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On the white spot

On-farm and in the laboratory, researchers are working to help smallholder shrimp farmers shield their stock from white spot and other diseases

BY ROBIN TAYLOR

The mysteries of a dangerous shrimp disease, estimated to have cost Asian farmers billions of dollars in lost production, are being unravelled through a two-pronged research approach.

Since 1996, a number of ACIAR projects have helped shrimp farmers across Asia tackle white spot disease (WSD), caused by the white spot syndrome virus. The work has important flow-on effects for Australian shrimp farmers.

Project leader Dr Richard Callinan says WSD is mysterious because there are a number of ways it can enter farmers' ponds. The project team knew that the virus, despite everyone's best efforts, would probably find its way into most ponds during the course of the crop.

"The trick is to help farmers understand how to manage a crop through to a profitable harvest, without tipping the

balance in favour of the virus and triggering a catastrophic disease outbreak," he says.

Dr Callinan says the work is important as shrimps provide a valuable source of income for many smallholder farmers in Asia.

World production of farmed shrimps was valued at more than US\$10 billion in 2005, with about 80% of production coming from Asia, largely from smallholder farmers.

In Indonesia, shrimps are the most important fisheries export. More than one-third of production comes from traditional extensive systems on small farms of less than two hectares.

These farmers have limited capacity to control production factors such as quality of seed (the tiny shrimps used to stock the pond) and the supply and quality of pond water.

Dr Callinan's project aimed to tackle these issues by working with farmers in Thailand, Indonesia and India to develop best-

management practices for shrimp farming.

Tapping into existing village-based farmer groups, the research team from the Directorate General of Fisheries, Indonesia, and the NSW Department of Primary Industries worked with key farmers in East Java and South Sulawesi to develop best-management practices.

They delivered training to farmers using demonstration ponds operated by the leading farmers.

Dr Callinan says better health-management practices are based on three principles:

- minimising the risk of introducing the virus into the pond with the seed;
- keeping the virus from entering ponds via other sources such as infected crabs or contaminated water; and
- good pond management, such as maintaining water quality to avoid stress on the shrimps.

Smallholder prawn ponds under cultivation in the West Godavari District of Andhra Pradesh, India.

He says the chances of success increase as the number of farmers participating increases. If a group of farmers in close proximity uses these principles, the level of viral contamination in an area is reduced, because there are clean farms close to one another.

Dr Callinan says that in parts of South Sulawesi, for example, where the soils are porous and ponds lose about five centimetres of water a day, farmers have to regularly replenish the water, which increases the potential for viruses coming in from neighbouring farms and infected waterways.

Conditions differ markedly between traditional (extensive), semi-intensive and intensive systems. Traditional ponds have a low stocking rate of about one to six shrimps per square metre, compared with about 15 for semi-intensive systems and 40 for intensive systems. In traditional systems, which are used by about 75% of Indonesian smallholder farmers, operators do not use paddle wheels to aerate the water and may feed shrimps with artificial feed for only part of the cropping period, if at all.

The project had mixed success in converting traditional farmers to the best-

management approach. Although many key farmers were able to grow shrimps effectively and not lose them to disease, other farmers were discouraged from adopting the methods because they could not access the credit needed to convert their traditional systems to semi-intensive ponds.

However, there was unexpected, enthusiastic adoption of the recommendations among non-target, traditional farmers in areas surrounding the demonstration site in Gresik in East Java, thanks to one of the key farmers, Mr Ridwan. He applied the new management practices that he was using in his semi-intensive ponds to his traditional extensive ponds, with great success. His neighbours, who all used the traditional system, noticed this and approached him for help. This group of farmers has now successfully produced several crops of high-quality shrimps.

“Given the right sort of extension support, there is no reason why this can’t go further in Indonesia,” says Dr Callinan, who is coordinating a second phase of the project.

He and his team are going back to Java and South Sulawesi to work on traditional

farms, saying the researchers now know much more about the best-management practices suited to traditional farmers.

At the laboratory level, another ACIAR project aims to reduce the impact of WSD in farmed shrimps. Project leader Dr Peter Walker, of CSIRO Livestock Industries, says that although the disease has been widely studied, outbreaks continue to occur. “These can be devastating for small farmers.”

The project is building on a major initiative coordinated by the Network for Aquaculture Centres (NACA), an inter-government agency based in Bangkok. NACA is working with smallholder farmers and government agencies in India to apply best-management practices to reduce disease risks.

The project also builds on the results of an earlier ACIAR project, which focused on improving scientific knowledge and developing technologies to increase diagnostic capabilities in Thailand and Australia, with expected flow-on throughout the region.

That project included a strong training component, promotion of



Dr Peter Walker and members of the field team discuss pond performance data collected on site in Andhra Pradesh, India.

