Surveillance

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Contents

Editorial

Bees, beekeeping and biosecurity

Over the past few months New Zealand's response to the Covid-19 crisis has clearly shown that at the heart of a robust biosecurity system is shared responsibility.

Our response to Covid-19 relies on all New Zealanders doing their bit to stop the spread of this disease, and as I write this in late May we are seeing the success of that approach. Businesses and schools are open again and life is beginning to return to a "new normal".

The organisation I head, Apiculture New Zealand (ApiNZ) represents all sectors of the apiculture industry, including beekeepers, honey producers, exporters and industry-related supply companies. The "shared responsibility" approach to biosecurity is something that our industry understands keenly, and it extends to working closely with government agencies and other primary-industry sectors.

Our tiny livestock travel far and wide, and our ability to control their movements is minimal. We know that monitoring and treating for pests and diseases is essential, and failure to do so will quickly spread these risks to other beekeepers. The two biggest existing challenges we face – the virulent varroa mite and the highly infectious bacterial disease American foulbrood (AFB) – must be constantly monitored and dealt with. Failure to control them would be disastrous for our industry and the many other sectors that depend on us for pollination and honey and bee products.

While managing these pests and diseases has become a necessary part of a beekeeper's everyday working life, it is the potential biosecurity threat that keeps our industry awake at night. Like all primary sectors we face ongoing biosecurity threats, whether it's the small hive beetle (which is already in Australia), the growing threat of the tropilaelaps mite (close by in Asia), or the Israeli acute paralysis virus. None of these threats to bees exist in New Zealand – and we want to keep it that way.

Managing biosecurity well is a combined effort and we recognise the critical role MPI plays as the front line of protection from exotic threats. A lot is at stake if we slip up, with the potential to seriously affect bee health and our honey and bee businesses through loss of product supply or market access.

The apiculture industry is also a growing contributor to New Zealand's economy, with well over $5 billion annually attributed to the total value of honey and bee products, and pollination. Our bees play a vital role in pollinating kiwifruit, stonefruit and pipfruit orchards, pastoral clover and seed crops – all essential and growing parts of our economy. However, the value of bees to New Zealand goes far beyond their contribution to the economy, as they are essential to the health of our environment.

Our industry is also unusual in the primary sector as we are landless farmers, with our bees mostly sited on other people's land. We work cross-functionally with multiple primary industries, meaning that we must be conscious of landowners' biosecurity needs. This responsibility was brought into sharp focus during the early days of the *Mycoplasma bovis* response, when a number of hives were put under lockdown, and in the kiwifruit Psa outbreak when it was found that bees could transmit the causal bacterium between plants.

Awareness of this responsibility led ApiNZ to develop a biosecurity checklist for our members, which was released earlier this year. The checklist was intended to change beekeepers' attitudes away from regarding biosecurity as a "box-ticking" exercise, to recognising it as an essential part of our relationship with primary-sector partners.

As well as reminders of the "clean on, clean off" approach expected of all beekeepers when visiting sites, the checklist includes records for logging hive movements and advice on how to comply during a biosecurity alert. This checklist has been further developed into a full set of protocols for all beekeepers to use while operating as essential services under Covid-19 Alert Levels 3 and 4. ApiNZ shared these protocols across our industry to ensure that two-metre distancing, sound hygiene practices (such as sanitising hands before and after opening and closing farm gates) and travelling in work "bubbles" would all become part of beekeepers' best-practice behaviour.

ApiNZ is committed to working collaboratively and proactively with government, research institutes and other agencies on biosecurity issues. ApiNZ has a dedicated Biosecurity & GIA Focus Group made up of industry leaders who work closely with MPI, as well as researchers investigating treatments for pests and diseases. We have partnered with MPI on the ApiWellbeing programme and supported Scion's biocontrol project researching giant willow aphids, as well as ongoing multi-agency research into myrtle rust. We also oversee the work of the Management Agency National AFB Pest Management Plan, which is responsible for eliminating AFB in managed colonies within New Zealand. ApiNZ has signed up to the Biosecurity Business Pledge and encouraged our members to do likewise.

New Zealand has a well-stocked, healthy bee population but our industry understands that the future depends on sharing responsibility for biosecurity among primary sectors, government, and even the wider public. That drives ApiNZ's biosecurity approach with the acknowledgement that there is always more work to do and that it requires ongoing vigilance.

Karin Kos
Chief Executive
Apiculture New Zealand

Passive surveillance and exotic disease investigation

Notifications to the Ministry for Primary Industries (MPI) via the exotic pest and disease hotline are an important component of New Zealand's animal health surveillance system. This article outlines the notification and investigation process and describes a recent case illustrating a low-key, collaborative and supportive approach to working with frontline veterinarians and their clients.

Passive surveillance and why it matters

The term "surveillance", meaning "watching over the actions and movements of suspect persons," came into English at the time of the French Revolution (Timpson, 2015). Today, in the field of animal health it refers to the monitoring of an animal population for the presence, absence or burden of disease. Among the objectives of our animal health surveillance system (Tana, 2014) are:

- the early detection of exotic diseases to enable eradication in the event of an incursion;
- supporting New Zealand's statements of freedom from diseases; and
- contributing to our international reporting obligations, including to the OIE (World Organisation for Animal Health).

Passive surveillance refers to the opportunistic use of data that has been generated for other purposes, usually from clinical cases in the population. New Zealand's main passive surveillance system, for pest and disease notification and investigation, is centred around MPI's exotic pest and disease hotline (0800 80 99 66) and relies heavily on the farmer/veterinarian network – the eyes and ears in New Zealand's production-animal surveillance system – to report suspect cases of exotic, new or emerging disease. There also exists under sections 44 and 46 of the Biosecurity Act 1993 a legal obligation on everyone in New Zealand to report suspect cases to MPI.

The MPI hotline and incursion investigation

Calls to the exotic pest and disease hotline are taken by a call centre, from which animal-related calls are forwarded to the duty Incursion Investigator (II) – one of a team of five veterinarians who have further training in exotic animal disease recognition and epidemiology. The team is based at Wallaceville in Upper Hutt, where they share a campus with the MPI Animal Health Laboratory (AHL). Calls come in from farmers or other members of the public, veterinary practitioners and veterinary diagnostic laboratories as well as from other divisions of MPI and other public-sector agencies. Less frequently an II may be contacted directly by a practising veterinarian or pathologist. Some notifications can rapidly be stood down when, after discussion with the caller, the duty II is satisfied that the disease or pest concerned is endemic. Otherwise the duty II may work with a pathologist or veterinarian to facilitate diagnostic work-up, in the process excluding exotic differentials and still hoping to arrive at an endemic diagnosis. However, where a notification raises suspicion of an incursion of a highly contagious, high-economic-impact disease such as foot-and-mouth disease (FMD), the Initial Investigating Veterinarian (IIV) network is activated.

The Initial Investigating Veterinarian network

IIVs are a network of veterinarians managed on behalf of MPI by AsureQuality, a state-owned enterprise and provider of food-quality assurance and biosecurity services. The IIV network consists of about 30 veterinarians throughout New Zealand, drawn from AsureQuality's own staff and from private practice. Rosters are maintained to provide a 24/7 service, with IIVs required to respond, investigate and make an initial report on a case of suspected vesicular disease within 5 hours. IIVs are familiar with the endemic diseases of New Zealand livestock and receive biennial training in the epidemiology and clinical signs of exotic diseases and the investigation process.

To engage an IIV, the duty II contacts AsureQuality via its National Service Manager (NSM) hotline. The NSM identifies the IIV closest to the property and the IIV is briefed by the duty II before attending. Where possible the farm veterinarian assists the IIV with the farm visit – with the former's time paid for by MPI. From the property, the IIV provides the duty II with a verbal clinical assessment, where possible supported by digital pictures, and an initial verbal epidemiological assessment of an animal or group of animals, with the aim of determining whether any specific disease or diseases can be immediately excluded. If exotic disease cannot be ruled out, an Incursion Investigator will then visit the property to investigate further and if necessary collect samples for exotic disease testing at the AHL.

If exotic disease is ruled out, the IIV provides the duty II with a written report within 24 hours of completing the farm visit. The duty II will also continue to work with the farm veterinarian to make an endemic disease diagnosis for the clinical presentation, with MPI paying for the veterinarian's time and any associated laboratory costs.

The system in action: Western Bay of Plenty, April 2020

Background

A drystock farmer had noticed that one of a mob of five 8-month-old heifers had diarrhoea. Five days later the diarrhoea had worsened despite an anthelminthic treatment, the heifer was not eating and veterinary attention was sought.

Farm veterinarian visit

The Murray Grey heifer presented as dull and depressed, with a temperature of 39.4°C (normal range 38.1–39.2), elevated heart and respiratory rates and rumen atony. She was moderately dehydrated and the perineum

was covered in dark, malodorous faeces. There was a copious bilateral mucopurulent nasal discharge, with the nostrils and muzzle covered in dried exudate (**Figure 1**). The animal salivated excessively and had foul-smelling breath with erosions and ulcers (some covered with a white plaque) on her tongue, dental pad, cheek mucosa and hard palate (**Figure 2**). She had a unilateral ocular discharge with a discrete corneal ulcer.

Figure 1: Dried exudate on the muzzle, dental pad ulceration and excessive salivation in an 8-month-old Murray Grey heifer (Photo: Greta van Zyl, AsureQuality)

Figure 2: Severe ulceration of the oral cavity and tongue of an 8-month-old Murray Grey heifer (Photo: Greta van Zyl, AsureQuality)

Blood samples were taken for next-day submission to a regional veterinary laboratory for testing. Bovine viral diarrhoea/mucosal disease (BVDMD) was considered the most likely diagnosis, followed by malignant catarrhal fever, but the veterinarian was also aware that other differentials for this presentation included exotic vesicular disease. With the onset of darkness it was not possible to assess the other four heifers in that mob or other animals on the property. Digital pictures of the oral lesions were shared with a senior colleague in the veterinary practice, who agreed with the presumptive diagnosis but also acknowledged that concerns about exotic vesicular disease were valid. He had seen similar lesions in animals during a training course run by the European Commission for the Control of Foot-and-mouth Disease (EUFMD) in a country where FMD is endemic (Brangenberg et al. 2011; Anonymous 2020).

Contacting MPI Incursion Investigation

That same evening the veterinarians discussed the pictures and the animal's history and clinical presentation with an MPI Incursion Investigator. They also put the II directly in contact with the farmer to discuss the health of the other 37 cattle on the property and the movement history of livestock, people and fomites on and off the property. While the II agreed with the presumptive diagnosis of BVDMD, vesicular disease could not be absolutely ruled out. With blood-test results for the endemic differentials up to 48 hours away, the II advised the farm owner and veterinarians that this was an appropriate case in which to activate the IIV system – a move that was welcomed by all for the speedier resolution and peace of mind that it would likely bring. The process was explained: an IIV would attend the farm early next morning and collect further epidemiological information and observe all cattle on the farm, with clinical examinations focusing on the sick heifer and other heifers that had been in contact with it. MPI would pay for this visit, and furthermore would pay testing fees for the samples already submitted to the laboratory.

Activating the IIV system

Again the same evening, the II called the duty NSM and an IIV was appointed to attend the property at first light next morning. Briefing notes were provided electronically to the IIV and followed up by a phone discussion.

IIV visit and rule-out of exotic disease

At the time, owing to restrictions in place under the Covid-19 Level 4 lockdown, the farm veterinarian could not help the IIV on the farm. The IIV confirmed and augmented the epidemiological information, reviewed the clinical history of the sick heifer and observed or examined all the cattle before reporting back to the II from the farm.

In summary, the II was able to exclude exotic vesicular disease, and supported the primary veterinarian's tentative diagnosis of BVDMD. As a result the exotic disease investigation was stood down and the focus shifted to confirming an endemic disease. At the request of the II, the IIV drew blood samples from animals in the same birth cohort as the sick heifer, to conduct further BVD virus testing.

Endemic differential confirmed

The II continued to liaise with the farm veterinarian to facilitate the work-up and confirmation of an endemic diagnosis. Haematology and serum biochemistry results were received from the laboratory 4 hours after the IIV's visit. The tests revealed white blood cell changes and increased fibrinogen, indicating an inflammatory process with some bacterial involvement. Electrolyte changes and increases in blood urea nitrogen and serum creatinine were consistent with dehydration and ongoing diarrhoea. Given the heifer's poor prognosis, the farmer arranged for the veterinarian to euthanase it the next morning. With BVD antigen testing results still pending, at the request of the II the farm veterinarian conducted a postmortem and submitted tissues to the laboratory for histopathology. Significant gross postmortem findings (**Figure 3**) included erosions in the nares and erosions and ulceration in the oral cavity, oesophagus and gastrointestinal tract. Lesions in the proximal oesophagus and distal large intestine were covered by diptheric membranes.

While awaiting histopathology results the heifer was confirmed as having a high positive result on antigen ELISA testing, suggesting an animal persistently infected with BVD virus. Subsequently histopathology revealed severe subacute multifocal ulcerative

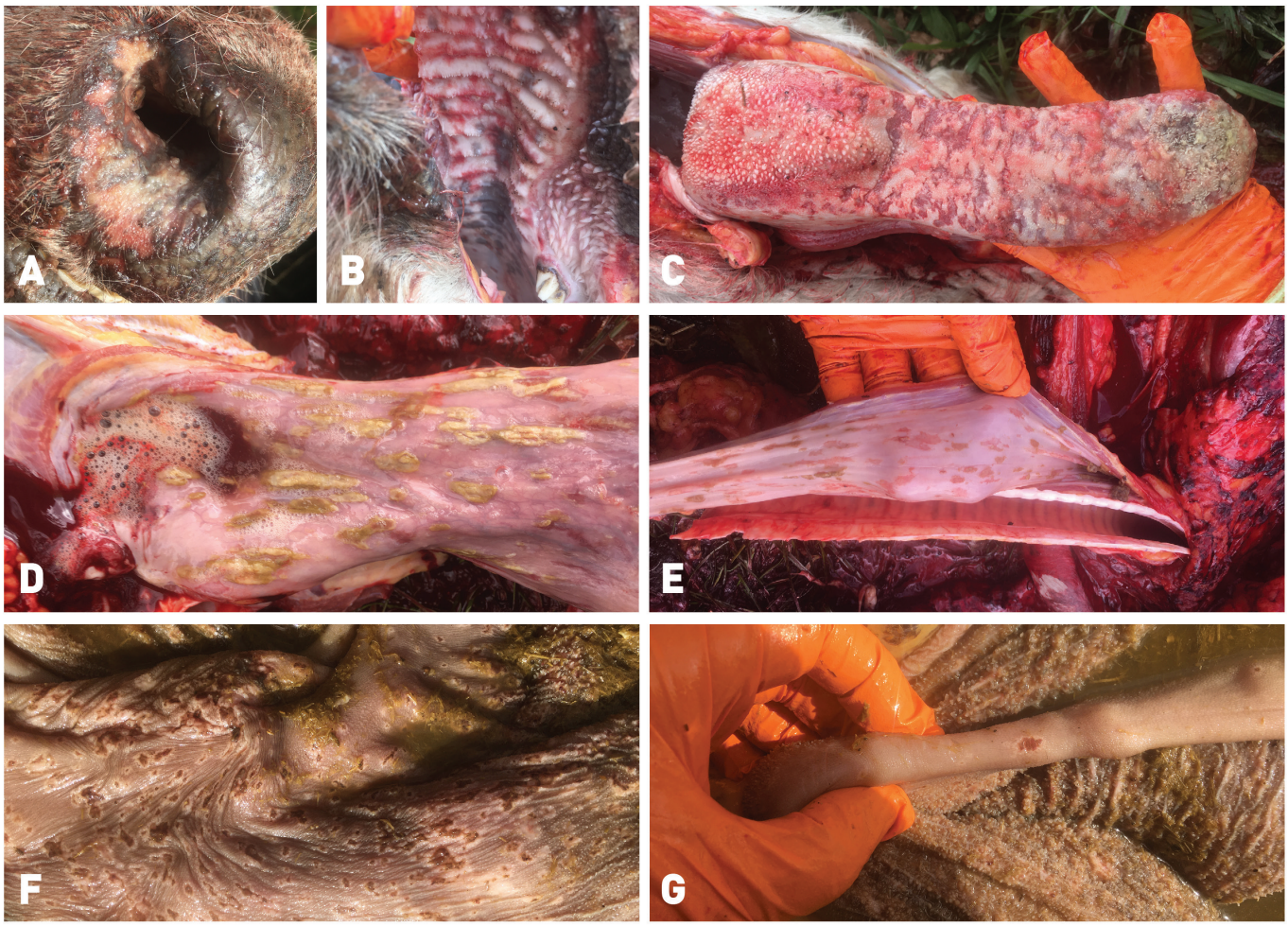

Figure 3: Mucosal disease lesions in an 8-month-old Murray Grey heifer showing erosions at the nares (A), ulcers on the hard palate (B), ulcers on the tongue (C), ulcers in the anterior oesophagus, some with a diptheric or pseudomembranous covering (D). Ulcers were also present in the distal oesophagus (E), rumen mucosa (F), and on a rumen pillar (G). (Photos: Verena Kwoka, Vetora Bay of Plenty).

and necrotising stomatitis, oesophagitis, and gastroenterocolitis with granulation tissue, lymphoid depletion and fibrin thrombi. There was also hepatic lipidosis and diffuse splenic and lymph node lymphocytolysis. The lesions were attributable to mucosal disease caused by persistent infection with BVD virus, and enhanced and complicated by secondary bacterial infections. The hepatic lipidosis indicated a period of negative energy balance prior to death. In light of the BVDMD confirmation, BVD antigen testing on the samples collected from the birth cohort was requested, to determine their BVD status and to help the farm veterinarian to develop a BVD control programme with the client.

Conclusion

Oral lesions in cattle can be attributed to a number of endemic and exotic diseases, so they can pose a diagnostic challenge (Holliman, 2005). Where an exotic disease is suspected, it is essential that MPI be notified as quickly as possible via the exotic pest and disease hotline. Early detection of an exotic disease incursion provides the best opportunity to successfully implement control measures. The longer the silent spread period, the more difficult it becomes to achieve successful control.

New Zealand's frontline veterinarians play a key role in exotic disease surveillance and have a legal obligation to report suspect cases. While involving regulatory authorities can be daunting to some, it should be viewed as a step in a collaborative effort in working up and resolving a case, with costs paid by MPI. This case demonstrates how working with MPI Incursion Investigators can produce benefits for farmers and veterinarians, and vitally contribute towards national surveillance for exotic diseases.

Acknowledgements

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Enhancing the engagement programme for New Zealand's animal health exotic pest and disease notification system

The Ministry for Primary Industries (MPI)'s exotic pest and disease notification system is one of New Zealand's main animal health surveillance systems for the early detection of exotic pests and diseases. This system helps underpin New Zealand's disease-status statements to the World Organisation for Animal Health (OIE) and trading partners, thereby enabling exports of our primary produce to high-value markets. It also meets the requirements of an early-warning system for the detection of new diseases by the OIE. The notification system consists of multiple components, as described by Tana (2014):

- a communication programme that encourages timely notification (referred to as the "stakeholder engagement programme" in this article);
- a 24/7 notification channel (the exotic pest and disease hotline);
- MPI's veterinary Incursion Investigators (for investigating notifications);
- a network of Initial Investigating Veterinarians throughout New Zealand (to rapidly assist with investigations);
- exotic pest and disease diagnostic laboratory capability;
- a data management system; and
- a legal requirement for all New Zealanders to report suspected incursions (sections 44 and 46 of the Biosecurity Act 1993).

Recently MPI has undertaken a project to formalise and enhance the stakeholder engagement programme. The objectives of this project are to:

- identify key potential notifiers and develop evidence-based methods to encourage timely and accurate notifications;
- develop systems to evaluate stakeholder engagement and to monitor notification patterns; and
- identify collaboration opportunities with key animal health stakeholders.

Once the objectives of the project are initially met, work to improve stakeholder engagement will continue under an ongoing engagement programme. This project aligns with Biosecurity 2025 Strategic Direction 1: A team of 4.7 million. It also aligns with the OIE Terrestrial Animal Health Code, which states that communication to stakeholders requires strategic and operational planning, adequate resourcing and management, and periodic review (OIE, 2019). The scope of the current project is limited to enhancing the stakeholder engagement programme, but will consider other components of the notification system if they impact on engagement (e.g. performance of the notification channel) or the ability to measure engagement (e.g. the data management system).

Methodology

The first step of the project is an internal review of the current engagement programme. This review aims to develop methods for assessing stakeholder engagement, collate MPI's notification engagement activities, establish a baseline of current engagement levels across stakeholders, and recommend future work. This review has been conducted in conjunction with a review of the wider animal health surveillance programmes (Phiri & Earl, 2020).

Assessing engagement in the notification system is challenging. Successful engagement means that all key stakeholders are being vigilant for exotic pests and diseases and are aware of the

Table 1: Attributes used to evaluate stakeholder engagement with the Animal Exotic Pest and Disease Notification system, and their definitions

Attribute	Definition
1. *Flexibility*	*The ability of engagement programme to adapt and respond to a change in the risk profile of an exotic organism.*
2. *Performance indicators and evaluation*	*Whether the engagement programme is regularly assessed against defined performance indicators, and whether actions are taken to address weaknesses.*
3. *Data management and storage*	*How well the data management system enables monitoring, analysis and reporting of notification data.*
4. *Resource availability*	*Availability of personnel and finance to effectively and regularly carry out engagement activities, with defined roles and responsibilities.*
5. *Appropriate and well-functioning networks**	*How well animal health networks are understood and targeted, and the effectiveness of animal health communication within these networks.*
6. *Acceptability and engagement*	*Vigilance for exotic disease, and awareness and willingness to participate in the notification system amongst identified notifiers.*
7. *Representativeness and bias*	*Whether notifications are representative of the animal population at risk (geographically, temporally, and species/sectors).*
8. *Positive predictive value*	*The proportion of notifications from a defined notifier group that are investigated, are positive, or initiate a response. This attribute estimates notification quality.*
9. *Timeliness*	*The length of time between onset of clinical signs in New Zealand and notification to MPI.*
10. *External communication and dissemination*	*The support, understanding and satisfaction of communication of the notification system among animal health organisations, and current collaboration of engagement activities.*
11. *Internal communication*	*The support, understanding and satisfaction of communication of the notification system within MPI.*
12. *Utility*	*How well the engagement programme meets its objectives and describes the changes that have been made to improve the programme.*

* Attribute created in addition to those defined within the Surveillance Evaluation Framework (SurF): Muellner et al, 2018

appropriate reporting mechanism. It is also important to identify and address any barriers to stakeholders participating in the system. The analysis cannot be based on notification data alone, as a lack of notifications may be due to a lack of unexpected disease events in the specified population during a certain time period. It is also difficult to research actual behaviour regarding the vigilance for, and actions taken following suspicion of, an exotic disease. The Surveillance Evaluation Framework (SurF) (Muellner et al., 2018) was therefore chosen to provide a comprehensive assessment of the engagement programme.

