A Brief Introduction on Non-targeted screening and risk assessment approaches for emerging risks in agro-products

Dr. Yanyang XU

Institute of Quality Standard & Testing Technology for Agro-Products
Chinese Academy of Agricultural Sciences

Overview of my talk

- A brief introduction of our institute
- Potential for collaboration & expected impact
- Progress &Challenges on non-targeted screening approaches & evaluation of combined effects of chemical mixtures

IQSTAP CAAS

- Established in 2003; Research institute within CAAS; >130 coworkers including PhD students;
- The sole institution dedicating in agro-product quality and safety control research at national level;
- Administration Office of National Expert Committee of Risk Assessment on Quality and Safety for Agro-products;
- WTO/TBT Notification and Enquiry Contact Point of Ministry of Agriculture
- National Codex Expert Committee on Methods of Analysis and sampling in agriculture.

Facilities

A research building of 17,000 ㎡ installed with state-of-the-art instruments

International Cooperation

Involvement in EU FP 6

- **Involved in the EU integrated project "Tracing the Origin of Food Commodities in Europe" (FP6-2003-FOOD-2A) which is widely known as TRACE and coordinated by Mr. Paul Brereton from the former Central Science Laboratory (now FERA) in York, UK.**

Science Committee Meeting of EU TRACE Project and Sino-EU Workshop on Development & Application of Trace Technologies for Food Safety and Quality, Beijing, Oct.16, 2008

International Cooperation

Involvement in EU FP 7

- **In collaboration with the European Center of Excellence for Automatic Identification and Data Capture (AIDC UK Ltd), Halifax, UK, IQSTAP has been selected as the Asian representative institute and one of the 13 partners of the EU FP7 project "Bright Animal" Practical Precision Livestock Farming for SMEs in Europe and World-wide" (FP7-KBBE-2007-2B).**

International Cooperation

Involvement in EU FP 7

- **In collaboration with the University of West of England, UK, on "EXCELMEAT: an international research network for the genetic improvement of pigmeat quality and the development of biosensing technologies as rapid and cost-effective tools for meat quality evaluation"(FP7-PEOPLE-2009-IRSES)**

Collaboration with other EU Countries

- Collaboration with France (INRA), Italy (Parma University)
- "Research on the Management System for Food Safety in EU Countries and China"---(Key Project of International Cooperation, MOST)

IQSTAP is responsible for the administration, and coordination of day-to-day Monitoring Program

- Monitoring Program
  - Risk Monitoring Program
    - Routine Monitoring
    - Special Monitoring
    - Others
  - Supervision and Spot Check

Routine monitoring program

- Monitored quarterly each year
- All the provinces and >150 cities
- >90 vegetables, fruits, teas, meats, poultry, egg and fishes
- 43,000 samples and obtained 1.5 million data

1,543,241 data

Obtained from 2015 routine monitoring program.

The real problems and challenges of agri-food in China：

Residues of the pesticides and veterinary drugs

- Limit of production scale & capability
- Producers' lack of knowledge and technology

Environmental pollutions

- Phthalate esters, Steroids, Bisphenol A, etc.
- Heavy metals, Biotoxins, Persistent organic pollutants(POPs)

Endocrine disrupting chemicals

Endocrine disrupting chemicals（EDCs）

- Attracted a great deal of scientific and public attention worldwide;
- A research hotspot in Europe;
- Unique Threats and Common Challenges
- However, conventional methods cannot satisfy the requirements for EDCs, such as identification, risk assessment, risk management.

Potential for collaboration & expected impact

Non-targeted screening and quantification methods to identify the Endocrine Disrupters

Based on high-resolution mass spectrometry (HRMS), ultra-high-performance liquid chromatography (UHPLC) coupled with comprehensive molecular databases.

Risk assessment approaches for assessing the potential risks caused by mixture pollutants

Identify the combined effects based on alternatives to animal testing.

