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Web-based microscopy brings finer focus to biosecurity

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Remote microscopy is making life easier for quarantine officers and others in the frontline of biosecurity protection by allowing experts in other cities, states or countries to see what's under a remotely located microscope. At stake is the future of Australia's valuable plant assets – not only commercial crops, but iconic native plants such as bottlebrush and willow myrtle.

Credit: Carl Davies

Rapid identification of exotic pests and pathogens is the key to timely and effective action to protect Australia's plants and animals. Remote microscopy, in particular, is a web-based, real-time, interactive and affordable diagnostic tool that allows non-experts to readily collaborate with experts – wherever they are – to identify pest specimens.

The Cooperative Research Centre (CRC) for National Plant Biosecurity has initiated a rapidly expanding remote microscopy network centred on Nikon web-based digital cameras and consoles. The network, which currently extends throughout Australia and New Zealand, Thailand, Lao PDR, Vietnam and East Timor, includes 41 remote microscopy 'nodes'. Australia has an additional 12 locations associated with the Australian Quarantine and Inspection Service (AQIS).

Scientists have used remote microscopy while communicating with experts in the United States to identify highly damaging mealybugs in Queensland, thus protecting our economically significant cotton industry. Remote microscopy has also been used to distribute information on myrtle rust (*Uredo rangelii*), a newly described pathogen closely related to eucalyptus/guava rusts. These rusts are serious threats to plants belonging to the family Myrtaceae, which includes iconic Australian natives such as willow myrtle (*Agonis* sp.) and bottlebrush (*Callistemon* spp.).

In Australia and overseas, remote microscopy technology is used to identify intercepted pests in quarantine settings by AQIS, the Ministry of Agriculture and Forestry New Zealand and other agricultural bodies. It is also used as a training tool for those involved in diagnostic, quarantine or educational roles at national collections, museums and universities.

Perhaps one of the most exciting applications of remote microscopy is its role in the creation of 'virtual taxonomic laboratories'.

CSIRO Ecosystem Sciences and the Chinese Academy of Sciences, for example, have developed a virtual workspace for online collaboration involving remote microscopy. The online laboratory allows people from Australia and China to work together, view each other's specimens and share information in real time. Virtual interactions with personnel in plant protection labs in Bangkok, Thailand, are also ensuring mutual education and collaboration. This is especially valuable for biosecurity threats such as fruit flies in South-East Asia and Australia.

Remote microscopy will also be integrated with existing databases and online resources such as PaDIL (Pests and Diseases Image Laboratory; www.padil.gov.au). In future, PaDIL will include remote microscopy within a portal that employs features of social networking sites such as Facebook. The aim is to facilitate the diagnostic process by capturing the data and images that pass between collaborating scientists using remote microscopy.

Remote microscopy will form part of a suite of online taxonomic tools accessed through PaDIL – including a plant biosecurity toolbox, contingency action plans and a dynamic online workspace – that will allow scientists to solve diagnostic problems through remote collaboration. PaDIL's online remote microscopy diagnostics website will allow users to make identification enquiries, upload images and communicate directly with experts, as well as access remote microscopy-facilitated training courses.

With progress being made to operate remote microscopy from Blackberrys, iPhones and other handheld devices such as ultra-mobile PCs, the technology is set to become cheaper, more accessible and portable.

The biosecurity sector in Australia and neighbouring countries is in dire need of tools and systems to make the most of a dwindling pool of taxonomic expertise. With the advent of remote microscopy and the emergence of pervasive social networking tools, web-based diagnostics promises to be a powerful addition to our biosecurity, quarantine and border protection resources.

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