Ruminant sectors (cattle, deer, goats, sheep) were selected to initially test the SurF methodology for assessing the engagement programme. Eleven attributes were selected from the SurF framework to provide a quantitative and qualitative analysis (**Table 1**). A further attribute, "Appropriate and well-functioning networks", was created in addition to the SurF attributes. A number of attributes were amended to better fit the objectives and design of the engagement programme. Stakeholder consultation as described in Phiri & Earl (2020) was also undertaken to inform the "External communication and dissemination" and "Internal communication" SurF attributes.

Results from the evaluation work thus far have been used by MPI's Surveillance and Incursion Investigation Animal Health (SIIAH) team to help guide an enhanced engagement programme plan for 2020–2021.

Work conducted to date

To date the review has included:

- collating current engagement programme activities;
- stakeholder analyses;
- an analysis of previous MPI stakeholder surveys and relevant literature;
- examining the current notification and investigation data; and
- carrying out stakeholder consultation.

The SIIAH team conducts a number of activities each year to engage with veterinarians, commercial diagnostic laboratories, the science community and others. As a result, stakeholder surveys have shown a high degree of awareness and willingness among private veterinarians and veterinary pathologists to notify suspected exotic pests and diseases to MPI. A hotline was also reported to be a preferred method of reporting among these stakeholders, rather than via email, an online form or a smartphone app. Survey work and the literature has demonstrated that farmers have a high degree of trust in veterinarians when animal health is concerned. However, livestock farmers' animal health network has likely become more complex in recent years, and more work is required on these networks to ensure all animal health professionals (e.g. scanning service providers, feed advisers and veterinary technicians) are included in the engagement programme. Further research on farmer behaviour is also intended with regard to animal health observation and monitoring, and thresholds of disease before contacting animal health professionals.

The MPI S&II group's notification and investigation database design has until recently limited the assessment of the quantitative SurF attributes, and work to data-mine its contents is ongoing. While the database captured detailed information of notifications and investigations, the review identified several areas where database improvements could enhance the SIIAH team's ability to analyse notifications and investigation data. These areas have been incorporated into the design of a new notification and investigation database within MPI's Surveillance Information Management System (SIMS). This new database also allows the creation of real-time reports including graphs and maps, which will enhance SIIAH's ability to monitor and communicate notification data.

Stakeholder consultation is considered essential to meet the objectives of the project, particularly to identify further opportunities for collaboration. Stakeholder consultation was conducted in 12 workshops including 30 agencies across the full animal health sector, as well as several MPI animal health teams. The methodology for stakeholder consultation is further described in Phiri & Earl (2020). Almost all consulted stakeholders were aware and supportive of the exotic pest and disease hotline and its role in the early detection system. They identified several strengths of the notification system, including existence of the IIV system, collaboration between their organisation and SIIAH staff for investigations and research, commercial laboratory expertise and the breadth of testing conducted during investigations. Stakeholder discussions were useful to identify potential barriers to engagement, opportunities for enhancing the notification system, and improvements to communicating notification data outputs that will be further considered. There was high enthusiasm among external stakeholders for increased collaboration between MPI and their organisations to enhance notifications. One example of an immediate action undertaken as a result of this consultation was republishing the quarterly equine diagnostic and investigation summaries from *Surveillance* in *Equine Veterinary Practitioner* (NZVA special interest branch).

Next steps

The initial review work has demonstrated that SurF provides a comprehensive framework for assessing engagement in the notification system. While the internal review is ongoing, work conducted to date has provided direction for activities in the stakeholder engagement programme for 2020–2021. Priority activities include:

- identifying and initiating effective strategies for engaging with non-veterinary animal health professionals such as veterinary technicians and farm consultants;
- maintaining the current high levels of engagement with private and specialist veterinarians while testing new engagement methods to support timely notifications. This may include providing more guidance for when to notify, and promoting the collaborative approach to investigations between the MPI SIIAH and private veterinarians (see, for example, article on page 4);
- initiating research among farmers to better understand their animal health concerns, and their behaviour during animal health events;
- enhancing collaboration with MPI's other animal health teams (e.g. Animal Trade, Readiness and Response, and Welfare) and relevant animal health organisations; and
- developing automated reports in SIMS to monitor notification and

investigation data, with summaries provided in the Surveillance Annual Report.

Further work includes expanding work to all animal health sectors, ongoing monitoring of notification data, and a programme of regular SurF reviews. These will continue to inform the development of the notification system's engagement programme.

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Quarterly report of diagnostic cases

IDEXX Laboratories

Bovine

The sudden death of a 2-month-old Jersey calf in Matamata-Piako was investigated. Necropsy findings included increased pleural and peritoneal effusions consisting of clear to mildly straw-coloured, non-clotting fluid. Histopathology revealed cardiomyocyte necrosis with mixed inflammatory infiltrates and lung oedema, suggestive of **ionophore toxicity** caused by monensin that had been included in the calf feed as a coccidiostat. Dose rates and mixing protocols were reviewed. The muscle tissues of choice for histological evaluation in suspected cases include cardiac papillary, left ventricular muscle and intercostal among the full range of necropsy tissues required for optimal investigation of sudden death cases.

Five days after being drenched with a levamisole/abamectin combination drench, a 6-month-old calf in Matamata-Piako showed neurological signs followed by recumbency necessitating euthanasia. Histological evaluation of the brain revealed changes consistent with **polioencephalomalacia**, a result of increased thiaminase following multiplication of thiaminase-producing ruminal bacteria or ingestion of plants containing thiaminase. Causes of this ruminal bacterial imbalance are not fully understood, but it is usually related to elevated carbohydrate in the diet (lush grass, increased grain), or subclinical rumen acidosis. Some anthelmintics act as co-factors to bacterial thiaminases, so the recent drenching could have been a contributory factor. Similar histologic changes can occur with lead poisoning and water deprivation or salt toxicity, which can be better differentiated by history and/or other laboratory tests.

A 4-month-old Wagyu heifer in Kāpiti presented with neurological signs including muscular rigidity, recumbency and twisting to the left. Listeriosis was suspected; the calf was euthanased and the brain harvested. Necropsy also revealed fibrinous pleurisy and peritonitis with enlarged mesenteric lymph nodes. Microscopic evaluation of the brain revealed extensive non-suppurative meningoencephalitis involving the forebrain as well as the hindbrain and brain stem, confirming the diagnosis of **listeriosis**. Typically lesions are predominantly in the brain stem. In addition, there was enteritis characterised by increased lymphoplasmacytic lamina propria infiltrates and crypt base neutrophilic aggregates extending into the muscularis mucosa. Multifocal mononuclear inflammatory aggregates were noted in the hepatic parenchyma and renal interstitium. Encephalitic listeriosis is the most common manifestation of this disease in cattle of this age, whereas enteric or septicaemic listeriosis more frequently follow intrauterine infection, resulting in stillbirth or neonatal disease. Enteric listeriosis in the older bovid has a shorter incubation period leading to earlier onset of disease than encephalitic listeriosis. Factors increasing susceptibility include high challenge level, virulence of strain, age and immunosuppression.

Several 18-month-old heifers on a Waikato dairy farm had been doing poorly and were losing weight within days after being administered a zinc bolus. They had also received a mineral bolus (iodine, cobalt and selenium) 2 months earlier, in January. Serum zinc levels were markedly increased in two heifers (130 and 170 umol/L; prophylactic level 20–35), consistent with severe **zinc toxicosis** in which haemolysis and death can occur. Damage to a zinc bolus within the rumen can be caused by interference with another ruminal bolus, resulting in large, sudden zinc release. Concurrent use of different ruminant boluses is contraindicated on data sheets, although the time interval is not usually clarified.

A further incident of zinc toxicity on the same property occurred in a 5-year-old dairy cow. Three weeks after receiving a zinc bolus the cow lost condition initially, then deteriorated rapidly and died. Necropsy revealed marked jaundice. Histopathology findings included a haemoglobinuric nephrosis and hepatocellular centrilobular cellular degeneration consistent with anoxia, supporting a diagnosis of **haemolysis**. Causes of haemolysis include toxicity caused by zinc, copper, sporidesmin (direct effect of high challenge), brassicas and onions, as well as leptospirosis, theileriosis and hypophosphataemia. The kidney zinc level was 74 mg/kg (reference range 40–60), confirming a diagnosis of **zinc toxicosis**. Intraruminal zinc bolus damage was again suspected, although in this case there was no interference by a second intraruminal bolus.

A 2-year-old Hereford bull in Kāpiti presented with granulomatous lesions in both nostrils. Histology of biopsies revealed multinodular pyogranulomatous lesions with Splendore-Hoepple material, consistent with infection by ***Actinobacillosis lignieresii***. Recent drought-like conditions leading to pasture shortage can cause livestock to graze coarse, thorny plants (e.g. thistles or gorse), causing skin abrasions, the portal of entry for bacterial pathogens.

A 7-year-old dairy cow in Waikato presented with watery scours and weight loss**.** ***Salmonella*** **Give**, an uncommon serotype, was isolated on culture of faecal samples. The farmer had noticed birds drinking from the stockwater troughs, a result of the season's drought-like conditions, and this was considered a likely source of infection.

An aging 11-year-old Friesian dairy cow in good body condition presented with marked swelling and tissue necrosis of the skin and subcutaneous tissues at the tail base (**Figure 1**). Initial histology of a biopsy showed extensive tissue necrosis and granulation tissue with an infiltrate of a poorly differentiated **adenocarcinoma** characterised by ciliated epithelial cells. The neoplasm was considered likely to represent secondary metastatic spread, the ciliated nature of the epithelial cells suggesting the tissue of origin to be either reproductive or respiratory tract. The primary neoplasm was not determined on necropsy.

A group of 6-month-old Taranaki dairy calves presented with weight loss and diarrhoea. Faecal cultures yielded a moderate growth of ***Yersinia pseudotuberculosis***. **Yersiniosis** occurs

more commonly in the cooler months. Stress factors are often underlying triggers for increased mucosal colonisation by this bacterium; the dry conditions this quarter, leading to pasture shortages, were a likely factor in this case.

Figure 1: Cow with tail-head swelling and necrosis owing to an infiltrative adenocarcinoma. Courtesy of submitter, Dr Hugh Bentall, Levin and Horowhenua Vets.

Ovine

A mob of 5-month-old lambs were affected with pink eye/ conjunctivitis, which tended to recur after treatment with trimethoprim sulphate. ***Moraxella ovis*** was isolated from bacterial cultures of eye swabs. The primary infectious causes of conjunctivitis in sheep are ***Chlamydophila pecorum*** and ***Mycoplasma conjunctivae***, with secondary opportunist bacterial infections including ***Moraxella sp.*** In contrast, bovine conjunctivitis or pink eye is usually a result of infection with ***Moraxella* spp.,** predominantly ***M. bovis***. The reoccurring infections in this case were likely a result of underlying primary infections with ***C. pecorum*** and/or ***M. conjunctivae***.

Equine

An 11-year-old Thoroughbred brood mare from Auckland presented with recurrent return to service and vaginal discharge. She had previously been treated for a uterine yeast infection. A cervical swab yielded ***Staphylococcus aureus***. Underlying factors for **chronic post-breeding endometritis** include impaired uterine defense mechanisms such as anatomic deformities, which enable entry of pathogens, and impaired uterine physiological mechanisms to clear post-breeding fluids and debris (Canisso et al., 2016). Yeast infections can arise after intrauterine antimicrobial lavage and can be problematic to treat.

A 3-day-old Warmblood foal in Otago presented with severe, acute diarrhoea. Genome sequences for ***Clostridium difficile*** toxins A and B (enterotoxin TcdA and cytotoxin TcdB) were detected on PCR, supporting the diagnosis of infection by ***Clostridial enterocolitis*** (Fraser, 2017). ***C. difficile*** is ingested by the neonatal foal from the environment, or from the mare, which may be subclinically shedding the bacteria. Susceptibility at this young age is related to the developing microbiome as well as the level of challenge, which is higher in a wet, faeces-contaminated environment, enabling colonisation of the intestines by the bacterium, releasing toxins and causing severe mucosal damage.

Avian

A weak and emaciated North Island brown kiwi (*Apteryx mantelli*) was found on Moturua Island, Northland. Evaluation of a blood smear revealed numerous ***Plasmodium* sp.** pathogens, and **avian malaria** was diagnosed. The term "avian malaria" may include different species depending on the author: some include only *Plasmodium* while others also include the closely related genera *Haemoproteus*, *Parahaemoproteus* and *Hepatocystis*, which are also known to produce the malaria pigment, haemozoin (Schoener et al., 2014). Avian malaria is continuing to cause morbidity and mortality in naïve birds, and is a particular concern to endangered native species in New Zealand. Insect vectors, predominantly mosquitoes, are crucial to the protozoal lifecycle, so the epidemiology of this disease is strongly related to the way their ecology and behaviour (Schoener et al., 2014) affects their seasonal abundance. In New Zealand ***Culex pervigilans*** is the confirmed vector (Massey et al., 2007).

Several 22-week-old birds, mostly males, in a commercial breeding poultry flock in Waikato showed signs of tracheitis. Histopathology on submitted necropsy tissues revealed severe tracheal mucosal erosion and ulceration with intraluminal heterophil aggregates. Although no inclusion bodies were seen, the findings were considered typical of the avian herpesvirus that causes **infectious laryngotracheitis**. The virus targets epithelial cells of the upper respiratory tract and conjunctivae**.** Cases in New Zealand are usually limited to the upper North Island. In unvaccinated flocks, a live attenuated vaccine is available for use in healthy birds in the face of an outbreak.

A juvenile hoiho/yellow-eyed penguin (*Megadyptes antipodes*) in moderately good condition was found dead in Otago, with blood around the vent. Necropsy revealed epicardial and endocardial haemorrhage, liver and splenic enlargement, and red mucoid intestinal contents. Histopathology revealed haemorrhages in the cardiac and adrenal tissues. There were large numbers of gram-positive bacterial rods throughout multiple organs, including within Kupffer cells, sinusoids and portal veins of the liver, splenic macrophages and arterioles, pulmonary capillaries, the renal interstitium and the intestinal lumen. ***Erysipelothrix rhusiopathiae*** was isolated from liver tissue, confirming a diagnosis of **erysipelas**. This bacterium affects multiple animal species and is a potential zoonosis. It can be found in terrestrial and aquatic environments and may be carried in the oral cavity and/or intestines of healthy animals (Hunter, 2012). The route of entry is via ingestion or skin abrasions. Infection in birds usually results in septicaemia and rapid death.

Reptilian

A 3-year-old red-eared turtle (*Trachemys scripta elegans*) was presented after ingesting pieces of lead. The serum lead level was 0.56 mg/L (toxic level > 0.2), confirming a diagnosis of **lead toxicosis**. After 2 weeks of chelation treatment with calcium EDTA, the lead level had slightly decreased, but at 0.35mg/L it was still in the toxic range, so treatment was continued and is ongoing at the time of writing.

Canine

A 3-year-old West Highland White dog presented with a testicular mass, which was surgically removed. Histopathology revealed a diffuse marked pyogranulatomous inflammation with fibrosis (**Figures 2 and 3**). The case was reported to MPI for rule-out of *Brucella*

canis. Periodic acid-Schiff (PAS) staining revealed numerous fungal hyphae (septate, branching forms), giving a diagnosis of **mycotic orchitis**. This is an unusual lesion in animals, with sparse reports in the literature. Submission of a urine sample for fungal culture was recommended for further investigation.

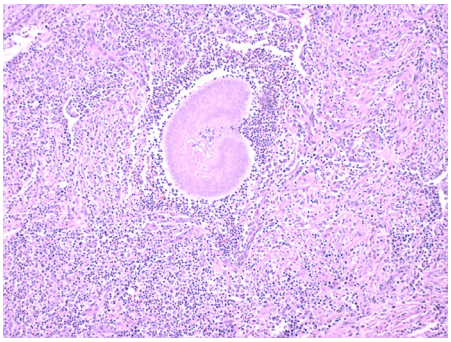

Figure 2: Canine testicular swelling: mycotic orchitis, pyogranulatomous.

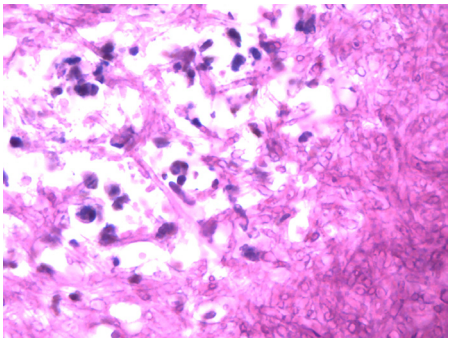

Figure 3: PAS staining to highlight numerous intralesional fungal elements. Courtesy of Dr. Alan Julian, pathologist, IDEXX Hamilton.

SVS Laboratories

Bovine

A 3-year-old Jersey cow from Waikato was found dead after showing signs of respiratory disease. Lung tissue was submitted to the laboratory for histopathology and culture. Histological evaluation revealed diffuse suppurative bronchopneumonia and ***Mannheimia haemolytica*** was isolated from the lung. This is a commensal organism of the nasopharynx in cattle, where it is a common cause of respiratory disease. Periods of stress such as transport, as well as prior viral disease, increase susceptibility to the disease.

In mid-March, a Waikato veterinarian performing pregnancy checks in a herd of 500 Jersey cows found seven with evidence of **pyometra**. Culture of cervical fluid was done for two of these cows. One yielded a pure culture of ***Trueperella pyogenes***, and the other had a mixed growth of *Escherichia coli*, a coagulase-negative *Staphylococcus* sp., and an alpha-haemolytic *Streptococcus* sp. The most commonly isolated bacteria in bovine pyometra are *T. pyogenes* and *Fusobacterium necrophorum*, with *Escherichia coli*, *Bacteroides* sp., *Mannheimia haemolytica*, *Streptococcus* sp. and *Staphylococcus* sp. also being frequently isolated. Cows that ovulate early after calving, while bacterial contamination of the uterus is still present, are more susceptible to pyometra. Inflammation of the uterine wall (endometritis) can inhibit prostaglandin production by the uterus and thus inhibit regression of the corpus luteum, which in turn causes the cervix to remain closed and purulent material to accumulate in the uterus (Karstrup et al. 2017).

In mid-March, a Waikato veterinarian was consulted when an entire mob of calves were scouring and losing weight. Some animals had pale mucous membranes. Zinc toxicity was suspected, based on the history of supplementation. Packed-cell volumes from five animals varied from 0.22 to 0.38 (reference range 0.26–0.48). No Heinz bodies were seen on the blood smear of one animal. The serum zinc levels of four animals ranged from 480 to 660 umol/L (prophylactic range for facial eczema control 20–35), confirming **zinc toxicity**, which is often associated with haemolytic anaemia. In some cases Heinz bodies may be present owing to oxidative damage, but in these animals the anaemia was quite mild and no Heinz bodies were seen.

In a similar case, in early April a Taranaki veterinarian investigated a dairy herd with decreased milk production and diarrhoea. The animals had received a zinc bolus 3 days previously, 2 weeks after the zinc sprayer had failed. Nine of 10 animals sampled had evidence of biliary damage, with GGT levels ranging from 242 to 2,990 U/L (reference range 1–36). Seven animals had high zinc levels (60–160 umol/L; toxic level > 35). This case was suspected to be **facial eczema** followed by **zinc toxicity**.

Ovine

In late January, a veterinarian in Waikato was called to investigate mortalities in a flock of sheep. Twelve out of 400 had died suddenly. Faecal egg counts on 10 animals showed seven had 100–550 strongyle eggs per gram (epg) of faeces, and one had 20,500 epg. Culture and PCR of the faeces of one animal revealed the presence of *Salmonella*. **Salmonellosis** was likely the cause of sudden death in this flock, but **parasitism** may have been a predisposing factor.

A veterinarian examined two lambs with severe anaemia requiring transfusion. A faecal egg count revealed **severe parasitism** with 8,000 and 12,500 strongyle epg of faeces, and both had 50 *Nematodirus* epg. *Monieza* eggs were also numerous in one lamb. Considering the anaemia, *Haemonchus contortus* was suspected, but larval culture was not done.

Equine

A 17-year-old Standardbred gelding developed multiple subcutaneous lumps in the pre-scapular, axillary and inguinal areas. The number of lesions had been increasing over a period of 3 months. Histology of one of the lumps revealed a non-encapsulated neoplasm infiltrating the subcutaneous tissue and surrounding a nerve. No lymph-node architecture was present. The neoplasm consisted of a mixed population of small lymphocytes, large lymphocytes and histiocytes, with occasional multinucleated giant cells. The large lymphocytes had round-to-pleomorphic nuclei with prominent nucleoli. Two to four mitotic figures per high-power field were present in the population of large lymphocytes. A diagnosis of **lymphoma** was made, with the mixed population suggestive of a T-cell-rich B-cell lymphoma.

Avian

Faeces from a chicken were sent to the laboratory after the owner had noticed haematochezia. A faecal egg count revealed 450 *Heterakis* epg, as well as small numbers of coccidia. ***Heterakis gallinarum*** is a nematode that lives in the caecum of several bird species, where heavy infections can cause typhilitis. The nematode can also carry *Histomonas meleagridis*, a protozoan parasite that can cause extensive hepatic necrosis (blackhead disease).

