Joint FAO/IAEA Programme
Nuclear Techniques in Food and Agriculture

Insect Pest Control Newsletter

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Contents

Citrus fruit showing infestation by a worm of the false codling moth, Thaumatotibia leucotreta*, a polyphagous tortricid moth resistant to many insecticides. It is of economic importance to many crops throughout sub-Saharan Africa, and important host crops include avocado, citrus, corn, cotton, macadamia, peach and plum. It is among the most feared invasive exotic pests, although the Sterile Insect Technique has been developed against false codling moth in South Africa, and can therefore be applied to eliminate early detected outbreaks.*

To Our Readers

The use of nuclear techniques is not confined to insect sterilization as part of the area-wide application of the Sterile Insect Technique (SIT) and related genetic control methods, where exposure to carefully selected doses of gamma or X rays maximizes the induction of dominant lethal mutations in germ cells of pest insects, while minimizing other physiological changes.

There are also applications of nuclear techniques in other areas of entomology. These include a) the use of radiation to study sperm precedence, immune responses, and parasitoid-host interactions, etc.; b) the employment of post-harvest disinfestation for quarantine or phytosanitary security in support of agricultural international trade (see new Coordinated Research Project under Announcements); and c) the application of radiation to increase the cost-effectiveness, trade and safety of classical and inundative releases of parasitoids and predators in support of the biological control of insect pests.

IAEA International Atomic Energy Agency

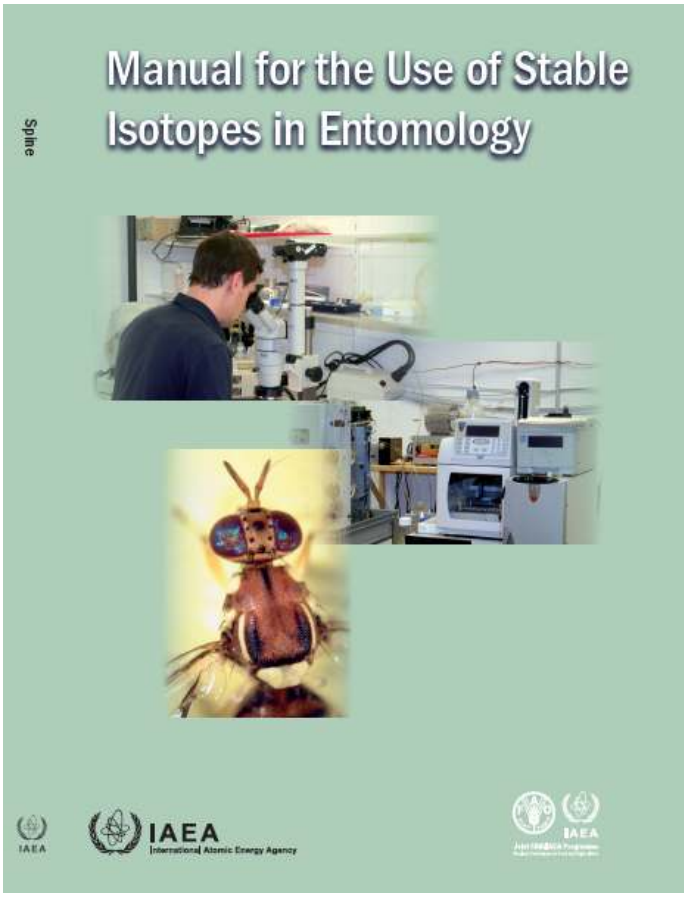
Nuclear techniques in a wider sense, however, also include the use of stable isotopes for studies on insect biology, behaviour, biochemistry, ecology and physiology. The third edition of the "IAEA Laboratory Training Manual on the Use of Nuclear Techniques in Insect Research and Control" published in 1992, focused mainly on the use of radio-nuclides in entomological research and the application of gamma irradiation to entomological problems. Since this publication the global scientific and social environment has changed dramatically. From an environmental perspective it is no longer acceptable to release radio-nuclides into the field, and it has become increasingly expensive to use them in the laboratory due to essential safety considerations. From a social perspective the perceived risk associated with using radio-nuclides is deemed far greater than it may have been in the past. Considering these aspects, many of the methodologies described in the 1992 manual are now deemed outdated or obsolete.

Technology will only become obsolete if there are viable alternatives. Stable isotope methods are a substitute for many radio-nuclide methods. The progress made in stable isotope science is a direct result of the interplay of the above factors. Stable isotopes pose no health or environmental risks and advances in isotope ratio mass spectrometry in terms of detection, accuracy and automation have broadened experimental possibilities immensely over the past twenty-five years.

Stable isotopes have significant potential in entomological research to answer many biological and ecological questions. Although there are numerous studies using stable isotopes in ecology, their use in entomology *per se* is limited. Natural processes in the biosphere lead to distinctive isotopic signals. These isotopic landscapes or isoscapes can be extremely useful in tracing insect movement, feeding patterns, nutrient and sperm transfer, and answering specific questions about resource usage, etc.

In response to repeated requests for information in this area a "Manual for the Use of Stable Isotopes in Entomology" has been prepared, which will hopefully make stable isotope techniques more widely known among entomologists. This manual is aimed at entomologists and ecologists and provides an introduction to the use of stable isotopes in entomological research. It strives to communicate the basic principles and techniques of stable isotope science and provide a springboard for further interest and research in this area.

Stable isotopes are non-radioactive, do not decay, do not emit radiation and are naturally omnipresent in the environment. Stable isotopes are completely safe and personnel face no adverse health risks when handling them. Therefore there are few safety considerations to be addressed, and also specialised regulations in terms of building and equipment are not required. These factors all help to reduce costs and facilitate their use. As a result it is also possible to safely release labelled insects into the environment.



Front cover of the Manual for the Use of Stable Isotopes in Entomology.

One of the main disadvantages of using stable isotopes is the capital cost of isotope ratio mass spectrometers required. Additionally, the equipment requires a temperature controlled environment and highly skilled personnel to maintain and service the sensitive instrumentation. These inconveniences may be overcome either by working in collaboration with an institution that has access to such equipment or by contracting-out isotope analysis to a commercial analysis laboratory. There are now many laboratories which offer isotope analysis on a pay per sample basis. Analysis costs are reasonable, depending on the isotope and the matrix ranging from $ 5-100 per sample. In addition, it is simple, safe and inexpensive to ship stable isotope samples across the world.

There are other documents issued in the first half of 2009 that I would like to point out. The first, "Collection of Entomological Baseline Data for Tsetse Area-wide Integrated Pest Management Programmes" 205 pp. was published under the FAO Animal Production and Health Guidelines series. Before embarking on technically and logistically complex area-wide programmes to establish tsetse-free areas, it is essential to collect accurate baseline data in order to develop an appropriate intervention strategy. This document provides detailed guidelines for the planning and implementation of entomological surveys and genetic analyses, and is also being used for a series of regional training courses focussed on baseline data

collection in support of member States involved in feasibility studies for the integrated use of SIT against tsetse populations.

A second one involves the final proceedings of the Coordinated Research Project (CRP) on "Enabling Technologies for the Expansion of Screwworm SIT Programmes", which was published as a series of 16 peer-reviewed articles in a Supplement to Medical and Veterinary Entomology [http://www3.interscience.wiley.com/journal/118540244/home]. The CRP focussed on population genetics and genetic sexing as components for improved planning and implementation of SIT for Old and New World screwworm, respectively *Chrysomya bezziana* and *Cochliomyia hominivorax*. In addition a third species, the flesh fly *Wohlfahrtia magnifica*, was included as it is a species that is increasing its distribution in Europe and North Africa.

Another relevant document is the APHIS/USDA Report on "United States, Mexico and Guatemala Fruit Fly Emergence and Release Facilities Review", in which FAO/IAEA participated. This is the first review of its type, directly comparing operations and performance of 8 of the 13 Mediterranean fruit fly and Mexican fruit fly emergence and release facilities in the United States, Mexico and Guatemala. The transport, emergence, feeding and handling of sterile fruit fly adults and their aerial distribution in the target area constitute the final steps of the SIT application process. They are critical to the overall success of SIT programmes. The 103 recommendations in this review were based on quality control guidelines in the Product Quality Control and Shipping Procedures for Sterile Mass-Reared Tephritid Fruit Flies (FAO/IAEA/USDA 2003) and Guidance for Packing, Shipping, Holding and Release of Sterile Flies in Area-wide Fruit Fly Control Programmes (FAO/IAEA 2007). [http://www.aphis.usda.gov/plant_health/plant_pest_info/fruit_flies/index.shtml].

Changing subject, I would also like to call attention to two new Coordinated Research Projects (CRPs) that will be initiated later this year, and for which we are encouraging the submission of relevant research proposals from interested researchers. The first CRP, entitled *"Development and Evaluation of Improved Strains of Insect Pests for SIT"*, is the successor to the 5-year CRP on "The Use of Molecular Tools to Improve the Effectiveness of SIT" that was concluded in mid-2008. Another CRP approved for the period 2009-2013, which will be managed by our colleagues from the Food and Environmental Protection Subprogramme of the Joint FAO/IAEA Programme with technical support from the Insect Pest Control Subprogramme, will focus on *"Development of Generic Irradiation Doses for Quarantine Treatments"*. This new CRP will establish and validate generic irradiation doses for groups of non-fruit fly pests of quarantine significance, including aphids, leafminers, mealybugs, mites, scale insects, thrips, and weevils (see details under Announcements). This is in support of our collaboration with the International Plant Protection Convention (IPPC), especially to help fill technical gaps in the context of the development of international sanitary and phytosanitary standards. Forms to submit research proposals can be found under [http://www-crp.iaea.org/] or under our website [http://www-naweb.iaea.org/nafa/ipc/index.html].

In terms of staff, we will be announcing soon one, and possibly two, professional positions for the mosquito SIT project. We hope be able to fill these positions in early 2010 with high calibre professionals in order to expand current efforts to develop sterile insect technologies for *Anopheles arabiensis* and other mosquitoes and to support technology transfer to mosquito projects in northern Sudan and in La Reunion, where the French Government has recently approved a four year feasibility project on mosquito SIT.

Staff of the Insect Pest Control Subprogramme.

Both past and ongoing activities are accessible in more detail in our web site http://www-naweb.iaea.org/nafa/ipc/index.html. I encourage you to visit it, and in particular to call your attention to the 2008 annual Activity Report on R&D activities of the Entomology Unit, which has been recently placed on the web page. Please let us know your ideas, questions and concerns. On behalf of our colleagues at Seibersdorf and headquarters, I would like to thank you for your continuing interest and support for our activities. We really do appreciate feedback and we hope that you continue to find this newsletter a source of useful information.

Jorge Hendrichs
Head,
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Insect Pest Control Subprogramme

http://www.iaea.org/programmes/nafa/d4/ipc/index.html

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Forthcoming Events

I. Research Coordination Meetings (RCMs) of Coordinated Research Projects (CRPs)

Final RCM of CRP on Improving Sterile Male Performance in Fruit Fly Sterile Insect Technique (SIT) Programmes. 21-25 September 2009, Pereybere, Mauritius.

Final RCM of CRP on Development of Mass Rearing for New World (*Anastrepha*) and Asian (*Bactrocera*) Fruit Fly Pests in Support of Sterile Insect Technique (SIT). 21-25 September 2009, Pereybere, Mauritius.

Third RCM of CRP on Development of Standardized Mass Rearing Systems for Male *Anopheles arabiensis* Mosquitoes. 21-25 September 2009, Bologna, Italy.

First RCM of CRP on Development of Generic Irradiation Doses for Quarantine Treatments. 5-9 October 2009, Vienna, Austria.

First RCM of CRP on Development and Evaluation of Improved Strains of Insect Pests for SIT. 16-20 November 2009, Vienna, Austria.

Second RCM of CRP on Biology of Male Mosquitoes in Relation to Genetic Control Programmes. 1-5 February 2010, Vienna, Austria.

Second RCM of CRP on Applying GIS and Population Genetics for Managing Livestock Insect Pests. 22-26 February 2010, Bagor, Indonesia.

First RCM of CRP on Improved Understanding of *Bactrocera* and *Anastrepha* Pests Species Complexes for Enhanced SIT Application to Facilitate International Trade. 14-18 June 2010, Vienna, Austria.

Third RCM of CRP on Improving SIT for Tsetse Flies through Research on their Symbionts and Pathogens. 26-30 July 2010, Nairobi, Kenya.

Second RCM of CRP on Increasing the Efficiency of Lepidoptera SIT by Enhanced Quality Control. 15-19 November 2010, Stellenbosch, South Africa.

II. Consultants and Other Planning Meetings

Consultants Meeting on Improved Understanding of *Bactrocera* and *Anastrepha* Pests Species Complexes for Enhanced SIT Application to Facilitate International Trade. 6-10 July 2009, Vienna, Austria.

Technical Panel on Pest Free Areas and Systems Approaches for Fruit Flies under the International Plant Protection Convention. 31 August-4 September 2009, Vienna, Austria.

Consultants Meeting on Enhancing Vector Refractoriness to Trypanosome Infection. 22-26 March 2010, Vienna, Austria.

Consultants Meeting to Update International FAO/IAEA/USDA Manual on "Product Quality Control and Shipping Procedures for Sterile Mass-reared Tephritid Fruit Flies. 10-14 May 2010, Vienna, Austria.

Consultants Meeting to Assess Applications of Area-wide Integrated Programmes as Part of Systems Approaches for Pest Risk Management Enhancing Vector Refractoriness to Trypanosome Infection. 19-23 July 2010, Vienna, Austria.

Technical Panel on Pest Free Areas and Systems Approaches for Fruit Flies under the International Plant Protection Convention. 4-8 October 2010, Valencia, Spain.

III. Other Meetings/Events

UN Workshop on Science and Food Security, 2 July 2009, Geneva, Switzerland.

Workshop to Develop a Detailed Action Plan for the Collection of Entomological Baseline Data for Tsetse Management in Southern Mozambique (under TC Project RAF5059), 20-31 July 2009, Maputo, Mozambique.

Meeting of Asia Regional Project Coordinators on Assessing Feasibility for Area-Wide SIT-Based Control of the Mediterranean Fruit Fly in the Middle East, 4-6 August 2009, Vienna, Austria.

42nd Annual Meeting of the Society for Invertebrate Pathology. 16-20 August 2009, Salt Lake City, Utah, USA

XIX Curso Internacional Sobre Moscas de la Fruta. 17-28 August 2009, Metapa de Dominguez, Chiapas, Mexico.

First National Coordinators Meeting of TC project RLA5057 "Establishing and Maintaining Fruit Fly Free and Low Prevalence Areas in Central America, Panama and Belize, Using the Sterile Insect Technique (SIT)". 18–21 August 2009, Guatemala City, Guatemala.

30th Meeting of International Scientific Council for Trypanosomiasis Research and Control (ISCTRC). 21-25 September 2009, Kampala, Uganda.

Regional Indian Ocean Fruit Fly Meeting. 21-25 September 2009, Pereybere, Mauritius.

FAO/IAEA Regional Training Course on Collection and Processing of Entomological and Other Relevant Geo-Referenced Data as Needed in SIT Based AW-IPM Campaigns Against Tsetse (under the TC Project RAF5060). 26 October-13 November 2009, Bobo Dioulasso, Burkina Faso.

International Congress on Biological Invasions (Symposium: The Sterile Insect Technique, an environment-friendly control tactic for preventing the establishment of invasive pest insects). 2-6 November 2009, Fuzhou, China (www.icbi2009.org).

FAO/IAEA Regional Training Course on Area-wide Integrated Pest Management of Tephritid Fruit Flies (under the TC Project). RAS5052. 2-6 November 2009, Fuzhou, China.

Meeting of Programme Against African Trypanosomiasis (PAAT) Advisory Group Coordinators. November 2009, Nairobi or Mombasa, Kenya.

FAO/IAEA Regional Training Course on Surveillance of Tephritid Fruit Flies in Support of Planning and Implementing Area-wide Integrated Pest Management Programmes (under the TC Project). 23-27 November 2009, Bangkok, Thailand.

Annual Meeting of the Entomological Society of America, Member Symposium: The Sterile Insect Technique: Achievements and Challenges for Area-Wide Integrated Pest Management. 13-16 December 2009, Indianapolis, Indiana, USA (www.entsoc.org/am/index.htm).

Workshop on Genotyping Analysis of Tsetse Fly Symbionts and Pathogens. 20-24 July 2010, Nairobi, Kenya.

8th International Symposium on Fruit Flies of Economic Importance. 26 September – 1 October 2010, Valencia, Spain.

12th Workshop of the IOBC Global Working Group on Arthropod Mass Rearing & Quality Control (AMRQC). 19-22 October 2010, Vienna, Austria.

Workshop on Evaluation of Field Cages for Lepidoptera SIT Behavioural Assessments. 21-22 November 2010, Stellenbosch, South Africa.

Past Events (July 2008 – June 2009)

I. Research Coordination Meetings (RCMs) of Coordinated Research Projects (CRPs)

First RCM of CRP on Biology of Male Mosquitoes in Relation to Genetic Control Programmes. 14-18 July 2008, Vienna, Austria.

First RCM of CRP on Applying GIS and Population Genetics for Managing Livestock Insect Pests. 18-22 August 2008, Vienna, Austria.

Fourth RCM of CRP on Molecular Technologies to Improve the Effectiveness of SIT. 18-22 August 2008, Antigua, Guatemala.

Fourth RCM of CRP on Improved and Harmonized Quality Control for Expanded Tsetse Production, Sterilization and Field Application. 13-17 October 2008, Addis Abeba, Ethiopia.

Second RCM of CRP on Improving SIT for Tsetse Flies through research on their Symbionts and Pathogens. 16-20 February 2009, Bobo Dioulasso, Burkina Faso.

First RCM of CRP on Increasing the Efficiency of Lepidoptera SIT Through Enhanced Quality Control. 27 April-1 May 2009, Christchurch, New Zealand.

