachora eucalypti	0.3071
7	Pseudoperonospora cubensis	0.3109	40	Puccinia versicolor	0.3088	73	Phomopsis prunorum	0.3071
8	Pythium aphanidermatum	0.3109	41	Pythium acanthicum	0.3088	74	Phyllosticta syringae	0.3071
9	Pythium splendens	0.3109	42	Pythium dissotocum	0.3088	75	Phytophthora syringae	0.3071
10	Pythium vexans	0.3109	43	Septoria lobeliae	0.3088	76	Plasmopara halstedii	0.3071
11	Botryotinia draytonii	0.3098	44	Tetraploa aristata	0.3088	77	Puccinia arthrocnemi	0.3071
12	Cyclaneusma minus	0.3098	45	Ustilago altilis	0.3088	78	Puccinia brachypodii var. poae-nemoralis	0.3071
13	Gibberella zeae	0.3098	46	Apiognomonia errabunda	0.3081	79	Puccinia dielsiana	0.3071
14	Leptosphaeria maculans	0.3098	47	Cylindrosporium samuelii	0.3081	80	Pythium rostratum	0.3071
15	Puccinia xanthii	0.3098	48	Davidiella macrospora	0.3081	81	Pythium scleroteichum	0.3071
16	Pythium myriotylum	0.3098	49	Diaporthe woodii	0.3081	82	Rhynchosporium orthosporum	0.3071
17	Sclerophthora macrospora	0.3098	50	Mycosphaerella recutita	0.3081	83	Sphaerodothis danthoniae	0.3071
18	Sphaeropsis sapinea	0.3098	51	Olpidium brassicae	0.3081	84	Sphaeropsis tumefaciens	0.3071
19	Stagonospora curtisii	0.3098	52	Physoderma trifolii	0.3081	85	Spilocaea pomi	0.3071
20	Ustilago hypodytes	0.3098	53	Phytophthora hibernalis	0.3081	86	Sporisorium amphilophis	0.3071
21	Albugo mesembryanthemi	0.3088	54	Pseudoseptoria stomaticola	0.3081	87	Synchytrium aureum	0.3071
22	Ampelomyces quisqualis	0.3088	55	Puccinia muehlenbeckiae	0.3081	88	Tilletia foetida	0.3071
23	Cladosporium brunneoatrum	0.3088	56	Pyrenochaeta terrestris	0.3081	89	Uromyces bulbinicola	0.3071
24	Coniothyrium leprosum	0.3088	57	Pythium paroecandrum	0.3081	90	Uromyces dactylidis	0.3071
25	Deightoniella arundinacea	0.3088	58	Taphrina aurea	0.3081	91	Uromyces microtidis	0.3071
26	Elsinoe rosarum	0.3088	59	Uromyces chenopodii	0.3081	92	Uromyces salsolae	0.3071
27	Erysiphe russellii	0.3088	60	Calonectria kyotensis	0.3071	93	Uromyces scillarum	0.3071
28	Farysia thuemenii	0.3088	61	Ceratobasidium cornigerum	0.3071	94	Wojnowicia graminis	0.3071
29	Hypomyces chrysospermus	0.3088	62	Claviceps nigricans	0.3071	95	Aspergillus niger	0.1573
30	Massarina walkeri	0.3088	63	Curvularia ramosa	0.3071	96	Cochliobolus heterostrophus	0.1573
31	Monilochaetes infuscans	0.3088	64	Drepanopeziza populi-albae	0.3071	97	Colletotrichum capsici	0.1573
32	Mycosphaerella circumscissa	0.3088	65	Hypomyces perniciosus	0.3071	98	Deightoniella torulosa	0.1573
33	Mycosphaerella linicola	0.3088	66	Leucostoma persoonii	0.3071	99	Guignardia citricarpa	0.1573

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Table 23 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
100	Lasiodiplodia theobromae	0.1573	117	Cercospora zinniae	0.1563	134	Puccinia levis	0.1563
101	Phytophthora palmivora	0.1573	118	Clonostachys rosea	0.1563	135	Puccinia purpurea	0.1563
102	Pseudocochliobolus eragrostidis	0.1573	119	Cochliobolus bicolor	0.1563	136	Pythium butleri	0.1563
103	Pseudocochliobolus verruculosus	0.1573	120	Cochliobolus nodulosus	0.1563	137	Pythium spinosum	0.1563
104	Trichoderma harzianum	0.1573	121	Cochliobolus victoriae	0.1563	138	Rosellinia necatrix	0.1563
105	Pythium middletonii	0.1566	122	Colletotrichum crassipes	0.1563	139	Setosphaeria rostrata	0.1563
106	Albugo ipomoeae-panduratae	0.1563	123	Colletotrichum truncatum	0.1563	140	Setosphaeria monoceras	0.1563
107	Alternaria helianthi	0.1563	124	Cordana musae	0.1563	141	Spegazzinia tessarthra	0.1563
108	Annulohypoxylon bovei var. bovei	0.1563	125	Cylindrocladiella camelliae	0.1563	142	Stemonitis herbatica	0.1563
109	Bipolaris curvispora	0.1563	126	Drechslera salviniae	0.1563	143	Trichoderma viride	0.1563
110	Bipolaris incurvata	0.1563	127	Exserohilum longirostratum	0.1563	144	Uromyces fabae	0.1563
111	Bipolaris urochloae	0.1563	128	Helicobasidium brebissonii	0.1563	145	Uromyces setariae-italicae	0.1563
112	Biscogniauxia nummularia	0.1563	129	Lecanicillium lecanii	0.1563	146	Verticillium theobromae	0.1563
113	Botryosphaeria rhodina	0.1563	130	Neocosmospora vasinfecta	0.1563	147	Trametes versicolor	0.1556
114	Ceratocystis paradoxa	0.1563	131	Penicillium italicum	0.1563	148	Ustilago segetum	0.1556
115	Cercospora arachidicola	0.1563	132	Peronospora antirrhini	0.1563			
116	Cercospora canescens	0.1563	133	Puccinia arachidis	0.1563			

Table 24. TAS fungal pathogens top 200 risk list generated from SOM analysis of Australian distributional data. . * Species with the same risk index were ranked in alphabetical order.

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
1	Didymella bryoniae	0.6843	34	Pestalotiopsis mangiferae	0.6315	67	Chondrostereum purpureum	0.359
2	Elsinoe ampelina	0.6843	35	Pycnoporus sanguineus	0.6315	68	Drechslera campanulata	0.359
3	Khuskia oryzae	0.6843	36	Alternaria porri	0.3685	69	Ganoderma applanatum	0.359
4	Leptosphaeria sacchari	0.6843	37	Asterina baileyi	0.3685	70	Gibberella baccata	0.359
5	Puccinia helianthi	0.6843	38	Botrytis allii	0.3685	71	Melampsoridium betulinum	0.359
6	Uromyces dianthi	0.6843	39	Ceratocystis fimbriata	0.3685	72	Phellinus gilvus	0.359
7	Alternaria citri	0.6838	40	Cochliobolus cynodontis	0.3685	73	Phellinus robustus	0.359
8	Alternaria cucumerina	0.6838	41	Colletotrichum coccodes	0.3685	74	Phellinus setulosus	0.359
9	Aspergillus niger	0.6838	42	Coniothyrium olivaceum	0.3685	75	Phoma medicaginis	0.359
10	Cochliobolus spicifer	0.6838	43	Davidiella dianthi	0.3685	76	Pycnoporus coccineus	0.359
11	Pseudoperonospora cubensis	0.6838	44	Erysiphe necator	0.3685	77	Sphaerotheca fuliginea	0.359
12	Pythium aphanidermatum	0.6838	45	Fusarium proliferatum	0.3685	78	Aecidium myopori	0.3585
13	Pythium vexans	0.6838	46	Gibberella fujikuroi	0.3685	79	Curvularia inaequalis	0.3585
14	Thanatephorus cucumeris	0.6747	47	Glomerella graminicola	0.3685	80	Diaporthe woodii	0.3585
15	Cochliobolus hawaiiensis	0.6415	48	Leveillula taurica	0.3685	81	Phytophthora hibernalis	0.3585
16	Cochliobolus lunatus	0.6415	49	Myrothecium roridum	0.3685	82	Pyrenochaeta terrestris	0.3585
17	Fusarium chlamydosporum	0.6415	50	Pestalotiopsis guepinii	0.3685	83	Pythium intermedium	0.3585
18	Moesziomyces bullatus	0.6415	51	Phoma pomorum var. pomorum	0.3685	84	Pythium paroecandrum	0.3585
19	Phakopsora pachyrhizi	0.6415	52	Phomopsis obscurans	0.3685	85	Uromyces chenopodii	0.3585
20	Alternaria padwickii	0.641	53	Phytophthora megasperma	0.3685	86	Alternaria longissima	0.3258
21	Aspergillus flavus	0.641	54	Pleospora herbarum	0.3685	87	Alternaria tenuissima	0.3258
22	Cochliobolus heterostrophus	0.641	55	Podosphaera pannosa	0.3685	88	Alternaria zinniae	0.3258
23	Colletotrichum capsici	0.641	56	Puccinia hieracii var. hieracii	0.3685	89	Botryosphaeria ribis	0.3258
24	Deightoniella torulosa	0.641	57	Pyrenophora tritici-repentis	0.3685	90	Cercospora apii	0.3258
25	Gloeocercospora sorghi	0.641	58	Uromyces transversalis	0.3685	91	Cerotelium fici	0.3258
26	Guignardia citricarpa	0.641	59	Gibberella zeae	0.368	92	Colletotrichum musae	0.3258
27	Lasiodiplodia theobromae	0.641	60	Leptosphaeria maculans	0.368	93	Coniella castaneicola	0.3258
28	Phytophthora palmivora	0.641	61	Penicillium italicum	0.368	94	Corynespora cassiicola	0.3258
29	Pseudocochliobolus eragrostidis	0.641	62	Puccinia xanthii	0.368	95	Epicoccum nigrum	0.3258
30	Pseudocochliobolus verruculosus	0.641	63	Pythium myriotylum	0.368	96	Fusarium anthophilum	0.3258
31	Trichoderma harzianum	0.641	64	Sclerophthora macrospora	0.368	97	Fusarium compactum	0.3258
32	Thelephora terrestris	0.632	65	Sphaeropsis sapinea	0.368	98	Fusarium poae	0.3258
33	Ganoderma lucidum	0.6315	66	Ustilago hypodytes	0.368	99	Fusarium sporotrichioides	0.3258

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Table 24 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
100	Fusarium subglutinans	0.3258	133	Cochliobolus miyabeanus	0.3253	166	Puccinia arachidis	0.3253
101	Gliocladium vermoesenii	0.3258	134	Cochliobolus nodulosus	0.3253	167	Puccinia fuirenicola	0.3253
102	Lewia infectoria	0.3258	135	Cochliobolus perotidis	0.3253	168	Puccinia levis	0.3253
103	Mycosphaerella berkeleyi	0.3258	136	Cochliobolus victoriae	0.3253	169	Puccinia liberta	0.3253
104	Pestalotiopsis palmarum	0.3258	137	Colletotrichum crassipes	0.3253	170	Puccinia nakanishikii	0.3253
105	Pithomyces chartarum	0.3258	138	Colletotrichum truncatum	0.3253	171	Puccinia polysora	0.3253
106	Pseudocochliobolus pallescens	0.3258	139	Coniella musaiaensis	0.3253	172	Puccinia purpurea	0.3253
107	Puccinia oahuensis	0.3258	140	Cordana musae	0.3253	173	Puccinia roseana	0.3253
108	Pythium sulcatum	0.3258	141	Curvularia fallax	0.3253	174	Pythium butleri	0.3253
109	Quambalaria pitereka	0.3258	142	Curvularia intermedia	0.3253	175	Pythium deliense	0.3253
110	Ramularia pitereka	0.3258	143	Cylindrocladiella camelliae	0.3253	176	Pythium spinosum	0.3253
111	Ulocladium atrum	0.3258	144	Daldinia eschscholzii	0.3253	177	Rigidoporus vinctus	0.3253
112	Aecidium crini	0.3253	145	Drechslera salviniae	0.3253	178	Rosellinia necatrix	0.3253
113	Albugo ipomoeae-aquaticae	0.3253	146	Eballistra oryzae	0.3253	179	Setosphaeria rostrata	0.3253
114	Albugo ipomoeae-panduratae	0.3253	147	Exserohilum longirostratum	0.3253	180	Setosphaeria monoceras	0.3253
115	Alternaria helianthi	0.3253	148	Fusarium oxysporum f.sp. niveum	0.3253	181	Sorosporium anthisteriae	0.3253
116	Aspergillus fumigatus	0.3253	149	Helicobasidium brebissonii	0.3253	182	Spegazzinia tessarthra	0.3253
117	Bipolaris curvispora	0.3253	150	Lecanicillium lecanii	0.3253	183	Sphaerophragmium acaciae	0.3253
118	Bipolaris incurvata	0.3253	151	Leucocintractia leucoderma	0.3253	184	Stemonitis herbatica	0.3253
119	Bipolaris sorghicola	0.3253	152	Mycosphaerella cruenta	0.3253	185	Stigmina mangiferae	0.3253
120	Bipolaris urochloae	0.3253	153	Mycosphaerella henningsii	0.3253	186	Trichoderma viride	0.3253
121	Botryosphaeria rhodina	0.3253	154	Nattrassia mangiferae	0.3253	187	Uromyces clignyi	0.3253
122	Calonectria quinqueseptata	0.3253	155	Neocosmospora vasinfecta	0.3253	188	Uromyces dactyloctenii	0.3253
123	Ceratiomyxa fruticulosa	0.3253	156	Ophiodothella syzygii	0.3253	189	Uromyces fabae	0.3253
124	Ceratocystis paradoxa	0.3253	157	Pericladium grewiae	0.3253	190	Uromyces orientalis	0.3253
125	Cercospora arachidicola	0.3253	158	Peronosclerospora maydis	0.3253	191	Uromyces setariae-italicae	0.3253
126	Cercospora canescens	0.3253	159	Pestalotiopsis theae	0.3253	192	Ustilago porosa	0.3253
127	Cercospora sorghi	0.3253	160	Phakopsora gossypii	0.3253	193	Verticillium theobromae	0.3253
128	Cercospora taccae	0.3253	161	Phyllachora sacchari	0.3253	194	Acremonium recifei	0.3162
129	Cercospora zinniae	0.3253	162	Phytophthora capsici	0.3253	195	Botryosphaeria stevensii	0.3162
130	Claviceps africana	0.3253	163	Pseudocercospora bradburyae	0.3253	196	Botryotinia fuckeliana	0.3162
131	Clonostachys rosea	0.3253	164	Pseudocercospora fuligena	0.3253	197	Cephaleuros virescens	0.3162
132	Cochliobolus bicolor	0.3253	165	Pseudocercospora stahlii	0.3253	198	Davidiella macrospora	0.3162

Table 24 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
199	Fuligo septica var. septica	0.3162	204	Phytophthora inundata	0.3162	209	Sphaerotheca pannosa	0.3162
200	Ganoderma australe	0.3162	205	Pycnoporus cinnabarinus	0.3162	210	Thielaviopsis basicola	0.3162
201	Gibberella pulicaris	0.3162	206	Schizopora paradoxa	0.3162	211	Verticillium lecanii	0.3162
202	Gongronella butleri	0.3162	207	Sordaria fimicola	0.3162	212	Wojnowicia hirta	0.3162
203	Myrothecium verrucaria	0.3162	208	Sphaerotheca fusca	0.3162			

Table 25. QLD fungal pathogens top 200 risk list generated from SOM analysis of Australian distributional data. . * Species with the same risk index were ranked in alphabetical order.

Rank* Species	risk index	Rank* Species	risk index	Rank* Species	risk index
1 Rhizopus stolonifer	0.0934	34 Gibberella avenacea	0.0492	67 Diaporthe woodii	0.047
2 Schizophyllum commune	0.0934	35 Gibberella baccata	0.0492	68 Mycosphaerella recutita	0.047
3 Pythium middletonii	0.0912	36 Heteropatella antirrhini	0.0492	69 Olpidium brassicae	0.047
4 Aecidium eburneum	0.0763	37 Heterotolyposporium piluliforme	0.0492	70 Physoderma trifolii	0.047
5 Bipolaris iridis	0.0763	38 Lophodermium pinastri	0.0492	71 Phytophthora hibernalis	0.047
6 Botrytis tulipae	0.0763	39 Melampsoridium betulinum	0.0492	72 Pseudoseptoria stomaticola	0.047
7 Didymella fabae	0.0763	40 Microdochium panattonianum	0.0492	73 Puccinia muehlenbeckiae	0.047
8 Mycosphaerella pinodes	0.0763	41 Microstroma juglandis	0.0492	74 Pyrenochaeta terrestris	0.047
9 Neonectria radicicola	0.0763	42 Parodiella banksiae	0.0492	75 Pythium paroecandrum	0.047
10 Phomopsis leptostromiformis	0.0763	43 Peronospora grisea	0.0492	76 Taphrina aurea	0.047
11 Pythium echinulatum	0.0763	44 Peronospora polygoni	0.0492	77 Uromyces chenopodii	0.047
12 Pythium mamillatum	0.0763	45 Phoma medicaginis	0.0492	78 Aecidium disciforme	0.0393
13 Rhizoctonia solani	0.0763	46 Phragmidium tuberculatum	0.0492	79 Aecidium oleariae	0.0393
14 Thanatephorus cucumeris	0.0763	47 Physoderma pulposum	0.0492	80 Aecidium plantaginis-variae	0.0393
15 Armillaria luteobubalina	0.0663	48 Phytophthora citricola	0.0492	81 Apiognomonia veneta	0.0393
16 Cylindrocarpon didymum	0.0663	49 Phytophthora erythroseptica	0.0492	82 Botryosphaeria stevensii	0.0393
17 Phoma macrostoma	0.0663	50 Puccinia alyxiae	0.0492	83 Botrytis elliptica	0.0393
18 Spilocaea pyracanthae	0.0663	51 Puccinia boroniae	0.0492	84 Cephaleuros virescens	0.0393
19 Trametes versicolor	0.0641	52 Puccinia dichondrae	0.0492	85 Ceratocystis paradoxa	0.0393
20 Ustilago segetum	0.0641	53 Puccinia pulverulenta	0.0492	86 Chondrostereum purpureum	0.0393
21 Thelephora terrestris	0.0564	54 Rhynchosporium secalis	0.0492	87 Chrysomyxa ledi var. ledi	0.0393
22 Armillaria mellea	0.0542	55 Seimatosporium dilophosporum	0.0492	88 Cladosporium macrocarpum	0.0393
23 Ganoderma lucidum	0.0542	56 Spermospora avenae	0.0492	89 Colletogloeum cryptum	0.0393
24 Pestalotiopsis guepini	0.0542	57 Sphaerotheca fuliginea	0.0492	90 Cylindrocarpon obtusisporum	0.0393
25 Pestalotiopsis mangiferae	0.0542	58 Sphaerotheca mors-uvae	0.0492	91 Drepanopeziza sphaerioides	0.0393
26 Pycnoporus sanguineus	0.0542	59 Uredo rhagodiae	0.0492	92 Entorrhiza casparyana	0.0393
27 Albugo trianthemae	0.0492	60 Uredo scirpi-nodosi	0.0492	93 Fuligo septica var. septica	0.0393
28 Alternaria radicina	0.0492	61 Uromyces danthoniae	0.0492	94 Fusicladium veronicae	0.0393
29 Botrytis fabae	0.0492	62 Uromycladium maritimum	0.0492	95 Ganoderma applanatum	0.0393
30 Colletotrichum circinans	0.0492	63 Wettsteinina phyllodiorum	0.0492	96 Gibberella pulicaris	0.0393
31 Dilophospora alopecuri	0.0492	64 Apiognomonia errabunda	0.047	97 Gloeotinia granigena	0.0393
32 Drechslera campanulata	0.0492	65 Cylindrosporium samuelii	0.047	98 Glomerella miyabeana	0.0393
33 Elsinoe veneta	0.0492	66 Davidiella macrospora	0.047	99 Heteropatella valtellinensis	0.0393

Table 25 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
100	Itersonilia perplexans	0.0393	133	Puccinia thuemenii	0.0393	166	Mastigosporium rubricosum	0.037
101	Meliola pomaderridis	0.0393	134	Pycnoporus coccineus	0.0393	167	Meliola cyathodis	0.037
102	Monographella nivalis var. nivalis	0.0393	135	Ramularia rhabdospora	0.0393	168	Microstroma album	0.037
103	Moreaua muelleriana	0.0393	136	Septoria nodorum	0.0393	169	Phallus indusiata	0.037
104	Mycosphaerella ribis	0.0393	137	Sordaria fimicola	0.0393	170	Phoma nebulosa	0.037
105	Mycosphaerella swartii	0.0393	138	Sphaceloma populi	0.0393	171	Phyllachora pomigena	0.037
106	Mycosphaerella walkeri	0.0393	139	Synchytrium taraxaci	0.0393	172	Puccinia plagianthi	0.037
107	Mycovellosiella fulva	0.0393	140	Uromyces betae	0.0393	173	Pythium afertile	0.037
108	Myriangium pritzelianum	0.0393	141	Uromyces beticola	0.0393	174	Pythium anandrum	0.037
109	Myrothecium verrucaria	0.0393	142	Uromyces trifolii	0.0393	175	Pythium intermedium	0.037
110	Oidium hardenbergiae	0.0393	143	Valsa ambiens	0.0393	176	Ramularia sphaeroidea	0.037
111	Passalora puncta	0.0393	144	Verticillium albo-atrum	0.0393	177	Scirrhia gahniae	0.037
112	Peronospora obovata	0.0393	145	Aecidium monocystis	0.037	178	Septoria pepli	0.037
113	Pestalotia casuarinae	0.0393	146	Aecidium myopori	0.037	179	Septoria silenes	0.037
114	Phaeocryptopus gaeumannii	0.0393	147	Amylostereum areolatum	0.037	180	Sphacelotheca densa	0.037
115	Phellinus gilvus	0.0393	148	Annulohypoxylon hians	0.037	181	Sphacelotheca hydropiperis	0.037
116	Phellinus robustus	0.0393	149	Aphanomyces raphani	0.037	182	Sphaerobolus stellatus	0.037
117	Phellinus setulosus	0.0393	150	Botrytis byssoidea	0.037	183	Stylina disticha	0.037
118	Phragmidium potentillae	0.0393	151	Cercospora kikuchii	0.037	184	Tetramyxa parasitica	0.037
119	Pseudocercospora correae	0.0393	152	Cladosporium sphaerospermum	0.037	185	Thecaphora leptocarpi	0.037
120	Pteroconium pterospermum	0.0393	153	Colletotrichum fuscum	0.037	186	Thielavia terricola	0.037
121	Puccinia arenariae	0.0393	154	Cordyceps robertsii	0.037	187	Tolyposporium juncophilum	0.037
122	Puccinia coprosmae	0.0393	155	Curvularia inaequalis	0.037	188	Ulocladium cucurbitae	0.037
123	Puccinia cyani	0.0393	156	Davidiella carinthiaca	0.037	189	Ustilago hydropiperis	0.037
124	Puccinia geranii-pilosi	0.0393	157	Discohainesia oenotherae	0.037	190	Ustilago utriculosa	0.037
125	Puccinia morrisonii	0.0393	158	Drechslera avenacea	0.037	191	Verticillium cinnabarinum	0.037
126	Puccinia oleariae	0.0393	159	Endothia gyrosa	0.037	192	Acremonium recifei	0.0293
127	Puccinia punctiformis	0.0393	160	Exobasidium japonicum	0.037	193	Aecidium soleniiforme	0.0293
128	Puccinia stylidii	0.0393	161	Fusarium redolens	0.037	194	Armillaria fumosa	0.0293
129	Puccinia subnitens	0.0393	162	Gibberella stilboides	0.037	195	Armillaria hinnulea	0.0293
130	Puccinia tasmanica	0.0393	163	Harzia verrucosa	0.037	196	Armillaria novae-zelandiae	0.0293
131	Puccinia tenuispora	0.0393	164	Itersonilia pastinacea	0.037	197	Athelia fuciformis	0.0293
132	Puccinia tetragoniae	0.0393	165	Leptostromella eucalypti	0.037	198	Botryotinia fuckeliana	0.0293

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Table 25 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
199	Chalara australis	0.0293	211	Pycnoporus cinnabarinus	0.0293	223	Thaptospora atrobrunnea	0.0293
200	Davidiella macrospora	0.0293	212	Pyrenochaeta lycopersici	0.0293	224	Thielaviopsis basicola	0.0293
201	Ganoderma australe	0.0293	213	Pyrenopeziza brassicae	0.0293	225	Tilletia inolens	0.0293
202	Gelasinospora retispora	0.0293	214	Pyrenophora chaetomioides	0.0293	226	Uredo bossiaeae	0.0293
203	Gongronella butleri	0.0293	215	Schizopora paradoxa	0.0293	227	Uromyces asperulae	0.0293
204	Harknessia eucalypti	0.0293	216	Sclerotinia trifoliorum	0.0293	228	Uromyces caryophyllinus	0.0293
205	Leptosphaeria maculans	0.0293	217	Septoria antirrhini	0.0293	229	Uromyces minor	0.0293
206	Meliola oleariae	0.0293	218	Septoria martiniae	0.0293	230	Uromyces otakou	0.0293
207	Microsphaeropsis hellebori	0.0293	219	Serpula lacrymans	0.0293	231	Uromycladium bisporum	0.0293
208	Moreaua lepidospermatis	0.0293	220	Sphaeropsis sapinea	0.0293	232	Verticillium lecanii	0.0293
209	Phytophthora inundata	0.0293	221	Sphaerotheca fusca	0.0293	233	Wojnowicia hirta	0.0293
210	Puccinia longispora	0.0293	222	Sphaerotheca pannosa	0.0293			

Table 26. NT fungal pathogens top 200 risk list generated from SOM analysis of Australian distributional data. . * Species with the same risk index were ranked in alphabetical order.

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
1	Albugo tragopogonis	0.6843	34	Venturia carpophila	0.6843	67	Blumeria graminis	0.3685
2	Alternaria dauci	0.6843	35	Venturia pyrina	0.6843	68	Botrytis allii	0.3685
3	Botryosphaeria obtusa	0.6843	36	Monilinia fructicola	0.6842	69	Ceratocystis fimbriata	0.3685
4	Botrytis cinerea	0.6843	37	Monilinia laxa	0.6842	70	Cercospora beticola	0.3685
5	Ceratocoma jacksoniae	0.6843	38	Penicillium digitatum	0.6842	71	Cercospora carotae	0.3685
6	Cladosporium herbarum	0.6843	39	Penicillium expansum	0.6842	72	Cladosporium iridis	0.3685
7	Claviceps purpurea	0.6843	40	Sclerotinia sclerotiorum	0.6842	73	Cochliobolus cynodontis	0.3685
8	Diplocarpon mespili	0.6843	41	Uromyces scaevolae	0.6842	74	Colletotrichum coccodes	0.3685
9	Gaeumannomyces graminis var. graminis	0.6843	42	Cochliobolus sativus	0.6838	75	Colletotrichum lindemuthianum	0.3685
10	Hyaloperonospora parasitica	0.6843	43	Colletotrichum orbiculare	0.6838	76	Colletotrichum trifolii	0.3685
11	Kuehneola uredinis	0.6843	44	Pythium splendens	0.6838	77	Coniothyrium olivaceum	0.3685
12	Leptosphaerulina trifolii	0.6843	45	Aecidium eburneum	0.6747	78	Davidiella dianthi	0.3685
13	Mycosphaerella brassicicola	0.6843	46	Armillaria luteobubalina	0.6747	79	Erysiphe euonymi-japonici	0.3685
14	Peronospora trifoliorum	0.6843	47	Bipolaris iridis	0.6747	80	Erysiphe necator	0.3685
15	Phragmidium rubi-idaei	0.6843	48	Botrytis tulipae	0.6747	81	Eutypa lata	0.3685
16	Phragmidium violaceum	0.6843	49	Didymella fabae	0.6747	82	Fulvisporium restifaciens	0.3685
17	Phytophthora citrophthora	0.6843	50	Mycosphaerella pinodes	0.6747	83	Fusarium culmorum	0.3685
18	Phytophthora cryptogea	0.6843	51	Neonectria radicicola	0.6747	84	Gibberella acuminata	0.3685
19	Pleiochaeta setosa	0.6843	52	Phomopsis leptostromiformis	0.6747	85	Lepteutypa cupressi	0.3685
20	Podosphaera leucotricha	0.6843	53	Pythium echinulatum	0.6747	86	Melampsora euphorbiae-gerardianae	0.3685
21	Pseudocercosporella capsellae	0.6843	54	Pythium mamillatum	0.6747	87	Moreaua rodwayi	0.3685
22	Puccinia chrysanthemi	0.6843	55	Trametes versicolor	0.6742	88	Mycosphaerella graminicola	0.3685
23	Puccinia coronata	0.6843	56	Ustilago segetum	0.6742	89	Peronospora arborescens	0.3685
24	Pyrenophora graminea	0.6843	57	Asterina systema-solare	0.6415	90	Peronospora destructor	0.3685
25	Pyrenophora teres	0.6843	58	Neofabraea alba	0.6415	91	Peronospora farinosa	0.3685
26	Pythium debaryanum	0.6843	59	Cylindrocarpon didymum	0.632	92	Peronospora hyoscyami f.sp. tabacina	0.3685
27	Stigmina carpophila	0.6843	60	Phoma macrostoma	0.632	93	Peronospora jaapiana	0.3685
28	Taphrina deformans	0.6843	61	Spilocaea pyracanthae	0.632	94	Peronospora viciae	0.3685
29	Trichothecium roseum	0.6843	62	Armillaria mellea	0.6315	95	Pestalotiopsis guepinii	0.3685
30	Urocystis agropyri	0.6843	63	Alternaria dianthicola	0.3685	96	Phoma exigua	0.3685
31	Uromyces trifolii-repentis	0.6843	64	Ascochyta pisi	0.3685	97	Phoma pomorum var. pomorum	0.3685
32	Ustilago bullata	0.6843	65	Asterina baileyi	0.3685	98	Phragmidium barnardii	0.3685
33	Ustilago tritici	0.6843	66	Aulographina eucalypti	0.3685	99	Phytophthora cactorum	0.3685

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Table 26 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
100	Phytophthora infestans	0.3685	133	Uromyces anthyllidis	0.3685	166	Lophodermium pinastri	0.359
101	Phytophthora megasperma	0.3685	134	Uromyces transversalis	0.3685	167	Melampsoridium betulinum	0.359
102	Plasmodiophora brassicae	0.3685	135	Uromycladium notabile	0.3685	168	Microdochium panattonianum	0.359
103	Pleospora herbarum	0.3685	136	Ustilago hordei	0.3685	169	Microstroma juglandis	0.359
104	Podosphaera pannosa	0.3685	137	Ustilago nuda	0.3685	170	Moreaua muelleriana	0.359
105	Pseudopeziza trifolii	0.3685	138	Venturia inaequalis	0.3685	171	Mycosphaerella swartii	0.359
106	Puccinia antirrhini	0.3685	139	Verticillium dahliae	0.3685	172	Parodiella banksiae	0.359
107	Puccinia aucta	0.3685	140	Botryotinia draytonii	0.368	173	Peronospora grisea	0.359
108	Puccinia cacao	0.3685	141	Cyclaneusma minus	0.368	174	Peronospora polygoni	0.359
109	Puccinia distincta	0.3685	142	Gibberella zeae	0.368	175	Phellinus gilvus	0.359
110	Puccinia graminis	0.3685	143	Leptosphaeria maculans	0.368	176	Phellinus setulosus	0.359
111	Puccinia hederaceae	0.3685	144	Penicillium italicum	0.368	177	Phoma medicaginis	0.359
112	Puccinia hieracii var. hieracii	0.3685	145	Sclerophthora macrospora	0.368	178	Phragmidium tuberculatum	0.359
113	Puccinia hordei	0.3685	146	Sphaeropsis sapinea	0.368	179	Physoderma pulposum	0.359
114	Puccinia lagenophorae	0.3685	147	Stagonospora curtisii	0.368	180	Phytophthora citricola	0.359
115	Puccinia ludwigii	0.3685	148	Ustilago hypodytes	0.368	181	Phytophthora erythroseptica	0.359
116	Puccinia magnusiana	0.3685	149	Aecidium oleariae	0.359	182	Pteroconium pterospermum	0.359
117	Puccinia oxalidis	0.3685	150	Albugo trianthemae	0.359	183	Puccinia alyxiae	0.359
118	Puccinia pelargonii-zonalis	0.3685	151	Alternaria radicina	0.359	184	Puccinia boroniae	0.359
119	Puccinia recondita	0.3685	152	Botrytis fabae	0.359	185	Puccinia dichondrae	0.359
120	Puccinia rhei-undulati	0.3685	153	Ceratocystis paradoxa	0.359	186	Puccinia morrisonii	0.359
121	Puccinia saccardoi	0.3685	154	Chondrostereum purpureum	0.359	187	Puccinia pulverulenta	0.359
122	Pucciniastrum epilobii	0.3685	155	Colletotrichum circinans	0.359	188	Puccinia punctiformis	0.359
123	Pyrenophora tritici-repentis	0.3685	156	Dilophospora alopecuri	0.359	189	Puccinia subnitens	0.359
124	Ramularia rubella	0.3685	157	Drechslera campanulata	0.359	190	Puccinia tetragoniae	0.359
125	Sclerotinia minor	0.3685	158	Drepanopeziza sphaerioides	0.359	191	Puccinia thuemenii	0.359
126	Septoria apiicola	0.3685	159	Elsinoe veneta	0.359	192	Pycnoporus coccineus	0.359
127	Septoria dianthi	0.3685	160	Ganoderma applanatum	0.359	193	Rhynchosporium secalis	0.359
128	Septoria lycopersici	0.3685	161	Gibberella avenacea	0.359	194	Seimatosporium dilophosporum	0.359
129	Septoria petroselini	0.3685	162	Gibberella baccata	0.359	195	Septoria nodorum	0.359
130	Septoria pisi	0.3685	163	Gloeotinia granigena	0.359	196	Spermospora avenae	0.359
131	Septoria rubi	0.3685	164	Heteropatella antirrhini	0.359	197	Sphaerotheca mors-uvae	0.359
132	Tilletia caries	0.3685	165	Heterotolyposporium piluliforme	0.359	198	Uredo rhagodiae	0.359

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Table 26 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
199	Uredo scirpi-nodosi	0.359	210	Cylindrosporium samuelii	0.3585	221	Pyrenochaeta terrestris	0.3585
200	Uromyces betae	0.359	211	Davidiella macrospora	0.3585	222	Pythium anandrum	0.3585
201	Uromyces danthoniae	0.359	212	Diaporthe woodii	0.3585	223	Pythium intermedium	0.3585
202	Uromyces trifolii	0.359	213	Exobasidium japonicum	0.3585	224	Sphacelotheca densa	0.3585
203	Uromycladium maritimum	0.359	214	Itersonilia pastinacea	0.3585	225	Sphacelotheca hydropiperis	0.3585
204	Verticillium albo-atrum	0.359	215	Mycosphaerella recutita	0.3585	226	Taphrina aurea	0.3585
205	Wettsteinina phyllodiorum	0.359	216	Olpidium brassicae	0.3585	227	Thecaphora leptocarpi	0.3585
206	Aecidium myopori	0.3585	217	Physoderma trifolii	0.3585	228	Tolyposporium juncophilum	0.3585
207	Amylostereum areolatum	0.3585	218	Phytophthora hibernalis	0.3585	229	Uromyces chenopodii	0.3585
208	Apiognomonia errabunda	0.3585	219	Pseudoseptoria stomaticola	0.3585	230	Ustilago hydropiperis	0.3585
209	Curvularia inaequalis	0.3585	220	Puccinia muehlenbeckiae	0.3585	231	Ustilago utriculosa	0.3585

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Table 27. SA fungal pathogens top 200 risk list generated from SOM analysis of Australian distributional data. . * Species with the same risk index were ranked in alphabetical order.