Three abandoned Australasian harrier (*Circus approximans)* chicks from Coromandel were found by a member of the public and fed meat. One died and the other two were handed to a wildlife rescue organisation. Examination of one chick revealed fractures of both femurs. A lead shot was present in the gastrointestinal tract. The whole blood

lead level was > 0.6 mg/L (reference range 0–0.02), confirming **lead toxicity**. There was also **hypocalcaemia**, with a serum calcium level of 1.65 mmol/L (reference range 2.12–3.30). The bird was euthanased and a post-mortem examination revealed soft mandibular and maxillary bones and multiple fractures associated with soft-tissue haemorrhage and bruising. The liver lead level was 5.5 mg/kg, consistent with **lead toxicity** and **metabolic bone disease**. Chelation therapy for lead toxicity can cause hypocalcaemia, but had not been given in this case. Diet is most likely to have caused the hypocalcaemia and metabolic bone disease in this case as muscle meat does not have sufficient calcium-to-phosphorus ratio.

Canine

An 8-year-old Border Collie cross from Bay of Plenty presented with acute vomiting and lethargy. Clinical examination revealed jaundice, and in-house biochemistry results showed liver disease, with markedly elevated bilirubin (199 umol/L; reference range 2–10), high ALP (1,106 U/L; reference range 20–150) and high ALT (635 U/L; reference range 10–118). There was also evidence of renal disease, with elevated creatinine (795 umol/L; reference range 27–124) and urea (52.5 umol/L; reference range 2.5–8.9). An in-house rapid assay for leptospirosis was negative. The blood samples were then sent to the laboratory for a CBC, which showed lymphopenia (0.6 x 10^9/L; reference range 1.1–5.3), and a rapid leptospirosis IgM assay, which was positive. The sample was then forwarded for MAT testing against a number of *Leptospira* serovars (Australis, Ballum, Canicola, Copenhageni, Grippotyphosa, Hardjo, Pomona and Tarassovi). The titres were 1:25 for Hardjo and < 1:25 for all the others. A convalescent serum sample taken 3 weeks later showed a greater than fourfold rise in titre against Copenhageni (1:200, consistent with exposure) and a twofold increase to 1:50 in the titre against Hardjo (which could be due to cross-reactivity). A diagnosis of **leptospirosis** caused by serovar **Copenhageni** was made. A recent study (Lizer et al. 2017) has determined that a rapid lateral flow IgM leptospiral assay had 75.7 percent sensitivity and 98.3 percent specificity when performed on acute-phase serum. When results of these assays are not consistent with the clinical history and other findings, it is important to investigate further with MAT testing on convalescent serum or PCR on a urine or blood sample.

Feline

A 4-month-old kitten from Hamilton presented with chronic diarrhoea. It had been treated with spiramycin and metronidazole, with no improvement. A faecal sample revealed the presence of ***Cryptosporidium*** antigen and ***Salmonella*** was cultured from the faeces.

Lagomorph

A 10-week-old rabbit from Bay of Plenty was found lethargic and unable to stand, and was taken to the veterinarian on the same day. The rabbit was underweight (380 g) compared with a littermate (610 g) and was also very dull and hypothermic (32.1°C; reference range 38.6–40.1). Despite supportive treatment the rabbit died 2 hours after admission and was submitted to the laboratory for post-mortem examination. There were multiple yellow areas through the liver lobes. Impression smears of these areas revealed numerous coccidial organisms as well as occasional heterophils. A faecal egg count revealed 700 strongyle epg and a very large number of coccidial oocysts. Hepatic coccidiosis in rabbits is caused by ***Eimeria steidae*** and is an important cause of mortality in weanlings.

Gribbles Veterinary Pathology

Bovine

A 6-month-old Friesian heifer on a Manawatu farm had diarrhoea and was recumbent and dehydrated. The faeces contained blood and pieces of intestinal mucosa. No *Salmonella* bacteria were isolated on culture of intestinal contents. Histopathological examination of the colon revealed severe necrotising colitis with ulceration and numerous intralesional coccidial oocysts and gametocytes, confirming a diagnosis of **coccidiosis**.

A 5-year-old Friesian cross cow from a Franklin dairy farm had significantly decreased milk production at the morning milking. She was subsequently seen to be struggling to breathe, having an extended neck and increased respiratory effort. The previous day the herd had been on rough pasture that included some unusual plant species. Owing to a lack of response to treatment, the cow was euthanased. Necropsy revealed a soft-tissue swelling dorsal to the larynx and a small amount of foam in the upper airways. Histological examination of the affected area revealed necrosuppurative inflammation associated with numerous large monomorphic bacterial rods. The diagnosis was **clostridial laryngitis/cellulitis**. It was presumed the infection was caused by a penetrating injury, possibly from ingestion of coarse or sharp plant material.

During this period a number of cases of ***Theileria orientalis*** **Ikeda** infection were identified at the Palmerston North laboratory, with some confirmed by PCR testing. The cases occurred in a wide variety of animals including calves, weaners, mixed-age dairy cows, steers and bulls. They originated from many areas of the lower North Island including Taranaki, Manawatu, Whanganui and Hawke's Bay. Pale mucous membranes and decreased production were common presenting signs. In cases where the packed cell volume was known, it varied from 0.08–0.22 (reference range 0.24–0.46). PCR was not performed on the majority of the cases in which *Theileria* organisms were identified on the blood film of anaemic animals. Most PCR-positive cases did not have a complete blood count or blood film review performed.

A few calves on a South Canterbury dairy farm died over a short period of time. One was necropsied and fluorescence of the brain consistent with a diagnosis of **polioencephalomalacia** was observed. After two further calves died and three others were noted to be sick, further veterinary investigation was requested. The sick calves had elevated rectal temperatures (up to 39.6°C; normal 38.6) and an increased respiratory rate. Necropsy of one affected animal revealed fibrinous pleuritis and peritonitis consistent with ***Pasteurella multocida*** **type B septicaemia**. Bacterial culture of the peritoneal exudate yielded a pure heavy growth of *P. multocida*.

A number of cows suddenly developed diarrhoea in a 1,000-cow Canterbury dairy herd. Routine screening tests for common enteric pathogens were all negative. One of the cows died and at necropsy pale areas were noted in the ventricular myocardium. Histopathological examination showed

that these corresponded to extensive areas of myofibre loss and condensation of myocardial stroma. Specimens of skeletal muscle also showed multifocal areas of myofibre necrosis and macrophage infiltration. The lesions were not typical of white muscle disease, and monensin toxicity was suggested as a possible aetiology that should be investigated. Examination of farm procedures revealed that just before this problem developed, a change had been made in the way mineral supplements and monensin were mixed and given to the cows, causing much higher monensin concentrations in parts of the supplement mixture. The combined epidemiological and pathological evidence suggested that **monensin toxicity** was the likely cause of the problem. At non-fatal doses, excessive monensin administration can result in diarrhoea.

Sections of parotid lymph node from a cow were submitted to the laboratory for examination because green discoloration of the parotid node had been found in most of a single line of cows during post-mortem inspection at a meat processing plant. Histopathological examination revealed a green pigment in macrophages in the cortex of the node. There was no observable inflammatory reaction to the presence of the pigment. It seems likely that this was **tattoo pigment** that had been carried in macrophages to the draining lymph node. Green tattoo pigment is sometimes used on the inside of the pinna in cattle.

A rising-1-year-old Hereford steer from Northland had chronic ill-thrift and over a period of 5 days developed lethargy, inappetence, diarrhoea, bilateral nasal discharge and pyrexia. A serum sample had no detectable antibodies to bovine viral diarrhoea virus (BVDV) when tested by ELISA, but there was a high positive result on a BVDV antigen ELISA test, consistent with a diagnosis of **persistent BVDV infection**.

A group of 20 mixed-age Friesian cows from a South Auckland property were dried off following a protocol that included the use of an internal teat sealant as well as an intra-mammary antibiotic preparation. Three days later, eight died with gangrenous mastitis affecting one to all four quarters. ***Pseudomonas aeruginosa*** was isolated on bacterial culture of milk samples from six of these cattle, and also from residual moisture found in the tubs that had contained the teat sealant and antibiotic products. Mould growth was incidentally seen on a tub lid. Cultures of shed water sources were negative. The diagnosis was ***Pseudomonas*** **mastitis**, which was attributed to bacterial growth in the tubs and consequential product contamination.

Three out of a hundred 5-month-old Friesian heifers on a Taranaki farm were observed to be in acute respiratory distress and two died. Necropsy revealed oedema and emphysema of the lungs, and histopathological examination showed changes consistent with **atypical interstitial pneumonia**. This condition occurs sporadically in New Zealand but, as in other countries, appears more common in autumn, often after a change in feed quality from poor to lush pasture. There is an association with exposure to high levels of L-tryptophan, which can be converted to 3-methylindole in the rumen. This, when absorbed into the bloodstream, is the source of the pneumotoxicity after metabolism by the mixed-function oxidase system, which is very active in the lungs.

A group of young Friesian bulls from Rotorua were found to have severe lesions of the skin. The dermatitis was mainly located on the face, and in particular around the eyes. Scab material was collected from some of the worst-affected animals and submitted to the laboratory for examination. The presence of characteristic bacterial forms consistent with ***Dermatophilus congolensis*** in gram-stained preparations from these samples resulted in a diagnosis of **dermatophilosis.**

On a Taranaki dairy farm, 10 of 300 cows were noted to have an acute onset of diarrhoea. They had reduced milk production and were very dull. Four of them had blood or fibrin in their faeces and were pyrexic. There had been a change in feed the day before the clinical signs were seen. Faecal samples from three of the affected animals were received at the laboratory for bacterial culture. A ***Salmonell*****a** species was isolated from all three samples, confirming a diagnosis of **salmonellosis**.

An adult cow from a farm near New Plymouth was presented for examination with an acute history of weight loss and decreased milk production over the previous 2 days. Clinical examination revealed pale mucous membranes and a mass on the left side of the thorax behind the elbow. Haematological testing showed a severe anaemia. There was no evidence of haemorrhage or haemolysis, and no *Theileria* species were identified on the blood smear. Histopathological examination of tissue from the mass revealed this to be a **haemangiosarcoma**. These tumours are rare in cattle. They may occur in the skin and subcutis or in visceral organs such as the liver and spleen. They are locally invasive and may metastasise widely. Given the severe anaemia and lack of evidence of other causes, internal metastasis with haemorrhage was suspected, but as far as we are aware no further investigations were carried out.

A group of calves on a farm near Ngongotaha were growing poorly and an investigation was initiated. Blood samples were collected from 12 animals. Of these, six had inadequate serum selenium concentrations (< 140 nmol/L; reference range 140–2000). Examinations for parasitism and enteric bacterial disease were negative and it was considered likely that **selenium deficiency** had been contributing significantly to the problem in these calves.

In South Waikato, a 6-month-old heifer calf suddenly died. There were no diagnostic findings at necropsy but histopathological examination of the liver revealed a suppurative hepatitis consistent with **septicaemia**. Unfortunately no fresh liver tissue was available for culture, so the aetiological agent could not be identified.

A 2-year-old dairy heifer from Waikato was noticed to be inappetent and severely jaundiced 2 weeks after being given a zinc bolus to help control facial eczema. Serum zinc concentration from a blood sample was 300 umol/L (recommended levels for facial eczema control 18–34). The jaundice was considered to be the result of haemolytic anaemia secondary to **zinc toxicity.**

Eight well-grown Jersey calves from a group of 100 aged 4–5 months on an Otago dairy farm were found dead over a period of about a week. Necropsy of one calf revealed a marked fibrinous peritonitis and enlargement of the spleen and liver**.** A heavy pure growth of *Pasteurella multocida* was cultured from the peritoneal fluid, supporting

a diagnosis of ***Pasteurella multocida* type B septicaemia**. The entire group of calves was treated with a long-acting broad spectrum antibiotic and no more deaths occurred.

In similar case, also in Otago, ***Pasteurella multocida*** was again isolated from the peritoneal fluid of a 6-month-old Friesian heifer calf found dead with severe fibrinous pleuritis and peritonitis, 2 weeks after the incident reported above. This calf was from a group of animals that were reported to be struggling to thrive with sporadic respiratory disease clinical signs and low numbers of deaths.

Forty of 150 bull-beef calves died over a 2-week period on an Otago farm. This group of animals had been transported in several short, easy stages from the North Island and had been on the farm for a week before they started wasting and dying. All appeared to have lost weight since their arrival despite being treated with an anthelmintic on the first day. Necropsy of one calf revealed no obvious gross lesions. Examination of a faecal sample from this animal revealed no strongyle worm eggs but there were large numbers of coccidial oocysts present. Histopathological examination of sections of the small intestine and colon showed moderate mucosal damage associated with coccidia, supporting a diagnosis of **coccidiosis.** Recent wet weather may have contributed to the heavy burdens in these calves.

A large group of 1,100 four-month-old dairy calves was gradually formed on a South Canterbury run-off property as calves purchased from a number of suppliers were intermittently added when they had reached a target body weight of > 65 kg. Over a period of about a month, 30 of these calves had gradually lost weight and died. Another 40 calves had more recently been found to be losing weight so they were removed from the group for preferential care. Although most improved, eight of them died. Two sick calves were necropsied and fresh and fixed samples of a range of tissues were collected. Bacterial culture of the lungs revealed only a heavy, mixed growth of contaminating bacteria, but histopathological examination of sections of fixed lung revealed a suppurative bronchopneumonia consistent with ***Histophilus somni*** infection. This condition is often associated with environmental stressors, which in this case possibly included recent transport, very wet weather and repeated addition of new animals to the group.

In mid-January there were six small outbreaks of **polioencephalomalacia** in 5-to-6-month-old calves on Southland dairy farms. At that time there was a lot of lush grass growth in this part of the country owing to recent high rainfall; a recent change of diet to lush pasture is a risk factor for this disease. Affected calves showed a range of nervous signs including ataxia, blindness, seizures and recumbency. Occasional animals died suddenly without showing any prior clinical abnormalities. The diagnosis in each of these outbreaks was made by observing the typical histopathological changes expected in this disease in the fixed brains of affected calves.

During this quarter, there were a number of outbreaks of **respiratory tract disease** in groups of dairy calves aged 5 to 7 months, mostly in Southland. Initially they were usually thought to be due to lungworm infestations, but there was no response to anthelmintic treatment and no lungworm larvae were identified in the faeces. The affected calves were otherwise normal and mortalities were minimal. They appeared to respond clinically to empirical antimicrobial treatment, so further investigation was therefore not pursued, but unfortunately the aetiology of these outbreaks remains unclear.

Three dairy farms in Otago and Southland had confirmed cases of **atypical interstitial pneumonia** during this period. Initially only single animals were affected on each property but on one farm four of a group of 100 heifers died after a short period of dyspnoea. Most of the affected animals were 2-year-old dairy heifers. In each case, the diagnosis was based on histological changes consistent with this disease in samples of fixed lung tissue. This condition often occurs following a rapid dietary change from dry upland pastures to lush lowland feed, exposing cattle to elevated concentrations of L-tryptophan, but unfortunately the dietary histories in these cases were not available.

Over a period of 2 weeks, eight animals from a group of 600 milking cows on a Southland farm suddenly died. Clinical signs before death included a sudden drop in milk production and massive haemorrhaging from the mouth, nose and rectum. Some were recumbent for a short period before death. Necropsies revealed few changes apart from pallor of organs and petechial haemorrhages throughout the viscera. Other cows in the group developed subcutaneous wheal-like skin lumps but were otherwise well. Histopathological examination of a range of tissues collected from a freshly dead cow revealed extensive subendocardial congestion and haemorrhage, occasionally accompanied by a neutrophilic infiltrate. There were also large areas of haemorrhage in the tracheal lining and the urinary bladder wall. The submucosa of the abomasum was expanded by haemorrhage. Unfortunately the intestinal mucosa was autolysed but there was abundant blood in the intestinal lumen. At the time of their death these cows were being fed palm kernel expeller (PKE) and grazing flood-damaged pasture and crop. An adjacent farm of similar size with a similar number of milking cows was using the same batch of PKE but did not experience the same animal health problems. The cows on this adjacent property were not being fed any crops and the pasture they were on had not been flood-damaged. It was suspected that exposure to a toxic compound in the flood-damaged pasture or crop may have been a factor in these deaths. The changes observed were similar to the severe haemorrhages seen in cases of **bracken fern (*Pteridium esculentum*) toxicity** caused by young fern fronds containing high concentrations of ptaquiloside. Chronic ingestion by cattle over a few weeks eventually results in bone marrow suppression and death from **acute haemorrhagic disease** as a consequence of severe thrombocytopaenia. However, further investigation revealed no bracken fern on the property and unfortunately no haematological testing was done. Therefore the presence or absence of thrombocytopaenia is unknown and the aetiology of this incident remains unclear.

Ovine

On a Canterbury property, six of a group of 200 lambs that had been gathered into yards for tailing were found to be very weak and unable to stand. Two were necropsied. The skeletal muscles were described as being pale at gross examination. Histopathological examination showed that the muscles from both lambs

had necrosis and mineralisation of myofibres. These histological lesions, along with the history, were consistent with a diagnosis of **white muscle disease** caused by selenium or vitamin E deficiency. Unfortunately the lambs had been administered selenium just prior to necropsy, so the liver selenium concentration was found to be high when measured. Vitamin E measurement was not performed.

A 4-year-old Romney ram from Auckland had forefoot pain suggestive of laminitis, as well as abdominal pain and tachypnoea. Dietary indiscretion was suspected, including ingestion of prophylactic zinc therapy intended for alpacas on the same property. The serum zinc concentration was 72 µmol/L (reference range 9–20), supporting a diagnosis of **zinc toxicity**.

On a Southland sheep farm, 10 ewes died over 4-day period. They had a short episode of khaki-coloured diarrhoea before death. A heavy growth of a ***Salmonella*** species was isolated from a sample of faeces from one of the affected animals, confirming a diagnosis of **salmonellosis.**

A large number of mature ewes on an Otago sheep farm had multiple lumps under the skin that on investigation were found to contain a purulent exudate. Multiple swabs taken from the lesions of several affected ewes all yielded heavy pure growths of ***Corynebacterium pseudotuberculosis*** on bacterial culture. This is the agent of **caseous lymphadenitis** (CLA), also known as "lympho" or "cheesy gland". This is a highly transmissible bacterial skin disease that most commonly occurs after shearing, which can help to spread the infection. It can be difficult to clear infection from endemically affected farms. Once quite common, this disease is now rarely seen at the laboratory.

On a sheep farm in North Otago a thousand 1-year-old hoggets were vaccinated by a contractor using a conveyor system. Over the next week more than 50 of these animals developed **vaccination site abscesses** and 15 died. Other groups of sheep vaccinated the same day using the same vaccine and conveyor system were unaffected. It had rained briefly the previous day, so the animals in the affected group may have had wet skin. The unaffected groups may have avoided getting wet by being in covered yards when it rained. A sample of purulent exudate from a vaccination site lesion was cultured and a heavy pure growth of ***Trueperella pyogenes*** was isolated. This is a significant opportunistic pathogen commonly associated with suppurative lesions in animals. It can be found on the mucous membranes and skin of cattle and sheep. The affected animals that were still alive received antimicrobial treatment and the lesions resolved.

On a farm in Bay of Plenty, one sheep from a flock of 60 was found dead. Four others were obviously lethargic and unwell and the owner noticed "bottle jaw" (submandibular oedema) in some. The sheep had received a triple combination anthelmintic 5 weeks previously. Clinical examination revealed pallor of mucous membranes and subsequent laboratory testing showed a severe but strongly regenerative anaemia as well as a marked hypoproteinaemia. Faecal egg counts on two animals showed very high numbers of **strongyle** eggs. Although larval culture to identify the worm genera present was not requested, it was considered highly likely that **haemonchosis** was the cause of the clinical signs.

Cervine

A trophy stag on a South Canterbury farm was noticed to be losing weight. About 3 weeks later it was noted to have hypopyon and had an elevated temperature of 40.5°C (normal 38-39). Treatment with antibiotics had no effect and the animal died within 24 hours. At necropsy the kidney was observed to have pale areas in the cortex and at the junction of the cortex and medulla. Histopathological examination revealed that these lesions consisted of a chronic vasculitis and interstitial nephritis. Lesions of vasculitis were also evident in other organs including the brain. These lesions were typical of **malignant catarrhal fever** caused by **ovine herpesvirus-2**.

Porcine

Eight of 16 two-week-old Saddleback piglets from a Northland litter became progressively weak. Some displayed seizures or vomiting, or both, before dying. One presented live for veterinary examination had cyanotic extremities, tachycardia, tachypnoea and hypothermia, and died despite supportive care. Necropsy revealed non-specific changes including purple lymph nodes, reddened gastrointestinal tract and kidneys, gelatinous fat deposits, multifocal lung collapse or consolidation, and clear yellow pleural fluid. Another piglet presented for examination was depressed and had peripheral cyanosis, a reddened ventrum, hypothermia and seizures. Necropsy findings were similar to those from the first animal. Multiple tissues from both piglets were collected for histopathological examination, which revealed congestion and haemorrhage in addition to eosinophilic intranuclear inclusions in the endothelial cells of multiple organs including lymph nodes, lungs, kidneys, colon and spleen. A diagnosis of systemic **porcine cytomegalovirus** infection was made. This virus can cause a systemic infection in neonates or immunosuppressed piglets, typically in association with respiratory signs (e.g. sneezing and respiratory distress) and it may sometimes result in the death of entire litters.

Camelid

During this period there were two cases of alpacas with **malignant melanoma**. One was a 9-year-old female from Manawatu with a mass protruding from the lower eyelid. The other was an adult male from Stratford with an ulcerated mass on the corner of the jaw. In both cases, biopsy confirmed the diagnosis through demonstration of variably pigmented melanocytes with highly atypical features.

