Expert Consultation on Managing Trans-boundary Diseases of Agricultural Importance in the Asia-Pacific

PROCEEDINGS AND RECOMMENDATIONS

NASC Complex, New Delhi
October 10-12, 2012

Organized by

Asia-Pacific Consortium on Agricultural Biotechnology (APCoAB)
Asia-Pacific Association of Agricultural Research Institutions (APAARI)
Indian Council of Agricultural Research (ICAR)

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NASC Complex, New Delhi
10-12 October, 2012

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Foreword

Trans-boundary diseases (TBDs) pose serious challenge to agriculture in the Asia-Pacific region. In recent years, UG-99, Avian Influenza, Swine Influenza, Nipah virus, foot and mouth disease, among other TBDs, have adversely affected agricultural productivity and livelihoods of associated communities in the region. In addition, exposure of humans to disease carrying vectors and pathogens of farm animals poses direct threat to human health. Consequently, TBDs contribute to poverty, poor nutrition and health of particularly smallholder agricultural producers. TBDs also act as barriers to trade since quarantine and other measures taken to prevent the spread of such organisms also lead to reduced access to international markets. In addition, trans-boundary pathogens are being viewed as potential bioterrorism agents, thus calling for appropriate biosecurity measures to optimize biological containment.

Over the past several years, research has gained insight into the biological nature and epidemiology of TBDs. But there remain huge gaps in understanding and implementing optimal management strategies (in economic, social and environment terms) of these diseases. Further research for developing fast and efficient diagnostic and prophylactic tools along with strengthening management systems comprising capacity building, skills development, policies, legal framework and operational strategies are warranted.

Managing trans-boundary diseases is one of the most important areas of regional cooperation in the Asia-Pacific region. Cross-boundary cooperation in surveillance, diagnostics, epidemiology and containment are the most effective means of combating this menace. To provide a common platform for addressing this issue, the biotechnology program of the Asia-Pacific Association of Agricultural Research Institutions (APAARI), popularly known as Asia-Pacific Consortium on Agricultural Biotechnology (APCoAB), in collaboration with the Indian Council of Agricultural Research (ICAR) organized an Expert Consultation on "Managing Trans-boundary Diseases of Agricultural Importance in the Asia-Pacific" on 10-12 October 2012 in New Delhi. APCoAB has been engaged in promoting application of biotechnology policies and tools for increasing agricultural productivity while enhancing biosafety and biosecurity. This expert consultation was, therefore, an additional one in the series of such events to deliberate on thematic issues of regional importance.

The expert consultation was attended by 161 participants from 20 countries including international experts on plant, animal and fish trans-boundary diseases from FAO, OIE, CG centres, heads of the Asia-Pacific NARS, national policy, management and research experts and other concerned stakeholders. The meeting took stock of the status of occurrence and impact of TBDs in Asia-Pacific countries, progress in R&D, and current and future needs to manage these diseases so as to minimize their economic, social and environmental impacts. Extensive discussions carried out during the sessions resulted in various recommendations concerning TBDs and their management in the region. It is our hope that these recommendations will help the policy

makers, ARD managers and regulatory officials to take appropriate decisions and put effective systems in place, including strengthened regional cooperation, to minimize the spread and impact of agriculturally important trans-boundary diseases.

S. Ayyappan
Secretary
Department of Agricultural Research & Education
and Director General
Indian Council of Agricultural Research

Raj Paroda
Executive Secretary
Asia-Pacific Association of
Agricultural Research Institutions

Acronyms and Abbreviations

AAU	Assam Agricultural University
ACC	Asiatic Citrus Canker
ACIAR	Australian Centre for International Agricultural Research
AHPNS	Acute Hepatopancreatic Necrosis Syndrome
APCoAB	Asia-Pacific Consortium on Agricultural Biotechnology
APPARI	Asia-Pacific Association of Agricultural Research Institutions
APPPC	Asia-Pacific Plant Protection Convention
ASDD	Abdominal Segment Deformity Disease
ASRB	Agricultural Scientists Recruitment Board
AVRDC	AVRDC- The World Vegetable Center
BAR	Bureau of Agricultural Research
BGRI	Borlaug Global Rust Initiative
CAA	Central Aquaculture Authority
CAHS	Centre for Animal Health Studies
CIBA	Central Institute of Brackishwater Aquaculture
CIFA	Central Institute of Freshwater Aquaculture
CIFE	Central Institute of Fisheries Education
CIMMYT	International Maize and Wheat Improvement Center
CSF	Classic Swine Fever
DAHDF	Department of Animal Husbandry, Dairying & Fisheries
DARE	Department of Agricultural Research and Education
DFID	Department for International Development, UK
DIVA	Differentiating Infected from Vaccinated Individuals
DRRW	Durable Rust Resistance in Wheat
EMS	Early Mortality Syndrome
EU	European Union
FAO-RAP	Food and Agricultural Organization of the United Nations- Regional office for Asia and the Pacific

FMD	Foot and Mouth Disease
GCWA	Global Conference on Women in Agriculture
GDP	Gross Domestic Product
GFAR	Global Forum on Agricultural Research
GF-TADs	Global Framework for Progressive Control of Trans-boundary Animal Diseases
HLB	Huanglongbing
HPAI	Highly Pathogenic Avian influenza
HSADL	High Security Animal Disease Laboratory
IARI	Indian Agricultural Research Institute
ICAR	Indian Council of Agricultural Research
ICARDA	International Center for Agricultural Research in the Dry Areas
IHHNV	Infectious hypodermal and hematopoietic necrosis
IMNV	Infectious myonecrosis virus
IPM	Integrated Pest Management
IPPC	International Plant Protection Convention
IVRI	Indian Veterinary Research Institute
JIRCAS	Japan International Research Center for Agricultural Sciences
KHV	Koi herpes virus
LLRUVAS	Lala Lajpat Rai University of Veterinary & Animal Sciences
MSGS	Monodon slow growth syndrome
NAAS	National Academy of Agricultural Sciences
NACA	Network of Aquaculture Centers in Asia-Pacific
NARI	National Agricultural Research Institute
NBFGR	National Bureau of Fish Genetic Resources
NRC-Equines	National Research Center for Equines
OIE	World Organization for Animal Health
PPR	Peste des petits ruminants
PPV&FRA	Protection of Plant Varieties & Farmers' Right Authority
RAU	Rajuvasu Agricultural University
RDA	Rural Development Administration

RPPO	Regional Plant Protection Organization
SAARC	South Asian Association for Regional Cooperation
SLCARP	Sri Lankan Council for Agricultural Research Policy
TAD	Trans-boundary Animal Disease
TBD	Trans-boundary Disease
TSV	Taura syndrome virus
USA	United States of America
VNN	Viral nervous necrosis
WAHID	World Animal Health Database
WAHIS	World Animal Health Information and Warning System
WHO	World Health Organization
WSD	White spot disease
WSSV	White spot syndrome virus
WTD	White tail disease
Xac	*Xanthomonas axonopodis pv. citri*
YHV	Yellow head virus

Expert Consultation on Managing Trans-boundary Diseases of Agricultural Importance in the Asia-Pacific

Background

The world, and more specifically the Asia-Pacific region, faces severe threats from a number of plant and animal diseases that occur as epidemics or are endemic across national boundaries and termed as trans-boundary diseases (TBDs). The TBDs not only adversely affect agricultural productivity but also contribute to poverty and hunger, particularly of small holder agricultural producers, and act as barriers to trade. In recent years, diseases like UG-99, plant viral diseases, Avian Influenza, Swine Influenza, NIPAH virus and Foot and Mouth disease among other trans-boundary diseases have adversely affected agriculture and, in turn, communities in the region. In addition, exposure of humans to disease carrying vectors and pathogens of farm animals pose direct threat to human health.

SPS regulations under WTO regime with regard to plant and animal diseases are aimed at facilitating trade while reducing the risk of international movement of pathogenic organisms whose introduction could have direct serious consequences to agricultural production system. Consequently, measures at preventing spread of such organism also lead to reduced access to international markets due to non-tariff trade barriers and requirement of quarantine for animal and plant diseases.

Trans-boundary pathogens are also being viewed as potential bioterrorism agents, thus calling for appropriate biosecurity measures to optimize biological containment mechanisms, including development of strong capacity in microbial forensics.

The strategy to address plant and animal TBDs is prevention, early warning including forecast, early detection and early control. Investment in early control and detection mechanisms will be critical to avoid high costs of control and eradication. Prevention and early warning requires a reduction of the possibilities of entry and establishment which can be accomplished through better border control and rapid diagnostic and surveillance tools. Cooperation of adjoining countries is required to ensure better monitoring and surveillance of TBDs.

Over the past several years, research has gained insight into the biological nature and epidemiology of TBDs. But, there remain huge gaps in understanding and implementing optimal management (in economic, social and environment terms) of these diseases. Further research for developing fast and efficient diagnostic and prophylactic tools along with strengthening management systems comprising capacity building, skills development, policies, legal framework and operational strategies are warranted, particularly through regional initiatives.

To address these issues at the regional level, APAARI in collaboration with ICAR organized Expert Consultation on “Managing Trans-boundary Diseases of Agricultural Importance in the Asia-Pacific” on 10-12 October, 2012 with the following objectives and expected outcomes:

Objectives

1. To identify the status and current and future research needs to manage important trans-boundary diseases to minimize economic, social and environmental adverse impact on communities, biomes and nations;
2. To prioritize areas of collaboration and partnerships for managing TBDs of regional/sub-regional importance;
3. To catalyze policy makers for needed thrust and support for AR4D relating to TBDs;
4. To build a network of TBDs related expertise involving international experts and agencies engaged in research and development related activities;
5. To identify human resource development needs for capacity building in managing and research related to TBDs.

Expected Outcomes

1. Identification of researchable areas for regional cooperation;
2. Identification of gaps in management of TBDs;
3. Development of policy with regard to TBDs in Asia-Pacific region;
4. Identification of regional network partners to address TBDs.

Inaugural Session

The session was chaired by Mr. Harish Rawat, Union Minister of State for Agriculture, Food Processing Industries and Parliamentary Affairs in presence of Dr. S. Ayyappan, DG, ICAR and Secretary, DARE, Dr. Raj Paroda, Executive Secretary, APAARI and 161 other participants from 20 countries.