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
1	Alternaria brassicicola	0.3944	34	Corynespora cassiicola	0.2305	67	Uromyces ehrhartae	0.2305
2	Puccinia horiana	0.3944	35	Daldinia concentrica	0.2305	68	Uromyces orchidearum	0.2305
3	Setosphaeria turcica	0.3944	36	Davidiella tassiana	0.2305	69	Uromycladium alpinum	0.2305
4	Uromyces appendiculatus	0.3944	37	Dothistroma septospora	0.2305	70	Aecidium disciforme	0.2238
5	Asterina systema-solare	0.3125	38	Epicoccum nigrum	0.2305	71	Aecidium plantaginis-variae	0.2238
6	Aureobasidium pullulans	0.3125	39	Fusarium compactum	0.2305	72	Apiognomonia veneta	0.2238
7	Cladosporium cladosporioides	0.3125	40	Fusarium poae	0.2305	73	Botryosphaeria stevensii	0.2238
8	Cochliobolus hawaiiensis	0.3125	41	Fusarium sporotrichioides	0.2305	74	Botrytis elliptica	0.2238
9	Cochliobolus lunatus	0.3125	42	Fusarium subglutinans	0.2305	75	Cephaleuros virescens	0.2238
10	Fusarium chlamydosporum	0.3125	43	Gliocladium vermoesenii	0.2305	76	Chrysomyxa ledi var. ledi	0.2238
11	Moesziomyces bullatus	0.3125	44	Lewia infectoria	0.2305	77	Cladosporium macrocarpum	0.2238
12	Neofabraea alba	0.3125	45	Mycosphaerella berkeleyi	0.2305	78	Colletogloeum cryptum	0.2238
13	Pestalotiopsis versicolor	0.3125	46	Mycosphaerella cryptica	0.2305	79	Cylindrocarpon obtusisporum	0.2238
14	Phakopsora pachyrhizi	0.3125	47	Nectria cinnabarina	0.2305	80	Diplodia phyllodiorum	0.2238
15	Cylindrocarpon didymum	0.3058	48	Pestalotiopsis palmarum	0.2305	81	Entorrhiza casparyana	0.2238
16	Macrophomina phaseolina	0.3058	49	Pithomyces chartarum	0.2305	82	Fuligo septica var. septica	0.2238
17	Phoma macrostoma	0.3058	50	Polystigma phyllodii	0.2305	83	Fusarium anthophilum	0.2238
18	Spilocaea pyracanthae	0.3058	51	Pseudocochliobolus pallescens	0.2305	84	Fusicladium veronicae	0.2238
19	Thelephora terrestris	0.299	52	Pseudolembosia magnifica	0.2305	85	Gibberella pulicaris	0.2238
20	Pythium middletonii	0.2526	53	Puccinia allii	0.2305	86	Glomerella miyabeana	0.2238
21	Acroconidiella tropaeoli	0.2305	54	Puccinia iridis	0.2305	87	Heteropatella valtellinensis	0.2238
22	Albugo centaurii	0.2305	55	Puccinia oahuensis	0.2305	88	Itersonilia perplexans	0.2238
23	Alternaria longissima	0.2305	56	Puccinia sorghi	0.2305	89	Meliola pomaderridis	0.2238
24	Alternaria sonchi	0.2305	57	Pythium sulcatum	0.2305	90	Monographella nivalis var. nivalis	0.2238
25	Alternaria tenuissima	0.2305	58	Quambalaria pitereka	0.2305	91	Mycosphaerella ribis	0.2238
26	Alternaria zinniae	0.2305	59	Ramularia pitereka	0.2305	92	Mycosphaerella walkeri	0.2238
27	Aphanomyces euteiches	0.2305	60	Ramularia primulae	0.2305	93	Mycovellosiella fulva	0.2238
28	Botryosphaeria ribis	0.2305	61	Seimatosporium falcatum	0.2305	94	Myriangium pritzelianum	0.2238
29	Cercospora apii	0.2305	62	Septoria gladioli	0.2305	95	Myrothecium verrucaria	0.2238
30	Cercospora resedae	0.2305	63	Sphaceloma violae	0.2305	96	Oidium hardenbergiae	0.2238
31	Cerotelium fici	0.2305	64	Stenocarpella maydis	0.2305	97	Passalora puncta	0.2238
32	Colletotrichum musae	0.2305	65	Ulocladium atrum	0.2305	98	Peronospora obovata	0.2238
33	Coniella castaneicola	0.2305	66	Uredo spyridii	0.2305	99	Pestalotia casuarinae	0.2238

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Table 27 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
100	Phaeocryptopus gaeumannii	0.2238	133	Harknessia eucalypti	0.2171	166	Guignardia citricarpa	0.1774
101	Phragmidium potentillae	0.2238	134	Leptosphaeria maculans	0.2171	167	Lasiodiplodia theobromae	0.1774
102	Pseudocercospora correae	0.2238	135	Meliola oleariae	0.2171	168	Phytophthora palmivora	0.1774
103	Puccinia arenariae	0.2238	136	Microsphaeropsis hellebori	0.2171	169	Pseudocochliobolus eragrostidis	0.1774
104	Puccinia coprosmae	0.2238	137	Moreaua lepidospermatis	0.2171	170	Pseudocochliobolus verruculosus	0.1774
105	Puccinia cyani	0.2238	138	Phytophthora inundata	0.2171	171	Trichoderma harzianum	0.1774
106	Puccinia geranii-pilosi	0.2238	139	Puccinia longispora	0.2171	172	Alternaria padwickii	0.1706
107	Puccinia oleariae	0.2238	140	Pycnoporus cinnabarinus	0.2171	173	Aspergillus flavus	0.1706
108	Puccinia stylidii	0.2238	141	Pyrenochaeta lycopersici	0.2171	174	Calonectria kyotensis	0.1706
109	Puccinia tasmanica	0.2238	142	Pyrenopeziza brassicae	0.2171	175	Gloeocercospora sorghi	0.1706
110	Puccinia tenuispora	0.2238	143	Pyrenophora chaetomioides	0.2171	176	Armillaria mellea	0.1639
111	Puccinia violae	0.2238	144	Schizopora paradoxa	0.2171	177	Ganoderma lucidum	0.1639
112	Ramularia rhabdospora	0.2238	145	Sclerotinia trifoliorum	0.2171	178	Pestalotiopsis guepini	0.1639
113	Sordaria fimicola	0.2238	146	Septoria antirrhini	0.2171	179	Pestalotiopsis mangiferae	0.1639
114	Sphaceloma populi	0.2238	147	Septoria martiniae	0.2171	180	Pycnoporus sanguineus	0.1639
115	Stromatinia gladioli	0.2238	148	Serpula lacrymans	0.2171	181	Acremonium strictum	0.1486
116	Synchytrium taraxaci	0.2238	149	Sphaeropsis sapinea	0.2171	182	Alternaria carthami	0.1486
117	Tandonella oleariae	0.2238	150	Sphaerotheca fusca	0.2171	183	Alternaria crassa	0.1486
118	Uromyces beticola	0.2238	151	Sphaerotheca pannosa	0.2171	184	Alternaria panax	0.1486
119	Uromycladium robinsonii	0.2238	152	Thaptospora atrobrunnea	0.2171	185	Alternaria passiflorae	0.1486
120	Valsa ambiens	0.2238	153	Thielaviopsis basicola	0.2171	186	Alternaria raphani	0.1486
121	Acremonium recifei	0.2171	154	Tilletia inolens	0.2171	187	Amorphotheca resinae	0.1486
122	Aecidium soleniiforme	0.2171	155	Uredo bossiaeae	0.2171	188	Appendiculella kiraiensis	0.1486
123	Armillaria fumosa	0.2171	156	Uromyces asperulae	0.2171	189	Ascochyta paspali	0.1486
124	Armillaria hinnulea	0.2171	157	Uromyces caryophyllinus	0.2171	190	Bartalinia robillardoides	0.1486
125	Armillaria novae-zelandiae	0.2171	158	Uromyces minor	0.2171	191	Bauerago cyperi-lucidi	0.1486
126	Athelia fuciformis	0.2171	159	Uromyces otakou	0.2171	192	Botryosphaeria dothidea	0.1486
127	Botryotinia fuckeliana	0.2171	160	Uromycladium bisporum	0.2171	193	Camarosporium eucalypti	0.1486
128	Chalara australis	0.2171	161	Verticillium lecanii	0.2171	194	Cercospora chenopodii	0.1486
129	Davidiella macrospora	0.2171	162	Wojnowicia hirta	0.2171	195	Cercospora eucalypti	0.1486
130	Ganoderma australe	0.2171	163	Cochliobolus heterostrophus	0.1774	196	Cintractia limitata	0.1486
131	Gelasinospora retispora	0.2171	164	Colletotrichum capsici	0.1774	197	Cladosporium oxysporum	0.1486
132	Gongronella butleri	0.2171	165	Deightoniella torulosa	0.1774	198	Cochliobolus australiensis	0.1486

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Table 27 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
199	Cochliobolus ravenelii	0.1486	226	Mycovellosiella brachycarpa	0.1486	253	Scopulariopsis brevicaulis	0.1486
200	Coniella fragariae	0.1486	227	Myriangium duriaei	0.1486	254	Septoria cucurbitacearum	0.1486
201	Curvularia clavata	0.1486	228	Oidium hortensiae	0.1486	255	Septoria geranii	0.1486
202	Curvularia trifolii	0.1486	229	Peronospora lamii	0.1486	256	Septoria obesa	0.1486
203	Cycloconium oleaginum	0.1486	230	Pestalotiopsis funerea	0.1486	257	Septoria sonchi	0.1486
204	Cymadothea trifolii	0.1486	231	Pestalotiopsis uvicola	0.1486	258	Sporisorium chamaeraphis	0.1486
205	Dictyochaeta fertilis	0.1486	232	Phacidiopycnis tuberivora	0.1486	259	Sporisorium consanguineum	0.1486
206	Drechslera biseptata	0.1486	233	Phaeoseptoria eucalypti	0.1486	260	Sporisorium enteromorphum	0.1486
207	Entyloma australe	0.1486	234	Phakopsora apoda	0.1486	261	Sporisorium exsertum	0.1486
208	Erysiphe aquilegiae var. aquilegiae	0.1486	235	Phialophora richardsiae	0.1486	262	Sporisorium lepturi	0.1486
209	Erysiphe begoniae	0.1486	236	Phoma banksiae-integrifoliae	0.1486	263	Sporisorium tenue	0.1486
210	Erysiphe pisi var. pisi	0.1486	237	Phyllachora eucalypti	0.1486	264	Sporisorium walkeri	0.1486
211	Erysiphe ulmariae	0.1486	238	Phyllachora parvicapsa	0.1486	265	Stagonospora nodorum	0.1486
212	Exobasidium japonicum	0.1486	239	Phyllosticta yuccae	0.1486	266	Stemphylium globuliferum	0.1486
213	Gibberella tricincta	0.1486	240	Phytophthora medicaginis	0.1486	267	Stemphylium lycopersici	0.1486
214	Hamaspora acutissima	0.1486	241	Phytophthora sojae	0.1486	268	Stenella lomatiae	0.1486
215	Hendersonia eucalypti	0.1486	242	Phytophthora vignae	0.1486	269	Tranzscheliella hypodytes	0.1486
216	Lembosia graphioides	0.1486	243	Pleospora papaveracea	0.1486	270	Uredo geitonoplesii	0.1486
217	Lineostroma banksiae	0.1486	244	Pleospora betae	0.1486	271	Uromyces tenuicutis	0.1486
218	Meliolina cladotricha	0.1486	245	Polythrinciopsis phragmitis	0.1486	272	Ustilago maydis	0.1486
219	Meliolina mollis	0.1486	246	Pseudocercospora kennediicola	0.1486	273	Ustilago trichophora	0.1486
220	Microbotryum prostratum	0.1486	247	Puccinia cnici	0.1486	274	Verticillium nigrescens	0.1486
221	Microbotryum reticulatum	0.1486	248	Puccinia gnaphaliicola	0.1486	275	Vizella banksiae	0.1486
222	Monographella cucumerina	0.1486	249	Pyrenophora erythrospila	0.1486	276	Vizella grevilleae	0.1486
223	Mycosphaerella marksii	0.1486	250	Pyrenophora tetrarrhenae	0.1486	277	Wilsonomyces carpophilus	0.1486
224	Mycosphaerella nubilosa	0.1486	251	Racospermyces digitatus	0.1486			
225	Mycosphaerella parva	0.1486	252	Ramularia uredinis	0.1486			

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Table 28. WA fungal pathogens top 200 risk list generated from SOM analysis of Australian distributional data. . * Species with the same risk index were ranked in alphabetical order.

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
1	Claviceps paspali	0.6843	34	Eutypa lata	0.3685	67	Puccinia lagenophorae	0.3685
2	Eudarluca caricis	0.6843	35	Fulvisporium restifaciens	0.3685	68	Puccinia ludwigii	0.3685
3	Gibberella intricans	0.6843	36	Fusarium culmorum	0.3685	69	Puccinia magnusiana	0.3685
4	Melampsora laricis-populina	0.6843	37	Fusarium proliferatum	0.3685	70	Puccinia oxalidis	0.3685
5	Mycosphaerella fragariae	0.6843	38	Gibberella acuminata	0.3685	71	Puccinia pelargonii-zonalis	0.3685
6	Mycosphaerella mori	0.6843	39	Gibberella fujikuroi	0.3685	72	Puccinia recondita	0.3685
7	Puccinia menthae	0.6843	40	Glomerella graminicola	0.3685	73	Puccinia rhei-undulati	0.3685
8	Sclerotium rolfsii	0.6843	41	Lepteutypa cupressi	0.3685	74	Puccinia saccardoi	0.3685
9	Septoria lactucae	0.6843	42	Leveillula taurica	0.3685	75	Pucciniastrum epilobii	0.3685
10	Spongospora subterranea	0.6843	43	Melampsora euphorbiae-gerardianae	0.3685	76	Ramularia rubella	0.3685
11	Tranzschelia discolor	0.6843	44	Moreaua rodwayi	0.3685	77	Sclerotinia minor	0.3685
12	Uromyces digitatus	0.6843	45	Mycosphaerella graminicola	0.3685	78	Septoria apiicola	0.3685
13	Uromyces striatus	0.6843	46	Myrothecium roridum	0.3685	79	Septoria dianthi	0.3685
14	Uromycladium tepperianum	0.6843	47	Peronospora arborescens	0.3685	80	Septoria lycopersici	0.3685
15	Ustilago avenae	0.6843	48	Peronospora destructor	0.3685	81	Septoria petroselini	0.3685
16	Rhizoctonia solani	0.6747	49	Peronospora farinosa	0.3685	82	Septoria pisi	0.3685
17	Aureobasidium pullulans	0.6415	50	Peronospora hyoscyami f.sp. tabacina	0.3685	83	Septoria rubi	0.3685
18	Cladosporium cladosporioides	0.6415	51	Peronospora jaapiana	0.3685	84	Tilletia caries	0.3685
19	Macrophomina phaseolina	0.6415	52	Peronospora viciae	0.3685	85	Uromyces anthyllidis	0.3685
20	Pestalotiopsis versicolor	0.6415	53	Phoma exigua	0.3685	86	Uromycladium notabile	0.3685
21	Calonectria kyotensis	0.641	54	Phomopsis obscurans	0.3685	87	Ustilago hordei	0.3685
22	Pestalotiopsis guepini	0.6315	55	Phragmidium barnardii	0.3685	88	Ustilago nuda	0.3685
23	Alternaria dianthicola	0.3685	56	Phytophthora cactorum	0.3685	89	Venturia inaequalis	0.3685
24	Alternaria porri	0.3685	57	Phytophthora infestans	0.3685	90	Verticillium dahliae	0.3685
25	Ascochyta pisi	0.3685	58	Plasmodiophora brassicae	0.3685	91	Botryotinia draytonii	0.368
26	Aulographina eucalypti	0.3685	59	Pseudopeziza trifolii	0.3685	92	Cyclaneusma minus	0.368
27	Blumeria graminis	0.3685	60	Puccinia antirrhini	0.3685	93	Puccinia xanthii	0.368
28	Cercospora beticola	0.3685	61	Puccinia aucta	0.3685	94	Pythium myriotylum	0.368
29	Cercospora carotae	0.3685	62	Puccinia cacao	0.3685	95	Stagonospora curtisii	0.368
30	Cladosporium iridis	0.3685	63	Puccinia distincta	0.3685	96	Aecidium oleariae	0.359
31	Colletotrichum lindemuthianum	0.3685	64	Puccinia graminis	0.3685	97	Albugo trianthemae	0.359
32	Colletotrichum trifolii	0.3685	65	Puccinia hederaceae	0.3685	98	Alternaria radicina	0.359
33	Erysiphe euonymi-japonici	0.3685	66	Puccinia hordei	0.3685	99	Botrytis fabae	0.359

Table 28 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
100	Ceratocystis paradoxa	0.359	133	Seimatosporium dilophosporum	0.359	166	Acroconidiella tropaeoli	0.3258
101	Colletotrichum circinans	0.359	134	Septoria nodorum	0.359	167	Albugo centaurii	0.3258
102	Dilophospora alopecuri	0.359	135	Spermospora avenae	0.359	168	Alternaria longissima	0.3258
103	Drepanopeziza sphaerioides	0.359	136	Sphaerotheca fuliginea	0.359	169	Alternaria sonchi	0.3258
104	Elsinoe veneta	0.359	137	Sphaerotheca mors-uvae	0.359	170	Alternaria zinniae	0.3258
105	Gibberella avenacea	0.359	138	Uredo rhagodiae	0.359	171	Aphanomyces euteiches	0.3258
106	Gloeotinia granigena	0.359	139	Uredo scirpi-nodosi	0.359	172	Cercospora resedae	0.3258
107	Heteropatella antirrhini	0.359	140	Uromyces betae	0.359	173	Cerotelium fici	0.3258
108	Heterotolyposporium piluliforme	0.359	141	Uromyces danthoniae	0.359	174	Coniella castaneicola	0.3258
109	Lophodermium pinastri	0.359	142	Uromyces trifolii	0.359	175	Corynespora cassiicola	0.3258
110	Microdochium panattonianum	0.359	143	Uromycladium maritimum	0.359	176	Daldinia concentrica	0.3258
111	Microstroma juglandis	0.359	144	Verticillium albo-atrum	0.359	177	Davidiella tassiana	0.3258
112	Moreaua muelleriana	0.359	145	Wettsteinina phyllodiorum	0.359	178	Diplodia phyllodiorum	0.3258
113	Mycosphaerella swartii	0.359	146	Amylostereum areolatum	0.3585	179	Dothistroma septospora	0.3258
114	Parodiella banksiae	0.359	147	Apiognomonia errabunda	0.3585	180	Fusarium anthophilum	0.3258
115	Peronospora grisea	0.359	148	Cylindrosporium samuelii	0.3585	181	Fusarium compactum	0.3258
116	Peronospora polygoni	0.359	149	Davidiella macrospora	0.3585	182	Fusarium poae	0.3258
117	Phellinus robustus	0.359	150	Exobasidium japonicum	0.3585	183	Fusarium subglutinans	0.3258
118	Phragmidium tuberculatum	0.359	151	Itersonilia pastinacea	0.3585	184	Gliocladium vermoesenii	0.3258
119	Physoderma pulposum	0.359	152	Mycosphaerella recutita	0.3585	185	Mycosphaerella cryptica	0.3258
120	Phytophthora citricola	0.359	153	Olpidium brassicae	0.3585	186	Nectria cinnabarina	0.3258
121	Phytophthora erythroseptica	0.359	154	Physoderma trifolii	0.3585	187	Polystigma phyllodii	0.3258
122	Pteroconium pterospermum	0.359	155	Pseudoseptoria stomaticola	0.3585	188	Pseudocochliobolus pallescens	0.3258
123	Puccinia alyxiae	0.359	156	Puccinia muehlenbeckiae	0.3585	189	Pseudolembosia magnifica	0.3258
124	Puccinia boroniae	0.359	157	Pythium anandrum	0.3585	190	Puccinia allii	0.3258
125	Puccinia dichondrae	0.359	158	Pythium paroecandrum	0.3585	191	Puccinia iridis	0.3258
126	Puccinia morrisonii	0.359	159	Sphacelotheca densa	0.3585	192	Puccinia oahuensis	0.3258
127	Puccinia pulverulenta	0.359	160	Sphacelotheca hydropiperis	0.3585	193	Puccinia sorghi	0.3258
128	Puccinia punctiformis	0.359	161	Taphrina aurea	0.3585	194	Puccinia violae	0.3258
129	Puccinia subnitens	0.359	162	Thecaphora leptocarpi	0.3585	195	Ramularia pitereka	0.3258
130	Puccinia tetragoniae	0.359	163	Tolyposporium juncophilum	0.3585	196	Ramularia primulae	0.3258
131	Puccinia thuemenii	0.359	164	Ustilago hydropiperis	0.3585	197	Seimatosporium falcatum	0.3258
132	Rhynchosporium secalis	0.359	165	Ustilago utriculosa	0.3585	198	Septoria gladioli	0.3258

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Table 28 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
199	Sphaceloma violae	0.3258	225	Cercospora zinniae	0.3253	251	Peronospora antirrhini	0.3253
200	Stenocarpella maydis	0.3258	226	Cochliobolus miyabeanus	0.3253	252	Pestalotiopsis theae	0.3253
201	Stromatinia gladioli	0.3258	227	Cochliobolus nodulosus	0.3253	253	Phakopsora gossypii	0.3253
202	Tandonella oleariae	0.3258	228	Cochliobolus perotidis	0.3253	254	Pseudocercospora bradburyae	0.3253
203	Uredo spyridii	0.3258	229	Colletotrichum crassipes	0.3253	255	Pseudocercospora fuligena	0.3253
204	Uromyces ehrhartae	0.3258	230	Colletotrichum truncatum	0.3253	256	Pseudocercospora stahlii	0.3253
205	Uromyces orchidearum	0.3258	231	Coniella musaiaensis	0.3253	257	Puccinia arachidis	0.3253
206	Uromycladium alpinum	0.3258	232	Cordana musae	0.3253	258	Puccinia fuirenicola	0.3253
207	Uromycladium robinsonii	0.3258	233	Curvularia fallax	0.3253	259	Puccinia levis	0.3253
208	Aecidium crini	0.3253	234	Curvularia intermedia	0.3253	260	Puccinia liberta	0.3253
209	Albugo ipomoeae-aquaticae	0.3253	235	Cylindrocladiella camelliae	0.3253	261	Puccinia nakanishikii	0.3253
210	Albugo ipomoeae-panduratae	0.3253	236	Daldinia eschscholzii	0.3253	262	Puccinia polysora	0.3253
211	Annulohypoxylon bovei var. bovei	0.3253	237	Drechslera salviniae	0.3253	263	Puccinia purpurea	0.3253
212	Aspergillus fumigatus	0.3253	238	Eballistra oryzae	0.3253	264	Puccinia roseana	0.3253
213	Bipolaris curvispora	0.3253	239	Erysiphe aquilegiae var. ranunculi	0.3253	265	Pythium butleri	0.3253
214	Bipolaris incurvata	0.3253	240	Exserohilum longirostratum	0.3253	266	Pythium deliense	0.3253
215	Bipolaris sorghicola	0.3253	241	Gibberella baccata	0.3253	267	Setosphaeria monoceras	0.3253
216	Bipolaris urochloae	0.3253	242	Leptosphaeria coniothyrium	0.3253	268	Sorosporium anthisteriae	0.3253
217	Biscogniauxia nummularia	0.3253	243	Leucocintractia leucoderma	0.3253	269	Sphaerophragmium acaciae	0.3253
218	Calonectria quinqueseptata	0.3253	244	Mycosphaerella cruenta	0.3253	270	Stemonitis herbatica	0.3253
219	Ceratiomyxa fruticulosa	0.3253	245	Mycosphaerella henningsii	0.3253	271	Stigmina mangiferae	0.3253
220	Ceratocystis paradoxa	0.3253	246	Neocosmospora vasinfecta	0.3253	272	Uromyces clignyi	0.3253
221	Cercospora arachidicola	0.3253	247	Ophiodothella syzygii	0.3253	273	Uromyces dactyloctenii	0.3253
222	Cercospora canescens	0.3253	248	Parodiella perisporioides	0.3253	274	Uromyces orientalis	0.3253
223	Cercospora sorghi	0.3253	249	Pericladium grewiae	0.3253	275	Uromyces setariae-italicae	0.3253
224	Cercospora taccae	0.3253	250	Peronosclerospora maydis	0.3253	276	Ustilago porosa	0.3253

Table 29. NSW bacterial pathogens risk list generated from SOM analysis of Australian distributional data. . * Species with the same risk index were ranked in alphabetical order.

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
1	Pseudomonas maculicola	0.4176	36	Xanthomonas holcicola	0.0761	71	Pseudomonas syringae pv tabaci	0.0014
2	Pseudomonas viridiflava	0.4176	37	Xanthomonas malvacearum	0.0761	72	Pseudomonas syringae pv tomato	0.0014
3	Xanthomonas vesicatoria	0.4176	38	Bacterium campestris	0.017	73	Pseudomonas viridiflava	0.0014
4	Pseudomonas cichorii	0.4174	39	Bacterium chrysanthemi	0.017	74	Pseudomonas cepacea	0.0014
5	Pseudomonas marginalis	0.4174	40	Bacterium solanacearum	0.017	75	Pseudomonas gladioli	0.0014
6	Xanthomonas pruni	0.4174	41	Corynebacterium insidiosum	0.0016	76	Pseudomonas syringae pv coriandricola	0.0014
7	Pseudomonas syringae pv phaseolicola	0.3426	42	Pseudomonas syringae pv syringae	0.0016	77	Pseudomonas syringae pv pisi	0.0014
8	Pseudomonas pseudoalcaligenes	0.3414	43	Xanthomonas campestris pv campestris	0.0016	78	Streptomyces scabies	0.0014
9	Chryseobacterium balustinum	0.3413	44	Xanthomonas campestris pv juglandis	0.0016	79	Xanthomonas arboricola pv pruni	0.0014
10	Hafnia alvei	0.3413	45	Acidovorax avenae ss avenae	0.0014	80	Xanthomonas campestris pv campestris	0.0014
11	Micrococcus radiourans	0.3413	46	Acidovorax avenae ss citrulli	0.0014	81	Xanthomonas campestris pv mangiferaeindicae	0.0014
12	Ochrobactrum anthropi	0.3413	47	Burkholderia gladioli ss gladioli	0.0014	82	Xanthomonas campestris pv begoniae	0.0014
13	Pseudomonas corrugata	0.3413	48	Clavibacter tritici	0.0014	83	Xanthomonas campestris pv carotae	0.0014
14	Pseudomonas eriobotryae	0.3413	49	Clavibacter michiganensis ss michiganensis	0.0014	84	Xanthomonas campestris pv incanae	0.0014
15	Xanthomonas vitians	0.3413	50	Clavibacter michiganense ss insidiosum	0.0014	85	Xanthomonas campestris pv pelargonii	0.0014
16	Corynebacterium michiganense	0.0775	51	Clavibacter michiganense ss michiganense	0.0014	86	Xanthomonas campestris pv pruni	0.0014
17	Pseudomonas marginata	0.0763	52	Clavibacter toxicus	0.0014	87	Xanthomonas fragariae	0.0014
18	Pseudomonas phaseolicola	0.0763	53	Corynebacterium flaccumfaciens	0.0014	88	Corynebacterium michiganense pv Insidiosum	0.0002
19	Xanthomonas begoniae	0.0763	54	Erwinia carotovora ss carotovora	0.0014	89	Corynebacterium michiganense pv Michiganense	0.0002
20	Xanthomonas juglandis	0.0763	55	Erwinia chrysanthemi	0.0014	90	Pseudomonas alliicola	0.0002
21	Xanthomonas phaseoli	0.0763	56	Erwinia herbicola	0.0014	91	Pseudomonas coronafaciens	0.0002
22	Bacillus mycoides	0.0761	57	Erwinia cypripedii	0.0014	92	Pseudomonas delphinii	0.0002
23	Erwinia aroideae	0.0761	58	Erwinia tracheiphila	0.0014	93	Pseudomonas gladioli pv Gladioli	0.0002
24	Herbaspirillum huttiense	0.0761	59	Pseudomonas cichorii	0.0014	94	Pseudomonas lachrymans	0.0002
25	Herbaspirillum rubrisubalbicans	0.0761	60	Pseudomonas fluorescens	0.0014	95	Pseudomonas mori	0.0002
26	Pseudomonas aeruginosa	0.0761	61	Pseudomonas syringae pv atrofaciens	0.0014	96	Pseudomonas primulae	0.0002
27	Pseudomonas flectens	0.0761	62	Pseudomonas syringae pv coronafaciens	0.0014	97	Pseudomonas savastanoi f sp Nerii	0.0002
28	Pseudomonas glycinea	0.0761	63	Pseudomonas syringae pv lachrymans	0.0014	98	Pseudomonas syringae pv Maculicola	0.0002
29	Pseudomonas striafaciens	0.0761	64	Pseudomonas syringae pv maculicola	0.0014	99	Pseudomonas syringae pv Mori	0.0002
30	Pseudomonas tabaci	0.0761	65	Pseudomonas syringae pv mori	0.0014	100	Pseudomonas syringae pv tomato	0.0002
31	Pseudomonas tonelliana	0.0761	66	Pseudomonas syringae pv passiflorae	0.0014	101	Pseudomonas tolaasi	0.0002
32	Serratia liquefaciens	0.0761	67	Pseudomonas syringae pv pisi	0.0014	102	Pseudomonas tomato	0.0002
33	Streptomyces scabiei	0.0761	68	Pseudomonas syringae pv porri	0.0014	103	Xanthomonas campestris pv vitians	0.0002
34	Xanthomonas antirrhini	0.0761	69	Pseudomonas syringae pv striafaciens	0.0014	104	Xanthomonas hyacinthi	0.0002
35	Xanthomonas cucurbitae	0.0761	70	Pseudomonas syringae pv syringae	0.0014	105	Xanthomonas papavericola	0.0002

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Table 30. NT bacterial pathogens risk list generated from SOM analysis of Australian distributional data. . * Species with the same risk index were ranked in alphabetical order.

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
1	Agrobacterium tumefaciens	0.3569	35	Pseudomonas syringae pv lachrymans	0.2428	69	Pseudomonas viridiflava	0.102
2	Erwinia carotovora	0.3569	36	Pseudomonas syringae pv maculicola	0.2428	70	Ralstonia solanacearum	0.102
3	Pseudomonas syringae	0.3569	37	Pseudomonas syringae pv mori	0.2428	71	Xanthomonas vesicatoria	0.102
4	Xanthomonas campestris	0.3569	38	Pseudomonas syringae pv passiflorae	0.2428	72	Pantoea agglomerans	0.1014
5	Streptomyces scabies	0.3563	39	Pseudomonas syringae pv pisi	0.2428	73	Pectobacterium carotovorum	0.1014
6	Curtobacterium flaccumfaciens	0.3448	40	Pseudomonas syringae pv porri	0.2428	74	Pseudomonas pseudoalcaligenes	0.1014
7	Agrobacterium vitis	0.3442	41	Pseudomonas syringae pv striafaciens	0.2428	75	Serratia marcescens	0.1014
8	Pseudomonas syringae pv phaseolicola	0.3321	42	Pseudomonas syringae pv syringae	0.2428	76	Pseudomonas cichorii	0.0899
9	Burkholderia cepacia	0.2555	43	Pseudomonas syringae pv tabaci	0.2428	77	Pseudomonas marginalis	0.0899
10	Burkholderia gladioli	0.2555	44	Pseudomonas syringae pv tomato	0.2428	78	Xanthomonas pruni	0.0899
11	Clavibacter michiganense	0.2549	45	Pseudomonas viridiflava	0.2428	79	Chryseobacterium balustinum	0.0893
12	Corynebacterium insidiosum	0.2549	46	Pseudomonas cepacea	0.2428	80	Hafnia alvei	0.0893
13	Pseudomonas syringae pv syringae	0.2549	47	Pseudomonas gladioli	0.2428	81	Micrococcus radiourans	0.0893
14	Xanthomonas campestris pv campestris	0.2549	48	Pseudomonas syringae pv coriandricola	0.2428	82	Ochrobactrum anthropi	0.0893
15	Xanthomonas campestris pv juglandis	0.2549	49	Pseudomonas syringae pv pisi	0.2428	83	Pseudomonas corrugata	0.0893
16	Corynebacterium michiganense	0.2434	50	Streptomyces scabies	0.2428	84	Pseudomonas eriobotryae	0.0893
17	Acidovorax avenae ss avenae	0.2428	51	Xanthomonas arboricola pv pruni	0.2428	85	Xanthomonas vitians	0.0893
18	Acidovorax avenae ss citrulli	0.2428	52	Xanthomonas campestris pv campestris	0.2428	86	Agrobacterium rhizogenes	0.0242
19	Burkholderia gladioli ss gladioli	0.2428	53	Xanthomonas campestris pv mangiferaeindicae	0.2428	87	Pseudomonas pisi	0.0242
20	Clavibacter tritici	0.2428	54	Xanthomonas campestris pv begoniae	0.2428	88	Bacillus subtilis	0.0127
21	Clavibacter michiganensis ss michiganensis	0.2428	55	Xanthomonas campestris pv carotae	0.2428	89	Enterobacter cloacae	0.0127
22	Clavibacter michiganense ss insidiosum	0.2428	56	Xanthomonas campestris pv incanae	0.2428	90	Erwinia herbicola	0.0127
23	Clavibacter michiganense ss michiganense	0.2428	57	Xanthomonas campestris pv pelargonii	0.2428	91	Pantoea ananatis	0.0127
24	Clavibacter toxicus	0.2428	58	Xanthomonas campestris pv pruni	0.2428	92	Pseudomonas marginata	0.0127
25	Corynebacterium flaccumfaciens	0.2428	59	Xanthomonas fragariae	0.2428	93	Pseudomonas phaseolicola	0.0127
26	Erwinia carotovora ss carotovora	0.2428	60	Clavibacter michiganensis	0.1141	94	Pseudomonas solanacearum	0.0127
27	Erwinia chrysanthemi	0.2428	61	Pseudomonas fluorescens	0.1135	95	Sphingomonas suberifaciens	0.0127
28	Erwinia herbicola	0.2428	62	Pseudomonas putida	0.1135	96	Stenotrophomonas maltophilia	0.0127
29	Erwinia cypripedii	0.2428	63	Acidovorax avenae	0.102	97	Xanthomonas begoniae	0.0127
30	Erwinia tracheiphila	0.2428	64	Bacillus cereus	0.102	98	Xanthomonas juglandis	0.0127
31	Pseudomonas cichorii	0.2428	65	Burkholderia andropogonis	0.102	99	Xanthomonas phaseoli	0.0127
32	Pseudomonas fluorescens	0.2428	66	Erwinia chrysanthemi	0.102	100	Agrobacterium radiobacter	0.0121
33	Pseudomonas syringae pv atrofaciens	0.2428	67	Pseudomonas andropogonis	0.102	101	Agrobacterium rubi	0.0121
34	Pseudomonas syringae pv coronafaciens	0.2428	68	Pseudomonas maculicola	0.102	102	Bacillus thuringiensis	0.0121

Table 30 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
103	Burkholderia caryophylli	0.0121	122	Pseudomonas delphinii	0.0121	141	Xanthomonas papavericola	0.0121
104	Cellulomonas flavigena	0.0121	123	Pseudomonas gladioli pv Gladioli	0.0121	142	Bacillus mycoides	0.0006
105	Chryseobacterium indologenes	0.0121	124	Pseudomonas lachrymans	0.0121	143	Erwinia aroideae	0.0006
106	Citrobacter freundii	0.0121	125	Pseudomonas mori	0.0121	144	Herbaspirillum huttiense	0.0006
107	Corynebacterium michiganense pv Insidiosum	0.0121	126	Pseudomonas mors-prunorum	0.0121	145	Herbaspirillum rubrisubalbicans	0.0006
108	Corynebacterium michiganense pv Michiganense	0.0121	127	Pseudomonas primulae	0.0121	146	Pseudomonas aeruginosa	0.0006
109	Enterobacter aerogenes	0.0121	128	Pseudomonas savastanoi	0.0121	147	Pseudomonas flectens	0.0006
110	Enterobacter gergoviae	0.0121	129	Pseudomonas savastanoi f sp Nerii	0.0121	148	Pseudomonas glycinea	0.0006
111	Erwinia mangiferae	0.0121	130	Pseudomonas syringae pv Maculicola	0.0121	149	Pseudomonas striafaciens	0.0006
112	Erwinia rhapontici	0.0121	131	Pseudomonas syringae pv Mori	0.0121	150	Pseudomonas tabaci	0.0006
113	Escherichia coli	0.0121	132	Pseudomonas syringae pv tomato	0.0121	151	Pseudomonas tonelliana	0.0006
114	Klebsiella oxytoca	0.0121	133	Pseudomonas tolaasi	0.0121	152	Serratia liquefaciens	0.0006
115	Klebsiella pneumoniae	0.0121	134	Pseudomonas tomato	0.0121	153	Streptomyces scabiei	0.0006
116	Methylobacterium mesophilum	0.0121	135	Rathayibacter toxicus	0.0121	154	Xanthomonas antirrhini	0.0006
117	Oerskovia turbata	0.0121	136	Rhizobium trifolii	0.0121	155	Xanthomonas cucurbitae	0.0006
118	Paenibacillus macerans	0.0121	137	Serratia fonticola	0.0121	156	Xanthomonas holcicola	0.0006
119	Pectobacterium atrosepticum	0.0121	138	Serratia proteamaculans	0.0121	157	Xanthomonas malvacearum	0.0006
120	Pseudomonas alliicola	0.0121	139	Xanthomonas campestris pv vitians	0.0121			
121	Pseudomonas coronafaciens	0.0121	140	Xanthomonas hyacinthi	0.0121			

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Table 31. QLD bacterial pathogens risk list generated from SOM analysis of Australian distributional data. . * Species with the same risk index were ranked in alphabetical order.