II. Consultants and Other Planning Meetings

Consultants Meeting on Review of Opportunities and Requirements for Implementing a CRP on Assessing the Potential for Improved Strains of Insect Pests for SIT. 18-22 August 2008, Antigua, Guatemala.

Technical Panel on Pest Free Areas and Systems Approaches for Fruit Flies under the International Plant Protection Convention. 1-5 September 2008, Vienna, Austria.

Consultants Meeting on Development of Bait Stations for Fruit Fly Suppression in Support of SIT. 29 October-1 November 2008, Mazatlán, Mexico.

Workshop on Suppressing the Mediterranean Fruit Fly by Integrating the Sterile Insect Technique on an Area-Wide Basis in Neretva Valley (Croatia and Bosnia and Herzegovina). 13-15 January 2009, Metković, Croatia.

Consultants Meeting to Develop a Design Concept for a Tsetse Fly Aerial Release System. 3-5 February 2009, Vienna, Austria.

Workshop on DNA Isolation and Detection of Tsetse Pathogens and Symbionts Using PCR. 9-13 February 2009, Bobo Dioulasso, Burkina Faso.

Workshop on Assessment of the Feasibility of SIT-Based Area-Wide Integrated Management of Old World Screwworm Flies in the Middle East. 17-19 March 2009, Vienna, Austria.

Planning Meeting for Coordination of Activities of IRD, CRVOI and the FAO/AIEA in Relationship to Feasibility of Mosquito Sterile Insect Technique for La Réunion. 22-24 March 2009, Vienna, Austria.

Consultants Meeting on Development of a Standard Planning and Design Format for New SIT Mass-Rearing Facilities. 20-24 April 2009, Vienna, Austria.

III. Other Meetings/Events

Symposium on African Trypanosomiasis (Symposium 9.1 – Medical and Veterinary Entomology) at the International Congress of Entomology. 6-12 July 2008, Durban, South Africa.

Symposium on Sterile Insect Technique on Perennial Crops (Symposium 1.8 – Pest Management: Perennial Crops) at the International Congress of Entomology. 6-12 July 2008, Durban, South Africa.

FAO/IAEA Regional Training Course on Protein Bait Technology for Suppression of Tephritid Fruit Flies as a part of SIT Application under the TC Project RAS5049. 15-19 September 2008, Hanoi, Vietnam.

FAO/IAEA Regional Training Course on Pest Risk Analysis as a Part of SIT Application under the TC Project RAS5049. 12-16 October 2008, Amman, Jordan.

Meeting of Programme Against African Trypanosomiasis (PAAT) Advisory Group Coordinators. 14-15 October 2008, Kampala, Uganda.

7th International Conference on Integrated Fruit Production. IOBC, working group on Integrated Plant Protection in Fruit Crops. 27-30 October 2008, Avignon, France.

7th Meeting of the Working Group of Fruit Flies of the Western Hemisphere (WGFFWH). 2-8 November 2008, Mazatlán, Mexico.

Meeting of the Technical Panel on Phytosanitary Treatments under the International Plant Protection Convention. 26-30 January 2009, Tokyo, Japan.

PATTEC/IAEA Tsetse Management Training Course. 23 February–13 March 2009, Mansini, Swaziland.

Eleventh Pacific Science Intercongress. Pacific Countries and their Ocean: Facing Local and Global Changes. 2-6 March 2009, Tahiti, French Polynesia.

Fourth Session of the Commission on Phytosanitary Measures, International Plant Protection Convention, FAO. 30 March-3 April 2009, Rome, Italy.

Standards Committee Meeting, International Plant Protection Convention, FAO. 4-8 May 2009, Rome, Italy.

Meeting of Programme Against African Trypanosomiasis (PAAT) Programme Committee Meeting. 7-8 May 2009, Smolenice, Slovakia.

Fourth Meeting of the IOBC, working group on Integrated Plant Protection in Olive Crops. 1-4 June 2009, Córdoba, Spain.

Note: Reports available upon request

Technical Cooperation Field Projects

The Insect Pest Control Subprogramme currently has technical responsibilities for the following technical cooperation projects that are managed by the IAEA's Department of Technical Cooperation. They can be classed under five major topics, namely:

- Fruit Flies
- Mosquitoes
- Moths
- Screwworm Flies
- Tsetse Flies

Project Number	Country	Title Continuing Projects	Technical Officer
BKF/5/004	Burkina Faso	Feasibility Study on Applying the Sterile Insect Technique to Create a Tsetse-Free Zone	Andrew Parker
BRA/5/057	Brazil	Establishment of Medfly, Fruit Fly Parasitoids and Codling Moth Rearing Facility	Rui Cardoso Pereira
BZE/5/002	Belize	Establishment of a Pilot Fruit Fly Free Area Using an Integrated Approach that Includes the Area-Wide Sterile Insect Technique	Jesús Reyes
CHI/5/047	Chile	Decreasing the Population of the Mediterranean Fruit Fly in the Arica Region	Rui Cardoso Pereira
CRO/5/002	Croatia	Feasibility Study for the Suppression of the Mediterranean Fruit Fly by Integrating the Sterile Insect Technique on an Area-Wide Basis in the Neretva Valley	Rui Cardoso Pereira
GUA/5/016	Guatemala	Establishment of Fruit Fly Free or Low Prevalence Areas using the Sterile Insect Technique	Jesús Reyes
INT/5/145	Interregional	Promotion of Insect Pest Control Using the Sterile Insect Technique	Jorge Hendrichs
ISR/5/012	Israel	Feasibility Study to Assess the Integration of the Sterile Insect Technique into Olive Fly Suppression Programmes	Andrew Jessup
JOR/5/010	Jordan	Strengthening the Capacity for the Area-wide Suppression of the Mediterranean Fruit Fly Using the Sterile Insect Technique	Jesús Reyes
KEN/5/022	Kenya	Integrated Area-wide Tsetse and Trypanosomosis Management in Lambwe Valley	Udo Feldmann
MAL/5/020	Mali	Feasibility Study for the Creation of a Zone Free of Tsetse	Udo Feldmann
MAR/5/016	Mauritius	Feasibility Study for the Suppression of the Melon Fly (*Bactrocera cucurbitae*) in Selected Areas of Mauritius	Jorge Hendrichs
MEX/5/029	Mexico	National Prevention Campaign Against the Cactus Moth	Rui Cardoso Pereira
MOR/5/028	Morocco	Assessing the Feasibility of Medfly Suppression through the Sterile Insect Technique	Jesús Reyes
MYA/5/014	Myanmar	Support for a Feasibility Study on Using the Sterile Insect Technique against Diamond Back Moth	Jesús Reyes
PAK/5/043	Pakistan	Development of Biological Control for Cotton Pest Management Using Nuclear Techniques	Jorge Hendrichs

PAL/5/003	T.T.U.J. Palestinian Authority	Strengthening the National Capacity for the Area-Wide Suppression of the Mediterranean Fruit Fly	Jesús Reyes
PAN/5/016	Panama	Capacity Building for Suppression of Fruit Flies of the Genus *Anastrepha* from the Azuero Peninsula using an Area-Wide Pest Management Approach	Jesús Reyes
RAF/5/052	Regional Africa	SIT Development for Control of *Anopheles* Mosquito	Mark Benedict
RLA/5/045	Regional Latin America	Preparation for Pilot Fruit Fly Free Area Using the Sterile Insect Technique	Jesús Reyes
SAF/5/007	South Africa	Expanding the Use of the Sterile Insect Technique Against Fruit Pests in the Western and Northern Cape	Jorge Hendrichs
SEN/5/029	Senegal	Feasibility Study to Create a Tsetse-Free Zone Using the Sterile Insect Technique	Marc Vreysen
SEY/5/003	Seychelles	Feasibility of Integrating the Sterile Insect Technique to the Ongoing Area-Wide Melon Fly Eradication Programme	Rui Cardoso Pereira
TUN/5/025	Tunisia	Use of Inherited Sterility as a Genetic Control Method Against the Carob Moth	Marc Vreysen
UGA/5/027	Uganda	Feasibility for a *Glossina fuscipes* Free Zone in the Lake Victoria Basin	Jesús Reyes
URT/5/022	United Republic of Tanzania	Assistance to a Feasibility Study for the Use of the Sterile Insect Technique	Udo Feldmann
YEM/5/009	Yemen	Emergency Assistance for Monitoring and Control of Old World Screwworm Flies in Yemen	Udo Feldmann
ZIM/5/012	Zimbabwe	Feasibility Study on the Use of SIT to Eradicate Tsetse in Zimbabwe	Udo Feldmann
		Projects that Started in 2009	
AFG5004	Afghanistan	Enhancing Crop Productivity Through Mutation Breeding and Pest Control	Rui Cardoso Pereira
CHD5002	Chad	Assessing the Feasibility of Using Sterile Insect Technique Components to Create a Tsetse-Free Zone in the Mandoul Region	Udo Feldmann
ETH5015	Ethiopia	Creating a Tsetse-Free Zone in the Southern Rift Valley	Udo Feldmann
ISR5014	Israel	Improving Artificial Mass-Rearing Systems for the Ethiopian Fruit Fly, *Dacus ciliatus*, and Establishing Optimal Sterilizing Doses: Towards Small-Scale SIT	Andrew Jessup
ISR5015	Israel	Strengthening the Capacity to Use the Sterile Insect Technique for the Olive Fruit Fly	Andrew Jessup
MAG5017	Madagascar	Developing Strategies for Integrated Management of Fruit Flies Based on the Sterile Insect Technique (SIT)	Rui Cardoso Pereira

MOR5031	Morocco	Controlling the Mediterranean Fruit Fly Using the Sterile Insect Technique and Other Conventional Methods	Jesús Reyes
PAN5018	Panama	Maintaining and Operating a Medfly-Free Area, Implementing a Fruit Fly Emergency Plan, and Suppressing *Anastrepha* spp. Fruit Flies in the Azuero Peninsula Using the Sterile Insect Technique	Jesús Reyes
RAF5059	Regional Africa	Supporting the Creation of a Tsetse-Free Zone in Southern Mozambique and North-East South Africa	Marc Vreysen Rui Cardoso Pereira
RAF5060	Regional Africa	Supporting the Use of the Sterile Insect Technique for Area-Wide Tsetse and Trypanosomosis Management (Phase II)	Udo Feldmann
RAS5051	Regional Asia	Developing Integrated Control of the Olive Fruit Fly	Andrew Jessup
RAS5052	Regional Asia	Sharing Regional Knowledge on the Use of the Sterile Insect Technique within Integrated Area-Wide Fruit Fly Pest Management Programmes	Rui Cardoso Pereira
RAS5053	Regional Asia	Assessing Feasibility for Area-Wide SIT-Based Control of the Mediterranean Fruit Fly in the Middle East	Jesús Reyes
RAS5054	Regional Asia	Contributing to the Assessment of the Feasibility of SIT-Based Area-Wide Integrated Management of Old World Screwworm Flies in the Middle East	Udo Feldmann
RER5014	Regional Europe	Suppressing the Mediterranean Fruit Fly by Integrating the Sterile Insect Technique on an Area-Wide Basis in Neretva Valley of Croatia and Bosnia and Herzegovina	Rui Cardoso Pereira
RLA5057	Regional Latin America	Establishing and Maintaining Fruit Fly Free and Low Prevalence Areas in Central America, Panama and Belize, Using the Sterile Insect Technique (SIT) (ARCAL CVI)	Jesús Reyes
SAF5011	South Africa	Refining an Integrated Application of SIT Against Some Key Lepidopteran Pests of Southern African Agricultural Crops	Jorge Hendrichs
SEN5031	Senegal	Implementing the Pre-Operational Phase to Create a Zone Free of *Glossina palpalis gambiensis* Using the Sterile Insect Technique (SIT)	Marc Vreysen
SUD5032	Sudan	Investigating the Use of the Sterile Insect Technique for Controlling Mosquitoes in Northern Sudan	Mark Benedict
TUN5026	Tunisia	Assessing the Use of Inherited Sterility as a Genetic Control Method against the Carob Moth	Marc Vreysen
UGA5031	Uganda	Assessing the Feasibility of Establishing a Tsetse Free Zone in Lake Victoria Basin	Jesús Reyes

Highlights for Technical Cooperation Projects

Eradication of Cactus Moth (*Cactoblastis cactorum*) Outbreak in Isla Contoy, Quintana Roo, Mexico (MEX5029)

As a result of the action taken by the Regional Program for the Eradication and Monitoring of the Cactus Moth in the Yucatan Peninsula, implemented after the first detection of the pest on July 31, 2006 in Isla Mujeres, municipality of Isla Mujeres, Quintana Roo, on May 4, 2007, there were 2 detections of the pest in Contoy Island National Park, also municipality of Isla Mujeres.

SENASA, through the "Dirección General de Sanidad Vegetal", in coordination with the "Comité Estatal de Sanidad Vegetal de Quintana Roo", under the Regional Program handled by the National Commission of Protected Areas of the Ministry of Environment and Natural Resources, intensified monitoring actions (sex pheromone traps and sampling).

In this way it defined the area of the outbreak and implemented measures for the suppression of the pest, which mainly consisted of removing the infested hosts and implementing the Sterile Insect Technique, with the participation of the Department of Agriculture United States of America and the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture.

In February 2009, a period of three biological cycles of the pest without detection was completed. According to the theoretical model of Tassan, the outbreak has therefore been eradicated.

Based on the foregoing, the fact that the pest has previously been eradicated from Isla Mujeres (see previous newsletter, January 2009) and in accordance with International Standard for Phytosanitary Measures (ISPM) No. 8 on delimitation of a pest in an area, Mexico is now free of *Cactoblastis cactorum* (Absent: pest eradicated).

Source: *North America Plant Protection Organization (24 April 2009)*

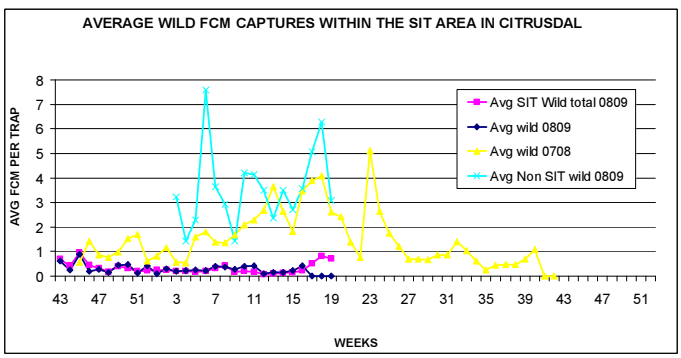
Excellent Results for SIT Application Against the False Codling Moth on Citrus (SAF5007)

After a hectic start in 2007, *Xsit* or *X Sterile Insect Technique*, a private-public commercial partnership, is settling down very nicely. The 2007-08 season was an extremely difficult season:

- The fast-tracking of the project at the request of the citrus producers, due to an inability to effectively combat false codling moth (FCM) with other control mechanisms.
- Designing, developing, installing and commissioning various once-off, specialized, equipment without any prior knowledge as to how effective these items would be under operational commercial circumstances, within a very limited time and an even more limited budget.
- The cobalt radiation source was only delivered and commissioned in March 2008, when the citrus season was almost over. Irradiation of the moths was therefore done in Stellenbosch at the Agricultural Research Council's Infruitec facility. Unfortunately, transporting the moths 200 km both ways to Citrusdal adversely affected recapture of the sterile moths, as well as their ability to compete with wild FCM.
- Orchard sanitation, the cornerstone of FCM control, was neglected by a number of producers, resulting in extensive damage to their crops, as well as to the image of the SIT programme.

Rearing of the false codling moth Thaumatotibia leucotreta.

However, this season (2008-09), *Xsit* has all their ducks in a row, the producers are practicing good orchard sanitation and the preliminary results look fantastic, as reflected by the graph below, representing comparative figures of wild FCM populations:



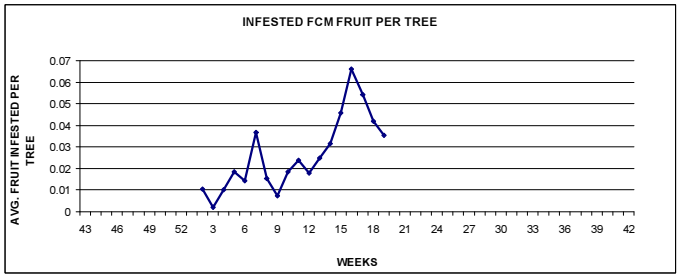
The ***yellow line (Avg Wild 07-08)*** represents the previous season's wild FCM trap catches, recorded on a weekly basis by *Xsit*'s staff within the SIT area. These numbers, although seemingly high, are still below the threshold of 10 wild FCM per trap per week required for export to the USA.

The ***dark blue line (Avg Wild 08-09)*** represents the same farms in the current season, and the ***pink line (Avg SIT Wild 0809)*** includes all the monitoring data within the entire SIT area (±4000 ha).

In comparison the ***light blue line (Avg Non SIT Wild 08-09)*** represents that area in Citrusdal where no SIT is yet being applied and FCM is still being suppressed with traditional chemical and mating disruption programs.

A number of conclusions can be made from this graph, the most important being that the release of sterile FCM is having a huge suppressing effect in the current season on the population of wild FCM in this Western Cape Province treatment area. Flight peaks of wild FCM have almost entirely disappeared, with consequent very low damage to fruit.

A second graph represents the total number of fruit infested by FCM larvae in the SIT area. *Xsit* monitors 1900 data trees in this area to determine the amount of damage that is caused by FCM. As a general guideline, one infested fruit per tree per week would constitute an infestation level that would make it economically viable to apply an additional insecticide treatment.



It is very obvious from this graph that the number of infested fruit is almost non-existent and far below the economic threshold of one fruit per tree per week: 0.07 represents only 133 fruit (from 1900 data trees). The final proof will be at harvest-time, but given the figures above, there is no doubt that *Xsit* is having an unbelievably successful season up to this point.

With regards to the future, SIT-trials will be conducted in all the major citrus-growing areas in Southern Africa, with the expansion of the SIT technology to these areas in mind. A trial is currently being conducted in Letsitele, a large citrus producing area in the Northern Province in South Africa. In the event that equally satisfactory results can be reproduced there, that area will be the next area where FCM-SIT will be commercialized.

