

International Conference Insects to Feed the World

Ede
The Netherlands

14 -17 May 2014



PROGRAMME

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Wednesday, 14 May 2014

PLENARY LECTURES (ROOM SCHOUWBURG)

- 09:00-09:15 **Objectives of the conference** - *Arnold van Huis, Wageningen University, The Netherlands*
09:15-09:45 **Setting the table for a hotter, flatter, more crowded earth: insects on the menu?** - *Sonny Ramaswamy, Director National Institute of Food and Agriculture, U.S. Department of Agriculture, Washington*

HARVESTING FROM NATURE

- 09:45-10:15 **Anthropo-entomophagy in Latin America: An overview of the importance of edible insects to local communities** - *Eraldo M. Costa Neto, Brazil*
10:15-10:45 **Ethno-entomophagy in Asia and the Pacific: historical perspectives and future directions** - *Alan Yen, Australia*
10:45-11:15 **Coffee/tea break**

11:15-12:35 ORAL PRESENTATIONS IN PARALLEL SESSIONS

Harvesting from nature (room Schouwburg)

- 11:15-11:35 Everyday entomophagy in rural Laos: Understanding the heterogeneity of insect consumption in dairy life (Nonaka, K., Murayama, N., Natsuhara, K. and Ono, E.)
11:35-11:55 Semi-cultivating edible insects: A historical perspective and future prospects (Van Itterbeeck, J.)
11:55-12:15 Harvesting and nutrition value of edible wasps in southwest China (Zhao, M., Feng, Y. and Chen, X.M.)
12:15-12:35 The Amazonian strategy to utilize edible insects can be extended? (Paoletti, M.G. and Manno, N.)

Harvesting from nature (room Kernhem)

- 11:15-11:35 Prospects and constraints for the use of insects as human food and animal feed in West Africa (Kenis, M. and Hien, K.)
11:35-11:55 Entomophagy in contemporary Japan: Imported insects compensate for a decline in wild harvesting (Payne, C.L.R.)
11:55-12:15 The other food: the status of entomophagy in Botswana (Obopile, M.)

Harvesting from nature (room Studio 2)

- 11:15-11:35 Entomophagous insects of Kanyakumari District, India (Basil-Rose M.R., Padua, J.C. and Punitha, A.)
11:35-11:55 What innovations to convert locusts invasions into a protein pulsed resource accessible to local population? (Randrianasolo-Rakotobe, H. and Rakotonandraina, N.)
11:55-12:15 Exploiting pest insects species *Sphenarium purpurascens* for human consumption: ecological, social, and economic repercussions (Cerritos Flores, R., Ponce-Reyes, R. and Rojas-García, F.)

- 12:30-13:15 **Lunch**

- 13:15-14:00 **Poster session**

PRODUCTION OF INSECTS AS FOOD AND FEED

PLENARY LECTURES (ROOM SCHOUWBURG)

- 14:00-14:30 **Small-scale production of edible insects for enhanced food security and rural livelihoods: experience from Thailand and Laos** - *Patrick B. Durst (FAO) and Yupa Hanboonsong, Thailand*
14:30-15:00 **Insect diseases: what are they and how to avoid them?** - *Jørgen Eilenberg and Annette Bruun Jensen, Denmark*
15:00-15:30 Coffee/Tea break

15:30-17:10

ORAL PRESENTATIONS IN PARALLEL SESSIONS

Projects (room Schouwburg)

15:30-15:50

GREEINSECT: a multidisciplinary research project on potentials and barriers for insect-farming for food and feed in Kenya (Roos, N., Owino, V., Kinyuru, J., Ekesi, S., Courtwright, G., Drew, D., Hanboonsong, Y., Vantomme, P., Chamnan, C., Olsen, S.B., Jensen, A.B. and Ayieko, M.)

15:50-16:10

PROteINSECT- do European citizens accept the use of insects for animal feed & human food? (Smith, R. and Pryor, R.E.)

16:10-16:30

WINFOOD PROJECT: development and evaluation of Amaranth grain based complementary foods enriched with termites and fish (Kinyuru, J.N., Konyole, S.O., Onyango-Omolo, S.A., Owino, V.O., Owuor, B.O., Estambale, B.B. and Roos, N.)

16:30-16:50

Perspectives of insect industry in South Korea: Government policies and R&D strategies (Jeong, J.)

Silkworms as food and feed (room Kernhem)

15:30-15:50

Silkworms to resolve the world's food crisis - the most acceptable insect as food and feed (Prabhakar C.J., Akai, H., Sumida, M., Sohn, B.H., Wu Jenmai and Sirimungkararat, S.)