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
1	Streptomyces scabies	0.1439	38	Hafnia alvei	0.0258	75	Clavibacter michiganense ss michiganense	0.0003
2	Pseudomonas fluorescens	0.1436	39	Micrococcus radiourans	0.0258	76	Clavibacter toxicus	0.0003
3	Pseudomonas putida	0.1436	40	Ochrobactrum anthropi	0.0258	77	Corynebacterium flaccumfaciens	0.0003
4	Agrobacterium vitis	0.1417	41	Pseudomonas corrugata	0.0258	78	Erwinia carotovora ss carotovora	0.0003
5	Pantoea agglomerans	0.1415	42	Pseudomonas eriobotryae	0.0258	79	Erwinia chrysanthemi	0.0003
6	Pectobacterium carotovorum	0.1415	43	Xanthomonas vitians	0.0258	80	Erwinia herbicola	0.0003
7	Serratia marcescens	0.1415	44	Corynebacterium insidiosum	0.0024	81	Erwinia cypripedii	0.0003
8	Agrobacterium rhizogenes	0.1178	45	Pseudomonas syringae pv syringae	0.0024	82	Erwinia tracheiphila	0.0003
9	Pseudomonas pisi	0.1178	46	Xanthomonas campestris pv campestris	0.0024	83	Pseudomonas cichorii	0.0003
10	Clavibacter michiganense	0.1159	47	Xanthomonas campestris pv juglandis	0.0024	84	Pseudomonas fluorescens	0.0003
11	Agrobacterium radiobacter	0.1157	48	Corynebacterium michiganense pv Insidiosum	0.0021	85	Pseudomonas syringae pv atrofaciens	0.0003
12	Agrobacterium rubi	0.1157	49	Corynebacterium michiganense pv Michiganense	0.0021	86	Pseudomonas syringae pv coronafaciens	0.0003
13	Bacillus thuringiensis	0.1157	50	Pseudomonas alliicola	0.0021	87	Pseudomonas syringae pv lachrymans	0.0003
14	Burkholderia caryophylli	0.1157	51	Pseudomonas coronafaciens	0.0021	88	Pseudomonas syringae pv maculicola	0.0003
15	Cellulomonas flavigena	0.1157	52	Pseudomonas delphinii	0.0021	89	Pseudomonas syringae pv mori	0.0003
16	Chryseobacterium indologenes	0.1157	53	Pseudomonas gladioli pv Gladioli	0.0021	90	Pseudomonas syringae pv passiflorae	0.0003
17	Citrobacter freundii	0.1157	54	Pseudomonas lachrymans	0.0021	91	Pseudomonas syringae pv pisi	0.0003
18	Enterobacter aerogenes	0.1157	55	Pseudomonas mori	0.0021	92	Pseudomonas syringae pv porri	0.0003
19	Enterobacter gergoviae	0.1157	56	Pseudomonas primulae	0.0021	93	Pseudomonas syringae pv striafaciens	0.0003
20	Erwinia mangiferae	0.1157	57	Pseudomonas savastanoi f sp Nerii	0.0021	94	Pseudomonas syringae pv syringae	0.0003
21	Erwinia rhapontici	0.1157	58	Pseudomonas syringae pv Maculicola	0.0021	95	Pseudomonas syringae pv tabaci	0.0003
22	Escherichia coli	0.1157	59	Pseudomonas syringae pv Mori	0.0021	96	Pseudomonas syringae pv tomato	0.0003
23	Klebsiella oxytoca	0.1157	60	Pseudomonas syringae pv tomato	0.0021	97	Pseudomonas viridiflava	0.0003
24	Klebsiella pneumoniae	0.1157	61	Pseudomonas tolaasi	0.0021	98	Pseudomonas cepacea	0.0003
25	Methylobacterium mesophilum	0.1157	62	Pseudomonas tomato	0.0021	99	Pseudomonas gladioli	0.0003
26	Oerskovia turbata	0.1157	63	Xanthomonas campestris pv vitians	0.0021	100	Pseudomonas syringae pv coriandricola	0.0003
27	Paenibacillus macerans	0.1157	64	Xanthomonas hyacinthi	0.0021	101	Pseudomonas syringae pv pisi	0.0003
28	Pectobacterium atrosepticum	0.1157	65	Xanthomonas papavericola	0.0021	102	Streptomyces scabies	0.0003
29	Pseudomonas mors-prunorum	0.1157	66	Bacterium campestris	0.0013	103	Xanthomonas arboricola pv pruni	0.0003
30	Pseudomonas savastanoi	0.1157	67	Bacterium chrysanthemi	0.0013	104	Xanthomonas campestris pv campestris	0.0003
31	Rathayibacter toxicus	0.1157	68	Bacterium solanacearum	0.0013	105	Xanthomonas campestris pv mangiferaeindicae	0.0003
32	Rhizobium trifolii	0.1157	69	Acidovorax avenae ss avenae	0.0003	106	Xanthomonas campestris pv begoniae	0.0003
33	Serratia fonticola	0.1157	70	Acidovorax avenae ss citrulli	0.0003	107	Xanthomonas campestris pv carotae	0.0003
34	Serratia proteamaculans	0.1157	71	Burkholderia gladioli ss gladioli	0.0003	108	Xanthomonas campestris pv incanae	0.0003
35	Pseudomonas pseudoalcaligenes	0.0279	72	Clavibacter tritici	0.0003	109	Xanthomonas campestris pv pelargonii	0.0003
36	Pseudomonas syringae pv phaseolicola	0.0261	73	Clavibacter michiganensis ss michiganensis	0.0003	110	Xanthomonas campestris pv pruni	0.0003
37	Chryseobacterium balustinum	0.0258	74	Clavibacter michiganense ss insidiosum	0.0003	111	Xanthomonas fragariae	0.0003

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Table 32. SA bacterial pathogens risk list generated from SOM analysis of Australian distributional data. . * Species with the same risk index were ranked in alphabetical order.

Rank* Species	risk index	Rank* Species	risk index	Rank* Species	risk index
1 Acidovorax avenae ss avenae	0.3604	35 Xanthomonas vesicatoria	0.0598	69 Pectobacterium carotovorum	0.0118
2 Acidovorax avenae ss citrulli	0.3604	36 Pseudomonas pseudoalcaligenes	0.0597	70 Serratia marcescens	0.0118
3 Clavibacter tritici	0.3604	37 Agrobacterium rhizogenes	0.0497	71 Pseudomonas cichorii	0.011
4 Clavibacter michiganensis ss michiganensis	0.3604	38 Pseudomonas pisi	0.0497	72 Pseudomonas marginalis	0.011
5 Erwinia carotovora ss carotovora	0.3604	39 Pseudomonas marginata	0.0489	73 Xanthomonas pruni	0.011
6 Erwinia chrysanthemi	0.3604	40 Pseudomonas phaseolicola	0.0489	74 Chryseobacterium balustinum	0.0109
7 Erwinia herbicola	0.3604	41 Xanthomonas begoniae	0.0489	75 Hafnia alvei	0.0109
8 Pseudomonas cichorii	0.3604	42 Xanthomonas juglandis	0.0489	76 Micrococcus radiourans	0.0109
9 Pseudomonas fluorescens	0.3604	43 Xanthomonas phaseoli	0.0489	77 Ochrobactrum anthropi	0.0109
10 Pseudomonas syringae pv atrofaciens	0.3604	44 Corynebacterium michiganense pv Insidiosum	0.0488	78 Pseudomonas corrugata	0.0109
11 Pseudomonas syringae pv coronafaciens	0.3604	45 Corynebacterium michiganense pv Michiganense	0.0488	79 Pseudomonas eriobotryae	0.0109
12 Pseudomonas syringae pv lachrymans	0.3604	46 Pseudomonas alliicola	0.0488	80 Xanthomonas vitians	0.0109
13 Pseudomonas syringae pv maculicola	0.3604	47 Pseudomonas coronafaciens	0.0488	81 Bacillus subtilis	0.001
14 Pseudomonas syringae pv mori	0.3604	48 Pseudomonas delphinii	0.0488	82 Enterobacter cloacae	0.001
15 Pseudomonas syringae pv passiflorae	0.3604	49 Pseudomonas gladioli pv Gladioli	0.0488	83 Erwinia herbicola	0.001
16 Pseudomonas syringae pv pisi	0.3604	50 Pseudomonas lachrymans	0.0488	84 Pantoea ananatis	0.001
17 Pseudomonas syringae pv porri	0.3604	51 Pseudomonas mori	0.0488	85 Pseudomonas solanacearum	0.001
18 Pseudomonas syringae pv striafaciens	0.3604	52 Pseudomonas primulae	0.0488	86 Sphingomonas suberifaciens	0.001
19 Pseudomonas syringae pv syringae	0.3604	53 Pseudomonas savastanoi f sp Nerii	0.0488	87 Stenotrophomonas maltophilia	0.001
20 Pseudomonas syringae pv tabaci	0.3604	54 Pseudomonas syringae pv Maculicola	0.0488	88 Agrobacterium radiobacter	0.0009
21 Pseudomonas syringae pv tomato	0.3604	55 Pseudomonas syringae pv Mori	0.0488	89 Agrobacterium rubi	0.0009
22 Pseudomonas viridiflava	0.3604	56 Pseudomonas syringae pv tomato	0.0488	90 Bacillus thuringiensis	0.0009
23 Streptomyces scabies	0.3604	57 Pseudomonas tolaasi	0.0488	91 Burkholderia caryophylli	0.0009
24 Xanthomonas arboricola pv pruni	0.3604	58 Pseudomonas tomato	0.0488	92 Cellulomonas flavigena	0.0009
25 Xanthomonas campestris pv campestris	0.3604	59 Xanthomonas campestris pv vitians	0.0488	93 Chryseobacterium indologenes	0.0009
26 Xanthomonas campestris pv mangiferaeindicae	0.3604	60 Xanthomonas hyacinthi	0.0488	94 Citrobacter freundii	0.0009
27 Bacterium campestris	0.2186	61 Xanthomonas papavericola	0.0488	95 Enterobacter aerogenes	0.0009
28 Bacterium chrysanthemi	0.2186	62 Acidovorax avenae	0.0119	96 Enterobacter gergoviae	0.0009
29 Bacterium solanacearum	0.2186	63 Bacillus cereus	0.0119	97 Erwinia mangiferae	0.0009
30 Clavibacter michiganensis	0.0607	64 Burkholderia andropogonis	0.0119	98 Erwinia rhapontici	0.0009
31 Pseudomonas fluorescens	0.0605	65 Erwinia chrysanthemi	0.0119	99 Escherichia coli	0.0009
32 Pseudomonas putida	0.0605	66 Pseudomonas andropogonis	0.0119	100 Klebsiella oxytoca	0.0009
33 Pseudomonas maculicola	0.0598	67 Ralstonia solanacearum	0.0119	101 Klebsiella pneumoniae	0.0009
34 Pseudomonas viridiflava	0.0598	68 Pantoea agglomerans	0.0118	102 Methylobacterium mesophilum	0.0009

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Table 32 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
103	Oerskovia turbata	0.0009	112	Bacillus mycoides	0.0001	121	Pseudomonas tonelliana	0.0001
104	Paenibacillus macerans	0.0009	113	Erwinia aroideae	0.0001	122	Serratia liquefaciens	0.0001
105	Pectobacterium atrosepticum	0.0009	114	Herbaspirillum huttiense	0.0001	123	Streptomyces scabiei	0.0001
106	Pseudomonas mors-prunorum	0.0009	115	Herbaspirillum rubrisubalbicans	0.0001	124	Xanthomonas antirrhini	0.0001
107	Pseudomonas savastanoi	0.0009	116	Pseudomonas aeruginosa	0.0001	125	Xanthomonas cucurbitae	0.0001
108	Rathayibacter toxicus	0.0009	117	Pseudomonas flectens	0.0001	126	Xanthomonas holcicola	0.0001
109	Rhizobium trifolii	0.0009	118	Pseudomonas glycinea	0.0001	127	Xanthomonas malvacearum	0.0001
110	Serratia fonticola	0.0009	119	Pseudomonas striafaciens	0.0001			
111	Serratia proteamaculans	0.0009	120	Pseudomonas tabaci	0.0001			

Table 33. TAS bacterial pathogens risk list generated from SOM analysis of Australian distributional data. . * Species with the same risk index were ranked in alphabetical order.

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
1	Curtobacterium flaccumfaciens	0.107	35	Pseudomonas syringae pv tomato	0.1037	69	Stenotrophomonas maltophilia	0.0022
2	Burkholderia cepacia	0.1058	36	Pseudomonas viridiflava	0.1037	70	Bacillus mycoides	0.0019
3	Burkholderia gladioli	0.1058	37	Pseudomonas cepacea	0.1037	71	Erwinia aroideae	0.0019
4	Corynebacterium michiganense	0.1056	38	Pseudomonas gladioli	0.1037	72	Herbaspirillum huttiense	0.0019
5	Agrobacterium vitis	0.1051	39	Pseudomonas syringae pv coriandricola	0.1037	73	Herbaspirillum rubrisubalbicans	0.0019
6	Pseudomonas syringae pv phaseolicola	0.1048	40	Pseudomonas syringae pv pisi	0.1037	74	Pseudomonas aeruginosa	0.0019
7	Clavibacter michiganense	0.1039	41	Streptomyces scabies	0.1037	75	Pseudomonas flectens	0.0019
8	Acidovorax avenae ss avenae	0.1037	42	Xanthomonas arboricola pv pruni	0.1037	76	Pseudomonas glycinea	0.0019
9	Acidovorax avenae ss citrulli	0.1037	43	Xanthomonas campestris pv campestris	0.1037	77	Pseudomonas striafaciens	0.0019
10	Burkholderia gladioli ss gladioli	0.1037	44	Xanthomonas campestris pv mangiferaeindicae	0.1037	78	Pseudomonas tabaci	0.0019
11	Clavibacter tritici	0.1037	45	Xanthomonas campestris pv begoniae	0.1037	79	Pseudomonas tonelliana	0.0019
12	Clavibacter michiganensis ss michiganensis	0.1037	46	Xanthomonas campestris pv carotae	0.1037	80	Serratia liquefaciens	0.0019
13	Clavibacter michiganense ss insidiosum	0.1037	47	Xanthomonas campestris pv incanae	0.1037	81	Streptomyces scabiei	0.0019
14	Clavibacter michiganense ss michiganense	0.1037	48	Xanthomonas campestris pv pelargonii	0.1037	82	Xanthomonas antirrhini	0.0019
15	Clavibacter toxicus	0.1037	49	Xanthomonas campestris pv pruni	0.1037	83	Xanthomonas cucurbitae	0.0019
16	Corynebacterium flaccumfaciens	0.1037	50	Xanthomonas fragariae	0.1037	84	Xanthomonas holcicola	0.0019
17	Erwinia carotovora ss carotovora	0.1037	51	Bacterium campestris	0.0231	85	Xanthomonas malvacearum	0.0019
18	Erwinia chrysanthemi	0.1037	52	Bacterium chrysanthemi	0.0231	86	Pantoea agglomerans	0.0014
19	Erwinia herbicola	0.1037	53	Bacterium solanacearum	0.0231	87	Pectobacterium carotovorum	0.0014
20	Erwinia cypripedii	0.1037	54	Acidovorax avenae	0.0033	88	Serratia marcescens	0.0014
21	Erwinia tracheiphila	0.1037	55	Bacillus cereus	0.0033	89	Chryseobacterium balustinum	0.0012
22	Pseudomonas cichorii	0.1037	56	Burkholderia andropogonis	0.0033	90	Hafnia alvei	0.0012
23	Pseudomonas fluorescens	0.1037	57	Erwinia chrysanthemi	0.0033	91	Micrococcus radiourans	0.0012
24	Pseudomonas syringae pv atrofaciens	0.1037	58	Pseudomonas andropogonis	0.0033	92	Ochrobactrum anthropi	0.0012
25	Pseudomonas syringae pv coronafaciens	0.1037	59	Ralstonia solanacearum	0.0033	93	Pseudomonas corrugata	0.0012
26	Pseudomonas syringae pv lachrymans	0.1037	60	Pseudomonas cichorii	0.0031	94	Pseudomonas eriobotryae	0.0012
27	Pseudomonas syringae pv maculicola	0.1037	61	Pseudomonas marginalis	0.0031	95	Xanthomonas vitians	0.0012
28	Pseudomonas syringae pv mori	0.1037	62	Xanthomonas pruni	0.0031	96	Agrobacterium radiobacter	0.0003
29	Pseudomonas syringae pv passiflorae	0.1037	63	Bacillus subtilis	0.0022	97	Agrobacterium rubi	0.0003
30	Pseudomonas syringae pv pisi	0.1037	64	Enterobacter cloacae	0.0022	98	Bacillus thuringiensis	0.0003
31	Pseudomonas syringae pv porri	0.1037	65	Erwinia herbicola	0.0022	99	Burkholderia caryophylli	0.0003
32	Pseudomonas syringae pv striafaciens	0.1037	66	Pantoea ananatis	0.0022	100	Cellulomonas flavigena	0.0003
33	Pseudomonas syringae pv syringae	0.1037	67	Pseudomonas solanacearum	0.0022	101	Chryseobacterium indologenes	0.0003
34	Pseudomonas syringae pv tabaci	0.1037	68	Sphingomonas suberifaciens	0.0022	102	Citrobacter freundii	0.0003

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Table 33 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
103	Enterobacter aerogenes	0.0003	109	Klebsiella pneumoniae	0.0003	115	Pseudomonas savastanoi	0.0003
104	Enterobacter gergoviae	0.0003	110	Methylobacterium mesophilum	0.0003	116	Rathayibacter toxicus	0.0003
105	Erwinia mangiferae	0.0003	111	Oerskovia turbata	0.0003	117	Rhizobium trifolii	0.0003
106	Erwinia rhapontici	0.0003	112	Paenibacillus macerans	0.0003	118	Serratia fonticola	0.0003
107	Escherichia coli	0.0003	113	Pectobacterium atrosepticum	0.0003	119	Serratia proteamaculans	0.0003
108	Klebsiella oxytoca	0.0003	114	Pseudomonas mors-prunorum	0.0003			

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Table 34. VIC bacterial pathogens risk list generated from SOM analysis of Australian distributional data. . * Species with the same risk index were ranked in alphabetical order.

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
1	Burkholderia cepacia	0.347	35	Serratia fonticola	0.3156	69	Pseudomonas fluorescens	0.0157
2	Burkholderia gladioli	0.347	36	Serratia proteamaculans	0.3156	70	Pseudomonas syringae pv atrofaciens	0.0157
3	Bacillus subtilis	0.3313	37	Bacterium campestris	0.1161	71	Pseudomonas syringae pv coronafaciens	0.0157
4	Clavibacter michiganense	0.3313	38	Bacterium chrysanthemi	0.1161	72	Pseudomonas syringae pv lachrymans	0.0157
5	Enterobacter cloacae	0.3313	39	Bacterium solanacearum	0.1161	73	Pseudomonas syringae pv maculicola	0.0157
6	Erwinia herbicola	0.3313	40	Corynebacterium michiganense	0.0314	74	Pseudomonas syringae pv mori	0.0157
7	Pantoea ananatis	0.3313	41	Corynebacterium insidiosum	0.0165	75	Pseudomonas syringae pv passiflorae	0.0157
8	Pseudomonas solanacearum	0.3313	42	Pseudomonas marginata	0.0165	76	Pseudomonas syringae pv pisi	0.0157
9	Sphingomonas suberifaciens	0.3313	43	Pseudomonas phaseolicola	0.0165	77	Pseudomonas syringae pv porri	0.0157
10	Stenotrophomonas maltophilia	0.3313	44	Pseudomonas syringae pv syringae	0.0165	78	Pseudomonas syringae pv striafaciens	0.0157
11	Agrobacterium rhizogenes	0.3164	45	Xanthomonas begoniae	0.0165	79	Pseudomonas syringae pv syringae	0.0157
12	Pseudomonas pisi	0.3164	46	Xanthomonas campestris pv campestris	0.0165	80	Pseudomonas syringae pv tabaci	0.0157
13	Agrobacterium radiobacter	0.3156	47	Xanthomonas campestris pv juglandis	0.0165	81	Pseudomonas syringae pv tomato	0.0157
14	Agrobacterium rubi	0.3156	48	Xanthomonas juglandis	0.0165	82	Pseudomonas viridiflava	0.0157
15	Bacillus thuringiensis	0.3156	49	Xanthomonas phaseoli	0.0165	83	Pseudomonas aeruginosa	0.0157
16	Burkholderia caryophylli	0.3156	50	Acidovorax avenae ss avenae	0.0157	84	Pseudomonas cepacea	0.0157
17	Cellulomonas flavigena	0.3156	51	Acidovorax avenae ss citrulli	0.0157	85	Pseudomonas flectens	0.0157
18	Chryseobacterium indologenes	0.3156	52	Bacillus mycoides	0.0157	86	Pseudomonas gladioli	0.0157
19	Citrobacter freundii	0.3156	53	Burkholderia gladioli ss gladioli	0.0157	87	Pseudomonas glycinea	0.0157
20	Enterobacter aerogenes	0.3156	54	Clavibacter tritici	0.0157	88	Pseudomonas striafaciens	0.0157
21	Enterobacter gergoviae	0.3156	55	Clavibacter michiganensis ss michiganensis	0.0157	89	Pseudomonas syringae pv coriandricola	0.0157
22	Erwinia mangiferae	0.3156	56	Clavibacter michiganense ss insidiosum	0.0157	90	Pseudomonas syringae pv pisi	0.0157
23	Erwinia rhapontici	0.3156	57	Clavibacter michiganense ss michiganense	0.0157	91	Pseudomonas tabaci	0.0157
24	Escherichia coli	0.3156	58	Clavibacter toxicus	0.0157	92	Pseudomonas tonelliana	0.0157
25	Klebsiella oxytoca	0.3156	59	Corynebacterium flaccumfaciens	0.0157	93	Serratia liquefaciens	0.0157
26	Klebsiella pneumoniae	0.3156	60	Erwinia carotovora ss carotovora	0.0157	94	Streptomyces scabies	0.0157
27	Methylobacterium mesophilum	0.3156	61	Erwinia chrysanthemi	0.0157	95	Streptomyces scabiei	0.0157
28	Oerskovia turbata	0.3156	62	Erwinia herbicola	0.0157	96	Xanthomonas arboricola pv pruni	0.0157
29	Paenibacillus macerans	0.3156	63	Erwinia aroideae	0.0157	97	Xanthomonas campestris pv campestris	0.0157
30	Pectobacterium atrosepticum	0.3156	64	Erwinia cypripedii	0.0157	98	Xanthomonas campestris pv mangiferaeindicae	0.0157
31	Pseudomonas mors-prunorum	0.3156	65	Erwinia tracheiphila	0.0157	99	Xanthomonas antirrhini	0.0157
32	Pseudomonas savastanoi	0.3156	66	Herbaspirillum huttiense	0.0157	100	Xanthomonas campestris pv begoniae	0.0157
33	Rathayibacter toxicus	0.3156	67	Herbaspirillum rubrisubalbicans	0.0157	101	Xanthomonas campestris pv carotae	0.0157
34	Rhizobium trifolii	0.3156	68	Pseudomonas cichorii	0.0157	102	Xanthomonas campestris pv incanae	0.0157

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Table 34 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
103	Xanthomonas campestris pv pelargonii	0.0157	111	Pseudomonas alliicola	0.0008	119	Pseudomonas syringae pv Maculicola	0.0008
104	Xanthomonas campestris pv pruni	0.0157	112	Pseudomonas coronafaciens	0.0008	120	Pseudomonas syringae pv Mori	0.0008
105	Xanthomonas cucurbitae	0.0157	113	Pseudomonas delphinii	0.0008	121	Pseudomonas syringae pv tomato	0.0008
106	Xanthomonas fragariae	0.0157	114	Pseudomonas gladioli pv Gladioli	0.0008	122	Pseudomonas tolaasi	0.0008
107	Xanthomonas holcicola	0.0157	115	Pseudomonas lachrymans	0.0008	123	Pseudomonas tomato	0.0008
108	Xanthomonas malvacearum	0.0157	116	Pseudomonas mori	0.0008	124	Xanthomonas campestris pv vitians	0.0008
109	Corynebacterium michiganense pv Insidiosum	0.0008	117	Pseudomonas primulae	0.0008	125	Xanthomonas hyacinthi	0.0008
110	Corynebacterium michiganense pv Michiganense	0.0008	118	Pseudomonas savastanoi f sp Nerii	0.0008	126	Xanthomonas papavericola	0.0008

Table 35. WA bacterial pathogens risk list generated from SOM analysis of Australian distributional data. . * Species with the same risk index were ranked in alphabetical order.

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
1	Agrobacterium tumefaciens	0.421	35	Bacterium chrysanthemi	0.2186	69	Acidovorax avenae	0.0119
2	Erwinia carotovora	0.421	36	Bacterium solanacearum	0.2186	70	Bacillus cereus	0.0119
3	Pseudomonas syringae	0.421	37	Clavibacter michiganensis	0.0607	71	Burkholderia andropogonis	0.0119
4	Xanthomonas campestris	0.421	38	Pseudomonas fluorescens	0.0605	72	Erwinia chrysanthemi	0.0119
5	Streptomyces scabies	0.4209	39	Pseudomonas putida	0.0605	73	Pseudomonas andropogonis	0.0119
6	Corynebacterium insidiosum	0.4091	40	Pseudomonas maculicola	0.0598	74	Ralstonia solanacearum	0.0119
7	Pseudomonas syringae pv syringae	0.4091	41	Pseudomonas viridiflava	0.0598	75	Pantoea agglomerans	0.0118
8	Xanthomonas campestris pv campestris	0.4091	42	Xanthomonas vesicatoria	0.0598	76	Pectobacterium carotovorum	0.0118
9	Xanthomonas campestris pv juglandis	0.4091	43	Pseudomonas pseudoalcaligenes	0.0597	77	Serratia marcescens	0.0118
10	Curtobacterium flaccumfaciens	0.3723	44	Agrobacterium rhizogenes	0.0497	78	Pseudomonas cichorii	0.011
11	Agrobacterium vitis	0.3722	45	Pseudomonas pisi	0.0497	79	Pseudomonas marginalis	0.011
12	Pseudomonas syringae pv phaseolicola	0.3713	46	Pseudomonas marginata	0.0489	80	Xanthomonas pruni	0.011
13	Burkholderia cepacia	0.3614	47	Pseudomonas phaseolicola	0.0489	81	Chryseobacterium balustinum	0.0109
14	Burkholderia gladioli	0.3614	48	Xanthomonas begoniae	0.0489	82	Hafnia alvei	0.0109
15	Clavibacter michiganense	0.3613	49	Xanthomonas juglandis	0.0489	83	Micrococcus radiourans	0.0109
16	Corynebacterium michiganense	0.3605	50	Xanthomonas phaseoli	0.0489	84	Ochrobactrum anthropi	0.0109
17	Burkholderia gladioli ss gladioli	0.3604	51	Corynebacterium michiganense pv Insidiosum	0.0488	85	Pseudomonas corrugata	0.0109
18	Clavibacter michiganense ss insidiosum	0.3604	52	Corynebacterium michiganense pv Michiganense	0.0488	86	Pseudomonas eriobotryae	0.0109
19	Clavibacter michiganense ss michiganense	0.3604	53	Pseudomonas alliicola	0.0488	87	Xanthomonas vitians	0.0109
20	Clavibacter toxicus	0.3604	54	Pseudomonas coronafaciens	0.0488	88	Bacillus subtilis	0.001
21	Corynebacterium flaccumfaciens	0.3604	55	Pseudomonas delphinii	0.0488	89	Enterobacter cloacae	0.001
22	Erwinia cypripedii	0.3604	56	Pseudomonas gladioli pv Gladioli	0.0488	90	Erwinia herbicola	0.001
23	Erwinia tracheiphila	0.3604	57	Pseudomonas lachrymans	0.0488	91	Pantoea ananatis	0.001
24	Pseudomonas cepacea	0.3604	58	Pseudomonas mori	0.0488	92	Pseudomonas solanacearum	0.001
25	Pseudomonas gladioli	0.3604	59	Pseudomonas primulae	0.0488	93	Sphingomonas suberifaciens	0.001
26	Pseudomonas syringae pv coriandricola	0.3604	60	Pseudomonas savastanoi f sp Nerii	0.0488	94	Stenotrophomonas maltophilia	0.001
27	Pseudomonas syringae pv pisi	0.3604	61	Pseudomonas syringae pv Maculicola	0.0488	95	Agrobacterium radiobacter	0.0009
28	Xanthomonas campestris pv begoniae	0.3604	62	Pseudomonas syringae pv Mori	0.0488	96	Agrobacterium rubi	0.0009
29	Xanthomonas campestris pv carotae	0.3604	63	Pseudomonas syringae pv tomato	0.0488	97	Bacillus thuringiensis	0.0009
30	Xanthomonas campestris pv incanae	0.3604	64	Pseudomonas tolaasi	0.0488	98	Burkholderia caryophylli	0.0009
31	Xanthomonas campestris pv pelargonii	0.3604	65	Pseudomonas tomato	0.0488	99	Cellulomonas flavigena	0.0009
32	Xanthomonas campestris pv pruni	0.3604	66	Xanthomonas campestris pv vitians	0.0488	100	Chryseobacterium indologenes	0.0009
33	Xanthomonas fragariae	0.3604	67	Xanthomonas hyacinthi	0.0488	101	Citrobacter freundii	0.0009
34	Bacterium campestris	0.2186	68	Xanthomonas papavericola	0.0488	102	Enterobacter aerogenes	0.0009

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Table 35 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
103	Enterobacter gergoviae	0.0009	114	Pseudomonas savastanoi	0.0009	125	Pseudomonas glycinea	0.0001
104	Erwinia mangiferae	0.0009	115	Rathayibacter toxicus	0.0009	126	Pseudomonas striafaciens	0.0001
105	Erwinia rhapontici	0.0009	116	Rhizobium trifolii	0.0009	127	Pseudomonas tabaci	0.0001
106	Escherichia coli	0.0009	117	Serratia fonticola	0.0009	128	Pseudomonas tonelliana	0.0001
107	Klebsiella oxytoca	0.0009	118	Serratia proteamaculans	0.0009	129	Serratia liquefaciens	0.0001
108	Klebsiella pneumoniae	0.0009	119	Bacillus mycoides	0.0001	130	Streptomyces scabiei	0.0001
109	Methylobacterium mesophilum	0.0009	120	Erwinia aroideae	0.0001	131	Xanthomonas antirrhini	0.0001
110	Oerskovia turbata	0.0009	121	Herbaspirillum huttiense	0.0001	132	Xanthomonas cucurbitae	0.0001
111	Paenibacillus macerans	0.0009	122	Herbaspirillum rubrisubalbicans	0.0001	133	Xanthomonas holcicola	0.0001
112	Pectobacterium atrosepticum	0.0009	123	Pseudomonas aeruginosa	0.0001	134	Xanthomonas malvacearum	0.0001
113	Pseudomonas mors-prunorum	0.0009	124	Pseudomonas flectens	0.0001			

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Table 36. NSW virus pathogens risk list generated from SOM analysis of Australian distributional data. . * Species with the same risk index were ranked in alphabetical order.

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
1	Apple stem grooving virus	0.5554	38	Raspberry bushy dwarf virus	0.4432	75	Sweet potato feathery mottle virus	0.0134
2	Apple stem pitting virus	0.5554	39	Ryegrass cryptic virus	0.4432	76	Tobacco necrosis virus	0.0134
3	strawberry mild yellow edge virus	0.5421	40	Ryegrass mosaic virus	0.4432	77	Tobacco streak virus	0.0134
4	strawberry vein banding virus	0.5421	41	Viola mottle virus	0.4432	78	Tomato yellow leaf curl virus	0.0134
5	Poinsettia mosaic virus	0.4566	42	Prune dwarf virus	0.099	79	watermelon mosaic virus 2	0.0134
6	Beet mosaic virus	0.4443	43	Alstroemeria mosaic virus	0.0989	80	Australian grapevine viroid	0.0011
7	Broccoli necrotic yellows virus	0.4443	44	carrot mosaic virus Y	0.0989	81	Australian grapevine yellows	0.0011
8	Carrot mottle virus	0.4443	45	dasheen mosaic virus	0.0989	82	Broad bean stain virus	0.0011
9	Carrot red leaf virus	0.4443	46	Dianella chlorotic mottle virus	0.0989	83	Chlorotic leaf spot virus	0.0011
10	Lucerne transient streak virus	0.4443	47	grapevine fleck virus	0.0989	84	Chrysanthemum carlavirus B	0.0011
11	Strawberry latent ringspot virus	0.4443	48	Grapevine leafroll ass. virus 1	0.0989	85	Chrysanthemum stunt viroid	0.0011
12	Tobacco ringspot virus	0.4443	49	Grapevine leafroll ass. virus 3	0.0989	86	Echtes Ackerbohnenmosaik virus	0.0011
13	Tomato aspermy virus	0.4443	50	Grapevine rupestris stem pitting virus	0.0989	87	Frangipani mosaic virus	0.0011
14	Arabis mosaic virus	0.4432	51	grapevine virus A	0.0989	88	Garlic yellow streak virus	0.0011
15	Beet cryptic virus 1	0.4432	52	leek yellow stripe virus	0.0989	89	Grapevine yellow speckle viroid 1	0.0011
16	Beet cryptic virus 2	0.4432	53	Pear blister canker viroid	0.0989	90	Grapevine yellow speckle viroid 2	0.0011
17	Beet pseudoyellows virus	0.4432	54	strawberry mottle virus	0.0989	91	Hibiscus chlorotic ringspot virus	0.0011
18	Carnation etched ring virus	0.4432	55	strawberry pallidosis virus	0.0989	92	Hop stunt viroid	0.0011
19	Carnation vein mottle virus	0.4432	56	Tomato leaf curl virus	0.0135	93	Lilium symptomless virus	0.0011
20	Cereal yellow dwarf virus	0.4432	57	Alternanthera mosaic virus	0.0134	94	Nicotiana velutina mosaic virus	0.0011
21	Chrysanthemum virus B	0.4432	58	Apium virus Y	0.0134	95	Ribgrass mosaic virus	0.0011
22	Dahlia mosaic virus	0.4432	59	Bamboo mosaic virus	0.0134	96	Soybean dwarf virus	0.0011
23	Hop latent virus	0.4432	60	Banana bunchy top virus	0.0134	97	Subterranean clover mottle virus	0.0011
24	Hop mosaic virus	0.4432	61	Banana streak mysore virus	0.0134	98	Tomato ringspot virus	0.0011
25	Iris severe mosaic virus	0.4432	62	Barley stripe mosaic virus	0.0134	99	Tristeza virus	0.0011
26	Lily symptomless virus	0.4432	63	Blackeye cowpea mosaic virus	0.0134	100	Velvet tobacco mottle virus	0.0011
27	Lily virus X	0.4432	64	Chloris striate mosaic virus	0.0134	101	Squash mosaic virus	0.0003
28	Maize mosaic virus	0.4432	65	Datura yellow vein virus	0.0134	102	Apple mosaic virus	0.0001
29	Malva vein clearing virus	0.4432	66	Ginger chlorotic fleck virus	0.0134	103	Bean yellow mosaic virus	0.0001
30	Narcissus latent virus	0.4432	67	Kennedia yellow mosaic virus	0.0134	104	Carrot mottle virus	0.0001
31	Narcissus mosaic virus	0.4432	68	Pandanus ringspot virus	0.0134	105	Cowpea aphid borne mosaic virus	0.0001
32	Narcissus yellow stripe virus	0.4432	69	Parsley latent virus	0.0134	106	Cucumber mosaic virus	0.0001
33	Nerine latent virus	0.4432	70	Paspalum striate mosaic virus	0.0134	107	Iris yellow spot virus	0.0001
34	Nerine virus X	0.4432	71	Passiflora virus Y	0.0134	108	Prunus necrotic ringspot virus	0.0001
35	Nerine virus Y	0.4432	72	Soybean spherical virus	0.0134	109	Rupestris stem pitting-associated virus	0.0001
36	Nerine yellow stripe virus	0.4432	73	Sugarcane bacilliform virus	0.0134	110	Sweet potato feathery mottle virus	0.0001
37	Potato virus A	0.4432	74	Sweet potato chlorotic stunt virus	0.0134	111	Sweet potato virus 2	0.0001

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Table 37. NT virus pathogens risk list generated from SOM analysis of Australian distributional data. . * Species with the same risk index were ranked in alphabetical order.