On that note, I would like to express our sincerest gratitude toward the IAEA, who has supported this programme from the outset. Without the advice of the various experts, as well as the financial contributions, *Xsit* would not have been possible and these excellent results would have been a dream. I sincerely hope that this fruitful relationship and support can be maintained during our future expansions.

Source: *Sampie Groenewald (General Manager of Xsit)*

Costa Rica Begins to Export Fresh Mature Tomato and Bell Pepper from an Area of Low Fruit Fly Prevalence (RLA5045)

The Costa Rican's Ministry of Agriculture and the United States Department of Agriculture (USDA), through the US Embassy in Costa Rica, signed the phytosanitary protocol which allows the export of fresh mature tomato and bell pepper (see photo below) from Costa Rica to the US.

Production of bell pepper in a greenhouse in Costa Rica.

Since 2005 there have been several places under surveillance to identify those that can qualify as a low fruit fly prevalence area. Results of the systematic surveillance carried out by the Ministry of Agriculture in cooperation with the FAO/IAEA Programme (Technical Cooperation projects RLA5045) and the Animal Plant Health Inspection Service (USDA) demonstrated that several locations in the Central Plateau provide the phytosanitary conditions for developing a systems approach based on low fruit fly prevalence. The area of Zarcero, in the province of Alajuela, under the management of several small producers, will be the first exporting.
(http://picasaweb.google.com/mesa806/AmbassadorCianchetteExportProtocol?authkey=vxc-klfnjOY&feat=directlink#)

Establishment of Medfly and Fruit Fly Parasitoids Rearing Facility (BRA5057)

São Francisco valley in Bahia and Pernambuco States of Brazil produces 90% of all mango exports from Brazil, mainly to Europe, USA and Japan (see photo of a mango grove in the valley below). These costumers request the suppression of medfly populations to low levels and in the case of USA and Japan, additional post-harvest quarantine treatment. The programme is making good progress in suppressing medfly populations in the pilot areas in order to achieve its objectives to expand the production, protect current exports, reduce insecticide use and fruit losses, and improve the quality of fruit production in this area.

The involvement of the fruit industry (mainly mango exporters) of São Francisco valley, as active players in the medfly control, including through the area-wide application of the SIT, is crucial for the sustainability of the programme in the future.

The availability of a new X ray machine represents the disappearance of a major current bottleneck and will allow increasing the production of the medfly mass rearing facility. For this reason the speedy installation and calibration of this machine is crucial for the entire project.

Area of mango production in São Francisco Valley, Brazil.

Establishment of a Pilot Fruit Fly Free Area Using an Integrated Approach that Includes the Area-Wide Sterile Insect Technique (BZE5002)

Under regional TC project RLA5045, Belize applied to become an IAEA Member State. This occurred in 2005, towards the end of this regional project. A new TC project was requested by the Governement of Belize (BZE5002), that includes a major involvement of the private sector, was started in 2007, aiming at suppressing populations of the established Mexican fruit fly. A pilot area to develop the project was selected close to Stan Creek valley, which engulfs most of the commercial citrus production (see photo below). The industry has made a major investment in order that the activities are carried out as planned, and progress and results so far show a positive evolution towards the proposed goals.

As a result of the project the citrus industry of Belize are becoming aware of the benefits of the project, adopting the technology transferred as the basis for qualifying potential areas for citrus juice and pulp processing.

Transport of citrus fruits to be processed in Belize.

Contributing to the Assessment of the Feasibility of SIT-Based Area-Wide Integrated Management of Old World Screwworm Flies in the Middle East (RAS 5054)

The Old World Screwworm (OWS) fly, *Chrysomya bezziana*, is an obligate parasite, notifiable to the World Organisation for Animal Health (OIE). It attacks all warm-blooded vertebrates and also humans. Several countries in the Middle East are currently OWS infested, including Bahrain, Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates. As of late 2007 OWS is also reported from Yemen. Several other countries are at risk of becoming infested, including Jordan and Syria.

At the request of the countries in the region, the Agency approved a new regional TC project entitled "Contributing to the Assessment of the Feasibility of SIT-Based Area-Wide Integrated Management of Old World Screwworm Flies in the Middle East" (RAS5054).

From 17 to 19 March 2009 national coordinators under this regional TC project met in Vienna and reviewed priority activities for the next 18 months. Particular emphasis was on (i) raising awareness regarding the OWS problem through issuing of Arabic language version of available screwworm fly posters (see: http://www-naweb.iaea.org/ nafa/ipc/Screw-Worm-Poster-1.pdf and ...-Poster-2.pdf); (ii) capacity building for standardised entomological and veterinary /parasitological monitoring; and (iii) addressing – jointly with international partners like the Arab Organisation for Agricultural Development (AOAD) and FAO – specific technical components to assess the feasibility of a SIT-based OWS management approach and planning AW-IPM operations against OWS flies in the region.

Supporting the Creation of a Tsetse-Free Zone in Southern Mozambique and North-East South Africa (RAF5059)

This new regional TC project between the Republic of South Africa and Mozambique will provide support to this bi-national initiative that aims at the eventual creation of a zone free of the tsetse flies species *Glossina brevipalpis* and *Glossina austeni*. In South Africa, the distribution of these two species is confined to KwaZulu Natal, but their belt extends into the southern part of Mozambique (and also into Swaziland - see below). A first regional technical meeting was organised at Hluhluwe in KwaZulu Natal (KZN) on 23-24 March 2009 and was attended by representatives of the Directorate of Veterinary Services of KZN (DVS KZN), the Onderstepoort Veterinary Institute (OVI), the Veterinary Services of Swaziland and Mozambique, the South African Nuclear Energy Corporation (NECSA), the University of Zululand, KZN Wildlife, the Department of Science and Technology, the Pan-African Tsetse and Trypanosomiasis Eradication Campaign (PATTEC) and FAO/IAEA.

With respect to the tsetse distribution in the target area, two new developments were reported, i.e. (1) the two target species *G. austeni* and *G. brevipalpis* have been trapped in KZN in areas where they had never been trapped before, and (2) during a recent survey in Swaziland, *G. austeni* was detected in the north-eastern part of the country, i.e. in the Mlawula Game reserve that borders with Mozambique. The planned surveys in Mozambique therefore need to be expanded to Swaziland and further surveys are needed in selected areas in KZN to update the exact distribution of the two species. These new findings necessitate the inclusion of Swaziland in any future regional Mozambique/South Africa tsetse control effort (see photo below).

The PATTEC coordinator (right) and colleagues from Mozambique and South Africa viewing the area where Glossina austeni *was recently trapped in Swaziland.*

In the immediate future, a workshop will be organised to develop a detailed action plan for the collection of entomological baseline data in Matutuíne District of Maputo Province and in Swaziland. This plan will be used to carry out the tsetse surveys in an efficient way (late 2009-2010). A regional training course on the collection of entomological base line data will be organised in Maputo in late 2009 or early 2010. Attempts will also be made to establish experimental colonies of the two target species originating from KZN for mating compatibility studies.

AU-PATTEC Training Course 'Strategic Project Management: A Methodological Approach to Tsetse Fly Eradication and Control (RAF5060)

At several international meetings dealing with the problem of tsetse and trypanosomosis (T&T) in the past years AU-PATTEC, FAO, IAEA and WHO concurred on the necessity of special training for senior staff of national PATTEC projects on the principles of project management, in addition to required technical training. In an effort to appropriately address these management training needs, AU-PATTEC, though its Coordination office in Addis Ababa, Ethiopia, in collaboration with the Management Development Institute (MDI), Manzini, Swaziland, and under the sponsorship of The Arab Bank for Economic Development for Africa (BADEA), developed a training manual designed to improve knowledge, attitudes and skills needed to manage donor funded projects in a strategic and methodical approach to tsetse fly suppression and eradication.

The course was conducted in Manzini, Swaziland, from 23 February to 13 March 2009, and consisted of 10 'Modules' covering: (1) Introduction and general principles of project management; (2) Basic tsetse biology and ecology; (3) Project management, organizational structures and standards; (4) Project activity management; (5) Project costing and budgeting; (6) Project integration management; (7) Project time planning and management; (8) Monitoring and evaluation of tsetse control projects; (9) Project risk management; and (10) Project quality management.

The Agency contributed – under its regional TC project 'Supporting the Use of the Sterile Insect Technique for Area-Wide Tsetse and Trypanosomosis Management (Phase II)' (RAF5060) – several lectures on the themes a) Principles of planning for AW-IPM operations against tsetse and the option of a SIT component, with particular emphasis on components of feasibility assessment and preparing for and implementing entomological baseline data collection; and b) Management principles in the context of large scale insect control and eradication programmes.

Binational Workshop on Suppressing the Mediterranean Fruit Fly by Integrating the Sterile Insect Technique on an Area-Wide Basis in the Neretva Valley (Croatia and Bosnia and Herzegovina) (RER5014)

The purpose of the binational workshop held in Metković, Croatia in January 2009 was: (1) to review the activities conducted, baseline data collected and results achieved under the preceding national project CRO5002 "Feasibility Study for the Suppression of the Mediterranean Fruit Fly by Integrating the Sterile Insect Technique on an Area-Wide Basis in Neretva Valley"; (2) to visit the working areas of the Neretva valley, both in Croatia and Bosnia and Herzegovina, and (3) to revise the workplan of the new regional project RER5014 "Suppressing the Mediterranean fruit fly by integrating the sterile insect technique on an area-wide basis in Neretva Valley". The workshop included the participation of 8 persons, including 4 participants from Croatia and 2 from Bosnia and Herzegovina), and for the IAEA the Programme Manager Officer, and the Technical Officer (see group photo below).

Participants of the Workshop on Suppressing the Mediterranean Fruit Fly by Integrating the Sterile Insect Technique on an Area-Wide Basis in the Neretva Valley, Metković, Croatia.

The activities conducted, baseline data collected and results achieved during the CRO5002 that were evaluated include technical and economic feasibility studies for the use of the sterile insect technique (SIT) integrated with other techniques, the installation of a trapping system, and trapping data analyzed and uploaded into GIS maps.

A new peach plantation established on the Bosnia and Herzegovina side of Neretva River Valley (close to Mostar).

Fly emergence and handling facility design, field cage tests to evaluate the mating compatibility and mating competitiveness, and studies of the overwintering population are subsequent activities necessary to advance the project to the next phase.

The geographical continuity of the area inside the Neretva valley, within which the migration of the flies largely takes place, represents the opportunity for an area-wide approach to the suppression of this pest integrating SIT with other methods, was the main reason to engage in a joint binational project for the 2009-2011.

The revision of the workplan of the RER5014 was done focused on the 2009 activities and some changes in the initial Project Logical Framework were made according to the needs of both national counterparts.

Coordinated Research Projects (CRPs) and Research Coordination Meetings (RCMs)

Project Number	CRP Title	Scientific Secretary
D4 10.20	Improving Sterile Male Performance in Fruit Fly SIT programmes (2004-2009)	Jorge Hendrichs
D4 10.21	Development of Mass Rearing for New World (*Anastrepha*) and Asian (*Bactrocera*) Fruit Flies (2004-2009)	Andrew Jessup
G 34.001	Development of Standardised Mass Rearing Systems for Male Mosquitoes (2005-2011)	Mark Benedict
D4 20.12	Improving SIT for Tsetse Flies through Research on their Symbionts and Pathogens (2007-2012)	Adly Abd Alla
G 34.002	Biology of Male Mosquitoes in Relation to Genetic Control Programmes (2008-2013)	Mark Benedict
D4 20.13	Applying Population Genetics and GIS for Managing Livestock Insect Pests (2008-2013)	Udo Feldmann
D4 10.22	Increasing the Efficiency of Lepidoptera SIT Through Enhanced Quality Control (2009-2014)	Marc Vreysen
	New CRP to Start in 2009	
D4.20.14	Development and Evaluation of Improved Strains of Insect Pests for SIT (2009-1014)	Gerald Franz
D6.20.08	Development of Generic Irradiation Doses for Quarantine Treatments (2009-2014, managed by Food and Environmental Protection Subprogramme)	Andrew Parker (co-secretary)

The Second Research Coordination Meeting of the CRP on *Improving SIT for Tsetse Flies through Research on their Symbionts and Pathogens*, 16-20 February 2009, Bobo Dioulasso, Burkina Faso

This second RCM was hosted by the Centre International de Recherche-Développement Sur l'Elevage en Zone Subhumide (CIRDES) in Bobo Dioulasso, Burkina Faso. Nineteen participants from fifteen countries attended the meeting together with one consultant from the USA and one observer from Uganda (see group photo below). The first two days of the meeting were devoted to presentations of the agreement and contract holders and of a consultant, whereas during the remainder of the meeting, the participants discussed in two working groups further research on tsetse pathogens and on tsetse symbionts.

The group recommended adding yeast as an additive to the blood diet of tsetse to increase their productivity. The group of Serap Aksoy demonstrated that *Wigglesworthia*-free flies could be obtained by adding 5% yeast to the blood. It was also recommended to generate primers to enable detection of the Salivary Gland Hypertrophy Virus in wild flies of different species and from different locations. Finally, the group emphasised the importance of collecting wild tsetse flies from the field to determine the prevalence of all symbionts, pathogens and parasites present

Participants of the second RCM on Improving SIT for Tsetse Flies through Research on their Symbionts and Pathogens, Bobo Dioulasso, Burkina Faso.

The First Research Coordination Meeting of the CRP on *Increasing the Efficiency of Lepidoptera SIT Through Enhanced Quality Control,* 27 April–1 May 2009, Christchurch, New Zealand

Lepidopteran insect pests such as codling moth, diamondback moth, oriental fruit moth, stem borers, false codling moth, cotton bollworm, and pink bollworm are among the most damaging species of food and fibre crops in the world and are the target of very significant quantities of broad-spectrum and persistent insecticides. The economic, social and environmental consequences of these insecticide interventions are immense, and there is increasing international consensus that intervention campaigns against such pests should be based on the area-wide concept of integrated pest management (AW-IPM), and that the sterile insect technique (SIT) can be considered as a key complementary control tactic for creating pest-free areas or areas of low pest prevalence within area-wide IPM programmes. However, further expansion of the SIT to target other key lepidopteran pests will require improvements that increase the quality control of mass-rearing, irradiation, shipping, release and field assessment activities.

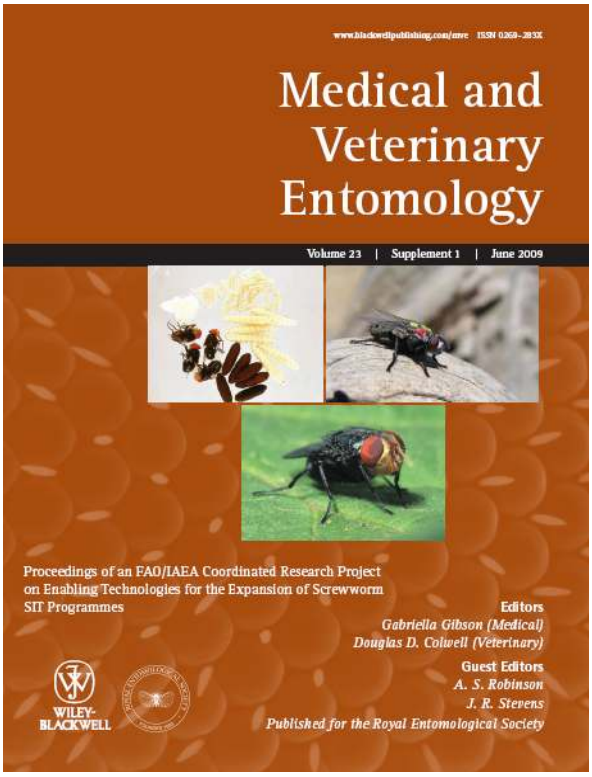
Participants of the first RCM on Increasing the Efficiency of Lepidoptera SIT Through Enhanced Quality Control, Christchurch, New Zealand.

A new CRP was therefore initiated to study and develop improved quality control systems for all aspects of the SIT. The first RCM of this CRP was held at the Canterbury Agriculture & Science Centre and was hosted by the "New Zealand Institute for Plant and Food Research". The meeting was attended by the 16 CRP participants (see group photo above) coming from 14 countries (Argentina, Austria, Australia, China, India, Israel, Malaysia, Mexico, New Zealand, Syria, Tunisia, South Africa, and USA).

The central theme of the CRP is quality of the released sterile moths in the field, and how this relates to parameters in the rearing, and this work will be carried out on various moth species: *Spodoptera litura* (Oriental Leafworm Moth), *Conophomorpha sinensis* (Litchi stem-end borer), *Epiphyas postvittana* (light brown apple moth), *Plutella xylostella* (diamond back moth), *Cydia pomonella* (codling moth), *Lobesia botrana* (European grapevine moth), *Ectomyelois ceratoniae* (date moth), *Hypsipyla grandella* (mahogany shoot borer), *Eldana saccharina* and *Chilo sacchariphagus* (sugar cane stalk borers), and *Cactoblastis cactorum* (cactus moth). Future research will focus on "Factors and variables that affect quality of lepidopterans used in SIT programs", and on "Tools and methods to assess field performance".

Proceedings of the CRP on *Enabling Technologies for the Expansion of Screwworm SIT Programmes*

The final Research Coordination Meeting of a Coordinated Research Project (CRP) on "Enabling Technologies for the Expansion of Screwworm SIT Programmes" was held in Canberra, Australia in December 2006 and a Supplement to Medical and Veterinary Entomology (Vol 23, June 2009) has just been published (see cover page below), as a series of peer-reviewed articles, which summarizes the results of the CRP.



Supplement to Medical and Veterinary Entomology with the proceedings of the CRP on Enabling Technologies for the Expansion of Screwworm SIT Programmes.