In his welcome speech, Dr. Ayyappan mentioned that trans-boundary plant pests and diseases, such as locusts, armyworms and wheat rust, and Epizootic Ulcerative Syndrome of fish as well as livestock diseases such as Avian Influenza, Foot and Mouth Disease, PPR, Swine fever have a direct economic impact by reducing agricultural and animal production. Apart from causing suffering and mortality in susceptible population, the diseases adversely affect food safety, human health, rural livelihoods and international trade. The national economy is directly influenced due to reduced access to international markets for the agricultural products and higher costs of regulatory compliance involved with inspection, treatment, etc. Therefore, it is necessary to effectively manage the trans-boundary diseases. It is advisable to have an effective quarantine system in place to prevent entry and establishment of trans-boundary diseases. Countries must also have in place a second line of defense consisting of suitable contingency plans to respond quickly to high threat diseases. This could be achieved by timely application of scientific knowledge for rapid response by way of appropriate implementation of technology. A disease outbreak in the neighboring country should always be taken as an immediate threat. In this context, it may be a good idea to emphasize the concept of one world - one health with the objective of creating a disease free world. Considering that agriculture including crop production, livestock rearing and aquaculture form the backbone of national economy in developing countries, it is essential to take up disease control initiatives, effective compliance to a regulatory system and develop scientific and risk-based standards that facilitate safe international trade in agricultural commodities.

Dr. Raj Paroda in his remarks elaborated on the background of expert consultation mentioning that it was one of the several activities organized by APAARI in collaboration with ICAR

during the recent past. In March 2012, APAARI and ICAR together organized the First Global Conference on Women in Agriculture in New Delhi which was attended by 760 participants from 50 countries. This expert consultation would address the equally challenging issue of trans-boundary diseases in agriculture related plants, animals and fish which pose serious problems to agriculture in the Asia-Pacific region. In recent years, UG-99, Avian Influenza, Swine Influenza, NIPAH virus and Foot and Mouth disease, among other trans-boundary diseases, have adversely affected agriculture and associated communities in the region. In addition, exposure of humans to disease carrying vectors and pathogens of farm animals pose direct threat to human health. In view of the need to deal with this issue at a regional level, APAARI in its General Assembly Meeting in Korea held in 2010 decided to organize an expert consultation of this topic and Dr. S. Ayyappan very kindly offered to host the event. APAARI had been engaged since the past 20 years in advocating appropriate agricultural research and development policies formulated through consultations such as the present one. In this context, the biotechnology program of APAARI, the Asia-Pacific Consortium on Agricultural Biotechnology, organized expert consultations and high level policy dialogues on contemporary topic like biotechnology for food security, biosafety harmonization and agricultural biosecurity in a number of Asia-Pacific countries. This expert consultation was one addition in the series to deliberate on thematic issues of regional importance. The meeting was expected to identify areas of research and development for cooperation in combating trans-boundary diseases on regional level.

Hon'ble Minister Mr. Harish Rawat in his inaugural address mentioned that agriculture continues to be the engine of inclusive and accelerated economic growth and livelihood security in the Asia-Pacific. This region comprising 39 countries, is characterized by huge diversity in size, population, agricultural and economic development as is a major supplier of food, accounting for 38% of the world's arable land, 90% of the world's rice, 40% of its cereals and 40% of its meat, 70% of the global food and vegetable market, 80% of the aquaculture market. Asia feeds nearly 60% of the world's population from one third of the geographical area. Over the past three decades, millions of people across the Asia-Pacific region have benefited from an improved standard of living due to extraordinary economic growth, higher per capita incomes, and increased food security. However, the increasing globalization of markets facilitates the introduction of trans-boundary plant, animal and fish diseases. In recent times, the list of imported exotic diseases and pests has grown while substantial progress is yet to be made in the control of local entrenched pathogens. With the prevailing factors such as climate change, ever increasing human mobility or travel and agricultural change, it is likely that trans-boundary diseases and pests will continue to pose a serious challenge. Since these diseases respect no internal, national and international borders, they require global perspectives and responses, conceptually and geographically. It is in the interest of the member countries and international community to avoid creating country or regional reservoirs for trans-boundary diseases and pests that will maintain the threat at global level.

In view of these concerns, it would be wise to educate and equip ourselves with all the necessary modalities and facilities through which the pathogens of these devastating diseases can be identified, characterized and diagnosed as quickly and reliably as possible and improved biosecurity measures are implemented. Considering that the concept of health is inherent to all species on Earth and it provides a unifying principle that sustains life at all levels, the amalgamation of many sub-disciplines of plant, veterinary and fisheries sciences as well as human medicine is critical to understanding and controlling emerging diseases. Therefore, national health systems will play a pivotal role to monitor, assess, predict and prevent the movement of trans-boundary diseases and pests in the coming decades.

Technical Session I: Status and Management of Plant Trans-boundary Diseases

Chair: Dr. S. Nagarajan, Former Chairman, PPVFRA, New Delhi, India
Co-Chair: Dr. Teodoro Sabas Solsoloy, Bureau of Agricultural Research, Philippines
Rapporteur: Dr. Narayan Rishi, Amity University, Noida, India

Keynote Lecture
Trans-boundary pests and diseases: Global scenario and the role of India in their management

Dr. Peter E. Kenmore, FAO, New Delhi, India

Dr. Peter Kenmore emphasized that trans-boundary plant pests (including diseases, weeds, insects, vertebrates, etc. in the IPPC definition) need to accomplish two things: (1) move across borders and (2) establish themselves and reproduce in the new ecosystem. By better sharing information and experience relating to the drivers of both movement and establishment, national plant production and protection programs can improve their performance and reduce risks of losses to trans-boundary pests. Pest movement is driven mostly by human trade in agricultural goods and human traffic itself (carrying plants) across borders. This will likely accelerate as the globalized economy continues to lower barriers to many goods and employment. The International Plant Protection Convention (IPPC) and its associated Regional Plant Protection Organizations (RPPOs) provide technical and science-based international negotiating arenas for countries to agree to compromise between increasing trade and traffic (and incomes) and protecting local production ecosystems. India participates in both the IPPC and the Asia-Pacific Plant Protection Convention (APPPC) including making assessed contributions and participating in standard-setting. Pest establishment is driven largely by disrupted ecosystems. Climate change is accelerating that disruption, but the main driver remains agricultural intensification that fails to strengthen ecosystem functions to improve resilience. This is the motivation for FAO's Save and Grow approach to sustainable production intensification.

The presentation also highlighted the prominent role of India in global desert locust surveillance and response system. The country has also been an important player in designing and evolving pest surveillance and integrated pest management systems for rice, sugarcane, wheat, coconut, vegetables, cotton, and several other crops. These systems include ecosystem analyses, farmer participation, and modern information and communication technologies. In total, India provides the largest resource of experience and capacity development for tropical countries, and should continue to increase its commitments and contributions to global trans-boundary pest management.

Keynote Lecture
The Borlaug Global Rust Initiative: Managing wheat rust through collaboration

W.R. Coffman, College of Agriculture and Life Sciences, Cornell University, Ithaca, NY, USA; K. Vijayaraghavan, Office of International Programs, College of Agriculture & Life Sciences, Cornell University, and Sathguru Management Consultants, Hyderabad, India; S.D. Evanega, DRRW, Cornell University, Ithaca, NY, USA

The Borlaug Global Rust Initiative (BGRI), established by CIMMYT, ICARDA, FAO, ICAR, and Cornell and fostered by the Durable Rust Resistance in Wheat (DRRW) project, is now a global

community of 1,400 wheat and rust scientists and other stakeholders. Since the BGRI's inception in 2008, and largely due to its inter-disciplinary and collaborative nature, stem rust research has advanced significantly and the global rust community has continued to realize Norman Borlaug's vision of a more secure wheat crop worldwide.

The DRRW project, a key component of the BGRI, is a global effort to mitigate the threat of Ug99 and other newly emerging races of wheat stem rust, *Puccinia graminis* f. sp. *tritici*. Funded by the Bill & Melinda Gates Foundation and the UK Department for International Development (DFID), the DRRW is based at Cornell University and is a consortium of scientists from over 20 collaborating institutions.

South Asia regional activities are coordinated by Sathguru Management Consultants. DRRW's focus in South Asia has been on rust surveillance, capacity building and breeding of wheat lines that are resistant to Ug99. DRRW in association with ICAR, and other constituent organizations, has been instrumental in bringing policy level interventions in the South Asian Association for Regional Cooperation (SAARC) nations to recognize Ug99 as a devastating disease threatening the wheat crop in the region. The efforts began in 2008 with the convening of the South Asia regional participants in developing effective strategy to combat Ug99 in the region.

Since then, with the help of global rust research experts from Africa, USA and Australia, DRRW has been exposing wheat scientists from the SAARC region to rust surveillance activities that include collecting rust samples, dispatching these samples to wheat rust labs, race analysis, purification of the rust race, etc. In order to expedite the breeding efforts and facilitate the release of Ug99 resistant wheat varieties, national programs in wheat-producing countries have been sending wheat germplasm to the international stem rust screening nurseries in Kenya and Ethiopia for testing the bread wheat lines in the context of these Ug99 hotspots.

To augment the breeding activities as well as expedite the time to market of rust resistant wheat varieties, DRRW is promoting upstream technologies such as the use of molecular markers to identify the rust resistance genes and their immediate deployment in the wheat germplasm. Scientists from South Asia have been provided exposure and access to biomaterials to work on molecular aspects of wheat improvement with reference to stem rust resistance for development of disease resistant and high yielding genotypes using molecular approaches of wheat research in a global perspective.

In accordance with the goals of the DRRW and the BGRI as a whole, it is important for SAARC countries to follow responsible gene deployment and replace stem rust susceptible varieties grown in the SAARC region with durably resistant varieties based on multi-genic and APR basis of resistance in order to maximize the impact that the DRRW project activities and accomplishments have on the region in the long term.

Panel Discussion

Panelists: Dr. Jaw-fen Wang, AVRDC- The World Vegetable Center, Tainan, Chinese Taipei
Dr. (Mrs.) Indu Sharma, DWR, Karnal, India
Dr. V.V. Ramamurthi, IARI, New Delhi, India
Dr. R.K. Jain, IARI, New Delhi, India

Key Discussion Points

- Global and regional co-operation is required for control of spread of TBDs.
- Focus has also to be on trans-crop pathogens.
- It is important to manage Begomo virus in effective vegetables. Exchange of information and knowledge would help in its management in the region.
- The possibility of locust mechanically transmitting plant pathogens need to be investigated.
- A diverse set of genes should be employed for introducing resistance which would be more durable.
- Focus has to be on diagnostics, diagnosis, surveillance and preparedness. Development of multiplex diagnostics will save time.
- Exchange of diagnosis reagents among countries will help in collective action on prevention of TBDs.
- Travel, trade and traffic though inevitable are the major drivers of spread of TBDs. Accordingly effective quarantine is most essential.
- Trans-boundary biosafety issues are also relevant to containing TBDs.

Recommendations

- Strong surveillance program with mandatory screening of seeds for contaminating viruses. Data feeding in common Tool Box which may be accessed by all.
- Urgent development of TBDs diagnostic facilities and tools like serum banks, PCR, multiplex PCR and chips with ensured uninterrupted operations.
- Establishment of regional diagnostic centers with adequate expertise and effective networking with national centers.
- Development of cost effective and rapid indigenous diagnostic kits in public-private partnership.
- Regular training of scientists, extension workers and farmers.
- Strong system of certification to ensure freedom from seed and plant borne diseases/ pests.
- Case study of some recently introduced trans-boundary diseases to identify and plug gaps in the existing protection system.
- Studies on socio-economic impact of important trans-boundary diseases.