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
1	Apple chlorotic leaf spot virus	0.5447	35	Cauliflower mosaic virus	0.0619	69	Subterranean clover mottle virus	0.0616
2	Turnip mosaic virus	0.5447	36	Cymbidium mosaic virus	0.0619	70	Tomato ringspot virus	0.0616
3	Tobacco mosaic virus	0.531	37	Grapevine fanleaf virus	0.0619	71	Tristeza virus	0.0616
4	Sugarcane mosaic virus	0.4692	38	Orchid fleck virus	0.0619	72	Velvet tobacco mottle virus	0.0616
5	Prune dwarf virus	0.469	39	Subterranean clover red leaf virus	0.0619	73	Apple mosaic virus	0.0278
6	Avocado Sun blotch viroid	0.4554	40	Beet mosaic virus	0.0618	74	Wheat streak mosaic virus	0.0278
7	Cherry rasp leaf virus	0.4554	41	Broccoli necrotic yellows virus	0.0618	75	Apple stem grooving virus	0.0276
8	Apple mosaic virus	0.4553	42	Carrot mottle virus	0.0618	76	Apple stem pitting virus	0.0276
9	Bean yellow mosaic virus	0.4553	43	Carrot red leaf virus	0.0618	77	Bean leafroll virus	0.0276
10	Carrot mottle virus	0.4553	44	Citrus exocortis viroid	0.0618	78	Carrot virus Y	0.0276
11	Cucumber mosaic virus	0.4553	45	Citrus psorosis	0.0618	79	Citrus tristeza	0.0276
12	Iris yellow spot virus	0.4553	46	Lucerne transient streak virus	0.0618	80	Bean common mosaic virus	0.0141
13	Prunus necrotic ringspot virus	0.4553	47	Lucerne witches broom	0.0618	81	Beet western yellows virus	0.0141
14	Rupestris stem pitting-associated virus	0.4553	48	Prune dwarf virus	0.0618	82	Broad bean wilt virus	0.0141
15	Sweet potato feathery mottle virus	0.4553	49	Strawberry latent ringspot virus	0.0618	83	carnation latent virus	0.0141
16	Sweet potato virus 2	0.4553	50	Tobacco ringspot virus	0.0618	84	carnation mottle virus	0.0141
17	Alfalfa mosaic virus	0.0894	51	Tomato aspermy virus	0.0618	85	iris mild mosaic virus	0.0141
18	Bean yellow mosaic virus	0.0894	52	Australian grapevine viroid	0.0616	86	Potato virus S	0.0141
19	cucumber mosaic virus	0.0894	53	Australian grapevine yellows	0.0616	87	Sowbane mosaic virus	0.0141
20	Potato leafroll virus	0.0894	54	Broad bean stain virus	0.0616	88	Strawberry crinkle virus	0.0141
21	Potato virus Y	0.0894	55	Chlorotic leaf spot virus	0.0616	89	Subterranean clover stunt virus	0.0141
22	Tobacco yellow dwarf virus	0.0894	56	Chrysanthemum carlavirus B	0.0616	90	tulip breaking virus	0.0141
23	Tomato spotted wilt virus	0.0894	57	Chrysanthemum stunt viroid	0.0616	91	white clover mosaic virus	0.0141
24	Celery mosaic virus	0.0893	58	Echtes Ackerbohnenmosaik virus	0.0616	92	Banana mild mosaic virus	0.0139
25	Pea Seed-borne Mosaic virus	0.0893	59	Frangipani mosaic virus	0.0616	93	Banana streak virus	0.0139
26	Barley yellow dwarf virus	0.0757	60	Garlic yellow streak virus	0.0616	94	Capsicum chlorosis virus	0.0139
27	Clover Yellow Vein virus	0.0757	61	Grapevine yellow speckle viroid 1	0.0616	95	High plains virus	0.0139
28	Lettuce mosaic virus	0.0757	62	Grapevine yellow speckle viroid 2	0.0616	96	Iris yellow spot virus	0.0139
29	Lettuce necrotic yellows virus	0.0757	63	Hibiscus chlorotic ringspot virus	0.0616	97	lettuce big vein virus	0.0139
30	Odontoglossum ringspot virus	0.0757	64	Hop stunt viroid	0.0616	98	Ornithogalum mosaic virus	0.0139
31	Potato virus X	0.0757	65	Lilium symptomless virus	0.0616	99	Passiflora latent virus	0.0139
32	Prunus necrotic ringspot virus	0.0757	66	Nicotiana velutina mosaic virus	0.0616	100	Passionfruit latent virus	0.0139
33	Tomato mosaic virus	0.0757	67	Ribgrass mosaic virus	0.0616	101	Peanut mottle virus	0.0139
34	Passionfruit woodiness virus	0.0755	68	Soybean dwarf virus	0.0616	102	Poinsettia mosaic virus	0.0139

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Table 37 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
103	Solanum nodiflorum mottle virus	0.0139	137	strawberry pallidosis virus	0.0137	171	Chrysanthemum virus B	0.0002
104	Soybean mosaic virus	0.0139	138	Sugarcane bacilliform virus	0.0137	172	Citrus cachexia	0.0002
105	strawberry mild yellow edge virus	0.0139	139	Sweet potato chlorotic stunt virus	0.0137	173	Citrus tatter leaf	0.0002
106	strawberry vein banding virus	0.0139	140	Sweet potato feathery mottle virus	0.0137	174	Citrus vein enation	0.0002
107	Sunflower ringspot virus	0.0139	141	Tobacco necrosis virus	0.0137	175	Citrus xyloporosis	0.0002
108	Tomato big bud virus	0.0139	142	Tobacco streak virus	0.0137	176	Cymbidium ringspot virus	0.0002
109	Alstroemeria mosaic virus	0.0137	143	Tomato yellow leaf curl virus	0.0137	177	Dahlia mosaic virus	0.0002
110	Alternanthera mosaic virus	0.0137	144	watermelon mosaic virus 2	0.0137	178	Datura rugose	0.0002
111	Apium virus Y	0.0137	145	Freesia mosaic virus	0.0003	179	Fig mosaic virus	0.0002
112	Bamboo mosaic virus	0.0137	146	Onion yellow dwarf virus	0.0003	180	Hop latent virus	0.0002
113	Banana bunchy top virus	0.0137	147	Abutilon mosaic	0.0002	181	Hop mosaic virus	0.0002
114	Banana streak mysore virus	0.0137	148	Apple flat limb	0.0002	182	Iris mosaic virus	0.0002
115	Barley stripe mosaic virus	0.0137	149	Apple platycarpa	0.0002	183	Iris severe mosaic virus	0.0002
116	Blackeye cowpea mosaic virus	0.0137	150	Apple ring spot	0.0002	184	Lily symptomless virus	0.0002
117	carrot mosaic virus Y	0.0137	151	Apple russet ring	0.0002	185	Lily virus X	0.0002
118	Chloris striate mosaic virus	0.0137	152	Apricot ring pox	0.0002	186	Maize dwarf mosaic	0.0002
119	dasheen mosaic virus	0.0137	153	Arabis mosaic virus	0.0002	187	Maize mosaic virus	0.0002
120	Datura yellow vein virus	0.0137	154	Avocado pear sunblotch	0.0002	188	Malva vein clearing virus	0.0002
121	Dianella chlorotic mottle virus	0.0137	155	Bean summer death	0.0002	189	Narcissus latent virus	0.0002
122	Ginger chlorotic fleck virus	0.0137	156	Beet cryptic virus 1	0.0002	190	Narcissus mosaic virus	0.0002
123	grapevine fleck virus	0.0137	157	Beet cryptic virus 2	0.0002	191	Narcissus yellow stripe virus	0.0002
124	Grapevine leafroll ass. virus 1	0.0137	158	Beet pseudoyellows virus	0.0002	192	Nerine latent virus	0.0002
125	Grapevine leafroll ass. virus 3	0.0137	159	Cabbage black ring spot	0.0002	193	Nerine virus X	0.0002
126	Grapevine rupestris stem pitting virus	0.0137	160	Capsicum mosaic	0.0002	194	Nerine virus Y	0.0002
127	grapevine virus A	0.0137	161	Carnation etched ring virus	0.0002	195	Nerine yellow stripe virus	0.0002
128	Kennedia yellow mosaic virus	0.0137	162	Carnation mosaic	0.0002	196	Nothoscordum mosaic virus	0.0002
129	leek yellow stripe virus	0.0137	163	Carnation ringspot	0.0002	197	Parsley virus Y	0.0002
130	Pandanus ringspot virus	0.0137	164	Carnation vein mottle virus	0.0002	198	Patchouli mild mosaic virus	0.0002
131	Parsley latent virus	0.0137	165	Cereal yellow dwarf virus	0.0002	199	Pea pimple pod virus	0.0002
132	Paspalum striate mosaic virus	0.0137	166	Chenopodium mosaic	0.0002	200	Peach calico virus	0.0002
133	Passiflora virus Y	0.0137	167	Cherry black canker	0.0002	201	Peach ringspot virus	0.0002
134	Pear blister canker viroid	0.0137	168	Cherry mottle leaf	0.0002	202	Pear stony pit virus	0.0002
135	Soybean spherical virus	0.0137	169	Cherry ring spot	0.0002	203	Pelargonium leaf-curl virus	0.0002
136	strawberry mottle virus	0.0137	170	Cherry rugose mosaic	0.0002	204	Peony ringspot virus	0.0002

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Table 37 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
205	Pepper Mild Mottle virus	0.0002	212	Rose mosaic virus	0.0002	219	Stock mosaic virus	0.0002
206	Plum line pattern virus	0.0002	213	Rugose leaf curl virus	0.0002	220	Sugarcane Fiji disease	0.0002
207	Potato aucuba mosaic virus	0.0002	214	Rugose leaf mosaic virus	0.0002	221	Sweet potato russet crack	0.0002
208	Potato spindle tuber virus	0.0002	215	Ryegrass cryptic virus	0.0002	222	Tomato yellow top virus	0.0002
209	Potato virus A	0.0002	216	Ryegrass mosaic virus	0.0002	223	Turnip yellow mosaic virus	0.0002
210	Raspberry bushy dwarf virus	0.0002	217	Sobemovirus	0.0002	224	Viola mottle virus	0.0002
211	Rhubarb closterovirus	0.0002	218	Sow thistle yellow vein virus	0.0002	225	Witches broom virus	0.0002

Table 38. QLD virus pathogens risk list generated from SOM analysis of Australian distributional data. . * Species with the same risk index were ranked in alphabetical order.

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
1	Tobacco mosaic virus	0.1061	35	Lucerne transient streak virus	0.0275	69	Cherry rugose mosaic	0.0262
2	Barley yellow dwarf virus	0.0799	36	Lucerne witches broom	0.0275	70	Chrysanthemum virus B	0.0262
3	Odontoglossum ringspot virus	0.0799	37	Prune dwarf virus	0.0275	71	Citrus cachexia	0.0262
4	Prunus necrotic ringspot virus	0.0799	38	Strawberry latent ringspot virus	0.0275	72	Citrus tatter leaf	0.0262
5	carnation latent virus	0.0786	39	Tobacco ringspot virus	0.0275	73	Citrus vein enation	0.0262
6	carnation mottle virus	0.0786	40	Tomato aspermy virus	0.0275	74	Citrus xyloporosis	0.0262
7	iris mild mosaic virus	0.0786	41	Abutilon mosaic	0.0262	75	Cowpea aphid borne mosaic virus	0.0262
8	Strawberry crinkle virus	0.0786	42	Alstroemeria mosaic virus	0.0262	76	Cucumber mosaic virus	0.0262
9	Subterranean clover stunt virus	0.0786	43	Apple flat limb	0.0262	77	Cymbidium ringspot virus	0.0262
10	tulip breaking virus	0.0786	44	Apple mosaic virus	0.0262	78	Dahlia mosaic virus	0.0262
11	white clover mosaic virus	0.0786	45	Apple platycarpa	0.0262	79	dasheen mosaic virus	0.0262
12	Cauliflower mosaic virus	0.0537	46	Apple ring spot	0.0262	80	Datura rugose	0.0262
13	Cymbidium mosaic virus	0.0537	47	Apple russet ring	0.0262	81	Dianella chlorotic mottle virus	0.0262
14	Grapevine fanleaf virus	0.0537	48	Apricot ring pox	0.0262	82	Fig mosaic virus	0.0262
15	Orchid fleck virus	0.0537	49	Arabis mosaic virus	0.0262	83	grapevine fleck virus	0.0262
16	Subterranean clover red leaf virus	0.0537	50	Avocado pear sunblotch	0.0262	84	Grapevine leafroll ass. virus 1	0.0262
17	Avocado Sun blotch viroid	0.0524	51	Bean summer death	0.0262	85	Grapevine leafroll ass. virus 3	0.0262
18	Cherry rasp leaf virus	0.0524	52	Bean yellow mosaic virus	0.0262	86	Grapevine rupestris stem pitting virus	0.0262
19	Freesia mosaic virus	0.0524	53	Beet cryptic virus 1	0.0262	87	grapevine virus A	0.0262
20	Iris yellow spot virus	0.0524	54	Beet cryptic virus 2	0.0262	88	Hop latent virus	0.0262
21	lettuce big vein virus	0.0524	55	Beet pseudoyellows virus	0.0262	89	Hop mosaic virus	0.0262
22	Onion yellow dwarf virus	0.0524	56	Cabbage black ring spot	0.0262	90	Iris mosaic virus	0.0262
23	Ornithogalum mosaic virus	0.0524	57	Capsicum mosaic	0.0262	91	Iris severe mosaic virus	0.0262
24	Prune dwarf virus	0.0524	58	Carnation etched ring virus	0.0262	92	Iris yellow spot virus	0.0262
25	Squash mosaic virus	0.0524	59	Carnation mosaic	0.0262	93	leek yellow stripe virus	0.0262
26	strawberry mild yellow edge virus	0.0524	60	Carnation ringspot	0.0262	94	Lily symptomless virus	0.0262
27	strawberry vein banding virus	0.0524	61	Carnation vein mottle virus	0.0262	95	Lily virus X	0.0262
28	Tomato big bud virus	0.0524	62	carrot mosaic virus Y	0.0262	96	Maize dwarf mosaic	0.0262
29	Beet mosaic virus	0.0275	63	Carrot mottle virus	0.0262	97	Maize mosaic virus	0.0262
30	Broccoli necrotic yellows virus	0.0275	64	Cereal yellow dwarf virus	0.0262	98	Malva vein clearing virus	0.0262
31	Carrot mottle virus	0.0275	65	Chenopodium mosaic	0.0262	99	Narcissus latent virus	0.0262
32	Carrot red leaf virus	0.0275	66	Cherry black canker	0.0262	100	Narcissus mosaic virus	0.0262
33	Citrus exocortis viroid	0.0275	67	Cherry mottle leaf	0.0262	101	Narcissus yellow stripe virus	0.0262
34	Citrus psorosis	0.0275	68	Cherry ring spot	0.0262	102	Nerine latent virus	0.0262

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Table 38 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
103	Nerine virus X	0.0262	124	Rose mosaic virus	0.0262	145	Broad bean stain virus	0.0013
104	Nerine virus Y	0.0262	125	Rugose leaf curl virus	0.0262	146	Chlorotic leaf spot virus	0.0013
105	Nerine yellow stripe virus	0.0262	126	Rugose leaf mosaic virus	0.0262	147	Chrysanthemum carlavirus B	0.0013
106	Nothoscordum mosaic virus	0.0262	127	Rupestris stem pitting-associated virus	0.0262	148	Chrysanthemum stunt viroid	0.0013
107	Parsley virus Y	0.0262	128	Ryegrass cryptic virus	0.0262	149	Echtes Ackerbohnenmosaik virus	0.0013
108	Patchouli mild mosaic virus	0.0262	129	Ryegrass mosaic virus	0.0262	150	Frangipani mosaic virus	0.0013
109	Pea pimple pod virus	0.0262	130	Sobemovirus	0.0262	151	Garlic yellow streak virus	0.0013
110	Peach calico virus	0.0262	131	Sow thistle yellow vein virus	0.0262	152	Grapevine yellow speckle viroid 1	0.0013
111	Peach ringspot virus	0.0262	132	Stock mosaic virus	0.0262	153	Grapevine yellow speckle viroid 2	0.0013
112	Pear blister canker viroid	0.0262	133	strawberry mottle virus	0.0262	154	Hibiscus chlorotic ringspot virus	0.0013
113	Pear stony pit virus	0.0262	134	strawberry pallidosis virus	0.0262	155	Hop stunt viroid	0.0013
114	Pelargonium leaf-curl virus	0.0262	135	Sugarcane Fiji disease	0.0262	156	Lilium symptomless virus	0.0013
115	Peony ringspot virus	0.0262	136	Sweet potato feathery mottle virus	0.0262	157	Nicotiana velutina mosaic virus	0.0013
116	Pepper Mild Mottle virus	0.0262	137	Sweet potato russet crack	0.0262	158	Ribgrass mosaic virus	0.0013
117	Plum line pattern virus	0.0262	138	Sweet potato virus 2	0.0262	159	Soybean dwarf virus	0.0013
118	Potato aucuba mosaic virus	0.0262	139	Tomato yellow top virus	0.0262	160	Subterranean clover mottle virus	0.0013
119	Potato spindle tuber virus	0.0262	140	Turnip yellow mosaic virus	0.0262	161	Tomato ringspot virus	0.0013
120	Potato virus A	0.0262	141	Viola mottle virus	0.0262	162	Tristeza virus	0.0013
121	Prunus necrotic ringspot virus	0.0262	142	Witches broom virus	0.0262	163	Velvet tobacco mottle virus	0.0013
122	Raspberry bushy dwarf virus	0.0262	143	Australian grapevine viroid	0.0013			
123	Rhubarb closterovirus	0.0262	144	Australian grapevine yellows	0.0013			

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Table 39. SA virus pathogens risk list generated from SOM analysis of Australian distributional data. . * Species with the same risk index were ranked in alphabetical order.

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
1	Papaya ringspot virus	0.3318	35	Pear blister canker viroid	0.1487	69	Soybean mosaic virus	0.0027
2	Watermelon mosaic virus	0.2416	36	strawberry mottle virus	0.1487	70	Sunflower ringspot virus	0.0027
3	Prune dwarf virus	0.2389	37	strawberry pallidosis virus	0.1487	71	Abutilon mosaic	0.0017
4	Squash mosaic virus	0.1804	38	Johnsongrass mosaic virus	0.0929	72	Apple flat limb	0.0017
5	Apple mosaic virus	0.153	39	Sugarcane mosaic virus	0.0929	73	Apple platycarpa	0.0017
6	Wheat streak mosaic virus	0.153	40	Avocado Sun blotch viroid	0.0919	74	Apple ring spot	0.0017
7	carnation latent virus	0.152	41	Cherry rasp leaf virus	0.0919	75	Apple russet ring	0.0017
8	carnation mottle virus	0.152	42	Tomato leaf curl virus	0.0912	76	Apricot ring pox	0.0017
9	iris mild mosaic virus	0.152	43	Apple mosaic virus	0.0902	77	Arabis mosaic virus	0.0017
10	Strawberry crinkle virus	0.152	44	Bean yellow mosaic virus	0.0902	78	Avocado pear sunblotch	0.0017
11	Subterranean clover stunt virus	0.152	45	Carrot mottle virus	0.0902	79	Bean summer death	0.0017
12	tulip breaking virus	0.152	46	Cowpea aphid borne mosaic virus	0.0902	80	Beet cryptic virus 1	0.0017
13	white clover mosaic virus	0.152	47	Cucumber mosaic virus	0.0902	81	Beet cryptic virus 2	0.0017
14	Apple stem grooving virus	0.1514	48	Iris yellow spot virus	0.0902	82	Beet pseudoyellows virus	0.0017
15	Apple stem pitting virus	0.1514	49	Prunus necrotic ringspot virus	0.0902	83	Cabbage black ring spot	0.0017
16	Bean leafroll virus	0.1514	50	Rupestris stem pitting-associated virus	0.0902	84	Capsicum mosaic	0.0017
17	Carrot virus Y	0.1514	51	Sweet potato feathery mottle virus	0.0902	85	Carnation etched ring virus	0.0017
18	Citrus tristeza	0.1514	52	Sweet potato virus 2	0.0902	86	Carnation mosaic	0.0017
19	Iris yellow spot virus	0.1504	53	Bean common mosaic virus	0.0043	87	Carnation ringspot	0.0017
20	lettuce big vein virus	0.1504	54	Beet western yellows virus	0.0043	88	Carnation vein mottle virus	0.0017
21	Ornithogalum mosaic virus	0.1504	55	Broad bean wilt virus	0.0043	89	Cereal yellow dwarf virus	0.0017
22	strawberry mild yellow edge virus	0.1504	56	Potato virus S	0.0043	90	Chenopodium mosaic	0.0017
23	strawberry vein banding virus	0.1504	57	Sowbane mosaic virus	0.0043	91	Cherry black canker	0.0017
24	Tomato big bud virus	0.1504	58	Freesia mosaic virus	0.0033	92	Cherry mottle leaf	0.0017
25	Alstroemeria mosaic virus	0.1487	59	Onion yellow dwarf virus	0.0033	93	Cherry ring spot	0.0017
26	carrot mosaic virus Y	0.1487	60	Banana mild mosaic virus	0.0027	94	Cherry rugose mosaic	0.0017
27	dasheen mosaic virus	0.1487	61	Banana streak virus	0.0027	95	Chrysanthemum virus B	0.0017
28	Dianella chlorotic mottle virus	0.1487	62	Capsicum chlorosis virus	0.0027	96	Citrus cachexia	0.0017
29	grapevine fleck virus	0.1487	63	High plains virus	0.0027	97	Citrus tatter leaf	0.0017
30	Grapevine leafroll ass. virus 1	0.1487	64	Passiflora latent virus	0.0027	98	Citrus vein enation	0.0017
31	Grapevine leafroll ass. virus 3	0.1487	65	Passionfruit latent virus	0.0027	99	Citrus xyloporosis	0.0017
32	Grapevine rupestris stem pitting virus	0.1487	66	Peanut mottle virus	0.0027	100	Cymbidium ringspot virus	0.0017
33	grapevine virus A	0.1487	67	Poinsettia mosaic virus	0.0027	101	Dahlia mosaic virus	0.0017
34	leek yellow stripe virus	0.1487	68	Solanum nodiflorum mottle virus	0.0027	102	Datura rugose	0.0017

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Table 39 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
103	Fig mosaic virus	0.0017	127	Pelargonium leaf-curl virus	0.0017	151	Apium virus Y	0.001
104	Hop latent virus	0.0017	128	Peony ringspot virus	0.0017	152	Bamboo mosaic virus	0.001
105	Hop mosaic virus	0.0017	129	Pepper Mild Mottle virus	0.0017	153	Banana bunchy top virus	0.001
106	Iris mosaic virus	0.0017	130	Plum line pattern virus	0.0017	154	Banana streak mysore virus	0.001
107	Iris severe mosaic virus	0.0017	131	Potato aucuba mosaic virus	0.0017	155	Barley stripe mosaic virus	0.001
108	Lily symptomless virus	0.0017	132	Potato spindle tuber virus	0.0017	156	Blackeye cowpea mosaic virus	0.001
109	Lily virus X	0.0017	133	Potato virus A	0.0017	157	Chloris striate mosaic virus	0.001
110	Maize dwarf mosaic	0.0017	134	Raspberry bushy dwarf virus	0.0017	158	Datura yellow vein virus	0.001
111	Maize mosaic virus	0.0017	135	Rhubarb closterovirus	0.0017	159	Ginger chlorotic fleck virus	0.001
112	Malva vein clearing virus	0.0017	136	Rose mosaic virus	0.0017	160	Kennedia yellow mosaic virus	0.001
113	Narcissus latent virus	0.0017	137	Rugose leaf curl virus	0.0017	161	Pandanus ringspot virus	0.001
114	Narcissus mosaic virus	0.0017	138	Rugose leaf mosaic virus	0.0017	162	Parsley latent virus	0.001
115	Narcissus yellow stripe virus	0.0017	139	Ryegrass cryptic virus	0.0017	163	Paspalum striate mosaic virus	0.001
116	Nerine latent virus	0.0017	140	Ryegrass mosaic virus	0.0017	164	Passiflora virus Y	0.001
117	Nerine virus X	0.0017	141	Sobemovirus	0.0017	165	Soybean spherical virus	0.001
118	Nerine virus Y	0.0017	142	Sow thistle yellow vein virus	0.0017	166	Sugarcane bacilliform virus	0.001
119	Nerine yellow stripe virus	0.0017	143	Stock mosaic virus	0.0017	167	Sweet potato chlorotic stunt virus	0.001
120	Nothoscordum mosaic virus	0.0017	144	Sugarcane Fiji disease	0.0017	168	Sweet potato feathery mottle virus	0.001
121	Parsley virus Y	0.0017	145	Sweet potato russet crack	0.0017	169	Tobacco necrosis virus	0.001
122	Patchouli mild mosaic virus	0.0017	146	Tomato yellow top virus	0.0017	170	Tobacco streak virus	0.001
123	Pea pimple pod virus	0.0017	147	Turnip yellow mosaic virus	0.0017	171	Tomato yellow leaf curl virus	0.001
124	Peach calico virus	0.0017	148	Viola mottle virus	0.0017	172	watermelon mosaic virus 2	0.001
125	Peach ringspot virus	0.0017	149	Witches broom virus	0.0017			
126	Pear stony pit virus	0.0017	150	Alternanthera mosaic virus	0.001			

Table 40. TAS virus pathogens risk list generated from SOM analysis of Australian distributional data. . * Species with the same risk index were ranked in alphabetical order.

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
1	Celery mosaic virus	0.5565	35	Apple russet ring	0.4432	69	Potato spindle tuber virus	0.4432
2	Pea Seed-borne Mosaic virus	0.5565	36	Apricot ring pox	0.4432	70	Rhubarb closterovirus	0.4432
3	Papaya ringspot virus	0.5557	37	Avocado pear sunblotch	0.4432	71	Rose mosaic virus	0.4432
4	Watermelon mosaic virus	0.5556	38	Bean summer death	0.4432	72	Rugose leaf curl virus	0.4432
5	Bean leafroll virus	0.5554	39	Cabbage black ring spot	0.4432	73	Rugose leaf mosaic virus	0.4432
6	Carrot virus Y	0.5554	40	Capsicum mosaic	0.4432	74	Sobemovirus	0.4432
7	Citrus tristeza	0.5554	41	Carnation mosaic	0.4432	75	Sow thistle yellow vein virus	0.4432
8	Iris yellow spot virus	0.5421	42	Carnation ringspot	0.4432	76	Stock mosaic virus	0.4432
9	lettuce big vein virus	0.5421	43	Chenopodium mosaic	0.4432	77	Sugarcane Fiji disease	0.4432
10	Ornithogalum mosaic virus	0.5421	44	Cherry black canker	0.4432	78	Sweet potato russet crack	0.4432
11	Tomato big bud virus	0.5421	45	Cherry mottle leaf	0.4432	79	Tomato yellow top virus	0.4432
12	Passionfruit woodiness virus	0.4576	46	Cherry ring spot	0.4432	80	Turnip yellow mosaic virus	0.4432
13	Johnsongrass mosaic virus	0.4567	47	Cherry rugose mosaic	0.4432	81	Witches broom virus	0.4432
14	Sugarcane mosaic virus	0.4567	48	Citrus cachexia	0.4432	82	Prune dwarf virus	0.099
15	Banana mild mosaic virus	0.4566	49	Citrus tatter leaf	0.4432	83	Alstroemeria mosaic virus	0.0989
16	Banana streak virus	0.4566	50	Citrus vein enation	0.4432	84	carrot mosaic virus Y	0.0989
17	Capsicum chlorosis virus	0.4566	51	Citrus xyloporosis	0.4432	85	dasheen mosaic virus	0.0989
18	High plains virus	0.4566	52	Cymbidium ringspot virus	0.4432	86	Dianella chlorotic mottle virus	0.0989
19	Passiflora latent virus	0.4566	53	Datura rugose	0.4432	87	grapevine fleck virus	0.0989
20	Passionfruit latent virus	0.4566	54	Fig mosaic virus	0.4432	88	Grapevine leafroll ass. virus 1	0.0989
21	Peanut mottle virus	0.4566	55	Iris mosaic virus	0.4432	89	Grapevine leafroll ass. virus 3	0.0989
22	Solanum nodiflorum mottle virus	0.4566	56	Maize dwarf mosaic	0.4432	90	Grapevine rupestris stem pitting virus	0.0989
23	Soybean mosaic virus	0.4566	57	Nothoscordum mosaic virus	0.4432	91	grapevine virus A	0.0989
24	Sunflower ringspot virus	0.4566	58	Parsley virus Y	0.4432	92	leek yellow stripe virus	0.0989
25	Citrus exocortis viroid	0.4443	59	Patchouli mild mosaic virus	0.4432	93	Pear blister canker viroid	0.0989
26	Citrus psorosis	0.4443	60	Pea pimple pod virus	0.4432	94	strawberry mottle virus	0.0989
27	Lucerne witches broom	0.4443	61	Peach calico virus	0.4432	95	strawberry pallidosis virus	0.0989
28	Prune dwarf virus	0.4443	62	Peach ringspot virus	0.4432	96	Tomato leaf curl virus	0.0135
29	Avocado Sun blotch viroid	0.4433	63	Pear stony pit virus	0.4432	97	Alternanthera mosaic virus	0.0134
30	Cherry rasp leaf virus	0.4433	64	Pelargonium leaf-curl virus	0.4432	98	Apium virus Y	0.0134
31	Abutilon mosaic	0.4432	65	Peony ringspot virus	0.4432	99	Bamboo mosaic virus	0.0134
32	Apple flat limb	0.4432	66	Pepper Mild Mottle virus	0.4432	100	Banana bunchy top virus	0.0134
33	Apple platycarpa	0.4432	67	Plum line pattern virus	0.4432	101	Banana streak mysore virus	0.0134
34	Apple ring spot	0.4432	68	Potato aucuba mosaic virus	0.4432	102	Barley stripe mosaic virus	0.0134

Table 40 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
103	Blackeye cowpea mosaic virus	0.0134	120	Australian grapevine viroid	0.0011	137	Subterranean clover mottle virus	0.0011
104	Chloris striate mosaic virus	0.0134	121	Australian grapevine yellows	0.0011	138	Tomato ringspot virus	0.0011
105	Datura yellow vein virus	0.0134	122	Broad bean stain virus	0.0011	139	Tristeza virus	0.0011
106	Ginger chlorotic fleck virus	0.0134	123	Chlorotic leaf spot virus	0.0011	140	Velvet tobacco mottle virus	0.0011
107	Kennedia yellow mosaic virus	0.0134	124	Chrysanthemum carlavirus B	0.0011	141	Squash mosaic virus	0.0003
108	Pandanus ringspot virus	0.0134	125	Chrysanthemum stunt viroid	0.0011	142	Apple mosaic virus	0.0001
109	Parsley latent virus	0.0134	126	Echtes Ackerbohnenmosaik virus	0.0011	143	Bean yellow mosaic virus	0.0001
110	Paspalum striate mosaic virus	0.0134	127	Frangipani mosaic virus	0.0011	144	Carrot mottle virus	0.0001
111	Passiflora virus Y	0.0134	128	Garlic yellow streak virus	0.0011	145	Cowpea aphid borne mosaic virus	0.0001
112	Soybean spherical virus	0.0134	129	Grapevine yellow speckle viroid 1	0.0011	146	Cucumber mosaic virus	0.0001
113	Sugarcane bacilliform virus	0.0134	130	Grapevine yellow speckle viroid 2	0.0011	147	Iris yellow spot virus	0.0001
114	Sweet potato chlorotic stunt virus	0.0134	131	Hibiscus chlorotic ringspot virus	0.0011	148	Prunus necrotic ringspot virus	0.0001
115	Sweet potato feathery mottle virus	0.0134	132	Hop stunt viroid	0.0011	149	Rupestris stem pitting-associated virus	0.0001
116	Tobacco necrosis virus	0.0134	133	Lilium symptomless virus	0.0011	150	Sweet potato feathery mottle virus	0.0001
117	Tobacco streak virus	0.0134	134	Nicotiana velutina mosaic virus	0.0011	151	Sweet potato virus 2	0.0001
118	Tomato yellow leaf curl virus	0.0134	135	Ribgrass mosaic virus	0.0011			
119	watermelon mosaic virus 2	0.0134	136	Soybean dwarf virus	0.0011			

Table 41. VIC virus pathogens risk list generated from SOM analysis of Australian distributional data. . * Species with the same risk index were ranked in alphabetical order.