The CRP focussed on population genetics and genetic sexing as components for improved planning and implementation of SIT for Old and New World screwworm, respectively *Chrysomya bezziana* and *Cochliomyia hominivorax*. In addition a third species, the flesh fly *Wohlfahrtia magnifica*, was included as it is a species that is increasing its distribution in Europe and North Africa. All articles in the Supplement can be downloaded at: http://www3.interscience.wiley.com/jounal/118540244/home.

Developments at the Entomology Unit Seibersdorf

TSETSE FLIES

Colony status

Whilst managing and controlling the salivary gland hypertrophy virus remains a top objective for the tsetse group, it was decided that research on the tsetse species *Glossina palpalis gambiensis* in support of the Technical Cooperation project in Senegal (SEN5031) is warranted. Therefore, a colony of *G. p. gambiensis* has been established from pupae supplied from the colony in CIRDES, Bobo Dioulasso, Burkina Faso. Four shipment of 2000 pupae each have been received, and we now have a colony of 3 600 producing females. The intention is to have a large enough colony for experimental work to look at sterility, chilling and competitiveness. To make room for this large colony we have discontinued two other colonies, i.e. the *G. brevipalpis* colony has been transferred to the Onderstepoort Veterinary Institute, South Africa, with a small part sent to West Virginia University, USA, and the *G. p. palpalis* colony has been transferred to the Institut de Recherche pour le Développement (IRD), Montpellier, France. We also intend to discontinue the *G. morsitans centralis* colony once an alternative location can be found to host it. In each case our priority is to ensure that the colony is secure in more than one location to minimize the risk of loosing a valuable resource.

As part of the shift in emphasis, a visiting scientist from Zimbabwe, Gratian Mutika, has joined the Unit for six months to work on various aspects of *G. p. gambiensis* biology and handling related to the Senegal project. This includes sex separation, pupal and adult chilling for irradiation and transportation and radiation biology. Gratian will also work on field cage competitiveness and compatibility tests and morphometrics for comparing the laboratory strain with the wild population. We hope to receive wild material from Senegal shortly in order to initiate a Senegal colony

Salivary gland hyperplasia

As reported in the last newsletter (January 2009), attempts are ongoing to develop a strategy to manage the Salivary Gland Hyperplasia Virus, that is hampering colony development of *Glossina pallidipes* due to reduced productivity. The virus management strategy is based on three axes, (1) blocking the virus replication using available commercial antiviral drugs, (2) inhibiting the virus infection by silencing virus specific genes using RNAi technology, and (3) neutralizing the virus infection using virus specific antibodies.

Work is ongoing to assess the impact of four antiviral drugs on the viral infection in *G. pallidipes* and to assess their toxicity for tsetse. The drugs acyclovir and valacyclovir were selected for further work. *G. pallidipes* flies fed on blood diet with valacyclovir for three generations showed a lower mortality and higher productivity in comparison with flies fed on a blood diet that contained acyclovir. Quantitative PCR analysis is used to assess the effect of the antiviral drugs on viral DNA replication.

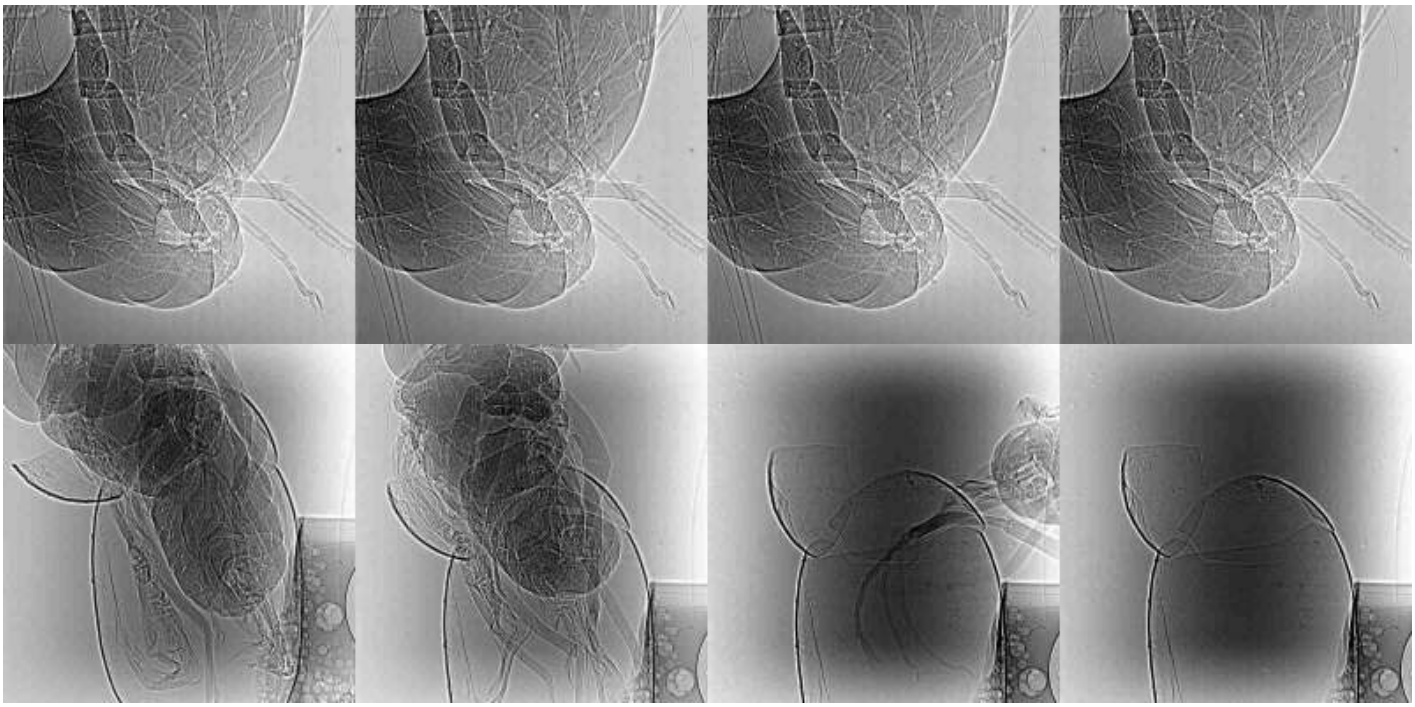
Experiments were started to assess the effect of suppressing the expression of the gene *p74* by RNAi on the virus infectivity. Three regions of the gene were amplified by PCR covering the N-terminal region, the C-terminal region and the whole length of the gene sequence. The PCR product was cloned into a 28I and a 38I LITMUS vector, after which the recombinant plasmid was controlled by a restriction enzyme and transformed into a HT115 (DE3) bacterium. The transformed bacteria were added to the blood diet, used to feed the flies and their effects are currently being monitored.

Attempts were also made to neutralize virus infection with virus specific antibodies. Two antibodies against the p47 protein were produced and are currently being mixed with the diet to feed the flies.

In collaboration with Max Bergoin (Montpellier) and his colleagues in Illkirch, France (Robert Drillien), studies on the structure of the virus were undertaken using cryo-electron microscopy. Initial pictures showed that the virus has a flat fragile envelope that apparently gets easily damaged by any of the purification steps. This information is quite important as it indicates that the virus is sensitive to any surface decontamination treatment. Further studies in this respect are foreseen.

In vivo investigation of the behaviour and morphology of larvae, pupa, and adult of tsetse flies by high speed X ray phase-contrast imaging

During his sabbatical in Seibersdorf in 2008, Daniel Briceño from Costa Rica studied sexual behaviour in a number of tsetse species. Tsetse do not exhibit obvious precopulatory courtship behaviour, but Daniel has already demonstrated a complex sequence of behaviours immediately preceding and during copulation in two tsetse species. The male genitalia of tsetse possess complex structures that differ substantially even between closely related species. During his sabbatical, Daniel concentrated on establishing the role and significance of some of these structures.



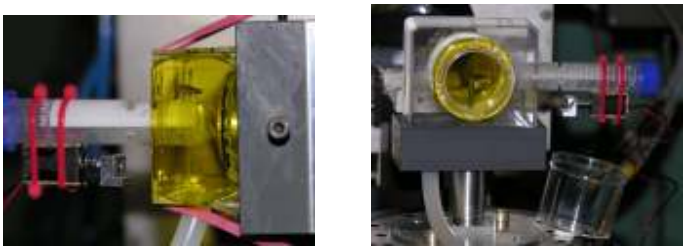
Sequences of X ray phase-contrast enhanced images taken during mating (top) and emergence from pupae of tsetse flies (bottom).

As part of this work, with the collaboration of the IAEA XRF Laboratory (NAAL) at the Seibersdorf Laboratories, he was able to take high-speed, high resolution X ray video and still images of tsetse flies during copulation using an X ray phase contract technique, at the Institute for Synchrotron Radiation (ISS), Forschungszentrum Karlsruhe GmbH, D-76344 Eggenstein-Leopoldshafen, Germany. This is the first time that X ray images of living tsetse have been obtained (see above).

The X ray phase-contrast radiography is a technique that enables soft tissues in whole small animals, especially insects, to be imaged where there is not enough material to produce satisfactory contrast by using normal X ray absorption radiography. It was used to investigate the relative position and movement of the male genetalia inside the female in live tsetse flies during copulation, as well as other processes such as adult eclosion and feeding.

A total of 6 species of flies were included in this study, males and females of *Glossina pallidipes, G. morsitans centralis, G. m. morsitans, G. swynnertoni, G. brevipalpis* and *G. f. fuscipes.* A group of pregnant females (*G. pallidipes)* was also studied with larvae at different stages of development.

Imaging of the living specimens was performed inside specially designed chambers. In the chamber a single female was glued to a pole and the male was inserted (flying free) by means of a remote device, (see on the right). During the mating a sequence of phase-contrast images was taken with a speed up to 250 frames per second and duration of a few minutes. Two cameras were used with pixel sizes about 2.5 μm and 20 μm and fields of view of 2 x 2 mm and 10 x 10 mm respectively. Other processes recorded included fly emergence from pupa, larvae and pupa development. Several attempts were made to record the fly feeding, unfortunately without success. A few frames from the collected sequences are shown in the figure above.



Containers, supplied with humid air, used during the studies of living tsetse flies.

Conclusion: For the first time live, high-speed X ray phase-contrast image sequences of mating tsetse flies were recorded with a spatial resolution in the single micrometer range. Other processes, including fly emergence from pupa, and various stages of larvae development, were also recorded *in vivo*. The recorded sequences of images provided sufficient information about the details of dynamic processes under study. The collected data will lead to a better understanding of tsetse fly morphology, behaviour, evolutionary biology and characterization of the selected organs.

FRUIT FLIES

Genetics

Polytene chromosome maps are very useful tools for genetical and molecular analyses and they are an essential prerequisite for the construction of genetic sexing strains (GSS), i.e. without this basic information the structure of GSS cannot be determined with the required accuracy.

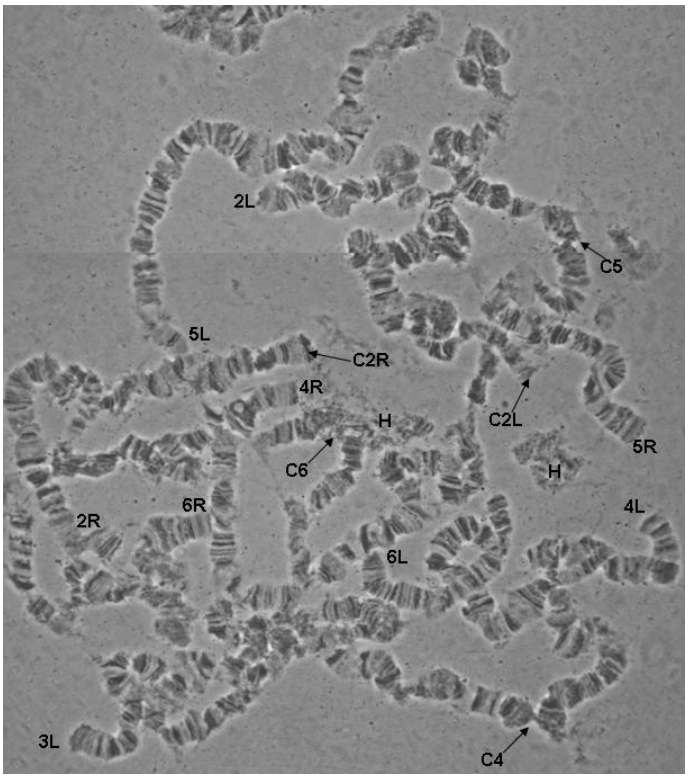
Work has continued on the analysis of the mitotic and polytene chromosomes of the melon fly *Bactrocera cucurbitae*. In agreement with the previous report we observe six pairs of chromosomes including the sex chromosomes. The figure below shows mitotic chromosome spreads from female and male larvae. Although the sex of the third-instar larvae could not be identified, the heterogametic sex (XY) is assumed to be the male, a situation that holds true for all Tephritidae species so far analyzed. Three of the autosomes are metacentric or slightly submetacentric and with the exception of the longest one the other two cannot easily be differentiated due to their similar size. The remaining autosome pairs are acrocentric (named A1 and A2 in figure below) and can be recognized by differences in their arm ratio.

The sex chromosomes are the smallest of the complement and are stained more heavily as compared to the autosomes. This observation combined with the absence of chromatid separation, indicates that both are mainly heterochromatic. The X chromosome is the longer of the pair and often shows a constriction with a satellite chromosome arm (asterix in figure a, below) usually observed in acrocentric chromosomes. Although previous studies have considered the X as a metacentric chromosome and not as acrocentric, further studies are needed to clarify this discrepancy. The Y chromosome is very small, i.e. nearly dot-like.

Mitotic chromosome spreads from female and male larvae of B. cucurbitae.

Well-spread preparations of *B. cucurbitae* polytene chromosomes are difficult to obtain due to the high degree of ectopic pairing, the numerous weak points and the coiling of chromosomes. As a consequence, polytene chromosomes are usually fragmented into pieces making it difficult to identify each chromosome in its entirety. Since the quality of chromosomes is crucial for their analysis our efforts were concentrated on improving the growing of the larvae. Therefore, we used a lower temperature for growing the larvae (20°C instead of 25°C) and avoided overcrowding in the larval cultures. Analysis of numerous polytene chromosome spreads showed that *B. cucurbitae* polytene nuclei have five long banded chromosomes (see figure next column) corresponding to the five autosomes. We never observed a sexual dimorphism in polytene nuclei, an indication supporting the non- polytenization of sex chromosomes.

These analyses allowed us to assemble the standard maps of all five autosomes of the *B. cucurbitae*.



Polytene chromosomes of B. cucurbitae.

Fruit Flies Rearing and Quality Control

Research and development in the fruit fly rearing laboratories over the last year has concentrated on streamlining production methods for a range of pest fruit fly species with a view to facilitating the transfer of insects from small-scale laboratory culture to large scale mass rearing colonies.

Fruit Fly Species / Strains / Genetic Sexing Strains (GSS) Currently Maintained at the Entomology Unit

***Anastrepha fraterculus*:**
2 strains: 1) Peru lab, 2) Hybrid Peru x Argentina

The Peru strain of the South American fruit fly (*A. fraterculus*) was used for studies on comparing the effects of radiation type (gamma vs. X ray irradiation) on quality parameters (adult eclosion, flight ability, fertility and field cage mating competitiveness). Pupae were exposed to different radiation doses from sub-lethal to lethal from either the standard GammaCell unit which produces gamma rays or from the RS2400 unit which produces X rays. This work was carried out with the assistance of two visiting scientists and one fellow all from Brazil. Results showed that there were no significant differences in the biological effectiveness of radiation types in the usual range of doses applied to produce sterile flies for SIT programmes.

Anastrepha fraterculus *irradiated with X rays during mating ability studies.*

***Anastrepha ludens*:**
2 strains : 1) Mexico lab, 2) Mexico wild

Pablo Liedo, a visiting scientist on sabbatical from Mexico, is carrying out trials on the Mexican fruit fly *A. ludens* with a view to establishing techniques for selecting for high survival rates, and other beneficial traits, in fruit fly colonies being reared for mass-production and SIT. Both strains are being used in these experiments. Basically flies are put under various types of stress and the survivors are collected and bred from. Their offspring are then tested in field cages for improved survival traits. This is an interesting project and the resulting techniques could, if early positive results can be replicated, be used in all mass-rearing facilities to manage mother stocks in order to improve the efficacy of SIT programmes.

***Bactrocera cucurbitae*:**
2 strains: 1) GSS strain (Hawaii), 2) Wild strain (Seychelles)

Two fellows, Raza Memon from Pakistan and Jaime Palma from Chile, used flies from the GSS strain of the melon fly *B. cucurbitae* for studies comparing X ray to gamma ray irradiation for SIT purposes. Results were the same as for the work done on the South American fruit fly as described above. Data from these trials will be used to justify the purchase of an X ray unit for the Nuclear Institute of Agriculture (NIA) in Tandojam, Pakistan.

Ishan Ul-Haq, a PhD student, also from Pakistan, is using melon fly for studies on the improvement of sterile male performance for SIT programmes. He has found that the feeding of methoprene in very small doses plus protein to adult flies will enhance their mating competitiveness when compared with flies fed only the standard sugar and water. The benefits of feeding the two compounds are synergistic. Also there are other benefits to the adult. It will survive longer than untreated flies, it will mate earlier, and assists in reducing the likelihood of female remating. These benefits have been confirmed in both laboratory based trials and field cage experiments. The objective of this work is for methoprene and protein, in addition to sugar and water, to be used as pre-release adult feed for sterile flies in melon fly SIT emergence and release facilities. The outcome is an improvement in the efficacy of SIT programmes.

***Bactrocera dorsalis*:**
2 strains: 1) GSS strain (Hawaii), 2) Wild strain (Thailand)

Colonies of these strains of Oriental fruit fly (*B. dorsalis*) have been established at the unit for use in a newly proposed Coordinated Research Project (CRP) entitled: "Improved Understanding of *Bactrocera* and *Anastrepha* Pest Species Complexes for Enhanced SIT Application and to Facilitate International Trade". The Oriental fruit fly complex is made up of several pest fruit fly species which are very similar to each other morphologically. Because of this similarity separate species are difficult to distinguish and this has impacts on quarantine regulations. For SIT, if one population or species is able to mate with another that has already been developed for SIT then the latter may be useful for SIT against the former. We will be testing in the laboratory and in field cages the possibility of using sterile flies from one species against another.

