

## **12th Workshop of the Arthropod Mass Rearing and Quality Control Working Group of the IOBC**

### **“Blueprint for the future of arthropod rearing and quality assurance”**

Vienna International Centre (VIC), Vienna, Austria  
Boardroom A (M building)  
October 19 - 22, 2010

#### **Joint Meeting in Vienna, Austria of:**

IOBC Global Working Group on Arthropod Mass Rearing and Quality Control (AMRQC)

Association of Natural Bio-control Producers (ANBP)

ASTM Subcommittee E35.30 on Natural Multi-Cellular Biological Control Organisms

International Biocontrol Manufacturers Association (IBMA), Invertebrate Biocontrol Agents  
Group

In cooperation with the International Atomic Energy Agency, Vienna, Austria

### **PROGRAM**

#### **Monday 18 October**

16:00-18:00 Registration at VIC gate 1

#### **Tuesday 19 October**

8:00 Registration at VIC gate 1

10:00 Informal reception, setting up of posters

11:00 **Opening address** – Tom Coudron, Patrick De Clercq, Andrew Parker

12:00 Lunch

**Symposium no. 1: The Role of Microbiota in Insect Mass Rearing and Quality Control  
(chair: Patrick De Clercq, Ghent University, Ghent, Belgium)**

**13:15 Basic and Applied Aspects of Insect Symbiosis**

Kostas Bourtzis (*Department of Environmental and Natural Resources Management, University of Ioannina, Agrinio, Greece*)

**13:35 Endosymbionts in predatory bugs of the genus *Macrolophus***

Thijs Machtelinckx<sup>1</sup>, Thomas Van Leeuwen<sup>1</sup>, Tom Van De Wiele<sup>2</sup>, Nico Boon<sup>2</sup>, Godelieve Gheysen<sup>3</sup>, Patrick De Clercq<sup>1</sup> (*Department of Crop Protection, Ghent University, Ghent, Belgium;*<sup>2</sup>*Laboratory of Microbial Ecology and Technology (LabMET), Ghent University, Ghent, Belgium;*<sup>3</sup>*Laboratory of Applied Molecular Genetics, Department of Molecular Biotechnology, Ghent University, Ghent, Belgium*)

**13:55 The intestinal microbiota of tephritid fruit flies as a potential tool to improve rearing and the sterile insect technique**

Michael Ben-Yosef, Eyal Ben-Ami, Sagi Gavriel, Edouard Jurkevitch, Boaz Yuval (*The Robert H. Smith Faculty of Agriculture, Food and Environment, The Hebrew University of Jerusalem, Rehovot, Israel*)

**14:15 Mass rearing Lepidoptera with persistent baculovirus infections**

Helen Hesketh, Rosie Hails (*Centre for Ecology & Hydrology, Wallingford, Oxfordshire, United Kingdom*)

**14:35 Hytrosaviridae as a threat to the successful application of the sterile insect technique for *Glossina pallidipes***

Adly Abd-Alla<sup>1</sup>, Andrew Parker<sup>1</sup>, Max Bergoin<sup>2</sup>, Marc Vreysen<sup>1</sup> (<sup>1</sup>*Insect Pest Control Laboratory, Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, Vienna, Austria;*<sup>2</sup>*Laboratoire de Pathologie Comparée, Université Montpellier 2, Montpellier, France*)

**14:55 Managing pests and diseases in commercial bumble bee production**

Petr Sima, Karel Bolckmans (*Koppert BV, Slovakia & The Netherlands*)

15:15 Coffee break and poster viewing

**Symposium no. 2: Entomopathogenic Nematodes: Producing a High Quality, Effective Product for Expanding the Agricultural Market (chair: Lynn LeBeck, ANBP, Clovis, CA, USA)**

**15:45 Advances in entomopathogenic nematode in vivo production and application methodology**

David Shapiro-Ilan<sup>1</sup>, Juan Morales-Ramos<sup>2</sup>, M. Guadalupe Rojas<sup>2</sup>, W. Louis Tedders<sup>3</sup> (<sup>1</sup>*USDA-ARS, SEFTNRL, Byron, GA, USA;*<sup>2</sup>*USDA-ARS, NBCL, Stoneville, MS, USA;*<sup>3</sup>*Southeastern Insectaries, Inc., Perry, GA, USA*)

