Plant pest surveillance in Australia

Paul Pheloung looks at aspects of plant pest surveillance

Abstract

Plant pests are a major problem in Australia causing productivity losses, incurring management costs, restricting trade and threatening biodiversity in natural ecosystems. Even with rigorous quarantine measures, new plant pests can enter Australia undetected. Surveillance programs are essential. They provide early detection of pest incursions so they can be eradicated, and they define Australia's plant health status for trade purposes.

Introduction

Plant pests include insects, weeds, fungi, bacteria, viruses and other organisms that are harmful to plants or, in the case of weeds, compete with or displace desirable plants. These pests are a major problem in Australia causing productivity losses, incurring management costs, restricting trade and threatening biodiversity in natural ecosystems. Most plant pests are exotic to Australia and were introduced from other parts of the world, mainly through trade and travel. As a relatively isolated continent, and with movements of goods and people from other countries only becoming significant in the last 200 years, Australia is still free of many potentially serious plant pests and benefits from rigorous quarantine measures to ensure these pests do not gain entry. Nevertheless, even with such measures in place, plant pests will continue to enter undetected and, where circumstances are favourable, form a self-sustaining population that will spread and over time become a permanent and undesirable part of the Australian flora and fauna.

Symptoms of sharka (plum pox virus) on apricot fruit and leaves
Photo by John Hammond, Agricultural Research Service, United States Department of Agriculture

A plant pest incursion into Australia can be eradicated through emergency response measures, but the chance of a successful and affordable eradication is dependent on a system of surveillance that will reveal the presence of the pest while it is still confined to a small area. Usually, by the time a pest population has grown to the extent that it is noticeable due to the damage it causes, the prospects for eradication become very poor and prohibitively expensive. It has been repeatedly stated (Nairn *et al.* 1996) that the benefits, in terms of avoided ongoing costs, far outweigh the direct costs of eradicating a pest before it becomes well established. But first, the pest must be detected through some kind of surveillance activity, which must be paid for and managed.

The International Plant Protection Convention, under the United Nations Food and Agriculture Organisation (FAO), is responsible for establishing International Standards for Phytosanitary Measures including Guidelines for Surveillance (FAO 1998). These guidelines distinguish broadly between general surveillance and specific surveys.

Specific surveys

Specific surveys are procedures where information is obtained on particular pests of concern at specific sites in an area over a defined period of time. Examples include a survey of insect pests in citrus orchards or a fungal infection in a cereal crop. Fielding a qualified search team is a costly exercise, particularly if the objective is the equivalent of finding a 'needle in the haystack' and finding nothing is the usual (and preferred) outcome. Clearly, the cost of having search teams routinely and continually searching all production systems, and the native bush for that matter, for every conceivable pest threat would outweigh the benefits derived from early detection and eradication.

It is therefore essential to identify where the risk is greatest and focus surveillance effort accordingly.

Analysis of trade patterns can suggest likely pathways for the introduction of pests. Coupled with knowledge of climate preferences, presence of suitable host plants and a means of spread, specific surveys can be designed to focus on the sites where the hazard is greatest. The Northern Australian Quarantine Strategy (NAQS), a program of the Australian Quarantine and Inspection Service (AQIS), includes a surveillance program that embodies this approach. NAQS surveillance is conducted along the coastal strip between Broome and Cairns, but that coastal strip is partitioned into risk zones and the frequency of surveys is proportional to the risk. In the northern islands of the Torres Strait, within a few kilometres of the Papua New Guinea mainland, comprehensive surveys are done twice a year while the remote southern coast of the Gulf of Carpentaria is surveyed just once every 5 years. NAQS has also developed target lists of the pests most likely to enter via Australia's north and the surveys focus on the hosts and situations in which these pests are likely to be found.

If a good methodology exists, specific surveys can be implemented at reasonably low cost. Fruit fly traps are an example. Many fruit flies are attracted to chemical lures and can therefore be enticed into an insect trap. A network of traps will reveal the presence of an insect target when just a few are present in a region and these traps can be quickly inspected on a routine basis. A network of insect traps placed in the vicinity of Australia's ports of entry and in the Torres Strait has proven to be an exceedingly effective early warning system. Prior to the establishment of this network, papaya fruit fly was detected in Cairns but this was by a grower and at a stage when the population had become well established. Consequently, the eradication campaign (which fortunately was successful) cost about $34 million and the cost to growers in lost markets and production in the meantime was estimated to be as high as $100 million. The trapping network that was subsequently put in place led to the detection of the Philippines fruit fly in Darwin, a pest of comparable importance to the papaya fruit fly. Because this pest was detected at a very early stage, the eradication cost was considerably less, at about $5 million.

General surveillance

General surveillance in Australia is essentially a process whereby information on particular pests that are of concern for an area is gathered from many sources, including the results of specific surveys. It includes measures to facilitate timely reporting on changes in plant pest status, such as a first record of a new pest or expansion in the range of a pest already present. Raising public awareness generally and specifically through the preparation and distribution of booklets and fact sheets on particular plant pests is a central component of general surveillance. General surveillance can effectively capitalise on other activities, such as routine crop monitoring for established pests, undertaken by professionals with the capacity to recognise new pests.