Technical Session II: Status and Management of Animal Trans-boundary Diseases

Chair: Dr. Simon Hearn, ACIAR, Canberra, Australia
Co-Chair: Dr. Ajit Maru, GFAR, Rome, Italy
Rapporteur: Dr. B. Pattnaik, IVRI, Nainital, India

Keynote Lecture
Initiatives for the control of priority trans-boundary animal diseases in South Asia

Dr. Subhash Morzaria, Emergency Centre for Trans-boundary Animal Diseases, FAO-RAP, Bangkok, Thailand; Dr. Mohinder Oberoi, Emergency Centre for Trans-boundary Animal Diseases Unit, SAARC, FAO, Kathmandu, Nepal

The presentation discussed the initiative under the umbrella of the Global Framework for Progressive Control of Trans-boundary Animal Diseases (GF-TADs) to engage with the countries in the South Asian region to identify priority diseases and the key needs to improve control of these diseases through a regional collaboration.

A large part of the national GDP of South Asian countries is derived from agriculture of which livestock is a significant component. Although there are many differences in livestock sectors of the eight South Asian countries, all are predominantly driven by demand for milk, eggs and meat, mainly derived from buffalo, cattle, sheep, goats and poultry. It is predicted that the demand for animal protein in the region will double in the next 20 years or so, mainly in face of population growth, urbanization and economic development. In a region where agriculture land is scarce, this doubling of demand for animal protein can only be achieved through efficiency gains from better management of production systems, requiring improvement of genetics of animals that are fit for purpose, improved feeding program and better health.

Unfortunately, the region is also endemic for many high impact infectious animal diseases that have restricted the development of livestock industry. These countries are endemic for foot and mouth disease (FMD), which causes large production losses, and peste des petits ruminants (PPR) which, when it strikes kills over 90% of the small ruminants. Highly pathogenic avian influenza is now persisting in the Indo-Gangetic plain with continuing losses in poultry. The disease is now so much entrenched in the poultry sectors in the sub-region that it is predicted that several years would be required before the disease can be eradicated. With the persistence of highly pathogenic avian influenza (HPAI) in the region, the risk of emergence of new variants of influenza viruses that might cause human pandemic remains. The South Asia region has been also identified as a 'hot spot' for high impact emerging and re-emerging infectious diseases due to a number of risk factors that include high human and livestock population, and rapidly expanding farming systems that are not biosecure.

A major initiative under the umbrella of GF-TADs was launched to engage with the countries in South Asia to identify priority diseases and the key needs to improve control of these diseases through a regional collaboration. Through a series of consultations, three priority diseases identified are FMD, PPR and HPAI, all of which are trans-boundary in nature and are collectively responsible for jeopardizing food security, threatening food safety and seriously impeding trade and market opportunities in livestock and livestock products in the region. In addition, these diseases have the greatest negative impact on the livelihoods of the smallholder livestock farmers, who represent the majority of the poor in the region, and are vulnerable to repeated shocks of disease outbreaks. Recent outbreaks of these diseases also clearly illustrate their global importance. FMD and HPAI have caused huge morbidity and mortality in cattle, sheep, goats, and poultry. Estimated losses due to these infectious diseases are $5 billion a year.

Based on these consultations, a proposal was developed by FAO to promote regional control of trans-boundary animal diseases (TADs) in South Asia under the umbrella of the South Asia Association for Regional Cooperation (SAARC). The EU is now funding the proposal and several components of the proposal were launched in 2009. Seven countries in SA are targeted; Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka, all of which have large poor populations. The diseases targeted are important to international trade. All three diseases are caused by highly infectious viruses, which are easily transmissible through air and contaminate farm products. The viruses spread across countries mainly through uncontrolled movement

of livestock and their products. The source of the diseases is often in poor livestock farming communities where livestock services are inadequate and the viruses continue to circulate in low producing livestock. Thus the interventions for TADs control will be strategically targeted at source and based on the principles of the GF-TADs.

Currently, there are good technological tools such as safe and efficacious vaccines, and highly specific and sensitive diagnostics tests to support disease control and surveillance program. However, the lack of formal regional cooperation and key sub-regional policy and technical support systems to enable significant progress in control of these TADs are lacking. Thus the main components of the regional TADs initiative are to establish a regional collaborative mechanism for the control of TADs and strengthen regional and national capacity in disease surveillance, diagnosis, disease reporting and information systems, and cross-border animal movement management. The regional approach will introduce integrated disease control program and demonstrate the success and impact of such measures on a regional basis. Linked with the program will be sound epidemiological studies and socio-economic impact assessment of disease control. Significant progress has been made since the launch of the program. This includes the establishment of the Regional Support Unit in Kathmandu, Nepal, recruitment of staff from the region to develop regional cadre of technical staff. In addition, leading diagnostic laboratories have been identified for these priority diseases and several training activities in disease risk assessment, disease information system, and diagnosis have been conducted. A number of cross border studies have also been conducted to better understand sub-regional value chains of livestock.

The presentation also discussed some of the success stories and lessons learned and the challenges of addressing the complex nature of controlling TADs on a regional basis.

Panel Discussion

Panelists: Dr. Tai-Young Hur, RDA, Chungnam, Korea
Dr. M.P. Yadav, Gurgaon, India
Dr. Arvind Kumar, LLRUV&AS, Hisar, India
Dr. A.K. Gahlot, RAU, Bikaner, India
Dr. Y.K.M. Reddy, CAHS, Chennai, India

Key Discussion Points

- FMD and PPR are the most serious TADs in South Asia, and controlling these two can substantially increase livestock production and food security in the region.
- Livestock sector is expanding significantly leading to more intensification of livestock farming with concomitant risk of TADs.
- Biosecurity and biosafety are of important concerns at farm level, within a country and between countries. Check on spread within the country can reduce international spread.
- Studies on epidemiology, risk analysis and information sharing need to improve across the region.
- There is need for capacity building in South Asia pertaining to diagnosis and reporting system of TADS.
- Diagnostic capabilities and platforms and partnership with farmers for disease reporting need improvement.

- Animal screening and appropriate certification system can prevent spread of TADs between neighbouring countries. Appropriate legislation is required to control cross-border animal movement.
- Impact of trade on transmission of TADs and the need for appropriate safety measures should be explained to administrators and policy makers.

Recommendations

- Among several TADs, there is a need to focus on control and preventing the spread of regionally important diseases such as FMD, HPAI, PPR and CSF.
- Adopt a multidisciplinary and multisectoral approach (One Health) to prevent and control the spread of TADs for increased livestock production, supporting livelihoods with food safety and security.
- Strengthen regional cooperation in the field of epidemiology, surveillance, disease information sharing and early warning system.
- Develop appropriate, user friendly and affordable diagnostics and vaccines to detect and contain incursion and spread of priority TADs.
- Develop mechanism to enhance biosecurity within as well as between countries in the region.
- Support development of regional control strategies and roadmaps with supportive policies for priority TADs.

Technical Session III: Status and Management of Fish Trans-boundary Diseases

Chair: Mr. Prabhath Wimal Kumara, SLCARP, Colombo, Sri Lanka
Co-Chair: Dr. Vishnu Bhatt, DAHDF, New Delhi, India
Rapporteur: Dr. P.K. Sahoo, CIFA, Bhubaneswar, India

Keynote Lecture
Status and management of fish trans-boundary diseases
Dr. (Mrs.) Indrani Karunasagar, Karnataka Veterinary, Animal and Fisheries Sciences University, Karnataka, India

The presentation stressed on the importance of trans-boundary diseases of fish and observed that with the import/export of fish and fish products, there is a risk of pathogen transfer and spread of diseases. Such a risk can be minimized through responsible movement of live aquatic animals and by adhering to the international guidelines.

An important constraint to the growth of global aquaculture is trans-boundary diseases which is an undesirable consequence of expansion, diversification and intensification together with an increase in trade. Trans-boundary diseases of aquatic animals, like those of plants and terrestrial animals are highly contagious having the potential for rapid spread across borders. Since they bring about significant socio-economic consequences, they need to be addressed appropriately.

Aquaculture world over has been affected by the movement of live aquatic animals and their products. International trade involving movement of hatchery stocks, new species for aquaculture, aquaculture products, ornamental fish, live food, bait fish, sport fish, etc. can result in pathogen

transfer. Hence, careful monitoring of the history and spread of trans-boundary diseases is of utmost importance. Transmissible aquatic animal pathogens such as *White spot syndrome virus* (WSSV) of shrimp, *Herpes virus* of Koi and common carp and *Epizootic ulcerative syndrome* in fish have taken their toll and crippled the sector at different times. Asia is a major seafood producer contributing substantially to trade in live aquatic animals.

Methodologies for surveillance, diagnosis, prevention, control and treatment continue to evolve as new pathogens emerge. There is a need for innovation in the approaches to laboratory diagnosis, public health, risk communication, contingency planning and response to outbreaks. There has to be a strong knowledge base on disease identification and control, training in aquatic animal health service, and harmonized research among countries. The global agency handling all these issues is the World Animal Health Organization (OIE). A case study of pathogen transfer in shrimp aquaculture was also discussed by the speaker.

Sixty per cent of disease loss in aquaculture is due to viral pathogens. In all of Asia, the culture of black tiger shrimp *Penaeus monodon* has gradually been replaced by the American white leg shrimp *P. vannamei*. For both the shrimp species, WSSV and Yellow head virus (YHV) are recognized as serious pathogens. Infectious myonecrosis virus (IMNV) is the next most lethal virus for *P. vannamei*. It was first reported from Brazil and believed to have been introduced through shrimp aquaculture stocks imported into Indonesia. Strangely, IMNV has not been reported from other countries in Asia. The introduction of tolerant stocks and implementation of biosecurity practices has helped manage the negative impact of Taura syndrome virus and Infectious hematopoietic and hypodermal necrosis virus that are serious pathogens of *P. vannamei*. Another problem recently reported for *P. vannamei* in Asia is abdominal segment deformity disease (ASDD) possibly caused by a previously unknown retrovirus-like agent. Since 2009, increased losses of *P. vannamei* are associated with Acute hepatopancreatic necrosis syndrome of unknown cause.