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
1	Zucchini Yellow Mosaic virus	0.4318	35	Banana mild mosaic virus	0.1439	69	Chenopodium mosaic	0.1268
2	Clover Yellow Vein virus	0.3975	36	Banana streak virus	0.1439	70	Cherry black canker	0.1268
3	Lettuce mosaic virus	0.3975	37	Capsicum chlorosis virus	0.1439	71	Cherry mottle leaf	0.1268
4	Lettuce necrotic yellows virus	0.3975	38	Cherry rasp leaf virus	0.1439	72	Cherry ring spot	0.1268
5	Potato virus X	0.3975	39	High plains virus	0.1439	73	Cherry rugose mosaic	0.1268
6	Tomato mosaic virus	0.3975	40	Passiflora latent virus	0.1439	74	Chlorotic leaf spot virus	0.1268
7	Cauliflower mosaic virus	0.3803	41	Passionfruit latent virus	0.1439	75	Chrysanthemum carlavirus B	0.1268
8	Cymbidium mosaic virus	0.3803	42	Peanut mottle virus	0.1439	76	Chrysanthemum stunt viroid	0.1268
9	Grapevine fanleaf virus	0.3803	43	Poinsettia mosaic virus	0.1439	77	Chrysanthemum virus B	0.1268
10	Orchid fleck virus	0.3803	44	Solanum nodiflorum mottle virus	0.1439	78	Citrus cachexia	0.1268
11	Subterranean clover red leaf virus	0.3803	45	Soybean mosaic virus	0.1439	79	Citrus tatter leaf	0.1268
12	Bean common mosaic virus	0.2707	46	Sunflower ringspot virus	0.1439	80	Citrus vein enation	0.1268
13	Beet western yellows virus	0.2707	47	Abutilon mosaic	0.1268	81	Citrus xyloporosis	0.1268
14	Broad bean wilt virus	0.2707	48	Apple flat limb	0.1268	82	Cymbidium ringspot virus	0.1268
15	Passionfruit woodiness virus	0.2707	49	Apple platycarpa	0.1268	83	Dahlia mosaic virus	0.1268
16	Potato virus S	0.2707	50	Apple ring spot	0.1268	84	Datura rugose	0.1268
17	Sowbane mosaic virus	0.2707	51	Apple russet ring	0.1268	85	Echtes Ackerbohnenmosaik virus	0.1268
18	Beet mosaic virus	0.2536	52	Apricot ring pox	0.1268	86	Fig mosaic virus	0.1268
19	Broccoli necrotic yellows virus	0.2536	53	Arabis mosaic virus	0.1268	87	Frangipani mosaic virus	0.1268
20	Carrot mottle virus	0.2536	54	Australian grapevine viroid	0.1268	88	Garlic yellow streak virus	0.1268
21	Carrot red leaf virus	0.2536	55	Australian grapevine yellows	0.1268	89	Grapevine yellow speckle viroid 1	0.1268
22	Citrus exocortis viroid	0.2536	56	Avocado pear sunblotch	0.1268	90	Grapevine yellow speckle viroid 2	0.1268
23	Citrus psorosis	0.2536	57	Bean summer death	0.1268	91	Hibiscus chlorotic ringspot virus	0.1268
24	Freesia mosaic virus	0.2536	58	Beet cryptic virus 1	0.1268	92	Hop latent virus	0.1268
25	Lucerne transient streak virus	0.2536	59	Beet cryptic virus 2	0.1268	93	Hop mosaic virus	0.1268
26	Lucerne witches broom	0.2536	60	Beet pseudoyellows virus	0.1268	94	Hop stunt viroid	0.1268
27	Onion yellow dwarf virus	0.2536	61	Broad bean stain virus	0.1268	95	Iris mosaic virus	0.1268
28	Prune dwarf virus	0.2536	62	Cabbage black ring spot	0.1268	96	Iris severe mosaic virus	0.1268
29	Strawberry latent ringspot virus	0.2536	63	Capsicum mosaic	0.1268	97	Lilium symptomless virus	0.1268
30	Tobacco ringspot virus	0.2536	64	Carnation etched ring virus	0.1268	98	Lily symptomless virus	0.1268
31	Tomato aspermy virus	0.2536	65	Carnation mosaic	0.1268	99	Lily virus X	0.1268
32	Johnsongrass mosaic virus	0.1611	66	Carnation ringspot	0.1268	100	Maize dwarf mosaic	0.1268
33	Sugarcane mosaic virus	0.1611	67	Carnation vein mottle virus	0.1268	101	Maize mosaic virus	0.1268
34	Avocado Sun blotch viroid	0.1439	68	Cereal yellow dwarf virus	0.1268	102	Malva vein clearing virus	0.1268

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Table 41 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
103	Narcissus latent virus	0.1268	130	Rugose leaf mosaic virus	0.1268	157	Blackeye cowpea mosaic virus	0.0172
104	Narcissus mosaic virus	0.1268	131	Ryegrass cryptic virus	0.1268	158	Carrot mottle virus	0.0172
105	Narcissus yellow stripe virus	0.1268	132	Ryegrass mosaic virus	0.1268	159	Chloris striate mosaic virus	0.0172
106	Nerine latent virus	0.1268	133	Sobemovirus	0.1268	160	Cowpea aphid borne mosaic virus	0.0172
107	Nerine virus X	0.1268	134	Sow thistle yellow vein virus	0.1268	161	Cucumber mosaic virus	0.0172
108	Nerine virus Y	0.1268	135	Soybean dwarf virus	0.1268	162	Datura yellow vein virus	0.0172
109	Nerine yellow stripe virus	0.1268	136	Stock mosaic virus	0.1268	163	Ginger chlorotic fleck virus	0.0172
110	Nicotiana velutina mosaic virus	0.1268	137	Subterranean clover mottle virus	0.1268	164	Iris yellow spot virus	0.0172
111	Nothoscordum mosaic virus	0.1268	138	Sugarcane Fiji disease	0.1268	165	Kennedia yellow mosaic virus	0.0172
112	Parsley virus Y	0.1268	139	Sweet potato russet crack	0.1268	166	Pandanus ringspot virus	0.0172
113	Patchouli mild mosaic virus	0.1268	140	Tomato ringspot virus	0.1268	167	Parsley latent virus	0.0172
114	Pea pimple pod virus	0.1268	141	Tomato yellow top virus	0.1268	168	Paspalum striate mosaic virus	0.0172
115	Peach calico virus	0.1268	142	Tristeza virus	0.1268	169	Passiflora virus Y	0.0172
116	Peach ringspot virus	0.1268	143	Turnip yellow mosaic virus	0.1268	170	Prunus necrotic ringspot virus	0.0172
117	Pear stony pit virus	0.1268	144	Velvet tobacco mottle virus	0.1268	171	Rupestris stem pitting-associated virus	0.0172
118	Pelargonium leaf-curl virus	0.1268	145	Viola mottle virus	0.1268	172	Soybean spherical virus	0.0172
119	Peony ringspot virus	0.1268	146	Witches broom virus	0.1268	173	Sugarcane bacilliform virus	0.0172
120	Pepper Mild Mottle virus	0.1268	147	Squash mosaic virus	0.0343	174	Sweet potato chlorotic stunt virus	0.0172
121	Plum line pattern virus	0.1268	148	Tomato leaf curl virus	0.0343	175	Sweet potato feathery mottle virus	0.0172
122	Potato aucuba mosaic virus	0.1268	149	Alternanthera mosaic virus	0.0172	176	Sweet potato feathery mottle virus	0.0172
123	Potato spindle tuber virus	0.1268	150	Apium virus Y	0.0172	177	Sweet potato virus 2	0.0172
124	Potato virus A	0.1268	151	Apple mosaic virus	0.0172	178	Tobacco necrosis virus	0.0172
125	Raspberry bushy dwarf virus	0.1268	152	Bamboo mosaic virus	0.0172	179	Tobacco streak virus	0.0172
126	Rhubarb closterovirus	0.1268	153	Banana bunchy top virus	0.0172	180	Tomato yellow leaf curl virus	0.0172
127	Ribgrass mosaic virus	0.1268	154	Banana streak mysore virus	0.0172	181	watermelon mosaic virus 2	0.0172
128	Rose mosaic virus	0.1268	155	Barley stripe mosaic virus	0.0172			
129	Rugose leaf curl virus	0.1268	156	Bean yellow mosaic virus	0.0172			

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Table 42. WA virus pathogens risk list generated from SOM analysis of Australian distributional data. . * Species with the same risk index were ranked in alphabetical order.

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
1	Watermelon mosaic virus	0.4829	35	Lucerne witches broom	0.0618	69	Beet western yellows virus	0.0141
2	Johnsongrass mosaic virus	0.4692	36	Prune dwarf virus	0.0618	70	Broad bean wilt virus	0.0141
3	Tomato leaf curl virus	0.469	37	Strawberry latent ringspot virus	0.0618	71	carnation latent virus	0.0141
4	Cowpea aphid borne mosaic virus	0.4553	38	Tobacco ringspot virus	0.0618	72	carnation mottle virus	0.0141
5	Alfalfa mosaic virus	0.0894	39	Tomato aspermy virus	0.0618	73	iris mild mosaic virus	0.0141
6	Bean yellow mosaic virus	0.0894	40	Australian grapevine viroid	0.0616	74	Potato virus S	0.0141
7	cucumber mosaic virus	0.0894	41	Australian grapevine yellows	0.0616	75	Sowbane mosaic virus	0.0141
8	Potato leafroll virus	0.0894	42	Broad bean stain virus	0.0616	76	Strawberry crinkle virus	0.0141
9	Potato virus Y	0.0894	43	Chlorotic leaf spot virus	0.0616	77	Subterranean clover stunt virus	0.0141
10	Tobacco yellow dwarf virus	0.0894	44	Chrysanthemum carlavirus B	0.0616	78	tulip breaking virus	0.0141
11	Tomato spotted wilt virus	0.0894	45	Chrysanthemum stunt viroid	0.0616	79	white clover mosaic virus	0.0141
12	Celery mosaic virus	0.0893	46	Echtes Ackerbohnenmosaik virus	0.0616	80	Banana mild mosaic virus	0.0139
13	Pea Seed-borne Mosaic virus	0.0893	47	Frangipani mosaic virus	0.0616	81	Banana streak virus	0.0139
14	Barley yellow dwarf virus	0.0757	48	Garlic yellow streak virus	0.0616	82	Capsicum chlorosis virus	0.0139
15	Clover Yellow Vein virus	0.0757	49	Grapevine yellow speckle viroid 1	0.0616	83	High plains virus	0.0139
16	Lettuce mosaic virus	0.0757	50	Grapevine yellow speckle viroid 2	0.0616	84	Iris yellow spot virus	0.0139
17	Lettuce necrotic yellows virus	0.0757	51	Hibiscus chlorotic ringspot virus	0.0616	85	lettuce big vein virus	0.0139
18	Odontoglossum ringspot virus	0.0757	52	Hop stunt viroid	0.0616	86	Ornithogalum mosaic virus	0.0139
19	Potato virus X	0.0757	53	Lilium symptomless virus	0.0616	87	Passiflora latent virus	0.0139
20	Prunus necrotic ringspot virus	0.0757	54	Nicotiana velutina mosaic virus	0.0616	88	Passionfruit latent virus	0.0139
21	Tomato mosaic virus	0.0757	55	Ribgrass mosaic virus	0.0616	89	Peanut mottle virus	0.0139
22	Passionfruit woodiness virus	0.0755	56	Soybean dwarf virus	0.0616	90	Poinsettia mosaic virus	0.0139
23	Cauliflower mosaic virus	0.0619	57	Subterranean clover mottle virus	0.0616	91	Solanum nodiflorum mottle virus	0.0139
24	Cymbidium mosaic virus	0.0619	58	Tomato ringspot virus	0.0616	92	Soybean mosaic virus	0.0139
25	Grapevine fanleaf virus	0.0619	59	Tristeza virus	0.0616	93	strawberry mild yellow edge virus	0.0139
26	Orchid fleck virus	0.0619	60	Velvet tobacco mottle virus	0.0616	94	strawberry vein banding virus	0.0139
27	Subterranean clover red leaf virus	0.0619	61	Apple mosaic virus	0.0278	95	Sunflower ringspot virus	0.0139
28	Beet mosaic virus	0.0618	62	Wheat streak mosaic virus	0.0278	96	Tomato big bud virus	0.0139
29	Broccoli necrotic yellows virus	0.0618	63	Apple stem grooving virus	0.0276	97	Alstroemeria mosaic virus	0.0137
30	Carrot mottle virus	0.0618	64	Apple stem pitting virus	0.0276	98	Alternanthera mosaic virus	0.0137
31	Carrot red leaf virus	0.0618	65	Bean leafroll virus	0.0276	99	Apium virus Y	0.0137
32	Citrus exocortis viroid	0.0618	66	Carrot virus Y	0.0276	100	Bamboo mosaic virus	0.0137
33	Citrus psorosis	0.0618	67	Citrus tristeza	0.0276	101	Banana bunchy top virus	0.0137
34	Lucerne transient streak virus	0.0618	68	Bean common mosaic virus	0.0141	102	Banana streak mysore virus	0.0137

Table 42 (continued).

Rank*	Species	risk index	Rank*	Species	risk index	Rank*	Species	risk index
103	Barley stripe mosaic virus	0.0137	140	Apricot ring pox	0.0002	177	Narcissus latent virus	0.0002
104	Blackeye cowpea mosaic virus	0.0137	141	Arabis mosaic virus	0.0002	178	Narcissus mosaic virus	0.0002
105	carrot mosaic virus Y	0.0137	142	Avocado pear sunblotch	0.0002	179	Narcissus yellow stripe virus	0.0002
106	Chloris striate mosaic virus	0.0137	143	Bean summer death	0.0002	180	Nerine latent virus	0.0002
107	dasheen mosaic virus	0.0137	144	Beet cryptic virus 1	0.0002	181	Nerine virus X	0.0002
108	Datura yellow vein virus	0.0137	145	Beet cryptic virus 2	0.0002	182	Nerine virus Y	0.0002
109	Dianella chlorotic mottle virus	0.0137	146	Beet pseudoyellows virus	0.0002	183	Nerine yellow stripe virus	0.0002
110	Ginger chlorotic fleck virus	0.0137	147	Cabbage black ring spot	0.0002	184	Nothoscordum mosaic virus	0.0002
111	grapevine fleck virus	0.0137	148	Capsicum mosaic	0.0002	185	Parsley virus Y	0.0002
112	Grapevine leafroll ass. virus 1	0.0137	149	Carnation etched ring virus	0.0002	186	Patchouli mild mosaic virus	0.0002
113	Grapevine leafroll ass. virus 3	0.0137	150	Carnation mosaic	0.0002	187	Pea pimple pod virus	0.0002
114	Grapevine rupestris stem pitting virus	0.0137	151	Carnation ringspot	0.0002	188	Peach calico virus	0.0002
115	grapevine virus A	0.0137	152	Carnation vein mottle virus	0.0002	189	Peach ringspot virus	0.0002
116	Kennedia yellow mosaic virus	0.0137	153	Cereal yellow dwarf virus	0.0002	190	Pear stony pit virus	0.0002
117	leek yellow stripe virus	0.0137	154	Chenopodium mosaic	0.0002	191	Pelargonium leaf-curl virus	0.0002
118	Pandanus ringspot virus	0.0137	155	Cherry black canker	0.0002	192	Peony ringspot virus	0.0002
119	Parsley latent virus	0.0137	156	Cherry mottle leaf	0.0002	193	Pepper Mild Mottle virus	0.0002
120	Paspalum striate mosaic virus	0.0137	157	Cherry ring spot	0.0002	194	Plum line pattern virus	0.0002
121	Passiflora virus Y	0.0137	158	Cherry rugose mosaic	0.0002	195	Potato aucuba mosaic virus	0.0002
122	Pear blister canker viroid	0.0137	159	Chrysanthemum virus B	0.0002	196	Potato spindle tuber virus	0.0002
123	Soybean spherical virus	0.0137	160	Citrus cachexia	0.0002	197	Potato virus A	0.0002
124	strawberry mottle virus	0.0137	161	Citrus tatter leaf	0.0002	198	Raspberry bushy dwarf virus	0.0002
125	strawberry pallidosis virus	0.0137	162	Citrus vein enation	0.0002	199	Rhubarb closterovirus	0.0002
126	Sugarcane bacilliform virus	0.0137	163	Citrus xyloporosis	0.0002	200	Rose mosaic virus	0.0002
127	Sweet potato chlorotic stunt virus	0.0137	164	Cymbidium ringspot virus	0.0002	201	Rugose leaf curl virus	0.0002
128	Sweet potato feathery mottle virus	0.0137	165	Dahlia mosaic virus	0.0002	202	Rugose leaf mosaic virus	0.0002
129	Tobacco necrosis virus	0.0137	166	Datura rugose	0.0002	203	Ryegrass cryptic virus	0.0002
130	Tobacco streak virus	0.0137	167	Fig mosaic virus	0.0002	204	Ryegrass mosaic virus	0.0002
131	Tomato yellow leaf curl virus	0.0137	168	Hop latent virus	0.0002	205	Sobemovirus	0.0002
132	watermelon mosaic virus 2	0.0137	169	Hop mosaic virus	0.0002	206	Sow thistle yellow vein virus	0.0002
133	Freesia mosaic virus	0.0003	170	Iris mosaic virus	0.0002	207	Stock mosaic virus	0.0002
134	Onion yellow dwarf virus	0.0003	171	Iris severe mosaic virus	0.0002	208	Sugarcane Fiji disease	0.0002
135	Abutilon mosaic	0.0002	172	Lily symptomless virus	0.0002	209	Sweet potato russet crack	0.0002
136	Apple flat limb	0.0002	173	Lily virus X	0.0002	210	Tomato yellow top virus	0.0002
137	Apple platycarpa	0.0002	174	Maize dwarf mosaic	0.0002	211	Turnip yellow mosaic virus	0.0002
138	Apple ring spot	0.0002	175	Maize mosaic virus	0.0002	212	Viola mottle virus	0.0002
139	Apple russet ring	0.0002	176	Malva vein clearing virus	0.0002	213	Witches broom virus	0.0002

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Table 43. Comparison of species risk rankings between the SOM analysis and PHA.

SOM rank	Species names	SOM risk index	SOM risk category	PHA risk category
1	Oryctes rhinoceros	0.7722	H	M
2	Sesamia inferens	0.7695	H	H, M
3	Diaphorina citri	0.6807	M	H
4	Aleurocanthus woglumi	0.6801	M	H, M
5	Stephanitis typica	0.6675	M	M
6	Xylosandrus compactus	0.6632	M	H
7	Pelopidas mathias	0.6446	M	M
8	Dicladispa armigera	0.6378	M	M
9	Acherontia styx	0.6356	M	M
10	Chilo auricilius	0.6338	M	H
11	Planococcus lilacinus	0.594	M	H, L
12	Batocera rubus	0.5836	M	H
13	Toxoptera odinae	0.5694	M	M
14	Orseolia oryzae	0.5676	M	M
15	Odoiporus longicollis	0.5669	M	H
16	Chilo infuscatellus	0.5559	M	H
17	Hypomeces squamosus	0.5395	M	H, M
18	Orgyia postica	0.5343	M	M
19	Rastrococcus invadens	0.519	M	H, M-H, M
20	Parasa lepida	0.5177	M	H
21	Bactrocera dorsalis	0.5008	M	H, M-H, M
22	Erionota thrax	0.4931	M	M-H
23	Schizaphis graminum	0.4895	M	M
24	Aproaerema modicella	0.4841	M	H
25	Attacus atlas	0.4821	M	H
26	Ceratovacuna lanigera	0.4774	M	H
27	Sternochetus frigidus	0.4586	M	H
28	Trichoplusia ni	0.4573	M	H, M
29	Dialeurodes citri	0.4532	M	M
30	Pyrilla perpusilla	0.4499	M	H, M
31	Chilo sacchariphagus	0.4491	M	H
32	Atherigona soccata	0.4395	M	H
33	Cricula trifenestrata	0.4329	M	H
34	Chilo partellus	0.4206	M	H
35	Omiodes indicata	0.4097	M	M
36	Bactrocera tau	0.4008	M	M
37	Bactrocera zonata	0.3802	M	H
38	Liriomyza huidobrensis	0.3743	M	H, M
39	Phyllotreta striolata	0.3604	M	M
40	Scotinophara coarctata	0.3589	M	M
41	Liriomyza trifolii	0.3431	M	H, M
42	Aulacaspis tegalensis	0.3262	M	H
43	Pseudococcus jackbeardsleyi	0.3105	M	H, M
44	Perkinsiella vastatrix	0.3052	M	H, M
45	Artona catoxantha	0.3043	M	L
46	Heterobostrychus aequalis	0.3037	M	L
47	Opisina arenosella	0.303	M	L
48	Chondracris rosea	0.2994	L	M

Table 43 (continued).

SOM rank	Species names	SOM risk index	SOM risk category	PHA risk category
49	Chromatomyia horticola	0.2827	L	H, M
50	Aphis fabae	0.2704	L	H, M
51	Tetramoera schistaceana	0.2684	L	H
52	Stauropus alternus	0.2642	L	H
53	Frankliniella intonsa	0.2636	L	H, M
54	Clanis bilineata	0.2594	L	M
55	Pieris brassicae	0.2576	L	M
56	Adoretus sinicus	0.2547	L	N
57	Amsacta lactinea	0.2544	L	M
58	Chlumetia transversa	0.253	L	H
59	Lepidiota stigma	0.2529	L	H, M
60	Bactrocera papayae	0.249	L	H, M-H, M
61	Holotrichia serrata	0.2382	L	M
62	Amsacta moorei	0.2331	L	M
63	Bactrocera carambolae	0.229	L	H
64	Oxya chinensis	0.2226	L	N
65	Pseudococcus comstocki	0.2102	L	H, M
66	Sesamia cretica	0.2093	L	M
67	Sitobion avenae	0.2092	L	M
68	Callosobruchus analis	0.2005	L	M
69	Trogoderma granarium	0.1894	L	H
70	Parabemisia myricae	0.1823	L	H, N
71	Liriomyza sativae	0.1733	L	H, M
72	Chrysodeixis chalcites	0.1606	L	M
73	Agromyza oryzae	0.157	L	H
74	Mamestra brassicae	0.156	L	H, M
75	Monochamus alternatus	0.1492	L	H
76	Prostephanus truncatus	0.1476	L	M
77	Cryptoblabes gnidiella	0.1442	L	M-H, N-L
78	Liriomyza bryoniae	0.1406	L	H
79	Autographa nigrisigna	0.1369	L	M
80	Delia antiqua	0.1347	L	M
81	Aleurothrixus floccosus	0.1345	L	L
82	Dialeurodes citrifolii	0.1299	L	H
83	Lymantria dispar	0.1284	L	H, M
84	Lissorhoptrus oryzophilus	0.1279	L	H
85	Haplothrips aculeatus	0.1248	L	M
86	Peridroma saucia	0.1231	L	H, M
87	Cicadulina mbila	0.1204	L	H, M
88	Anoplophora chinensis	0.1067	L	H
89	Dysaphis plantaginea	0.099	L	H
90	Hadula trifolii	0.0969	L	H, M
91	Lymantria monacha	0.0956	L	H
92	Acronicta rumicis	0.094	L	M
93	Autographa gamma	0.0923	L	M
94	Zabrotes subfasciatus	0.086	L	M
95	Schistocerca gregaria	0.0818	L	M
96	Adoxophyes orana	0.0732	L	M

Table 43 (continued).

SOM rank	Species names	SOM risk index	SOM risk category	PHA risk category
97	Carposina sasakii	0.0717	L	M, L
98	Popillia japonica	0.0716	L	M
99	Anoplophora glabripennis	0.0707	L	M
100	Diuraphis noxia	0.0702	L	H
101	Coptotermes formosanus	0.07	L	H
102	Grapholita inopinata	0.0699	L	L
103	Phyllotreta cruciferae	0.0695	L	M
104	Anoplophora malasiaca	0.0664	L	M
105	Selenaspidus articulatus	0.0655	L	H
106	Sitodiplosis mosellana	0.0647	L	M
107	Delia floralis	0.0646	L	M
108	Caryedon serratus	0.0645	L	M
109	Contarinia tritici	0.0633	L	M
110	Sitona hispidulus	0.063	L	M
111	Metamasius hemipterus	0.0627	L	M, L
112	Grapholita funebrana	0.0615	L	H
113	Opogona sacchari	0.059	L	M
114	Cacoecimorpha pronubana	0.0376	L	M
115	Anthonomus bisignifer	0.0356	L	M
116	Phorodon humuli	0.0329	L	M
117	Cacopsylla pyricola	0.0323	L	L
117	Philaenus spumarius	0.0323	L	L-M
117	Epilachna varivestis	0.0323	L	M
120	Mythimna unipuncta	0.0317	L	H
121	Cydia splendana	0.0308	L	H
121	Pandemis cerasana	0.0308	L	H
121	Psila rosae	0.0308	L	H
121	Eurygaster integriceps	0.0308	L	H, M
121	Loxostege sticticalis	0.0308	L	H, M
121	Meromyza saltatrix	0.0308	L	H, M
121	Acrolepiopsis assectella	0.0308	L	L
121	Delia coarctata	0.0308	L	M
121	Delia radicum	0.0308	L	M
121	Elasmopalpus lignosellus	0.0308	L	M
121	Empoasca fabae	0.0308	L	M
121	Haplothrips tritici	0.0308	L	M
121	Oulema melanopus	0.0308	L	M
121	Rhyacionia buoliana	0.0308	L	M
121	Sitona cylindricollis	0.0308	L	M
136	Spodoptera littoralis	0.0304	L	H, M
137	Cryptophlebia leucotreta	0.03	L	H, M, L
137	Sesamia calamistis	0.03	L	M
139	Nomadacris septemfasciata	0.0283	L	H
140	Megalurothrips sjostedti	0.022	L	M
141	Ceratitis cosyra	0.0209	L	M
142	Heteronychus licas	0.0208	L	H
143	Scirtothrips aurantii	0.0196	L	H, M
144	Zonocerus elegans	0.0184	L	M

Table 43 (continued).

SOM rank	Species names	SOM risk index	SOM risk category	PHA risk category
145	Busseola fusca	0.0153	L	H
146	Helopeltis schoutedeni	0.0077	L	M
147	Phenacoccus madeirensis	0.0054	L	L
147	Zonocerus variegatus	0.0054	L	M
149	Sesamia nonagrioides	0.0037	L	N
150	Anastrepha fraterculus	0	L	H
150	Anthonomus grandis	0	L	H
150	Cerataphis lantaniae	0	L	H
150	Ceroplastes cirripediformis	0	L	H
150	Ceutorhynchus assimilis	0	L	H
150	Curculio elephas	0	L	H
150	Dalbulus maidis	0	L	H
150	Dasineura pyri	0	L	H
150	Dendroctonus frontalis	0	L	H
150	Dendroctonus ponderosae	0	L	H
150	Diaprepes abbreviatus	0	L	H
150	Frankliniella insularis	0	L	H
150	Frankliniella tritici	0	L	H
150	Hypothenemus obscurus	0	L	H
150	Melanoplus sanguinipes	0	L	H
150	Meligethes aeneus	0	L	H
150	Monochamus galloprovincialis	0	L	H
150	Stenoma catenifer	0	L	H
150	Trialeurodes abutiloneus	0	L	H
150	Xyleborus dispar	0	L	H
150	Anastrepha striata	0	L	H, M
150	Cephus cinctus	0	L	H, M
150	Cephus pygmeus	0	L	H, M
150	Dasineura brassicae	0	L	H, M
150	Helicoverpa zea	0	L	H, M
150	Lygus lineolaris	0	L	H, M
150	Ostrinia nubilalis	0	L	H, M
150	Platynota stultana	0	L	H, M
150	Rhagoletis pomonella	0	L	H, M
150	Spodoptera eridania	0	L	H, M
150	Thrips angusticeps	0	L	H, M
150	Choristoneura rosaceana	0	L	M-H, M
150	Spodoptera frugiperda	0	L	H, M, N
150	Mamestra configurata	0	L	L
150	Agriotes obscurus	0	L	L
150	Diaspis boisduvalii	0	L	L
150	Dyspessa ulula	0	L	L
150	Orthezia praelonga	0	L	L
150	Paracoccus marginatus	0	L	L
150	Spilonota ocellana	0	L	L
150	Macrosteles quadrilineatus	0	L	N
150	Acrosternum hilare	0	L	M, L

Table 43 (continued).

SOM rank	Species names	SOM risk index	SOM risk category	PHA risk category
150	Epitrix cucumeris	0	L	M, L
150	Acalymma vittatum	0	L	M
150	Agriotes lineatus	0	L	M
150	Agrotis exclamationis	0	L	M
150	Anastrepha obliqua	0	L	M
150	Anastrepha serpentina	0	L	M
150	Anthonomus signatus	0	L	M
150	Anticarsia gemmatalis	0	L	M
150	Castniomera licus	0	L	M
150	Caulophilus oryzae	0	L	M
150	Cerotoma trifurcata	0	L	M
150	Colaspis hypochlora	0	L	M
150	Conotrachelus nenuphar	0	L	M
150	Corythuca gossypii	0	L	M
150	Diabrotica balteata	0	L	M
150	Diabrotica barberi	0	L	M
150	Diabrotica undecimpunctata	0	L	M
150	Diabrotica virgifera virgifera	0	L	M
150	Diatraea saccharalis	0	L	M
150	Edessa meditabunda	0	L	M
150	Frankliniella fusca	0	L	M
150	Heliothis virescens	0	L	M
150	Homalodisca coagulata	0	L	M
150	Hortensia similis	0	L	M
150	Leptinotarsa decemlineata	0	L	M
150	Malacosoma disstria	0	L	M
150	Mayetiola destructor	0	L	M
150	Melanoplus bivittatus	0	L	M
150	Metcalfa pruinosa	0	L	M
150	Piezodorus guildinii	0	L	M
150	Psylliodes chrysocephala	0	L	M
150	Rhagoletis fausta	0	L	M
150	Rhagoletis indifferens	0	L	M
150	Spodoptera latifascia	0	L	M
150	Tecia solanivora	0	L	M

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Table 44. The top 200 risk list for plant pathogen species absent from Australia.

Rank	Species Name	Risk Index	Rank	Species Name	Risk Index	Rank	Species Name	Risk Index
1	Ustilago avenae	0.9108	35	Alternaria japonica	0.517	69	Mycosphaerella cruenta	0.3161
2	Phytophthora infestans	0.8872	36	Fusarium oxysporum f.sp. lini	0.5162	70	Phytophthora colocasiae	0.3156
3	Mycovellosiella fulva	0.8867	37	Pyrenophora tritici-repentis	0.5118	71	Verticillium albo-atrum	0.309
4	Cochliobolus sativus	0.8655	38	Nectria galligena	0.492	72	Ulocladium atrum	0.3073
5	Setosphaeria turcica	0.8121	39	Cronartium ribicola	0.484	73	Asperisporium caricae	0.3071
6	Phytophthora nicotianae	0.8069	40	Fusarium sacchari	0.4713	74	Armillaria ostoyae	0.3031
7	Sporisorium sorghi	0.8067	41	Ceratocystis fimbriata	0.4634	75	Monosporascus cannonballus	0.303
8	Gaeumannomyces graminis var. tritici	0.7891	42	Septoria cannabis	0.4512	76	Ophiostoma piceae	0.3022
9	Claviceps purpurea	0.7767	43	Pythium splendens	0.4478	77	Pseudoperonospora cannabina	0.3022
10	Puccinia striiformis	0.7655	44	Cryphonectria parasitica	0.4406	78	Cronartium quercuum	0.2936
11	Phaeosphaeria nodorum	0.7488	45	Didymella lycopersici	0.4313	79	Aecidium mori	0.2931
12	Colletotrichum orbiculare	0.7477	46	Podosphaera macularis	0.4301	80	Olpidium brassicae	0.2919
13	Mycosphaerella graminicola	0.7291	47	Passalora sojina	0.4287	81	Uredo cajani	0.2871
14	Sclerotinia sclerotiorum	0.7132	48	Cercospora sorghi	0.4227	82	Mycosphaerella pruni-persicae	0.2858
15	Sporisorium cruentum	0.7106	49	Nematospora coryli	0.419	83	Alternaria solani	0.2825
16	Rosellinia necatrix	0.709	50	Didymella rabiei	0.4177	84	Ustilago shiraiana	0.2795
17	Septoria apiicola	0.6835	51	Mycosphaerella pyri	0.4164	85	Gymnosporangium fuscum	0.2761
18	Cladosporium cucumerinum	0.6833	52	Phomopsis asparagi	0.4024	86	Fusarium oxysporum f.sp. lentis	0.2725
19	Phytophthora capsici	0.6762	53	Erysiphe orontii	0.3991	87	Stagonospora sacchari	0.2583
20	Sclerospora graminicola	0.6737	54	Alternaria sesami	0.399	88	Cryptodiaporthe populea	0.2553
21	Botrytis fabae	0.6663	55	Fomes fomentarius	0.3914	89	Lachnella willkommii	0.2512
22	Puccinia graminis	0.6455	56	Colletotrichum linicola	0.3804	90	Monographella nivalis	0.2476
23	Colletotrichum sublineolum	0.6376	57	Septoria glycines	0.3766	91	Phialophora cinerescens	0.2475
24	Fusarium oxysporum f.sp. vasinfectum	0.6292	58	Mycosphaerella gibsonii	0.362	92	Peronosclerospora philippinensis	0.2465
25	Puccinia asparagi	0.5988	59	Hemileia vastatrix	0.3564	93	Synchytrium endobioticum	0.2392
26	Leptosphaeria coniothyrium	0.5971	60	Guignardia bidwellii	0.3509	94	Hypocrea rufa	0.2387
27	Phaeolus schweinitzii	0.5839	61	Didymella lentis	0.3448	95	Armillaria mellea	0.2371
28	Bipolaris sacchari	0.5802	62	Kabatiella zeae	0.34	96	Moesziomyces bullatus	0.234
29	Puccinia coronata	0.5606	63	Cronartium flaccidum	0.3384	97	Exobasidium vexans	0.2328
30	Colletotrichum circinans	0.5551	64	Aphanomyces euteiches	0.3359	98	Fomitopsis pinicola	0.2327
31	Monilinia fructigena	0.5498	65	Ceratocystis ulmi	0.3312	99	Fusarium oxysporum f.sp. batatas	0.2299
32	Puccinia purpurea	0.5404	66	Peronospora viciae	0.3278	100	Corticium koleroga	0.2295
33	Ustilago crameri	0.5274	67	Colletotrichum tabacum	0.3272	101	Mycosphaerella dearnessii	0.2282
34	Pseudoperonospora humuli	0.5224	68	Elsino veneta	0.3212	102	Acremonium strictum	0.2279

Table 44 (continued).

Rank	Species Name	Risk Index	Rank	Species Name	Risk Index	Rank	Species Name	Risk Index
103	Botryosphaeria dothidea	0.2261	137	Gymnosporangium yamadae	0.1818	171	Armillaria heimii	0.1132
104	Gremmeniella abietina	0.2258	138	Mycosphaerella laricis-leptolepie	0.1818	172	Pseudopeziza tracheiphila	0.1124
105	Fusarium oxysporum f.sp. phaseoli	0.2247	139	Phialophora gregata	0.1775	173	Gibberella xylarioides	0.1113
106	Tilletia indica	0.2245	140	Didymella applanata	0.1772	174	Peronospora rubi	0.1069
107	Mycosphaerella holci	0.2226	141	Fusarium proliferatum	0.1759	175	Bipolaris heveae	0.104
108	Alternaria gaisen	0.2223	142	Phoma pinodella	0.1702	176	Camptomeris leucaenae	0.1039
109	Rhizopus stolonifer	0.2223	143	Fusarium oxysporum f.sp. trach	0.1701	177	Puccinia cacabata	0.1038
110	Cercospora zeae-maydis	0.22	144	Rhizina undulata	0.1687	178	Dactuliochaeta glycines	0.1021
111	Gymnosporangium asiaticum	0.2171	145	Puccinia polysora	0.1686	179	Calonectria kyotensis	0.1011
112	Ascochyta sorghi	0.2141	146	Phomopsis juniperivora	0.1653	180	Sclerotinia borealis	0.0998
113	Blumeriella jaapii	0.2122	147	Diaporthe phaseolorum var. mer	0.1645	181	Sclerophthora rayssiae var. zeae	0.0981
114	Sphaeropsis sapinea	0.2095	148	Erysiphe cichoracearum	0.1544	182	Didymascella thujina	0.0933
115	Sphaceloma arachidis	0.2088	149	Ciborinia camelliae	0.1535	183	Cercospora caribaea	0.0902
116	Pythium ultimum	0.2085	150	Oidium heveae	0.1522	184	Mycosphaerella henningsii	0.089
117	Sphacelotheca sacchari	0.2083	151	Inonotus weirii	0.1482	185	Ganoderma boninense	0.0888
118	Sphaceloma perseae	0.2055	152	Polyscytalum pustulans	0.1467	186	Phytophthora drechsleri f.sp. cajani	0.0879
119	Pleospora herbarum	0.2051	153	Physoderma leproides	0.1444	187	Rhizoctonia oryzae	0.0878
120	Diaporthe helianthi	0.2005	154	Sphaeropsis tumefaciens	0.1385	188	Mycosphaerella populorum	0.0876
121	Cercospora nicotianae	0.1982	155	Coleosporium ipomoeae	0.1384	189	Rhabdocline pseudotsugae	0.0854
122	Venturia cerasi	0.1981	156	Ganoderma philippii	0.1351	190	Apiognomonia erythrostoma	0.0845
123	Peronosclerospora sacchari	0.1965	157	Meria laricis	0.1351	191	Rhizoctonia tuliparum	0.0831
124	Phakopsora vitis	0.1959	158	Mycosphaerella tassiana	0.1347	192	Elsino? australis	0.0768
125	Phakopsora ampelopsidis	0.1954	159	Phragmidium rubi-idaei	0.1307	193	Ramularia onobrychidis	0.0753
126	Botryosphaeria berengeriana f.sp. pyricola	0.1953	160	Phomopsis sclerotioides	0.1302	194	Phomopsis cocoes	0.0752
127	Balansia oryzae-sativae	0.1952	161	Phoma tracheiphila	0.1277	195	Choanephora cucurbitarum	0.0697
128	Diaporthe phaseolorum var. caulivora	0.1923	162	Phomopsis theae	0.1275	196	Claviceps fusiformis	0.0694
129	Rigidoporus microporus	0.1898	163	Rosellinia arcuata	0.1233	197	Puccinia hemerocallidis	0.0691
130	Fusarium oxysporum f.sp. radicis-lycopers	0.1891	164	Oncobasidium theobromae	0.1216	198	Cryptostroma corticale	0.0676
131	Chrysomyxa abietis	0.187	165	Nectria rigidiuscula	0.1213	199	Phakopsora meibomiae	0.0657
132	Aspergillus fumigatus	0.1869	166	Rosellinia bunodes	0.1212	200	Mycena citricolor	0.0611
133	Cladosporium musae	0.1864	167	Puccinia psidii	0.1209	201	Bipolaris incurvata	0.0609
134	Gibberella pulicaris	0.1853	168	Gibberella stilboides	0.1151	202	Alternaria linicola	0.0579
135	Armillaria tabescens	0.1852	169	Diaporthe eres	0.1147	203	Colletotrichum kahawae	0.0545
136	Peronospora farinosa f.sp. spinaciae	0.1834	170	Fusarium oxysporum f.sp. cann	0.1145	204	Phaeoramularia angolensis	0.0526

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Table 45. The top 200 risk list for plant pathogen species absent from NSW.

