

Broilers almost ready for market in an intensive broiler farm owned by a family in Lombok.

Understanding BIRD FLU

Avian influenza is not only a threat to human lives, it has also caused serious harm to South-East Asia's tourism and poultry industries. ACIAR projects are helping to mount a strong response

BY KAREN MCGHEE

When Bali was hit for the first time by an outbreak of the deadly H5N1 bird flu strain, the local economy was still reeling from the impact of bombings in the island's Kuta nightclub and restaurant precinct. It was late 2003 and another crushing blow for local tourism, Bali's main industry.

Officially, there have been no human deaths in Bali caused by bird flu—also known as avian influenza (AI). But the threat is enough to create panic whenever and wherever the disease appears.

“AI outbreaks get heavily reported in the press and the demand for chicken goes right down, which causes hardship for farmers and anyone else dependent on the local poultry industry,” explains University of New England (UNE) economist Dr Phil Simmons, who recently began an ACIAR project to assess AI's impact on poverty in Indonesia. “But there's also an awful lot of concern about the wider potential flow-ons to tourism. Bali's tourist industry is probably now operating at about 40% capacity [due to bombings in 2002 and 2005] and the last thing they need are more fears about AI.”

In March 2007, Bali had just experienced its fourth outbreak. But the preliminary results of Dr Simmons's surveys on the island indicate the disease claimed about half the chickens it did during earlier outbreaks.

“It suggests that farmers are responding better and implementing biosecurity measures, which they haven't done before,” says Dr Simmons. “We're also seeing a lot more vaccinating of chickens, so that may have also been significant.”

The project is being managed in Indonesia by another UNE researcher, Dr Budi Santosa, who has helped recruit and train a local team of agriculturalists—mostly extension officers—from Indonesia's Ministry of Agriculture to conduct the surveys. So far, raw data have been gathered from 200 households in Bali and 200 on the nearby island of Lombok. The project will run for at least another two years.

Like everywhere that has experienced AI outbreaks, exactly what is happening with the H5N1 strain in Bali and elsewhere in Indonesia is unclear. However, these are early days in the history of the disease. As hundreds of millions of dollars worldwide are poured into researching



PARTNER COUNTRIES: Indonesia, Vietnam

PROJECTS: AH/2004/040: The epidemiology, pathogenesis and control of highly pathogenic avian influenza in ducks in Indonesia and Vietnam; AH/2005/032: Identification of policy responses to minimise negative socioeconomic impacts of an avian influenza epidemic in Indonesia; AH/2006/050: Control and characterisation of highly pathogenic avian influenza strains in poultry in Indonesia; AH/2006/164: Future directions for animal health services in Indonesia

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Collecting and unloading broilers produced under contract for wet markets (where birds are sold live) in Mataram, Lombok.



Extracting blood from a leg-banded duck in a study to source the spread of avian influenza in the Mekong delta of Vietnam.

and preventing the spread of H5N1, fears remain that it could develop into a deadly global human pandemic.

Avian influenza is caused by a virus and, as its name suggests, is primarily a disease of birds. But late last century, probably in southern China, the highly pathogenic H5N1 strain that can kill people emerged. Officially, the first human deaths attributed to the disease occurred in Hong Kong in 1997 when it claimed the lives of six people and caused serious illness in another 12.

Since then, the H5N1 virus has been detected during outbreaks throughout Asia and in the Middle East, western Europe and Africa. Worldwide, the disease has officially infected more than 310 people, claiming the lives of at least 189.

And hundreds of millions of birds, mostly domestic chickens, have either been killed directly by the disease or culled as part of efforts to contain its spread. More than 75 of the human deaths have occurred in Indonesia, all of which officials say have been restricted to the islands of Java and Sumatra.

It is now known that it is not easy for people to catch AI from chickens or other poultry—that it requires a lot of very close contact with infected birds

have occurred.

With a strong history of collaborative research into animal diseases in the Asia-Pacific, ACIAR was poised for a strong

response to the bird flu crisis. It began planning research projects in late 2004 on the transmission and impact of the disease in the region, and now has investigations under way in Vietnam as well as Indonesia. These projects exploit research strengths previously demonstrated by Australia and are primarily aimed at filling knowledge gaps so that better-informed disease-control decisions can be made.