**16:05 Production technology of entomopathogenic nematodes in China**

Richou Han (*Guangdong Entomological Institute, Guangzhou, China*)

**16:25 Quality assured mass production of entomopathogenic nematodes**

Andrew Brown, Jeremy Pearce, John Godliman (*Becker Underwood Ltd., Littlehampton, West Sussex, United Kingdom*)

**16:45 Mass production efficacy and nematode quality - contradicting targets?**

Arne Peters (*e-nema GmbH, Schwentinental, Germany*)

**17:05 Open discussion**

Lynn LeBeck (*ANBP, Clovis, CA, USA*)

## Wednesday 20 October

**Symposium no. 3: SIT Applications and Other Uses of Irradiation Technology (chair: Andrew Parker, IAEA, Seibersdorf, Austria)**

**8:30 Production, shipment and use of natural enemies facilitated by irradiation**

Jorge Hendrichs<sup>1</sup>, Kenneth Bloem<sup>2</sup>, Gernot Hoch<sup>3</sup>, James E. Carpenter<sup>4</sup>, Patrick Greany<sup>5</sup>, Alan S. Robinson<sup>1</sup> (<sup>1</sup>*Joint FAO/IAEA Division, Vienna, Austria;* <sup>2</sup>*Centre for Plant Health Science & Technology, USDA-APHIS-PPQ, Raleigh, NC, USA;* <sup>3</sup>*Department of Forest and Soil Sciences, BOKU – University of Natural Resources and Applied Life Sciences, Vienna, Austria;* <sup>4</sup>*USDA-ARS Crop Protection and Management Research Unit, Tifton, GA, USA;* <sup>5</sup>*2770 Pine Ridge Road, Tallahassee, FL, USA*)

**8:50 Use of irradiation for economical production of *Trichogramma chilonis* and its field augmentation to manage insect pests of sugarcane and cotton**

Nazir Ahmad, Muhammad Sarwar, Raza Muhammad Memon (*Nuclear Institute of Agriculture, Tando Jam, Sindh, Pakistan*)

**9:10 Fruit fly parasitoid mass rearing, quality control and field release**

Pablo Montoya, Jorge Cancino, Lía Ruiz, Patricia Lopez (*Programa Moscafrut SAGARPA-IICA, Tapachula, Chiapas, Mexico*)

**9:30 Review of largest tephritid fruit fly emergence and release facilities**

Pedro A. Rendon (*USDA/APHIS/PPQ/CPHST, Guatemala, Guatemala*)

**9:50 Enhancement of sterile male performance: Nutritional, semiochemical, and hormonal pre-release treatments for tephritid fruit flies**

Rui Pereira<sup>1</sup>, Peter Teal<sup>2</sup>, Boaz Yuval<sup>3</sup>, Pablo Liedo<sup>4</sup>, Todd Shelly<sup>5</sup>, Jorge Hendrichs<sup>1</sup> (<sup>1</sup>*Insect Pest Control Section, Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture, Vienna, Austria;* <sup>2</sup>*Center for Medical, Agricultural and Veterinary Entomology, USDA-ARS, Gainesville, FL, USA;* <sup>3</sup>*Department of Entomology, Hebrew University, Rehovot, Israel;* <sup>4</sup>*Departamento de Entomología, El Colegio de la Frontera Sur (ECOSUR), Tapachula, Chiapas, Mexico;* <sup>5</sup>*USDA-APHIS, Waimanalo, HI, USA*)

10:10 Coffee break and poster viewing

**10:40 Field cage assessment of fruit fly competitiveness and compatibility: the example of *Anastrepha fraterculus***

Teresa Vera (*CONICET, Las Talitas, Argentina*)

**11:00 The process of revising the FAO/IAEA/USDA manual for product quality control and shipping procedures for sterile mass-reared tephritid fruit flies**