Rank	Species Name	Risk Index	Rank	Species Name	Risk Index	Rank	Species Name
1	Puccinia triticina	0.9207	35	Colletotrichum gossypii	0.605	69	Fusarium oxysporum f.sp. conglutinans
2	Peronospora destructor	0.9137	36	Puccinia asparagi	0.5988	70	Nectria cinnabarina
3	Cercospora beticola	0.9004	37	Ustilago scitaminea	0.5981	71	Didymella lycopersici
4	Peronospora farinosa	0.8846	38	Phaeolus schweinitzii	0.5839	72	Podosphaera macularis
5	Venturia inaequalis	0.8706	39	Ascochyta gossypii	0.5823	73	Passalora sojina
6	Albugo candida	0.8553	40	Puccinia arachidis	0.5786	74	Ceratobasidium cereale
7	Puccinia sorghi	0.8311	41	Fusarium oxysporum f.sp. niveum	0.5784	75	Botrytis tulipae
8	Leveillula taurica	0.8079	42	Blumeria graminis	0.5772	76	Cercospora sorghi
9	Magnaporthe grisea	0.799	43	Fusarium oxysporum f.sp. cucumerinum	0.5675	77	Gloeocercospora sorghi
10	Pyrenophora graminea	0.7905	44	Cochliobolus lunatus	0.5669	78	Nematospora coryli
11	Botryosphaeria ribis	0.7419	45	Sphaerulina oryzina	0.5658	79	Paecilomyces lilacinus
12	Alternaria alternata	0.7113	46	Pythium graminicola	0.5608	80	Mycosphaerella pyri
13	Sporisorium cruentum	0.7106	47	Monilinia fructigena	0.5498	81	Podosphaera mors-uvae
14	Rosellinia necatrix	0.709	48	Didymella fabae	0.5461	82	Fusarium sporotrichioides
15	Pythium aphanidermatum	0.6948	49	Gibberella intricans	0.5272	83	Fusarium oxysporum f.sp. melonis
16	Lasiodiplodia theobromae	0.6871	50	Pseudoperonospora humuli	0.5224	84	Phomopsis asparagi
17	Alternaria helianthi	0.6844	51	Alternaria japonica	0.517	85	Erysiphe orontii
18	Cladosporium cucumerinum	0.6833	52	Fusarium oxysporum f.sp. lini	0.5162	86	Alternaria sesami
19	Phytophthora capsici	0.6762	53	Glomerella graminicola	0.5089	87	Fomes fomentarius
20	Sclerospora graminicola	0.6737	54	Ustilaginoidea virens	0.5081	88	Monographella albescens
21	Trichoderma harzianum	0.6726	55	Tilletia barclayana	0.5064	89	Alternaria dianthicola
22	Podosphaera aphanis	0.6643	56	Nectria galligena	0.492	90	Phytophthora medicaginis
23	Lophodermium pinastri	0.6584	57	Mycosphaerella arachidis	0.4858	91	Colletotrichum linicola
24	Colletotrichum musae	0.6514	58	Cronartium ribicola	0.484	92	Curvularia
25	Myrothecium roridum	0.6509	59	Lecanicillium lecanii	0.4772	93	Septoria glycines
26	Magnaporthe salvinii	0.6427	60	Entyloma oryzae	0.4691	94	Mycosphaerella gibsonii
27	Alternaria longipes	0.6352	61	Physoderma maydis	0.4679	95	Phakopsora euvitis
28	Peronosclerospora sorghi	0.6312	62	Alternaria padwickii	0.467	96	Hemileia vastatrix
29	Fusarium oxysporum f.sp. vasinfectum	0.6292	63	Gibberella acuminata	0.4548	97	Alternaria mali
30	Aspergillus niger	0.6221	64	Uromyces ciceris-arietini	0.452	98	Guignardia bidwellii
31	Cochliobolus miyabeanus	0.6208	65	Septoria cannabis	0.4512	99	Phaeosphaeria avenaria f.sp. avenaria
32	Gibberella avenacea	0.6178	66	Thanatephorus cucumeris	0.4432	100	Phytophthora vignae
33	Cercospora kikuchii	0.6165	67	Nattrassia mangiferae	0.4418	101	Kabatiella zeae
34	Alternaria radicina	0.6129	68	Cryphonectria parasitica	0.4406	102	Cronartium flaccidum

Table 45 (continued).

Rank	Species Name	Risk Index	Rank	Species Name	Risk Index	Rank	Species Name
103	Ceratocystis ulmi	0.3312	137	Elsinoe batatas	0.2501	171	Pythium ultimum
104	Peronospora viciae	0.3278	138	Alternaria triticina	0.2486	172	Sphacelotheca sacchari
105	Colletotrichum tabacum	0.3272	139	Phialophora cinerescens	0.2475	173	Puccinia hordei
106	Pseudocercospora fuligena	0.3225	140	Peronosclerospora philippinensis	0.2465	174	Sphaceloma perseae
107	Mycosphaerella cruenta	0.3161	141	Phytophthora meadii	0.2458	175	Pleospora herbarum
108	Phytophthora colocasiae	0.3156	142	Mycosphaerella fijiensis	0.2406	176	Coniothyrium wernsdorffiae
109	Phytophthora palmivora	0.3147	143	Verticillium chlamydosporium	0.2393	177	Diaporthe helianthi
110	Verticillium albo-atrum	0.309	144	Synchytrium endobioticum	0.2392	178	Cercospora nicotianae
111	Ulocladium atrum	0.3073	145	Hypocrea rufa	0.2387	179	Venturia cerasi
112	Asperisporium caricae	0.3071	146	Armillaria mellea	0.2371	180	Marasmius crinis-equi
113	Armillaria ostoyae	0.3031	147	Uromyces transversalis	0.2343	181	Peronosclerospora sacchari
114	Monosporascus cannonballus	0.303	148	Moesziomyces bullatus	0.234	182	Phakopsora vitis
115	Ophiostoma piceae	0.3022	149	Exobasidium vexans	0.2328	183	Phakopsora ampelopsidis
116	Pseudoperonospora cannabina	0.3022	150	Fomitopsis pinicola	0.2327	184	Botryosphaeria berengeriana f.sp. pyricola
117	Phytophthora fragariae	0.2968	151	Neotyphodium coenophialum	0.2312	185	Balansia oryzae-sativae
118	Cronartium quercuum	0.2936	152	Fusarium oxysporum f.sp. batatas	0.2299	186	Diaporthe phaseolorum var. caulivora
119	Aecidium mori	0.2931	153	Corticium koleroga	0.2295	187	Elsino? mangiferae
120	Olpidium brassicae	0.2919	154	Mycosphaerella dearnessii	0.2282	188	Rigidoporus microporus
121	Cryphonectria cubensis	0.2885	155	Acremonium strictum	0.2279	189	Fusarium oxysporum f.sp. radicis-lycopersici
122	Uredo cajani	0.2871	156	Botryosphaeria dothidea	0.2261	190	Pezicula malicorticis
123	Mycosphaerella pruni-persicae	0.2858	157	Gremmeniella abietina	0.2258	191	Chrysomyxa abietis
124	Sclerotinia minor	0.2835	158	Mycosphaerella citri	0.2254	192	Aspergillus fumigatus
125	Alternaria solani	0.2825	159	Fusarium oxysporum f.sp. phaseoli	0.2247	193	Phaeocryptopus gaeumannii
126	Phomopsis longicolla	0.281	160	Tilletia indica	0.2245	194	Cladosporium musae
127	Ustilago shiraiana	0.2795	161	Mycosphaerella holci	0.2226	195	Gibberella pulicaris
128	Gymnosporangium fuscum	0.2761	162	Alternaria gaisen	0.2223	196	Armillaria tabescens
129	Drepanopeziza ribis	0.2757	163	Rhizopus stolonifer	0.2223	197	Peronospora farinosa f.sp. spinaciae
130	Erynia neoaphidis	0.2732	164	Cercospora zeae-maydis	0.22	198	Gymnosporangium yamadae
131	Fusarium oxysporum f.sp. lentis	0.2725	165	Gymnosporangium asiaticum	0.2171	199	Mycosphaerella laricis-leptolepidis
132	Cochliobolus victoriae	0.2621	166	Pyrenopeziza brassicae	0.2153	200	Pythium deliense
133	Stagonospora sacchari	0.2583	167	Ascochyta sorghi	0.2141	201	Phialophora gregata
134	Cryptodiaporthe populea	0.2553	168	Blumeriella jaapii	0.2122	202	Didymella applanata
135	Lachnella willkommii	0.2512	169	Sphaeropsis sapinea	0.2095	203	Phoma pinodella
136	Colletotrichum capsici	0.2504	170	Sphaceloma arachidis	0.2088	204	Fusarium oxysporum f.sp. tracheiphilum

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Table 46. The top 200 risk list for plant pathogen species absent from QLD.

Rank	Species Name	Risk Index	Rank	Species Name	Risk Index	Rank	Species Name
1	Ustilago scitaminea	0.8756	35	Botrytis aclada	0.4961	69	Cladosporium musae
2	Cercospora beticola	0.8606	36	Rhynchosporium secalis	0.4802	70	Trichoderma harzianum
3	Puccinia sorghi	0.8123	37	Phytophthora capsici	0.478	71	Colletotrichum kahawae
4	Puccinia triticina	0.8057	38	Sarocladium oryzae	0.4647	72	Phomopsis theae
5	Cochliobolus miyabeanus	0.7917	39	Cochliobolus lunatus	0.4614	73	Guignardia bidwellii
6	Colletotrichum gossypii	0.7915	40	Phytophthora cactorum	0.4542	74	Alternaria japonica
7	Puccinia striiformis	0.777	41	Puccinia asparagi	0.4531	75	Urocystis cepulae
8	Lasiodiplodia theobromae	0.7534	42	Monographella albescens	0.4512	76	Alternaria alternata
9	Alternaria longipes	0.7519	43	Plasmopara halstedii	0.449	77	Didymella lycopersici
10	Hemileia vastatrix	0.7421	44	Rosellinia necatrix	0.4476	78	Puccinia psidii
11	Sphaerulina oryzina	0.7289	45	Helminthosporium solani	0.4437	79	Blumeria graminis
12	Ustilaginoidea virens	0.728	46	Sphaceloma perseae	0.4393	80	Uromyces ciceris-arietini
13	Myrothecium roridum	0.7153	47	Entyloma oryzae	0.4355	81	Phaeolus schweinitzii
14	Botryosphaeria ribis	0.7116	48	Pyrenophora graminea	0.4269	82	Armillaria heimii
15	Sporisorium cruentum	0.7026	49	Diaporthe phaseolorum var. sojae	0.4218	83	Septoria glycines
16	Pythium aphanidermatum	0.6926	50	Coleosporium ipomoeae	0.4196	84	Cryphonectria cubensis
17	Asperisporium caricae	0.6553	51	Mycosphaerella gibsonii	0.4094	85	Phomopsis asparagi
18	Podosphaera pannosa	0.6468	52	Cladosporium cucumerinum	0.4087	86	Phaeoramularia angolensis
19	Stenocarpella maydis	0.6451	53	Colletotrichum circinans	0.4056	87	Camptomeris leucaenae
20	Thanatephorus cucumeris	0.6306	54	Nectria rigidiuscula	0.4044	88	Puccinia carthami
21	Nematospora coryli	0.6274	55	Pseudocercospora fuligena	0.3985	89	Moesziomyces bullatus
22	Mycosphaerella henningsii	0.6256	56	Curvularia	0.3915	90	Uredo cajani
23	Albugo candida	0.6242	57	Lophodermium pinastri	0.3851	91	Phakopsora meibomiae
24	Puccinia allii	0.6221	58	Alternaria sesami	0.3805	92	Dactuliochaeta glycines
25	Gloeocercospora sorghi	0.6188	59	Corticium koleroga	0.377	93	Fusarium sporotrichioides
26	Cercospora kikuchii	0.5866	60	Rigidoporus microporus	0.3712	94	Alternaria padwickii
27	Pyrenophora teres	0.5769	61	Rosellinia bunodes	0.3412	95	Microcyclus ulei
28	Peronospora farinosa	0.5729	62	Colletotrichum tabacum	0.341	96	Gibberella xylarioides
29	Erysiphe necator	0.557	63	Stemphylium sarciniforme	0.3397	97	Claviceps fusiformis
30	Cercospora zeae-maydis	0.5566	64	Phakopsora euvitis	0.3377	98	Gibberella avenacea
31	Passalora sojina	0.5542	65	Fusarium oxysporum f.sp. lini	0.3366	99	Nectria cinnabarina
32	Aspergillus niger	0.5154	66	Gibberella stilboides	0.3327	100	Phomopsis longicolla
33	Venturia inaequalis	0.5055	67	Lecanicillium lecanii	0.3254	101	Fusarium oxysporum f.sp. phaseoli
34	Sclerospora graminicola	0.497	68	Mycena citricolor	0.3251	102	Colletotrichum capsici

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Table 46 (continued).

Rank	Species Name	Risk Index	Rank	Species Name	Risk Index	Rank	Species Name
103	Fusarium sacchari	0.243	137	Cronartium quercuum	0.1876	171	Phialophora gregata
104	Bipolaris heveae	0.2424	138	Moniliophthora roreri	0.1864	172	Ustilago shiraiana
105	Coniella diplodiella	0.2411	139	Stagonospora sacchari	0.1854	173	Diaporthe helianthi
106	Ustilago crameri	0.2383	140	Phytophthora fragariae	0.1835	174	Tilletia indica
107	Erysiphe orontii	0.2371	141	Alternaria radicina	0.1831	175	Cercospora elaeidis
108	Podosphaera aphanis	0.2365	142	Fusarium culmorum	0.1802	176	Phomopsis juniperivora
109	Fusarium oxysporum f.sp. niveum	0.2352	143	Monographella nivalis	0.1799	177	Alternaria solani
110	Phytophthora colocasiae	0.2347	144	Puccinia cacabata	0.179	178	Elsino? veneta
111	Botrytis fabae	0.2346	145	Olpidium brassicae	0.1761	179	Fusarium oxysporum f.sp. lentis
112	Oidium heveae	0.2285	146	Crinipellis perniciosa	0.1744	180	Phoma foveata
113	Phomopsis viticola	0.2265	147	Mycosphaerella holci	0.1724	181	Peronospora viciae
114	Botryosphaeria dothidea	0.2258	148	Sphaeropsis tumefaciens	0.1699	182	Mycosphaerella pyri
115	Ascochyta sorghi	0.225	149	Botryotinia squamosa	0.1661	183	Didymella fabae
116	Rosellinia pepo	0.2231	150	Puccinia hordei	0.1639	184	Fusarium oxysporum f.sp. elaeidis
117	Choanephora cucurbitarum	0.2219	151	Peronosclerospora philippinensis	0.1629	185	Phomopsis cocoes
118	Puccinia pittieriana	0.218	152	Aecidium mori	0.1622	186	Ganoderma philippii
119	Cercospora caribaea	0.2176	153	Synchytrium psophocarpi	0.1609	187	Microdochium panattonianum
120	Mycosphaerella dearnessii	0.2164	154	Armillaria mellea	0.16	188	Mycovellosiella koepkei
121	Alternaria dianthicola	0.2129	155	Monilinia fructigena	0.1598	189	Didymella lentis
122	Phytophthora erythroseptica var. erythroseptica	0.2111	156	Cronartium ribicola	0.1581	190	Phoma pinodella
123	Nectria galligena	0.2104	157	Chondrostereum purpureum	0.1569	191	Alternaria linicola
124	Elsinoe brasiliensis	0.209	158	Tranzschelia pruni-spinosae var. discolor	0.1548	192	Podosphaera macularis
125	Eutypa lata	0.2063	159	Peronosclerospora sacchari	0.1524	193	Kabatiella zeae
126	Verticillium albo-atrum	0.202	160	Exobasidium vexans	0.1514	194	Fusarium oxysporum f.sp. tracheiphilum
127	Pleospora betae	0.1993	161	Sclerotinia trifoliorum	0.1514	195	Phakopsora vitis
128	Monosporascus cannonballus	0.1971	162	Alternaria mali	0.1508	196	Phakopsora ampelopsidis
129	Cochliobolus victoriae	0.1937	163	Sphaceloma poinsettiae	0.1505	197	Podosphaera mors-uvae
130	Phaeosphaeria avenaria f.sp. avenaria	0.1924	164	Colletotrichum linicola	0.1498	198	Erysiphe cichoracearum
131	Diaporthe phaseolorum var. meridionalis	0.1917	165	Cryphonectria parasitica	0.1479	199	Gymnosporangium clavipes
132	Fusarium oxysporum f.sp. batatas	0.1912	166	Sphaceloma arachidis	0.1473	200	Spilocaea pyracanthae
133	Septoria cannabis	0.1909	167	Alternaria triticina	0.144	201	Armillaria ostoyae
134	Erynia radicans	0.1906	168	Spilocaea oleaginea	0.1422	202	Fomitopsis pinicola
135	Didymella rabiei	0.1898	169	Marasmius crinis-equi	0.1388	203	Alternaria gaisen
136	Mycosphaerella rabiei	0.1898	170	Aspergillus fumigatus	0.1381	204	Gymnosporangium asiaticum

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Table 47. The top 200 risk list for plant pathogen species absent from VIC.

Rank	Species Name	Risk Index	Rank	Species Name	Risk Index	Rank	Species Name	Risk Index
1	Ustilago hordei	0.862	35	Rosellinia necatrix	0.3584	69	Sporisorium cruentum	0.263
2	Puccinia triticina	0.6779	36	Puccinia pelargonii-zonalis	0.3542	70	Physoderma alfalfae	0.2609
3	Ustilago zeae	0.6775	37	Diplocarpon earlianum	0.352	71	Glomerella cingulata	0.2607
4	Puccinia allii	0.6355	38	Pyrenophora chaetomioides	0.3502	72	Peronospora manshurica	0.2596
5	Puccinia coronata	0.6165	39	Heterobasidion annosum	0.3501	73	Drepanopeziza ribis	0.2594
6	Rhynchosporium secalis	0.6101	40	Helicobasidium brebissonii	0.3494	74	Mycosphaerella berkeleyi	0.2563
7	Macrophomina phaseolina	0.6087	41	Uromyces ciceris-arietini	0.3471	75	Colletotrichum linicola	0.2556
8	Peronospora destructor	0.5768	42	Cochliobolus miyabeanus	0.3461	76	Myrothecium roridum	0.2503
9	Claviceps purpurea	0.5531	43	Puccinia purpurea	0.3371	77	Colletotrichum truncatum	0.2465
10	Pyrenophora teres	0.5259	44	Tilletia controversa	0.3347	78	Penicillium digitatum	0.2424
11	Monilinia fructigena	0.5247	45	Podosphaera macularis	0.3337	79	Septoria cannabis	0.2413
12	Pyrenophora graminea	0.513	46	Fusarium oxysporum f.sp. cucumerinum	0.3275	80	Fusarium oxysporum f.sp. niveum	0.2397
13	Puccinia sorghi	0.508	47	Blumeria graminis	0.3268	81	Ceratobasidium cereale	0.2388
14	Venturia inaequalis	0.5009	48	Colletotrichum orbiculare	0.3243	82	Venturia cerasi	0.2388
15	Peronospora farinosa	0.4841	49	Fusarium oxysporum f.sp. vasinfectum	0.3242	83	Alternaria longipes	0.2385
16	Chalara elegans	0.474	50	Didymella rabiei	0.317	84	Spilocaea oleaginea	0.2379
17	Botrytis tulipae	0.4531	51	Fusarium oxysporum f.sp. lini	0.3121	85	Ustilago crameri	0.2369
18	Albugo candida	0.4434	52	Guignardia bidwellii	0.3118	86	Botrytis fabae	0.2333
19	Nectria galligena	0.4384	53	Stemphylium sarciniforme	0.3103	87	Puccinia hordei	0.2309
20	Phoma medicaginis var. medicaginis	0.4344	54	Phytophthora capsici	0.308	88	Ustilago scitaminea	0.2305
21	Leptosphaeria coniothyrium	0.4322	55	Cronartium ribicola	0.3053	89	Phaeosphaeria avenaria f.sp. avenaria	0.2212
22	Pseudoperonospora humuli	0.4295	56	Didymella lycopersici	0.3024	90	Cochliobolus heterostrophus	0.2193
23	Podosphaera pannosa	0.4239	57	Phytophthora fragariae	0.2927	91	Aspergillus niger	0.2179
24	Magnaporthe grisea	0.4234	58	Cronartium flaccidum	0.2899	92	Nattrassia mangiferae	0.2158
25	Podosphaera aphanis	0.4213	59	Gymnosporangium fuscum	0.2878	93	Alternaria dianthicola	0.2156
26	Spilocaea pyracanthae	0.4186	60	Phaeolus schweinitzii	0.2794	94	Blumeriella jaapii	0.2143
27	Urocystis cepulae	0.4059	61	Alternaria citri	0.2792	95	Pleiochaeta setosa	0.2134
28	Erysiphe necator	0.4034	62	Ceratocystis ulmi	0.2775	96	Alternaria radicina	0.2124
29	Cladosporium cucumerinum	0.3898	63	Kabatiella caulivora	0.2728	97	Chrysomyxa abietis	0.2108
30	Lophodermium pinastri	0.376	64	Penicillium italicum	0.2693	98	Pezicula malicorticis	0.2107
31	Puccinia carthami	0.376	65	Sclerophthora macrospora	0.2688	99	Botryosphaeria ribis	0.2085
32	Puccinia asparagi	0.367	66	Colletotrichum circinans	0.267	100	Entyloma dahliae	0.2071
33	Plasmopara halstedii	0.3628	67	Coniella diplodiella	0.2658	101	Mycosphaerella pyri	0.2034
34	Magnaporthe salvinii	0.3627	68	Mycosphaerella rabiei	0.264	102	Ramularia onobrychidis	0.2027

Table 47 (continued).

Rank	Species Name	Risk Index	Rank	Species Name	Risk Index	Rank	Species Name	Risk Index
103	Cryphonectria parasitica	0.1999	137	Monilochaetes infuscans	0.1416	171	Diaporthe eres	0.1037
104	Peronospora viciae	0.1988	138	Polyscytalum pustulans	0.138	172	Rhabdocline pseudotsugae	0.1033
105	Glomerella tucumanensis	0.1903	139	Diaporthe helianthi	0.137	173	Mycosphaerella arachidis	0.1018
106	Ceratocystis paradoxa	0.1901	140	Pseudoperonospora cannabina	0.1367	174	Peronospora rubi	0.1007
107	Sclerospora graminicola	0.1868	141	Nectria cinnabarina	0.1351	175	Cochliobolus carbonum	0.0995
108	Gremmeniella abietina	0.1851	142	Fomes fomentarius	0.135	176	Alternaria alternata	0.0966
109	Botrytis anthophila	0.1762	143	Rhizina undulata	0.1338	177	Peronospora farinosa f.sp. chenopodii	0.0963
110	Fusarium sporotrichioides	0.1758	144	Didymella fabae	0.1304	178	Passalora sojina	0.0937
111	Neotyphodium coenophialum	0.1746	145	Glomerella graminicola	0.1293	179	Gibberella acuminata	0.0858
112	Coniothyrium wernsdorffiae	0.1712	146	Mycocentrospora cladosporioides	0.1291	180	Hypoxylon mammatum	0.0857
113	Lachnella willkommii	0.1706	147	Alternaria mali	0.1289	181	Cronartium quercuum	0.0848
114	Colletotrichum gossypii	0.17	148	Phytophthora palmivora	0.1288	182	Aspergillus terreus	0.0832
115	Armillaria mellea	0.1687	149	Monosporascus cannonballus	0.1223	183	Paecilomyces lilacinus	0.0824
116	Pythium splendens	0.1679	150	Fusarium oxysporum f.sp. cannabis	0.1204	184	Didymascella thujina	0.0815
117	Alternaria japonica	0.1638	151	Fusarium oxysporum f.sp. cubense	0.1187	185	Septoria glycines	0.0815
118	Alternaria helianthi	0.1624	152	Pythium graminicola	0.118	186	Fusarium proliferatum	0.0809
119	Synchytrium endobioticum	0.1551	153	Phytophthora porri	0.1165	187	Phomopsis longicolla	0.0807
120	Erysiphe orontii	0.1549	154	Gnomonia comari	0.1163	188	Phomopsis asparagi	0.0806
121	Meria laricis	0.1545	155	Lasiodiplodia theobromae	0.1163	189	Curvularia	0.0803
122	Pythium myriotylum	0.1535	156	Alternaria sesami	0.1157	190	Phomopsis juniperivora	0.0796
123	Cochliobolus lunatus	0.1533	157	Fusarium oxysporum f.sp. radicis-lycopersici	0.1144	191	Phytophthora boehmeriae	0.0794
124	Colletotrichum musae	0.1527	158	Erynia neoaphidis	0.1134	192	Mycosphaerella cruenta	0.0788
125	Diaporthe phaseolorum var. sojae	0.1521	159	Alternaria triticina	0.112	193	Phytophthora cambivora	0.0761
126	Fusarium oxysporum f.sp. lentis	0.1508	160	Fomitopsis pinicola	0.1084	194	Cercospora nicotianae	0.0751
127	Pythium aphanidermatum	0.1502	161	Cercospora sorghi	0.1083	195	Tilletia barclayana	0.0751
128	Peronosclerospora sorghi	0.15	162	Pythium vexans	0.1083	196	Fusarium oxysporum f.sp. phaseoli	0.0748
129	Puccinia arachidis	0.1493	163	Olpidium brassicae	0.1073	197	Apiognomonia erythrostoma	0.0741
130	Physoderma leproides	0.1476	164	Armillaria ostoyae	0.107	198	Pythium arrhenomanes	0.0734
131	Fusarium oxysporum f.sp. conglutinans	0.1471	165	Cryptodiaporthe populea	0.107	199	Tilletia indica	0.073
132	Phialophora cinerescens	0.1468	166	Ascochyta gossypii	0.1062	200	Pythium deliense	0.072
133	Gibberella intricans	0.1456	167	Lecanicillium lecanii	0.1058	201	Gymnosporangium asiaticum	0.0713
134	Phoma tracheiphila	0.1455	168	Rhizoctonia tuliparum	0.1057	202	Diaporthe phaseolorum var. caulivora	0.0703
135	Didymella ligulicola	0.1423	169	Sclerotinia borealis	0.1048	203	Stenocarpella maydis	0.0694
136	Ophiostoma piceae	0.1418	170	Bipolaris sacchari	0.1043	204	Entyloma oryzae	0.0673

Table 48. The top 200 risk list for plant pathogen species absent from TAS.

Rank	Species Name	Risk Index	Rank	Species Name	Risk Index	Rank	Species Name
1	Phytophthora infestans	0.7913	35	Kabatiella caulivora	0.408	69	Entyloma dahliae
2	Gibberella avenacea	0.6782	36	Puccinia helianthi	0.4047	70	Rhizina undulata
3	Cercospora beticola	0.6739	37	Leveillula taurica	0.4019	71	Plasmopara halstedii
4	Pseudoperonospora humuli	0.6635	38	Stemphylium sarciniforme	0.3962	72	Rhabdocline pseudotsugae
5	Alternaria brassicicola	0.654	39	Peronospora destructor	0.3957	73	Lachnella willkommii
6	Cronartium ribicola	0.6498	40	Cronartium flaccidum	0.3911	74	Ceratobasidium cereale
7	Gibberella zeae	0.6291	41	Colletotrichum acutatum	0.3871	75	Ramularia onobrychidis
8	Venturia pirina	0.6272	42	Didymella lycopersici	0.3802	76	Polyscytalum pustulans
9	Albugo candida	0.5983	43	Didymella bryoniae	0.3799	77	Hypoxylon mammatum
10	Ustilago zeae	0.5897	44	Pezicula malicorticis	0.3751	78	Didymella lentis
11	Puccinia asparagi	0.5816	45	Nectria cinnabarina	0.365	79	Cryphonectria parasitica
12	Peronospora hyoscyami f.sp. tabacina	0.576	46	Peronospora manshurica	0.3645	80	Colletotrichum linicola
13	Heterobasidion annosum	0.5593	47	Septoria cannabis	0.3585	81	Blumeriella jaapii
14	Puccinia allii	0.5507	48	Alternaria radicina	0.3555	82	Venturia cerasi
15	Podosphaera aphanis	0.5496	49	Blumeria graminis	0.3506	83	Fomes fomentarius
16	Puccinia triticina	0.5366	50	Gymnosporangium fuscum	0.3489	84	Pleiochaeta setosa
17	Pyrenophora graminea	0.5364	51	Melampsora medusae	0.3483	85	Armillaria ostoyae
18	Pyrenophora tritici-repentis	0.535	52	Lophodermium pinastri	0.3435	86	Ophiostoma piceae
19	Monilinia fructigena	0.5277	53	Chrysomyxa abietis	0.3432	87	Guignardia bidwellii
20	Ceratocystis ulmi	0.5228	54	Tilletia controversa	0.3414	88	Didymascella thujina
21	Podosphaera pannosa	0.522	55	Meria laricis	0.3402	89	Gnomonia comari
22	Gibberella fujikuroi	0.5034	56	Fusarium oxysporum f.sp. lini	0.3372	90	Colletotrichum orbiculare
23	Sporisorium sorghi	0.4985	57	Peronospora farinosa	0.3339	91	Fomitopsis pinicola
24	Podosphaera macularis	0.4942	58	Alternaria porri	0.3306	92	Puccinia carthami
25	Helicobasidium brebissonii	0.491	59	Venturia inaequalis	0.3296	93	Magnaporthe salvinii
26	Urocystis cepulae	0.4858	60	Cladosporium cucumerinum	0.3293	94	Physoderma alfalfae
27	Phytophthora fragariae	0.4839	61	Puccinia sorghi	0.3278	95	Mycosphaerella pyri
28	Pseudoperonospora cubensis	0.4687	62	Synchytrium endobioticum	0.3262	96	Magnaporthe grisea
29	Mycosphaerella linicola	0.445	63	Pyrenophora teres	0.3243	97	Sclerophthora macrospora
30	Drepanopeziza ribis	0.4398	64	Glomerella cingulata	0.3225	98	Pythium graminicola
31	Fusarium oxysporum	0.4332	65	Pyrenophora chaetomioides	0.3204	99	Fusarium oxysporum f.sp. melonis
32	Erysiphe necator	0.4313	66	Aphanomyces euteiches	0.3199	100	Coniella diplodiella
33	Gremmeniella abietina	0.4214	67	Phialophora cinerescens	0.3174	101	Cryptodiaporthe populea
34	Sphacelotheca reiliana	0.4098	68	Phaeolus schweinitzii	0.3173	102	Phragmidium rubi-idaei

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Table 48 (continued).

Rank	Species Name	Risk Index	Rank	Species Name	Risk Index	Rank	Species Name
103	Cochliobolus heterostrophus	0.2283	137	Cochliobolus miyabeanus	0.1638	171	Phytophthora medicaginis
104	Sclerotinia borealis	0.2268	138	Mycosphaerella rabiei	0.1636	172	Fusarium sporotrichioides
105	Alternaria japonica	0.2249	139	Myrothecium roridum	0.1629	173	Phytophthora cambivora
106	Peronospora rubi	0.2216	140	Alternaria mali	0.1603	174	Passalora sojina
107	Apiosporina morbosa	0.2206	141	Phaeoisariopsis griseola	0.1571	175	Cochliobolus carbonum
108	Colletotrichum truncatum	0.2202	142	Rosellinia necatrix	0.1568	176	Phoma pinodella
109	Trichoderma harzianum	0.2187	143	Apiognomonia erythrostoma	0.1555	177	Diaporthe vaccinii
110	Didymella rabiei	0.2179	144	Phytophthora porri	0.1543	178	Fusarium oxysporum f.sp. radicis-lycopersici
111	Olpidium brassicae	0.2146	145	Sporisorium cruentum	0.1542	179	Pythium myriotylum
112	Ustilago crameri	0.2137	146	Diaporthe phaseolorum var. sojae	0.154	180	Gibberella intricans
113	Botrytis fabae	0.2124	147	Alternaria helianthi	0.1528	181	Penicillium digitatum
114	Mycosphaerella populorum	0.2095	148	Glomerella graminicola	0.152	182	Botryosphaeria ribis
115	Cronartium comandrae	0.209	149	Stenocarpella maydis	0.1491	183	Septoria glycines
116	Coniothyrium wernsdorffiae	0.2081	150	Pythium arrhenomanes	0.1487	184	Gymnosporangium asiaticum
117	Endocronartium harknessii	0.2049	151	Neotyphodium coenophialum	0.1428	185	Atropellis piniphila
118	Cronartium coleosporioides	0.2008	152	Uromyces ciceris-arietini	0.1413	186	Gibberella pulicaris
119	Phytophthora capsici	0.2004	153	Anisogramma anomala	0.1409	187	Ciborinia camelliae
120	Cronartium comptoniae	0.1961	154	Puccinia purpurea	0.1367	188	Kabatiella zeae
121	Gymnosporangium clavipes	0.195	155	Alternaria longipes	0.1351	189	Pseudopeziza tracheiphila
122	Phytophthora sojae	0.1918	156	Fusarium oxysporum f.sp. niveum	0.1336	190	Fusarium proliferatum
123	Botryotinia squamosa	0.1908	157	Lecanicillium lecanii	0.1336	191	Phomopsis longicolla
124	Cronartium quercuum	0.1904	158	Alternaria linicola	0.1334	192	Mycosphaerella berkeleyi
125	Diaporthe citri	0.1903	159	Diaporthe helianthi	0.132	193	Alternaria citri
126	Sclerospora graminicola	0.1873	160	Phytophthora richardiae	0.1267	194	Inonotus weirii
127	Pseudoperonospora cannabina	0.1826	161	Spilocaea oleaginea	0.1249	195	Pythium aphanidermatum
128	Colletotrichum circinans	0.1823	162	Nattrassia mangiferae	0.1245	196	Fusarium oxysporum f.sp. lentis
129	Ceratocystis fimbriata	0.1796	163	Fusarium oxysporum f.sp. vasinfectum	0.1233	197	Phomopsis asparagi
130	Fusarium oxysporum f.sp. conglutinans	0.1786	164	Phomopsis sclerotioides	0.1226	198	Erysiphe cichoracearum
131	Phaeosphaeria avenaria f.sp. avenaria	0.1749	165	Fusarium oxysporum f.sp. cannabis	0.1216	199	Cryptostroma corticale
132	Botryotinia porri	0.1734	166	Penicillium italicum	0.1183	200	Ceratocystis wageneri
133	Rhizoctonia tuliparum	0.1715	167	Pythium vexans	0.1183	201	Cochliobolus lunatus
134	Erysiphe orontii	0.1709	168	Erynia neoaphidis	0.1176	202	Ustilago scitaminea
135	Ulocladium atrum	0.1695	169	Alternaria alternata	0.1161	203	Gymnosporangium juniperi-virginianae
136	Armillaria mellea	0.1666	170	Aspergillus niger	0.1149	204	Physoderma maydis

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Table 49. The top 200 risk list for plant pathogen species absent from NT.

