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FOOD AND NUTRITION SECURITY

The biosecurity, health, trade nexus

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From field to lab

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ABSTRACT



The Crawford Fund has supported a long-running program providing plant pathology and entomology support for smallholder farmers and provincial and district staff in southern Lao PDR. The program has involved over 32 volunteers, mentors and students covering 55 cash crops involved in poverty alleviation. The program has focused on identifying the key pests and diseases while working directly with the farmers to develop appropriate management practices. We endeavour to empower

government advisers to work with farmers to alleviate poverty, for example through the production of high value horticulture crops. Activities have included workshops, establishment of small diagnostic laboratories, and the development of pest and disease checklists and extension materials. Benefits also flow to Australia, with volunteers and mentors gaining exposure to pests and diseases not present in Australia, and the opportunity to build professional networks. This case study describes the 'field to lab' approach that has characterised this program and made it successful. Dr Anderson visited Savannakhet and Champasak provinces in February and March 2019 as a volunteer with the Australian Volunteer Program. She worked with local government advisers to visit smallholder farmers and survey the leaf diseases that affect bananas in southern Lao PDR. In-field training for identification of banana leaf diseases was undertaken. Samples were taken to the laboratory for preliminary identification, providing the opportunity for training in specific techniques for working with banana leaf pathogens. Samples were sent to colleagues in internationally recognised laboratories for formal identification, making use of specialised resources not present in Lao PDR. During COVID, ongoing support for the identification of pest and diseases and their management has been through the use of social media such as WhatsApp which link the network of past volunteers, mentors and Lao counterparts.

This talk is about my six week volunteer stint in Lao PDR in 2019, looking at leaf spot pathogens of banana. Since 2009, the Crawford Fund has had a program in southern Lao PDR, working with local smallholder farmers and provincial and district staff to identify pest and disease issues and develop control measures to specifically suit each location. The program has involved 32 volunteers, mentors, and students, and it has covered 55 cash crops that were important in alleviating poverty. The Crawford Fund has also been involved in the development of two laboratories – one in Pakse and one in Savannakhet – and also a glasshouse in Savannakhet.

Bananas in Lao PDR are extremely important: the fruit and flowers of local varieties such as Kuay Nam are consumed, and leaves are used as food

This record has been prepared from a transcript and the slides of the Zoom presentation.

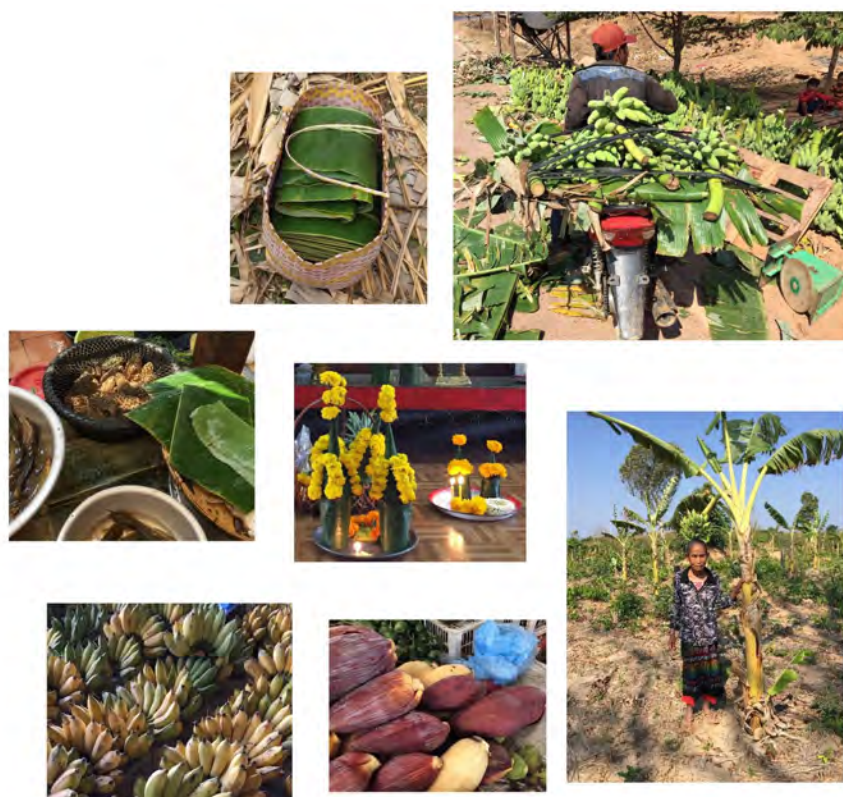


Figure 1. Banana in Lao PDR.

wrappings. Banana leaves are also culturally significant, because they are involved in the manufacturing of offerings. Bananas are important sources of cash, both being traded domestically and also for export. The bananas on the back of the motorbike in Figure 1 are some Kuay Nam bound for Vietnam. There are also large Cavendish plantations which are foreign-owned concessions and significant from a biosecurity point of view.