Equine

A 15-year-old mare from Wairarapa presented with a bulging mass over the left nasofrontal bone. Histopathological examination of a biopsy revealed granulomatous inflammation associated with abundant eosinophilic hyaline extracellular material. The material stained orange-red with Congo red stain and displayed birefringence under polarised light, confirming a diagnosis of **nasal amyloidosis.** This is an uncommon but recognised form of localised amyloidosis in horses, and the causes include chronic inflammation and plasma cell myeloma. However, most cases seem to be idiopathic. Lesions may be associated with dyspnoea, epistaxis and respiratory stertor.

A 2-year-old horse in Canterbury had a subcutaneous mass on the lateral stifle. The mass was well circumscribed. Histopathological examination showed that it was composed of large oval mononuclear cells, spindle cells and many multinucleated cells. Many of the multinucleated cells contained haemosiderin. These findings were consistent with a diagnosis of **giant cell tumour of soft parts**, a type of sarcoma. These tumours are sporadically seen in horses, and the area over the stifle is a relatively common site.

Avian

More than 30 percent of chickens from a commercial free-range layer farm in Horowhenua suddenly stopped laying, with no evidence of clinical disease. Three were euthanased and necropsied but nothing significant was found. Histopathologic examination of fixed tissues showed that one chicken had a necrosuppurative interstitial nephritis, another had a heterophilic pneumonia and oophoritis, and the third had a mild heterophilic hepatitis. Collectively these lesions were suggestive of septicaemia. These findings, in conjunction with the clinical history, were also considered suspicious for pasteurellosis. However, bacterial culture of fresh liver tissue from one of the birds yielded an isolate identified as ***Gallibacterium anatis***. This is a gram-negative bacterium in the family Pasteurellacae, closely related to *Pasteurella*. It is reported as a cause of increased mortality in intensively reared chickens, and poor weight gain in broiler chickens. In layer flocks it has been reported to cause a sudden drop in egg production, which can be confused with pasteurellosis, infectious bronchitis, avian influenza or Newcastle disease. It is a commensal of the upper respiratory tract and lower genital tract in poultry, but can cause sepsis, oophoritis, peritonitis, hepatitis, enteritis or respiratory disease in chickens. There are no pathognomonic lesions and culture of the organism is required for diagnosis. Other domesticated and wild birds can be infected and in overseas reports it is described as an emerging pathogen in poultry, with a propensity to acquire multiple drug resistance.

Canine

A litter of ten 2-month-old German Shepherd puppies in Waikato were clinically bright and active but had intermittent diarrhoea. Faecal material was collected for laboratory testing. Cultures for the potentially zoonotic enteric bacteria *Campylobacter* and *Salmonella* were negative. ELISA tests for *Giardia* and *Cryptococcus* were also negative and no worm eggs were found. However, there were very large numbers of coccidia in the faeces, resulting in a diagnosis of clinical **coccidiosis**. This is a relatively uncommon finding in dogs, but a month later there was another case in Waikato, this time in a 3-month-old Yorkshire Terrier puppy. Again, large numbers of coccidia but no worm eggs were seen in the faeces. No bacterial cultures were performed in this case but, in contrast to the previous case, a *Giardia* ELISA test was positive so ***Giardia* infection** may also have been contributing to the diarrhoea in this dog.

A 10-week-old heading dog puppy developed severe respiratory distress and was euthanased. Necropsy revealed the lungs to be diffusely firm and discoloured. On histopathological examination there was a severe interstitial pneumonia with marked type 2 pneumocyte hyperplasia. Multifocally, alveolar septa were disrupted by necrosis associated with low numbers of protozoal tachyzoites suspicious for *Toxoplasma gondii* or *Neospora caninum*. Subsequent PCR testing of fixed tissue identified the former, indicating a **protozoal pneumonia caused by *Toxoplasma gondii***. In this case the source of infection was likely to be ingestion of oocysts from the faeces of a wild kitten that had been seen regularly near the puppy's kennel.

Feline

A litter of four orphaned Domestic Longhaired kittens from a Ruapehu animal shelter presented with wasting, followed by anorexia, vomiting and death (or euthanasia). The kittens were 5–6 weeks old when the clinical signs began. On necropsy of one kitten gross pathological findings included dehydration, emaciation and a flabby small intestine with bile-stained mucoid contents. The latter correlated with the histopathological findings of necrotising enterocolitis with mucosal atrophy and marked crypt regeneration. These lesions were consistent with the clinically suspected diagnosis of **feline panleukopenia**. The virus that causes this is highly resistant and persistent in the environment, and while the disease is now uncommon thanks to widespread vaccination, it still occasionally causes disease, particularly where vaccinal and maternal immunity are lacking. The virus tends to target rapidly dividing cells in the enteric crypts and lymphoid system.

An 8-year-old Bengal cat from Manawatu went missing for a week and after it returned a jaw mass developed. Biochemistry testing at the veterinary clinic showed a marked increase in total protein (125 g/L; reference range 54–82) with a hyperglobulinaemia (104 g/L; reference range 15–57). A complete blood count was requested. There was an abnormal white blood cell differential scattergram but the total white blood cell count was within normal limits (15.6 x 10^9/L; reference range 7–20 x 10^9). Examination of the blood film revealed a large number of mononuclear round cells with features consistent with plasma cells (intensely basophilic cytoplasm, pale perinuclear golgi area, eccentric nuclei with a coarse chromatin pattern). These comprised 22 percent of all the nucleated cells present. Serum protein electrophoresis was performed and showed a classic monoclonal antibody pattern with a tall, narrow spike in the gamma-globulin region. Together with the other findings, this supported the presence of a neoplastic immunoglobulin-secreting B-cell tumour. Although immunophenotyping was not performed, the characteristic morphology of the cells seen in circulation supported a diagnosis of **plasma cell leukaemia** in this case, secondary to **feline myeloma-related disorder**. Unfortunately neither cytology nor histology were performed on the jaw mass.

A 10-week-old kitten from Auckland was failing to thrive and had passed adult nematodes in its faeces. Haematological and biochemical testing performed previously had shown a marked leucocytosis (54.7 x 10^9/L; reference range 7–20 x 10^9) with neutrophilia (41.5 x 10^9/L; reference range 2.5–12.5 x 10^9), lymphocytosis (12 x 10^9/L; reference range 1.5–7 x 10^9) and monocytosis (1.1 x 10^9/L; reference range 0–0.9 x 10^9). Serum electrolyte changes included hyponatraemia (sodium 136 mmol/L; reference range 147–160) and hyperkalaemia (potassium 6.3 mmol/L; reference range 3.6–5.6).

A sample of faeces contained 100 ascarid eggs per gram and moderate numbers of coccidial oocysts. It was also positive for ***Giardia*** when tested using an antigen ELISA. These findings supported a diagnosis of **combined ascariasis, coccidiosis and giardiasis**. The inflammatory leucocytosis and electrolyte changes found in the blood tests were considered likely to be due to severe endoparasitism and enteritis.

Lagomorph

Three rabbits from Auckland were found dead. Necropsy revealed what appeared to be abscesses in their viscera. Fixed tissues submitted for histopathological examination showed hepatic inflammation centred on bile ducts (cholangiohepatitis) with intralesional coccidial life stages, consistent with **hepatic coccidiosis** caused by ***Eimeria stiedae***. This species of coccidia has a direct and host-specific life cycle. Sporozoites migrate from the intestinal tract to the liver and develop within the biliary epithelium. Oocysts are shed in the bile and subsequently in the faeces. This infection may often be subclinical, but is capable of causing debilitation and death in young rabbits.

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Quarterly report of investigations of suspected exotic diseases: January to March 2020

Exotic disease investigations are managed and reported by Diagnostic and Surveillance Services, Wallaceville. The following is a summary of investigations of suspected exotic and emerging diseases during the period from January to March 2020.

African swine fever excluded

A veterinarian in Auckland contacted MPI via the exotic pest and disease hotline to report possible African swine fever (ASF) in 2-week-old piglets from a small backyard piggery. A sow had produced 16 piglets, of which six died suddenly. The sow remained healthy. Clinical signs prior to death included vomiting and seizures. Causes of death in piglets include exotic viruses such as ASF, classical swine fever (CSF) and porcine reproductive and respiratory syndrome (PRRS). Endemic causes include circovirus-associated disease and bacterial sepsis. Two freshly dead piglets underwent post-mortem examination under the direction of an Incursion Investigator, and fresh and formalin-fixed samples were collected. Fresh tissues were sent to MPI's Animal Health Laboratory (AHL), where molecular assays for ASF, CSF and PRRS returned negative results. Histopathology showed changes including interstitial pneumonia in both piglets; one also had a focal enteropathy and the other an encephalopathy. Porcine circovirus was considered a likely cause, but confirmatory diagnosis was not pursued further. Exotic disease was excluded and the investigation was closed.

Mastitis event investigated

A West Coast veterinary practitioner contacted MPI via the exotic pest and disease hotline to report a farm affected by high-morbidity mastitis and lameness in dairy cows. The vet was concerned that this could be the result of infection with *Mycoplasma bovis*. The investigation was referred to MPI's *Mycoplasma bovis* programme (https://www.mpi.govt.nz/protection-and-response/mycoplasma-bovis/) and a veterinarian visited the farm, examined affected cows and collected milk and blood samples for testing at the AHL. *M. bovis* was excluded by serology and PCR testing, and the investigation was transferred back to the incursion investigation team to check for other pathogens. The mastitis cases were re-sampled by the local veterinarian and submitted to a regional laboratory for aerobic culture. Microscopic examination of the milk samples did not find evidence of infection with the alga *Prototheca*. Culture results confirmed 21 cows had *Staphylococcus aureus*, eight had *Streptococcus uberis* , and one sample was contaminated and thus of no diagnostic value. The summer timing of sampling was not ideal as the epidemic of mastitis had started in spring. The lack of response to intramammary therapy is more consistent with *S. aureus* as the predominant pathogen, rather than other streptococcal species, because its intracellular proclivity requires extended exposure to high concentrations of antibiotics for an effective cure. Furthermore, the rapid increase in number of mastitis cases during spring was consistent with a cow-associated organism (such as *S. aureus*) that is spread by milking equipment. It was concluded that this event was most likely caused by *S. aureus*, while exotic *Mycoplasma* species including *M. bovis* were ruled out, and the investigation was closed.

Rabbit pox excluded

A veterinary pathologist contacted MPI via the exotic pest and disease hotline to report a possible case of rabbit pox in a pet rabbit. A sternal skin mass had been present for about a year, but had recently increased in size and begun to ulcerate. There were five other rabbits in the household and these were unaffected. The mass had been excised and histology had revealed sheaves of spindle-shaped cells mixed with small nodules of more irregular-shaped cells and collagen. These findings were consistent with a soft-tissue sarcoma such as Shope fibroma, which is caused by rabbit poxvirus (**Figure 1**). Tissue samples were submitted to the AHL (Wallaceville), where a generic molecular assay for poxviruses returned a negative result. This enabled rabbit pox to be excluded as a possible cause of the sarcoma, and the investigation was closed.

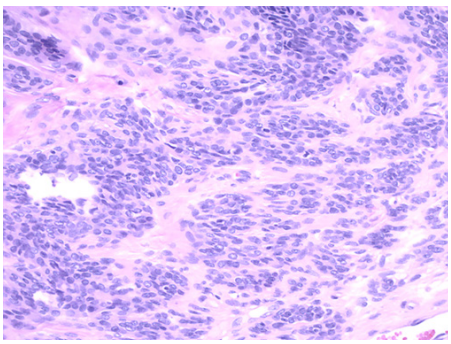

Figure 1: Sheaves of spindle-shaped cells mixed with collagen, potentially consistent with Shope fibroma (H&E stained, 200x). Photomicrograph by Alan Julian, IDEXX.

Rabbit liver lesions investigated

A member of the public in Northland contacted MPI via the exotic pest and disease hotline to report what he thought were tuberculosis-like lesions in a rabbit he had shot to feed his dog. The rabbit liver contained many small pale linear lesions he described as "micro-abscesses". Although the notifier had disposed of the carcass by the time he called the hotline, he subsequently shot two more rabbits whose livers again contained multifocal well-demarcated white lesions, which he considered were similar to what he had previously seen. Tissue samples were collected into formalin and submitted for histopathological examination. Microscopically the livers exhibited massive dilation of the bile ducts with numerous coccidia, presumed to be *Eimeria stiedae*, a common and widespread coccidial parasite of rabbits that causes liver lesions. Exotic disease and bovine tuberculosis were ruled out and the investigation was closed.

Rabies virus excluded

A companion animal veterinarian contacted MPI via the exotic pest and disease hotline to discuss a progressive neurological condition, potentially consistent with rabies, in a 5-year-old neutered male Domestic Medium-haired cat. Furthermore, the cat had bitten its owner. The indoor/outdoor cat had been intermittently disorientated for 4 days. On the fifth day it was presented to the veterinarian because the abnormal behaviour had progressed to staring at the wall, head-pressing, and what was described as "kicking at his head" and "doing somersaults". In the veterinarian's consulting room the cat appeared hunched and in pain; it was also fractious and bit the owner. After light anaesthesia to enable further examination the cat suddenly revived, bit the bars of the recovery cage and growled very loudly. The likelihood that it had a brain tumour was discussed with the owners, who then elected to have the cat euthanased. Subsequently the veterinarian considered rabies as a differential and called MPI. Rabies is a significant exotic zoonotic viral disease of the lyssavirus family and causes progressive, fatal encephalitis with behavioural changes (Spickler, 2012). New Zealand has robust import health standards for cats and dogs, to prevent the entry of rabies. This cat had not been imported, but given its access to the outdoors there was a remote possibility that it could have come into contact with a rabid cat or dog brought into New Zealand by an unofficial route. The duty Incursion Investigator arranged for necropsy, and the cat's brain was submitted to the AHL, then sent to the Australian Animal Health Laboratory in Geelong, Victoria, for lyssavirus fluorescent antibody testing and PCR. Both assays were negative, enabling rule-out of rabies. The investigation was closed. Subsequent histopathological examination identified a peri- and intra-ventricular tumour consistent with an ependymoma, which is a rare tumour arising from cells lining the ventricles of the brain. In a study of 18 cats with ependymal tumours, clinical signs included altered mentation or behaviour, seizures, circling, propulsive gait, generalised discomfort and loss of condition (Woolford et al., 2013).

Canine distemper virus excluded

A veterinarian in Northland called the exotic pest and disease hotline to report possible canine distemper in a 4-week-old puppy that presented with fever, anorexia and a slight head-tilt. Its four littermates were healthy. Distemper is a notifiable viral disease whose clinical signs include encephalitis. Whole blood and a nasal swab were collected and submitted to the AHL, where PCR testing for distemper virus returned a negative result. The pup was eventually euthanased owing to progression of the neurological signs. Post-mortem examination found that it was hydrocephalic, with probable parietal hypoplasia and crania bifida. A congenital defect was established as the cause and the investigation was closed.

Canine brucellosis excluded

A veterinary pathologist called the exotic pest and disease hotline to report possible brucellosis in a dog with orchitis. The 6-year-old Huntaway dog was off-colour and lethargic, with a fever and a swollen, painful testicle. One cause of orchitis and epididymitis in dogs is *Brucella canis,* a bacterial pathogen exotic to New Zealand. An aspirate sample was collected and cytology showed the presence of inflammation. The dog was subsequently castrated, and serum and testicular tissue samples were collected and submitted to the AHL. PCR testing of fresh testicular tissue for *B. canis* was negative, and serum was negative in the *Brucella* card test. Exotic disease was excluded and the investigation was closed.

Blastomycosis excluded

A veterinary pathologist called the exotic pest and disease hotline to report a possible case of blastomycosis after yeast-like cells were identified in skin scrapings from a 6-year-old domestic cat with pyogranulomatous skin lesions. Blastomycosis is caused by the exotic saprophytic fungus *Blastomyces dermatitidis*, and has never been reported in New Zealand. Follow-up samples including whole blood, serum and urine were collected and tested for antigen by enzyme immunoassay. All samples were negative. The lesions resolved uneventfully and the investigation was closed.

Histoplasmosis excluded

A veterinary pathologist called the exotic pest and disease hotline to report finding a suspected exotic fungal organism in lymph-node aspirate from a 1-year-old spayed female Labrador Retriever. The dog had presented with a subcutaneous inguinal mass, but was otherwise well. Aspirates from the lymph node showed a mixed pyogranulomatous and lymphocytic population. The suspect organism was found intracellularly within a macrophage, and resembled the exotic fungal organism *Histoplasma capsulatum*. Only a single structure was seen. *H. capsulatum* is exotic to New Zealand but is present throughout the rest of the world, often in association with bird and bat excrement. The dog in this case had not travelled overseas and had not associated with any animals that had travelled, but nevertheless histopathology was pursued to exclude *H. capsulatum*. Histopathological findings were consistent with the cytology, showing pyogranulomatous inflammation. No agents were detected by H&E or other stains for bacteria and fungi. The cause of this lesion was not found, but histoplasmosis was excluded and the investigation was closed.

Exotic ticks excluded

A member of the public in the Auckland region called the exotic pest and disease hotline to report finding a tick on his cat. Tick surveillance is important because of the potential for incursions of exotic ticks such as the brown dog tick (*Rhipicephalus sanguineus*) and the exotic disease agents that ticks can vector. Exotic ticks can infest companion animals, but this cat was not imported and no member of the household had recently travelled overseas. The New Zealand cattle tick, *Haemaphysalis longicornis,* can also be found on other domestic animals, including cats, and there were cattle on the adjacent property. The tick was submitted to PHEL (Tamaki) and confirmed to be a NZ cattle tick. The investigation was closed.

In a similar case, a member of the public in Auckland called the exotic pest and disease hotline to report finding a tick on their dog. The owner had recently returned with the dog from Northland. The tick was sent to PHEL (Tamaki), where it too was identified as

H. longicornis. The investigation was closed.

Pigeon rotavirus confirmed in racing pigeons

An avian veterinarian contacted MPI via the exotic pest and disease hotline to report possible pigeon rotavirus in racing pigeons soon after a Canterbury-based race in March 2019. Pigeon rotavirus is a highly contagious viral disease that causes depression, regurgitation, diarrhoea and hunched posture. It spread through Australian pigeons during 2016 and 2017 (Hunnam et al., 2019) and through pigeons in Europe in 2017 (Rubbenstroth et al., 2019). After the New Zealand race, pigeons from three racing lofts experienced vomiting and diarrhoea that resembled the clinical signs seen overseas. Mortality was about 5 percent. Histology on the livers of autopsied pigeons showed hepatic necrosis similar to that reported overseas with pigeon rotavirus (McCowan et al., 2018). RTqPCR testing was carried out by Biosecurity New Zealand in partnership with the Australian Animal Health Laboratory in Geelong, Victoria, and pigeon rotavirus was confirmed as the cause of the outbreaks. The NZ virus was confirmed to be most closely related to the Australian pigeon rotavirus strains, using archived materials from a similar outbreak in December. Dates of infection in some lofts were eventually traced back to late December 2018 using archived samples. The disease was subsequently confirmed in 16 racing pigeon lofts around New Zealand. The pathway of entry into New Zealand is unclear, but possibilities include migrating birds and accidental introduction on contaminated equipment. The Australian strain is closely related to a rotavirus isolated in Europe in 2017, indicating that intercontinental spread is not unprecedented. An MPI response was initiated in March 2019, aimed at ensuring pigeon breeders are informed about the disease and its control and management within lofts. Since the disease was already widespread at the time of notification, eradication was not considered possible. More information can be found at MPI's pigeon rotavirus response, https://www.mpi.govt.nz/protection-and-response/responding/alerts/pigeon-rotavirus/.

Avian influenza and Newcastle disease in wild birds excluded

Several members of the public called MPI and the Department of Conservation (DOC) to report mass illness of red knots (*Calidris canutus*) at the Miranda bird sanctuary, with clinical signs including emaciation and inability to fly. The number of birds affected increased to 25 over 3 days. Mortality was not a feature of the illness, and the birds were initially taken to a local wildlife clinic for testing and supportive treatment. Avian influenza virus and Newcastle disease virus were ruled out by molecular testing of choanal and cloacal swabs at the AHL. A blood smear from one bird revealed large numbers of protozoal haemoparasites consistent with *Haemoproteus* sp. (avian malaria). Botulism or some other intoxication was considered as a possible cause or contributor. Botulism was considered unlikely because clinical signs were not typical, and toxicity associated with an algal bloom or shellfish is difficult to confirm owing to the vast number of possible agents and unavailability of laboratory tests. Exotic disease was excluded and the investigation was closed.

Figure 2 A: Southern black-backed gulls (*Larus dominicanus*) from a mass mortality event on a Horowhenua beach. Photo: Shaun Garea.

Figure 2 B

A member of the public contacted MPI via the exotic pest and disease hotline to report a mass mortality of southern black-backed gulls (*Larus dominicanus*) on a Horowhenua beach. Dead birds were littered along several hundred metres of shoreline (**Figure 2**) and other birds displayed neurological signs of varying severity. Concurrent reports indicated that this scene was replicated along 15 km of adjoining beaches and coastline, with a conservative estimate of up to 200 dead gulls. Fifteen birds were submitted to Massey University Wildbase Pathology for post-mortem examination and sampling. Oral and cloacal swabs were collected into avian transport medium, and a range of fresh tissues from three gulls were submitted to the AHL, where PCR tests for avian influenza, avian paramyxovirus-1 and West Nile virus were negative, ruling out exotic disease. Investigation of this event is continuing.

Seal mortality investigated

A member of the public called the exotic pest and disease hotline to report four dead New Zealand fur seals (*Arctocephalus forsteri*) washed up on a Canterbury beach. An AsureQuality veterinarian was sent to confirm the report and collect material for testing, but only one animal was fresh enough for a worthwhile necropsy. The male seal pup was sent to Wildbase Pathology for post-mortem examination and histology. Examination revealed signs of pneumonia, and histology revealed filling of the small bronchi, bronchioles and alveolar septae by degenerate neutrophils admixed with pyknotic debris and aggregates of gram-negative coccobacillary bacteria. The cause of death was determined to be severe gram-negative bacterial bronchopneumonia, most likely acquired through extension of bacteria from the upper respiratory tract rather than a primary bacteraemia. Bacterial bronchopneumonia can be the result of underlying compromise of the respiratory tree (such as initial viral infection or immunosuppression), or it may be secondary to other stressors such as declining body mass. Confirming the cause of death in marine mammals is often complicated by autolysis and the difficulty of obtaining

samples. No definitive reason for the cluster of mortalities was found, but the mortality event abated and the investigation was closed.