Rank	Species Name	Risk Index	Rank	Species Name	Risk Index	Rank	Species Name	Risk Index
1	Glomerella tucumanensis	0.5772	35	Cercospora elaeidis	0.2613	69	Cercospora kikuchii	0.1478
2	Hemileia vastatrix	0.5458	36	Bipolaris sacchari	0.2585	70	Guignardia musae	0.1477
3	Puccinia polysora	0.494	37	Puccinia sorghi	0.2462	71	Marasmius crinis-equi	0.1477
4	Ceratocystis paradoxa	0.4779	38	Alternaria dauci	0.2397	72	Mycosphaerella brassicicola	0.1473
5	Uromyces appendiculatus	0.4769	39	Claviceps fusiformis	0.2395	73	Puccinia graminis	0.1462
6	Mycosphaerella arachidis	0.4705	40	Phaeoramularia angolensis	0.2377	74	Cochliobolus sativus	0.1449
7	Pseudoperonospora cubensis	0.4581	41	Sclerospora graminicola	0.2362	75	Puccinia triticina	0.1413
8	Mycosphaerella henningsii	0.4346	42	Septoria lycopersici	0.2357	76	Claviceps africana	0.1405
9	Sporisorium sorghi	0.433	43	Nectria rigidiuscula	0.2318	77	Bipolaris heveae	0.1379
10	Lasiodiplodia theobromae	0.4197	44	Nattrassia mangiferae	0.2117	78	Phytophthora colocasiae	0.1356
11	Mycosphaerella fijiensis	0.4105	45	Myrothecium roridum	0.2116	79	Botryosphaeria ribis	0.1312
12	Gloeocercospora sorghi	0.4022	46	Ustilago zeae	0.2098	80	Ceratocystis fimbriata	0.1297
13	Phaeoisariopsis griseola	0.3976	47	Ascochyta sorghi	0.2046	81	Fusarium oxysporum f.sp. elaeidis	0.1256
14	Macrophomina phaseolina	0.3944	48	Didymella bryoniae	0.1986	82	Colletotrichum kahawae	0.1255
15	Mycovellosiella fulva	0.3913	49	Trachysphaera fructigena	0.1972	83	Rosellinia bunodes	0.1178
16	Corticium salmonicolor	0.378	50	Phytophthora citrophthora	0.1964	84	Albugo candida	0.1143
17	Ustilago scitaminea	0.3712	51	Colletotrichum capsici	0.1946	85	Puccinia kuehnii	0.1138
18	Gibberella xylarioides	0.3643	52	Plasmopara viticola	0.1945	86	Phytophthora cactorum	0.1115
19	Alternaria porri	0.358	53	Magnaporthe salvinii	0.1834	87	Armillaria heimii	0.1114
20	Glomerella graminicola	0.3555	54	Cercospora nicotianae	0.1829	88	Cochliobolus lunatus	0.1108
21	Phytophthora infestans	0.3429	55	Peronosclerospora sorghi	0.179	89	Fusarium oxysporum	0.1046
22	Sphacelotheca reiliana	0.3402	56	Fusarium oxysporum f.sp. vasinfectum	0.1782	90	Ascochyta gossypii	0.0979
23	Leveillula taurica	0.3321	57	Aspergillus niger	0.1768	91	Puccinia striiformis	0.0958
24	Mycosphaerella cruenta	0.329	58	Thanatephorus cucumeris	0.1738	92	Mycovellosiella koepkei	0.0953
25	Phellinus noxius	0.3207	59	Puccinia melanocephala	0.1722	93	Passalora sojina	0.0945
26	Sporisorium cruentum	0.3087	60	Sarocladium oryzae	0.1686	94	Corticium koleroga	0.0945
27	Cercospora beticola	0.3062	61	Pythium aphanidermatum	0.168	95	Cercospora caribaea	0.0943
28	Colletotrichum gossypii	0.2753	62	Diplocarpon rosae	0.1594	96	Pythium vexans	0.0935
29	Cladosporium musae	0.2734	63	Curvularia	0.1577	97	Nematospora coryli	0.0912
30	Alternaria brassicicola	0.2718	64	Elsino? batatas	0.1569	98	Tilletia barclayana	0.0912
31	Colletotrichum truncatum	0.2697	65	Ganoderma philippii	0.1528	99	Mycosphaerella graminicola	0.0889
32	Colletotrichum musae	0.2687	66	Taphrina deformans	0.1527	100	Asperisporium caricae	0.0862
33	Rigidoporus microporus	0.2645	67	Stenocarpella macrospora	0.1526	101	Didymella lycopersici	0.0852
34	Colletotrichum lindemuthianum	0.2614	68	Physoderma maydis	0.1505	102	Crinipellis perniciosa	0.0851

Table 49 (continued).

Rank	Species Name	Risk Index	Rank	Species Name	Risk Index	Rank	Species Name	Risk Index
103	Cryphonectria cubensis	0.0846	137	Puccinia psidii	0.052	171	Pythium irregulare	0.0347
104	Uredo cajani	0.0842	138	Verticillium dahliae	0.052	172	Diaporthe vexans	0.0337
105	Diaporthe phaseolorum var. sojae	0.0827	139	Rhizoctonia oryzae	0.0507	173	Alternaria citri	0.0337
106	Pythium splendens	0.0795	140	Coleosporium ipomoeae	0.0502	174	Colletotrichum circinans	0.0326
107	Mycosphaerella coffeicola	0.0785	141	Bipolaris incurvata	0.0501	175	Fusarium sacchari	0.0323
108	Microcyclus ulei	0.0784	142	Camptomeris leucaenae	0.0499	176	Tilletia tritici	0.0323
109	Alternaria longipes	0.0764	143	Mycosphaerella pini	0.0496	177	Synchytrium endobioticum	0.032
110	Sclerotinia sclerotiorum	0.0757	144	Mycosphaerella holci	0.0488	178	Peronospora farinosa	0.0316
111	Uromyces viciae-fabae	0.0753	145	Rosellinia necatrix	0.0483	179	Fusarium oxysporum f.sp. phaseoli	0.0315
112	Sphaceloma fawcettii var. scabiosa	0.0748	146	Pythium graminicola	0.0473	180	Diaporthe phaseolorum var. meridionalis	0.0313
113	Colletotrichum dematium	0.0746	147	Colletotrichum coccodes	0.047	181	Moniliophthora roreri	0.0311
114	Puccinia helianthi	0.0743	148	Exobasidium vexans	0.0453	182	Cladosporium cucumerinum	0.031
115	Cercospora zeae-maydis	0.074	149	Gibberella stilboides	0.0449	183	Penicillium italicum	0.0303
116	Stenocarpella maydis	0.0728	150	Elsino? ampelina	0.0443	184	Diaporthe phaseolorum var. caulivora	0.03
117	Mycena citricolor	0.0712	151	Ustilago hordei	0.044	185	Monographella nivalis	0.03
118	Dactuliochaeta glycines	0.0667	152	Ganoderma boninense	0.0436	186	Peronospora farinosa f.sp. chenopodii	0.03
119	Marasmiellus scandens	0.0665	153	Claviceps purpurea	0.0435	187	Physoderma alfalfae	0.03
120	Colletotrichum acutatum	0.065	154	Peronospora farinosa f.sp. betae	0.0433	188	Phytophthora fragariae	0.03
121	Rosellinia arcuata	0.0643	155	Phaeosphaeria nodorum	0.0427	189	Puccinia hordei	0.03
122	Alternaria sesami	0.0632	156	Podosphaera leucotricha	0.0426	190	Alternaria japonica	0.0287
123	Didymella pinodes	0.0624	157	Puccinia pittieriana	0.0425	191	Alternaria helianthi	0.0286
124	Gaeumannomyces graminis var. tritici	0.0615	158	Tilletia laevis	0.0411	192	Pythium deliense	0.0286
125	Phomopsis longicolla	0.0606	159	Rhynchosporium secalis	0.041	193	Podosphaera pannosa	0.0285
126	Sphaceloma perseae	0.0602	160	Oncobasidium theobromae	0.0405	194	Phytophthora capsici	0.0277
127	Phakopsora meibomiae	0.0601	161	Gibberella intricans	0.0394	195	Penicillium digitatum	0.0267
128	Spilocaea oleaginea	0.06	162	Monilochaetes infuscans	0.0386	196	Peronospora destructor	0.0267
129	Oidium heveae	0.0599	163	Ascochyta pisi	0.0382	197	Albugo ipomoeae-panduratae	0.0261
130	Monilinia fructicola	0.0589	164	Peronosclerospora sacchari	0.038	198	Pyrenophora chaetomioides	0.0241
131	Peronospora parasitica	0.0576	165	Pythium arrhenomanes	0.0375	199	Fusarium sporotrichioides	0.0236
132	Rosellinia pepo	0.0567	166	Guignardia bidwellii	0.0367	200	Guignardia citricarpa	0.0229
133	Mycosphaerella citri	0.056	167	Urocystis cepulae	0.0367	201	Phoma foveata	0.0226
134	Septoria apiicola	0.0556	168	Elsino? australis	0.0363	202	Rhizopus stolonifer	0.0221
135	Pythium debaryanum	0.0556	169	Phomopsis cocoes	0.0356	203	Fusarium oxysporum f.sp. melonis	0.0207
136	Sphaeropsis tumefaciens	0.0548	170	Balansia oryzae-sativae	0.0353	204	Entyloma dahliae	0.0205

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Table 50. The top 200 risk list for plant pathogen species absent from SA.

Rank	Species Name	Risk Index	Rank	Species Name	Risk Index	Rank	Species Name	Risk Index
1	Puccinia triticina	0.6779	35	Mycosphaerella pini	0.3474	69	Venturia cerasi	0.2388
2	Ustilago zeae	0.6775	36	Uromyces ciceris-arietini	0.3471	70	Ceratobasidium cereale	0.2388
3	Puccinia allii	0.6355	37	Cochliobolus miyabeanus	0.3461	71	Alternaria longipes	0.2385
4	Sclerotinia sclerotiorum	0.6118	38	Ulocladium atrum	0.3425	72	Spilocaea oleaginea	0.2379
5	Leveillula taurica	0.5778	39	Puccinia purpurea	0.3371	73	Ustilago crameri	0.2369
6	Peronospora destructor	0.5768	40	Podosphaera macularis	0.3337	74	Trichoderma harzianum	0.2345
7	Sphacelotheca reiliana	0.5487	41	Blumeria graminis	0.3268	75	Botrytis fabae	0.2333
8	Gibberella avenacea	0.5423	42	Fusarium oxysporum f.sp. vasinfectum	0.3242	76	Ustilago scitaminea	0.2305
9	Alternaria brassicicola	0.5388	43	Discosphaerina fulvida	0.3232	77	Phragmidium rubi-idaei	0.2299
10	Pleospora betae	0.5293	44	Didymella rabiei	0.317	78	Phaeosphaeria avenaria f.sp. avenaria	0.2212
11	Setosphaeria turcica	0.5255	45	Fusarium oxysporum f.sp. lini	0.3121	79	Verticillium albo-atrum	0.2204
12	Monilinia fructigena	0.5247	46	Guignardia bidwellii	0.3118	80	Cochliobolus heterostrophus	0.2193
13	Pyrenophora graminea	0.513	47	Stemphylium sarciniforme	0.3103	81	Aspergillus niger	0.2179
14	Pyrenophora tritici-repentis	0.5127	48	Phytophthora capsici	0.308	82	Nattrassia mangiferae	0.2158
15	Puccinia sorghi	0.508	49	Cronartium ribicola	0.3053	83	Alternaria dianthicola	0.2156
16	Venturia inaequalis	0.5009	50	Didymella lycopersici	0.3024	84	Blumeriella jaapii	0.2143
17	Peronospora farinosa	0.4841	51	Colletotrichum acutatum	0.2988	85	Pleiochaeta setosa	0.2134
18	Sclerotinia trifoliorum	0.4732	52	Cronartium flaccidum	0.2899	86	Chrysomyxa abietis	0.2108
19	Albugo candida	0.4434	53	Gymnosporangium fuscum	0.2878	87	Pezicula malicorticis	0.2107
20	Nectria galligena	0.4384	54	Phaeolus schweinitzii	0.2794	88	Botryosphaeria ribis	0.2085
21	Pseudoperonospora humuli	0.4295	55	Alternaria citri	0.2792	89	Elsino? fawcettii	0.2077
22	Podosphaera pannosa	0.4239	56	Helminthosporium solani	0.2788	90	Entyloma dahliae	0.2071
23	Magnaporthe grisea	0.4234	57	Ceratocystis ulmi	0.2775	91	Mycosphaerella pyri	0.2034
24	Podosphaera aphanis	0.4213	58	Coniella diplodiella	0.2658	92	Ramularia onobrychidis	0.2027
25	Spilocaea pyracanthae	0.4186	59	Fusarium oxysporum f.sp. melonis	0.265	93	Cryphonectria parasitica	0.1999
26	Monographella nivalis	0.4138	60	Mycosphaerella rabiei	0.264	94	Peronospora viciae	0.1988
27	Cladosporium cucumerinum	0.3898	61	Sporisorium cruentum	0.263	95	Phaeoisariopsis griseola	0.1906
28	Didymella applanata	0.3891	62	Glomerella cingulata	0.2607	96	Glomerella tucumanensis	0.1903
29	Fusarium culmorum	0.3756	63	Peronospora manshurica	0.2596	97	Ceratocystis paradoxa	0.1901
30	Puccinia asparagi	0.367	64	Mycosphaerella berkeleyi	0.2563	98	Sclerospora graminicola	0.1868
31	Magnaporthe salvinii	0.3627	65	Colletotrichum linicola	0.2556	99	Gremmeniella abietina	0.1851
32	Rosellinia necatrix	0.3584	66	Colletotrichum truncatum	0.2465	100	Phaeocryptopus gaeumannii	0.1804
33	Heterobasidion annosum	0.3501	67	Septoria cannabis	0.2413	101	Botrytis anthophila	0.1762
34	Helicobasidium brebissonii	0.3494	68	Fusarium oxysporum f.sp. niveum	0.2397	102	Fusarium sporotrichioides	0.1758

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Table 50 (continued).

Rank	Species Name	Risk Index	Rank	Species Name	Risk Index	Rank	Species Name	Risk Index
103	Neotyphodium coenophialum	0.1746	137	Ceratocystis fimbriata	0.1312	171	Guignardia citricarpa	0.088
104	Coniothyrium wernsdorffiae	0.1712	138	Didymella fabae	0.1304	172	Hypoxylon mammatum	0.0857
105	Lachnella willkommii	0.1706	139	Glomerella graminicola	0.1293	173	Cronartium quercuum	0.0848
106	Colletotrichum gossypii	0.17	140	Mycocentrospora cladosporioides	0.1291	174	Aspergillus terreus	0.0832
107	Armillaria mellea	0.1687	141	Alternaria mali	0.1289	175	Paecilomyces lilacinus	0.0824
108	Pythium splendens	0.1679	142	Phytophthora palmivora	0.1288	176	Didymascella thujina	0.0815
109	Alternaria japonica	0.1638	143	Monosporascus cannonballus	0.1223	177	Septoria glycines	0.0815
110	Alternaria helianthi	0.1624	144	Fusarium oxysporum f.sp. cannabis	0.1204	178	Fusarium proliferatum	0.0809
111	Synchytrium endobioticum	0.1551	145	Fusarium oxysporum f.sp. cubense	0.1187	179	Phomopsis longicolla	0.0807
112	Erysiphe orontii	0.1549	146	Gnomonia comari	0.1163	180	Phomopsis asparagi	0.0806
113	Meria laricis	0.1545	147	Lasiodiplodia theobromae	0.1163	181	Curvularia	0.0803
114	Pythium myriotylum	0.1535	148	Alternaria sesami	0.1157	182	Phomopsis juniperivora	0.0796
115	Cochliobolus lunatus	0.1533	149	Fusarium oxysporum f.sp. radicis-lycopersici	0.1144	183	Phytophthora boehmeriae	0.0794
116	Phytophthora sojae	0.1531	150	Erynia neoaphidis	0.1134	184	Mycosphaerella cruenta	0.0788
117	Colletotrichum musae	0.1527	151	Alternaria triticina	0.112	185	Phytophthora cambivora	0.0761
118	Diaporthe phaseolorum var. sojae	0.1521	152	Fomitopsis pinicola	0.1084	186	Cercospora nicotianae	0.0751
119	Fusarium oxysporum f.sp. lentis	0.1508	153	Cercospora sorghi	0.1083	187	Tilletia barclayana	0.0751
120	Pythium aphanidermatum	0.1502	154	Olpidium brassicae	0.1073	188	Fusarium oxysporum f.sp. phaseoli	0.0748
121	Peronosclerospora sorghi	0.15	155	Armillaria ostoyae	0.107	189	Apiognomonia erythrostoma	0.0741
122	Puccinia arachidis	0.1493	156	Cryptodiaporthe populea	0.107	190	Pythium arrhenomanes	0.0734
123	Physoderma leproides	0.1476	157	Ascochyta gossypii	0.1062	191	Tilletia indica	0.073
124	Fusarium oxysporum f.sp. conglutinans	0.1471	158	Lecanicillium lecanii	0.1058	192	Pythium deliense	0.072
125	Phialophora cinerescens	0.1468	159	Rhizoctonia tuliparum	0.1057	193	Gymnosporangium asiaticum	0.0713
126	Botryotinia squamosa	0.1461	160	Sclerotinia borealis	0.1048	194	Diaporthe phaseolorum var. caulivora	0.0703
127	Phoma tracheiphila	0.1455	161	Bipolaris sacchari	0.1043	195	Stenocarpella maydis	0.0694
128	Didymella ligulicola	0.1423	162	Diaporthe eres	0.1037	196	Entyloma oryzae	0.0673
129	Ophiostoma piceae	0.1418	163	Rhabdocline pseudotsugae	0.1033	197	Ciborinia camelliae	0.0671
130	Polyscytalum pustulans	0.138	164	Mycosphaerella arachidis	0.1018	198	Nematospora coryli	0.0645
131	Diaporthe helianthi	0.137	165	Peronospora rubi	0.1007	199	Guignardia musae	0.0635
132	Pseudoperonospora cannabina	0.1367	166	Cochliobolus carbonum	0.0995	200	Gibberella pulicaris	0.0632
133	Nectria cinnabarina	0.1351	167	Alternaria alternata	0.0966	201	Aspergillus fumigatus	0.0627
134	Fomes fomentarius	0.135	168	Peronospora farinosa f.sp. chenopodii	0.0963	202	Phakopsora pachyrhizi	0.0626
135	Rhizina undulata	0.1338	169	Passalora sojina	0.0937	203	Cercospora kikuchii	0.0616
136	Physoderma maydis	0.1329	170	Ganoderma boninense	0.0918	204	Sclerotinia minor	0.0612

Table 51. The top 200 risk list for plant pathogen species absent from WA.

Rank	Species Name	Risk Index	Rank	Species Name	Risk Index	Rank	Species Name	Risk Index
1	Puccinia striiformis	0.8222	35	Erysiphe necator	0.4034	69	Kabatiella caulivora	0.2728
2	Peronospora farinosa f.sp. betae	0.6907	36	Cladosporium cucumerinum	0.3898	70	Penicillium italicum	0.2693
3	Puccinia triticina	0.6779	37	Didymella applanata	0.3891	71	Colletotrichum circinans	0.267
4	Ustilago zeae	0.6775	38	Didymella bryoniae	0.3885	72	Coniella diplodiella	0.2658
5	Mycovellosiella fulva	0.64	39	Lophodermium pinastri	0.376	73	Fusarium oxysporum f.sp. melonis	0.265
6	Puccinia allii	0.6355	40	Puccinia carthami	0.376	74	Mycosphaerella rabiei	0.264
7	Monilinia laxa	0.5831	41	Puccinia asparagi	0.367	75	Sporisorium cruentum	0.263
8	Gibberella zeae	0.5788	42	Plasmopara halstedii	0.3628	76	Physoderma alfalfae	0.2609
9	Peronospora destructor	0.5768	43	Rosellinia necatrix	0.3584	77	Peronospora manshurica	0.2596
10	Sphacelotheca reiliana	0.5487	44	Heterobasidion annosum	0.3501	78	Drepanopeziza ribis	0.2594
11	Alternaria brassicicola	0.5388	45	Phoma foveata	0.3496	79	Pyrenopeziza brassicae	0.2587
12	Sclerotium cepivorum	0.5332	46	Mycosphaerella pini	0.3474	80	Mycosphaerella berkeleyi	0.2563
13	Pleospora betae	0.5293	47	Uromyces ciceris-arietini	0.3471	81	Colletotrichum linicola	0.2556
14	Setosphaeria turcica	0.5255	48	Puccinia purpurea	0.3371	82	Phytophthora fragariae var. rubi	0.2526
15	Monilinia fructigena	0.5247	49	Podosphaera macularis	0.3337	83	Monilinia fructicola	0.2522
16	Pseudoperonospora cubensis	0.5159	50	Fusarium oxysporum f.sp. cucumerinum	0.3275	84	Myrothecium roridum	0.2503
17	Podosphaera mors-uvae	0.5108	51	Blumeria graminis	0.3268	85	Penicillium digitatum	0.2424
18	Puccinia sorghi	0.508	52	Colletotrichum orbiculare	0.3243	86	Septoria cannabis	0.2413
19	Venturia inaequalis	0.5009	53	Fusarium oxysporum f.sp. vasinfectum	0.3242	87	Melampsora medusae	0.2401
20	Pseudocercosporella herpotrichoides	0.4991	54	Elsinoe veneta	0.3241	88	Fusarium oxysporum f.sp. niveum	0.2397
21	Venturia carpophila	0.4854	55	Didymella rabiei	0.317	89	Venturia cerasi	0.2388
22	Peronospora farinosa	0.4841	56	Fusarium oxysporum f.sp. lini	0.3121	90	Alternaria longipes	0.2385
23	Chalara elegans	0.474	57	Guignardia bidwellii	0.3118	91	Spilocaea oleaginea	0.2379
24	Botrytis aclada	0.47	58	Stemphylium sarciniforme	0.3103	92	Ustilago crameri	0.2369
25	Botrytis tulipae	0.4531	59	Phytophthora capsici	0.308	93	Botrytis fabae	0.2333
26	Diaporthe citri	0.4498	60	Cronartium ribicola	0.3053	94	Puccinia hordei	0.2309
27	Nectria galligena	0.4384	61	Didymella lycopersici	0.3024	95	Phaeosphaeria avenaria f.sp. avenaria	0.2212
28	Phoma medicaginis var. medicaginis	0.4344	62	Phytophthora fragariae	0.2927	96	Verticillium albo-atrum	0.2204
29	Leptosphaeria coniothyrium	0.4322	63	Cronartium flaccidum	0.2899	97	Cochliobolus heterostrophus	0.2193
30	Pseudoperonospora humuli	0.4295	64	Gymnosporangium fuscum	0.2878	98	Aspergillus niger	0.2179
31	Podosphaera pannosa	0.4239	65	Phaeolus schweinitzii	0.2794	99	Nattrassia mangiferae	0.2158
32	Alternaria porri	0.4146	66	Alternaria citri	0.2792	100	Alternaria dianthicola	0.2156
33	Urocystis cepulae	0.4059	67	Helminthosporium solani	0.2788	101	Blumeriella jaapii	0.2143
34	Microdochium panattonianum	0.4035	68	Ceratocystis ulmi	0.2775	102	Alternaria radicina	0.2124

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Table 51 (continued).

Rank	Species Name	Risk Index	Rank	Species Name	Risk Index	Rank	Species Name	Risk Index
103	Chrysomyxa abietis	0.2108	137	Phoma tracheiphila	0.1455	171	Bipolaris sacchari	0.1043
104	Elsinoe fawcettii	0.2077	138	Didymella ligulicola	0.1423	172	Diaporthe eres	0.1037
105	Entyloma dahliae	0.2071	139	Ophiostoma piceae	0.1418	173	Rhabdocline pseudotsugae	0.1033
106	Mycosphaerella pyri	0.2034	140	Monilochaetes infuscans	0.1416	174	Mycosphaerella arachidis	0.1018
107	Ramularia onobrychidis	0.2027	141	Polyscytalum pustulans	0.138	175	Peronospora rubi	0.1007
108	Cryphonectria parasitica	0.1999	142	Diaporthe helianthi	0.137	176	Cochliobolus carbonum	0.0995
109	Peronospora viciae	0.1988	143	Pseudoperonospora cannabina	0.1367	177	Alternaria alternata	0.0966
110	Phaeoisariopsis griseola	0.1906	144	Nectria cinnabarina	0.1351	178	Peronospora farinosa f.sp. chenopodii	0.0963
111	Glomerella tucumanensis	0.1903	145	Fomes fomentarius	0.135	179	Passalora sojina	0.0937
112	Ceratocystis paradoxa	0.1901	146	Rhizina undulata	0.1338	180	Ganoderma boninense	0.0918
113	Sclerospora graminicola	0.1868	147	Physoderma maydis	0.1329	181	Guignardia citricarpa	0.088
114	Gremmeniella abietina	0.1851	148	Ceratocystis fimbriata	0.1312	182	Gibberella acuminata	0.0858
115	Gloeotinia granigena	0.1844	149	Didymella fabae	0.1304	183	Hypoxylon mammatum	0.0857
116	Phaeocryptopus gaeumannii	0.1804	150	Glomerella graminicola	0.1293	184	Cronartium quercuum	0.0848
117	Botrytis anthophila	0.1762	151	Mycocentrospora cladosporioides	0.1291	185	Paecilomyces lilacinus	0.0824
118	Neotyphodium coenophialum	0.1746	152	Phytophthora palmivora	0.1288	186	Didymascella thujina	0.0815
119	Lachnella willkommii	0.1706	153	Uromyces transversalis	0.1283	187	Septoria glycines	0.0815
120	Armillaria mellea	0.1687	154	Monosporascus cannonballus	0.1223	188	Fusarium proliferatum	0.0809
121	Alternaria japonica	0.1638	155	Pythium graminicola	0.118	189	Phomopsis longicolla	0.0807
122	Alternaria helianthi	0.1624	156	Phytophthora porri	0.1165	190	Phomopsis asparagi	0.0806
123	Synchytrium endobioticum	0.1551	157	Gnomonia comari	0.1163	191	Curvularia	0.0803
124	Erysiphe orontii	0.1549	158	Lasiodiplodia theobromae	0.1163	192	Phomopsis juniperivora	0.0796
125	Meria laricis	0.1545	159	Alternaria sesami	0.1157	193	Mycosphaerella cruenta	0.0788
126	Cochliobolus lunatus	0.1533	160	Erynia neoaphidis	0.1134	194	Phytophthora cambivora	0.0761
127	Phytophthora sojae	0.1531	161	Alternaria triticina	0.112	195	Cercospora nicotianae	0.0751
128	Colletotrichum musae	0.1527	162	Fomitopsis pinicola	0.1084	196	Tilletia barclayana	0.0751
129	Diaporthe phaseolorum var. sojae	0.1521	163	Pythium vexans	0.1083	197	Fusarium oxysporum f.sp. phaseoli	0.0748
130	Fusarium oxysporum f.sp. lentis	0.1508	164	Olpidium brassicae	0.1073	198	Apiognomonia erythrostoma	0.0741
131	Pythium aphanidermatum	0.1502	165	Armillaria ostoyae	0.107	199	Pythium arrhenomanes	0.0734
132	Physoderma leproides	0.1476	166	Cryptodiaporthe populea	0.107	200	Tilletia indica	0.073
133	Fusarium oxysporum f.sp. conglutinans	0.1471	167	Ascochyta gossypii	0.1062	201	Pythium deliense	0.072
134	Phialophora cinerescens	0.1468	168	Lecanicillium lecanii	0.1058	202	Gymnosporangium asiaticum	0.0713
135	Botryotinia squamosa	0.1461	169	Rhizoctonia tuliparum	0.1057	203	Diaporthe phaseolorum var. caulivora	0.0703
136	Gibberella intricans	0.1456	170	Sclerotinia borealis	0.1048	204	Stenocarpella maydis	0.0694

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Table 52. Top 100 risk list of insect pests for the USA generated from a SOM analysis.

rank	Insect pest species	risk index	p/a	rank	Insect pest species	risk index	p/a	rank	Insect pest species	risk index	p/a
1	Icerya purchasi	0.9839	p	35	Heliothrips haemorrhoidalis	0.7882	p	69	Thrips simplex	0.609	p
2	Saissetia oleae	0.9727	p	36	Parlatoria ziziphi	0.7847	p	70	Spoladea recurvalis	0.6056	p
3	Planococcus citri	0.9702	p	37	Schizaphis graminum	0.7709	p	71	Cadra cautella	0.604	p
4	Myzus persicae	0.963	p	38	Ceratitis capitata	0.7705	p	72	Oryzaephilus surinamensis	0.5997	p
5	Coccus hesperidum	0.9603	p	39	Sitobion avenae	0.7579	p	73	Helicoverpa zea	0.5966	p
6	Aphis spiraecola	0.9518	p	40	Cydia pomonella	0.7568	p	74	Heliothis virescens	0.5959	p
7	Chrysomphalus dictyospermi	0.9418	p	41	Liriomyza trifolii	0.751	p	75	Dysmicoccus brevipes	0.5911	p
8	Lepidosaphes beckii	0.9388	p	42	Taylorilygus pallidulus	0.7476	p	76	Parthenolecanium persicae	0.5889	p
9	Plutella xylostella	0.9002	p	43	Aphis craccivora	0.7365	p	77	Parthenolecanium corni	0.5879	p
10	Bemisia tabaci	0.8976	p	44	Acanthoscelides obtectus	0.7303	p	78	Bemisia tabaci (B biotype)	0.5847	p
11	Brevicoryne brassicae	0.8962	p	45	Rhopalosiphum padi	0.7285	p	79	Metopolophium dirhodum	0.5845	p
12	Pseudococcus longispinus	0.8942	p	46	Gynaikothrips ficorum	0.7114	p	80	Dialeurodes citri	0.5777	p
13	Aphis gossypii	0.8889	p	47	Rhopalosiphum rufiabdominale	0.7089	p	81	Unaspis citri	0.5752	p
14	Eriosoma lanigerum	0.8854	p	48	Hyperomyzus lactucae	0.7046	p	82	Drosophila melanogaster	0.5743	p
15	Saissetia coffeae	0.8836	p	49	Toxoptera citricida	0.7011	p	83	Rhyzopertha dominica	0.5706	p
16	Phthorimaea operculella	0.8828	p	50	Pseudaulacaspis pentagona	0.6914	p	84	Pieris rapae	0.5705	p
17	Thrips tabaci	0.879	p	51	Diaspidiotus perniciosus	0.6896	p	85	Spodoptera exigua	0.5682	p
18	Rhopalosiphum maidis	0.8671	p	52	Etiella zinckenella	0.6867	p	86	Atherigona orientalis	0.568	p
19	Trichoplusia ni	0.863	p	53	Scolytus rugulosus	0.6839	p	87	Pantomorus cervinus	0.5669	p
20	Nezara viridula	0.8586	p	54	Peridroma saucia	0.6815	p	88	Elasmopalpus lignosellus	0.5629	p
21	Delia platura	0.8563	p	55	Mythimna unipuncta	0.6702	p	89	Spodoptera frugiperda	0.5627	p
22	Chrysomphalus aonidum	0.85	p	56	Hemiberlesia rapax	0.6701	p	90	Saccharicoccus sacchari	0.5567	p
23	Hemiberlesia lataniae	0.8394	p	57	Tribolium castaneum	0.6699	p	91	Parasaissetia nigra	0.5565	p
24	Phyllocnistis citrella	0.8285	p	58	Frankliniella schultzei	0.6693	p	92	Parlatoria oleae	0.5507	p
25	Aonidiella aurantii	0.8261	p	59	Frankliniella occidentalis	0.6494	p	93	Lipaphis erysimi	0.5494	p
26	Aspidiotus nerii	0.824	p	60	Orthezia insignis	0.6476	p	94	Aspidiotus destructor	0.546	p
27	Pectinophora gossypiella	0.8228	p	61	Lepidosaphes ulmi	0.6473	p	95	Lepidosaphes gloverii	0.5436	p
28	Toxoptera aurantii	0.8201	p	62	Ceroplastes floridensis	0.6387	p	96	Manduca sexta	0.5429	p
29	Agrotis ipsilon	0.8146	p	63	Viteus vitifoliae	0.6338	p	97	Ferrisia virgata	0.5247	p
30	Aleurothrixus floccosus	0.8132	p	64	Nipaecoccus nipae	0.6312	p	98	Pentalonia nigronervosa	0.5212	p
31	Macrosiphum euphorbiae	0.8122	p	65	Phoracantha semipunctata	0.6266	p	99	Diuraphis noxia	0.5181	p
32	Acyrthosiphon pisum	0.8038	p	66	Ceroplastes rusci	0.6197	p	100	Melanaphis sacchari	0.5134	p
33	Sitophilus zeamais	0.7973	p	67	Parlatoria pergandii	0.6192	p				
34	Aphis fabae	0.7915	p	68	Liriomyza huidobrensis	0.6125	p				

Table 53. Comparison of SOM predictions of risk with species present in the NAPIS database.

