

AQUA CULTURE

A s i a P a c i f i c

A Nursery Business
in India

Resistance to White
Spot in Black Tiger
Shrimp

Challenges in Marine
Fish Culture in Asia

A Philippine Mariculture
Park Experience

Improving Health
Management





Broodstock at the Shrimp Disease Control and Genetic Improvement Centre, Taiwan.

Photo credit: Kemily Huang. p21

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Mini symposium on shrimp biotechnology



Grace Chu-Fang Lo (sixth from left), KC Han-Ching Wang (third from right) and Professor Chung-I Lin (third left) with speakers and participants.

Passing the baton on shrimp biotechnology to Gen X and millennials in Taiwan

The first generation of commercial shrimp farmers is most likely the baby boomers and as they approach retirement age, universities and industry need to educate the generation X and millennials on shrimp farming technology. Taiwan bequeathed the legacy of shrimp farming to Asia with the establishment of the monodon breeding technology by Dr I-C Liao in the 1970s; it is apt if the younger generation continues to lead and be well trained to bring the industry to its next level.

The objective of the mini symposium on Frontier Aquaculture Science was to garner the interest of undergraduate students (third year) in frontier aquaculture at the National Cheng Kung University (NCKU), to get them to consider a career in the shrimp farming industry, as young entrepreneurs, biotechnologists or researchers. Together, Professor Grace Chu-Fang Lo, Professor KC Han-Ching Wang and Vice Principal Professor Chung-I Lin, wished to foster students' independent learning, encourage students to understand research work and develop organisational, presentation and communication skills. Basically, the students

planned the program, developed the introduction speeches and polished up on their English language skills for this symposium. Speakers were asked to comment on the students' performance.

"In the next 10 years, Taiwan's institutes of higher learning have to combine education and research. In the past, NCKU was a leading research university in Taiwan. We now need to combine and promote research together with education. This event provided an opportunity for these NCKU's students to improve their skills, while the invited scholars provided inspiration to the students and cultivate their interests in aquaculture. At this symposium, they get an insight on the development of a productive and sustainable industry," said Professor Lin in his welcome address.

Industry challenges

This mini symposium was held at the Translational Centre for Marine Biotechnology, Annan Campus, NCKU in Tainan. Student Chin-Hao Chen was chairman. Topics for the five presentations were very diverse. Dr Zuridah Merican, Aqua Culture Asia Pacific, Singapore started the symposium with her presentation on the future role of the young generation in aquaculture. Her take was that as shrimp farming moves towards more intensive and controlled systems, its future will be in the hands of a new generation of young farmers and entrepreneurs. Although they can learn from the older generation, they must use science and digital technology to control production parameters to achieve success.

In disease management, Dr Celia R Lavilla-Pitogo, Consultant, Philippines said that having a grasp on challenges in implementing biosecurity for effective and shrimp health is critical. "Experiences have taught us that diseases happen not just due to the mere presence of pathogens but its outbreak is an interplay of factors resulting in weaknesses and susceptibility of hosts, strength of pathogens and increase in the number of opportunists. Biosecurity is a challenge because culture systems are large and open to various intrusions. Where breaches in biosecurity happen, early recognition of diseases, abnormality in shrimp behaviour and quality of culture environments is important to



Dr Celia R Lavilla-Pitogo with students who also prepared and organized the tea breaks



Anchalee Tassanakajon and student moderator in the background

avoid losses. This requires disease diagnosis, professionalism of health services and shrimp health care at each stage of culture.”

Molecular control of diseases

Research in the molecular aspects of diseases and their applications in disease management were discussed by three presenters. At the Centre of Excellence for Molecular Biology and Genomics of Shrimp, Department of Biochemistry, Chulalongkorn University, Thailand, Professor Anchalee Tassanakajon and Assistant Professor Kunlaya Somboonwiwat have been working on basic and applied research on shrimp immunity and molecular pathways to immobilize disease pathogens. “Such basic research is important to gain knowledge on the host defence mechanisms for the implementation of effective measures to prevent disease outbreaks. Shrimp rely on the innate immune system to defend against a range of microbes by recognising and destroying them via cellular and humoral immune responses. Our work led us to focus on antimicrobial peptides (AMPs) and melanisation. Melanisation also plays a crucial role in the killing and deposition of invading pathogens. In her presentation “From immunity to disease resistance: bringing back basic research to shrimp farming”, Anchalee said that aquaculture needs biotechnology to prevent disease outbreaks. Little knowledge on biotechnology has been applied in shrimp when compared to that in agriculture.

Kunlaya presented on “Shrimp antimicrobial peptide antilipopolysaccharide factor (Alf): basic and potential applications.” A major isoform of *Penaeus monodon*'s antilipopolysaccharide factor (ALFPm3) is a potential candidate for use in shrimp disease control. “It exhibits a broad antimicrobial activity spectrum against filamentous fungi, gram-positive and gram-negative bacteria including *Vibrio harveyi* causing vibriosis and *Vibrio parahaemolyticus* (Vp) causing acute

hepatopancreatic necrosis disease (AHPND). It acts against bacteria by binding to and permeabilising the bacterial membrane resulting in cell lysis. The anti-viral property of ALFPm3 against white spot virus (WSV) was investigated. ALFPm3 inhibited WSSV propagation in crayfish haematopoietic cell culture and in shrimp.” She described the anti-WSSV activities of ALFPm3. The recombinant protein of ALFPm3 used as shrimp feed supplement showed its ability to control AHPND and also to prevent WSD.

Anchalee discussed a recent work on the exposure of *Litopenaeus vannamei* to non-lethal heat shock (NLHS). A direct injection of recombinant heat shock 70 could enhance resistance to specific strain of Vp causing acute hepatopancreatic necrosis disease (VpAHPND) inducing innate immunity. “Acute heat shock treatment at 28-38°C for 30 min once or chronic treatment daily over 7 days for 5 mins gave resistance to AHPND for 30 days. When challenged with VpAHPND during the recovery period, at day 3, 7 and 30, shrimp exposed to either acute or chronic NLH survived 50% compared to 20% at day 3 for untreated shrimp.”

She added, “We also researched on direct muscle injection of recombinant heat shock protein (LvHSP 70) which for it to be effective, needed to get to the haemocytes. We tracked with antibodies. We saw mortality was 90% in untreated shrimp compared to high survival in treated shrimp in challenge tests. Now the challenge is to develop a stable HSP.”

In the final presentation, Professor Han-Ching Wang discussed the dynamics of the shrimp stomach bacterial microbiomes in an AHPND affected pond. According to Wang, the AHPND *V. parahaemolyticus* with extra-chromosomal elements produced a virulent toxin which damages shrimp hepatopancreas. Whether all AHPND outbreaks are caused by this *Vibrio* alone or with the involvement of other elements is still unclear. “We propose that destabilisation of the microbiota in either the pond or seawater may cause an outbreak. We collected samples of post larvae from ponds from 21-36 days after stocking. Using culture independent metagenomics approach, we then characterised the AHPND related microbiome. By calibrating with AHPND-associated microbiomes in a Vietnamese pond which succumbed to an outbreak, we could cluster the stomach microbiome into two distinct groups and predicted the microbiome changes associated with a AHPND outbreak. Instead of just the abundance of this Vp being the critical factor, there were actually third-party microbiota which could be potential AHPND biomarkers. Altered bacterial metabolism of stomach biota might alter host environment and increase Vp virulence.”



Kunlaya Somboonwiwat



Student Chin-Hao Chen was chairman for the symposium



Zhe-Song Tang



Chang-Shang Lai