***Bactrocera invadens*:**
1 laboratory strain (Kenya)

The invasive fruit fly (*B. invadens*) is one of the species of the Oriental fruit fly complex. Its invasion has had an enormously adverse impact on many African nations. It originated apparently in Sri Lanka and was first discovered in Kenya in 2003. In the six years since then this species has spread across Equatorial Africa and further south into Mozambique and Namibia. It is a major threat to efficient production and to export to other markets.

Mating studies have been initiated and have commenced with "forced" mating between the invasive fruit fly (IFF) and the Oriental fruit fly (OFF). We have found that if male IFF are caged with female OFF and if male OFF are caged with female IFF both crosses result in numerous, high quality and highly fertile F_1 hybrids. The F_2 and F_3 generations of these hybrids are also of high quality, fecundity and fertility. Early data suggest that the hybrids, at least up to the F_3 hybrids mate earlier, and are more fertile than either of the two parental lines. If these data are replicable it may be possible to use the interspecific

hybrid in SIT programmes for both the IFF and the OFF. Confirmatory trials in field cage mating competitiveness trials with host trees are scheduled for mid 2009. Both the GSS and the "wild" Thai strains of OFF will be tested.

Bactrocera invadens *female.*

***Bactrocera oleae*:**
3 strains: 1) Lab, 2) Greece wild, 3) Hybrid Lab x Israel

Work on the olive fly *B. oleae* (OLF) during 2008/2009 has concentrated on improving the laboratory rearing to assist up-scaling production to mass-rearing levels for future SIT programmes. Two technical cooperation (TC) projects are currently being supported on this subject. The first entitled: "Strengthening the Capacity to Use the Sterile Insect Technique for the Olive Fruit Fly" is implemented in Israel and the second: "Strengthening the Capacity to Use the Sterile Insect Technique for the Olive Fruit Fly" is a regional project that includes several countries in the Near East region.

Staff of the Entomology Unit, in collaboration with, Dina Orozco, a visiting scientist from Mexico, have made excellent progress over the last 12 months in testing cheaper larval diets. A reduction in the amount of the expensive cellulose fibres used as diet bulking material by replacing 50% with corn cob flour has been shown to be feasible for use in small scale rearing in the laboratory. Up-scaling to simulated mass-rearing conditions have pointed out that mould control on the diet is an essential requirement as mould severely affects productivity and insect quality. Tests have commenced on optimising the mixture and composition of preservatives for use in mass-rearing situations.

Another issue that was found to be important was reducing water loss from the larval diet. The drier the diet the less mould, but the more pupation in the diet. This latter is not an ideal situation as it requires extra time and staffing to wash pupae from the diet and also has some adverse effects on subsequent insect quality. We have shown that increasing the relative humidity around the diet for at least the first 4 to 5 days improves productivity and insect quality.

We have also been working on optimising the design of trays for holding larval diet. We need trays that are easy to clean (as mould is deadly to newly emerged larvae), easy to handle, maintain diet moisture as efficiently as possible and reduces pupation inside the larval diet while being suitable for mass-rearing. Mechanisms for tray stacking and enclosure are associated issues that are also being tested. Results to date suggest that relatively shallow and narrow trays are best at solving some of these problems.

We are also testing new adult cage designs. The objective here is to ensure the cage is easy to look after once in the adult rearing room and also thereafter during cleaning. Also egging panel set up and egg collection should be as simple a process as possible whilst ensuring egg quality by reducing the possibility of desiccation. Previous work on developing the flat, wax-covered egging panel has given us sufficient justification in moving over all OLF production to this system. The new cage designs are being based on incorporating the flat egging panel.

The OLF group is working closely with scientists in Israel, Greece, the USA and other countries.

***Bactrocera philippinensis*:**
1 laboratory strain (Philippines)

We have just received the first batch of the Philippines fruit fly *B. philippinensis* from Sotero Resilva, a visiting scientist from the Philippines and it is growing very well in our laboratory. This pest species is, like *B. invadens*, a member of the Oriental fruit fly complex of species. We will be testing its capacity for cross breeding with Oriental fruit fly using the same procedures developed for *B. invadens*.

***Ceratitis capitata*:**
2 strains: 1) Vienna-8 *tsl* strain, 2) Argentina

The Entomology Unit continues to maintain mother colonies of the Mediterranean fruit fly *C. capitata* used around the world for SIT programmes: the Vienna-8 *tsl* strain. This strain was developed by scientists from the fruit fly genetics group at the Entomology Unit. In this strain females have a gene for heat intolerance at the egg stage. If eggs are heated then the females die leaving just males. So only males are then reared for subsequent sterilisation and release. At times in mass-rearing facilities around the world this strain breaks down and when this occurs it needs replenishing. The Entomology Unit then supplies new stock.

Collaboration with the United States Department of Agriculture (USDA)

Staff of the Entomology Unit collaborated with two visiting scientists from the USDA, Guy Hallman and Scott Myers for a period of one month. The collaboration was the first of a possible future relationship on post-harvest

treatments with the USDA. The fruit fly laboratories (rearing and genetics) of the Entomology Unit are unique in the world in being able to conduct experiments that can compare treatment responses of many pest fruit fly species at the same time and under the same roof. The benefit is that such comparison trials are more statistically valid and cost-effective than carrying out these trials in separate regions. The USDA has taken advantage of this and carried out some comparison trials on the effectiveness of low-temperature based quarantine treatments that exist against Mediterranean fruit fly (medfly) and against other quarantine pest species. In this case the cold tolerance (about 1°C) of medfly was compared to that of the following species *B. invadens*, *B. dorsalis*, and *A. ludens*. Future collaboration may involve irradiation (gamma ray and X ray) quarantine treatments.

Collaboration with a Visiting Scientist from the Philippines

Staff of the Entomology Unit is collaborating with a visiting scientist from the Philippines, Sotero Resilva, who is studying the development of eye colour in pharate adults (i.e. during the pupal maturation stage). It has been established that the optimal time to irradiate fruit fly pupae is at a specific point of eye pigmentation. As a "rule of thumb" this point is approximately at 80% pupal maturation (i.e. 80% of the time it takes for a newly pupated larva to reach adult eclosion). Pupal maturation times vary between fruit fly species and pupal holding temperatures. This work will add to previous studies on other pest fruit flies being mass-reared for SIT. The aim is to include eye colour charts in the FAO/IAEA/USDA quality control manual as a quality test for improving the efficiency and efficacy of SIT.

Shipments of fruit flies and rearing materials to other researchers and/or SIT programmes

The FAO/IAEA Fruit Fly Rearing group is considered by Member States and other countries as a valuable resource for fruit fly species and for its experience in rearing fruit flies of various species in the laboratory. During 2008/2009 one to several shipments of olive fly were made to Italy, Spain, Arizona, California and Israel; of medfly to Portugal, Czech Republic, Greece, Belgium and Croatia; of cherry fruit fly (*Rhagoletis cerasi*) to Greece; and of insect feed and equipment to Israel, Spain, Portugal and England.

MOSQUITOES

The mosquito SIT project welcomed Ms. Clelia Oliva from the University of La Réunion, France for a 6-month internship to carry out research as the conclusion of her master's degree. Her primary project is to determine whether any of several chemicals have promise as radioprotectants for *Anopheles arabiensis*. She is also studying the effect of tray colour on survival and development rates of larvae as a basis for selecting the final material to be used in mass production. As a secondary component to the latter project, she is determining whether larval colour change induced by tray colour has potential as an adult marking method. Clelia hopes to obtain funding to continue her PhD studies at the University of La Réunion and to perform portions of her research at the Entomology Unit of the FAO/IAEA Agriculture & Biotechnology Laboratory.

Jeremie Gilles, a consultant at the IAEA, has been working in the mosquito group since September 2009. The current target of the IAEA mosquito programme is to produce one million *An. arabiensis* males per day. To that end, essential data on the density of larvae per ml, the amount of diet needed, and the nature of the interactions between larvae are required on traits that are important in mass-production: survival, development rate and size. To address these complex interactions he has studied the effect of larval density and food concentration on the development and survival of *An. arabiensis* immature stages. Also, in the context of mass production and release, larval diet is a key factor for the quality of the produced males in terms of flight capacity, mating ability, and competitiveness. For these reasons, he has been working on the development of a new diet formulation for *An. arabiensis* larvae. This new diet should be affordable, readily available and provide good quality males. Finally, he is also doing a life-table analysis of the different strains of *An. arabiensis*, in particular the 5-33 GSS-V1 strain (Genetc Sexing Strain).

The La Réunion Island preliminary studies for the SIT feasibility project were boosted by initiation of research activities on the island with funding obtained by Institut de Recherche pour le Développement (IRD). Part of the funding, obtained from the French Ministry of Health, was used for two visits of project leadership and staff to the Agency to clarify roles and to identify further funding opportunities. The four year research phase into which the project is entering will determine whether SIT against *Anopheles arabiensis* on Réunion is feasible. On the basis of this programme, a second phase of more focused activities will be considered.

Staff from the mosquito group attended the European Mosquito Control Association meeting in Turin, Italy 9-13 May. They reported that because of the confluence of the spread of *Aedes albopictus* in Europe and the chikungunya epidemics on La Réunion and in northern Italy, the majority of the meeting presentations were devoted to this species. The Agency SIT programme is considering working on *Ae. albopictus* if funding becomes available. Until then, however, the activities remain largely focused on *Anopheles arabiensis*.

Reports

Meeting of the Technical Panel on Phytosanitary Treatments under the International Plant Protection Convention, 26-30 January 2009, Tokyo, Japan

The FAO/IAEA was invited to participate in the International Plant Protection Convention's (IPPC's) Technical Panel for Phytosanitary Treatments (TPPT) which recommends to the Commission of Phytosanitary Measures (CPM) quarantine phytosanitary treatments for use in international agriculture trade on a world-wide basis. A meeting is held generally once a year and this year's meeting was held in Tokyo, Japan.

The meeting was attended by 13 TPPT members, two representatives from the Japan and two representatives from the IPPC Secretariat. The 13 TPPT members are experts in various fields of research, development and application of postharvest phytosanitary treatments. They came from Argentina, Australia, Austria, China, Japan, Jordan, the Republic of Korea, New Zealand, South Africa, the UK and the USA.

The TPPT met to (1) review contributions from signatories for new internationally recommended phytosanitary treatments; (2) to draft responses to those submissions or to respond to requests for more technical supporting information; and (3) to discuss calls for new phytosanitary treatments.

All three activities mentioned above were carried out following presentation and review of 82 items including papers, submissions and recommendations. The items dealt with international phytosanitary treatments ranging from wooden packaging materials (e.g. crates and pallets) to fresh fruits, vegetables, cut flowers and planting material. Treatments reviewed included fumigation of wooden material with methyl iodide, phosphine and sulfuryl fluoride; microwave irradiation of wooden material; cold and heat (including vapour heat and hot water) treatment of fresh horticultural commodities and irradiation.

Of relevance to the FAO/IAEA were discussions and resolutions on submissions dealing with irradiation. Agenda items 35, 36, 37, 40 and 62 dealt with a submission and supporting documents put forward in 2007 by the USDA for "Generic irradiation treatments for all insects except lepidopteran pupae and adults (Insecta: Lepidoptera) in any host commodity". At the 2007 meeting of the TPPT a request for more information was drafted and subsequently sent to the USDA. These extra data were received by the IPPC Secretariat for discussion at the 2009 TPPT meeting.

The meeting resolved to ensure that quarantine treatments for plant products and their packaging that have been developed by some countries should be made available to other countries without the ability to conduct the necessary research and development themselves on a world-wide uniform basis. The necessity for bilateral agreement on these schedules will remain (for example pest lists will need to be drawn up by each exporting country) but the exporting country will have options (internationally acceptable quarantine schedules) set up by the IPPC through the CPM (as recommendations from the various Technical Panels).

Consultants Meeting to Develop a Design Concept for a Tsetse Fly Aerial Release System, 3-5 February 2009, Vienna, Austria

Several tsetse AW-IPM programmes with an SIT component are under development with the assistance of the IAEA and some of these programmes are anticipated to reach the stage of operational release of sterile males soon. There is, therefore, an urgent need for a functional aerial release system adapted to the specific requirements of tsetse SIT.

The first aerial release of tsetse flies was conducted on Unguja Island, Zanzibar for the elimination programme of *Glossina austeni*. For this the sterile males were placed into carton boxes, 50 to 100 flies per box, and the boxes were released by hand from a chute built into the floor of an aircraft. However, such a technique is not suitable, nor economical for use in larger areas.

Fruit flies and screwworms are normally released from the air as chilled and immobilized adult insects. This allows the easy handling of large numbers of insects so that large areas can be covered in one release flight. In principle any of the systems used for the release of fruit flies or screwworms could be adapted for tsetse release, but tsetse SIT presents challenges that make this difficult.

The first challenge is that tsetse field densities are much lower than screwworm and particularly fruit fly densities, requiring the release of only 5-7 flies per second compared with many hundreds for fruit flies. Achieving these low release rates, with adequate uniformity, would be difficult with existing systems. Secondly, the cost of producing tsetse flies is much higher than the production cost of fruit flies. For sterile fruit fly release, because of the much lower production cost, a certain level of fly loss is accepted but this level would not be acceptable for the much more expensive sterile tsetse flies.

A consultants' group meeting was, therefore, convened to review available current release systems and draw up an outline design for a system suitable for tsetse chilled fly release. The technical requirements of chilled tsetse release were listed and critical points in fly handling and holding, precision and monitoring of release rates, flight path length and flight endurance, maintenance, repair and

security assessed. Based on the requirements, the existing release systems were reviewed and assessed for their suitability for tsetse release. The meeting agreed that none of the existing systems could meet the requirements, although some components might be used in the development of a new system. Finally the meeting assembled a series of recommendations and guides for designing a system, principal amongst which was the recommendation that the tsetse flies should be held in small containers of just a few thousand flies each to minimize damage to the flies and improve the handling and distribution.

Subsequent to the meeting an initial design has been produced and a prototype will be ready for testing shortly.

Workshop on DNA Isolation and Detection of Tsetse Pathogens and Symbionts Using PCR, 9-13 February 2009, Bobo Dioulasso, Burkina Faso

The workshop on DNA isolation and detection of tsetse pathogens and symbionts using PCR was hosted by the Centre International de Recherche-Développement Sur l'Elevage en Zone Subhumide (CIRDES) and was attended by eight participants and three lecturers from eleven countries. Several oral presentations were given that provided an overview on general principles of the PCR, on the factors that might affect the obtained results, on the different applications of the PCR for the Salivary Gland Hyperplasia Virus (SGHV) work, and on the current progress of the work on *Wolbachia* and *Sodalis*.

Participants of the workshop on DNA isolation and detection of tsetse pathogens and symbionts using polymerase chain reaction (PCR), Bobo-Dioulasso, Burkina Faso.

Two sessions of tsetse dissections were organised, which focussed on the detection of hypertrophied salivary gland symptoms, on the separation of ovaries and testes, and on the collection of the haemolymph under aseptic conditions to initiate *Sodalis* cultures. Using the monitor connected to the microscope, all participants could view the dissection demonstrations, and were given later the opportunity to practice the dissections themselves. In addition, demonstrations were given on how to prepare slides to observe *Sodalis* bacteria under the compound microscope. In addition, several practical sessions were organised on DNA extraction for virus detection and demonstrations were given on extractions of the genomic DNA from the tsetse abdomen using the cetyltrimethylammoniumbromide (CTAB) for *Wolbachia* diagnosis and using the DNeasy kit (Qiagen) method for *Sodalis* diagnosis. Finally, there were three sessions on the use of PCR and how to detect the virus in the samples extracted by the manual method using two sets of primers. Methods were likewise demonstrated on detecting *Wolbachia* and *Sodalis* in the DNA samples extracted by the CTAB and DNeasy methods, and a comparison was made of the three different methods to detect the SGHV, *Wolbachia* and *Sodalis.*

Planning Meeting for Coordination of Activities of IRD, CRVOI and the FAO/IAEA in relationship to the Feasibility of Mosquito SIT for La Réunion, 22-24 March 2009, Vienna, Austria

La Réunion has many characteristics that are ideal for elimination of *Anopheles arabiensis* using the SIT: (1) The breeding areas are relatively small and well-defined by geographic barriers, (2) the numbers of mosquitoes are relatively low, (3) the infrastructure of transportation and communication is excellent, (4) a considerable amount of information regarding the location of breeding sites and seasonal abundance exists, and (5) an existing surveillance and control programme.

While the existing surveillance programme has effectively suppressed *Anopheles* mosquito populations near the highest human population densities, it is unlikely that these programmes will ever lead to eradication. Epidemics of chikungunya virus in 2006- 2008 renewed the focus on vector control, but now against *Aedes albopictus*. This vector is difficult to control, widespread on the island and is unlikely to be eliminated by current methods being applied for its control.

To discuss this issues, a meeting was organized with the participation of two French Scientists: Didier Fontenille (IRD) and Koussay Dellagi (CRVOI), with the objective to: (1) to clarify the specific roles of the parties in the SIT-Reunion Phase I project to study the feasibility of SIT and other control methods against *Anopheles arabiensis* and *Aedes albopictus;* (2) to identify high priority research activities for which no funds have been identified; (3) to identify possible sources of support including money and personnel; and (4) to outline a timetable of activities to be conducted related to the Agency participation.

As a follow up to this meeting a visit was conducted to La Réunion with the objective to participate in a project coordination workshop. This meeting was successful, helpful and necessary for all the partners of the SIT feasibility project; from the evaluations it was evident that the project is satisfactory in terms of the science and the

budget allocated to the entire project, although more can be done on both fronts. Solutions and alternatives to address the negative/weak points identified by the participants were proposed and discussed.