In the early years there was little international trade in live or frozen shrimp between Asia and Americas. After 1980, as the industry grew, a number of diseases were listed by OIE that emerged in the Americas or Asia and subsequently got introduced to other continents. Several examples are available to prove the movement of pathogens along with the fish and their products. Monodon baculovirus was first reported in America in imported live *P. monodon* but later found to be common in wild and farmed Asian, Australian and African penaeid shrimp. IHHNV was introduced into the Americas through importation of live *P. monodon* from the Philippines in mid 70's which later spread throughout Americas and affected the entire shrimp farming industry. Taura syndrome virus emerged in *P. vannamei* farms in 1991-92 in Equador and by 1999 was transferred to South East Asia through live shrimps resulting in severe loss to the industry. WSSV emerged in East Asia and spread to most of Asia by 1994. By 1995, it reached USA and spread to other shrimp farming countries in the Americas. It is now the dominant disease of farmed shrimp in the Americas. Most recent disease in the Americas is IMNV. Within three years, it has been transferred to South East Asia with live *P. vannamei* and because of its potential to spread, it has been listed by the OIE in 2005. Lack of national strategies and non-compliance by those involved in the aqua industry has resulted in serious diseases.

Despite the negative impact of diseases on the shrimp farming industry, it continues to grow contributing to nutritional and food security and the livelihood of the fisher community, and hence development of management strategies to minimize the impact of infectious and contagious diseases is very important. Newly emerged diseases and outbreaks of familiar ones continue to challenge shrimp. The speaker also stressed that the FAO One Health concept necessitates all human

and veterinary health specialists from diverse specialties and regions to address trans-boundary issues. It is also necessary to build a knowledge base and capacity together with investments in biosecurity and quarantine facility, aquatic animal health testing infrastructure, regulatory frame works, partnerships, proper reporting and notifications and planned emergency response. The industry needs to rely on domesticated lines of brood stock that has undergone selection for disease resistance. Movement of live fish should be closely monitored for the risk of pathogen spread. A continuous surveillance program to identify disease free zones must be in place. The risks can be minimized by compliance with the code of conduct for responsible trading.

Panel Discussion

Panelists: Dr. K.V. Rajendran, CIFE, Mumbai, India
Dr. A.S. Sahul Hameed, CAH College, Vellore, India
Dr. S.V. Alavandi, CIBA, Chennai, India
Dr. J.K. Jena, NBFGR, Lucknow, India

Key Discussion Points

- Intensification of aquaculture has adversely affected fish health. Along with, climate change is driving expansion of favorable conditions and spread of pathogens.
- Trans-national research agenda is required to be drawn up to effectively handle trans-boundary disease issues. There is necessity to speed up the process of listing of fish diseases of importance.
- Host-parasite relationship, risk analysis and development of diagnostic capability needs to be prioritized before importing a new fish variety.
- Awareness and capacity building of the fish farmers are necessary for timely intervention and control.
- Development of database on economic impact of fish diseases should be initiated.
- Initiatives on climate resilient aquaculture including development of controlled environment facility to assess effect of climate change are necessary.
- Bio-remediation is required as there is ever increasing intensive aquaculture.

Recommendations

- Investment should be made in setting up local fish breeding centers for production of SPF seed in the country, especially for shrimps, to avoid risk of import of pathogens along with SPF stocks.
- Co-cultivation of different crustacean species should be avoided as one or the other species might act as reservoir of pathogen affecting the entire stock.
- Research should be directed towards development of crustacean cell lines.
- There is a need for implementation of quarantine by all the countries in the Asia-Pacific region.
- Co-operation and networking between various Institutes and organizations need to be further strengthened for better health management.
- Thrust on farmers' awareness and their capacity building should be given priority.
- Diagnostic capability for newer and exotic pathogens should be developed.
- Disease preparedness, surveillance and generation of data on loss due to disease should also be the priority for the countries in the region.

- Controlled environment laboratories should be created for assessment of vulnerability of hosts and virulence of pathogens keeping in view the climate change and temperature-dependent spread of the diseases and change in virulence.
- Emphasis should be given on developing trans-national research programs involving cooperative work on pathogen and host on a regional level.
- Establishment of national and regional repository on aquatic animal pathogens should be taken up.
- Strict screening of aquatic organisms and products, particularly Artemia, hosts carrying copepodid parasites, broods, etc. need to be done.
- Personnel involved in quarantine services should undergo regular refresher courses to update their capacity in diagnosis/diagnostics.
- Listing of a new disease by OIE, after its recognition as a significant economic loss causing disease, should be done expeditiously to enable swift action

Technical Session IV(a): Breakout Group Discussion for Identifying Key Issues on Plant TBDs

Facilitator: Dr. T.P. Rajendran, ICAR, New Delhi, India
Rapporteur: Dr. R.K. Jain, IARI, New Delhi, India

Recommendations

- Need to document potential TBDs of Asia-Pacific region and their prioritization based on risk analysis.
- Need to establish Asia-Pacific platform for developing TBDs diagnostics and risk assessment capabilities.
- Need to identify working groups for survey and surveillance of emerging and re-emerging trans-boundary disease threats and their vectors of Asia-Pacific region to map and identify hotspots.
- Need for HRD for creating rapid response teams to deal with emergency situations, like locust attack, and vector spread.
- Need to establish antiserum banks/vaccine banks for exotic pests/pathogens as well as new/emerging pests/diseases.

Technical Session IV(b): Breakout Group Discussion for Identifying Key Issues on Animal TBDs

Facilitator: Dr. Mohinder Oberoi, ECTAD, FAO-Nepal
Rapporteur: Dr. D.K. Sarma, AAU, Guwahati, India

Recommendations

Policy

- Advocacy with the policy makers for enhanced support to trans-boundary disease management and regional cooperation.
- Development of robust and comprehensive disease surveillance and reporting system.
- Setting up of public-private partnership for developing diagnostics, vaccines and for effective delivery mechanism.

- Setting up of preparedness plans/standard operating procedure for each of the important trans-boundary animal diseases.
- Implementation of strategic control program of diseases instead of undertaking mass vaccination.
- Development of effective mechanism for educating livestock producers and on the incentives.
- Need to setup regional referral laboratories for the important trans-boundary animal diseases.
- Need for regional coordination to address disease control measures on a regional basis.

Research

- Undertake research programs on disease epidemiology, socio-economy and disease forecasting models.
- Need to develop rapid diagnostics and vaccines for the emerging and re-emerging diseases.
- Undertake research on pathobiological aspects of the pathogens for developing good vaccine.
- Research on disease mapping and identifying hotspots of virus entrenchment/ecology.

Education

- Need to strengthen veterinary colleges and state veterinary service system for effective education, capacity building and services.
- Regular review of veterinary course curricula and introduction of veterinary epidemiology as a separate subject.

Technical Session IV(c): Breakout Group Discussion for Identifying Key Issues on Fish TBDs

Facilitator: Dr. K.M. Shanker, College of Fisheries, Mangalore, India
Rapporteur: Dr. (Mrs.) Usha Moza, ICAR, New Delhi, India

Recommendations

1. Fish disease diagnosis is still in its infancy compared to animal husbandry. To overcome this gap, the following needs to be done urgently:
   - ♦ Establishment of disease diagnostic laboratories wherever aquaculture is taken as an entrepreneurial activity and Improvement of such existing facilities to qualified standard.
   - ♦ Development of diagnostic expertise in almost all countries of Asia-Pacific, particularly at level 1 and 2 viz. field level diagnosis. In aquaculture, only efficient field level diagnosis can pave the way for preventive measures which otherwise are very difficult.
   - ♦ Human resource for field level diagnosis needs to be developed by the respective countries on a continuous basis.
2. Disease surveillance and reporting mechanism necessary to counter disease threats is either lacking or in its infancy in many Asia-Pacific countries due to lack of infrastructure. All such countries need to have:

- ♦ Permanent surveillance programs for disease reporting. The surveillance needs to be done for both wild and cultured fishes and should have most recent information on status of disease in any country.
- ♦ Affected countries should share information with other countries through APAARI.

3. The other issues like disease zoning, health certificate and risk analysis can be taken up once the above two issues are addressed properly.

Technical Session V: Priorities for Policies, Research and Regional Management of Plant Trans-boundary Diseases

Chair: Dr. R.D. Ghodake, NARI, Papua New Guinea
Co-Chair: Dr. S.K. Datta, ICAR, New Delhi, India
Rapporteur: Dr. Rajan, ICAR, New Delhi, India

Keynote Lecture
Impact of trade, travel, weather and vulnerability on the R&D and policy advocacy on the TBDs

Dr. S. Nagarajan, Former Chairman, PPV&FRA, New Delhi, India

International trade in agricultural commodities has been increasing due to dismantling of trade and tariff barrier. Palm oil, soybean oil, peas, fruits and nuts are among the major agriculture commodities imported by India. While these bring benefits, sanitary and phytosanitary considerations are becoming important since while being aimed at preventing the spread of diseases and pests, these also act to block trade and access to commodities. Similarly, while tourism and travel bring income and employment, global travelers can also unwittingly become carriers of plant disease propagules. It is believed that the spread of *Puccunia striiformis striiformis* in Australia was facilitated by travelers from the British Isles where it already existed. Later, the disease spread to New Zealand. Macro weather systems and orography may enable dispersal of pathogens over space and time. Cyclone formed in Bay of Bengal during November and crossing the coast south of Guntur, if dissipated to Maharashtra or MP, then the associated rain scrubbed Pgt rust uerodiniospores land on the wheat crop there. If the host is vulnerable, the rust appears within four weeks. It is also known that cyclonic systems are associated with long-range dissemination and increase of Asiatic citrus canker (ACC) (*Xanthomonas axonopodis pv. citri - Xac*) in Florida. On the other hand, there is no evidence of the spread of yellow rust and Ug99 that way. Globalised plant breeding and dominance of limited number of wheat varieties increases genetic vulnerability and facilitates occurrence of pandemics. It is suggested that neighboring countries should jointly keep a constant vigil on the potential trans-boundary disease and pest risks and risk analysis should be carried out. Molecular diagnostic kits should be developed against serious pathogens. Countries should actively participate in SPS discussions and post agricultural attache's in embassies to coordinate collaborative action.

Panel Discussion

Panelists: Dr. Narayan Rishi, Amity University, Noida, India
Dr. B.L. Jalali, Former Director of Research, HAU, Hissar, India
Dr. T.P. Rajendran, ICAR, New Delhi, India
Dr. A.K. Joshi, CIMMYT South Asia Regional Office, Kathmandu, Nepal

Key Discussion Points

- Survey of distribution of pests needs to be undertaken more intensively.
- Rapid and reliable pest identification, taxonomy and diagnostics are important prerequisites for combating epidemics.
- Quarantine system has a very important role in preventing entry and spread of trans-boundary diseases. Attention needs to be given not only to international quarantine but also to interstate quarantine.
- Awareness and capacity building of personnel involved in policy management and field level implementation of trans-boundary disease control is essential.

Recommendations

Policy

- Develop a mechanism for third country quarantine where the risk is too high or expertise for testing/certification is not available in the country.
- Develop a mechanism for off-shore quarantine facilities at Andaman and Nicobar Islands (for high risk pests) in the region.
- Pre-import and post-entry quarantine to be strengthened with matching support in terms of infrastructure, manpower and fund.
- Develop emergency action plan and rapid response teams to deal with sudden outbreak of pests in the region.