15:50-16:10

Ideal edible insect: High value, safety food and innovative products with complete value chain of eri silkworm (*Samia ricini* D.) in Thailand (Sirimungkararat, S., Saksirirat, W. and Wongson, D.)

16:10-16:30

Pury, a fine powder made from silkworm pupae as an alternate of nutritious food for human nutrition (Astuti, T., Kusharto, C.M. and Mas'ud, H.)

16:30-16:50

Insects: Potential of stable isotope tools for optimizing insect production management (Hood-Nowotny, R.)

Farming different species (room Studio 2)

15:30-15:50

High potential for mass rearing katydid (*Ruspolia differens*) and palm weevil (*Rhynchophorus phoenicis*) for food in the Lake Victoria basin (Nyeko, P., Okia, C.A., Nusula, N., Odongo, W., Nzabamwita, H.P., Ndimubandi, J., Jaronski, S. and Roininen, H.)

15:50-16:10

Edible mealworm species: the effect of diets composed of organic side stream material (Van Broekhoven, S., Oonincx, D.G.A.B., Van Huis, A. and Van Loon, J.J.A.)

16:10-16:30

The rearing and utilization of cockroach in Yunnan, China (Feng, Y., Chen, X.M. and Zhao, M.)

16:30-16:50

Two rearing substrates on *Tenebrio molitor* meal composition: issues on aquaculture and biodiesel production (Belforti M., Lussiana C., Malfatto V., Rotolo L., Zoccarato, I. and Gasco L.)

16:50-17:10

An aquatic worm production concept for the valorisation of food by-products (Laarhoven, B., Elissen, H.J.H., Temmink, H., Buisman, C.J.N.)

OFFICIAL OPENING

PLENARY SESSION (ROOM SCHOUWBURG)

17:15-17:45

African edible-insects: inventory, diversity, commonalities and contribution to food and nutritional security- *Segenet Kelemu, Director General icipe (African Insect Science for Food and Health), Nairobi, Kenya*

17:45-18:30

Opening statements

Ernst van den Ende, Managing Director, Plant Sciences Group, Wageningen University and Research Centre, The Netherlands

Hans Hoogeveen JD MPA, Director General Agro at the Ministry of Economic Affairs, The Netherlands

Eduardo Rojas-Briales, Assistant Director-General, FAO Forestry Department, FAO Headquarters, Rome

Thursday, 15 May

FOOD SAFETY, LEGISLATION AND POLICY

PLENARY LECTURE (ROOM SCHOUWBURG)

09:00–09:30 **Safety and quality considerations of insects for food and feed** - *Adrian Charlton, United Kingdom*

ORAL PRESENTATIONS IN PARALLEL SESSIONS

Legislation and food safety (room Schouwburg)

09:30–09:50 PROteINSECT- promoting legislation change to help feed the world (Pryor, R. E. and Smith, R.)

09:50–10:10 Use of insects as a protein source in feed and food: Safety and EU legislative aspects (Van der Spiegel, M. and Noordam, M.)

10:10–10:30 Risk assessment of novel proteins in food: Are insect proteins allergenic? (Broekman, H.C.H.P., Knulst, A.C., Den Hartog Jager, C.F., Gaspari, M., De Jong, G.A.H., Houben, G.F. and Verhoeckx, K.C.M.)

10:30–10:50 Microbiological status of edible insects sold as pet feed in Germany (Grabowski, N.Th., Jansen, W. and Klein, G.)

Food safety (room Kernhem)

09:30–09:50 Inactivation of *Salmonella* spp. and *Ascaris suum* in batch and continuous black soldier fly treatments (Lalander, C.H., Diener, S. and Vinnerås, B.)

09:50–10:10 Evaluation of feed safety aspects in feeding organic layers with fresh house fly larvae (*Musca domestica*) reared in poultry manure (Nordentoft, S., Fischer, C., Hald, B., Enemark, H., Thapa, S. and Bjerrum, L.)

10:10–10:30 Nutrition and heavy metal levels in the mound termite, *Macrotermes bellicosus* (Smeathman) (Isoptera: Termitidae), at three sites under varying land use in Abeokuta, southwestern Nigeria (Idowu, A.B., Ademolu, K.O. and Bamidele, J.A.)

10:30–10:50 Multifaceted aspects of insect pathogenic and commensal bacteria in insect based food (Nielsen-LeRoux, C.)

Nutrition (room Studio 2)

09:30–09:50 Towards an effective insect supply chain: meeting qualitative requirements and quantitative demands (Vrij, E.M.P. and Peters, M.)