Patrick Gomes<sup>1</sup>, Jorge Hendrichs<sup>2</sup>, Rui Pereira<sup>2</sup>, Andrew Parker<sup>2</sup> (<sup>1</sup>*USDA-APHIS-PPQ, Raleigh, North Carolina, USA;* <sup>2</sup>*Joint FAO/IAEA Division, Vienna International Centre, Vienna, Austria*)

**11:20 Mass rearing and quality control for false codling moth SIT application**

Sampie Groenewald (*Xsit Pty Ltd, Citrusdal, South Africa*)

**11:40 Development of quality control procedures for Lepidoptera**

James Carpenter<sup>1</sup>, Greg Simmons<sup>2</sup>, Tom Blomefield<sup>3</sup>, Stephen Hight<sup>4</sup> (<sup>1</sup>*USDA-ARS, Tifton, GA, USA;* <sup>2</sup>*USDA-APHIS, Moss Landing, CA, USA;* <sup>3</sup>*Agricultural Research Council, Stellenbosch, Western Cape, South Africa;* <sup>4</sup>*USDA-ARS, Tallahassee, FL, USA*)

12:00 Lunch

**Symposium no. 4: Application of New Technology to Mass Insect Rearing and Quality Control (chair: Tom Coudron, USDA-ARS, Columbia, MO, USA)**

**13:15 On the genetic improvement of parasitoids: lessons from *Nasonia* wasps**

Leo Beukeboom (*Centre for Ecological and Evolutionary Studies, University of Groningen, Haren, the Netherlands*)

**13:35 Developments in sexing tsetse pupae and new packing materials for shipping**

Andrew Parker (*Insect Pest Control Laboratory, Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, Vienna, Austria*)

**13:55 On the road to a mosquito SIT programme: Mass rearing tools and quality control**

Fabrizio Balestrino, Mark Benedict, Clelia Oliva, Sharon Soliban, Jeremie Gilles (*IAEA, Vienna, Austria*)

**14:15 Applications of biomanufacturing and bioreactor technology for developing new insect diets**

Allen Cohen (*North Carolina State University, Raleigh, NC, USA*)

**14:35 Calculating the costs of rearing: from laboratory to mass rearing for mosquito control**

Jack Rhodes, Megan Quinlan, Jonathan Knight, Adrian Leach, John Mumford (*Imperial College London, London, United Kingdom*)

**14:55 Standardization of mass-rearing Lepidoptera for evaluation of the efficacy of transgenic crops**

J. J. Adamczyk (*Kika de la Garza Subtropical Agricultural Research Center, USDA-ARS, Weslaco, TX, USA*)

15:15 Coffee break and poster viewing

**Symposium no. 5: New, Novel, Innovative and Emerging Applications of Insect Rearing (chair: Karel Bolckmans, Koppert BV, Berkel en Rodenrijs, The Netherlands)**

**15:45 Applications for mass reared arthropods, an overview**

Karel Bolckmans (*Koppert BV, Berkel en Rodenrijs, The Netherlands*)

**16:05 Mass production of insects for aquaculture-Part I: market perspectives for a sustainable protein source**

Sal Cherch, Ernest Papadoyianis (*Organic Nutrition, LLC, Boca Raton, FL, USA*)

**16:25 Mass production of insects for aquaculture-Part II: an innovative solution to the protein bottleneck**

Ernest Papadoyianis (*Organic Nutrition, LLC, Boca Raton, FL, USA*)

**16:45 *Tenebrio molitor* as a source of insect protein**

Juan Morales-Ramos<sup>1</sup>, Guadalupe Rojas<sup>1</sup>, David Shapiro-Ilan<sup>2</sup>, Louis Tedders<sup>3</sup> (<sup>1</sup>*USDA-ARS NBCL, Stoneville, Mississippi, USA*; <sup>2</sup>*USDA-ARS FTNRU, Byron, Georgia, USA*; <sup>3</sup>*Southeastern Insectaries Inc., Perry, Georgia, USA*)

**17:05 Mass rearing insects for the pet food industry**

Clay Ghann (*Ghann's Cricket Farm, Inc., Augusta, GA, USA*)

**17:25 Mass rearing insects for the production of animal feed from bio-available waste**

Hans Wollmann, David Drew (*Agriprotein, South Africa and Germany*)

19:30 Conference dinner

**Thursday 21 October**

Excursion to IAEA SIT rearing facility, Seibersdorf. A sign-up list for the two groups will be available at registration and during the first day of the workshop.

