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With more than 7 million mouths to feed, world food security (insecurity would be a better description), is high on the international radar. In his article, Les Baxter points out that the term food security means that sufficient quantities of food must be available, that people must have sufficient resources to obtain nutritious food, that it is used appropriately, and that a consistent food supply is not subject to sporadic or periodic shocks. Plant pathogens adversely affect all of these factors. They reduce the quantity and quality of food, they reduce income through reduced marketable yield, and disease epidemics result in sporadic reductions in food supply.

Plant pathology is an applied discipline in which important advances have followed devastating disasters. Richard Strange mentions the Irish potato famine in the mid-nineteenth century. One million people died from a total population of 8 million, and about 1.5 million emigrated, many to Australia. Contemporary investigations into this famine established the germ theory of disease, the importance of environmental conditions on disease progression, and the potential for control with chemicals and through selective breeding.

It comes as a surprise to realise that most plants are not attacked by pathogens. Philip Keane describes the many physical and chemical barriers that plants have developed to minimise invasion by microorganisms, so that resistance is more common than susceptibility. Those pathogens that are able to invade are often highly specialised. Some establish a biotrophic relationship with the host, which is controlled by a gene-for-gene interaction of resistance genes in the host and virulence genes in the pathogen. Invasion triggers responses in the host, setting up a molecular arms race that is described by David Guest. Improved understanding of invasion and host response have resulted in improved selection of resistant genotypes through the use of molecular markers, as described by Manisha Shankar and her colleagues, or through providing targets for breeding, with an example given by Amanda Able and her co-authors.

Fusarium is a ubiquitous genus of fungal pathogens. Many cause important diseases of food and fibre crops such as wheat, maize, bananas, cotton and pines. Lester Burgess and Wayne Bryden describe some of these pathogens that not only reduce yield, but also produce mycotoxins that contaminate grain, with the potential to cause serious toxicoses in man and stock. Jeremy Allen describes another toxicosis, annual ryegrass toxicity, which causes fatal poisoning of sheep and other livestock. This is a curious tale of interactions between completely different organisms: ryegrass, a seed-gall forming plant parasitic nematode and a hitchhiking, toxigenic bacterium. There is also a fungus involved, as a biocontrol agent.

Australia is in a fortunate position: its recent agricultural history and physical isolation mean that many pathogens do not occur here. This is a privileged position that must be maintained, because it provides a competitive advantage in relation to market access for many agricultural products. Simon McKirdy and colleagues outline the tension between the identification of a pathogen and whether or not its presence results in disease. This has important implications for trade, because trade can be halted if a pathogen is identified, even though disease symptoms have never been seen. Dominie Wright gives an example that emphasises the importance of accurate identification of pathogens of quarantine significance. In 2004 a consignment of wheat was rejected by an importing country because it was believed that it contained spores of the quarantinable fungus *Tilletia indica.* This pathogen causes Karnal bunt, a disease never recorded in Australia, and where this pathogen was not known to occur. If confirmed, it would jeopardise wheat exports worth $4 billion. A task force of plant pathologists screened wheat samples from consignments in transit and in store, and found that there had been a misidentification; the contaminating spores were from similar, but different pathogens from other hosts. The wheat export industry heaved a sigh of relief, and the plant pathologists returned to their day jobs.

The Karnal bunt example illustrates the difficulties of separating morphologically similar fungal species; as a result, DNA sequence-based techniques are becoming increasingly important diagnostic tools. Roger Shivas and Lei Cai discuss the implications of these techniques in relation to biosecurity. It is now known that some plant pathogens with very wide host ranges and that are morphologically indistinguishable, are actually complexes of cryptic species that differ in host range, pathogenicity and geographic distribution. As a result, a disease that occurs in one country may be caused by a different but morphologically similar pathogen in another country. How can the biosecurity agencies deal with this? Disease lists provide names, but these names may not reflect current taxonomy.

Another example of how molecular diagnostics can both clarify the taxonomy, but complicate the pathology is given by Mike Stukely. These techniques have shown that what was previously considered to be a small number of variable *Phytophthora* spp. isolated from native ecosystems in Western Australia are clusters of morphologically similar species, raising questions of whether these are all equally pathogenic, and have similar host ranges.

Plant pathogens are spread by wind, water, in soil, on infected plants and by vectors including man. Dominie Wright and Mingpei You describe how they have used CSI methods to compare spore loads on different types of fabric. This emphasises the importance of minimising the spread of plant pathogens by cleaning clothing and equipment between visiting crops on different properties, in different areas and in different countries.

This issue of *Microbiology Australia* has drawn attention to plant pathology and plant pathogens. The skills of Australian plant pathologists underpin the quality and quantity of food and fibre crops for domestic consumption and export. Mikael Hirsch provides an outline of where plant biosecurity is heading, with shifts towards national systems in terms of legislation, diagnostics and surveillance. Recent advances in molecular taxonomy have thrown up challenges for regulatory authorities, particularly in relation to re-evaluating which plant pathogens occur in Australia, and whether similar symptoms worldwide are always caused by the same organism. Traditional pathology skills in diagnostics, taxonomy, extension and research will still be needed, imaginatively supplemented with the new skills and opportunities provided by molecular biology. There are exciting times ahead.

Biography

Prof Elaine Davison. Much of my career as a plant pathologist has been in the Western Australian public service in forestry and horticulture. Now ‘retired,’ I hold an adjunct position at Curtin University, and am the President of the Australasian Plant Pathology Society.