Research

- Regular and stringent survey and surveillance is required to map the distribution of pests and to identify pest hotspots. Advanced IT tools should be used for surveillance.
- Preparation of database on survey and surveillance reports of pests of significance.
- Need to prepare list of pests not reported in the region and list of pests having restricted distribution in the region.
- Generation of comprehensive data on epidemiology for predicting the disease development especially in the context of global warming.
- Use of simulation models for developing an early warning system to predict outbreaks of pests and diseases. Remote sensing may also be used for the same.
- Development of reliable and quick diagnostics for detection and identification of pests/pathogens/races/biotypes/strains using digitized keys and molecular techniques and promote use of nanotechnology in rapid detection and identification of pests.
- Accreditation of diagnostic laboratories at central and state levels including some well-equipped laboratories in private sector for quick and accurate identification of pests. There is also a need for National Certification Program for Seed Health.
- Development of eco-friendly alternatives to methyl bromide for disinfestation of quarantine pests.
- Development of SOPs with special reference to import inspection and quarantine clearance; and revise/update laboratory manuals for use in Plant Quarantine Stations.
- Establishment of Asia-Pacific Centre for Microbial Forensics and Agricultural Biosecurity including common high level containment/biosecurity facilities for handling high risk pests and diagnostic laboratories along with common diagnostic reagents including antisera bank, primers database, standardized and validated protocols and remote microscopy for taxonomic identification of pests.

- Proficiency testing for harmonization of diagnostics (as being done by ISTA) in the region.
- Establishment of Regional Diagnostic Platform in order to have mechanism for continuous provision of diagnostic reagents, antisera bank and common standardized procedures.
- Attenuated or inactivated threat agents are needed for proficiency testing to serve as assay controls.
- Establishment of regional repository of reference material such as museum specimens of insect pests/cultures of microbes/symptoms.
- Development of web-based portal for digitized pest identification system in the region and countries to collaborate with each other.
- Development of roster of experts on taxonomists and quarantine personnel.
- Need to identify variability in pest strains in different countries in the region and to develop varieties with durable resistance.

Capacity Building and Awareness

- Strengthen plant quarantine stations in terms of manpower, infrastructure (laboratories, treatment facilities and greenhouses) and expertise with special emphasis on advanced diagnostics for detection of pests, their strains/biotypes, and pest risk analysis through regular trainings.
- Need to organize trainers' trainings at regional level.
- Need to develop training manuals.
- Need to increase awareness on plant quarantine issues among custom officials, travellers and other stakeholders.

Technical Session VI: Priorities for Policies, Research and Regional Management of Animal Trans-boundary Diseases

Chair: Dr. Subhash Morzaria, ECTAD, FAO-RAP, Bangkok, Thailand
Co-Chair: Prof. K.M.L. Pathak, ICAR, New Delhi, India
Rapporteur: Dr. R. Venkataramanan, IVRI, Bangalore, India

Keynote Lecture
Standard setting, a way to translate scientific knowledge into guidelines to support disease control strategies - The role of OIE

Dr. Joseph Domenech, World Organization for Animal Health (OIE), Paris, France

Animal diseases are major causes affecting production, human health and international trade in food of animal origin. In developing countries, they also undermine food security and economic development, both at the level of village smallholders and in the more organized production chains supplying urban and export markets. For some of highly contagious diseases which are of trans-boundary nature, studies have shown that the cost of controlling outbreaks in free trading countries is so high that prevention programs make good economic returns of investment, especially for exporting countries. In countries with no international trade and less productive livestock farming systems, the economic efficiency of control depends on diseases, individual countries, chosen strategy and specific conditions. All countries try to maintain measures to ensure that food is safe for consumers and to prevent the spread of pests or diseases among animals and plants. An important trend is the emergence or reemergence of diseases due to many changing

factors including globalization of movements of animals, animal products, humans, evolution of farming systems, wildlife, changes in climate and new ecosystems favorable to vector multiplication, human population demography, urbanization and food diet changes. The increasing internal trans-boundary trade has led to the SPS Agreement which has been designed to set out clearer rights and obligations for food safety and animal and plant health measures which affect trade and at the same time to ensure that unnecessary health and safety regulations are not used as an excuse to protect domestic producers from foreign competition.

In these contexts, the disease control strategies at national, regional and international levels must be based on scientific evidences and the international standards, guidelines and recommendations have to provide to Member Countries very clear information to guide the preparation of effective methods, strategies and policies including appropriate veterinary legislation.

OIE has the unique mandate to edict standards, guidelines and recommendations in the field of animal health and zoonosis. They are published in the "Terrestrial Code" and in the "Terrestrial Manual" and they represent real foundations to prepare control strategies. Transforming science into disease control strategies contributes to improving animal and public health situation, domestic production and trade, global food security and, in developing countries, income generation, small farmers livelihoods as well as poverty alleviation.

The OIE standard setting is based on responsive, transparent and rapid procedures. It starts with the involvement of the best recognized and independent experts who are invited to participate to ad hoc specialized groups which report to the Specialist Commissions. All draft texts are sent to member countries for comments prior to their presentation to the World Assembly for adoption. The OIE also plays a role in defining, supporting and implementing national, regional and international policies and through various activities such as organizing international conferences, publishing scientific and technical journals, developing and implementing partnership and capacity building programs for example in the field of veterinary services capabilities, laboratories or education. Besides elaborating standards and recommendations on animal health and welfare, the mandates and roles of OIE cover other essential aspects such as information on animal disease situations, collection and dissemination of veterinary scientific information, support to veterinary services and veterinary education, improvement of food safety and food security, management of risks at the animal-human interface ecosystems (the One Health concept), and promotion of research and international cooperation. This is described in the Fifth Strategic Plan which covers the period 2011–2015.

The OIE considers that prevention and control programs have to be based on effective and continuous surveillance, early detection and warning, and immediate response to any disease outbreak. Other basic principles are that effective official Veterinary Services are crucial and have to be considered as a public good, whose quality and compliance with OIE standards can be evaluated using the OIE Tool for the evaluation of Performance of Veterinary Services (OIE PVS Tool). Partnership with other stakeholders, including private veterinarians, livestock producers, the veterinary product and animal feed industries and operators in the downstream marketing sector is indispensable to develop and implement control strategies. Also important is the existence of regularly updated laws and regulations and totally transparent world animal health information and warning system, as described and implemented by the OIE (WAHIS and WAHID systems), supplemented by a number of information and data-analysis platforms developed in partnership with other agencies, including the Food and Agriculture Organization

of the United Nations (FAO) and the World Health Organization (WHO). While the commitment of national governments is a prerequisite for implementing control strategies, action at regional and international levels is also vital in harmonizing and coordinating prevention and control programs, Regional networks of diagnostic laboratories and epidemiological surveillance teams, built in close collaboration with regional and international organizations involved, are indispensable tools. Among the tools to be included in control programs OIE promotes and contributes to develop are: surveillance systems for domestic and wild animals, national and international diagnostic laboratories, vaccines (particularly quality control centers and vaccine banks), emergency plans and data base on farms and animal movements, and animal identification. Some examples of OIE programs activities to support national, regional and international control programs were presented as well as some collaborating mechanisms and initiatives developed with major partners such as FAO and WHO.

Panel Discussion

Panelists: Dr. S.K. Bandopadhay, ASRB, New Delhi, India
Dr. A.S. Nanda, DAHDF, New Delhi, India
Dr. A.B. Pandey, IVRI, Nainital, India
Dr. D. Kulkarni, HSADL, Bhopal, India
Dr. Dilip K. Sarma, AAU, Guwahati, India

Key Dicussion Points

- Quarantine services and infrastructure need to be improved.
- Epidemiological studies of animal diseases need to be strengthened.
- There is a need for balance between liberal international trade of animals under WTO and the effective prevention of trans-boundary diseases.
- Disease diagnostics and vaccine development need to be strengthened.
- Some national laboratory facilities for animal disease control can serve other countries in the region.
- Regional and sub-regional collaboration is important in control of trans-boundary animal diseases.

Recommendations

- Epidemiology and disease reporting system in the region needs to be strengthened as this is the key element for the control of TADs. This in combination with improved communication and information sharing between the countries will hasten the process of management of the TADs.
- Economic impact analysis of priority TADs should be conducted and cost-benefit analysis included for various disease scenarios as a basis for seeking financial support for TADs control. Appearance of new pathogens, changes in the biological nature of existing pathogens (e.g. emergence of new strains of viruses) in any country need to be shared with its neighbors for the benefit of all.
- Longitudinal monitoring of key pathogens that cause TADs should be included in regional disease control strategies and appropriate platforms should be established to share information.
- Risk analysis and disease modeling capacity in the region need to be strengthened.
- A commonly agreed sub-regional mechanism including diagnostic and epidemiology networks should be established to address high impact TADs in the region.

- For control of priority TADs development and application of new diagnostics and vaccines should focus on the regional needs. Pen side diagnostic tests for quick deployment which can be widely used at the field level will help in early diagnosis and application of rapid response measures. The research initiatives on vaccines should focus on increasing the duration of immunity, thermostability and DIVA compliance using newer technologies. The scaling up of the vaccines and diagnostics to meet the demands to be taken up with the participation of the industry under public-private partnerships.
- There should be a common policy for introduction of new generation vaccines/new strains of viruses in existing vaccines and other biologicals in the region as it will benefit all stakeholders in the region.
- The existing regional laboratories should be strengthened and wherever required new regional laboratories established for the diagnosis of TADs with effective linkages.
- Control of TADs needs to be undertaken on the regional basis for which development of strong cooperation and political will of all policy makers is essential and will be the key element for success.