Aedes albopictus, *vector of chikungunya.*

The shortage of available and trained human resources was identified as one of the major hurdles of implementation and there was a consensus among the attendees that this issue be dealt with without delay. A regional meeting with the COI (Indian Ocean Commission) will be organised in September 2009 to introduce the various islands to the concept of mosquito SIT. The COI expects great interest in SIT from these islands.

Finally, the working group recommended the establishment of a technical advisory group for the supervision and the coordination of the research activities and a steering committee, composed of the interested institutions of La Réunion that will monitor the progress of the project and liaise with the donors, community and technical advisory group. Committee meetings will take place every year.

Fourth Session of the Commission on Phytosanitary Measures, International Plant Protection Convention, FAO. 30 March- 3 April 2009, Rome, Italy

From March 30 to April 3, the Fourth Session of the Commission on Phytosanitary Measures (CPM) took place at FAO Headquarters in Rome, where the International Plant Protection Organization (IPPC) Secretariat is based. There were ca. 350 participants, including 109 out of 170 representatives of the Contracting Parties, regional plant protection organizations, specialized UN agencies and other international and regional institutions related to plant protection.

During the meeting the CPM accepted to integrate the topic "Establishment of Pest Free Places of Production and Pest Free Production Sites for Fruit Flies" into the recently drafted standard "Systems Approaches for Pest Risk Management of Fruit Flies".

The following International Standards for Phytosanitary Measures (ISPM) were revised and adopted:

- amendments to ISPM No. 5 "Glossary of Phytosanitary Terms"
- appendix to ISPM No. 5 "Glossary of Phytosanitary Terms on Terminology of the Convention on Biological Diversity (CBD)" in relation to the "Glossary of Phytosanitary Terms"
- revision of ISPM No. 15 "Guidelines for Regulating Wood Packaging Material in International Trade"
- adoption as annexes to ISPM No. 28 "Phytosanitary Treatments for Regulated Pests" of eight irradiation treatments: six related to several species of fruit flies (*Anastrepha ludens*, *A. obiqua*, *A. serpentina*, *Bactrocera jarvisi*, *B. tryoni* and *Rhagoletis pomonella*), one related to the codling moth (*Cydia pomonella*), and most importantly one dealing with the generic irradiation treatment for fruit flies of the family Tephritidae
- new standard "Categorization of Commodities According to their Pest Risk" (ISPM No 32).

To see the complete list of the 32 ISPMs and download the documents in various languages, please visit the IPPC website at: www.ippc.int/IPP/En/default.jsp.

Annual Meeting of the Standards Committee of the Commission on Phytosanitary Measures, International Plant Protection Convention, 4-8 May 2009, Rome, Italy

The meeting took place at FAO Headquarters in Rome from 4–8 May 2009. There were 24 officially nominated Members representing the FAO's seven regions. During the meeting the SC revised the draft ISPM on "Systems Approaches for pest risk management of fruit flies (Tephritidae)" which after minor changes was approved to be sent for country consultation. Also the draft specification for an "Experimental protocol to determine host status of fruits to fruit flies (Tephritidae)" was revised. The draft was modified to reflect the importance of the host status in Pest Risk Analysis, including Pest Risk Management. The SC approved the draft to be sent for country consultation.

Consultants Meeting on Development of a Standard Planning and Design Format for New SIT Mass-Rearing Facilities, 20-24 April 2009, Vienna Austria

The first insect mass-rearing facility was built in Florida for screwworm fly in the late 1950s. Over these last five decades the Sterile Insect Technique (SIT) has also progressed for other pest insects from the laboratory bench to the large scale "factory" level of sophistication. Facilities around the world have also been built for different insects (http://www.ididas.iaea.org/IDIDAS/default.htm) and they are all designed to produce mass-reared, sterile

insects, but each one differs from the other in design and resource usage. Unfortunately, some facilities have been found to be deficient in design and resource use and, therefore, they needed considerable redesign or their cost-effectiveness for SIT has been less than optimal.

Despite this undesirable occurrence, SIT has been demonstrated to be very successful in the suppression, containment, eradication or prevention of target pest insect populations. Consequently a number of national authorities are now looking for advice on building their own facilities for SIT programmes against a wide range of pest insect species. They need to know, among other related issues, how to determine the optimum size, the best location and the most cost-efficient design and equipment. The answers to these queries vary considerably with location, climate and the environment, the scale and the target pest, the funding available and the Government's objective, and many other variables.

When national or regional authorities, who wish to build their own SIT mass-rearing facilities approach existing facilities for advice on how to start they are confronted with a very wide range of different styles of planning and design, and types of construction and energy efficiencies. In addition, each existing facility will list a series of deficiencies of which to be aware. Considering the cost to build, run and maintain such a facility, a standard format for planning and design of mass-rearing facilities for SIT purposes would be extremely useful for FAO and IAEA Member States.

Based on the experience of managers of existing mass-rearing facilities, there are some common, but important, considerations that should be taken into account to facilitate the task of designing a cost-effective mass-rearing facility. There are many, but some of the main concerns are:

- Site selection
- Design of buildings for optimal process, product and staff flow
- Safe storage of equipment and consumables
- Appropriate warehouse space for sufficient stocks
- Backups for key equipment, processes, and utilities
- Balancing requirements and costs for automation and manual labour
- Balancing investment and future energy efficiencies and maintenance costs
- Waste treatment, disposal and impact on the environment
- Requirements for research, quality control, hygiene, staff amenities and occupational health and safety

A consultants meeting was therefore organised at the IAEA, Vienna from 20-24 April 2009, to discuss the requirements for a standard process for planning and designing new mass-rearing facilities and the activities required to further develop such a standard. Consultants presented information on rearing facilities including flow patterns for staff, equipment and insects as well as highlighting problem areas and solutions.

Following the presentations discussions were held on how to set up a list of important issues that need to be addressed for new insect rearing facilities and how to evaluate their importance. The FAO/IAEA Interactive Spreadsheet for Design and Operation of Insect Mass Rearing Facilities, which is in its internal review phase for publication, was then introduced as a model for new facility planning and design. The spreadsheet was examined in detail at the meeting and some suggestions for modification and improvement were made. This spreadsheet has not been constructed to include work flow considerations. These were discussed and will be incorporated in new facility planning and design phases in addition to the results from spreadsheet.

Meeting of Programme Against Trypanosomiasis (PAAT), Programme Committee Meeting, 7-8 May 2009, Smolenice, Slovakia

FAO organised and the Slovak Academy of Sciences (SAS) kindly hosted the 13th Meeting of the Programme Committee of the Programme Against African Trypanosomiasis (PAAT) at the SAS Conference Centre in Smolenice, Slovak Republic, 7–8 May 2009.

The meeting reviewed progress and issues that require particular attention by the international tsetse and trypanosomosis (T&T) 'community' under ongoing African Development Bank (AfDB) supported national efforts to create T&T free zones, which are part of the Africa Union coordinated Pan-African Tsetse and Trypanosomosis Campaign (AU-PATTEC).

Participants of the meeting of Programme Against Trypanosomiasis (PAAT), Programme Committee Meeting, Smolenice, Slovakia.

The participants also discussed training needs on T&T intervention and related relevant fields and identified areas for which PAAT should either generate guidelines for standardised feasibility assessment, for example the sequential aerosol technique (SAT) for tsetse control, or where PAAT, in close consultation with PAAT international partners, should generate standards for quality assurance, for example for trypanocidal drugs or for tsetse control fabric.

Announcements

Announcements of FAO/IAEA Regional Training Courses

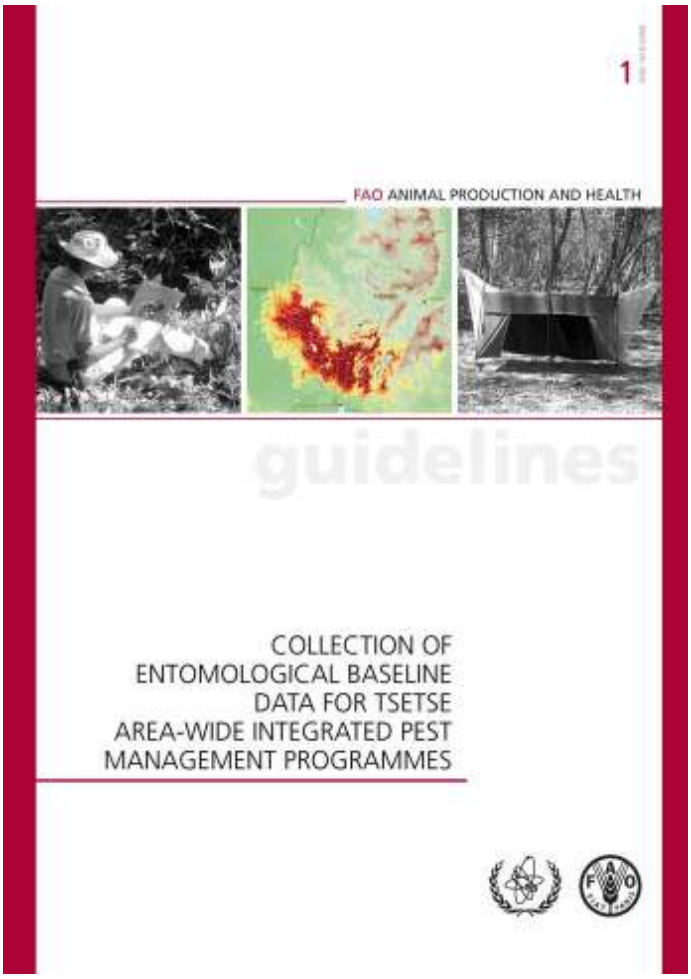
During the second semester of 2009, the following FAO/IAEA Regional Training Courses will take place:

- *Standardised Collection and Processing of Entomological and other Relevant Geo-Referenced Data as Needed in SIT-Based AW-IPM Campaigns against Tsetse* (under TC Project RAF5060). 26 October – 13 November 2009, Bobo Dioulasso, Burkina Faso (nominations must be received at the IAEA by 31 July 2009).
- *Area-wide Integrated Pest Management of Tephritid Fruit Flies* (under the TC Project RAS5052). 2-6 November 2009, Fuzhou, China (nominations must be received at the IAEA by 15 August 2009).
- *Surveillance of Tephritid Fruit Flies in Support of Planning and Implementing Area-wide Integrated Pest Management Programmes* (under the TC Project RAS5052). 23-27 November 2009, Bangkok, Thailand (nominations must be received at the IAEA by 31August 2009).

Application procedure: Nominations should be submitted on the standard IAEA application form for training courses/workshops (downloadable from: http://www-tc.iaea.org/tcweb/participion/astrainee/default.asp). Completed forms should be endorsed by and submitted through the official channels established (namely the Ministry of Foreign Affairs, the National Atomic Energy Authority, the Office of the United Nations Development Programme, or the office of the FAO Resident Representative or the Ministry of Agriculture). The completed forms must be received by the International Atomic Energy Agency, P.O. Box 100, A-1400 Vienna, Austria. Advance nominations by facsimile (+43-1-26007), or e-mail (official.mail@iaea.org) are welcome.

New FAO/IAEA Guidelines on the "Collection of Entomological Baseline Data for Tsetse Area-wide Integrated Pest Management Programmes"

Several sub-Saharan Member States have expressed the intention to embark on national or regional programmes to create sustainable tsetse-free zones under the umbrella of the PATTEC initiative. It is imperative that these programmes be implemented using an area-wide integrated pest management approach (i.e. targeting an entire population within a circumscribed area) for the results to be sustainable. Most area-wide integrated pest management (AW-IPM) programmes are technically complex and require in-depth knowledge about the ecology and population dynamics of the target insect.



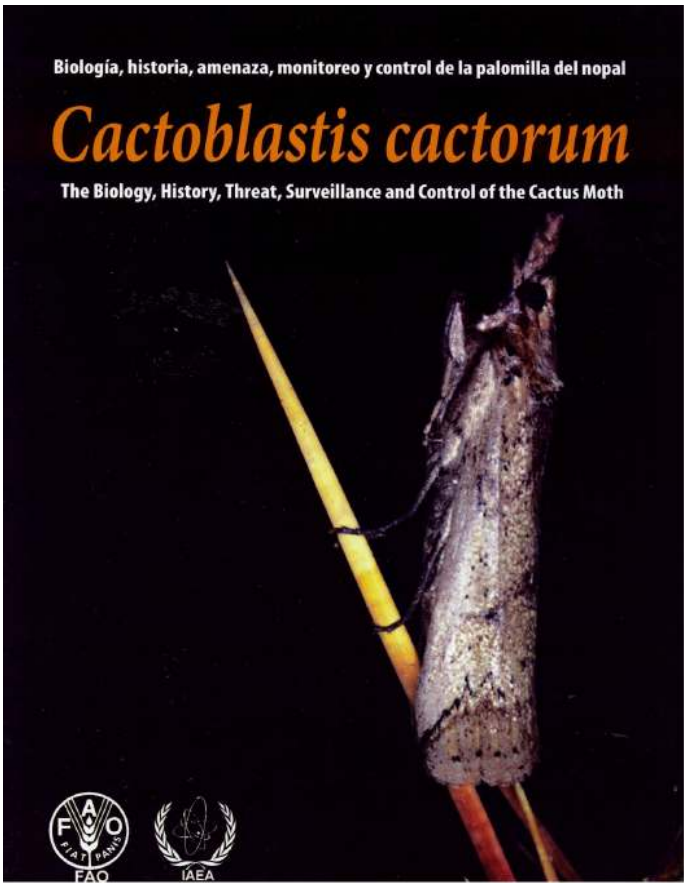
In that respect, new detailed guidelines were developed on the collection of entomological base line data within the context of tsetse AW-IPM and published under the FAO Animal Production and Health series. As most Member States are in the second phase of the phased conditional approach (i.e. feasibility study), the publication of this document comes timely.

The document is composed of three parts: (1) the first provides an overview of the basic biology and anatomy of the tsetse fly, and is intended for those who are new to the field of tsetse, (2) the second part covers the planning and preparation of a baseline survey, and is intended for use by senior entomological staff who will be involved in the actual development of the survey strategy, and (3) the third part deals with the implementation of a survey and targets technicians and entomologists in the field.

The guidelines make reference to modern spatial tools such as GPS, remote sensing and GIS, emphasise the need for good land use land cover maps for the planning and implementation of a survey, and provide details of a new Access-based data base (Tsetse Intervention Recording and Reporting System) that has been specifically developed for tsetse surveys and monitoring purposes.

New FAO/IAEA Book "The Biology, History, Threat, Surveillance and Control of the Cactus Moth"

During the Regional Program for the Eradication and Monitoring of the Cactus Moth in Yucatan Peninsula, Mexico, and under the Technical Cooperation project "National Prevention Campaign Against Cactus Moth" (MEX5029) a 93 pages book entitled "The Biology, History, Threat, Surveillance and Control of the Cactus Moth" was produced with the collaboration of the experts H. Zimmermann, S. Bloem and H. Klein as authors. The book is bilingual (English and Spanish) with the coordination of Mayra Pérez Sandi Cuen.



Cover of published book (bilingual: English and Spanish) on cactus moth.

Call for Submission of Research Proposals for a new Coordinated Research Project on Development of Generic Irradiation Doses for Quarantine Treatments

Regulatory authorities and scientists from many internationally recognised institutions have studied research data on the effectiveness of irradiation as a quarantine treatment against a large range of insect pest species infesting various fruits and vegetables. These authorities have concluded that generic doses are possible, negating the need to develop or validate specific irradiation doses tailored to individual arthropod species.

In 2003, the International Plant Protection Convention approved the International Standard for Phytosanitary Measures Guidelines for the Use of Irradiation as a Phytosanitary Measure (ISPM 18), which facilitated the start of international trade in irradiated fresh fruits between countries such as Australia and New Zealand in 2005 and between India and the USA in 2006. Despite these successes, important gaps in knowledge still remain and a previous CRP on Irradiation as a Phytosanitary Treatment of Food and Agricultural Commodities recommended that generic doses for major arthropod groups be investigated. There are a number of other critical pests of quarantine significance from non fruit fly species and comparatively little research has been performed on their susceptibility to inactivation by irradiation. These include mites, thrips, mealybugs, weevils, leaf miners, aphids and scale insects.

This new 5-year Coordinated Research Project will establish validated irradiation doses for such non-fruit fly species of quarantine significance. The project results will strengthen existing irradiation standards developed by the International Plant Protection Convention, thereby facilitating international trade for various fruit, vegetable and other commodities through the use of generic irradiation doses for a wide range of quarantine pests.

This CRP will be managed by the Food and Environment Protection Subprogramme of the Joint FAO/IAEA Division, in conjunction with technical support from the Insect and Pest Control Subprogramme. Information on the IAEA Coordinated Research Programme and how to apply for research contracts and research agreements can be found at http://www-crp.iaea.org/.

Call for Submission of Research Proposals for New CRP on Development and Evaluation of Improved Strains of Insect Pests for SIT

The sterile insect technique (SIT) is an increasingly important component of area-wide integrated pest management (AW-IPM) programmes for certain key insect pests. The use of this technology is meeting the needs of Member States as they deal with the impact of globalisation and climate change on the increasing problem of invasive pest species. The SIT has the ability to eradicate new outbreaks of pests so as to prevent their establishment. Among the major threats to agricultural production and trade are fruit flies and Lepidoptera pests and these are major targets for ongoing and future SIT programmes. Globalisation and climate change are also leading to an increase in new outbreaks of mosquito borne diseases and major efforts are underway to develop new control techniques, including the SIT, for the mosquito species responsible for these outbreaks.

Operational use of the SIT continues to reveal areas where new technologies are needed to improve efficiency and thus lead to more cost effective programmes. There are many options for increasing the efficiency of the SIT,

e.g. improved mass-rearing, release technology, quality control, etc, even when operational programmes are already underway. However, one critical area identified by programme managers where important advances can be made concerns the improvement of the strains themselves that are being reared and released. One example of how strain improvement can significantly enhance efficiency has been the use of genetic sexing strains (GSS) in SIT programmes for the Mediterranean fruit fly *Ceratitis capitata*. A technology developed through the Agency's CRP programme with support from the Entomology Unit of the FAO/IAEA Agriculture and Biotechnology Laboratory in Seibersdorf.