Banana disease issues are not well documented, apart from *Fusarium* wilt. A bit of work has been done on pests (Vansilalom 2016). The focus of my work was leaf spot diseases: the leaf spot pathogens are quite important because of the cultural uses of the leaves.

The project

In a survey of banana leaf disease, I and my colleagues from the Provincial Agriculture and Forestry Office in the south of the country went out to quite a few locations. We surveyed villages and smallholder plantations and looked mainly for banana freckle and banana leaf streak, collecting leaf samples and also noting anything else of concern, such as the occurrence of banana weevil borer (bottom right in Figure 2).

As I mentioned, two laboratories have been set up: entomology and pathology laboratories in Pakse and Savannakhet. However, they cannot handle the

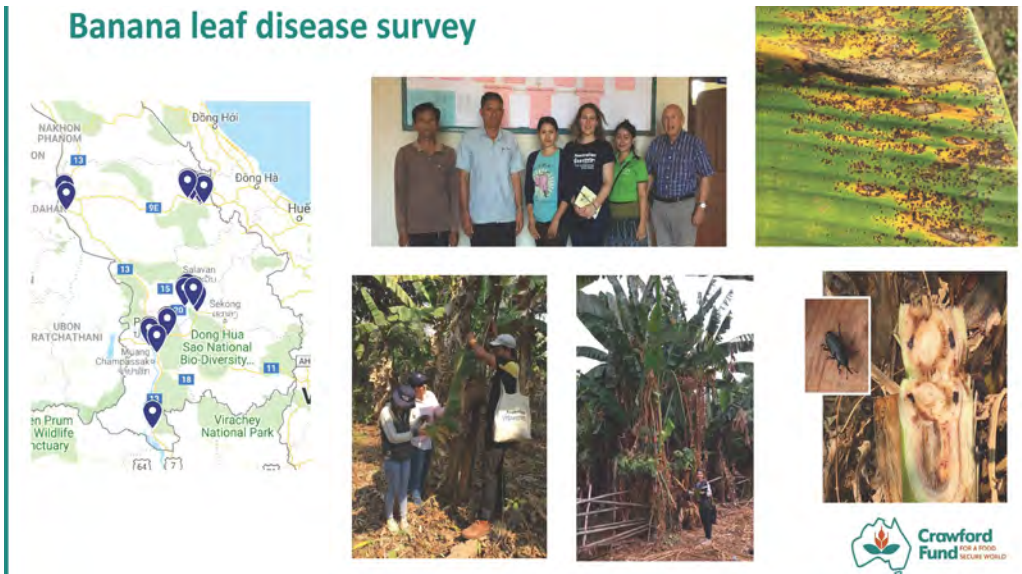


Figure 2. Banana leaf disease survey.

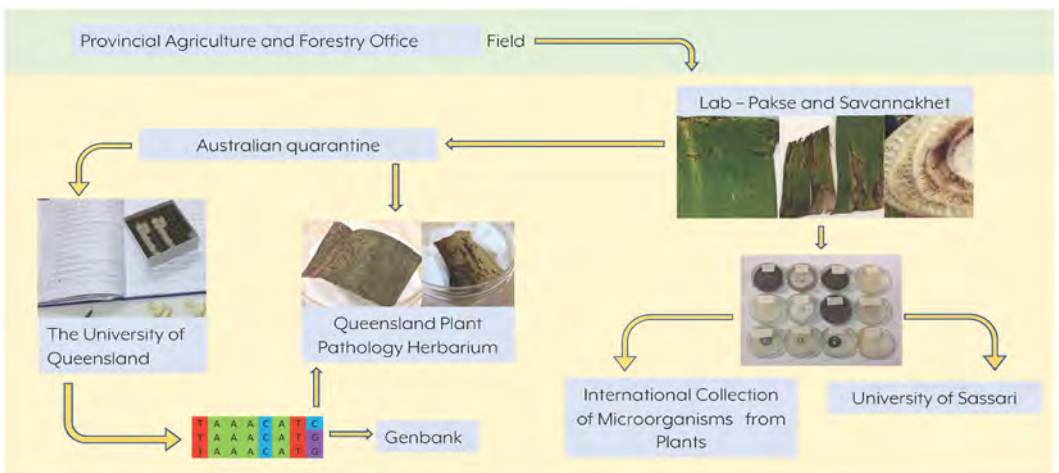


Figure 3. From the field to the lab.