The Indonesian Government sought assistance from ACIAR directly when it realised its veterinary infrastructure could be improved. Australian Government veterinarians had already established their credentials in the area through involvement in AusAID's decade-long Eastern Islands Veterinary Services Project in Indonesia.

"Australians on that project did a great job, and it has had a long-lasting impression on the Indonesians," says ACIAR's Animal Health Research Program Manager, Dr Peter Rolfe.

The development of Indonesia's capabilities to manage AI, a trans-boundary disease with no respect for geographical or



PHOTO: PHIL SIMMONS

A market stall for fresh poultry meat in Mataram, Lombok.

political boundaries, will be helped through a new project being established by the NSW Department of Primary Industries' Dr Helen Scott-Orr.

A major logistical issue for a disease such as AI is how to manage it across different levels of government, especially in such a geographically diverse country as Indonesia. The project, which is in the early stages of development, plans to pilot an approach that would demonstrate how central, provincial and local jurisdictions can cooperate to control a range of animal diseases.

"What's really required when a virus is rapidly moving and spreading is a coherent approach, and this project will try to strengthen Indonesia's institutional capacity to define what diseases different parts of government will manage and control," Dr Rolfe says. "It's an institutional and policy-type development project, which is quite different for animal health projects in ACIAR."

There are also, of course, direct returns from ACIAR's AI work for Australia, which has so far remained H5N1-free. "Certainly,

our own biosecurity is an important driver for the work we're doing," Dr Rolfe says.

And it's also been important, he says, for ACIAR's research to complement, and not replicate, efforts already under way as part of the massive global effort directed at AI.

One of the big unknowns surrounding the disease is the role ducks play in its transmission. These birds certainly contract H5N1 and their blood develops antibodies to the virus responsible, but they do not always become as sick as chickens, nor die at the same high rate. However, they can still shed and spread the virus, which suggests they may be a significant reservoir for the disease.

In a major ACIAR project that could prove critical to the way bird flu is tackled in South-East Asia, Dr Joanne Meers from Queensland University is coordinating research aimed at understanding the transmission of H5N1 in domestic ducks.

The project is focused on small-scale Indonesian and Vietnamese farmers with flocks ranging from fewer than 20 birds up to several hundred. CSIRO's Australian ↪

Bird flu facts

- Avian influenza (AI) is a disease caused by an influenza type A virus.
- H5N1 is a form of highly pathogenic avian influenza (HPAI).
- Symptoms of H5N1 in birds include respiratory distress, massive bleeding from internal organs and diarrhea, which cause nearly 100% mortality.
- Humans infected with H5N1 show flu-like signs and also eye infections and life-threatening complications such as pneumonia and severe respiratory distress.
- As of June 2007, 310 people worldwide had contracted H5N1, and 189 of those had died.
- Humans can become infected with H5N1 after eating undercooked poultry, or through very close contact with an infected animal or, extremely rarely, an infected person (probably only one episode).
- The natural reservoir of H5N1 is migratory water fowl, particularly ducks.
- H5N1 has been confirmed in 45 countries on three continents.
- Isolated outbreaks of low pathogenic AI have occurred in Australia, but so far H5N1 has not been reported.



A family-run broiler farm outside Mataram, Lombok. In tropical climates, poultry sheds are elevated to allow ventilation.

PHOTO: PHIL SIMMONS

Animal Health Laboratory, in Geelong, is collaborating on the project. And in Indonesia, ACIAR researchers are working closely with colleagues at the Disease Investigation Centre, at Wates, Java. In Vietnam, the project involves a close research partnership with the Regional Animal Health Centre, in Ho Chi Minh City, and the National Institute of Veterinary Research, in Hanoi.

“There has been a lot of media coverage and extension work throughout both Vietnam and Indonesia and the public health message has been fairly well delivered,” Dr Meers says. “There’s a lot of funding going into different sorts of publicity: posters, radio programs and high-profile [local] movie stars recruited to get the message across. So, they’ve really made a lot of effort, especially to try to

prevent people from becoming infected by their chickens or ducks—to minimise their exposure.”