09:50–10:10 Human chitinases' variability and implications for chitin digestion in populations eating insects (Paoletti, M.G., Mostacciuolo, M.L., Battisti, A., Mostacero Leon, J. and Manno, N.)

10:10–10:30 Nutritional and anti-nutritional composition of most preferred ant and termite species used as food by the tribes of Arunachal Pradesh, India (Chakravorty, J.)

10:30–10:50 Ethanol extract of *Bombys batryticatus* induces apoptosis in human hepatoma cell SMMC-7721 via the modulation of Bax/Bcl-2 and P21 expression pathway (Wu, W-P, Wu, J-Y, Zhang, R-F., Feng, J-N and Wang, D.)

10:50–11:20 **Coffee/tea break**

PLENARY LECTURES (ROOM SCHOUWBURG)

11:20–11:35 The role of the FAO in assisting countries to develop regulatory frameworks to include insects in the food and feed sectors (Afton Halloran, Paul Vantomme and Christopher Münke) (15 min)

11:35–12:00 Legislation and regulation of insects as food and feed - the EU perspective (European Commission - Health & Consumers Directorate-General - DG SANCO) Sirkku Heinimaa and Wolfgang Trunk

12:00–12:30 Discussion

12:30–13:15 **Lunch**

13:15–14:00 **Poster session**

INSECTS AS FEED: SPECIFIC PRODUCTION SYSTEMS

PLENARY LECTURES (ROOM SCHOUWBURG)

- 14:00–14:30 **Black soldier fly farming: The entomology link in kiloton/month (and above) production chains** – John C. Schneider, USA
14:30–15:00 **AgriProtein: Building the worlds' largest insect rearing protein farm – a history and vision** - David Drew, South Africa

15:00–15:30 **Coffee/tea break**

15:30–17:30 ORAL PRESENTATIONS IN PARALLEL SESSIONS

Insects as feed - general (room Schouwburg)

- 15:30-15:50 Current status on use of insects as animal feed (Makkar, H.P.S.)
15:50-16:10 The Insect Biorefinery, an efficient tool for industrial production of insects and derivatives (Hubert, A.)
16:10-16:30 The benefits of using insects as fish and animal feed (Miura, T., Ido, A., Ohta, T., Iwai, T., Kusano, K., Kobayashi, S., Kishida, T. and Miura, C.)
16:30-16:50 Case study: Insects as feed (Pieterse, E., Hoffman, L.C. and Drew, D.W.)
16:50-17:10 Industrial fruit fly mass rearing for the application of the Sterile Insect Technique (Abd-Alla A. M. M., Caceres, C., Parker, A.G., and Vreysen, M.J.B.)
17:10-17:30 EnviroFlight, USA: Industrial cultivation of black soldier flies for animal feed (Courtright, G.)

Aquaculture (room Kernhem)

- 15:30-15:50 Insect meal: a promising source of nutrients in the diet of Atlantic salmon (*Salmo salar*) (Lock, E.J., Arsiwalla, T. and Waagbø, R.)
15:50-16:10 Use of *Tenebrio molitor* larvae meal in diets for gilthead sea bream *Sparus aurata* juveniles (Piccolo, G., Marono, S., Gasco, L., Iannaccone, F., Bovera, F. and Nizza, A.)
16:10-16:30 Mealworm (*Tenebrio molitor*) as a potential ingredient in practical diets for rainbow trout (*Oncorhynchus mykiss*) (Gasco, L., Belforti, M., Rotolo L., Lussiana, C., Parisi G., Terova G., Roncarati A. and Gai, F.)
16:30-16:50 Substitution of fish meal by *Tenebrio molitor* meal in the diet of *Dicentrarchus labrax* juveniles (Gasco, L., Gai, F., Piccolo, G., Rotolo, L., Lussiana, C., Molla, P. and Chatzifotis, S.)
16:50-17:10 Insects are a sustainable alternative to fishmeal in aquaculture feed. Past and future (Henry, M. and Fountoulaki, E.)
17:10-17:30 Mass production system of housefly (*Musca domestica*) for waste reutilization and as feed for chickens and shrimps (Chen, J., Zhao, G. and Han, R.)