Tracheal mite excluded

A beekeeper called the exotic pest and disease hotline to report sudden high mortality in one of two hives at the apiary site. Over the 24 hours prior to the notification, a number of dead and dying bees were seen just outside the entrance of the affected hive. In discussion with an Apiary Officer, and as part of general surveillance for exclusion of relevant bee exotic agents, a sample of bees was submitted to PHEL (Tamaki), where tracheal dissection excluded the presence of tracheal mites (*Acarapis woodi*). An exotic component was excluded and the colony gradually recovered. The investigation concluded that the most likely cause of the mortality was exposure of bees to a toxin. Exotic agents were excluded and the investigation was stood down.

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Quarterly report of investigations of suspected exotic marine and freshwater pests and diseases: January to March 2020

Exotic disease investigations are managed and reported by the MPI Diagnostic and Surveillance Services, Wallaceville. The following is a summary of investigations of suspected exotic marine and freshwater diseases and pests during the period from January to March 2020.

New to New Zealand alga, Lyttelton

NIWA notified MPI of a new to New Zealand alga collected during the MPI Marine High Risk Site Surveillance survey (MHRSS) in Lyttelton. Several specimens were collected from marina pontoons at two locations. Molecular sequencing identified the species as *Fushitsunagia catenata* whose native range is Japan and Korea. The type locality is Shimodo, Japan. *F. catenata* has not previously been reported outside its native range so the likelihood of its becoming established in New Zealand is hard to assess. Environment Canterbury was notified of the detection and the risk assessment, and the investigation was closed.

Unusual green seaweed, Whangarei

A member of the public swimming at Whangarei Heads noticed an unusual ball of seaweed attached to a rock. Photos were taken of the seaweed and sent to MPI for identification. The alga was tentatively identified by an Incursion Investigator as the native green alga *Codium fragile*. The photos were sent to NIWA's Marine Invasives Taxonomic Service (MITS) taxonomists, who confirmed the identification. As *C. fragile* is native to New Zealand, there was no biosecurity risk and the investigation was closed.

Skin lesions on grey mullet, Paparoa, Northland

A member of the public caught a grey mullet (*Mugil cephalus*) with unusual skin lesions. The fish was one of several caught, but only one displayed the symptoms. The fish was sent to the MPI Animal Health Laboratory (AHL) for testing to rule out exotic strains of *Aeromonas salmonicida,* the bacterium that causes the disease furunculosis. PCR tests were negative for *A. salmonicida*, but positive for *Myxobolus episqamalis*. This myxozoan parasite was first detected on grey mullet in New Zealand in 2015. It causes granular lesions on the scales and fins of grey mullet, which affect the appearance of the fish but have not been associated with mortalities. The prevalence of the parasite appears to be low within the fish population and it has likely been naturally present in New Zealand for many years but hitherto undetected. As it is established and widespread in New Zealand the investigation was closed.

Tubeworms found on vessel hull, Napier

Hawke's Bay Regional Council staff found several unknown polychaete tubeworms on a vessel hull during a hull inspection in Napier Harbour. Photos of the tubeworms were sent to MITS for identification. A NIWA taxonomist identified the worms as from the serpulid family, most likely a *Hydroides* species. A sample was needed for identification to species level but the vessel had already left Napier. A traceback of the vessel's movements over the previous 12 months indicated it had only travelled in New Zealand waters, including Whangarei, Great Barrier Island, Slipper Island, Tauranga, Hicks Bay, Tolaga Bay and Gisborne. Several species of *Hydroides* tubeworms are already present in New Zealand. The risk that this was a new to New Zealand species appears to be low and therefore the investigation was closed.

Dead crabs washed up on Back Beach, Nelson

A large number of dead crabs were washed up on an estuarine beach near Nelson. Videos of the dead crabs show a large number distributed along the high tide mark. The species could not be confirmed from the video, but based on the habitat was likely to be the endemic species *Hemiplax hirtipes*, commonly known as stalk-eyed mud crab and a common estuarine species. No sample of the crabs was collected by the notifier, so the cause of death could not be determined. No subsequent mortality events have been reported. Environmental conditions at the time were hot and sunny with a strong breeze, which may have contributed to the mortalities.

Unusual organisms washed up, Southland

The notifier found a large number of unusual, fleshy organisms washed up on Oreti Beach in Southland. They ranged in size from about 10 to 30 cm. Photos were sent to MITS for identification. Taxonomists identified the organisms as an indigenous holothurian (sea cucumber), *Paracaudina chilensis*. This species (**Figure 1**) lives buried in soft sediment and can be exposed by severe weather and waves. As there was no biosecurity issue the investigation was closed.

New to New Zealand seaweed, Wellington

A Victoria University staff member collected seaweed specimens they believed were *Schizymenia apoda* in Whairepo Lagoon, a small inlet in downtown Wellington. *S. apoda* is a non-indigenous red alga established in several New Zealand ports and was first reported in 2009. The specimens were sequenced by Victoria University as part of a research project and identified as *S. dubyi*, which is morphologically very similar to *S. apoda* and can only be differentiated by molecular techniques. In fact both species were growing together in the lagoon. *S. dubyi* is widespread throughout the world, including

Australia. New Zealand has three native *Schizymenia* species and it is likely that *S. dubyi* has been present for some time but assumed to be one of the other species. NIWA is re-examining samples collected from other ports to determine whether *S. dubyi* may be more widely distributed. There is no biosecurity risk associated with this species and therefore the investigation was closed.

Suspect ascidian on vessel hull, Picton

Marlborough District Council biosecurity officers observed ascidians suspected to be *Clavelina oblonga* on a vessel in Picton that originated from Wellington. This is a non-indigenous ascidian currently only known to be present at Smokehouse Bay, Great Barrier Island. Photos of the ascidian were sent to MITS, where they were identified as the closely related *C. lepadiformis* (lightbulb ascidian), another non-indigenous species known to occur in both Picton and Wellington. As the species was already established in Picton, there was no additional biosecurity risk and the investigation was closed.

Fish mortality, Lake Taupo

A member of the public reported seeing more than 10 small dead fish during a morning swim in Lake Taupo. The notifier believed the fish may have been trout, and described the water as unusually warm in the area where the dead fish were seen. Many freshwater fish, including trout, are sensitive to high water temperatures, which are often correlated with low levels of dissolved oxygen. No sample was able to be collected owing to the delay between observing the fish and reporting them to MPI. The notifier was asked to contact MPI again if they again noticed any similar events. The cause of death was inconclusive but may have been related to water temperature.

Suspect grey side-gilled sea-slug, Auckland

A member of the public notified MPI of a large number of sea-slugs on Kohimarama Beach, Auckland. The notifier believed they might be grey side-gilled sea-slugs (*Pleurobranchaea maculata*). Consumption of dead *P. maculata* was implicated in the death of several dogs in 2009 after the slugs were found to have tetrodotoxin present in their bodies. Photos of the sea-slugs were requested, to rule out *P. maculata*. The photos were consistent with the ragged sea hare (*Bursatella leachii*), which occurs worldwide, including in New Zealand waters, and MITS confirmed this identification. In late summer, *B. leachii* spawn en masse in shallow tidal bays and then die. Large numbers of them may then wash ashore. The investigation was closed.

Figure 1: Specimens of the holothurian *Paracaudina chilensis* washed up on Oreti Beach, Southland. (Photo: Macaela Hawkins.)

Shellfish mortality, Horowhenua

A Fisheries Officer contacted an Incursion Investigator to report a mass mortality of shellfish at Waikawa beach on the Horowhenua coast. The mortality event had actually occurred 3 days previously and although specimens were collected, unfortunately they were not suitable for diagnostic testing. The main species collected were *Dosinia anus*, but *Crassula aequilatera*, *Paphies subtriangulata*, and *Spisula discors* were also present. The cause of the mortalities remained inconclusive.

Dead fish in estuary, Bay of Islands

A member of the public reported a large number of small dead fish in a shallow waterway near some mangroves. Photos of the fish were requested, but were not of sufficient resolution to identify the species. An Incursion Investigator sent a collection kit for the notifier to collect some specimens for diagnostic testing at the AHL, but transport delays meant that no specimens were able to be collected. It is possible that the shallow tidal location and large number of fish contributed to a case of localised oxygen depletion. Additionally, biotoxin testing by MPI near the site indicated elevated levels of icthyotoxic plankton that may have also contributed to the mortality. However, the cause remained inconclusive.

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Biological risk of *Calathea* house plant investigated

When a consignment of various house-plant species was imported into New Zealand for commercial propagation, one species, *Calathea orbifolia* (Magnoliopsida: Marantaceae), was denied border entry as it was not listed on MPI's Plants Biosecurity Index (PBI). The importer queried this decision, pointing out that this species was currently offered for sale in NZ. MPI's Plant Health Incursion Investigation Team was subsequently notified and an investigation initiated to determine the biological risk associated with this plant.

While there are more than 20 species of *Calathea* and numerous cultivars, the investigation determined that it was unclear exactly how many are present in NZ or how long they have been here. It is known that some species have been cultivated here for many decades as house plants, but interpretation of available information is difficult owing to the large number of synonyms of some species (e.g. >10 for one species). In addition, traded plants are called by a mixture of currently accepted species names, old species names (synonyms) and varietal names. Despite this complexity, when a list of *Calathea* plants currently offered for sale is compiled from NZ websites and compared with the PBI, some species are present and traded but are not on the PBI, including *C. orbifolia*.

It is not unusual for a plant to be present and commercially propagated in NZ yet absent from the PBI. The PBI is a list of species that have been assessed by MPI to identify any biosecurity risks, and for which measures have been identified in an Import Health Standard (IHS) to manage the risks if those species are imported. While all plants on the list are accepted by the Environmental Protection Authority (EPA) as present in NZ, the PBI is not a list of all plant species present in NZ, nor does it list endemic species. Many (possibly thousands) of exotic plant species likely to be present in NZ are absent from the PBI and other NZ databases. Plant importers frequently assume that all the species present in NZ are known and listed somewhere, but this is not the case: it is still unclear how many exotic plant species are present, particularly garden and amenity species.

Despite cultivation of *Calathea* house plants for many decades, investigation found no readily accessible records of *C. orbifolia* or other *Calathea* species in NZ herbaria or in other mainstream collections and databases. As indicated above, this is not surprising, as records of many exotic garden and amenity plant species are informal, such as plant stock lists and nursery catalogues. Botanical names may be used loosely in these informal records so it can be difficult to determine the correct species names and identities of plants listed. These records are not considered reliable for biosecurity regulatory purposes, although they are obviously useful for indicative reasoning during investigation. Hence, the absence of a plant species from NZ databases is not evidence that it was previously absent from the country.

To check the authenticity of the plant being traded as *C. orbifolia*, a single plant labelled *Calathea orbifolia* was purchased from a garden centre (**Figure 1**) and sent to Manaaki Whenua – Landcare Research's (MWLR) botanists for identification. Based on morphological analysis, MWLR confirmed the specimen as *C. orbifolia*. Molecular analysis of leaf samples sent to EcoGene further confirmed this.

Figure 1: *Calathea orbifolia* plant.

A core function of the Plant Health Incursion Investigation Team is to investigate and assess the biological risk of species newly detected by our targeted and general surveillance programmes (mostly notified through the pest and disease hotline, 0800 80 99 66). Apart from the incident in question, the investigation found no evidence of other imports (including illegal imports) of *C. orbifolia* into NZ. This indicated that the species had been present and cultivated here for many years and had been distributed widely as a result. Regardless, because a full risk assessment and IHS did not exist for *C. orbifolia*, the Incursion Investigator made an initial assessment of the biological risk to determine whether further action was warranted. The investigation concluded that the biological risk was very low and no further action by MPI was justified. *Calathea* spp. are tropical plants with a low risk of naturalisation in NZ and no reference could be found suggesting any invasive potential. Additionally, the investigation concluded there were many plants in NZ similar to *C. orbifolia*; that is, plants that have been present and cultivated here for many decades, yet not recorded on official lists, including the PBI. Historic investigations by incursion investigators are testament to that.
As highlighted in this investigation, there is inadequate cataloguing of cultivated plants in NZ. This has implications for commercial growers and plant breeders acting in good faith, and can also impede the enforcement of the law regarding illegal plant imports. It is also an impediment to the EPA's determination of a plant's "New Organism" status under the Hazardous Substances and New Organisms (HSNO) Act 1996 (that is, its presence in NZ prior to 29 July 1998). An improved, more definitive list of all the plant species present in NZ is required.

Therefore, it is very encouraging to announce that a major initiative to significantly improve the documentation and recording of cultivated plants in New Zealand has been funded through MPI's Sustainable Food & Fibre Futures fund and industry partners: the Royal NZ Institute of Horticulture Inc, MWLR

and several horticultural organisations. The 3-year project "Taking Stock: Resolving New Zealand's Cultivated Plants Problem" commenced in January 2020 and aims to co-ordinate scattered information, check the taxonomy of species and document the correct and current plant names. The resulting information will be publicly available on the New Zealand Plant Names Database (Ngā Tipu o Aotearoa) and the New Zealand Organisms Register (NZOR). This project will also submit applications to the EPA for section 26 presence in NZ determinations.

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Plant health surveillance and incursion investigation report: January to March 2020

The Ministry for Primary Industries (MPI) Biosecurity Surveillance and Incursion Investigation Plant Health (BSIIPH) Team and Plant Health and Environment Laboratory (PHEL) investigate and diagnose suspect exotic pests and diseases in the plant and environment sectors. Incursion Investigators (IIs) and PHEL scientists are based in Auckland, Wellington, Rotorua and Christchurch. These teams provide field investigation, diagnostic testing and technical expertise to detect and report new pests and diseases affecting plants and the environment. They support surveillance and response functions, including carrying out research and development for better diagnostic tools and processes to manage biological risks.

Incursion Investigators received 389 plant and environment notifications (**Figure 1**) during the 3-month period, 100 fewer than for the same period in 2019. New Zealand confirmed its first case of Covid-19 coronavirus on 28 February 2020. By then the novel coronavirus outbreak had already slowed global trade, with more than 60 countries reporting cases of Covid-19, limiting travel, trade and shipping. Consequently, New Zealand importers and exporters reported very significant disruptions to global supply chains. It is highly likely that the reduced number of notifications during this period correlated with the Covid-19 pandemic that restricted international travellers and trade into New Zealand.

Of the 389 notifications, investigators immediately stood down 79 cases as a biological risk was ruled out. A further 37 notifications were redirected to other agencies responsible for managing the pest concerned. The rest (273 cases), were further investigated to rule out a biosecurity issue.

During this period, 13 suspected new to New Zealand organisms were reported, most being plant-associated fungi. During the investigation, expert advice is often sought from internal stakeholders such as MPI's PHEL, Plant Imports, Biosecurity Science & Risk Assessment (BSRA), Legal, Compliance, and Intelligence and Targeting Teams (ITT). In some investigations external industry stakeholders are consulted, particularly if the host is of significance to any of our Government Industry Agreement (GIA) partners. Several of the 13 new to New Zealand cases still remain active, as the investigations to confirm or rule out a new organism can take several months. Once the organism's status is confirmed, the investigation outcome is reported in the plant health surveillance and incursion investigation report. Some examples of the outcomes from this period and earlier notifications are provided below.

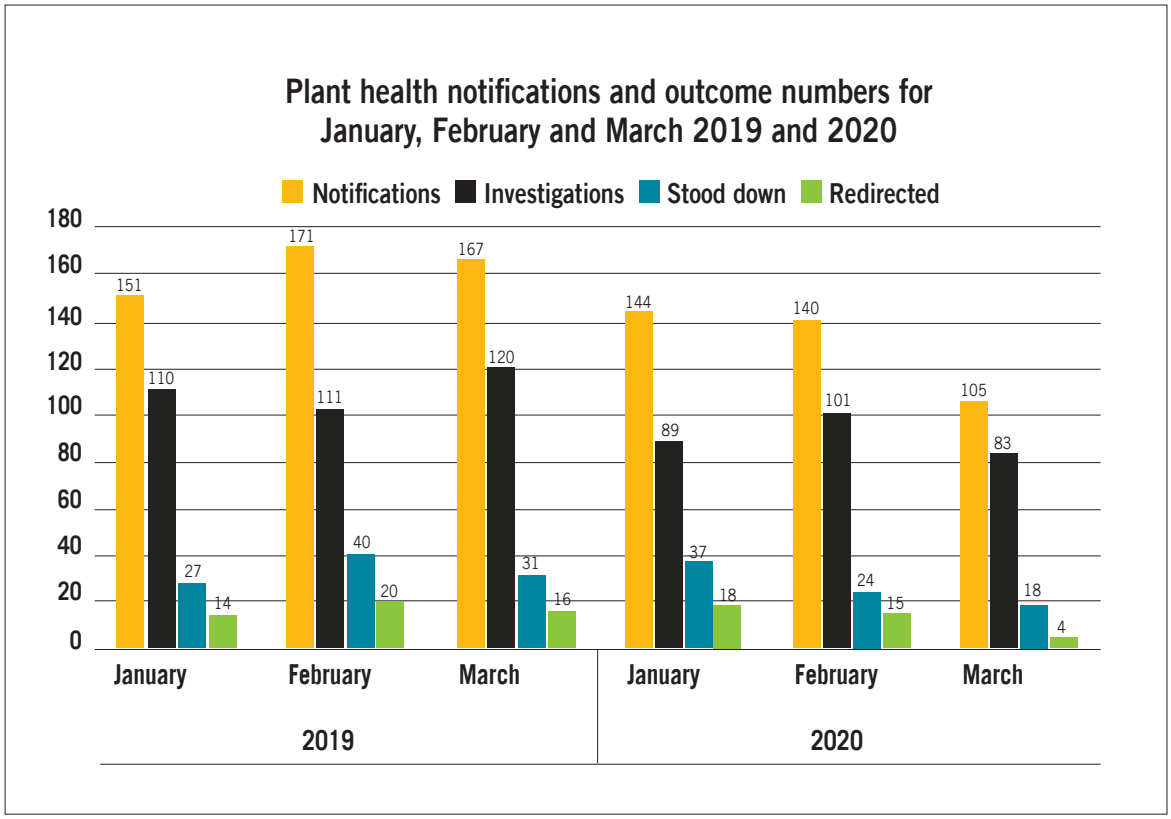

Figure 1: Plant health notifications, investigations and other outcomes, January – March 2019 and 2020

Suspected new to New Zealand organisms

New tropical house cricket

The manager of a boatyard in a light industrial area backing onto a Port of Tauranga container yard captured an unusual live cricket and notified a Senior Quarantine Officer. The specimen was provided to PHEL Entomology and identified as an exotic species, the tropical house cricket *Gryllodes sigillatus*. This species is not present in New Zealand and is listed as an unwanted and regulated organism. It is thought to be native to southern or southeast Asia, although it now has a worldwide distribution generally restricted to warmer tropical climates. *G. sigillatus* is regarded as a "nuisance pest" because it exists almost exclusively around human habitation, sheltering in cracks and crevices in brickwork, between pavement blocks and surrounding buildings. It is omnivorous and active at night.

The notifier heard cricket noises in the walls of the property for at least a month before catching the cricket and notifying Biosecurity New Zealand via the exotic pest and disease hotline (0800 80 99 66). In the previous 3 months the boat company had imported goods from Brisbane, Australia, where *G. sigillatus* is present. To investigate whether a population existed, in late August 2019 the II conducted a site inspection, focusing on suitable habitats inside and outside the building, the area around the point of detection, and other areas where the notifier had heard cricket noises. A single live cricket, later identified by PHEL as an adult male *G. sigillatus*, was found in one of the areas where the notifier had previously heard cricket noises. Suspecting an established population, Flybusters/AntiAnts (FBA) was contracted to treat and monitor the detection site and neighbouring premises. A barrier spray (Termidor 100SC) was applied, and a flushing agent (pyrethrum and piperonyl butoxide mixture) was applied to cracks and crevices that could possibly harbour crickets. Coinciding with increased night temperature favouring cricket activity, post-treatment monitoring using 10 baited dome/pitfall traps and 15 glue boards commenced in early October 2019. This resulted in the detection of 25 *G. sigillatus* individuals of differing life stages, indicating that reproduction had occurred at the site. Consequently the monitoring period was extended for a further 75 days, with traps being serviced fortnightly until January 2020. The population at the boatyard was eradicated under urgent measures by treating the infestation area and conducting follow-up monitoring surveys for 3 months, confirming zero cricket activity. The notifier has not reported any more cricket activity.

New fungus on grapevines

In 2010 grape plants, *Vitis vinifera*, showing signs of dieback were submitted from a vineyard in Hastings to PHEL Mycology for analysis. A fungus that was suspected to be an undescribed *Coniothyrium*-like species was isolated from that sample and sent to the Westerdijk Fungal Biodiversity Institute (formerly the Centraalbureau voor Schimmelcultures) in the Netherlands for validation. Westerdijk Institute mycologists confirmed that it was an undescribed species and described it in 2019 as *Neoconiothyrium viticola*. This species is likely a saprophyte or opportunistic pathogen and already established in New Zealand, therefore not a biosecurity issue.