8:30 First group, return at 14:30

11:30 Second group, return at 17:00

## Friday 22 October

### Symposium no. 6: New and Future Applications for Mass Rearing Insects and Quality Control (chair: Norman Leppla, University of Florida, Gainesville, FL, USA)

#### 8:30 Growth of insect rearing in the 21st century

Norman Leppla<sup>1</sup>, Frank Davis<sup>2</sup> (<sup>1</sup>University of Florida, IFAS, Entomology and Nematology Department, Gainesville, FL, USA; <sup>2</sup>Mississippi State University, Department of Entomology and Plant Pathology, MS, USA)

#### 8:50 A new Canadian Forest Service state-of-the-art insect rearing and quarantine facility

Peter Ebling (Natural Resources Canada, Sault Ste. Marie, Ontario, Canada)

#### 9:10 Expansion of screwworm production in Panama

Muhammad Chaudury (USDA-ARS, Panama City, Panama)

#### 9:30 Insect rearing and african sugarcane area-wide integrated pest management: challenges and achievements

Des Conlong (South African Sugarcane Research Institute, Mount Edgecombe, KwaZulu- Natal, South Africa)

#### 9:50 Increasing production of *Trichogramma* by substituting artificial diets for factitious host eggs

Shoel Greenberg<sup>1</sup>, Norman Leppla<sup>2</sup> (<sup>1</sup>USDA, ARS Beneficial Insects Research Laboratory, Weslaco, TX, USA; <sup>2</sup>University of Florida, IFAS, Entomology and Nematology Department, Gainesville, FL, USA)

#### 10:10 Production attributes of *Trichogramma* reared on Eri silkworm eggs vis-a-vis *Corcyra* eggs and economics of the rearing system

Yadavalli Lalitha, Sushilkumar Jalali, T. Venkatesan, S. Sriram (National Bureau of Agriculturally Important Insects, Bangalore, Karnataka, India)

#### 10:30 Quality and process control in mass-rearing systems for predators of adelgids

Allen Cohen<sup>1</sup>, Carole Cheah<sup>2</sup>, Fred Hain<sup>1</sup>, Thom Hodgson<sup>1</sup>, Kathleen Kidd<sup>3</sup> (<sup>1</sup>North Carolina State University, Raleigh, NC, United States; <sup>2</sup>Connecticut Agricultural Experiment Station, Windsor, CT, USA; <sup>3</sup>NCDA Plant Industry-Plant Protection, Cary, NC, USA)

10:50 Coffee break and poster viewing

### Symposium no. 7: Predatory Mites (chair: Kim Gallagher Horton, Sterling Insectary, Delano, CA, USA)

#### 11:10 Twenty five years of mass production of *Phytoseiulus persimilis* a “bug farm” or an industry?

Shimon Steinberg (BioBee Sde Eliyahu Ltd., Kibbutz Sde Eliyahu, Bet Shean Valley, Israel)

#### 11:30 Life styles of phytoseiid mites: implications for rearing and biological control strategies

James McMurtry (*University of California, Riverside, CA, USA*)

**11:50 Trends in predatory mite production and delivery systems**

Richard GreatRex (*Syngenta Bioline, Essex, United Kingdom*)

**12:10 Demand versus supply in biocontrol: disturbance of natural balance?**

Pierre Ramakers (*Plant Research International, Wageningen UR, Bleiswijk, The Netherlands*)

**12:30 Open discussion**

Kim Gallagher Horton (*Sterling Insectary, Delano, CA, USA*)