Black soldier fly and Housefly as feed (room Studio 2)

- 15:30-15:50 Nutrient digestibility of *Hermetia illucens* and *Tenebrio molitor* meal in broiler chickens (Schiavone, A., De Marco, M., Rotolo, L., Belforti, M., Martinez Mirò, S., Madrid Sanchez, J., Hernandez Ruiperez, F., Bianchi, C., Sterpone, L., Malfatto, V., Katz, H., Zoccarato, I., Gai, F. and Gasco, L.)
15:50-16:10 Parameters affecting larval development in the mass rearing of *Musca domestica* (Diptera: Muscidae) (Pastor, B., Martínez-Sánchez, A. and Rojo, S.)
16:10-16:30 Evaluation and improvement of a house fly larvae production system in Mali (Koné, N., Nacambo, S. and Kenis, M.)
16:30-16:50 Efficiency and scalability in producing feed from manure using the common housefly (Fischer, C.H., Heckmann, L.H.L., Nordentoft, S., Hald, B. and Bjerrum, L.)
16:50-17:10 Utilization of *Hermetia illucens* larvae for the production of food and feed (Katz, H., Rumpold, B., Katz, P., Fröhling, A. and Schlüter, O.)
17:10-17:30 Cactus as feedstock to produce protein from *Hermetia illucens* in South Africa (Tarrisse, A.)
17:30-17:50 Black soldier fly–Microbes Union: Efficient waste recycling agent and valuable renewable resource (Zheng, L.Y., Zhang, J.B., Li, Q. and Yu, Z.N.)

18:30 **Conference dinner**

Friday, 16 May

NUTRITION, PROCESSING, CONSUMER ATTITUDES AND GASTRONOMY

PLENARY LECTURE (ROOM SCHOUWBURG)

09:00 – 09:30 **The last and critical step in promoting insects as food: Getting people to eat them -**
Paul Rozin, USA

ORAL PRESENTATIONS IN PARALLEL SESSIONS

Introducing insects as food (room Schouwburg)

09:30-09:50 Welcoming the world to our table: Hospitality and edible insects (Looy, H. and Wood, J.R.)

09:50-10:10 Taste First: Deliciousness as an argument for entomophagy (Reade, B., Evans, J. and Bom Frøst, M.)

10:10-10:30 The role of design in introducing insects to the UK diet (Dasan, A.)

Coffee/tea break

11:00-11:20 Willingness to pay for new food products from insect protein: Initial evidence from a choice experiment study in Kenya (Alemu, M.H. and Olsen, S.B.)

11:20-11:40 Longitudinal changes in acceptance of edible insects by students at Montana State University (Dunkel, F.V. and Stokhof de Jong, S.)

11:40-12:00 Introducing Entomophagy to America through children's education and culinary events (Ceadel, M.)

12:00-12:20 Can mass-production of insects contribute to alleviating malnutrition in developing countries? (Roos, N.)

12:20-12:40 Sustainable critters or delicious fritters? Consumer perceptions of edible insects in The Netherlands and Thailand (Tan, H.S.G., Tinchon, P., Steenbekkers, L.P.A., Lakemond, C.M.M. and Fischer, A.R.H.)

12:40-13:00 Effect of edible termite-based complementary foods on growth and micronutrient status of 6-15 month old Kenyan infants – a randomised trial (Owino, V.O., Omollo, S.A., Konyole, S.O., Kinyuru, J.N., Owuor, B., Skau, J., Roos, N., Michaelsen, K.; Friis, H. and Estambale, B.B.)

Developing a sustainable business crickets for food in Africa; the Flying Food project (room Kernhem)

09:30-09:50 The Flying Food project on crickets in Africa, general introduction (Van Deventer, H., Gianotten, N., De Graaf, M., Kamukama, D., Mancheron, H. and Vrij, M.)

09:50-10:10 Rearing of crickets in Kenya and Uganda (Gianotten, N.)

10:10-10:30 Processing and new insect based products (Van Deventer, D. and Vrij, M.)

Coffee/tea break

11:00-11:20 Market development and business case (Kamukama, D. and Mancheron, H.)

11:20-11:40 Triple loop monitoring and learning approach of Flying Food (De Graaf, M.)

Farming and nutritional quality (room Kernhem)

11:40-12:00 Cricket Farming, Reproduction and Economic Potential for Small Farmers (Fuah, A.M., Siregar, H.C.H. and Siregar R.S.)

12:00-12:20 Nutritional assessment of the rare edible monster crickets and soldier termites consumed in the South Eastern districts of Zimbabwe (Musundire, R.)

12:20-12:40 Chemical profiling in the edible stink bug, *Encosternum delegorguei* consumed in South-Eastern districts of Zimbabwe (Musundire R., Cheseto X. and Torto B.)