White spot disease (WSD)

- WSD is caused by white spot syndrome virus.
- Symptoms include rubbing of the body against rocks, no response to feeding, lethargy, red discolouration of the body, and pinhead-sized white spots on the body or fins.
- The virus first emerged in China in 1992 and has since spread to most shrimp-farming countries around the world.
- WSD has cost the farmed-shrimp industry billions of dollars in lost production over the past 10 years, and can be devastating for smallholder farmers.
- Research supported by ACIAR has developed polymerase chain reaction (PCR) and epidemiological tests to identify the diseases.
- The use of PCR-screened seed, along with best-management practices on-farm to reduce stress and prevent transfer of the virus between ponds, is the best insurance a farmer can have against crop failure.

standard diagnostic procedures and commercialisation of diagnostic kits. A shrimp virus-detection kit developed by CSIRO Livestock Industries and Mahidol University, Bangkok, is being produced commercially.

The kit detects very low levels of infection in prawn populations, and can be used to source virus-free broodstock and monitor populations to keep them virus-free.

There are now about 20 diagnostic laboratories in Thailand that undertake polymerase chain reaction (PCR) testing, providing services to about 80,000 small-scale shrimp farmers.

One of the main causes of disease is infected seed, so a key factor in getting a crop through to harvest is screening the seed to make sure it is not infected with the white spot syndrome virus.

The earlier project developed methods for detecting both white spot and yellow head virus using PCR. This screening for white spot syndrome virus in seed shrimps was the key element in the success of a rescue-and-recovery plan to eradicate viral diseases in the Thai shrimp-culture industry, which has resulted in an estimated extra 600,000 tonnes of shrimp production since 1996.

By using specific genetic markers, the researchers can also use PCR to trace the source of the virus in the hatcheries and ponds. When a crop fails, they can tell exactly how the virus entered the system.

In the current project, the researchers are using these genetic markers in a large field-trial in Andhra Pradesh, India, to pinpoint the sources of infection and help prevent the disease. The project is also helping to increase the reliability of seed screening by training laboratory technicians and key scientists in PCR technology.

More than 25 people have been trained in the program, and several scientists have received training at the Australian Animal Health Laboratory in Geelong, Victoria.

Two workshops in India have also introduced a novel calibrating service for laboratories and hatcheries across the country.

Participation in the inter-calibration exercise is voluntary and results are strictly confidential. Thirty-eight laboratories

were asked to test samples on their own, using the PCR test kit of their choice. Each laboratory could view their own results and compare them with others.

“The anonymity allowed us to give confidential feedback to the participating laboratories, as well as to the agencies involved in trying to manage the situation,” Dr Walker says.

A replica of the project is also under way in Indonesia, where another 25 technicians have been trained in PCR and inter-laboratory calibrations have been conducted.

“This inter-calibration of PCR service laboratories and hatcheries is the first to be conducted anywhere in the world,” Dr Walker says. “We see this as the first step in a model for the Asian region. If we get it right in India and replicate it in Indonesia, I believe we’ll get uptake by other governments throughout the region.”

India’s Marine Products Export Development Authority (MPEDA), which provided financial support for the project, now wants to introduce a national accreditation program for testing laboratories.

Results from research into shrimp diseases in Asia will help Australia protect its own shrimp-farming industry against WSD.

“Australia remains disease-free, but the potential for outbreaks cannot be ignored,” Dr Walker says. “Through this project we are learning how to best manage the disease, which should reduce the risk of introduction and improve our response if an outbreak does occur.”

Yellow head virus and white spot syndrome virus are both exotic to Australia, but a yellow-head-like virus (gill-associated virus, or GAV) is known to affect Australian cultured shrimps.

Researchers in the ACIAR projects made important progress in understanding the epidemiology of GAV outbreaks on Australian farms. Results have been incorporated into a best-practice manual for Australian farmers, produced in collaboration with the Australian Prawn Farmers Association.

New low-cost technology, such as a pond-side enzyme-linked immuno-sorbent assay (ELISA) test, has also been developed, with the potential to benefit farmers in Australia and Asia. ■



A farmer displays produce from a successful crop of black tiger shrimps at a distribution centre in Andhra Pradesh, India.



PARTNER COUNTRIES: Thailand, India, Indonesia, Vietnam

PROJECTS: FIS/2002/075: Application of PCR for improved shrimp health management in the Asian region; FIS/1996/098: Diagnostic tests and epidemiological probes for prawn viruses in Thailand and Australia

DESCRIPTION: These projects aimed to help Asian shrimp farmers fight the viral disease white spot syndrome through on-farm practices and via virus screening in the laboratory

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