processing of all the samples, and so we drew on our international network to identify the pathogens that were present. After our team had collected samples, we brought them back to the laboratories in Pakse and Savannakhet (Figure 3). The photos at top right in Figure 3 show, on the left, leaf samples with banana freckle. A number of fungal pathogens can cause those symptoms. Similarly, the symptoms of leaf streak can be caused by a number of fungal pathogens.

Those fungi are quite slow growing, and therefore instead of trying to grow them in the laboratory in Laos we prepared them for returning to Australia under Australian quarantine. We dried the specimens, gamma radiated them,

- Growers – no major change to practices
- Verifiable records of freckle pathogens and leaf streak pathogens present
- Lao colleagues - skills



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First report of *Phyllosticta* spp. associated with banana freckle disease in southern Lao PDR

Jay M. Anderson¹ · Cecilia O'Dwyer² · Sengphet Phanthavong¹ · Kaisone Sengsouichan¹ · Andre Drenth³ · Samrit Vilavong¹ · Lester W. Burgess⁴



Figure 4. Outcomes of the project.

and then lodged them in the Queensland Plant Pathology Herbarium as voucher specimens. We also prepared samples in solutions that inactivate the pathogens but preserve the DNA, and we brought those back to The University of Queensland where we could use sequencing to identify the fungi present. The data we generated were matched up with the specimens that we had sent to the Queensland Plant Pathology Herbarium, and also submitted to GenBank. We also did some isolations in the lab, and we had duplicate collections in case of losses. One of those went to the International Collection of Microorganisms from Plants (ICMP) in New Zealand, and the other went to the University of Sassari in Italy. ICMP have recently sent us back some DNA to work with and do further confirmation.

Outcomes

For the smallholder farmers, the project did not lead to any changes. They have a system that suits them: occasional de-leafing gets rid of their banana leaf spot issues. It is a low input system that allows them time to earn off-farm income and to spend time with the family, but still brings in needed cash. We gave out some advice for management of the banana weevil borer: it was a cultural control technique that did not cost the farmers any extra money.

For the Australian and Lao researchers and extension officers, the project led to capacity building, and we have contributed verifiable records of the freckle pathogens and leaf streak pathogens (Figure 4). That information is publicly available and internationally available, contributing to scientific knowledge with a good scientific basis. We have also published that work (Anderson *et al.* 2021). I think it is very important for us to help our Lao colleagues have the opportunity to publish and be recognised.

Acknowledgements

From Figure 5 you can see how big a network we have been able to draw on to do this work, and people who have helped. In particular I would like to



Figure 5. Acknowledgements.

acknowledge Professor Lester Burgess and the other volunteers who have worked before me to set up the laboratories, and also the Crawford Fund for funding the laboratories and the banana leaf survey.

Dr Juliane Henderson (The University of Queensland; Biosecurity Queensland), Ms Kathy Grice (Queensland Dept of Agriculture and Fisheries) and Dr Madaline Healey (University of the Sunshine Coast) provided me with some tips and tricks for working with banana diseases, banana pathogens, and also about life in Laos.

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Dr Jay Anderson is a Senior Research Fellow at the Centre for Organics Research at Southern Cross University. She is a plant pathologist focused on integrated disease management of tropical and subtropical horticultural crops. Jay has worked in government, university, private enterprise and in an industry representative body, and in all these roles, her work focused on practical solutions for farmers. Jay volunteered through the Australian Volunteer Program with the Crawford Fund's long-term program in Lao PDR where she was able to use her pathology skills to work with colleagues studying banana leaf diseases in the south of the country. She considers it a career highlight to meet smallholder farmers and share her knowledge with Lao colleagues, learning so much from them and her Australian counterparts. A short video interview on this experience is at <https://www.youtube.com/watch?v=EZJTj7b6LJ4>