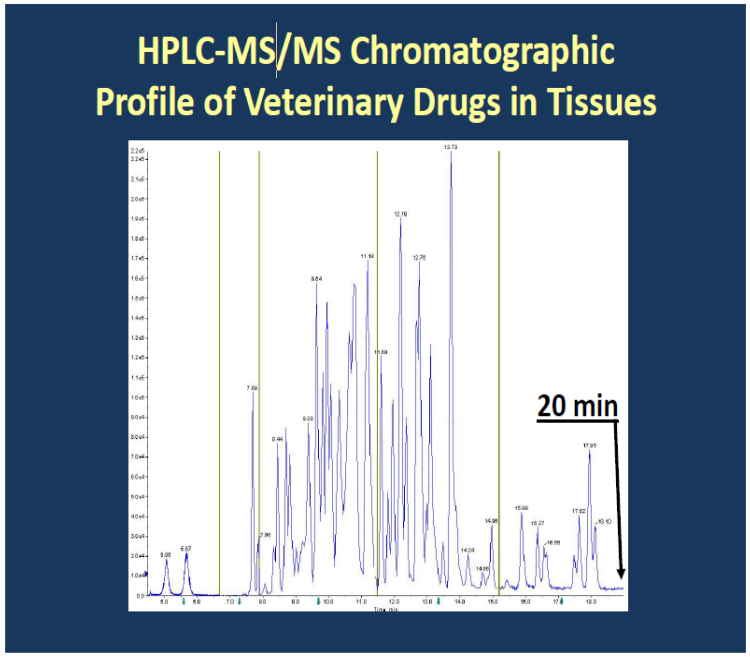
Establish criteria to decide how to regulate these risks

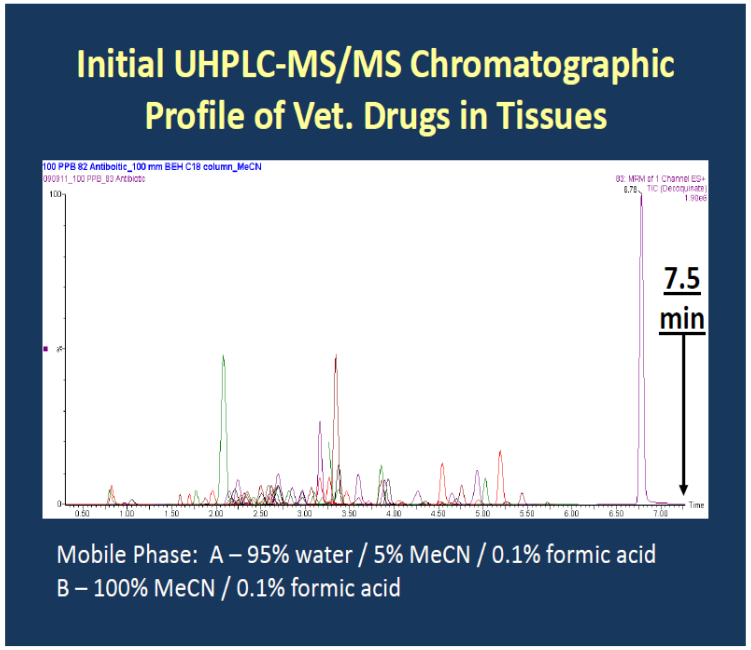
Improved quality and safety of consumer products and increase mutual trust and trade between EU and China.

Progress & challenges in non-targeted screening approaches

Established a multi-residue analytical method

- MS/MS spetra library which contained hundreds of pollutants





✓ Sample extraction. Food matrices due to inherent sample complexity and diversity and a large analyte concentration range.

✓ Data analysis. large amount of data needs to be processed efficiently.

Joint acute and endocrine disruptive toxicities of binary pesticide mixtures to *early life stages of zebrafish*

the expression of genes in the hypothalamic-pituitary-gonadal axis

The expression of genes are assessed, the transcription of many key genes (vtg1, Vtg2, erb1) were affected after exposure to pesticides.