Edible insects and nutrition (room Studio 2)

- 09:30-09:50 Mealworms: Alternate source of lipids (Danthine, S., Blecker, C., Paul, A., Caparros Medigo, R., Haubruge, E., Taofic, A., Lognay, G., Fauconnier, M-L., Frédéricich, M. and Francis, F.)
- 09:50-10:10 Lipid extraction of four insect species: Effect of extraction method and potential use as food ingredient (Tzompa-Sosa, D.A., Yi, L., Van Valenberg, H.J.F., Van Boekel, M.A.J.S. and Lakemond, C.M.M.)
- 10:10-10:30 Proteomics mass spectrometry to discover changes in protein composition: analyzing gut protein content and protein digestibility (America, A.H.P., Cordewener, J.H.G. and Van der Meer, I.M.)
- 10:30-11:00 **Coffee/tea break**
- 11:00-11:20 Blood profile and nutrient status of *Macaca fascicularis* as animal model fed with pupa meal (Astuti, D.A., Sajuthi, D., Irma H.S. and T.B. Clarkson)
- 11:20-11:40 Insect biochemistry: The assessment of nutritional factors by metabolomics (Snart, C.J.P., Kapranas, A., Hardy, I.C.W. and Barrett, D.A.)
- 11:40-12:00 Preliminary chemical analysis of extracts from *Encosternum delegorguei* using Gas Chromatography Mass Spectroscopy (Zvidzai, C.J.)
- 12:00-12:20 Nutrient composition of four species of winged termites consumed in Western Kenya (Kinyuru, J.N.; Konyole, S.O., Roos, N., Onyango, C.A., Owino, V.O., Owuor, B., Estambale, B.B. and Kenji, G.M.)
- 12:40-13:00 Traditional processing of selected edible insects of Zimbabwe (Manditsera, F. A. and Zvidzai C. J.)

- 12:40-13:15
13:15-14:00

Lunch
Poster session

ENVIRONMENTAL ISSUES

PLENARY LECTURES (ROOM SCHOUWBURG)

- 14:00-14:30 **Conversion of organic wastes into insect biomass and added value products: an integrated approach towards sustainability** - Santos Rojo, Spain
- 14:30-15:00 **Generic Life Cycle Assessment of proteins from insects** – Bart Muys, Belgium

- 15:00-15:30

Coffee/tea break

- 15:30-16:50

ORAL PRESENTATIONS IN PARALLEL SESSIONS

Entomophagy (room Schouwburg)

- 15:30-15:50 Consumers' associations with insects in the context of food consumption: comparisons from acceptors to disgusted (Cunha, L. M., Moura, A.P. and Costa-Lima, R.)
- 15:50-16:10 Moving beyond the Bizarre Foods concept and tapping the "foodie" culture to promote entomophagy (Why, A. and Ricci, J.)
- 16:10-16:30 Business models based on insect inclusiveness (Klewer, M. and Real, F.)
- 16:30-16:50 Roadmap towards a flowering global insect industry (Peters, M. and Veldkamp, T.)

Environment (room Kernhem)

- 15:30-15:50 Can greenhouse gas emissions be reduced by inclusion of waste-fed larvae in livestock feed? (Zanten, H.H.E. van, Van Holsteijn, F.H., Oonincx, D.G.A.B., Mollenhorst, H., Bikker, P., Meerburg, B.G. and De Boer, I.J.M.)
- 15:50-16:10 Third Millennium Farming: utilizing city bio-wastes in a strategy for high-yield urban farming (Dzamba, J.)
- 16:10-16:30 Conversion of food waste directly to sustainable feed ingredients for animals and plants (Marchant, P.B., Vickerson, A. and Radley, R.)
- 16:30-16:50 Environmental sustainability of insect production (Oonincx, D.G.A.B.)

Promoting entomophagy (room Studio 2)

- 15:30-15:50 Open Source: Why we need open knowledge sharing to help insects feed the world (Imrie-Situnayake, D.)
- 15:50-16:10 Global awareness starts locally: the "Buggy Buffet" model to enhance conversation and adoption (Grant, J.F. and Follum, R.A.)
- 16:10-16:30 The hockey stick pattern in the acceptance of edible insects in The Netherlands (Dicke, M., Van Huis, A., Peters, M. and Van Gorp, H.)
- 16:30-16:50 Consumer acceptance of insect-based meat substitutes (Caparros Megido, R., Gierts, C., Blecker, C., Brostaux, Y., Danthine, S., Paul, A., Haubruge, É., Alabi, T. and Francis, F.)

CLOSURE OF THE CONFERENCE

PLENARY LECTURES (ROOM SCHOUWBURG)

- 17:00-17:30 **Way forward to bring insects in the human food chain** – *Paul Vantomme (FAO HQ), Italy*
- 17:30-18:00 **Conclusions and recommendations**

Saturday, 17 May

Excursion programme