12:45 Closing remarks

13:00 Lunch

14:00 AMRQC business meeting - Tom Coudron, Patrick De Clercq

TBD - business meetings

## Posters

### Symposium no. 1

**1.P1 Bacterial community of the spined soldier bug gut**

Alejandro P. Rooney, Thomas A. Coudron (*USDA-ARS-NCAUR, Peoria, IL, USA; USDA-ARS-BCIRL, Columbia, MO, USA*)

### Symposium no. 2

**2.P1 Development of Management Programs for White Grubs in California Blueberries**

David Haviland, Natalie Hernandez (*University of California Cooperative Extension, Kern County, CA, USA*)

### Symposium no. 3

**3.P1 Fecundity and percentage egg hatch of potato tuber moth F<sub>1</sub> progeny of 150-Gy irradiated parents crossed with irradiated moths**

George Saour, Hayat Makee (*Atomic Energy Commission, Damascus, Syrian Arab Republic*)

**3.P2 Thailand mass rearing and quality control of *Bactrocera dorsalis* (Hendel) and *Bactrocera correcta* (Bezzi)**

Suksom Chinvinijkul, Supaap Pinkaew, Watchreeporn Orankanok (*Irradiation for Agricultural Development Division, Bureau of Agricultural Product Quality Development, Department of Agricultural Extension, Ministry of Agriculture and Cooperatives, Bangkok, Thailand*)

- 3.P3 Application of nuclear techniques in the mass rearing of *Nesolynx thymus* (Hymenoptera: Eulophidae), an endoparasitoid of Uzi fly *Exorista sorbillans***  
Md. Mahbub Hasan, Md. Rayhan Uddin, Md. Ataur Rahman Khan, Aminuzzaman Md. Saleh Reza (*Department of Zoology, Rajshahi University, Rajshahi-6205, Bangladesh*)
- 3.P4 VIENNA 7/Mix 99 downunder — the Western Australian experience of rearing a genetic sexing strain medfly for use in SIT programmes**  
Roselia Fogliani, Bill Woods (*Department of Agriculture and Food Western Australia, South Perth, Western Australia, Australia*)
- 3.P5 Preliminary study of pupal diapause and artificial rearing to Chinese citrus fruit fly, *Bactrocera minax***  
Changying Niu, Yongcheng Dong (*Plant Science and Technology College, Wuhan, China*)
- 3.P6 Feasibility study for the genetic control of *Aedes albopictus***  
Arianna Puggioli, Anna Medici, Marco Carrieri, Romeo Bellini (*Centro Agricoltura Ambiente "G.Nicoli", Med. & Vet. Dept., Crevalcore, Bologna, Italy*)
- 3.P7 Laboratory colonization of *Aedes albopictus* and effect on some fitness parameters**  
Anna Medici, Arianna Puggioli, Marco Carrieri, Romeo Bellini (*Centro Agricoltura Ambiente G.Nicoli, Med. & Vet. Dept., Crevalcore, Bologna, Italy*)

#### Symposium no. 4

- 4.P1 Olive fly: from small scale production to large scale mass-rearing**  
Sohel Ahmad, Viwat Wornoyaporn, Ihsan ul Haq, Carlos Cáceres, Andrew Jessup (*FAO/IAEA Agriculture and Biotechnology Laboratories, Seibersdorf, Austria*)
- 4.P2 *Ephestia kuehniella* eggs sterilization for *Trichogramma ostrinae* Pang et Chen (Hymenoptera: Trichogrammatidae) mass production**  
Mylène St-Onge<sup>1</sup>, Daniel Cormier<sup>2</sup>, Silvia Todorova<sup>3</sup>, Éric Lucas<sup>1</sup> (<sup>1</sup>*Université du Québec à Montréal, Montréal, Québec, Canada*; <sup>2</sup>*Institut de recherche et de développement en agroenvironnement, Saint-Bruno-de-Montarville, Québec, Canada*; <sup>3</sup>*Anatis Bioprotection, St-Jacques-le-Mineur, Québec, Canada*)
- 4.P3 A new type of solid, semi-solid, and semi-liquid arthropod artificial diets using colloids to replace gelling agents**  
Guadalupe Rojas, Juan Morales-Ramos (*USDA-ARS BCPRU, Stoneville, MO, USA*)
- 4.P4 New frontiers in the biological control of insects**  
Thomas Coudron, Holly Popham, Kent Shelby, David Stanley (*USDA-ARS, Columbia, MO, USA*)
- 4.P5 Wheat germ oil in larval diet influences gene expression in adult oriental fruit fly**  
Chiou Ling Chang<sup>1</sup>, Thomas Coudron<sup>2</sup>, Cynthia Goodman<sup>2</sup>, David Stanley<sup>2</sup>, Shiheng An<sup>3</sup>, Qisheng Song<sup>3</sup> (<sup>1</sup>*USDA-ARS-PBARC, Hilo, HI, USA*; <sup>2</sup>*USDA-ARS-BCIRL, Columbia, MO, USA*; <sup>3</sup>*University of Missouri, Columbia, MO, USA*)