MAL + CPM — Synergism

MAL + PRO — Antagonism

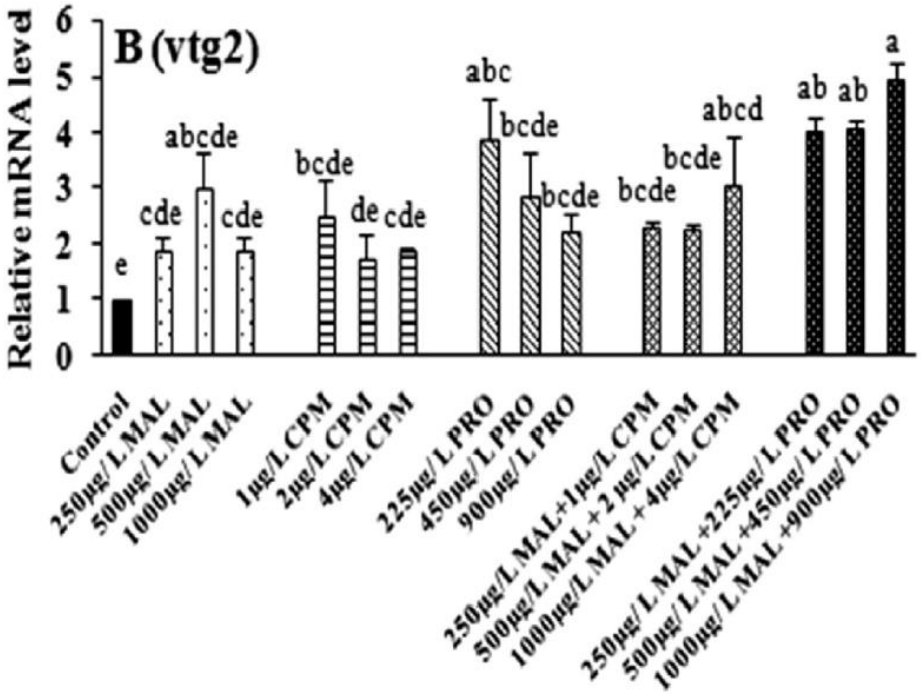


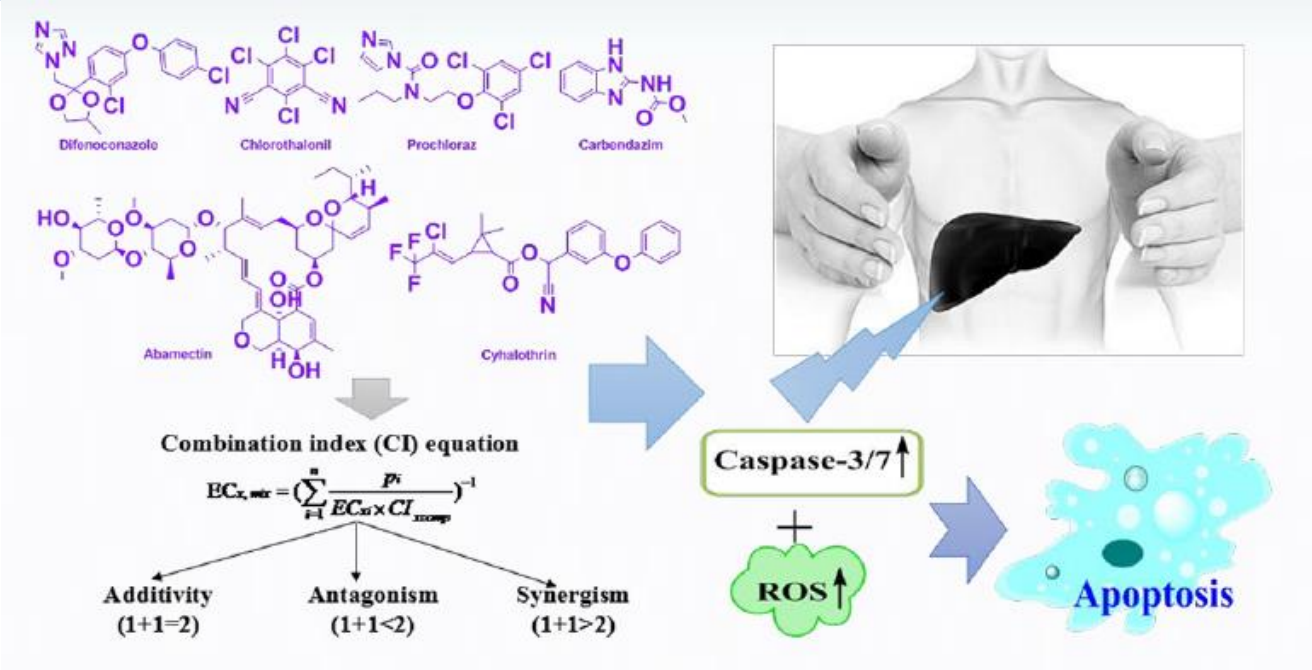
Table 3
The joint effect of binary mixture of MAL + PRO to zebrafish larvae.

Exposure time (h)	LC_{50}(95% CL[a]) mg/L		AI	Type of combined action
	MAL	PRO		
24	31.58 (26.55–41.64)	2.56 (2.10–3.11)	−1.19	Antagonism
48	28.00 (21.94–32.63)	2.27 (1.78–2.65)	−1.38	Antagonism
72	28.00 (21.94–32.63)	2.27 (1.78–2.65)	−1.86	Antagonism
96	19.00 (9.09–25.41)	1.55 (0.74–2.06)	−1.14	Antagonism

[a] CL = confidence limit.