New fungus on cedar

The fungus *Heterotruncatella spartii*, which had not previously been recorded from New Zealand, was found recently in Ashburton during an investigation into suspect sirococcus shoot blight caused by *Sirococcus strobilinus* on mature Atlas cedar, *Cedrus deodara*. Sirococcus shoot blight was not detected on symptomatic foliage, branch, or soil samples collected from the tree but *H. spartii* was isolated from a foliage sample. However, it was not considered to be the cause of the dieback symptoms observed, partly because it was not consistently isolated from symptomatic tissue, and partly because published information suggests it is endophytic/saprobic rather than pathogenic. Described in 2015 as *Truncatella spartii* and reported as saprobic, it was first isolated from the stems of Spanish broom, *Spartium junceum,* and placed in the new genus *Heterotruncatella*, in 2019 as *H. spartii*. It has reportedly been isolated from different *Pinus* species in the US, Tunisia, Ethiopia, China and Mexico. A single report links *H. spartii* with dieback disease on stone pine, *Pinus pinea,* in Tunisia, but although this study found an association with disease, no pathogenicity testing was undertaken to demonstrate causation. The likelihood that *H. spartii* caused the observed decline symptoms in the New Zealand cedar trees is considered very low, and an association within the tree as an endophyte or saprophyte is more likely. Furthermore, there have been no reports of this fungus causing disease on cedar or other hosts, so no further action is warranted.

New fungus on palm tree

In February 2018 a plant sample showing leaf lesions was collected from a phoenix palm (*Phoenix canariensis*) in East Tamaki, Auckland, and submitted to PHEL Mycology for analysis. A suspected undescribed *Pilidium* species was isolated from that sample and sent to the Westerdijk Institute for validation. Mycologists confirmed that it was a species new to science and described it in 2019 as *Pilidium novae-zelandiae*. It is likely to be a weak or secondary pathogen established in New Zealand and not a biosecurity issue.

New fungus on kōhūhū

In August 2017 a sample of kōhūhū, *Pittosporum tenuifolium,* with leaf lesions was collected from a commercial site in Rotorua and submitted to PHEL Mycology for analysis. A suspected undescribed *Parafenestella* species was isolated from the sample and sent to the Westerdijk Institute for validation, where mycologists confirmed that it was a species new to science and described it in 2019 as *Parafenestella pittospori*. This is a saprophyte or opportunistic pathogen contributing to the leaf lesions.

New fungus on bottlebrush tree

A PHEL mycologist reported two new to New Zealand fungi associated with leaf-spot symptoms on bottlebrush, *Callistemon* sp., during High Risk Site Surveillance (HRSS) at the Port of Tauranga. The two fungi, *Phaeomoniella niveniae* and *Hortaea thailandica,* were identified using molecular methods. *Phaeomoniella niveniae* has only been isolated previously from a rare coastal plant in South Africa, *Nivenia stokoei,* and it is not known whether it was a causal agent of the leaf-spot symptoms. *Hortaea thailandica* is considered a weak pathogen, has been frequently isolated from leaf spots caused by cercosporoid fungi, and is likely to have contributed to the spots seen on

the bottlebrush sample. This is its first record in New Zealand. *Callistemon* is a genus of exotic ornamental woody shrubs with bottlebrush-shaped flowers. It is not known how *P. niveniae* or *H. thailandica* were introduced, nor their current distribution in New Zealand, but they may have been present and undetected for some time. Neither is considered likely to pose a biosecurity issue; the host plant is not economically or environmentally significant and no other potential host plants of significance were identified. Plant Pest Information Network (PPIN) reports have been completed.

Alleocheta sp. was also identified from the bottlebrush sample but was not confirmed as new to New Zealand. This isolate is closely related to *A. neodilophospora,* which has been isolated from *Callistemon pinifolius* in Australia. The genus *Alleocheta* is present in New Zealand and there is no evidence of a biological risk associated with this detection.

New fungus on endemic sedge

Leaf spots and dieback symptoms were found on the endemic sedge *Carex secta* during HRSS at Auckland International Airport. A PHEL mycologist identified *Neodevriesia sexualis* and *Didymella aurea*, which are both present in New Zealand, as well as several other species new to science that were tentatively identified as *Stagonospora* sp. or *Phaespharia* sp. Cultures of these undescribed fungi were sent to the Westerdijk Institute for further identification.

Of all the above mentioned fungi, only *D. aurea* has been isolated before from *C. secta*, but it is unknown whether this fungus alone was the cause of the symptoms seen. It is possible that the newly detected species also contributed to the symptoms, but having likely been present in New Zealand for many years they are not considered a biosecurity issue. The investigation was closed as the results from the Westerdijk Institute might take months to arrive and may or may not affect the outcome. Following receipt of those results a new investigation may be opened. The Department of Conservation will be kept informed as per the MPI-DOC memorandum.

New fungus on olive trees

In January 2020, a Wairarapa olive grower reported symptoms exhibited on olive trees in his grove that he had observed for the past 3 years. The *Olea europaea* "Barnea" trees were alive and growing, but showed wood discolouration and had crumbling, dying bark at the base of the trunk. The grower had not noted any decrease in productivity nor any significant change in the environmental conditions except that the Wairarapa area was becoming drier, with fewer winter frosts. The grower had severed about 800 of the affected trees at waist height and had good recovery rate, with about 99.5 percent of the trees re-growing to their original size. However, the symptoms were still persistent and the bark dieback had gradually progressed up the trunk to about a metre above ground level. Samples (trunk, soil, roots) from three trees were submitted to PHEL for analysis.

The PHEL Mycology Team isolated six fungal species from the samples, most of which are known to be present here, but one species new to New Zealand, *Pseudophaeomoniella oleae*, was isolated from one tree. In Italy, this type strain was isolated from the blackened xylem of a wilting olive tree that was also infected by the pathogenic bacterium *Xylella fastidiosa*, the cause of olive quick decline syndrome (OQDS), but *P. oleae* has also been associated with mild symptoms in olive trees not infected with *X. fastidiosa*. The pathogenicity of *P. oleae* has been investigated to establish its association with OQDS, but tests on olive plantlets indicated that it has no more than a marginal role. Information about the distribution of *P. oleae* is limited, but it is likely to be widespread in Italy. There is no information about its distribution in other countries. It is a weak plant pathogen and unlikely to act as a primary agent. Therefore the investigation concluded that it was unlikely to be the main pathogen in this case. *Pleurostoma richardsiae*, another organism isolated from this sample, is known as an aggressive pathogen of olives and more likely to be the primary pathogen in this case. Since *P. oleae* has also been associated with *X. fastidiosa* in Italy, PHEL conducted bacteriology tests, which returned a negative result, i.e. *X. fastidiosa* was not detected by real-time PCR analysis of the samples.

New fungus on kōhūhū

An Auckland resident reported signs of dieback in a kōhūhū, *Pittosporum tenuifolium,* shrub on their property. Symptoms included a sticky, white ooze characteristic of white flux, a stress-related disease. Samples of wood and soil analysed by PHEL Mycology identified the new to New Zealand fungus *Elongisporangium helicandrum*. This species can be a saprophyte or an opportunistic pathogen in plants and soils, depending on external factors. It is considered established in New Zealand, and was likely not responsible for the signs of dieback reported in this case. It will be added to the PPIN mycology spreadsheet.

Suspect new fungus on oak

A single fungal fruiting body was found on the bark of a mature oak tree, *Quercus robur,* in the grounds of a Rotorua school. It was seen by an agronomist on the trunk at a height of 20 metres while undertaking routine work on notable trees in the area. No pathogenic symptoms were observed on the tree. Scion Research analysed the specimen and although fungal isolates did develop, it was not possible to identify the species by either microscopic structure or genetic sequence. It was therefore suspected to be new to New Zealand. PHEL Mycology received two plates containing fungal cultures, from which a number of marker genes were sequenced and analysed to attempt identification. One isolate was identified as *Mortierella* sp., a genus of fungi not usually associated with plant disease. The second isolate was a basidiomycete fungus that could not be more specifically identified. No plant pathogenic fungi were identified so the results provided no evidence of a biosecurity issue and the investigation was closed.

Suspect new plants on Trademe and Facebook

MPI Border Clearance Services (BCS) forwarded a report from members of the public of three suspect new to New Zealand plants for sale on Trademe and Facebook. The plants were identified as "String of Turtles", *Peperomia prostrata* and the wax plants *Hoya iyi* and *H. heuschkeliana.* The *P. prostrata* information related to an ongoing investigation first notified in December 2019. *Hoya* is a genus of tropical plants

mostly native to Asia and there is no evidence to suggest any are invasive. Some species are included in the Plants Biosecurity Index (PBI) https://www1.maf.govt.nz/cgi-bin/bioindex/bioindex.pl. Nursery stock can be imported if the species is approved by MPI through listing on the PBI and meets Import Health Standard 155.02.06: Importation of Nursery Stock. However, neither *H. iyi* nor *H. heuschkeliana* meets those criteria and they cannot be legally imported. *Hoya iyi* is distributed through China and northern Indo-China. The taxonomic position of *H. heuschkeliana* is uncertain. Technical advice from PHEL Botany concluded that it was unlikely either of these species posed a greater biosecurity issue than any of the other *Hoya* species listed on the PBI. While all plants in the PBI have officially been determined by the Environmental Protection Authority (EPA) to be present in New Zealand, the PBI does not list every plant species present, nor endemic species. The investigation concluded that a very low biological risk was likely to result from the presence of these species and no further action was warranted.

Suspected new mushroom for sale

An undescribed *Pleurotus* species was identified after a mushroom grower notified MPI that a suspect new blue oyster mushroom variety was being sold online in New Zealand. An incursion investigation was subsequently initiated. Blue oyster mushroom spawn advertised as *Pleurotus ostreatus* was acquired from a retailer by an II and sent to the PHEL, where mycologists identified it as an undescribed species of *Pleurotus* currently referred to as *Pleurotus* sp. OB (POB) and previously unrecorded in New Zealand. POB and a number of other species belong to the *P. ostreatus* species complex, which is different from *P. ostreatus*. In April 2019 the EPA determined that *P. ostreatus* was present in New Zealand. A voucher specimen of mushrooms from Manaaki Whenua–Landcare Research (MWLR) was pivotal in the EPA determination. This specimen was obtained in 1995 from a supermarket in Dunedin, where the mushrooms were labelled as a product of New Zealand and confirmed by PHEL to be the true *P. ostreatus* (i.e. the OA group). This changed the status of *P. ostreatus* to a non-regulated species, and it was then listed on the MPI website as eligible for import in May 2019. However, since that change no *P. ostreatus* have been imported, as none have met the import requirements. All *P. ostreatus* spawn samples tested by PHEL have been found to be either hybrids or POB, not the true *P. ostreatus* (i.e. OA group). These consignments have either been reshipped or destroyed by MPI's Border Clearance Services (BCS). At the time of this investigation, importers were not aware that many commercial strains were misidentified as *P. ostreatus,* and this has led to confusion within the industry. An investigation found that in late 2019 a New Zealand mushroom retailer imported four strains of "*Pleurotus ostreatus*" from a US supplier. The parcel was not detected at the International Mail Centre (IMC) and therefore delivered without inspection. The importer contacted MPI and the BCS arranged for a quarantine officer to collect samples. By that time the importer had made multiple sub-cultures from the original material but not told BCS. Four cultures collected by the quarantine officer were forwarded to PHEL, where two strains were identified as hybrids and the remaining two strains as POB. Since other plates collected had been sub-cultured from the imported strains, no further testing was necessary.

Back-tracing by the II revealed 10 retailers throughout New Zealand in possession of blue oyster mushroom spawn, received from either the original importer or a client of the importer. All available POB and hybrid cultures were recalled by the II and held at PHEL awaiting a decision by the Plant Germplasm Imports (PGI) Team. The mushroom samples held at PHEL are in two forms: cultures on petri plates and cultures in micro-tubes stored in a freezer. The PGI Team has recently instructed PHEL to destroy the samples on petri plates and to retain the samples in micro-tubes at PHEL as reference material.

Pleurotus sp. OB is a new species to New Zealand that is cultivated for human consumption and has commercial potential. The biological risk it poses is not clear but microscopic airborne spores could possibly disseminate and establish in our natural habitat, as the climate and environmental conditions are conducive. Concerns have been raised that if POB became established in the wild it could potentially replace native fungi, but a risk assessment provided by Biosecurity Science & Risk Assessment (BSRA) for *P. ostreatus* has determined that it does not pose a significant biosecurity risk. Accordingly, if a risk assessment was done for POB, it would not pose a biosecurity risk. The II managed this issue under urgent measures by recalling all known cultures, thus mitigating the biological risk. The investigation report has been provided to the PGI Team for their information and action, and they are currently liaising with the relevant parties and likely to request an EPA determination for POB.

Investigation positive; urgent measures prevent establishment

These investigations found organisms that were not known to be present in New Zealand, under circumstances that enabled treatments to be applied and biosecurity mitigation confirmed. They typically involved imported goods and containers.

Brown marmorated stink bug cases

Brown marmorated stink bug (BMSB), *Halyomorpha halys* is on the MPI high-priority organism list. During this quarter, the Plant Health Team investigated 55 suspect BMSB cases, of which 35 involved native or established pentatomid species and 20 investigations confirmed exotic species. These 20 included 17 BMSB detections, two yellow-spotted stink bug (YSSB, *Erthesina fullo*) detections and one of western conifer-seed bug, *Leptoglossus occidentalis*. Seven of the positive BMSB detections were associated with international travellers, four with imported vehicles, and the rest were on inanimate goods such as mail, coffee plungers, foldable pet playpens and office furniture. Examples are presented below. A suspect BMSB identified from photos was found on a house floor when a traveller returning from Italy was unpacking their luggage. All items in the suitcase were searched and shaken, and the room inspected for other stink bugs but none were found. An II visited the house to interview the notifier and inspect an unopened suitcase, but no more stink bugs were found.

The specimen was taken to PHEL and confirmed to be a male BMSB.
A single live suspect BMSB was reported by a child who found the bug on the inside of a kitchen window at his grandparents' house in Sumner, Christchurch. Photos were submitted and a PHEL entomologist preliminarily identified the specimen as BMSB. The II interviewed the notifier, his mother and his grandparents. The latter owned a farm in Pennsylvania, USA, where BMSB is a nuisance pest, and they recognised the species. The grandparents had not been overseas recently, nor had any international travellers visited, so the most likely pathway of entry was via parcels the couple frequently received from Amazon in the US that included books, electronics and cosmetics. The recent US purchases and packaging material were considered the most likely means of entry and the II concluded that the BMSB was a sole bug associated with those parcels. An II and a PHEL entomologist conducted full inspection of the interior and exterior of the property, including a small shed where luggage and imported goods were stored. No further BMSB were found. The specimen was confirmed by PHEL as a non-reproductive female BMSB.
A single live suspect BMSB was found in the suitcase of Auckland travellers the day they arrived home from France. A PHEL entomologist tentatively identified it from a photo provided by the notifier. The suitcase and other personal belongings had been stored outdoors in France prior to departure. After the notifier carefully inspected their luggage and found no further BMSB, the contents were emptied into a dresser. As a precaution, an II and a PHEL entomologist visited the property the following morning to conduct an inspection. One further live BMSB was found inside the same suitcase as the first bug. A thorough search was then conducted of clothing in the dresser, other personal belongings that had been stored outdoors in France, additional suitcases, and risk areas of the house. No further BMSB were found. PHEL Entomology confirmed both specimens as non-reproductive female BMSB. Information pamphlets were issued to the passenger's family, who were encouraged to distribute them widely.

A Chief Quarantine Officer (CQO) found a live suspect BMSB inside a light trap at an Auckland Transitional Facility (TF). A photo was submitted to MPI and a PHEL entomologist validated the identification, which was later confirmed as a male on receipt of the specimen. The insect was not directly associated with any particular imported product. Containers had recently been received at the TF from Hong Kong, Korea, China and Australia. The two containers from China and Korea (within the known range of BMSB) had not been flagged for biosecurity inspection at the border as they did not contain risk goods. The TF mostly handled laboratory equipment and chemicals. The CQO ensured the TF was thoroughly inspected but no further BMSB were found.

An Approved Person (AP) from a Wellington TF reported to Border Clearance Services (BCS), Wellington that a dead suspect BMSB had been found on palletised cartons of coffee plungers from Italy. The pallet had been part of a Freight all Kinds (FAK) container that had been heat-treated offshore. Dead BMSB are not a biosecurity issue and the presence of dead organisms indicated the offshore treatment had worked. The II received the specimen and a PHEL entomologist confirmed it was a male BMSB. No further action was deemed necessary.

Exotic ant cases

BSIIPH investigated eight notifications of suspect exotic ant species. Four of them involved species already established in the country: *Iridomyrmex suchieri*, *Ochetellus glaber*, *Tetramorium bicarinatum* and *Technomyrmex jocosus*. Summaries of the investigations are presented below.

Live ants were found in a yacht that had recently arrived from Fiji and been lifted to a hard stand for maintenance. The yacht had arrived into the Ports of Auckland, where it was inspected and cleared entry by QOs. About 2 weeks later ants were seen on board and reported to an MPI Inspector. Specimens were identified by PHEL Entomology as the ghost ant, *Tapinoma melanocephalum*, which is not present in New Zealand and is listed as Regulated on the Biosecurity Organisms Register for Imported Commodities (BORIC). A pest-control contractor was engaged to carry out surveillance and treatment. Attractant and toxic bait was laid after an ant trail was seen leading from the cockpit to a small hole in the forward hatch surround. Twenty monitoring traps were deployed between the deck and cabin, and a non-repellent residual insecticide was sprayed on the ground below the yacht and hard stand when ghost ant activity was still present on the deck of the yacht. Ten monitoring traps were laid around the hard stand to detect any ghost ants that might have escaped. The yacht was re-inspected twice after the second treatment and no further ghost ant activity was found. The II was advised by the yacht owner that dry goods had been moved off the vessel into a nearby apartment before maintenance work began. A visual inspection was conducted by the pest controller and as a precautionary measure a non-repellent insecticide was applied to the site and 10 monitoring traps were deployed. After one ghost ant was found in a monitoring trap at the apartment, additional bait was applied to the site as a precaution. A follow-up treatment was carried out 2 days later, and subsequent inspection of the dry goods area did not reveal any more ghost ants. Further non-repellent residual insecticide was sprayed around the perimeter of the apartment. A final inspection found no signs of ghost ant activity on the yacht or at the apartment.

A company in Newmarket, Auckland, received a FedEx courier parcel from the US that was infested with live ants. The II requested that the parcel be re-sealed immediately and placed in a freezer overnight to mitigate the biological risk. The specimens were identified by a PHEL entomologist as the Singapore ant, *Trichomyrmex destructor*, a species not present in New Zealand. The Singapore ant is of tropical origin and has a medium risk of establishment in New Zealand, given its ability to establish in urban areas. It was likely in this instance to have been attracted to biscuits in the parcel that provided a means of entry. The notifier was provided with educational information on invasive ants.

Suspect exotic ants were found in an empty shipping container post-border, in a damaged area of wooden flooring and in the door seal and hinges when it was being re-purposed for its next shipment. The container, one of 12 in the consignment, originated in Malaysia and had been transhipped through Singapore, arriving into Port Otago. The shipment of 1-tonne bags of fish meal was then transferred by rail to Bluff

the next day. The container had been returned to Dunedin 7 days later for refurbishment before reloading when the ants were found. It was isolated pending ant identification and received two applications of residual knockdown spray (Pestigas) inside and out to mitigate spread. Specimens were identified by a PHEL entomologist as *Technomyrmex* sp. They could not be identified to species level, though were confirmed not to be either *T. jocosus* (present in New Zealand) or the worldwide tramp species *T. albipes,* not present here. The container was fumigated with methyl bromide to MPI Approved Treatment Standard VCE1. The annual National Invasive Ant Surveillance (NIAS) programme for the 2020 season has both Dunedin and Bluff scheduled for surveillance to determine whether exotic ants are present. NIAS sites are categorised from high to low according to the biological risk and resources. The Port Otago depot will be surveyed as a high-priority site. Bluff has not been surveyed as part of NIAS in recent years: it has a lower priority owing to the low volume of container traffic and a less conducive climate for ants, so the decision whether to include the Bluff site is pending.

In another suspect exotic ant case, the investigation was closed without final species identification because specimens were not submitted after several requests. However, all the specimens seen were dead and located underneath the seal of a jar of Australian peanut butter, so there was no biosecurity issue.

Wood-boring insects

Ten investigations were carried out on suspect exotic wood-boring insects. These investigations are usually very complex and often involve site inspection to assess the extent of the infestation, to recall large wooden items for destruction or fumigation, and to verify post-treatment efficacy from the fumigator. Pests identified were mostly members of the beetle family Bostrichidae (*Dinoderus minutus*, *Heterobostrychus aequalis*, *H. pileatus*, *Lyctus africanus*, *Micrapate* sp. and one unidentifiable specimen). Two more families were found and are included in the summaries that follow.

On discovering borer beetles emerging from a wooden bed frame imported from India, the customer returned the piece of furniture to the importer, a nationwide retail store. The furniture, purchased 20 months before discovery of the borer, was then shrinkwrapped in cling film and moved to the importer's TF in Auckland. The importer inspected furniture in the supplier's distribution centre and found another item that was infested with borer beetles. All the specimens were identified by a PHEL entomologist as African powder-post beetle, *Lyctus africanus*, exotic to New Zealand. The retail chain recalled the two furniture lines and the II organised methyl bromide fumigation by an approved and certified provider. The retail chain advised that more than a hundred items of the infested lines had been sold nationwide. The II provided details of the investigation to the Incursion Investigation Team to alert them to the possibility of similar reports of infested furniture purchased from the retail chain. The original notifier was asked to look for signs of recent insect activity on wooden items in the house (sawdust, chewing damage, new exit holes, live beetles) but none were detected. The MPI Treatments & Inanimate Pathway Team was informed about the failure of the pre-shipment fumigation treatment in the country of origin.

A large amount of frass was found upon opening a box containing a wooden wreath from China, purchased from a local store the previous Christmas. The notifier was advised by the II to freeze the wreath for a week before sending it to MPI. Subsequently an II extracted two grubs that a PHEL entomologist recognised as the larvae of an unidentified longhorn borer. Whether the larvae were exotic could not be confirmed, but it was likely since the wreath had been kept in the original box since purchase. The store manager advised that no other customers had reported borer activity in other Christmas wreaths and that all the wreaths had been sold. The MPI Target Evaluation Team (TET) reviewed the import documentation and found that the wreaths were incorrectly declared as "artificial". Additionally, an MPI Multi-Use Number (also known as a MPI Permit Number) had been incorrectly used on this product. The Multi-Use Number Scheme has been suspended until the number holder submits an action plan to prevent a reccurrence.