Technical Session VII: Priorities for Policies, Research and Regional Management of Fish Trans-boundary Diseases

Chair: Mr. Ropate Ligairi, DOA, Raiwaqa, Fiji
Co-Chair: Dr. (Mrs) B. Meenakumari, ICAR, New Delhi, India
Rapporteur: Dr. Gaurav Rathore, CIFE, Mumbai, India

Keynote Lecture

Priorities in research, policies and regional cooperation for effective management of fish trans-boundary diseases

Dr. A.G. Ponniah, Central Institute of Brackishwater Aquaculture, Chennai, India

Aquaculture is the fastest growing food sector. Emergence of diseases especially those that are trans-boundary in nature, can derail the expansion of aquaculture. Globalization of trading of aquatic animals and its products has increased the risk of aquatic animal pathogens spread. To arrest the emergence of new alien diseases, there is need to improve the capacity to diagnose trans-boundary pathogens. Greater emphasis in understanding the causative factors behind mass mortalities is required in order to advise the farmers to take preventive steps and to address the risks due to trans-boundary diseases. In this connection, one of the neglected fields is that of aquatic disease epidemiology. More efforts are required in understanding the dynamics of various pathogens, natural reservoirs, carriers and presence of genetic variants which differ in virulence. Though aquaculture is handled by the Agriculture Ministry, other ministries like Commerce and Environment & Forests are also involved and there is need for coordination between these ministries. Regulations aimed at restricting the entry of new pathogens and control of disease spread imposes large costs in terms of trade restrictions, surveillance, and control or eradication programs. For these to be effective, it is essential that there be close coordination between central and state ministries. Unless the risks of spread of alien pathogens through import of raw material for processing is understood by all the stakeholders involved, effective measures to address the risks cannot be put in place. The existing mechanisms for reporting and confirmation of diseases needs to be strengthened and rapid response mechanisms in the event of the occurrence of a trans-boundary disease needs to be put in place. The Network

of Aquaculture Centers in Asia-Pacific (NACA) has done considerable work in bringing about awareness on trans-boundary diseases. These efforts need to be further strengthened with regular capacity building programs. Mechanisms for sharing of information and materials for testing on a real time scale need to be put in place. The presentation also covered case histories of successful adoption of research, policy and regional cooperation initiatives that have helped in containing the spread of aquatic trans-boundary diseases.

Panel Discussion

Panelists: Dr. P. Jayasankar, CIFA, Bhubaneswar, India
Dr. Vishnu Bhatt, DAHDF, New Delhi, India
Dr. R. Paul Raj, CAA, Chennai, India
Dr. Madan Mohan, ICAR, New Delhi, India

Key Discussion Points

- There is a need to identify priority TADs for each country in the region and work in cooperation to control diseases of common interest.
- Diagnostics and vaccine development should be a high priority.
- Development of capacity building on awareness at various levels, including that of fish farming communities, towards disease monitoring and prevention.
- Need for greater interstate cooperation in managing diseases and disease threats.
- Development of indigenous fish needs production facilities.

Recommendations

TADs for priority attention (India)

- **Crustaceans:** white spot disease (WSD), monodon slow growth syndrome (MSGS), infectious hypodermal and hematopoietic necrosis (IHHNV), white tail disease (WTD)
- **Finfish:** epizootic ulcerative syndrome, viral nervous necrosis (VNN)
- **Molluscs:** Infection with *Perkinsus olseni*.

TADs for priority attention (other Asia-Pacific countries)

- **Crustaceans:** Yellow head virus (YHV), Taura syndrome virus (TSV), infectious myonecrosis virus (IMNV), early mortality syndrome (EMS)/acute hepatopancreatic necrosis syndrome (AHPNS)
- **Finfish:** Koi herpes virus (KHV)
- **Molluscs:** *Bonamia*, *Marteilia*, Osterid herpes virus

Management of existing TADs

- Control the spread of existing TADs to new areas within the country and prevent entry of more virulent forms of pathogen from outside the country.
- Prevent entry of potential TADs in the country and institutionalize mechanisms for emergency response for potential TAD threats.

Research priorities

- Development of diagnostics with greater sensitivity and specificity.

- Development of vaccines for effective control of TADs.
- Strengthening of quarantine protocols to detect the threat of unknown pathogens (application of metagenomics).
- Scientific disease investigations of mass mortalities of infectious nature.
- Epidemiological studies of TADs,
  - ♦ Distribution and occurrence,
  - ♦ Transmission to natural waters,
  - ♦ Effect of climate change and environmental variables.
- Human resource development on import risk analysis.
- Pathogenomics and proteomics of trans-boundary aquatic animal pathogens of priority.
- Transcriptome and proteome analysis of host in response to TADs of priority to India and the region.

Policy

- Implementation of National Surveillance Plan for early warning and emergency response.
- Strengthening of quarantine and certification framework for all aquatic animal imports specially *L. vannamei* and ornamental fishes.
- Reduction of imports by establishing multiplication centers or creation of more number of SPF facilities.
- Awareness programmes on farm level biosecurity, surveillance and monitoring, and incentive for voluntary disclosure of diseases.
- Post-border monitoring of aquatic animal imports of ornamental fish, live feed and seafood for processing.
- Establishment of national strategy and institutional mechanism for managing disease risks (National Biosecurity Authority).
- Harmonization of policies and legislation between center and states.
- Greater involvement of stakeholders and public-private partnership.

Regional cooperation

- Active participation with regional organizations such as NACA and SAARC on TADs in the form of facilitating safe trade, disease reporting and harmonization of diagnostic protocols.
- Bilateral arrangements with neighboring countries on sharing of information and resources.
- Creation of network of diagnostic laboratories in the region and referral laboratories.
- Capacity building on epidemiology, mathematical modeling and risk assessment.

Session VIII: Plenary Lectures

Chair: Dr. R.B. Singh, NAAS, New Delhi, India
Co-Chair: Dr. N.K. Krishna Kumar, ICAR, New Delhi, India
Rapporteur: Dr. R.K. Singh, NRC-Equines, Hisar, India

Integrated pest management strategy of citrus greening disease (Huanglongbing) in the severely infested areas

Dr. Youichi Kobori, Japan International Research Center for Agricultural Sciences (JIRCAS), Tsukuba, Japan

Citrus greening disease (Huanglongbing; HLB) is one of the world's most destructive diseases of citrus. Initially, HLB was limited to the subtropical areas of East and Southeast Asian countries. However, at the beginning of the 21st century, HLB invaded Brazil and the United States of America, the two biggest citrus producing countries in the world. The pathogen is a phloem-inhabiting bacterium of the genus *Candidatus* liberibacter. There are two principal means of transmission; graft transmission, and transmission through vector insects. In Asian countries, HLB is transmitted by the Asian citrus psyllid, *Diaphorina citri*.

HLB has spread rapidly in the Mekong Delta Area of Vietnam in association with increasing citrus production in the area. In response to this situation, from 2006 to 2011, JIRCAS and Southern Fruit Research Institute of Vietnam carried out a research project, "Development of prevention techniques for citrus greening disease in severely infected areas". The project focused sustainable citrus production, in the severely infected areas not the eradication or perfect prevention of HLB. For this purpose, a well-defined integrated pest management (IPM) system for the sustainable citrus production was implemented. The three principal techniques followed were: 1) effective use of disease-free seedlings, 2) delaying the transmission of infection from the vector insect by the intensive use of systemic insecticides, and 3) application of fertilizer suitably to increase early stage of growth before infection. In addition, risk factors were assessed by simulation model and, the effects of delay in transmission of infection on the yield in practical citrus production fields were estimated. On-farm demonstration of the integration of these techniques was conducted for the evaluation of economic impact of the techniques on the management of orchards.

In the presentation, the research activities carried out to develop the IPM system of HLB were elaborated.

Management of trans-boundary animal and plant diseases by Australia

Dr. Slava Zeman, Australian High Commission, New Delhi, India

The presentation described the policies and research in Australia that has effectively prevented transgress of exotic pathogens in to the continent. Australia's natural borders provide a significant barrier to the entry of exotic pests and diseases that may affect the status of animal and plant health in the country. Supported by an extensive legislative framework, the Australian Government and State authorities provide a network of measures and systems that have been established to form a biosecurity continuum from pre-border inspection through to post-border monitoring and surveillance. Australia plays a role in monitoring and managing exotic pests and diseases of concern to animal and plant health through regional involvement with the international standard setting bodies, the International Plant Protection Convention (IPPC) and the World Organisation for Animal Health (OIE).

Need for knowledge management in biosecurity

Drs. Ravi Khetarpal, Kavya Dashora, Martin Parr and Roger Day, CABI, New Delhi, India

Agriculture is highly vulnerable to trans-boundary and native pests and diseases as well as emergence of new strains and biotypes, resulting in annual loss of about 30-40% across crops. The shift towards intensive agriculture, trade liberalization and losses caused by plant and animal pests have all contributed to an increased awareness of biosecurity to achieve food security and improved trade prospects.

It is well known that effective engagement with biosecurity requires effective knowledge management around influencing factors and actors. Knowledge on biosecurity needs to be held holistically, ideally in places where knowledge is collected and collated. This may include information on regulations, market intelligence, supply chain (commercial, customs, transport), databases on diseases and pests, risk management (pre border, border, post border), researchable projects and agendas and outputs stakeholders, infrastructure and expertise, capacity building, training modules, status of biosecurity, regional and international linkages, awareness and public participation, and a whole range of other inputs.. The integration of all relevant knowledge at a platform level and customization according to need is crucial. Such effective knowledge management involves connecting people to create, share and exploit knowledge more effectively and to the tools they need to process information and knowledge.

Many developing countries are striving to institute strong regulatory systems, institutions, infrastructure, and expertise. India, for example, has recently developed a National Agricultural Biosecurity System. Such an approach also necessitates a more integrated communications and knowledge management approach for plant and animal health to cover policies, regulations, diagnostics, certification, surveillance, early warning systems, forecasting, teaching and training. Ensuring that the relevant audiences know where to find and how to access and use the knowledge resources is a challenge, but essential to build evidence based policy and interventions. National knowledge resources in developing countries would help deliver appropriate and customized information for policy makers, researchers and implementation in the public or private sector. A knowledge resource should aim to collect and collate the rich but scattered and often inaccessible locally relevant information on a single platform; the information should be customized to stakeholders in trade, field management, academia, etc. Access to the right knowledge is crucial for emergency crisis management in response to the spread of trans-boundary diseases and pests.

Development of any knowledge management strategy for national biosecurity is best achieved through rigorous needs assessment followed by a phase of contextualizing these needs in the global landscape of plant and animal health information systems. Any platforms built as a result will thus be well-informed. There are excellent information portals at FAO and its Regional Office at Bangkok which can be drawn upon. CABI also continues to make significant contributions through its knowledge management and knowledge for development themes. CABI's publishing products such as CAB Abstracts, Compendia, books, etc. are authoritative sources on technical matters, market intelligence, risk analysis and standards development. The research and development outputs of CABI in pest management, in the areas of diagnostics and bioservices are truly global, contributing to an international drive to improve food security and safety and in establishing a diagnostic network where CABI acts a secretariat and a clearing-house system in which samples from one country can be sent for analysis to another country anonymously. CABI's Plantwise Database and knowledge management platform has just been awarded by ALPSP Award for Publishing Innovation 2012 a Highly Commended Certificate.

Recommendations

- Biosecurity should be framed, supported by extensive legislative framework and network of measures and systems provided by federal and state governments, to form a biosecurity continuum from pre-border inspection to post-border monitoring and surveillance.

- Knowledge management systems for decision support are important in effective implementation of biosecurity. It is essential to establish necessary linkages among various sources of knowledge related to biosecurity.
- Appropriate institutional mechanisms involving national, international programs such as APAARI should ensure an integrated approach for managing the knowledge and applying it to achieve comprehensive biosecurity, and collaboration of all stakeholders, industry and various ministries and departments at national, regional and international levels. Capacity building at various levels especially in pest risk assessment, surveillance as well as in ensuring deployment of technologies and good practices should be a high priority.
- The various programs on these lines should be critically analyzed by peer scientific groups and the successful experiences documented and widely shared.