Progress in evaluation of combined effects of chemical mixtures

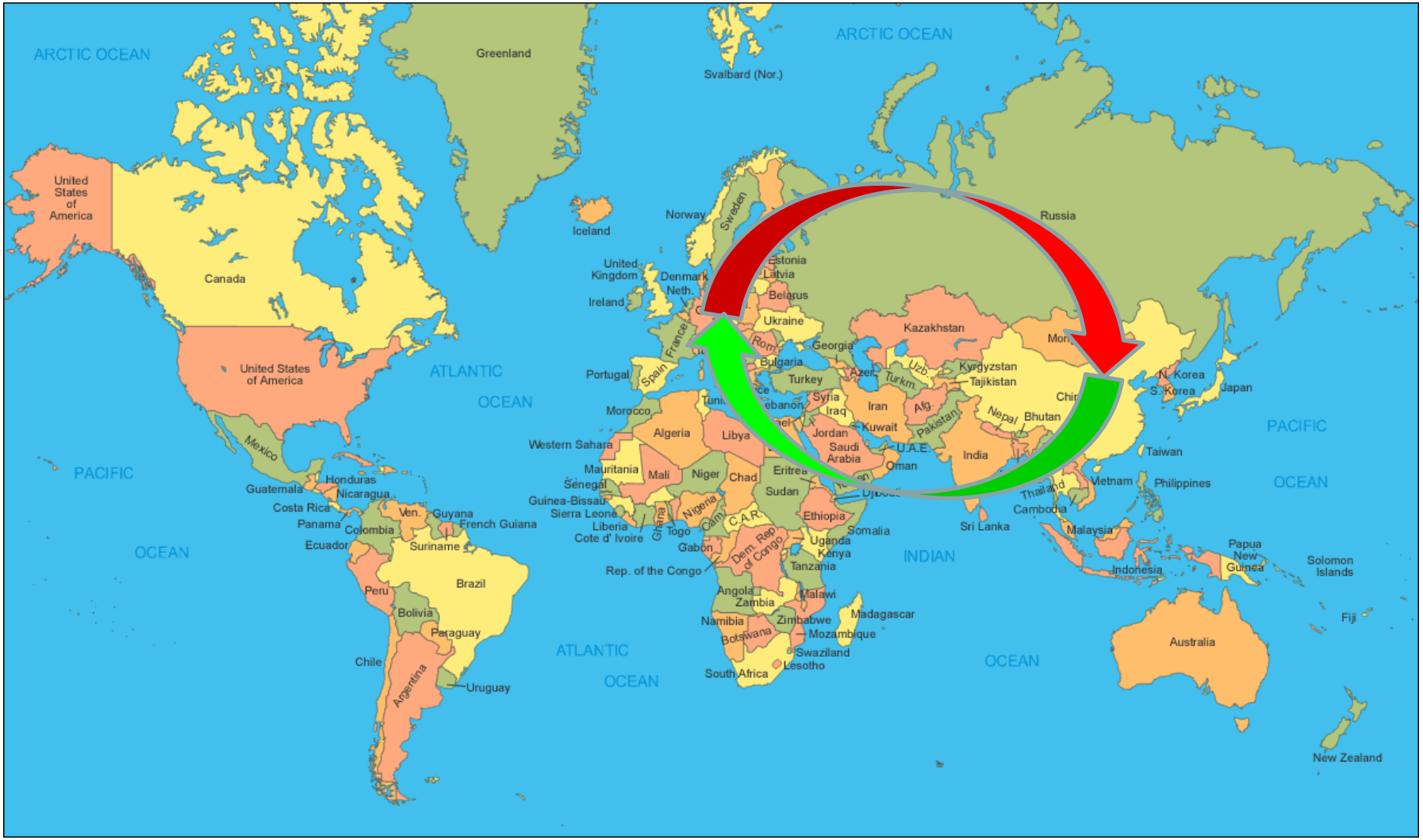
Combined cytotoxic effects of pesticide mixtures on human *hepatocarcinoma cell line*



- ✓ **ROS level and apoptosis-related protein Caspase-3/7 content**
- ✓ **The combined effects of these pesticide mixtures with the prediction was based on a combination index (CI)-isobologram equation**
- ✓ Measure effect of candidate compounds on cell growth & apoptosis.

Proposed topics for future collaboration

- Non-targeted screening and quantification methods for Endocrine Disrupters;
- The toxicity of the multiple chemical mixtures;
- Omics-Based Biomarkers for the Identification of EDCs;
- Molecular mechanisms of joint toxicity



xuyanyang@caas.cn

Tel:+86 10 82106539/+86 136 4113 8928