SIT programmes are currently being implemented for several very important fruit fly and Lepidoptera species where the development of improved strains would lead to major increases in efficiency of the SIT component. This new CRP will focus on these species. For mosquitoes, where released sterile females would still act as disease vectors, strains such as that developed for the Mediterranean fruit fly which allow the release of only males are essential for the development for SIT.

Strain improvement can be achieved using different approaches, but all rely on some form of stable genetic change being introduced and maintained in the improved strain. Genetic change can be introduced either using classical genetics (as in the case of medfly GSS) or modern biotechnology, specifically genetic transformation. Both approaches have advantages and disadvantages relating to transferability of systems between species, stability in mass-rearing, regulatory approval etc.

Of significance to the use of genetic transformation, is the adoption of a standard (RSPM No. 27) produced by the North American Plant Protection Organisation (NAPPO) which provides guidelines for the confined release of transgenic insects. This confinement includes transgenic insects that have been sterilized by irradiation in SIT programmes.

The two most important areas which can be considered as targets for the development of improved strains for SIT field programmes are 1) strains that allow for the production of males only for sterilization and release (GSS) and 2) strains that incorporate a genetic marker to reliable and cheaply differentiate released insects from wild insects (marker strains). The major outcome of the use of these improved strains will be a more cost-effective and efficient implementation of SIT programmes for major insect pests of agriculture and human health.

Among the expected proposals for Research Agreements and Research Contracts, preference will be given to institutions having specialists in:

1. Classical genetics of mosquitoes, fruit flies and Lepidoptera including the isolation of selectable genes and chromosome translocations
2. Isolation of sex-specific gene promoters and lethal genes in pest species
3. Using genetic sexing strains in operational SIT programmes
4. Development of marker strains in insect pests.

The specific objectives of the CRP are:

1. To transfer existing technologies (genetic and/or molecular) for the construction of sexing strains in key insect pests
2. To develop and integrate molecular and genetic marker strains to monitor released insects in the field, to tag transgenes and to determine the mating status of females in the field
3. To establish targeted and stabilized transgenic strains to expand the safe and effective use of improved strains for SIT
4. To encourage and attract participants to the CRP in the field of Lepidoptera genetics.

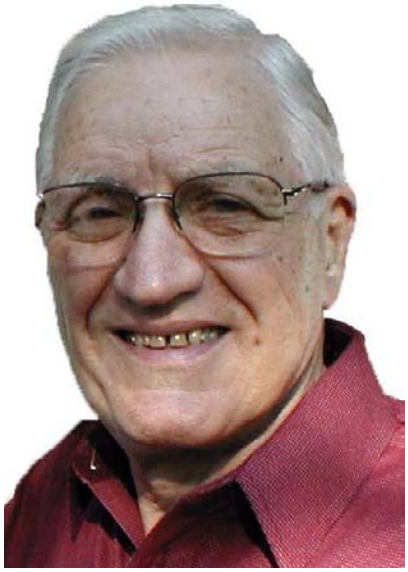
The expected duration of the CRP is 5 years (2009-2014) and the first RCM is planned for November 2009 in Vienna, Austria. For application please contact Gerald Franz (g.franz@iaea.org). Details of the IAEA Research coordination programme and the necessary application forms can be found on the IAEA web site (http://www-crp.iaea.org/).

News

IN MEMORIAM

Claude Henri Schmidt
1924 – 2009

Dr. Claude Henri Schmidt, Research Entomologist and a former program leader and administrator within the Agricultural Research Service, US Department of Agriculture, died unexpectedly at his home in Fargo, North Dakota on February 4, 2009. He was 84 years of age.



From January 1962 to January 1964, Dr. Schmidt served in the International Atomic Energy Agency (IAEA), Vienna, Austria as Chief Entomologist in the Department of Research and Isotopes. At that time the United Nations system was wrestling with how to create an effective institutional platform for employing ionizing radiation and radioisotope in solving problems related to food and agriculture. Largely in response to President Dwight Eisenhower's "Atoms for Peace" speech to the UN General Assembly in December 1953, the IAEA had come into being in 1957. Also, in 1957 the Food and Agriculture Organization (FAO) had established an Atomic Energy Branch in its Agriculture Department in Rome, Italy. By 1959 the IAEA had created an Agriculture Unit within its Department of Research and Isotopes. Dr. Schmidt was part of the team that was determined to merge these FAO and IAEA thrusts into one effective program, and thus in October 1964 was established the Joint FAO/IAEA Division of Atomic Energy in Agriculture (currently the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture).

In anticipation of the formation of the Joint FAO/IAEA Division, Dr. Schmidt and his colleagues established the Insect and Pest Control Section in 1963 and recruited Dr. Jack Keller from Mississippi to serve as Section Head. Also in 1963 Dr. Schmidt and his colleagues established the Entomology Unit within the IAEA Laboratory in Seibersdorf, Austria near Vienna and recruited Dr. John Monroe of Australia to serve as its first Director.

In October, 1962, Dr. Schmidt and his colleagues had assembled a Panel of Experts in Vienna to develop a plan for "Insect Control by the Sterile Male Technique", which resulted in the Section's first Coordinated Research Program (CRP) to develop this technology for use against tropical fruit flies, tsetse flies and the olive fly. Soon thereafter, Dr. Schmidt and his colleagues convened an "International FAO/IAEA Symposium on the Use and Application of Radioisotopes and Radiation in the Control of Plant and Animal Insect Pests" in Athens, Greece in April 1963. This Symposium helped to chart the way forward in the application of radioactive tracers to studies in insect ecology, the metabolism of pesticides and their behaviour and fate in the environment, and in the use of the sterile insect technique.

In response to the critical need for advanced training of scientists and technicians in developing countries, Dr. Schmidt and his colleagues convened the first Interregional FAO/IAEA Training Course on "Use of Radiation and Radioisotopes in Entomology" at Gainesville, Florida in October, 1963. This course was an instant success and it was repeated every second year until 2006 with generous support of the US Department of Energy, the US Department of Agriculture, the Florida Department of Agriculture and Consumer Services and the University of Florida.

Dr. Schmidt was a very gracious person of sincere goodwill, warm, kind, and enthusiastically devoted to his family, to his entire team, to his many friends and to human welfare generally. He was born on May 6, 1924 in Geneva, Switzerland to Roger Augustus Schmidt, a homeopathic medical doctor, and Lucette Wuhrmann Schmidt. The family moved to San Francisco, California in 1935 when Claude was 11 years old.

After serving in the US Army in World War II and also the Korean War, he enrolled in the Iowa State College Graduate School where he earned a Ph.D. in Entomology. Immediately upon receiving the Ph.D., Dr. Schmidt joined the Agricultural Research Service in Orlando, Florida and conducted research on insect repellents and on the radiation biology of mosquitoes.

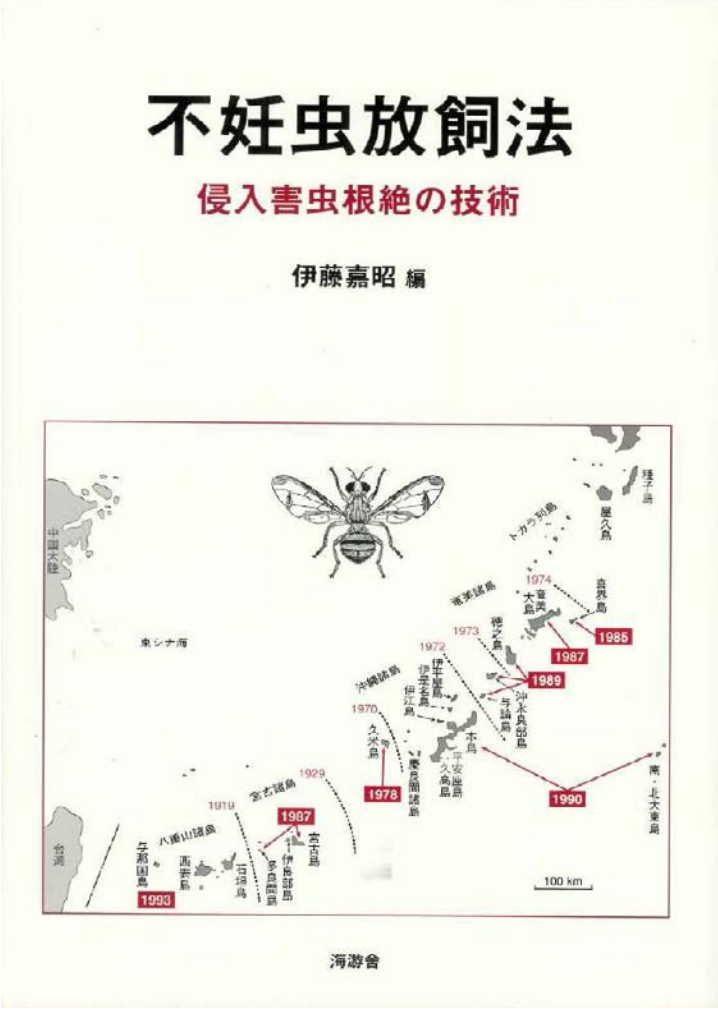
Upon Dr. Schmidt's return to the USA from Vienna, he was selected to create an Insect Physiology Section in the Metabolism and Radiation Research Laboratory, Fargo, North Dakota and later served in Beltsville, Maryland as Chief of the Insects Affecting Man and Animals Research Branch, Entomology Research Division, Agricultural Research Service. Dr. Schmidt served in various administrative capacities until his retirement in October of 1988. After retirement, Dr. Schmidt remained active in state and community affairs, especially those pertaining to the control of insect vectors of disease.

Source: Waldemar Klassen

Sterile Insect Release Method: A Technique for Eradication of Introduced Insect Pests

A book edited by Prof. Yosiaki Itô was published by Kaiyusha Publication Company in Tokyo in 2008 (in Japanese, see front cover pictured). The 327 page book entitled "Sterile Insect Released Method: A Technique for Eradication of Introduced Insect Pests" deals with 3 major issues: (1) Basics of SIT, including the history of the SIT and successful cases of eradication around the world; (2) Melon fruit fly (*Bactrocera cucurbitae*) Okinawa eradication programme and lessons learned in terms of modelling, mass production, mating behaviour quality control, genetic quality control of colony, sperm competition and cryptic female choice, and dispersal; (3) Advances made in the pilot eradication project against sweet potato weevil (*Cylas formicarius*) by using a combination of male annihilation by sex pheromone and SIT.

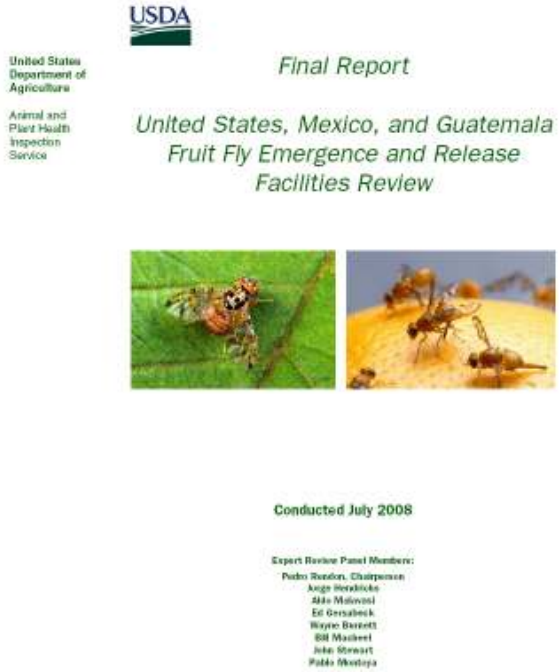
Source: Yosiaki Itô (*book editor*)



Cover of SIT book edited by Y. Itô.

United States, Mexico, and Guatemala Fruit Fly Emergence and Release Facilities Review.

This review is a summary of the current status and performance of all APHIS-USDA fruit fly emergence and release facilities in the United States, Mexico, and Guatemala. It is based on site visits and discussions with facility staff and program managers. The review contains recommendations for each emergence and release facility (ERF). An international expert panel conducted the site visits to Sarasota, FL; Edinburg and Harlingen, TX: Los Alamitos, CA; Tijuana, Reynosa, and Tapachula, Mexico, and Retalhuleu, Guatemala in July 2008 (see front page of the report below). For the complete report please visit :http://www.aphis.usda.gov/plant_health/plant_pest_info/fruit_flies/downloads/facilities-review.pdf.



The threat from exotic fruit fly (Diptera: Tephritidae) entry and establishment in the United States remains high due to a number of factors. APHIS responds to exotic fruit fly risks with an integrated prevention, and regulatory activities. To prevent establishment of the Mediterranean fruit fly (*Ceratitis capitata*) and the Mexican fruit fly (*Anastrepha ludens*), APHIS and their cooperators operate domestic and off-shore sterile insect technique (SIT) programs in high risk areas. The transport, emergence feeding and handling of sterile fruit fly adults and their aerial distribution in the target area constitute the final steps of the SIT process. Therefore, emergence and release operations are critical to the overall success of SIT programs.

Emergences and release facilities operated by APHIS and its cooperators require the following:

- Modernization to implement new technologies, efficiencies, and worker safety.
- Standardization of operating procedures and quality control assessments.
- Periodic review by an independent international panel for quality assurance

The goal of this review is to maintain sterile fly quality through improvements in the operational efficiency and cost-effectiveness of current fruit fly emergence and release programs. Recommendations in this review were based on quality control guidelines in Product Quality Control and Shipping Procedures for Sterile Mass-Reared Tephritid Fruit Flies (FAO/IAEA/USDA 2003) and the Guidance for Packing, Shipping, Holding and Release of Sterile Flies in Area-wide Fruit Control Programmes (FAO/IAEA 2007).

Source: APHIS-USDA (*final report*)

Screwworm SIT Pilot Project at the Border of Brazil and Uruguay

Screwworm, which affects animals and humans, is present in all countries of South America, except Chile, and in 2002 alone caused losses estimated at more than 3 600 million dollars, without considering the problems to public health causes.

A small pilot project has been implemented in an area on the border between Brazil and Uruguay, with the participation of these countries and Paraguay, the FAO, the Inter-American Development Bank (IDB) and the American-Mexico Commission for the Eradication of Screwworm (COMEXA).

The project seeks to train staff and to demonstrate suppression of screwworm. Application of the sterile insect technique as part of an integrated approach is an excellent example of the peaceful use of atomic energy to serve the farmer, and of the latest technological advances, without risk to human health.

The screwworm is characterized by the presence of fly larvae in wounds on live animals, and can also affect humans. If these infections are not addressed, they are often fatal. The sterile insect technique has great advantages because it is environmentally friendly, harmless to humans, and despite a high initial investment has a good cost-benefit ratio, which in past programs was at 1:10 for the United States and 1:4 for Mexico, i.e. for every dollar invested, 10 were recovered in the U.S. and 4 in Mexico.

During the pilot demonstration test for South America (see logo in the figure below), which began in February 2009, sterile insects travelled from Mexico (where they are produced by COMEXA), to the border between Uruguay (Artigas) and Brazil (Rio Grande do Sul), where they were subsequently released by small aircraft. The process was repeated for nine consecutive weeks.

Logo of the pilot test project conducted at the border of Brazil and Uruguay (www.gusanobarrenador.org.mx).

FAO supported the successful use of the sterile insect technique when the screwworm caused an international health emergency when it was accidentally introduced from its original habitat in the American Continent to Libya in 1988. On that occasion, FAO led a successful eradication program with other partners and the assistance of international donors, avoiding the establishment in Africa and spread to other continents.

Source: Moises Vargas, FAO Regional Office Santiago (http://www.rlc.fao.org/, 23 February 2009).

The USA declares Mendoza Fruit Fly-Free (Argentina)

After three years, technicians from the Department of Agriculture in the United States (USDA-APHIS) gave the nod to ISCAMEN regarding the effectiveness of the programme against Mediterranean fruit fly in Valle de Uco and South Oasis of Mendoza Province.

This means that once the positive outcome of the audit is regulated, the whole apple, pear, cherry, plum and peach of that origin may enter the U.S. market without the requirement of quarantine treatment, something which the Government could begin to materialize before the end of the year.

For operators is signifies the reduction in marketing costs which are involved in the quarantine treatment in cold chambers (17 days minimum) and shipping times. During the first quarter of this month, a commission of four technicians of the USDA also audited the new bioplant for the production of sterile insects located in Santa Rosa.

Moreover, experts have assessed the actions of the monitoring program for the eradication of the pest in the oases

North, East and Valle de Uco, and internal check posts and sanitary barriers. The audit also included an evaluation of the Risk Mitigation System, designed to prevent re-infestation with Mediterranean fruit fly in the declared free zones in both Mendoza and Patagonia.

Indeed, the Minister of Production, Guillermo Migliozzi, highlighted the history of this region, which achieved recognition from the U.S. government in 2007 and for the past two seasons has been exporting their products without drawbacks. This will represent an extension northward of the area recognized as fruit fly free in Patagonia and reduce the costs of marketing.

In the ranking of destinations, the U.S. is the biggest market in volume and foreign exchange for the province.

Potential Impact: Industry estimates have allowed a projection of future commercial benefits for Mendoza. With the example of the Upper Black River Valley in Patagonia, it is estimated that pome fruit growers are saving a dollar per box of 18 kilos (at an average price of $13), leaving aside the treatment of the pest and coordination of maritime firms.

Source: Losandes.com.ar (*6 April 2009*)

APHIS-USDA Meets with California Cotton Pest Control Board

On December 16, 2008, APHIS-USDA representatives met with the California Cotton Pest Control Board in Fresno, California, to discuss the progress in the pink bollworm eradication efforts. All reports on the Pink Bollworm Area-Wide Eradication Program, which includes the release of sterile moths, indicate that the program has been highly successful in the cotton-growing areas of Arizona, California, Texas, New Mexico, and northern Mexico. Native pink bollworm populations were reduced in excess of 90 percent in most of the pink bollworm eradication zones.