As part of the reinstatement process the company will be audited on the use of its multi-use number, and compliance outcomes will be reported back. The number holder confirmed that they will be implementing changes to the documentation process for Christmas decorations, to ensure all compositions of the products are provided to the brokerage for clearance. They will also be requesting that the buyers confirm on their orders whether any product or article contains any natural product/material, no matter how little.

A live larva was found in one of two bamboo butterfly nets purchased from a $2 store in Whakatane. The larva was placed in the freezer and submitted to PHEL, along with the bamboo handles. The specimen was the larva of an unidentified beetle in the family Bostrichidae, and most likely not a New Zealand species. The handles were destructively sampled and additional, different insects were extracted from one of them. PHEL Entomology identified these as a hymenopteran pupa found inside a lepidopteran pupa, and a queen carpenter ant, *Camponotus* sp., an unwanted organism. It was not known whether these insects were dead or alive at the time of purchase, as they had been frozen prior to submission to MPI. The II contacted the store and arranged for the goods to be withdrawn owing to the presence of risk organisms. A small selection of bamboo butterfly nets from a range of other $2 stores and the original store were provided and frozen before destructive sampling. A braconid wasp and four bostrichid beetles (one *Dinoderus* sp. and three *D. minutus*) were extracted. The bostrichid beetles were found in four bamboo butterfly nets. The import documentation did not stipulate that the nets had a bamboo component (they were simply labelled "Butterfly Catcher Net"), which is why they had been assessed as a low risk. The bamboo should have been treated offshore and inspected upon arrival to comply with the relevant IHS (https://www.biosecurity.govt.nz/dmsdocument/1223-bamboo-cane-willow-and-rattan-from-all-countries-import-health-standard.) There was no documentation to confirm that the bamboo had been treated offshore or inspected on arrival. The MPI ITT and Plant Imports Teams were asked to set an alert to audit subsequent imports and update the risk profile register.

Signs of borer damage were reported from kwila decking purchased from

a nationwide builder's hardware warehouse. Although no live insects had been seen, the damaged decking was returned to the Auckland supply store. During destructive sampling three incomplete and desiccated insect specimens were obtained, suggesting that they were long dead and therefore not a biosecurity issue. PHEL identified the specimens as the pinhole borer, *Platypus* sp., a genus that is present in NZ but could not be identified to species level.

Illegally imported seeds and plant investigations

Reports of suspect illegal trade involving seeds for sowing and live plants continue to be some of the most common notifications through the exotic pest and disease hotline, and this quarter 25 cases were investigated. The complexity of these investigations is demonstrated by the following examples.

A PHEL botanist reported that the Chinese money plant, *Pilea peperomiodes*, was being sold on Trademe under the name *Peperomia polybotrya*. Trademe had been alerted to the listing and it was removed. On contacting the seller it was determined that they had purchased several plants from the offshore e-commerce site Etsy, but could not recall from what country or whether the package was conveyed by express courier mail or standard post. The plant is not listed on the PBI and cannot be legally imported into New Zealand, but the person of interest (POI) had planned to on-sell plants through Trademe (although they had only received one plant). MPI's mail database (Quanmail) was searched, revealing that four seizure events of live plants and soil at the Auckland International Mail Centre (IMC) had been associated with this POI. Letters were sent on three occasions by the IMC but it is possible that the listing on Trademe preceded them. Questioning revealed the plants had been withdrawn from sale after a Trademe user advised that *P. peperomiodes* was actually an illegal import and not listed on the PBI. The importer, under their own initiative, burnt the plant as they did not want to break the rules and were worried about getting into trouble with MPI. The II sent the importer another letter informing them of the correct import procedure for plant material. Blatant reoffending can be referred to the Compliance Team and result in prosecution.

Seeds of *Nigella papillosa,* commonly known as African bride, were intercepted by IMC staff on 22 January. As part of the interception process IMC staff contacted the importer, who revealed that she had previously received another package of *N. papillosa* seeds from overseas. BSIIPH was then contacted as the matter became a post-border investigation. The II searched online and found that *N. papillosa* seeds were already widely available in New Zealand through a number of major retailers. The investigator examined documentation from one of the importers to determine the scale of *N. papillosa* imports and discovered that the importer had been importing the seeds since 2017. Further investigation showed that in most instances the importer had provided invoices to the TET that described the seeds as *Nigella papillosa*, then informed TET that a synonym for the seeds is *N. hispanica*, which is listed in the PBI as "basic requirements" for seed import, so the TET then released the consignments. However, PHEL botanists pointed out that *N. hispanica* is not an accepted synonym of *N. papillosa* but a separate species not listed in the PBI, so the seeds had been incorrectly given biosecurity clearance. The biological risk posed by *N. papillosa* is unknown but considered to be negligible to low. While some *Nigella* species have weedy characteristics (e.g. *N. hispanica* and *N. damascene,* both listed as Basic in the PBI for seeds), no evidence has been found to show that this is the case for *N. papillosa*. New Zealand's climatic conditions may be a limiting factor for establishment of this species. *Nigella papillosa* has been imported since at least 2017 and there have been no reports of invasiveness or biosecurity issues. It is a temperate species closely related to several other *Nigella* species present in New Zealand. Since no reference could be found linking *N. papillosa* to invasive potential, and the species is likely to be already widely distributed, the II concluded that there was a biosecurity issue but the biological risk was low, and the investigation was closed with no further action warranted. Subsequently the importer was informed by the Plant Imports Team that *N. papillosa* is not a synonym for *N. hispanica*, and *N. papillosa* seeds are not permitted for import as this species is not listed on the PBI.

A staff member working for an Auckland plant importer contacted MPI after learning that another nursery had received plants from a mutual supplier that were incorrectly identified on import documents. There was concern that the mini monster plant, *Rhaphidophora tetrasperma*, had been received instead of the specified lacy tree philodendron, *Philodendron selloum*. A specimen submitted to an independent laboratory for molecular analysis was confirmed as *R. tetrasperma*. The notifier assisted *New Zealand Plant Producers Incorporated* (NZPPI) with an application to the EPA for approval to import *R. tetrasperma* for release without controls. Technical advice provided by the MPI Biosecurity Science & Risk Assessment Team (BSRA), and the EPA decision document for *R. tetrasperma*, indicated that a biosecurity issue still remained, albeit low. However, the II determined that the biological risk was low as the plants had undergone post-entry quarantine inspections as part of the import process and did not exhibit any pest or disease symptoms, so the three nurseries with *R. tetrasperma* plants could release them to the retail market. Plant Imports is currently engaging with industry representatives for the addition of *R. tetrasperma* to the PBI.

MPI's National Pest Plant Accord (NPPA) co-ordinator notified the Plant Health Team of sales on the internet of banana passionfruit, *Passiflora* 'Tacsonia' subgroup, along with wandering jew, *Tradescantia fluminensis* (both listed on the NPPA) and an aquatic plant. All plants on the Accord list are unwanted organisms under the Biosecurity Act 1993 (BA). The NPPA is a cooperative agreement between: MPI, New Zealand Plant Producers Incorporated (NZPPI), unitary and regional councils and Department of Conservation who work together to prevent the sale, distribution and propagation of pest plants listed in the Accord. Banana passionfruit plants were said to be on sale at a Wellington farmers' market so the II coached a QO to conduct a site inspection to validate the claim. The QO reported only one stall selling plants and banana passionfruit plants were not found so no further action was warranted. However, a wandering jew cultivar patented as the

variety "Pink Princess" was offered for sale online. PHEL Botany determined that the parentage of this cultivar was *T. fluminensis* after comparing the DNA sequence data with information held in GenBank. The online retailer was contacted and informed that communication of these plants was a breach of sections 52 and 53 of the Biosecurity Act. The retailer replied that once they were made aware through social media that this plant could not be sold they ceased advertising it and destroyed all stock by leaving the plants to dry in the sun before disposal in the inorganic waste.

This was one of two investigations of *T. fluminensis* this quarter. In the second case, PHEL Botany examined photos from Facebook and considered the plants were cultivars of *T. fluminensis*. The II advised the three sellers of the biosecurity status of the plant, after which they all removed their listings.

An aquatic plant for sale on Facebook was reported anonymously to MPI and was identified by PHEL Botany as *Bucephalandra* sp., thought to be a new organism under the Hazardous Substances and New Organisms (HSNO) Act 1996 as it is not listed on the PBI and no specimen is registered in any New Zealand herbarium or listed for commercial trade. The Facebook account appeared to be under an alias, but the ITT was able to identify the POI. The II conducted an interview and the POI advised that the plants were sourced from local pet stores, Trademe and private sales. The person claimed they did not know what species of plants they had purchased 2 years earlier to set up their aquarium. The genus *Bucephalandra* comprises at least 30 species, all native to Borneo and found in tropical rivers. Given its native climatic range, it is unlikely this species could become naturalised in New Zealand, so it is considered a low biological risk. The POI was instructed to discontinue advertising and selling the plant.

Khapra beetle larvae in Tauranga

A sofa purchased from an Auckland company that had imported a container load of furniture from China was found to be infested with khapra beetle, *Trogoderma granarium*. Specimens identified by PHEL as larvae and adults were found by the Tauranga resident in the sofa and its packaging. *Trogoderma granarium* is an unwanted organism not present in New Zealand; it is considered one of the 100 worst pests in the world and one of the most destructive pests of grain products and seeds. In unfavourable conditions the larvae can remain dormant for up to 7 years. The II arranged for a Tauranga QO to undertake a site inspection and treat the garage and living areas with one-shot cargo-hold insecticide. The infested sofa and 51 other pieces of unsold furniture from the container were withdrawn from sale and fumigated using methyl bromide. Customers who had received furniture from the same consignment were contacted and advised to contact MPI if they noticed any insect activity. The II traced back the import documents and the TET confirmed the authenticity of the certificate under the General Administration of Customs of the People's Republic of China (GACC). The container was also traced and no insect contamination had been reported since it was commissioned in May 2017. It is unclear where the infestation occurred but since the contamination was throughout the furniture and packaging, it likely originated at the manufacturer or while packing the sofas. The biological risk was mitigated under urgent measures and the investigation closed. MPI has a relationship with the Australian Department of Agriculture, Water and Environment (DAWE) colleagues whereby such detections are reported for information. The Plant Health representative advised their DAWE colleague of this case.

Suspect booklice, Wellington

Fabric Christmas decorations imported from India by a company located in Wellington were found to be contaminated with large numbers of booklice. Specimens were identified by entomologists at The Museum of New Zealand Te Papa Tongarewa and subsequently confirmed by a PHEL entomologist as *Liposcelis corrodens*, *L. decolor* and *L. entomophila*. The former two of these are present in New Zealand but *L. entomophila* has never been recorded. All products from the consignment were wrapped and placed in a freezer for 5 days to ensure all the booklice were dead. Investigation information was provided to the importer for feedback to the Indian exporter.

Yellow-spotted stink bug, Dunedin

A live suspect YSSB found inside a box of tote bags imported from China was reported by a Dunedin company, prompting the II to ask the notifier to contain in sea containers all the product, both on and off site. Two Dunedin QOs inspected the processing facility and the TF where the goods were devanned but no further YSSB were found. The specimen was confirmed as a male YSSB (an unwanted and regulated species) so the II directed that all remaining stock be fumigated with methyl bromide.

Suspect sea spurge, Himatangi Beach

A member of the public advised the Incursion Investigation Team of an iNaturalist post in October 2019 (https://inaturalist.nz/observations/34943019) showing photos of a single immature plant that had been identified as a possible sea spurge, *Euphorbia paralias*, a species prohibited in New Zealand. The initial identification was made by a member of the public who then sent photos to the former curator of the Sul Ross Herbarium in Texas, USA, for confirmation. The response posted on iNaturalist was that it was most likely *E. paralias*. The II contacted the Department of Conservation (DOC) in Palmerston North and requested that they locate, contain and submit all *E. paralias* plants to PHEL Botany for identification. The site inspection by DOC searched at least 500 m each side of the initial detection site and across the full storm surge zone, but no more suspect *E. paralias* plants were found. PHEL botanists advised an interim species identification as *E. paralias* and this was confirmed by MWLR botanists at the Allan Herbarium, Lincoln. DOC Palmerston North was informed to advise other relevant local authorities. MPI's Long-Term Planning & Transition Team, who manage the sea spurge programme, were notified and the case was transferred to their responsibility.

Tomato brown fruit rugose virus on capsicum seeds

A New Plymouth commercial seed company imported three types of *Capsicum annuum* (pepper) seeds from Israel: one for distribution to the New Zealand market and two for export to Germany and then to Poland before

re-importation into New Zealand for a supermarket marketing campaign. Under the IHS 155.02.05 Seeds for Sowing, *Capsicum* seeds from all countries must be accompanied by a phytosanitary certificate (PC) endorsed with additional declarations for three quarantine pests: *Pepper chat fruit viroid, Potato spindle tuber viroid* and *Tomato brown rugose fruit virus*. The PC and additional declarations were provided by the Israeli exporter to ensure that the pepper seeds were free from any of these pests. PHEL Virology tested two of the seed types and reported *Tomato brown rugose fruit virus* (TBRFV) from one type (which was scheduled for export). This seed-borne pathogen is a major pest of peppers and tomatoes that can leave the fruit visibly blotchy and unmarketable.

The first outbreak of TBRFV was reported on tomatoes in Israel in 2014, and then in Jordan (2015), Mexico (2018), Germany (2018), the US (2018). In 2019 it became established in Italy (Sicily), northern Palestine, the UK, Netherlands, Turkey, Greece, China and Spain. TBRFV is a regulated pest in New Zealand and has been reported in MPI's Emergent Risk system since February 2016. Further alerts in September 2018 and early 2019 about its distribution, expansion and detection in peppers led to New Zealand implementing emergency measures in March 2019 requiring testing of tomato and pepper seeds imported for sowing.

The importer advised that tomato and pepper seeds from the same Israeli supplier had been imported in 2014 and 2018. Most of the seed had already been sold to customers. However, seed still available at their facility was tested by PHEL and was negative for TBRFV. The grower organisation Tomatoes NZ is proactively managing this emerging risk and has issued a TBRFV fact sheet for their growers at https://www.tomatoesnz.co.nz/assets/Uploads/TNZ-Exotic-Pest-Fact-Sheets-14-final.pdf. MPI's Plant Imports Team was contacted and asked to inform the Israeli National Plant Protection Organisation (NPPO) of this interception. The New Zealand importer and supplier are discussing export documentation required to facilitate reshipping the infected seed, and once finalised the outcome will be conveyed to the investigator.

Aerogarden with seeds ordered on Amazon

A member of the public received an educational letter from a QO at the Auckland IMC advising him that an Aerogarden indoor-garden kit purchased from Amazon in the US had been seized at the mail centre. The POI subsequently contacted the II Team after a second garden kit arrived intact in the mail at his Wainuiomata property. As these garden kits contained growing medium and regulated seeds for sowing they did not comply with IHS 155.02.05 Seeds for sowing and Soil, Rock, Gravel, Sand, Clay and Water (SOWTER). The II directed the notifier to courier the seeds and growing medium to MPI, Christchurch, for destruction and advised him to be cautious when purchasing this type of product on line.

Live jumping beetle, Auckland

An Auckland resident found a live jumping insect inside a package containing novelty fairy lights from the US. The specimen was frozen for 48 hours to mitigate the biological risk and then submitted for identification. PHEL Entomology identified the tumbling flower beetle, *Tolidopalpus* sp. This beetle family consists of 1,500 species worldwide and is aptly named for the beetle's unique tumbling motion when disturbed. Usually seen on flowers, the tumbling flower beetle is not known to be an economic or invasive pest. The genus *Tolidopalpus* consists of five species, one of which (ruled out by PHEL) is present in New Zealand. The II concluded the beetle was an isolated case and no further action was warranted.

Dead scorpion in clothing worn in Costa Rica

A Waiheke Island traveller recently returned from a holiday in Costa Rica and found a dead scorpion in her washing basket while doing laundry from her holiday. An II directed the notifier to thoroughly search all her belongings; no further scorpions were found. PHEL Entomology identified the specimen as a bark scorpion, *Centruroides* sp. There are no native or established populations of scorpions in New Zealand. This genus is found in the southern region of North America, Central America (where the notifier had just visited) and northern South America. Descriptions of its habitats suggest it will use any available shelter, including clothing and suitcases. There are 70 species of *Centruroides*, some of which are highly venomous and considered a risk to human health. As the scorpion was dead, no further action was required.

Christmas decorations with pine cones, Auckland

A nationwide homeware store notified MPI Quarantine after staff found several lines of Christmas decorations with pine cones at their inward-goods TF. At the time of notification most product for the season had been distributed so a recall was initiated by the II. All returned stock was secured in two 20-foot containers with MPI seals at the importer's TF. As the facility was in the process of moving premises, the containers would remain sealed until April 2020, at which point they were to be treated to mitigate the biological risk.

Tiny insects in raw cotton, Dunedin

Staff at a Dunedin laboratory that tests the quality of imported fabric found many live insects and one live caterpillar in a shipment of raw cotton from India. The insects were found during a quality-control check while unpacking and inspecting the fabric, before the consignment was to be frozen in line with their standard operating procedure. Specimens were submitted to the II and identified by a PHEL entomologist as the pink bollworm, *Pectinophora gossypiella*, an unwanted organism and a regulated pest in New Zealand. This species is distributed throughout southern Europe, Africa, the Middle East, Asia, Australia and the Pacific Islands; it also occurs from the southern US to Argentina, including the Caribbean. It is a worldwide pest of cotton and in some regions is the predominant cotton pest. The company froze the cotton fabric for 48 hours, thus mitigating the biosecurity risk. The notifier from the laboratory informed the procurement team, who in turn advised the Indian supplier of the detections and issued a warning to ensure future consignments were insect-free.

Exotic bug on sandpaper, Christchurch

A live insect was found at a Christchurch importer's warehouse in a shipment of

sandpaper imported from Germany. The consignment was categorised as low-risk and not requiring inspection on entry into New Zealand. After the insect was found, the notifier and his staff inspected the entire consignment at the warehouse and found no more insects. A PHEL entomologist identified the specimen as the Western conifer-seed bug, *Leptoglossus occidentalis*, a regulated and unwanted species that is not present in New Zealand. Originally from North America, it has been accidentally introduced into Europe, including Germany. The bug feeds on the sap of developing conifer cones, and its sap-sucking causes the seeds to wither. The solitary bug had been frozen so no further action was warranted.

Investigation positive; urgent measures limit harm

These investigations resulted in detection of organisms that were not known to be present in New Zealand, and treatment was applied where possible to all retrievable items (usually recent imports). There may be some residual risk associated with items that could not be retrieved.

Spider cases

The Plant Health Team investigated 11 cases of unknown spiders from Australia, Japan, South Africa and the US. These were found in grapes and an assortment of goods such as parcels, pallets, containers, soy wax, a shoebox, CD racks and on some travellers. In most cases the spiders turned out to be either native or established species so there was no biosecurity issue. In three cases, investigators were unable to obtain specimens for identification because the notifier became uncommunicative after the initial contact. This does happen occasionally and in such situations the investigator will endeavour to make contact to rule out the biosecurity issue. In these three cases, the investigators were able to close each case using provisional identifications from photos provided that indicated the spiders were not exotic, or because effective countermeasures had already been taken, such as a site inspection, spraying with insecticide or freezing the risk goods and disposing of them in refuse destined for deep burial.

Wooden decorations from China

A member of the beekeeping industry reported two Trademe auctions for potentially non-compliant wooden coasters. The auctions offered direct shipment from China. The coasters, with a thin layer of bark attached, were advertised for wedding or party décor. Two China-based Trademe stores were identified with several auctions running for these items. Both stores were informed that wooden items with bark attached require an approved treatment and/or inspection by government officials under the Import Health Standard "Bark from all countries" (https://www.biosecurity.govt.nz/dmsdocument/1220). They were informed that unless these requirements were met, the items should not be listed for sale in New Zealand. One of the stores responded confirming it would no longer list the item. No reply was received from the second seller, but no further listings of this type have been found on Trademe. Contact was made with a buyer in New Zealand, who voluntarily incinerated the coasters after learning of the biosecurity issue. They noted that "the items received were much smaller than advertised anyway." Investigators are often informed that e-commerce purchases are not what the buyer expected! *Caveat emptor*.

Pine cone on artificial decoration, Pukekohe

At a nationwide retail store, a Pukekohe shopper found real pine cones attached to artificial Christmas decorations imported from China. Two lines of product were identified: a "eucalyptus Christmas pack" and a pine branch. The II contacted the chain's compliance manager, who immediately withdrew all the risk goods from all stores and initiated an enquiry that revealed more than 2,000 of them had been sold nationwide. Since the Customs Declaration tariff code had not disclosed the presence of real pine cones, the consignment had not been targeted for inspection by the TET. No treatment had been done at the New Zealand border as per the requirements for IHS "Dried and Preserved Plant Material and Plant Material for Research" (https://www.mpi.govt.nz/dmsdocument/1653-dried-and-preserved-plant-material-and-plant-material-for-research-import-health-standard) and the decorations from both lines had been given biosecurity clearance. At the conclusion of the recall process 1,831 items had been shipped to the Customer Return Centre for destruction. All items were steam sterilised and deeply buried. The TET was informed of the importer's failure to declare the presence of real pine cones on the decorations.

Fertiliser accidentally released

A Quarantine Officer from the IMC in Wellington reported that two small tins of fertiliser had been accidentally released when label information was missing. All ingredients must be listed to meet the IHS for Fertiliser and Growing Media of Plant Origin (https://www.mpi.govt.nz/dmsdocument/1654/direct). The importer was contacted and confirmed that it had received the fertiliser, which had been sent by a family member in Australia employed by the fertiliser company. A full ingredients list was provided to MPI and after consultation with the TET it was established that the fertiliser was compliant. A copy of the IHS was provided to the importer and the family member for reference and they agreed to comply with the IHS for future shipments.