Pest species	SOM risk index	State[1]	NAPIS[2]	SOM correct[3]
Planococcus citri	0.8973	Florida	established	1
Bemisia tabaci	0.8797	Florida	found	1
Epilachna varivestis	0.8395	Arizona	established	1
Epilachna varivestis	0.7984	New York	established	1
Lymantria dispar	0.7953	California	being eradicated	1
Oulema melanopus	0.7754	Alabama	established	1
Oulema melanopus	0.7754	Georgia	established	1
Oulema melanopus	0.7754	Illinois	established	1
Oulema melanopus	0.7754	Maryland	established	1
Oulema melanopus	0.7754	Missouri	established	1
Oulema melanopus	0.7754	North Carolina	established	1
Oulema melanopus	0.7754	South Carolina	established	1
Oulema melanopus	0.7754	Tennessee	established	1
Oulema melanopus	0.7754	Virginia	established	1
Oulema melanopus	0.7479	California	not found	0
Popillia japonica	0.7434	Arkansas	established	1
Popillia japonica	0.7434	Mississippi	established	1
Popillia japonica	0.7434	Texas	found	1
Popillia japonica	0.7434	Alabama	established	1
Popillia japonica	0.7434	Georgia	established	1
Popillia japonica	0.7434	Illinois	established	1
Popillia japonica	0.7434	Maryland	established	1
Popillia japonica	0.7434	Missouri	established	1
Popillia japonica	0.7434	North Carolina	established	1
Popillia japonica	0.7434	South Carolina	established	1
Popillia japonica	0.7434	Tennessee	established	1
Popillia japonica	0.7434	Virginia	established	1
Oulema melanopus	0.7404	Connecticut	established	1
Oulema melanopus	0.7404	Massachusetts	established	1
Oulema melanopus	0.7404	Michigan	established	1
Oulema melanopus	0.7404	New Jersey	established	1
Oulema melanopus	0.7404	New York	established	1
Oulema melanopus	0.7404	Ohio	established	1
Oulema melanopus	0.7404	Pennsylvania	established	1
Popillia japonica	0.726	Connecticut	established	1
Popillia japonica	0.726	Massachusetts	established	1
Popillia japonica	0.726	Michigan	established	1
Popillia japonica	0.726	New Jersey	established	1
Popillia japonica	0.726	New York	established	1
Popillia japonica	0.726	Ohio	established	1
Popillia japonica	0.726	Pennsylvania	established	1
Epilachna varivestis	0.723	Minnesota	not found	0
Lymantria dispar	0.7214	Oregon	being eradicated	1
Lymantria dispar	0.7214	Washington	being eradicated	1
Oulema melanopus	0.7123	Arizona	not found	0
Oulema melanopus	0.7123	Delaware	established	1
Oulema melanopus	0.7123	Iowa	established	1
Oulema melanopus	0.7123	Indiana	established	1
Oulema melanopus	0.7123	Kentucky	established	1
Oulema melanopus	0.7123	West Virginia	established	1
Oulema melanopus	0.7123	Kansas	not found	0
Popillia japonica	0.7046	Arizona	not found	0
Popillia japonica	0.7046	Oklahoma	not found	0
Popillia japonica	0.7046	Delaware	established	1
Popillia japonica	0.7046	Iowa	established	1
Popillia japonica	0.7046	Indiana	established	1
Popillia japonica	0.7046	Kentucky	established	1
Popillia japonica	0.7046	West Virginia	established	1
Popillia japonica	0.7046	Kansas	found	1
Phyllocnistis citrella	0.6899	Florida	not found	0
Ceratitis capitata	0.6656	Florida	not found	0
Oulema melanopus	0.6641	Oregon	established	1
Oulema melanopus	0.6641	Washington	established	1
Lymantria dispar	0.6634	Connecticut	not found	0
Lymantria dispar	0.6634	Massachusetts	not found	0
Lymantria dispar	0.6634	Michigan	not found	0
Lymantria dispar	0.6634	New Jersey	not found	0
Lymantria dispar	0.6634	New York	not found	0
Lymantria dispar	0.6634	Ohio	not found	0
Oulema melanopus	0.6398	Maine	established	1
Oulema melanopus	0.6398	Wisconsin	established	1
Popillia japonica	0.6322	Wisconsin	established	1
Popillia japonica	0.6322	Maine	not found	0
Popillia japonica	0.5805	California	found	1
Oulema melanopus	0.5719	Colorado	established	1
Oulema melanopus	0.5719	Nebraska	not found	0
Oulema melanopus	0.5719	Minnesota	established	1
Oulema melanopus	0.5719	New Hampshire	established	1
Oulema melanopus	0.5719	Utah	established	1
Lymantria dispar	0.566	Maine	not found	0
Lymantria dispar	0.561	Alabama	not found	0
Lymantria dispar	0.561	Arkansas	not found	0
Lymantria dispar	0.561	Georgia	not found	0
Lymantria dispar	0.561	Missouri	not found	0
Lymantria dispar	0.561	Mississippi	not found	0
Lymantria dispar	0.561	Tennessee	not found	0
Lymantria dispar	0.561	Texas	not found	0
Lymantria dispar	0.561	Illinois	not found	0
Lymantria dispar	0.561	North Carolina	not found	0
Lymantria dispar	0.561	South Carolina	not found	0
Lymantria dispar	0.561	Virginia	not found	0
Popillia japonica	0.5597	Oregon	found	1
Popillia japonica	0.5597	Washington	found	1
Epilachna varivestis	0.5504	Idaho	not found	0
Lymantria dispar	0.5461	Arizona	not found	0
Lymantria dispar	0.5461	Kansas	not found	0
Lymantria dispar	0.5461	Oklahoma	not found	0
Lymantria dispar	0.5461	Iowa	not found	0
Lymantria dispar	0.5461	Indiana	not found	0
Lymantria dispar	0.5461	Kentucky	not found	0
Lymantria dispar	0.5461	West Virginia	not found	0
Popillia japonica	0.5354	Colorado	being eradicated	1
Popillia japonica	0.5354	New Mexico	being eradicated	1
Popillia japonica	0.5354	Utah	being eradicated	1
Popillia japonica	0.5354	Minnesota	established	1
Popillia japonica	0.5354	New Hampshire	established	1
Popillia japonica	0.5354	Rhode Island	established	1
Popillia japonica	0.5354	Nebraska	found	1
Aphis craccivora	0.5294	Florida	established	1
Oulema melanopus	0.4893	Idaho	established	0
Rhyacionia buoliana	0.4386	Indiana	established	0
Bemisia tabaci	0.4217	Texas	not found	1
Oulema melanopus	0.416	North Dakota	not found	1
Oulema melanopus	0.416	Montana	established	0
Oulema melanopus	0.416	Vermont	established	0
Oulema melanopus	0.416	Wyoming	established	0
Lymantria dispar	0.4113	Colorado	not found	1
Lymantria dispar	0.4113	Utah	not found	1
Lymantria dispar	0.4113	Rhode Island	not found	1
Popillia japonica	0.3946	Idaho	not found	1
Lymantria dispar	0.3792	Idaho	eradicated	0
Maconellicoccus hirsutus	0.3728	Florida	established	0
Rhyacionia buoliana	0.3632	Idaho	established	0
Aphis glycines	0.3587	Oklahoma	found	0
Aphis glycines	0.3587	Indiana	established	0
Aphis glycines	0.3587	Delaware	found	0
Planococcus citri	0.3572	California	found	0
Rhagoletis completa	0.338	Arizona	not found	1
Diaphorina citri	0.3283	Florida	established	0
Cylas formicarius	0.3246	Alabama	established	0
Cylas formicarius	0.3246	Arkansas	not found	1
Cylas formicarius	0.3246	South Carolina	not found	1
Aphis glycines	0.3191	Colorado	not found	1
Aphis glycines	0.3163	Maine	established	0
Aphis glycines	0.3163	Wisconsin	established	0
Aphis glycines	0.3118	Maryland	established	0
Aphis glycines	0.3118	North Carolina	found	0
Aphis glycines	0.3118	Tennessee	not found	1
Diuraphis noxia	0.3024	Arizona	established	0
Anthonomus grandis	0.2932	Maryland	not found	1
Anthonomus grandis	0.2932	South Carolina	not found	1
Anthonomus grandis	0.2932	Virginia	not found	1
Popillia japonica	0.2859	Montana	being eradicated	0
Popillia japonica	0.2859	South Dakota	found	0
Popillia japonica	0.2859	North Dakota	not found	1
Popillia japonica	0.2859	Nevada	not found	1
Popillia japonica	0.2859	Wyoming	not found	1
Popillia japonica	0.2859	Vermont	established	0
Lymantria dispar	0.2731	Montana	not found	1
Lymantria dispar	0.2731	North Dakota	not found	1
Lymantria dispar	0.2731	Nevada	not found	1
Lymantria dispar	0.2731	South Dakota	not found	1
Lymantria dispar	0.2731	Wyoming	not found	1
Cerotoma trifurcata	0.2701	California	being eradicated	0
Rhyacionia buoliana	0.2552	Montana	found	0
Rhyacionia buoliana	0.2552	Nevada	found	0
Diaprepes abbreviatus	0.2466	Florida	found	0
Pectinophora gossypiella	0.2225	North Carolina	not found	1
Pectinophora gossypiella	0.2225	Arkansas	not found	1
Pectinophora gossypiella	0.2225	Louisiana	not found	1
Anthonomus grandis	0.2155	Delaware	not found	1
Aphis glycines	0.2134	Vermont	established	0
Agriotes lineatus	0.1941	Washington	established	0
Agriotes lineatus	0.1941	Oregon	found	0
Agriotes obscurus	0.1879	Washington	established	0
Agriotes obscurus	0.1879	Oregon	found	0
Euproctis chrysorrhoea	0.1835	New Hampshire	not found	1
Diuraphis noxia	0.1818	Maryland	not found	1
Lymantria monacha	0.1811	California	not found	1
Homalodisca coagulata	0.1721	Arizona	being eradicated	0
Homalodisca coagulata	0.1721	Oklahoma	found	0
Homalodisca coagulata	0.1481	California	established	0
Lymantria dispar	0.1456	Florida	not found	1
Operophtera brumata	0.1312	Massachusetts	established	0
Operophtera brumata	0.1312	Connecticut	found	0
Operophtera brumata	0.1312	New York	not found	1
Lymantria monacha	0.1245	Oregon	not found	1
Lymantria monacha	0.1245	Washington	not found	1
Monochamus sutor	0.1239	California	not found	1
Anthonomus grandis	0.1229	New Mexico	being eradicated	0
Pectinophora gossypiella	0.1133	New Mexico	established	0
Spodoptera littoralis	0.1062	Florida	not found	1
Acrolepiopsis assectella	0.1046	Oregon	not found	1
Tipula paludosa	0.1011	New York	not found	1
Tipula paludosa	0.1011	Massachusetts	not found	1
Tipula paludosa	0.1011	New Jersey	not found	1
Tipula paludosa	0.1011	Ohio	not found	1
Tipula paludosa	0.093	Maine	not found	1
Anoplophora glabripennis	0.092	Massachusetts	being eradicated	0

Table 53 (continued).

Pest species	SOM risk index	State[1]	NAPIS[2]	SOM correct[3]	Pest species	SOM risk index	State[1]	NAPIS[2]	SOM correct[3]	Pest species	SOM risk index	State[1]	NAPIS[2]	SOM correct[3]
Anoplophora glabripennis	0.092	Connecticut	not found	1	*Autographa gamma*	0.0193	Nevada	not found	1	*Dendrolimus sibiricus*	0.0071	Oregon	not found	1
Anoplophora glabripennis	0.092	Michigan	not found	1	*Autographa gamma*	0.0193	South Dakota	not found	1	*Dendrolimus sibiricus*	0.0071	Washington	not found	1
Anoplophora glabripennis	0.092	Ohio	not found	1	*Autographa gamma*	0.0193	Vermont	not found	1	*Anoplophora glabripennis*	0.0067	Montana	not found	1
Anoplophora glabripennis	0.092	New Jersey	not found	1	*Autographa gamma*	0.0193	Wyoming	not found	1	*Anoplophora glabripennis*	0.0067	Nevada	not found	1
Anoplophora glabripennis	0.092	New York	not found	1	*Ips typographus*	0.0188	Montana	not found	1	*Anoplophora glabripennis*	0.0067	Vermont	not found	1
Anoplophora glabripennis	0.0884	Georgia	not found	1	*Ips typographus*	0.0188	South Dakota	not found	1	*Pityogenes chalcographus*	0.0067	Maine	not found	1
Anoplophora glabripennis	0.0884	Mississippi	not found	1	*Ips typographus*	0.0188	Vermont	not found	1	*Pityogenes chalcographus*	0.0067	Wisconsin	not found	1
Anoplophora glabripennis	0.0884	Tennessee	not found	1	*Autographa gamma*	0.0184	Michigan	not found	1	*Epiphyas postvittana*	0.0065	Idaho	not found	1
Anoplophora glabripennis	0.0884	Texas	not found	1	*Ips typographus*	0.0183	Connecticut	not found	1	*Monochamus sutor*	0.0065	Maine	not found	1
Anoplophora glabripennis	0.0884	Virginia	not found	1	*Ips typographus*	0.0183	Massachusetts	not found	1	*Trogoderma granarium*	0.0064	Oregon	not found	1
Anoplophora glabripennis	0.0884	Illinois	not found	1	*Ips typographus*	0.0183	Michigan	not found	1	*Trogoderma granarium*	0.0064	Washington	not found	1
Anoplophora glabripennis	0.0883	California	not found	1	*Ips typographus*	0.0183	New York	not found	1	*Dendrolimus sibiricus*	0.0061	Montana	not found	1
Bactrocera cucurbitae	0.0879	Florida	not found	1	*Ips typographus*	0.0183	Ohio	not found	1	*Dendrolimus sibiricus*	0.0061	Nevada	not found	1
Trogoderma granarium	0.0852	Florida	not found	1	*Ips typographus*	0.0183	Pennsylvania	not found	1	*Dendrolimus sibiricus*	0.0061	Vermont	not found	1
Spodoptera litura	0.0785	Florida	not found	1	*Autographa gamma*	0.0181	Maine	not found	1	*Dendrolimus sibiricus*	0.0061	Wyoming	not found	1
Agriotes lineatus	0.0747	Michigan	not found	1	*Autographa gamma*	0.0181	Wisconsin	not found	1	*Lobesia botrana*	0.0058	Nevada	not found	1
Agriotes lineatus	0.0747	New Jersey	not found	1	*Lymantria monacha*	0.0173	Michigan	not found	1	*Lobesia botrana*	0.0058	Wyoming	not found	1
Agriotes lineatus	0.0747	New York	not found	1	*Acrolepiopsis assectella*	0.0146	Massachusetts	not found	1	*Monochamus saltuarius*	0.0058	Pennsylvania	not found	1
Agriotes obscurus	0.0736	Michigan	not found	1	*Acrolepiopsis assectella*	0.0146	Michigan	not found	1	*Ips typographus*	0.0054	Florida	not found	1
Agriotes obscurus	0.0736	New Jersey	not found	1	*Acrolepiopsis assectella*	0.0146	New York	not found	1	*Eupoecilia ambiguella*	0.0053	Nevada	not found	1
Agriotes obscurus	0.0736	New York	not found	1	*Acrolepiopsis assectella*	0.0146	Ohio	not found	1	*Eupoecilia ambiguella*	0.0053	Wyoming	not found	1
Epiphyas postvittana	0.0691	Florida	not found	1	*Ips sexdentatus*	0.0139	Connecticut	not found	1	*Monochamus sutor*	0.0052	South Dakota	not found	1
Scirtothrips dorsalis	0.0688	Florida	established	0	*Ips sexdentatus*	0.0139	Massachusetts	not found	1	*Agriotes obscurus*	0.0049	Nevada	not found	1
Anoplophora glabripennis	0.0687	Oregon	not found	1	*Ips sexdentatus*	0.0139	Michigan	not found	1	*Agriotes lineatus*	0.0049	Nevada	not found	1
Anoplophora glabripennis	0.0687	Washington	not found	1	*Ips sexdentatus*	0.0139	Ohio	not found	1	*Ips typographus*	0.0049	Colorado	not found	1
Ceratitis capitata	0.0684	California	being eradicated	0	*Trogoderma granarium*	0.0122	California	not found	1	*Ips typographus*	0.0049	Minnesota	not found	1
Anoplophora glabripennis	0.0628	Delaware	not found	1	*Acrolepiopsis assectella*	0.012	Maine	not found	1	*Ips typographus*	0.0049	New Hampshire	not found	1
Anoplophora glabripennis	0.0628	Indiana	not found	1	*Acrolepiopsis assectella*	0.012	Wisconsin	not found	1	*Ips typographus*	0.0049	Rhode Island	not found	1
Anoplophora glabripennis	0.0628	Oklahoma	not found	1	*Diaprepes abbreviatus*	0.0119	California	being eradicated	0	*Ips typographus*	0.0049	Utah	not found	1
Anoplophora glabripennis	0.0628	Wisconsin	not found	1	*Epiphyas postvittana*	0.0119	California	eradicated	0	*Acrolepiopsis assectella*	0.0048	Nevada	not found	1
Operophtera brumata	0.0619	Rhode Island	established	0	*Ips sexdentatus*	0.0119	Maine	not found	1	*Acrolepiopsis assectella*	0.0048	Vermont	not found	1
Agriotes lineatus	0.0609	Maine	not found	1	*Ips sexdentatus*	0.0119	Wisconsin	not found	1	*Ceratitis capitata*	0.0048	Arizona	not found	1
Agriotes obscurus	0.0605	Maine	not found	1	*Monochamus sutor*	0.0118	Connecticut	not found	1	*Maconellicoccus hirsutus*	0.0047	Arizona	not found	1
Anoplophora chinensis	0.0589	Washington	eradicated	0	*Monochamus sutor*	0.0118	Massachusetts	not found	1	*Anoplophora chinensis*	0.0036	Nevada	not found	1
Anoplophora chinensis	0.056	California	not found	1	*Monochamus sutor*	0.0118	Michigan	not found	1	*Anoplophora chinensis*	0.0036	Vermont	not found	1
Anoplophora glabripennis	0.0545	Maine	not found	1	*Monochamus sutor*	0.0118	Pennsylvania	not found	1	*Autographa gamma*	0.0036	Colorado	not found	1
Anoplophora glabripennis	0.0545	West Virginia	not found	1	*Anoplophora chinensis*	0.0111	Colorado	not found	1	*Autographa gamma*	0.0036	Utah	not found	1
Anoplophora chinensis	0.0454	Mississippi	not found	1	*Anoplophora chinensis*	0.0111	New Hampshire	not found	1	*Ips sexdentatus*	0.0029	Montana	not found	1
Anoplophora chinensis	0.0454	Texas	not found	1	*Anoplophora chinensis*	0.0111	Utah	not found	1	*Ips sexdentatus*	0.0029	Vermont	not found	1
Anoplophora chinensis	0.0454	Georgia	not found	1	*Pityogenes chalcographus*	0.01	Connecticut	not found	1	*Eupoecilia ambiguella*	0.0028	Colorado	not found	1
Homalodisca coagulata	0.0452	New Mexico	not found	1	*Pityogenes chalcographus*	0.01	Massachusetts	not found	1	*Eupoecilia ambiguella*	0.0028	New Mexico	not found	1
Anoplophora chinensis	0.0434	Michigan	not found	1	*Pityogenes chalcographus*	0.01	Michigan	not found	1	*Dendrolimus sibiricus*	0.0027	Maine	not found	1
Anoplophora chinensis	0.0434	New York	not found	1	*Pityogenes chalcographus*	0.01	New Jersey	not found	1	*Lymantria monacha*	0.0024	Utah	not found	1
Diaprepes abbreviatus	0.0399	Texas	establied	0	*Pityogenes chalcographus*	0.01	New York	not found	1	*Dendrolimus sibiricus*	0.0021	California	not found	1
Phyllocnistis citrella	0.037	California	established	0	*Pityogenes chalcographus*	0.01	Ohio	not found	1	*Lobesia botrana*	0.002	Colorado	not found	1
Autographa gamma	0.0342	Idaho	not found	1	*Pityogenes chalcographus*	0.01	Pennsylvania	not found	1	*Lobesia botrana*	0.002	New Mexico	not found	1
Anoplophora chinensis	0.0317	Maine	not found	1	*Ceratitis capitata*	0.009	Alabama	not found	1	*Ceratitis capitata*	0.0018	New Mexico	not found	1
Anoplophora chinensis	0.0317	Wisconsin	not found	1	*Ceratitis capitata*	0.009	Georgia	not found	1	*Aeolesthes sarta*	0.0016	Vermont	not found	1
Anoplophora chinensis	0.0287	Delaware	not found	1	*Ceratitis capitata*	0.009	Louisiana	not found	1	*Autographa gamma*	0.0016	Georgia	not found	1
Anoplophora chinensis	0.0287	Indiana	not found	1	*Ceratitis capitata*	0.009	Mississippi	not found	1	*Autographa gamma*	0.0016	Maryland	not found	1
Anoplophora chinensis	0.0287	West Virginia	not found	1	*Ceratitis capitata*	0.009	North Carolina	not found	1	*Autographa gamma*	0.0016	Virginia	not found	1
Anoplophora glabripennis	0.0238	Colorado	not found	1	*Ceratitis capitata*	0.009	South Carolina	not found	1	*Dendroctonus micans*	0.0016	Mississippi	not found	1
Anoplophora glabripennis	0.0238	Minnesota	not found	1	*Ceratitis capitata*	0.009	Texas	not found	1	*Epiphyas postvittana*	0.0016	Maine	not found	1
Anoplophora glabripennis	0.0238	New Hampshire	not found	1	*Maconellicoccus hirsutus*	0.0089	Alabama	not found	1	*Epiphyas postvittana*	0.0016	Wisconsin	not found	1
Anoplophora glabripennis	0.0238	Utah	not found	1	*Maconellicoccus hirsutus*	0.0089	Georgia	not found	1	*Pityogenes chalcographus*	0.0016	Montana	not found	1
Tipula paludosa	0.0226	New Hampshire	not found	1	*Maconellicoccus hirsutus*	0.0089	Mississippi	not found	1	*Pityogenes chalcographus*	0.0016	Vermont	not found	1
Ips typographus	0.0217	Maine	not found	1	*Maconellicoccus hirsutus*	0.0089	North Carolina	not found	1	*Ips typographus*	0.0016	Arizona	not found	1
Ips typographus	0.0217	Wisconsin	not found	1	*Maconellicoccus hirsutus*	0.0089	South Carolina	not found	1	*Ips typographus*	0.0016	Delaware	not found	1
Maconellicoccus hirsutus	0.0212	New York	being eradicated	0	*Maconellicoccus hirsutus*	0.0089	Tennessee	not found	1	*Ips typographus*	0.0016	Indiana	not found	1
Maconellicoccus hirsutus	0.0212	New Jersey	not found	1	*Crocidosema aporema*	0.0084	Wisconsin	not found	1	*Ips typographus*	0.0016	Kentucky	not found	1
Crocidosema aporema	0.0209	Delaware	not found	1	*Ips sexdentatus*	0.008	Florida	not found	1	*Ips typographus*	0.0016	West Virginia	not found	1
Diaprepes abbreviatus	0.0209	Arizona	not found	1	*Epiphyas postvittana*	0.0077	Oregon	not found	1	*Autographa gamma*	0.0015	Delaware	not found	1
Autographa gamma	0.0193	North Dakota	not found	1	*Epiphyas postvittana*	0.0077	Washington	not found	1	*Autographa gamma*	0.0015	Oklahoma	not found	1

Table 53 (continued).

Pest species	SOM risk index	State[1]	NAPIS[2]	SOM correct[3]	Pest species	SOM risk index	State[1]	NAPIS[2]	SOM correct[3]	Pest species	SOM risk index	State[1]	NAPIS[2]	SOM correct[3]
Epiphyas postvittana	0.0015	Montana	not found	1	*Ips sexdentatus*	0.0009	Delaware	not found	1	*Epiphyas postvittana*	0.0001	Missouri	not found	1
Epiphyas postvittana	0.0015	North Dakota	not found	1	*Ips sexdentatus*	0.0009	Indiana	not found	1	*Epiphyas postvittana*	0.0001	North Carolina	not found	1
Epiphyas postvittana	0.0015	Nevada	not found	1	*Ips sexdentatus*	0.0009	Kentucky	not found	1	*Epiphyas postvittana*	0.0001	Oklahoma	not found	1
Epiphyas postvittana	0.0015	South Dakota	not found	1	*Ips sexdentatus*	0.0009	West Virginia	not found	1	*Epiphyas postvittana*	0.0001	South Carolina	not found	1
Epiphyas postvittana	0.0015	Vermont	not found	1	*Lobesia botrana*	0.0009	Arkansas	not found	1	*Epiphyas postvittana*	0.0001	Texas	not found	1
Epiphyas postvittana	0.0015	Wyoming	not found	1	*Lobesia botrana*	0.0009	Maryland	not found	1	*Epiphyas postvittana*	0.0001	Virginia	not found	1
Hylobius abietis	0.0015	Tennessee	not found	1	*Pityogenes chalcographus*	0.0009	Arkansas	not found	1	*Epiphyas postvittana*	0.0001	West Virginia	not found	1
Lymantria monacha	0.0015	Texas	not found	1	*Pityogenes chalcographus*	0.0009	Georgia	not found	1	*Trogoderma granarium*	0.0001	Alabama	not found	1
Trogoderma granarium	0.0015	Nevada	not found	1	*Pityogenes chalcographus*	0.0009	Illinois	not found	1	*Trogoderma granarium*	0.0001	Arkansas	not found	1
Trogoderma granarium	0.0015	South Dakota	not found	1	*Pityogenes chalcographus*	0.0009	Maryland	not found	1	*Trogoderma granarium*	0.0001	Arizona	not found	1
Trogoderma granarium	0.0015	Wyoming	not found	1	*Pityogenes chalcographus*	0.0009	Missouri	not found	1	*Trogoderma granarium*	0.0001	Colorado	not found	1
Ips typographus	0.0015	Alabama	not found	1	*Pityogenes chalcographus*	0.0009	North Carolina	not found	1	*Trogoderma granarium*	0.0001	Georgia	not found	1
Ips typographus	0.0015	Arkansas	not found	1	*Pityogenes chalcographus*	0.0009	South Carolina	not found	1	*Trogoderma granarium*	0.0001	Iowa	not found	1
Ips typographus	0.0015	Georgia	not found	1	*Pityogenes chalcographus*	0.0009	Texas	not found	1	*Trogoderma granarium*	0.0001	Illinois	not found	1
Ips typographus	0.0015	Illinois	not found	1	*Ceroplastes japonicus*	0.0008	Oregon	not found	1	*Trogoderma granarium*	0.0001	Kansas	not found	1
Ips typographus	0.0015	Louisiana	not found	1	*Lobesia botrana*	0.0008	Kentucky	not found	1	*Trogoderma granarium*	0.0001	Louisiana	not found	1
Ips typographus	0.0015	Maryland	not found	1	*Lobesia botrana*	0.0008	West Virginia	not found	1	*Trogoderma granarium*	0.0001	Minnesota	not found	1
Ips typographus	0.0015	Missouri	not found	1	*Pityogenes chalcographus*	0.0007	Minnesota	not found	1	*Trogoderma granarium*	0.0001	Missouri	not found	1
Ips typographus	0.0015	Mississippi	not found	1	*Pityogenes chalcographus*	0.0007	New Hampshire	not found	1	*Trogoderma granarium*	0.0001	North Carolina	not found	1
Ips typographus	0.0015	North Carolina	not found	1	*Pityogenes chalcographus*	0.0007	Rhode Island	not found	1	*Trogoderma granarium*	0.0001	Nebraska	not found	1
Ips typographus	0.0015	South Carolina	not found	1	*Pityogenes chalcographus*	0.0007	Utah	not found	1	*Trogoderma granarium*	0.0001	New Mexico	not found	1
Ips typographus	0.0015	Tennessee	not found	1	*Monochamus sutor*	0.0006	Colorado	not found	1	*Trogoderma granarium*	0.0001	Oklahoma	not found	1
Ips typographus	0.0015	Texas	not found	1	*Monochamus sutor*	0.0006	New Hampshire	not found	1	*Trogoderma granarium*	0.0001	South Carolina	not found	1
Eupoecilia ambiguella	0.0014	Missouri	not found	1	*Pityogenes chalcographus*	0.0006	Delaware	not found	1	*Trogoderma granarium*	0.0001	Texas	not found	1
Eupoecilia ambiguella	0.0014	West Virginia	not found	1	*Pityogenes chalcographus*	0.0006	Indiana	not found	1	*Trogoderma granarium*	0.0001	West Virginia	not found	1
Maruca vitrata	0.0013	Maine	not found	1	*Pityogenes chalcographus*	0.0006	Kentucky	not found	1	*Unaspis yanonensis*	0.0001	Oregon	not found	1
Maruca vitrata	0.0013	Wisconsin	not found	1	*Pityogenes chalcographus*	0.0006	West Virginia	not found	1	*Xylotrechus quadripes*	0.0001	Idaho	not found	1
Acrolepiopsis assectella	0.0012	Georgia	not found	1	*Trogoderma granarium*	0.0006	Idaho	not found	1	*Bactrocera cucurbitae*	0	California	being eradicated	0
Acrolepiopsis assectella	0.0012	Illinois	not found	1	*Xylotrechus quadripes*	0.0006	Nevada	not found	1	*Diaphorina citri*	0	Louisiana	established	0
Acrolepiopsis assectella	0.0012	Tennessee	not found	1	*Xylotrechus quadripes*	0.0006	Vermont	not found	1	*Diaphorina citri*	0	Texas	established	0
Ips sexdentatus	0.0012	Minnesota	not found	1	*Epiphyas postvittana*	0.0005	Colorado	not found	1	*Cryptophlebia leucotreta*	0	California	found	0
Ips sexdentatus	0.0012	New Hampshire	not found	1	*Epiphyas postvittana*	0.0005	Minnesota	not found	1	*Diaphorina citri*	0	California	found	0
Ips sexdentatus	0.0012	Rhode Island	not found	1	*Epiphyas postvittana*	0.0005	Nebraska	not found	1	*Diaphorina citri*	0	Georgia	found	0
Ips sexdentatus	0.0012	Utah	not found	1	*Epiphyas postvittana*	0.0005	New Mexico	not found	1	*Diaphorina citri*	0	South Carolina	found	0
Maconellicoccus hirsutus	0.0012	Colorado	not found	1	*Epiphyas postvittana*	0.0005	Rhode Island	not found	1	*Aeolesthes sarta*	0	Ohio	not found	1
Trogoderma granarium	0.0011	Connecticut	being eradicated	0	*Epiphyas postvittana*	0.0005	Utah	not found	1	*Anoplophora malasiaca*	0	Delaware	not found	1
Epiphyas postvittana	0.0011	Connecticut	not found	1	*Monochamus saltuarius*	0.0005	Mississippi	not found	1	*Anoplophora malasiaca*	0	Mississippi	not found	1
Epiphyas postvittana	0.0011	Massachusetts	not found	1	*Monochamus saltuarius*	0.0004	Oklahoma	not found	1	*Anoplophora malasiaca*	0	New Hampshire	not found	1
Epiphyas postvittana	0.0011	Michigan	not found	1	*Ceroplastes destructor*	0.0003	Florida	not found	1	*Anoplophora malasiaca*	0	Nevada	not found	1
Epiphyas postvittana	0.0011	New Jersey	not found	1	*Dendrolimus sibiricus*	0.0003	Connecticut	not found	1	*Anoplophora malasiaca*	0	New York	not found	1
Epiphyas postvittana	0.0011	Ohio	not found	1	*Dendrolimus sibiricus*	0.0003	Massachusetts	not found	1	*Anoplophora malasiaca*	0	Ohio	not found	1
Epiphyas postvittana	0.0011	Pennsylvania	not found	1	*Dendrolimus sibiricus*	0.0003	Michigan	not found	1	*Anoplophora malasiaca*	0	Utah	not found	1
Ips sexdentatus	0.0011	Alabama	not found	1	*Maruca vitrata*	0.0003	Illinois	not found	1	*Anoplophora malasiaca*	0	Vermont	not found	1
Ips sexdentatus	0.0011	Arkansas	not found	1	*Maruca vitrata*	0.0003	Maryland	not found	1	*Anoplophora malasiaca*	0	Wisconsin	not found	1
Ips sexdentatus	0.0011	Georgia	not found	1	*Maruca vitrata*	0.0003	Mississippi	not found	1	*Bactrocera cucurbitae*	0	Alabama	not found	1
Ips sexdentatus	0.0011	Illinois	not found	1	*Maruca vitrata*	0.0003	North Carolina	not found	1	*Bactrocera cucurbitae*	0	Arizona	not found	1
Ips sexdentatus	0.0011	Maryland	not found	1	*Maruca vitrata*	0.0003	Tennessee	not found	1	*Bactrocera cucurbitae*	0	Georgia	not found	1
Ips sexdentatus	0.0011	Missouri	not found	1	*Spodoptera littoralis*	0.0002	Delaware	not found	1	*Bactrocera cucurbitae*	0	Louisiana	not found	1
Ips sexdentatus	0.0011	Mississippi	not found	1	*Spodoptera littoralis*	0.0002	South Dakota	not found	1	*Bactrocera cucurbitae*	0	North Carolina	not found	1
Ips sexdentatus	0.0011	North Carolina	not found	1	*Spodoptera littoralis*	0.0002	Wyoming	not found	1	*Bactrocera cucurbitae*	0	South Carolina	not found	1
Ips sexdentatus	0.0011	South Carolina	not found	1	*Spodoptera litura*	0.0002	New Mexico	not found	1	*Bactrocera cucurbitae*	0	Texas	not found	1
Ips sexdentatus	0.0011	Tennessee	not found	1	*Epiphyas postvittana*	0.0001	Alabama	not found	1	*Ceroplastes destructor*	0	Alabama	not found	1
Ips sexdentatus	0.0011	Texas	not found	1	*Epiphyas postvittana*	0.0001	Arkansas	not found	1	*Ceroplastes destructor*	0	Arizona	not found	1
Lymantria monacha	0.0011	West Virginia	not found	1	*Epiphyas postvittana*	0.0001	Arizona	not found	1	*Ceroplastes destructor*	0	Louisiana	not found	1
Trogoderma granarium	0.0011	Michigan	not found	1	*Epiphyas postvittana*	0.0001	Delaware	not found	1	*Ceroplastes destructor*	0	Oregon	not found	1
Trogoderma granarium	0.0011	Ohio	not found	1	*Epiphyas postvittana*	0.0001	Georgia	not found	1	*Ceroplastes destructor*	0	Texas	not found	1
Acrolepiopsis assectella	0.001	West Virginia	not found	1	*Epiphyas postvittana*	0.0001	Iowa	not found	1	*Ceroplastes japonicus*	0	Arizona	not found	1
Monochamus sutor	0.001	Mississippi	not found	1	*Epiphyas postvittana*	0.0001	Illinois	not found	1	*Ceroplastes japonicus*	0	Texas	not found	1
Dendrolimus sibiricus	0.0009	Colorado	not found	1	*Epiphyas postvittana*	0.0001	Indiana	not found	1	*Chilo suppressalis*	0	Georgia	not found	1
Dendrolimus sibiricus	0.0009	New Hampshire	not found	1	*Epiphyas postvittana*	0.0001	Kansas	not found	1	*Chilo suppressalis*	0	Mississippi	not found	1
Dendrolimus sibiricus	0.0009	Rhode Island	not found	1	*Epiphyas postvittana*	0.0001	Kentucky	not found	1	*Cryptophlebia leucotreta*	0	Alabama	not found	1
Dendrolimus sibiricus	0.0009	Utah	not found	1	*Epiphyas postvittana*	0.0001	Maryland	not found	1	*Cryptophlebia leucotreta*	0	Arkansas	not found	1
Ips sexdentatus	0.0009	Arizona	not found	1						*Cryptophlebia leucotreta*	0	Colorado	not found	1

Table 53 (continued).

Pest species	SOM risk index	State[1]	NAPIS[2]	SOM correct[3]	Pest species	SOM risk index	State[1]	NAPIS[2]	SOM correct[3]	Pest species	SOM risk index	State[1]	NAPIS[2]	SOM correct[3]
Cryptophlebia leucotreta	0	Delaware	not found	1	*Monochamus alternatus*	0	Maine	not found	1	*Spodoptera littoralis*	0	Mississippi	not found	1
Cryptophlebia leucotreta	0	Georgia	not found	1	*Monochamus alternatus*	0	Michigan	not found	1	*Spodoptera littoralis*	0	North Carolina	not found	1
Cryptophlebia leucotreta	0	Iowa	not found	1	*Monochamus alternatus*	0	Mississippi	not found	1	*Spodoptera littoralis*	0	New Jersey	not found	1
Cryptophlebia leucotreta	0	Idaho	not found	1	*Monochamus alternatus*	0	Montana	not found	1	*Spodoptera littoralis*	0	Tennessee	not found	1
Cryptophlebia leucotreta	0	Missouri	not found	1	*Monochamus alternatus*	0	North Dakota	not found	1	*Spodoptera littoralis*	0	Utah	not found	1
Cryptophlebia leucotreta	0	Mississippi	not found	1	*Monochamus alternatus*	0	New Hampshire	not found	1	*Spodoptera littoralis*	0	Virginia	not found	1
Cryptophlebia leucotreta	0	North Carolina	not found	1	*Monochamus alternatus*	0	New Jersey	not found	1	*Spodoptera litura*	0	Alabama	not found	1
Cryptophlebia leucotreta	0	New Mexico	not found	1	*Monochamus alternatus*	0	New York	not found	1	*Spodoptera litura*	0	Georgia	not found	1
Cryptophlebia leucotreta	0	Nevada	not found	1	*Monochamus alternatus*	0	Ohio	not found	1	*Spodoptera litura*	0	Maryland	not found	1
Cryptophlebia leucotreta	0	Oklahoma	not found	1	*Monochamus alternatus*	0	Oklahoma	not found	1	*Spodoptera litura*	0	North Carolina	not found	1
Cryptophlebia leucotreta	0	South Carolina	not found	1	*Monochamus alternatus*	0	Pennsylvania	not found	1	*Spodoptera litura*	0	Oklahoma	not found	1
Cryptophlebia leucotreta	0	Tennessee	not found	1	*Monochamus alternatus*	0	Rhode Island	not found	1	*Spodoptera litura*	0	Tennessee	not found	1
Cryptophlebia leucotreta	0	Utah	not found	1	*Monochamus alternatus*	0	Texas	not found	1	*Spodoptera litura*	0	Virginia	not found	1
Cryptophlebia leucotreta	0	Vermont	not found	1	*Monochamus alternatus*	0	Utah	not found	1	*Unaspis yanonensis*	0	Alabama	not found	1
Cryptophlebia leucotreta	0	Wyoming	not found	1	*Monochamus alternatus*	0	Virginia	not found	1	*Unaspis yanonensis*	0	Georgia	not found	1
Dendrolimus sibiricus	0	North Carolina	not found	1	*Monochamus alternatus*	0	Vermont	not found	1	*Xylotrechus quadripes*	0	Connecticut	not found	1
Dendrolimus sibiricus	0	South Carolina	not found	1	*Monochamus alternatus*	0	West Virginia	not found	1	*Xylotrechus quadripes*	0	Florida	not found	1
Dendrolimus sibiricus	0	Tennessee	not found	1	*Monochamus alternatus*	0	Wisconsin	not found	1	*Xylotrechus quadripes*	0	Illinois	not found	1
Dendrolimus sibiricus	0	Virginia	not found	1	*Pityogenes chalcographus*	0	Florida	not found	1	*Xylotrechus quadripes*	0	Indiana	not found	1
Diaphorina citri	0	Arizona	not found	1	*Planococcus lilacinus*	0	Oregon	not found	1	*Xylotrechus quadripes*	0	Massachusetts	not found	1
Hypothenemus hampei	0	South Carolina	not found	1	*Scirtothrips dorsalis*	0	Mississippi	not found	1	*Xylotrechus quadripes*	0	Michigan	not found	1
Monochamus alternatus	0	Arkansas	not found	1	*Scirtothrips dorsalis*	0	South Carolina	not found	1	*Xylotrechus quadripes*	0	Missouri	not found	1
Monochamus alternatus	0	California	not found	1	*Scirtothrips dorsalis*	0	Tennessee	not found	1	*Xylotrechus quadripes*	0	New York	not found	1
Monochamus alternatus	0	Connecticut	not found	1	*Scirtothrips dorsalis*	0	Texas	not found	1	*Xylotrechus quadripes*	0	Ohio	not found	1
Monochamus alternatus	0	Delaware	not found	1	*Spodoptera littoralis*	0	Alabama	not found	1	*Xylotrechus quadripes*	0	Oklahoma	not found	1
Monochamus alternatus	0	Florida	not found	1	*Spodoptera littoralis*	0	Arkansas	not found	1	*Xylotrechus quadripes*	0	Rhode Island	not found	1
Monochamus alternatus	0	Georgia	not found	1	*Spodoptera littoralis*	0	Colorado	not found	1	*Xylotrechus quadripes*	0	South Carolina	not found	1
Monochamus alternatus	0	Illinois	not found	1	*Spodoptera littoralis*	0	Delaware	not found	1	*Xylotrechus quadripes*	0	Texas	not found	1
Monochamus alternatus	0	Indiana	not found	1	*Spodoptera littoralis*	0	Georgia	not found	1	*Xylotrechus quadripes*	0	Wisconsin	not found	1
Monochamus alternatus	0	Massachusetts	not found	1	*Spodoptera littoralis*	0	Maryland	not found	1					

[1] The state list in which the SOM risk index applies to

[2] The record of that species in that state as recorded in NAPIS

[3] Whether the SOM risk index matches that of NAPIS (assuming a SOM risk index above 0.5 predicts presence and below predicts absence)

9. References

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