Source: Stephanie Bloem (*USDA*).

Adult of pink bollworm Pectinophora gossypiella.

USA: California State considers battling apple moths with sterile apple moths

Federal agriculture officials have begun discussions with grape growers in the Carneros wine region about conducting the state's first pilot program to release sterile light brown apple moths in infested lands on the border of Sonoma and Napa counties.

While no decision has been made, agricultural leaders in both counties are voicing support for a field trial to provide data for what may become the main method for eradicating the apple moth in California.

"What they need is some on-the-ground information," said Dave Whitmer, Napa County's agricultural commissioner. He said farmers and environmentalists have told him they support the use of sterile moths, and the trial could provide "some pest management benefit" to growers in the Carneros region.

The apple moth, an insect originally from Australia, was first confirmed in California two years ago. The federal government has allocated $75 million to fight the pest, which officials maintain can attack more than 250 crops and such native species as cypress and oak trees. The larvae damages fruit by feeding on the plant surface. Ag officials say the moth also can deform young oak and cypress seedlings and damage new growth in forest canopies.

The state has found 25 apple moths in Sonoma County and currently has established quarantine areas near Sebastopol and in the south county, the latter lands within a boundary that extends east through Napa County nearly to Benicia. The area suggested for the trial lies within that quarantine area.

Critics dispute that the moth is a threat. Last year they succeeded in stopping government efforts to conduct aerial spraying with a synthetic pheromone designed to disrupt mating. More recently, critics have urged the federal government to downgrade the danger level of the pest, a step that would end the quarantines and the accompanying rules meant to ensure crops going to market are free of the pest.

Instead of pheromone spraying, state and federal officials last year announced that they would pursue a program to release millions of sterile apple moths. That technique, which would prevent the insect from producing offspring, has been used with such pests as the Mediterranean fruit fly and the pink bollworm.

Source: pressdemocrat.com (*1 April 2009*)

Perfumed fruit flies lead pest moths astray

Applecross and Dalkeith, Western Australia residents may have previously noticed bright red objects hanging in their local street trees.

These were traps for the native orchard pest - light brown apple moth, part of a Department of Agriculture and Food trial to develop better ways to eradicate outbreaks of insect pests in urban areas.

Department senior technical officer Ian Lacey said in an innovative approach to reduce the moth population, sterile fruit flies were used to confuse the male moths and prevent them from mating.

Mr Lacey said female moths attracted male moths by releasing a pheromone scent and creating a perfumed trail for the males to follow.

"In the mating disruption trial, thousands of sterile male fruit flies were released carrying minute amounts of moth pheromone on their bodies," he said.

"The male moths were attracted to the pheromone-laced fruit flies and were unable to find the female moths."

Technical officer Jeremy Lindsey releases pheromone treated fruit flies in Dalkeith.

Mr Lacey said the department would like to thank the local residents for their cooperation and interest in the trial.

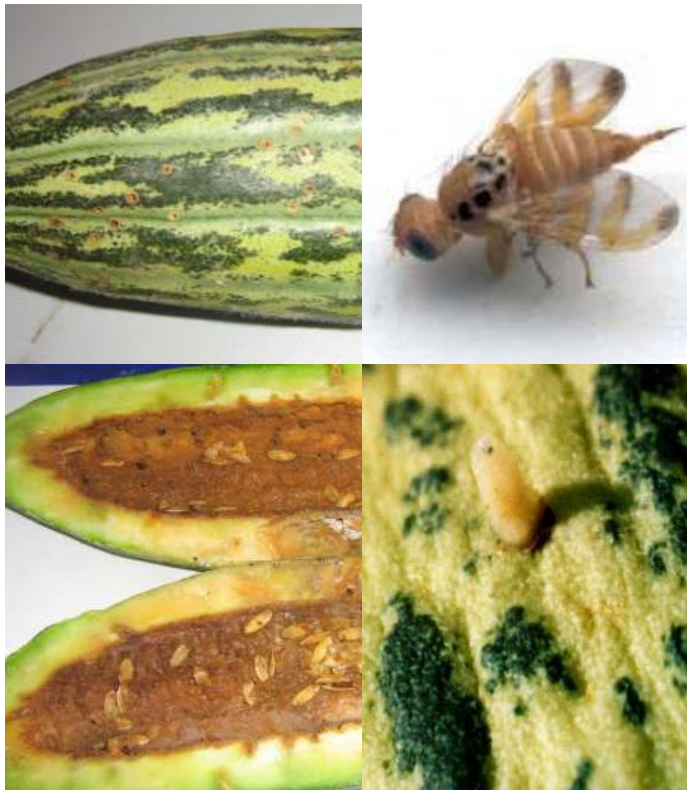
Source: http://www.agric.wa.gov.au (*5 May 2009*)

Workshop organized by German Technical Cooperation (GTZ) for the Integrated Control of the Baluchistan Melon Fly in Central Asia

The Baluchistan or Russian melon fly, *Myiopardalis pardalina* (Diptera: Tephritidae) is an important pest of melon crops in Turkey, Iran, Armenia, Azerbaijan, Afghanistan, Pakistan and north India. It appears to have invaded Central Asia (Turkmenistan, Uzbekistan, Kazakhstan, and Tajikistan) within the last 10 years. The original range of the fly was the Middle East, Caucasus and Western Asia where it has been known for at least 100 years. As a result of the spread of the pest, melon production has been dramatically reduced in those countries where it has recently become established mainly as a result of the farmers having little or no understanding, or indeed knowledge, of the pest and very little capacity to control the fly.

The melon sector has been badly affected and the level of exports to Russia and other markets been severely reduced resulting in reduced income to the farmers and foreign earning for the countries concerned. A number of countries have begun to research the impacts and methods of control for this pest sponsored by a number of agencies including the FAO in Afghanistan and GTZ in Uzbekistan in the autonomous Republic of Karakalpakistan. These trials have yielded some encouraging results which appear to offer some hope for successful management of this pest in those countries that are just beginning to suffer the effects.

A workshop was organized by GTZ, whose objective was to bring together representatives from those countries currently facing the problem of the Baluchistan melon fly, those that already have some experience with the Baluchistan melon fly, and international experts who have been working more broadly on fruit fly control projects. There were participants from: Azerbaijan; Iran; Turkey; Armenia; Tajikistan; Kazakhstan; Turkmenistan; Afghanistan; and Uzbekistan.



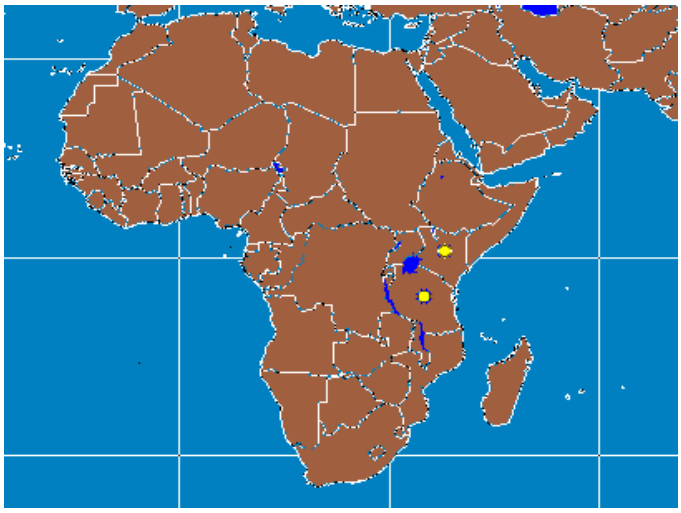
Baluchistan melon fly, Myiopardalis pardalina. *Top right: Adult female; top left: melon showing the larvae exit holes; bottom right: larva exiting the fruit for pupation; bottom left: damage caused to the fruit (photos by: Galiya Maussumbayeva (top and bottom left), Nassar Farrar (top right), and Elmurad Toreniyasov (bottom right).*

The workshop was intended to provide a mechanism whereby information, experience and control strategies could be exchanged and a set of general recommendations put together to provide guidance on the control of Baluchistan Melon Fly in these (and other) countries. The participants are responsible for disseminating this information to growers on return to their own countries. The longer term objective was that participants should continue to network and provide new information to each other, as it becomes available, and share the development of new strategies that may prove effective against Baluchistan melon fly.

Source: GZT (*report of the workshop by Jon Knight*)

The Solanum Fruit Fly, *Bactrocera latifrons*, in Africa: its Origin, Distribution, Host Plant Specificity and Interspecific Competition in Tanzania

The Solanum fruit fly *Bactrocera latifrons* (Hendel) was detected for the first time in Tanzania in 2006. It is an invasive fruit fly pest of Asian origin that was recently introduced to the African continent. Given its pest status, it is of major concern to African horticultural activities.



Current Bactrocera latifrons *distribution in Africa (www.africamuseum.be/fruitfly/AfroAsia.htm).*

Dissemination of information on this, and related pests was deemed necessary in order to inform the African agricultural community on the presence of this new pest species. With this objective a web page was developed (www.africamuseum.be/fruitfly/AfroAsia.htm) with support from FAO/IAEA and put on-line in October 2007. It was decided to incorporate information for all introduced *Bactrocera* species currently found on the African continent. The website contains information on the following topics: Recognition of the group; separation from native *Dacus* and *Bactrocera* and between the introduced *Bactrocera*; list of host plants; distribution; attractants; and future reading.

Specimens identified as *B. latifrons* from Tanzania were indeed confirmed as belonging to this species on morphological and molecular grounds. It is considered to be widespread in Tanzania. Most records seem to be associated with areas where local eggplants (*S. aethiopicum* and *S. macrocarpon*) are grown. When alternative hosts are present, the pest seems to prefer *S. anguivi* and *S. scabrum* compared to the other solanaceous species. *B. latifrons* is the predominant infester of Solanaceous crops and, hence, occupies a specific niche within the fruit flies of economic significance. Given the importance of Solanaceous crops such as tomato in the country, the pest has a large potential to cause serious damage to agriculture. However, the problem can be regarded as less dramatic than the invasion of *Bactrocera invadens* a few years earlier. *B. latifrons* does not have the same wide host spectrum, the densities encountered are much lower, and it does not seem to spread as fast as *B. invadens* (or at least, is not detected that easily and fast as *B. invadens*). It would be useful to expand the study in other parts of eastern Africa, with emphasis on regions were local eggplants are customary grown.

Source: Marc De Meyer *(Royal Museum for Central Africa, Belgium).*

First Plant Quarantine Interception in Europe of *Bactrocera minax*, and a New Host Record

Bactrocera minax (Chinese citrus fruit fly), larvae were detected in *Citrus macroptera* fruit of Asian origin during a phytosanitary inspection at Heathrow Airport, London, in November 2008. This new host record is the first plant quarantine interception of *B. minax* by a European country (Dick Drew, Ian White and Marc De Meyer, pers. comm.).

Not only has it previously not been listed in the European Plant Protection Organisation (EPPO) non-compliance reports, but neither has it been intercepted in the North American Plant Protection Organization (NAPPO) region, which includes Mexico, USA and Canada (Walther Enkerlin, pers. comm.). As a non-European fruit fly, this species is quarantine listed within the European Union (European Plant Health Directive 2000/29/EC; Annex designation I/A1).

The Plant Health and Seeds Inspectorate of England and Wales, who made the interception, were unable to determine with certainty the exact origin of the fruit. It was imported directly from India, but it is strongly suspected that they had in fact come from Bangladesh.

Source: Sharon Reid (*The Food and Environment Research Agency, UK*)

Effective Codling Moth Suppression through the Host Removal in Urban Areas

In southern Brazil the host tree removal programme has been very successful in reducing the codling moth population at all outbreak sites in urban areas. In Lages, the moth population was reduced from 39.5 males per trap per year in 400 traps to 0.025 males per trap per year in 1 800 traps and in Vacaria from 13.66 to 0.25 in the same period. During this period almost 90 000 host plants were removed and replaced by non host plants.

Due this success in Brazil, Argentina and Chile are interested in adopting the same measures in the isolated area of Chile Chico along their border. The small and isolated area includes approximately 1,200 ha of urban and commercial host area in Chile Chico and 400 ha on the Argentine side.

The following strategies were defined: extend the monitoring, removal of host, application of natural enemies and finally SIT to assure eradication.

Source: Adalecio Kovaleski (*Embrapa, Vacaria, Brazil*)

South African $1.2 Billion Fruit Industry Braced for Fly Invasion

South Africa's 12.8 billion-rand (ca. $1.2 billion) fruit industry is braced for a possible invasion of a new species of fruit fly that has spread across the Africa continent in the past five years.

"We're very aware of it and we're doing a lot of surveillance," Justin Chadwick, chief executive officer of the region's Citrus Growers Association, said by phone today from Hillcrest, South Africa. "It's concerning because it's a more vigorous fruit fly that can damage a wider range of host species."

Bactrocera invadens, originally from Sri Lanka, was discovered in Kenya in 2003 and has spread southward. South Africa, which closed its borders to Namibian fruit exporters after the pest turned up there in November, is yet to be affected, Chadwick said. Citrus sales in South Africa rose 53 percent to 5 billion rand in 2008, according to the Department of Agriculture. Outbreaks of *Bactrocera invadens* could cause countries to stop buying South African apples, mangoes and citrus fruits, said Marc Vreysen, who heads a United Nations biotechnology lab in Seibersdorf, Austria.

"The scary part about these fruit flies is that they're so virulent," Andrew Jessup, an entomologist at the lab, said in an interview yesterday. "The U.S. is particularly scared of this one. These flies are good at adapting to new climates."

The insects, which can travel as much as 100 kilometres (62 miles) over their 3-month lives, eat the fruit and lay eggs inside the flesh.

Source: Bloomberg.com (*10 March 2009*)

First Irradiated Australian Lychees to New Zealand

For the first time fresh lychees from Australia have been exported to New Zealand after years of quarantine negotiations. The first consignment of lychees was recently sent from Brisbane to New Zealand. Farmers hope to export 200 tonnes of lychees to New Zealand annually by 2013.

Lychees are grown in far north and central Queensland and the north coast of NSW. The lychee industry already contributes to Australia's horticulutre industries and regional communities, producing 4,500 tonnes of the tropical fruit, worth $16 million each year.

Lychee exports to New Zealand were permitted after a new import policy was finalised which will require fresh Australian lychees to undergo a range of quarantine measures, including pre-export irradiation.

Further, all lychee fruit for export to New Zealand must be sourced from orchards that produce commercial lychee under standard cultivation, pest-control, harvesting and packing house procedures.

Lychees, fruits that Australia started to export to New Zealand after-post-harvest irradiation treatment.

Recent success in lychee exports follows improvements in post-harvest handling and the development of quality assurance programmes and cooperative marketing groups.

Source: Farmonline, Queensland Country Life (*gcl.farmonline.com.au 15 December 2008).*

Interesting Published Articles

Tardigrades as a Potential Model Organism in Space Research

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Abstract

Exposure of living organisms to open space requires a high level of tolerance to desiccation, cold, and radiation. Among animals, only anhydrobiotic species can fulfill these requirements. The invertebrate phylum Tardigrada includes many anhydrobiotic species, which are adapted to survive in very dry or cold environmental conditions. As a likely by-product of the adaptations for desiccation and freezing, tardigrades also show a very high tolerance to a number of other, unnatural conditions, including exposure to ionizing radiation. This makes tardigrades an interesting candidate for experimental exposure to open space.

This paper reviews the tolerances that make tardigrades suitable for astrobiological studies and the reported radiation tolerance in other anhydrobiotic animals. Several studies have shown that tardigrades can survive γ-irradiation well above 1 kilogray, and desiccated and hydrated (active) tardigrades respond similarly to irradiation. Thus, tolerance is not restricted to the dry anhydrobiotic state, and I discuss the possible involvement of an efficient, but yet undocumented, mechanism for DNA repair.

Other anhydrobiotic animals (*Artemia, Polypedium*), when dessicated, show a higher tolerance to γ-irradiation than hydrated animals, possibly due to the presence of high levels of the protective disaccharide trehalose in the dry state. Tardigrades and other anhydrobiotic animals provide a unique opportunity to study the effects of space exposure on metabolically inactive but vital metazoans.

The full paper was published in: Astrobiology, 7: 757-566 (2009).

Cytological Attributes of Sperm Bundles Unique to F_1 Progeny of Irradiated Male Lepidoptera: Relevance to Sterile Insect Technique Programs

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Abstract

The unique genetic phenomena responsible for inherited F_1 sterility in Lepidoptera and some other arthropods provided advantages for the use of inherited sterility in a sterile insect technique (SIT) program. Lepidopteran females generally can be completely sterilized at a dose of radiation that only partially sterilizes males of the same species. When these partially sterile males mate with fertile females, many of the radiation-induced deleterious effects are inherited by the F_1 generation. At the appropriate dose of radiation, egg hatch of females mated with irradiated males is reduced and the resulting (F_1) offspring are both highly sterile and predominantly male. Lower doses of radiation used to induce F_1 sterility increase the quality and competitiveness of there released insects. However, during a SIT program it is possible that traps used to monitor wild moth populations and overflooding ratios (marked released males vs unmarked wild males) may capture unmarked F_1 sterile males that cannot be distinguished from wild fertile males.

In this study we developed a cytological technique with orcein and Giemsa stains to distinguish adult F_1 progeny of irradiated males and fertile males. Our observations on 6 pest species in 5 families of Lepidoptera indicate that F_1 males (sterile) from irradiated fathers can be distinguished from fertile males by the nuclei cluster in the eupyrene sperm bundles. The nuclei cluster in the fertile males exhibited a regular and organized arrangement of the sperm and was homogeneously stained, whereas in F_1 males the nuclei cluster of sperm was disorganized, irregular and unevenly stained.

The full paper was published in: Florida Entomologist 92: 80-86 (2009).

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