Session IX: Plenary Discussion and Recommendations

Co-Chairs: Dr. S. Ayyappan, ICAR, New Delhi, India
Dr. Raj Paroda, APAARI, New Delhi, India
Rapporteur: Dr. J.L. Karihaloo, APCoAB, APAARI, New Delhi, India

In his introductory remarks, Dr. Ayyappan observed that the consultation was unique in that all the trans-boundary issues related to agricultural sub-sectors, crops, animals and fish were covered here. There was important cross learning across sectors and countries and sub-regions. He stressed that the recommendations should clearly bring out the policy and other issues that need to be addressed on priority by policy makers and trans-boundary disease managers. Dr. Paroda observed that all sub-sectors are important and, therefore, must be promoted together for fully addressing the important trans-boundary issues. He expressed the need for establishing OIE like body for plant sector also.

Following these opening remarks, the rapporteurs of previous sessions presented the recommendations of each session which were further discussed. Following general and sub-sector related specific issues and recommendations were approved by the participants.

Key issues in management of trans-boundary diseases

Following policy, research and capacity development issues and gaps in management of trans-boundary diseases at national and regional levels were identified:

Plant TBDs

- Insufficient documentation of potential TBDs of Asia-Pacific region and their prioritization based on risk analysis.
- Lack of a common Asia-Pacific platform for developing TBDs diagnostics and risk assessment capabilities.
- Lack of regional level working groups for survey and surveillance and mapping of emerging and re-emerging trans-boundary diseases and their vectors.
- Inadequate human resources to create rapid response teams for dealing with emergency situations, like locust attack, and vector spread.
- Lack of antiserum/vaccine banks for exotic pests/pathogens as well as new and emerging pests and diseases.

Animal TBDs

Policy

- Limited awareness of policy makers for enhanced support to trans-boundary disease management and regional cooperation.
- Absence of robust and comprehensive disease surveillance and reporting system and strategic control program of diseases.
- Limited public-private partnership for developing diagnostics and vaccines, and for effective delivery mechanism.
- Lack of preparedness plans and standard operating procedures to deal with important trans-boundary animal diseases.
- Absence of coordination to address disease control measures on a regional basis and to setup regional referral laboratories for important trans-boundary animal diseases.

Research

- Very few research programs on disease epidemiology, socio-economic impact and disease forecasting models.
- Limited progress in development of rapid diagnostics and vaccines for the emerging and re-emerging diseases as also research on pathobiological aspects of the pathogens for developing good vaccine.
- Lack of comprehensive disease mapping surveys and identification of hotspots of virus entrenchment.

Education

- Limited course content in veterinary syllabi on epidemiology and other TBD related topics.

Fish TBDs

- Fish disease diagnosis is still in its infancy compared to animal husbandry. Shortage of diagnostic laboratories and expertise.
- Disease surveillance and reporting mechanism necessary to counter disease threats is either lacking or in its infancy in many Asia-Pacific countries due to lack of infrastructure.

Recommendations for management of trans-boundary diseases

General recommendations

- Containment of trans-boundary diseases should be framed and supported by extensive legislative framework and network of measures and systems provided by national and state governments, to form a biosecurity continuum from pre-border inspection to post-border monitoring and surveillance.
- Appropriate institutional mechanisms involving national and international programs such as APAARI should ensure an integrated approach to achieve comprehensive biosecurity, and collaboration of all stakeholders, industry and various ministries and departments at national, regional and international levels.
- Knowledge management systems for decision support are important in effective implementation of biosecurity measures against TBDs. It is essential to establish necessary linkages among

various sources of knowledge related to biosecurity. Capacity building at various levels especially in pest risk assessment, surveillance as well as in ensuring deployment of technologies and good practices should be a high priority.

- Active participation with regional organizations such as ASEAN, SAARC and NACA on TBDs for facilitating safe trade, disease reporting and harmonization of diagnostic protocols.
- Bilateral arrangements with neighboring countries on sharing of information and resources.
- Creation of network of diagnostic laboratories in the region and referral laboratories.
- Capacity building on epidemiology, mathematical modeling and risk assessment.

Plant TBDs

Policy

- Pre-import and post-entry quarantine to be strengthened with matching support in terms of infrastructure, manpower and funding.
- Develop a mechanism for third country quarantine where the risk is too high or expertise for testing and certification not available in the country. In India, develop off-shore quarantine facilities at Andaman and Nicobar Islands for high risk pests.
- Develop emergency action plan and rapid response teams to deal with sudden outbreak of pests in the region.

Research

- Regular and intensive survey and surveillance to map the distribution of pests and to identify pest hotspots. Advanced IT tools to be used for surveillance.
- Preparation of database on survey and surveillance reports of pests of significance as also of pests not reported or having restricted distribution in the region.
- Generation of comprehensive data on epidemiology and use of remote sensing and simulation models for developing an early warning system to predict outbreaks of pests and diseases.
- Development of reliable and quick diagnostics for detection and identification of pests and strains using digitized keys, molecular techniques and nanotechnology.
- Accreditation of diagnostic laboratories at central and state level including some well-equipped laboratories in private sector for quick and accurate identification of pests. There is also a need for National Certification Program for Seed Health.
- Development of SOPs with special reference to import inspection and quarantine clearance; and update laboratory manuals for use in Plant Quarantine Stations.
- Development of eco-friendly alternatives to methyl bromide for disinfestation of quarantine pests.
- Establishment of Asia-Pacific Centre for Microbial Forensics and Agricultural Biosecurity comprising high level biosecurity facilities for handling high risk pests, and diagnostic laboratories with required equipment and consumables including antisera bank, primers databases, standardized and validated protocols and remote microscopy.
- Establishment of Regional Diagnostic platform for sharing of diagnostic reagents, antisera bank and common standardized procedures.
- Proficiency testing for harmonization of diagnostics (as being done by ISTA) in the region.

- Establishment of regional repository of reference material such as museum specimens of insect pests, cultures of microbes, infected/infested material.
- Development of web-based portal for digitized pest identification system in the region and countries to collaborate with each other.
- Development of roster of experts on taxonomists and quarantine personnel.

Capacity Building/Awareness

- Strengthen plant quarantine stations in terms of manpower, infrastructure (laboratories, treatment facilities and greenhouses) and expertise with special emphasis on advanced diagnostics for detection of pests and their strains, and pest risk analysis through regular trainings.
- Increase awareness on plant quarantine issues among custom officials, travelers and other stakeholders.

Animal TBDs

- Strengthening of epidemiology and disease reporting system in the region along with, improving the communication and information sharing between the countries.
- Economic impact analysis of priority TADs and cost-benefit analysis for various disease scenarios as a basis for seeking financial support for TADs control.
- Information sharing among countries with respect to appearance of new pathogens and strains.
- Longitudinal monitoring of key TAD causing pathogens to be included in regional disease control strategies and appropriate platforms established to share this information.
- Risk analysis and modeling capacity in the region to be strengthened.
- A commonly agreed sub-regional mechanism including diagnostic and epidemiology networks to be established to address high impact TADs in the region.
- For control of priority TADs, development and application of new diagnostics and vaccines to focus on the regional needs. Pen side diagnostic tests for quick deployment which can be widely used at the field level will help in early diagnosis and application of rapid response measures. Research on vaccines to focus on increasing the duration of immunity, thermostability and DIVA compliance using newer technologies. Public-private partnerships are recommended for scaling up production.
- Develop a common policy for introduction of new generation vaccines/ virus strains other biologicals in the region.
- The existing regional laboratories for the diagnosis of TADs to be strengthened and where required new regional laboratories established with effective linkages.
- Control of TADs needs to be undertaken on the regional basis for which development of strong cooperation and political will of policy makers is essential.

Fish TBDs

TADs for priority attention (India):

- **Crustaceans:** white spot disease (WSD), monodon slow growth syndrome (LSNV), infectious hypodermal and hematopoietic necrosis (IHHNV), white tail disease (WTD)
- **Finfish:** epizootic ulcerative syndrome, viral nervous necrosis (VNN)
- **Molluscs:** Infection with *Perkinsus olseni*.

TADs for priority attention (other Asia-Pacific countries)

- **Crustaceans:** yellow head virus (YHV), taura syndrome virus (TSV), infectious myonecrosis virus (IMNV), early mortality syndrome (EMS)/Acute hepatopancreatic necrosis syndrome (AHPNS)
- **Finfish:** Koi herpes virus (KHV)
- **Molluscs:** *Bonamia*, *Marteilia*, Osterid herpes virus

Policy

- Establishment of national strategy and institutional mechanism for managing disease risks (National Biosecurity Authority).
- Implementation of National Surveillance Plan for early warning and emergency response.
- Strengthening of quarantine and certification framework for all aquatic animal imports specially *L. vannamei* and ornamental fishes.
- Establishment of multiplication centers or increasing SPF facilities.
- Organizing awareness programmes on farm level biosecurity, surveillance and monitoring, and incentive for voluntary disclosure of diseases.
- Post-border monitoring of aquatic animal imports of ornamental fish, live feed and seafood for processing.
- Harmonization of policies and legislation between centre and states.
- Greater involvement of stakeholders and Public-private partnership.

Research

- Development of diagnostics with greater sensitivity and specificity.
- Development of vaccines for effective control.
- Strengthening of quarantine protocols to detect the threat of unknown pathogens (application of metagenomics).
- Epidemiological studies on distribution and occurrence, transmission to natural waters, effect of climate change and environmental variables.
- Investigations in infectious diseases causing mass mortalities.
- Pathogenomics and proteomics of trans-boundry aquatic animal pathogens of priority to India.
- Transcriptome and proteome analysis of host in response to TADs of priority to India and the region.
- Human resource development on import risk analysis.