**Symposium no. 6**

- 6.P1 A new world-wide database of insect, mite and nematode cultures available for distribution.**  
Peter Ebling (*Natural Resources Canada, Sault Ste. Marie, Ontario, Canada*)
- 6.P2 Artificial rearing of *Anastrepha fraterculus* (Wiedemann 1830) (Diptera: Tephritidae): Egg-viability and models of cages**  
Juliana García Carrión (*Servicio Nacional de Sanidad Agraria, Lima, Peru*)
- 6.P3 A global quality index for *Trichogramma***  
Shoil Greenberg<sup>1</sup>, Norman Leppla<sup>2</sup> (<sup>1</sup>*USDA, ARS Beneficial Insects Research Laboratory, Weslaco, Texas, USA;* <sup>2</sup>*University of Florida, IFAS, Entomology and Nematology Department, Gainesville, Florida, USA*)
- 6.P4 Determination of critical storage period of mass reared host eggs parasitized by *Trichogramma evanescens* for efficient adult parasitoid emergence**  
Md. Mahmudunnabi, Syed Nurul Alam (*Bangladesh Agricultural Research Institute (BARI), Gazipur, Dhaka, Bangladesh*)
- 6.P5 Artificial rearing of a reduviid predator *Rhynocoris marginatus* (Fab.) (Hemiptera: Reduviidae) using meat-based artificial diet**  
K. Sahayaraj, S. Balasubramanian (*St. Xavier's College (Autonomous), Palayamkottai/Tamil Nadu, India*)
- 6.P6 Effects of olive oil and yeast in liver-based artificial diet for the production of *Orius laevigatus***  
Samira Safarian<sup>1,3</sup>, Ahmad Ashouri<sup>1</sup>, Hamid Reza Sarraf Moayeri<sup>2</sup>, Reza Talaei Hassanloui<sup>1</sup>, Sima Kabiri<sup>1</sup> (<sup>1</sup>*Department of Plant Protection, Campus of Agriculture and Natural Resources, University of Tehran, Karaj, Iran;* <sup>2</sup>*Department of Plant Protection, Faculty of Agriculture, Zanjan University, Zanjan, Iran;* <sup>3</sup>*Gyah Bazr Alvand Corporation, Tehran, Iran*)
- 6.P7 Developmental and reproductive fitness of *Adalia bipunctata* on factitious and artificial foods**  
Maarten Bonte, Patrick De Clercq (*Department of Crop Protection, Ghent University, Ghent, Belgium*)
- 6.P8 A record of three Korea indigenous species newly developed as biological control agents for controlling aphids**  
Hyunjin Shin, Wooyeun Kim, Taesu Kim (*SESL Corporation, Nonsan, Chungnam, Republic of Korea*)

**Symposium no. 7**

- 7.P1 Mass rearing of *Neoseiulus longispinosus* (Evans) (Acari: Phytoseiidae) under field and laboratory conditions in Himachal Pradesh in India**  
Usha Chauhan, P.R. Gupta (*Dr YS Parmar University, Solan-Nauni, HP, India*)