Investigation positive; no action taken

These investigations revealed organisms that were not previously known to be present in New Zealand, but no action was taken. Typically they included cases where a risk assessment indicated that a potentially new to New Zealand organism (or a newly described indigenous organism) had become well established and was considered unlikely to damage economic, environmental, social and cultural values. Alternatively, the organism may have already been established and been under management by MPI and/or local authorities.

Dead insect in ceramic canisters, Auckland

At a homewares warehouse in Auckland, an unusual dead insect was found while staff conducted a quality check of ceramic canisters recently imported from Lisbon, Portugal. This was the only insect found while unpacking 40 boxes from the consignment. Although a dead insect does not present a biosecurity threat, a sample was requested and was identified by a PHEL entomologist as a snail-killing fly, *Euthycera* sp., a genus

not present in New Zealand. These flies are typically found near standing waters such as ditches, lakes and ponds. Without investigating further, the II concluded the fly's habitat may have been near to where the goods were made or packaged. The II advised the notifier of the outcome and reminded them to call MPI's exotic pest and disease hotline if any live insects were found in future consignments.

Mushroom spawn incorrectly imported

An Auckland importer flagged by MPI TET for an audit regime owing to previous non-compliance issues, was found to have received a consignment of mushroom spawn incorrectly released by MPI owing to misinterpreted lab results. The sample submitted to PHEL Mycology was identified as an undescribed *Pleurotus* species. The importer had an import permit for the congeneric *P. ostreatus*. The spawn from this undescribed species had been grown for 2–3 months in the importer's mushroom shed and the mushrooms made available to the retail market around December 2019. No spawn or mushrooms had been sold to other growers. In early January 2020 the exhausted mushroom logs were mulched and composted. After about a year the material would be well composted and could be used as fertiliser for vegetables on the importer's property. The importer advised that after harvesting the logs no new mushrooms grew. Considering the sterilising effect from high temperatures generated during composting, the biological risk was deemed to be very low, with no further action required. MPI's PGI Team and ITT were informed of the investigation outcome. As with the *P. ostreatus* investigation reported above (p. 30), this investigation again highlights the complexities of importing mushroom spawn.

Investigation for high-impact pests; negative

These investigations resulted from reports of suspected high-impact pests or diseases that were proven to be not present in New Zealand, or investigations established that they were already in the country. The majority of notifications were of suspected BMSB and fruit flies (35 and 16 investigations respectively). Exotic fruit flies were ruled out from photos provided to the II or dead specimens submitted to PHEL. Summaries of the remaining investigations are provided below.

Sea spurge plants in a garden

The owner of a beach house that backs onto a tidal inlet at Waikawa Beach, Horowhenua, reported the presence of suspect sea spurge, *Euphorbia paralias*. Initial discussion and the notifier's description led PHEL Botany (Auckland) and the Investigator to believe the plant was *E. lathyris* not *E. paralias*. After examining photos provided to PHEL Botany the initial identification was confirmed as cape spurge, *E. lathyris*. This poisonous plant is widespread throughout the North Island, and in the South Island is common in Nelson, Marlborough, Canterbury and Otago, especially on old goldfields. The property owner was advised of the identification and that the plant is poisonous to humans and most livestock.

Suspect watermelon virus, Auckland

A QO noticed viral symptoms on a watermelon her mother had recently purchased from an Auckland supermarket. The symptoms included ring spots and an unusual interior shape. The supermarket confirmed that the watermelon was New Zealand-grown. A sample was collected by an II and submitted to PHEL for assessment. No viruses, regulated or local, were detected. It is possible that the symptoms were a result of abiotic factors.

Suspect aquatic weeds, Taupo

A resident of Taupo District reported aquatic weeds in the Kuratau River near his property. DOC reported *Lagarosiphon major* (oxygen weed) and *Hydrilla verticillata* and informed the Waikato Regional Council. As *H. verticillata* is a notifiable organism and an unwanted organism under the BA, the council notified MPI. Photographs of the two aquatic weeds were assessed by PHEL Botany and a NIWA botanist, who agreed on the *L. major* identification but suggested the other aquatic weed was not *H. verticillata* but instead a species of *Potamogeton*, likely the native *P. ochreatus*. Advice on control of infestations in flowing water is provided by regional councils or local Department of Conservation officers. Therefore the notifier was advised to contact the Waikato Regional Council for information about the status and responsibility for control of *L. major* in the region.

Suspect Asian gypsy moth, Taranaki

A suspect Asian gypsy moth larva, *Lymantria dispar,* was found on the window frame of a residential dwelling in Okato, Taranaki. The II requested photographs and directed the specimen to be placed in a freezer for 24 hours. High-quality photos enabled the specimen to be identified by PHEL Entomology as a nest and larva of the wool carder bee, *Anthidium manicatum*. This species has been established in New Zealand since 2006 and has had no significant impact on the apicultural industry or on native bees. The investigation was closed as it does not pose any biosecurity threat.

Suspect white-spotted sawyer beetle

A Hamilton resident reported finding a suspect white-spotted sawyer beetle, *Monochamus scutellatus,* in his living room. He had not been overseas and had not imported any goods in the past 12 months. His neighbour had recently conducted renovations, which may have provided a pathway for the beetle. However, when submitted to PHEL it was identified as a longhorn beetle, *Didymocantha obliqua*, native to Australia but established in New Zealand.

Negative – other

These investigations were negative for the presence of any biological risk.

Pests of stored products

During this period there were 19 notifications of insects found in stored products. Some samples contained more than one species. Common pantry pests identified included moths, *Plodia interpunctella* (6), *Ephestia elutella* (2) and *E. kuehniella* (3); booklice, *Liposcelis bostrychophila* (1) and *L. corrodens* (1); beetles, *Stegobium paniceum* (1), *Tribolium castaneum* (1), *T. confusum* (2) and *Sitophilus oryzae* (2); and the cockroach *Drymaplaneta semivitta* (1). In one case identification was not possible because the specimen was desiccated and any biosecurity problem could be ruled out. In most cases the II asks the notifier to freeze the infested product for 48

hours as an extra precaution to mitigate the biological risk.

Pests and diseases on vegetables and fruits

The Plant Health Team received 13 notifications from members of the public reporting suspect exotic pests and diseases on imported and locally grown vegetables and fruits such as avocado, bananas, grapes, kiwifruits, oranges, garlic and watermelons.

An MPI employee was handed five bags of leaves collected by a Marlborough property owner from various trees he suspected were diseased. Five fungi were isolated from the different host plants. First, *Didymella macrostoma* was isolated from *Prunus* leaves. This fungus has been reported as saprobic on dead plant tissues. Second, *Neodidymelliopsis* sp. was isolated from *Pittosporum* leaves. This isolate could not be identified to species level and is likely an undescribed species. However, it is identical to a fungus previously isolated in New Zealand (*Phoma* sp. ICMP 11466). There are no reports of significant disease caused by species of *Neodidmelliopsis* spp. The third isolate was *Diaporthe passiflorae* from *Heuchera* sp. leaves. This fungus has been identified from New Zealand and has been reported to cause canker on blueberry (*Vaccinium* sp.) stems and post-harvest rot in kiwifruit (*Actinidia* sp.)

Fourth was *Diaporthe* sp., from *Veronica* sp. leaves. This fungus could not be identified to species level and is likely undescribed. Sequence analysis showed this isolate is closely related to *D. rudis*. Finally, an *Alternaria* species was isolated from *Magnolia* leaves. This isolate belongs to the *Alternaria* section Infectoriae (one of the largest and most complicated sections within the genus) and is likely undescribed. Most of these fungi are either saprophytes or endophytes and are present in New Zealand. There is no associated biological risk and no further action was warranted.

An exporter of commercial sweetcorn products contacted MPI following a positive pre-export test for genetically modified (GM) constructs in a sample of sweetcorn powder manufactured from locally grown corn. The seed had been imported from the US and the aggregated sample tested, had been grown in four paddocks. The sweetcorn powder was all designated for export to the Asian market, while the frozen corn kernels were both exported and sold domestically. New Zealand has zero tolerance for GMOs without approval (outside of containment). Further testing of individual samples yielded a negative result in all paddocks. An analytical laboratory in France advised that for this type of analysis the difference between the two results could be attributed to sampling bias. The level of contamination was below the maximum level of 0.1 percent stipulated in MPI import requirements. The biological risk was determined to be negligible to low, as the level of contamination detected was less than 0.1 percent. The production company said that once the drought conditions had abated to enable tilling of the soil, all four paddocks would be sown into grass at the end of autumn for feeding stock over the winter. The land would remain fallow in the meantime. The sweetcorn green waste generated from harvesting the four paddocks was distributed as stock feed to 22 farms in Waikato, Bay of Plenty, Taupo and Poverty Bay. As there were no detectable GMOs in the harvest there was no biosecurity issue in this use of the green waste. The TET provided reassurance that all border requirements had been met for the importation of the seed from the US.

Insects on containers, mail and packaging

In most of the 14 notifications associated with imports from China, the Czech Republic, Germany, India and the US, live larvae and adult insects were identified.

Burnt pine longhorn beetle

There were two finds of burnt pine longhorn beetle during this period. On opening boxes of bed covers and diapers imported from Sweden, a Carterton resident found a live beetle. A second beetle was found by the Royal New Zealand Air Force staff on board an aircraft returning from Australia. In both instances photos provided to PHEL were identified as *Arhopalus ferus*, commonly known as the burnt pine longhorn beetle, which is established in New Zealand.

Egg mass not associated with imports

The owner of an Auckland property reported finding an egg mass on a shelf inside his carport. There was no apparent association with any importation of goods or overseas travellers at the house. Photos of insect pupae submitted to PHEL Entomology were insufficient for an identification. When a specimen was requested the notifier advised that the adults had emerged from the pupae. Additional photos submitted were consistent with the wool carder bee, *Anthidium manicatus*, present in New Zealand.

Large moth on store floor, Christchurch

A large live moth with four spots on its wings was found on the floor of a nationwide chain store in Papanui, Christchurch. The moth was larger than the notifier's hand, was near the door and when captured it began laying eggs. From the description and clear photos of the moth, it was identified as a female gum emperor moth, *Opodiphthera eucalypti*, established in New Zealand.

Unknown flying insect, Auckland Airport

An unusual insect was captured as it flew through the refuelling area at Auckland International Airport. From a photo provided to a PHEL entomologist it was identified as most likely one of the native bees. No further investigation was undertaken.

Live cockroach in hotel room, Auckland

Cleaning staff found a live cockroach while servicing an Auckland hotel room. Australian and Fijian guests had recently stayed in the room. Owing to the damaged state of the cockroach it could not be identified from a photo so another specimen was requested. PHEL Entomology identified the American cockroach, *Periplaneta americana*, present in New Zealand and not a biosecurity problem.

Cockroaches on aircraft engine, Auckland

Live cockroaches were found in an aircraft engine brought into Auckland from Papua New Guinea to be serviced.

The importer had notified staff at the international air cargo TF that freighted the engine, who then advised the Incursion Investigation Team. Photos provided by the importer indicated the Australian cockroach, *Periplaneta australasiae*, which is common in tropical areas around the world and also established in New Zealand. The notifier had sprayed the entire engine with insecticide and was advised to freeze and dispose of the cockroaches as a precaution.

Inconclusive

These investigations have been stood down because results (or absence of results) could not determine the presence or absence of a biological risk, and it was decided that further investigative activity was not warranted.

Suspect fruit flies

Notifications from this quarter included five investigations of suspected fruit flies. The reports were categorised as inconclusive because the II could not categorically rule out the presence of any biosecurity issue, predominantly because the notifiers were unable to provide specimens for identification. Verbal descriptions of the insects were not consistent with fruit flies. Additionally, most of the notifications were reported from areas serviced with fruit-fly surveillance traps. These traps are regularly monitored and caught no exotic fruit flies this season. The biosecurity issue was deemed low and the investigations were stood down.

Unknown insect in tea from China

While pouring himself a cup of tea, using tea leaves imported from China, a Red Beach resident found a small insect in his cup. The notifier thought the insect was most likely associated with the tea leaves. It was not known whether it was alive or dead when the boiling water was added, or whether it was killed during the brewing process. Photos showed a cockroach nymph. On receipt of the specimen, PHEL Entomology identified a juvenile cockroach but no identification to species level was possible. As the notifier had purchased the tea leaves in bulk, then transferred them to a separate container, it is plausible that a local contamination occurred through this process. The possibility of the cockroach being exotic could not be ruled out. The notifier was advised that he could freeze the tea leaves to mitigate the risk of other live cockroaches.

Damaged wood in campervan from France

Staff doing a warrant of fitness inspection of a campervan imported from France in 2008 found rotting wood they attributed to insect damage. Photos supplied showed a white frass of fungal and insect origin. Consultation with PHEL Entomology suggested the frass was likely from a species of decay moth, commonly seen with rotting wood in New Zealand. PHEL Pathology suggested the white fungus was likely an environmental species and not a biosecurity issue. As a precaution, the II placed the wood in a quarantine bin.

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PEST WATCH: 24 July 2019 – 22 April 2020

Biosecurity is about managing risks: protecting New Zealand from exotic pests and diseases that could harm our natural resources and primary industries. MPI's Diagnostic and Surveillance (D&S) Directorate devotes much of its time to ensuring that organisms that may be new to New Zealand come to its attention, and are appropriately investigated.

This information was compiled from notifications to MPI of suspected new to New Zealand organisms. The list includes organism records validated between 24 July 2019 to 22 April 2020. The plant information is held in the MPI Plant Pest Information Network (PPIN) database. Location refers to areas defined in Crosby et al. (1998). Wherever possible, common names have been included. Records in this format were previously published in the now discontinued magazine *Biosecurity.*

To report suspect new pests and diseases to MPI phone 0800 80 99 66

Validated new to New Zealand reports

Type	Organism	Host	Location	Submitted by	Comments
Bacterium	*Acetobacter musti* *no common name*	Isolated from kombucha drink	Auckland	(Landcare Research) General Surveillance	Not known to be a plant pathogen. Part of a fermenting microbial community.
Bacterium	*Acetobacter papayae* *no common name*	*Isolated from kombucha drink*	*Auckland*	(Landcare Research) General Surveillance	Not known to be a plant pathogen. Part of a fermenting microbial community.
Chromist	*Halophytophthora avicenniae* *no common name*	Stream water	Auckland	(Landcare Research) General Surveillance	Species of *Halophytophthora*, including *H. avicenniae*, are mostly known as leaf decomposers of mangroves, but have also been found from inland freshwater habitats (Nakagiri 2000; Reeser et al. 2011; Yang and Hong 2014).
Chromist	*Phytophthora xserendipita* *no common name*	Soil near a dead kauri tree (*Agathis australis*)	Bay of Plenty	(Scion) High Risk Site Surveillance	A hybrid of *P. cactorum* and *P. hedraiandra*, both of which are present in New Zealand.
Fungus	*Ambrosiella roeperi* *no common name*	*Quercus sp.* *oak*	*Auckland*	(PHEL) High Risk Site Survey	*A. roeperi* is the primary fungal symbiont of the granulate ambrosia beetle, *Xylosandrus crassiusculus*. Not considered to be plant pathogenic.
Fungus	*Anthostomella ravennica* *no common name*	*Feijoa sellowiana* feijoa	Auckland	(PHEL) General Surveillance	Originally reported as saprobic on dead stems of *Ammophila arenaria* in Italy.
Fungus	*Austropuccinia psidii* *myrtle rust*	*Metrosideros kermadecensis* Kermadec pōhutukawa	Kermadec Islands	(PHEL) General Surveillance	First found at the Kermadec Islands in March 2017. Subsequently found on mainland New Zealand in May 2017, on *M. excelsa* in Northland. Following the initial eradication attempt, myrtle rust was found from several other regions and it is now widely spread throughout New Zealand (Ho et al. 2019; Toome-Heller et al. 2020).
Fungus	*Candida argentea* *no common name*	*Inanimate*	*Auckland*	(PHEL) General Surveillance	Not known to be a plant pathogen.
Fungus	*Colletotrichum perseae* *no common name*	*Persea americana* avocado	Bay of Plenty	(PHEL) General Surveillance	Described from avocado in Israel in 2017.
Fungus	*Colletotrichum tofieldiae* *no common name*	*Dietes* sp. iris	Bay of Plenty	(PHEL) High Risk Site Survey	Reported overseas as a root endophyte of *Arabidopsis* (thale cress).
Fungus	*Didymella lethalis* *no common name*	*Vicia sativa* *common vetch*	*Auckland*	(PHEL) High Risk Site Survey	Originally reported in New Zealand as a different *Didymella* species, this fungus is a known endophyte that can also cause root lesions on pea plants.
Fungus	*Heterotruncatella spartii* *no common name*	*Cedrus deodara* Himalayan cedar	Mid Canterbury	(PHEL) General Surveillance	Also known as *Truncatella spartii*, it is not known to be a plant pathogen of cedar.

Validated new to New Zealand reports

Type	Organism	Host	Location	Submitted by	Comments
Fungus	*Hortaea thailandica* *no common name*	*Callistemon* sp. bottlebrush	Bay of Plenty	(PHEL) High Risk Site Survey	*Hortaea thailandica* is likely to have contributed to the leaf spots observed on this host.
Fungus	*Neoconiothyrium viticola* *no common name*	*Vitis vinifera* *grape*	*Hawke's Bay*	(PHEL) General Surveillance	The fungus discovered during this surveillance was identified as a suspect new to science species. It was described as *N. viticola* in 2019.
Fungus	*Neodevriesia sexualis* *no common name*	*Carex secta* pukio, makura grass	Auckland	(PHEL) High Risk Site Survey	The fungus discovered during this surveillance was identified as a suspect new to science species. It was described as *N. sexualis* in 2019.
Fungus	*Parafenestella pittospori* *no common name*	*Pittosporum tenuifolium* kōhūhū	Bay of Plenty	(PHEL) General Surveillance	The fungus discovered during this surveillance was identified as a suspect new to science species. It was described as *P. pittospori* in 2019.
Fungus	*Pezicula neosporulosa* *no common name*	*Actinidia chinensis* *kiwifruit*	*Bay of Plenty*	(PHEL) High Risk Site Survey	An endophytic species. Detected as a result of re-analysing sequence data from samples previously deposited in New Zealand culture collections.
Fungus	*Phaeomoniella niveniae* *no common name*	*Callistemon* sp. bottlebrush	Bay of Plenty	(PHEL) High Risk Site Survey	Previously recorded on *Nivenia stokoei* (Stokoe's bush iris) in South Africa.
Fungus	*Phaeosphaeriopsis glaucopunctata* *no common name*	*Ruscus aculeatus* Butcher's broom	Mid Canterbury	(Scion) High Risk Site Survey	A foliar pathogen that causes leaf spots and necrosis on *Ruscus* species.
Fungus	*Pichia manshurica* *no common name*	*Isolated from kombucha drink*	*Auckland*	(Landcare Research) General Surveillance	Found commonly in natural fermentations including rotting plant material. Not a plant pathogen.
Fungus	*Pilidium novae-zelandiae* *no common name*	*Phoenix sp.* *palm*	*Auckland*	(PHEL) General Surveillance	The fungus discovered during this surveillance was identified as a suspect new to science species. It was described as *P. novae-zelandiae* in 2019.
Fungus	*Pseudoplagiostoma corymbiicola* *no common name*	*Corymbia ficifolia* red flowering gum	Bay of Plenty	(PHEL) High Risk Site Survey	The fungus discovered during this surveillance was identified as a suspect new to science species. It was described as *P. corymbiicola* in 2018.
Fungus	*Thelonectria torulosa* *no common name*	*Pinus radiata* radiata pine	Hawke's Bay	(Scion) Forest Biosecurity Survey	This fungus has not been reported as a pathogen.
Insect	*Phacodes personatus* *longhorn beetle*	Under bark of *Ecucalyptus* sp; flew into house.	Whanganui	(PHEL) General Surveillance; (Scion) High Risk Site Survey	Individuals observed since 2016. One account of beetles being collected from under the bark of *Eucalyptus.*
Nematode	*Bursaphelenchus hildegardae* *nematode worm*	*Pinus radiata* radiata pine	Taupo	(PHEL) General Surveillance	This nematode was likely reported as *B. eggersi* during the 1960s.

If you have any enquiries regarding this information please contact surveillance@mpi.govt.nz

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  Postal: PO Box 3866, Christchurch 8140
  Tel: 03 379 9484 Fax: 03 379 9485

- DUNEDIN
  Courier: Invermay Research Centre, Block A, Puddle Alley, Mosgiel, Dunedin 9053
  Postal: PO Box 371, Dunedin 9053
  Tel: 03 489 4600 Fax: 03 489 8576

INDEXX LABORATORIES

- HAMILTON
  Courier: Cnr Anglesea and Knox Streets, Hamilton
  Postal: PO Box 944, Hamilton
  Tel: 07 839 1470 Fax: 07 839 1471

- PALMERSTON NORTH
  Courier: IVABS Building, 1st Floor, Massey University, Tennant Drive, Palmerston North
  Postal: PO Box 325, Palmerston North
  Tel: 06 353 3983 Fax: 06 353 3986

SVS LABORATORIES

- HAMILTON
  PO Box 10304
  Hamilton 3241
  Ph: 0800 SVS LABS (0800 787 522) or 07 444 5101
  Fax: 07 444 5102
  Email: info@svslabs.nz

To report suspected exotic land, freshwater and marine pests, or exotic diseases in plants or animals, call:

0800 80 99 66

Investigation and Diagnostic Centre – Wallaceville
66 Ward Street
Upper Hutt
Tel: 04 526 5600

Investigation and Diagnostic Centre – Tamaki
231 Morrin Road
St Johns
Auckland
Tel: 09 909 3568

Investigation and Diagnostic Centre – Christchurch
14 Sir William Pickering Drive
Christchurch
Tel: 03 943 3209

Biosecurity New Zealand
Ministry for Primary Industries
Manatū Ahu Matua