Exactly what, if any, role ducks might have played in human infections reported from Indonesia and Vietnam remains unclear.

“Most strains of AI are maintained in ducks—it’s not something specific about H5N1,” Dr Meers says. “What’s been unusual is for ducks to become sick with any form of AI, but it now seems that certain H5N1 strains can cause quite significant disease in ducks.”

The ACIAR work is investigating evidence that not all duck breeds are equally susceptible. If that proves to be

the case, it could be possible to make recommendations about the best breeds to farm in the interests of minimising the flow of the disease during outbreaks.

The project will also investigate how well vaccines work in ducks to prevent them shedding bird flu virus. In Vietnam, where authorities have ruled that all ducks and chickens should be vaccinated, there is suspicion that recent

outbreaks may have been caused by the failure of vaccines used in ducks, or the illegal raising of ducks that have not been vaccinated properly.

“So we’re hoping to be able to develop recommendations for authorities about the role of ducks in general, how vaccination

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might best work, and how infection in ducks could effectively be monitored,” Dr Meers says. “A lot of decisions are being made now on fairly minimal evidence because they have to be. We’re trying to fill in those knowledge gaps to aid development of more effective policies.”

There is no question H5N1 can devastate communities that rely, directly and indirectly, on poultry for protein and as an income source. And, of course, the human infection and death toll is already tragic enough. But the really big fear is that the H5N1 virus will change to become a highly virulent human pathogen capable of claiming many millions of lives worldwide.

Because of this threat, understanding the way the virus is evolving, and watching it closely, is critical. And that is exactly

what a new project headed by University of Melbourne veterinary virologist Dr Jagoda Ignjatovic is designed to do.

Supported by ACIAR, Dr Ignjatovic is investigating how the virus is changing in response to vaccination in Indonesia. There is no doubt H5N1 will change—many viruses do—but compared with other viruses, avian influenza viruses, including H5N1, show a particularly high mutation rate.

“We hope to track the changes, see the directions these mutations take, and try to predict their impact,” Dr Ignjatovic says. “It’s particularly important because at the moment no one is sure what particular mutations in the H5N1 virus would cause human-to-human transmission.”

The work will directly assess how well vaccination is working in Indonesia to reduce the viral load in chickens and how

mutations in the virus are affecting that. The project builds on close ties previously established by Dr Ignjatovic and colleagues through work in Indonesia on infectious bursal disease, an unrelated but deadly viral illness of chickens.

“It’s definitely an advantage that we’ve already worked with the Indonesian Institute for Veterinary Science, in Bogor, one of our partners in this project, so we know the people involved and the set-up of the poultry industry,” Dr Ignjatovic says.

The work also involves researchers at CSIRO’s Australian Animal Health Laboratory, Geelong, and a private company, AusVet Animal Health Services Pty Ltd.

As well as its high propensity for change, the H5N1 virus also has the ability to infect a much wider range of species than most other avian influenza viruses. Already in Indonesia it has been documented in cats and pet birds, such as parrots, and may also infect dogs.

“At this stage, these species are thought to be dead-ends for the infection so they don’t act as reservoirs,” Dr Ignjatovic says. “But it’s of concern because there are so many animals that people, particularly in Indonesia, live in close contact with.”

Will H5N1 reach Australia? Some believe it’s only a matter of time. It could arrive via live chickens carried on illegal fishing boats, the prohibited import of infected produce, or even migratory birds.

ACIAR’s AI research activities are part of a coordinated and cooperative effort that also involves the Australian Quarantine Inspection Service and the Australian Biosecurity CRC for Emerging Infectious Disease.

“Our work provides important returns to Australia in two ways: it seeks to control the disease at its source, and if you do that it becomes less of a threat to us,” Dr Rolfe says. “But there’s also a capacity-enhancement side to it, whereby our scientists become familiar with and understand and experience this disease in a real-world way.

“We won’t truly appreciate the importance of the capabilities and knowledge that these projects are building around the country until AI appears here.” ■

PHOTO: JOERG HENNING

Poultry markets are an important transmission method for avian influenza.