Expert Consultation on Managing Trans-boundary Diseases of Agricultural Importance in the Asia-Pacific

10-12 October 2012

Program

Wednesday (10 Oct 2012)

08:30-09:00	**Registration**	
09:00-10:10	**Inaugural Session**	
09:00-09:10	Welcome Address	*Dr. S. Ayyappan*, Secretary, DARE & DG, ICAR and Chairman, APAARI
09:10-09:25	Brief about Consultation	*Dr. Raj Paroda*, Executive Secretary, APAARI & Chairman TAAS
09:25-09:40	Remarks	*Dr. Raj Paroda*, Executive Secretary, APAARI & Chairman TAAS
09:40-09:55	Release of Publication and Inaugural Address	*Shri Harish Rawat*, Hon'ble Union Minister of State for Agriculture, Food Processing Industries and Parliamentary Affairs
09:55-10:10	Vote of Thanks	*Dr. K.M.L. Pathak*, DDG (AS), ICAR & Chairman, Organizing Committee
10:10-10:40	**Group Photograph & High Tea**	

10:40-12:20	**Technical Session I**	
	Status and Management of Plant Trans-boundary Diseases	
	Chair: *Dr. S. Nagarajan*, Former Chairman, PPVFRA, New Delhi, India	
	Co-Chair: *Dr. Teodoro Sabas Solsoloy*, Bureau of Agricultural Research, Philippines	
	Rapporteur: *Dr. Narayan Rishi*, Amity University, Noida, India	
Keynote Presentations		
Trans-boundary diseases – Global scenario and India's role in their management		*Dr. Peter Kenmore*, FAO, New Delhi, India
The Borlaug Global Rust Initiative (BGRI): Managing wheat rust through collaboration.		*Dr. Ronnie Coffman*, Cornell University, USA (with K. Vijayaraghavan and S.D. Evanega)
Panel Discussion		
Dr. Jaw-fen Wang, AVRDC- The World Vegetable Center, Chinese Taipei; *Dr.* (*Mrs.*) *Indu Sharma*, DWR, Karnal, India; *Dr. V.V. Ramamurthi*, IARI, New Delhi, India; *Dr. R.K. Jain*, IARI, New Delhi, India		
General Discussion		
Concluding remarks by Chair & Co-Chair		

12:20-14:00 **Technical Session II**

Status and Management of Animal Trans-boundary Diseases

Chair: *Dr. Simon Hearn*, ACIAR, Australia
Co-Chair: *Dr. Ajit Maru*, GFAR, Italy
Rapporteur: *Dr. B. Pattnaik*, IVRI, Uttarakhand, India

Keynote Presentation

Initiatives for the control of priority trans-boundary animal diseases in South Asia	*Dr. Subhash Morzaria*, ECTAD, FAO-RAP, Bangkok, Thailand

Panel Discussion

Dr. Tai-Young Hur, RDA, Korea; *Dr. M.P. Yadav*, Gurgaon, India; *Dr. Arvind Kumar*, LLRUVAS, Hisar, India; *Dr. A.K. Gahlot*, RAU, Bikaner, India; *Dr. Y.K.M. Reddy*, CAHS, Chennai, India

General Discussion

Concluding remarks by Chair & Co-Chair

14:00-14:30 **Lunch**

14:40-16:10 **Technical Session III**

Status and Management of Fish Trans-boundary Diseases

Chair: *Mr. Prabhath Wimal Kumara*, SLCARP, Sri Lanka
Co-Chair: *Dr. Vishnu Bhatt*, DAHDF, New Delhi, India
Rapporteur: *Dr. P.K. Sahoo*, CIFA, Orissa, India

Keynote Presentation

Status and management of fish trans-boundary diseases	*Dr. (Mrs.) Indrani Karunasagar*, KVAFSU, Mangalore, India

Panel Discussion

Dr. K.V. Rajendran, CIFE, Mumbai, India; *Dr. A.S. Sahul Hameed*, CAH College, Vellore, India; *Dr. S.V. Alavandi*, CIBA, Chennai, India; *Dr. J.K. Jena*, NBFGR, Lucknow, India

General Discussion

Concluding remarks by Chair & Co-Chair

16:10-16:30 **Tea/Coffee**

16:30-17:30 **Technical Session IV**

Breakout Group Discussions for Identifying Key Issues in Plant, Animal and Fish TBDs

Facilitator (Plant): *Dr. T.P. Rajendran*, ICAR, New Delhi, India
Rapporteur (Plant): *Dr. R.K. Jain*, IARI, New Delhi, India

Facilitator (Animal): *Dr. Mohinder Oberoi*, ECTAD, FAO-Nepal
Rapporteur (Animal): *Dr. Dilip K. Sarma*, AAU, Guwahati, India

Facilitator (Fish): *Dr. K.M. Shankar*, College of Fisheries, Mangalore, India
Rapporteur (Fish): *Dr. (Mrs.) Usha Moza*, ICAR, New Delhi, India

19:30 **Reception Dinner Hosted by Secretary, DARE and DG, ICAR**

Thursday (11 Oct 2012)

09:00-10:30 **Technical Session V**

Priorities for Policies, Research and Regional Management of Plant Trans-boundary Diseases

Chair: *Dr. R.D. Ghodake*, NARI, Papua New Guinea
Co-Chair: *Dr. Iftikhar Ahmad*, PARC, Pakistan
Rapporteur: *Dr. Rajan*, ICAR, New Delhi, India

Keynote Presentation

Impact of trade, travel, weather and vulnerability on the R&D and policy advocacy on the TBDs. — *Dr. S. Nagarajan*, Former Chairman, PPVFRA, New Delhi, India

Panel Discussion

Dr. Narayan Rishi, Amity University, Noida, India; *Dr. B.L. Jalali*, Former Director, HAU, Hisar, India; *Dr. T.P. Rajendran*, ICAR, New Delhi, India; *Dr. A.K. Joshi*, CIMMYT, Kathamndu, Nepal

General Discussion

Concluding remarks by Chair & Co-Chair

10:30-11:00 **Tea/Coffee**

11:00-13:00 **Technical Session VI**

Priorities for Policies, Research and Regional Management of Animal Trans-boundary Diseases

Chair: *Dr. Subhash Morzaria*, ECTAD, FAO-RAP, Bangkok, Thailand
Co-Chair: *Prof. K.M.L. Pathak*, ICAR, New Delhi, India
Rapporteur: *Dr. R. Venkataramanan*, IVRI, Bangaluru, India

Keynote Presentation

Standard setting, a way to translate scientific knowledge into guidelines to support disease control strategies – The role of OIE — *Dr. Joseph Domenech*, OIE, France

Panel Discussion

Dr. S.K. Bandyopadhay, ASRB, New Delhi, India; *Dr. A.S. Nanda*, DAHDF, New Delhi, India; *Dr. A.B. Pandey*, IVRI, Nainital, India; *Dr. D. Kulkarni*, HSADL, Bhopal, India; *Dr. Dilip K. Sarma*, AAU, Guwahati, India

General Discussion

Concluding remarks by Chair & Co-Chair

13:00-14:00 **Lunch**

14:00-15:30 **Technical Session VII**

Priorities for Policies, Research and Regional Management of Fish Trans-boundary Diseases

Chair: *Mr. Ropate Ligairi*, Department of Agriculture, Fiji
Co-Chair: *Dr. (Mrs.) B. Meenakumari*, ICAR, New Delhi, India
Rapporteur: *Dr. Gaurav Rathore*, CIFE, Mumbai, India

Keynote Presentation	
Priorities in research, policies and regional cooperation for effective management of fish trans-boundary diseases	*Dr. A.G. Ponniah*, CIBA, Chennai, India
Panel Discussion	
Dr. P. Jayasankar, CIFA, Bhubaneswar, India; *Dr. Vishnu Bhatt*, DAHDF, New Delhi, India; *Dr. R. Paul Raj*, CAA, Chennai, India; *Dr. Madan Mohan*, ICAR, New Delhi, India	
General Discussion	
Concluding remarks by Chair & Co-Chair	
15:30-16:00	**Tea/Coffee**

16:00-17:30	**Session VIII**
	Plenary Lectures
	Chair: *Dr. R.B. Singh*, NAAS, New Delhi, India Co-Chair: *Dr. N.K. Krishna Kumar*, ICAR, New Delhi, India Rapporteur: *Dr. R.K. Singh*, NRC-Equines, Hissar, India
Integrated pest management strategy of citrus greening disease (Huanglongbing) in the severely infested areas	*Dr. Youichi Kobori*, JIRCAS, Japan
Management of trans-boundary animal and plant diseases by Australia	*Dr. Slava Zeman*, Australian High Commission, New Delhi, India
Need for knowledge management in biosecurity	*Dr. Ravi Khetarpal*, CABI, New Delhi, India
General Discussion	
Concluding remarks by Chair & Co-Chair	
19:30	**Dinner Hosted by APAARI**

Friday (12 Oct 2012)

09:00-11:00	**Session IX**
	Plenary Discussion and Recommendations
	Co-Chairs: *Dr. S. Ayyappan*, ICAR, New Delhi, India *Dr. Raj Paroda*, APAARI, New Delhi, India Rapporteur: *Dr. J.L. Karihaloo*, APCoAB, APAARI, New Delhi, India
12:30-14:00	**Lunch**
14:00-16:00	**Visit to National Agricultural Science Museum**

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The Asia-Pacific Association of Agricultural Research Institutions (APAARI) is a regional association that aims to promote the development of National Agricultural Research Systems (NARS) in the Asia-Pacific region through inter-regional and inter-institutional cooperation. The overall objectives of the Association are to foster the development of agricultural research in the Asia-Pacific region so as to promote the exchange of scientific and technical information, encourage collaborative research, promote human resource development, build organizational and management capabilities of member institutions and strengthen cross-linkages and networking among diverse stakeholders. To meet these needs, the Association: i) convenes General Assembly once in two years, holds regular Executive Committee meetings twice a year and organizes consultations, workshops, trainings, etc., ii) collects, collates and disseminates research findings, iii) maintains links with other fora in the region and outside through meetings, participation and information exchange, and iv) promotes need based collaboration in research projects among member institutions, analyzing priorities and focusing on regional agricultural development.

For details, please visit: *www.apaari.org*

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The Asia-Pacific Consortium on Agricultural Biotechnology (APCoAB) was established in 2003 under the umbrella of APAARI. APCoAB has the mission to, "Harness the benefits of agricultural biotechnology for human and animal welfare through the application of latest scientific technologies while safeguarding the environment for the advancement of society in the Asia-Pacific Region". APCoAB's main thrusts are to (i) serve as a neutral forum for the key partners engaged in research, development, commercialization and education/learning of agricultural biotechnology as well as environmental safety in the Asia-Pacific region; (ii) facilitate and promote the process of greater public awareness and understanding relating to important issues of IPR, sui generis systems, biosafety, risk assessment, harmonization of regulatory procedures, and benefit sharing in order to address various concerns relating to adoption of agricultural biotechnology; and (iii) facilitate human resource development for meaningful application of agricultural biotechnology to enhance sustainable agricultural productivity, as well as product quality, for the welfare of both farmers and consumers.

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Indian Council of Agricultural Research (ICAR)

The Indian Council of Agricultural Research (ICAR) is an autonomous organisation under the Department of Agricultural Research and Education (DARE), Ministry of Agriculture, Government of India. Formerly known as Imperial Council of Agricultural Research, it was established on 16 July 1929 as a registered society under the Societies Registration Act, 1860 in pursuance of the report of the Royal Commission on Agriculture. The ICAR has its headquarters at New Delhi.

The Council is the apex body for co-ordinating, guiding and managing research and education in agriculture including horticulture, fisheries and animal sciences in the entire country. With 99 ICAR institutes and 53 agricultural universities spread across the country this is one of the largest national agricultural systems in the world.

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