Plant pest surveillance must operate within the broader context of plant health management in Australia. The ability to diagnose or name suspect organisms depends on well-trained diagnosticians, effective techniques, and reference collections. This is particularly challenging for the identification of pests not previously described in Australia. Well-maintained specimen-based collections are equally important in defining pest status in Australia. They include what organisms are present, where and when they are found, and on what host plants. With the growth of digital technologies and the Internet, tools have been developed to allow rapid and convenient access to such information through the Australian Virtual Herbarium (http://www.chah.gov.au/avh/) and the Australian Plant Pest Database (http://www.planthealthaustralia.com.au/our_projects/display_project.asp?category=4&ID=1). These systems actually aggregate specimen-based data from numerous sources, Australian herbariums in the case of the AVH and invertebrate and pathogen collections in the case of the APPD, and generate a report in response to an Internet based user query.

Fire blight infects terminal leaves on an unpruned and uncovered apple tree
Photo (c) Keith Weller, Agricultural Research Service, United States Department of Agriculture

Colorado potato beetle
Photo by Scott Bauer. Agricultural Research Service, United States Department of Agriculture

Other functions of plant health surveillance

The preceding discussion has focused on early detection surveillance. Plant pest surveillance is also an essential component of an emergency response to a pest incursion—attempting eradication is pointless unless the extent of an incursion can be reliably determined and monitored to a point where surveillance establishes that the pest is no longer present.

A recent example of this is the discovery of citrus canker, a serious bacterial disease of citrus species, in a citrus production orchard in Queensland. An essential part of the response to that detection was to quickly undertake a comprehensive surveillance program in the region where the detection occurred, and in other regions where a linkage to the infected region was likely, including nurseries and backyards. This was important to determine the true extent of the disease so that an eradication program could be effectively managed. Effective and rapid delimitation of the extent of the disease was critical for producers whose livelihood depends on being able to sell their fruit to markets, both interstate and overseas, that impose trade restrictions because of the presence of citrus canker.

Another very important role for surveillance is to provide assurance that particular plant pests are not present in an area. Increasingly, this type of data is becoming critical for Australian trade. Quarantine measures applied to imported products to exclude particular pests require some justification that the pest is not already established in Australia. Similarly, such data is important in supporting Australian assertions that exported plant products are not infested or infected with pests of concern to other importing countries, or for that matter, other states within Australia. Exports of Australian fruit to Japan from the Murray River district are dependent on a fruit fly trapping program in the area that demonstrates the absence of fruit flies known to be present in other parts of the country. Examples of the need for such data arose recently following the detection of citrus canker, discussed earlier, and following a claim by an importing country that a consignment of Australian wheat was infected with the Karnal bunt fungus, a pest that affects the quality of wheat. This fungus has never been recorded in Australia and strict quarantine measures are in place to prevent its introduction. Nevertheless, it was necessary to assemble a body of evidence to demonstrate the absence of the pest in Australia. This was based on activities around the country that contribute to general surveillance for the pest and extensive tests on samples of wheat collected prior to export.

Who pays?

While eradicating a pest before it becomes established can offer major benefits in terms of avoided costs, early detection surveillance does impose a cost that must be met.

Clearly, while the benefits of surveillance for plant pests are potentially very large, the cost is also large and therefore best shared by government and those in the private sector that directly benefit. The Australian Government assumes primary responsibility for providing quarantine services at the international borders and also funds the NAQS program that serves the national interest and

Quarantine officer inspecting a fruit fly trap as part of the Northern Australia Quarantine Strategy

operates in sparsely populated regions of the north. The State and Territory governments have primary responsibility for preparing for and reacting to plant pest emergencies although the Australian Government does assist financially where there is a clear national good.

Surveillance to support market access has been the responsibility of State/Territory governments and the private sector. Ongoing monitoring for the management of established pests has been the responsibility of the private sector.

Plant Health Australia (PHA) was incorporated in 2000 to facilitate a partnership between government and industry in dealing with plant health problems. This includes brokering an arrangement for funding the response to plant health emergencies that includes contributions from government and industry. An important step towards this arrangement is the development of industry specific biosecurity plans that, among other things, identify and categorise the major pest threats. While the plans focus on how to respond to an incursion, they could also provide a basis for early detection surveillance activities that ensure incursions of major pests will be detected as early as possible.

References

FAO, 1998, Guidelines For Surveillance. *International Standards for Phytosanitary Measures Publication No. 6.* http://www.ippc.int/IPP/En/ispm.htm.

Nairn, M. E., Allen P. G., Inglis A. R. and Tanner C., 1996, *Australian Quarantine: a shared responsibility.* Department of Primary Industries and Energy, Canberra.

Author

Dr Paul Pheloung works in the Office of the Chief Plant Protection Officer with the Australian Government Department of Agriculture, Fisheries and Forestry. Paul currently has responsibility for plant pest surveillance projects. While employed by the Department of Agriculture Western Australia he has previously worked on weed risk assessment decision support tools. Paul has also been a part of the Northern Australia Quarantine Strategy and was a manager in Biosecurity Australia dealing with plant health risks associated with trade.