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(upper) Dissection of samples of guava, that was irradiated for phytosanitary proposes, at the port of entry in the USA, after arrival in first commercial shipment from Mexico; (lower) aspects of the processing of the shipment, from outside (left) and from inside (right) the transport boxes .

To Our Readers

The technical year 2008 has again been a period of intense activity for all of us working at the Insect Pest Control Subprogramme of the Joint FAO/IAEA Food and Agriculture Programme. From the content of this newsletter you can see that there is much interesting news and action to report in terms of R&D, information and knowledge management activities, and the application of area-wide control and SIT.

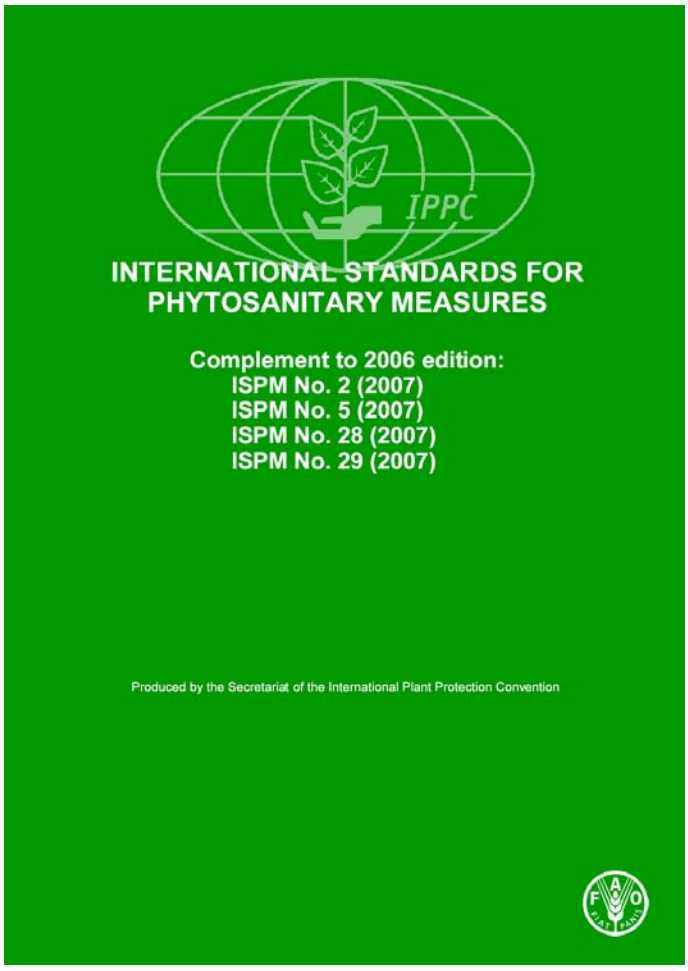
We are concluding the 2007-2008 cycle of the technical cooperation programme, with a number of technical cooperation projects reaching their end. At the same time we are starting the new 2009-2011 cycle with a series of new projects that have been developed together with counterparts in our Member States through a lengthy process during 2007/2008 and that have been recently approved by the IAEA Board of Governors. On pages 8 and 9 you can find a listing with the new projects that have been funded for 2009-2011 (exceptionally three years). In addition, there are a number of other projects not listed that although approved were unfortunately not funded, and which therefore are waiting for extrabudgetary funds in order to be initiated.

IAEA International Atomic Energy Agency

In terms of normative activities, we have been increasingly involved in supporting the Secretariat of the International Plant Protection Convention (IPPC), headquartered at FAO in Rome, to develop international standards and to create capacity in Member States in order to apply them. The IPPC [https://www.ippc.int/id/13292] is a multilateral treaty for cooperation in plant protection to secure action to prevent the spread and introduction of pests of plants and plant products, and to promote appropriate measures for their control. It is governed by the Commission on Phytosanitary Measures, which adopts International Standards for Phytosanitary Measures (ISPMs).

The Convention had its beginnings over one hundred and twenty years ago with the agreement by twelve countries to establish regulatory measures for grapevines under the Phylloxera Convention. This led to the increasing recognition of the need to address other transboundary plant pests and enlist phytosanitary cooperation among all countries. Currently the IPPC has a membership of 170 countries.

Since the establishment of the World Trade Organization (WTO) in the early 1990s, the IPPC has played a prominent role in relation to the Agreement on the Application of Sanitary and Phytosanitary Measures (the SPS Agreement), encouraging international harmonization and elaborating international standards to help ensure that phytosanitary measures are not used as unjustified barriers to agricultural trade.



Our involvement started through participation in a thorough revision of ISPM No. 3, *Code of Conduct for the Import and Release of Exotic Biological Control Agents* to update and broaden its scope. The use and transboundary shipment of sterile insects had so far been excluded from ISPM No. 3, because biological control agents had been defined as self-replicating organisms. Since the implementation of the sterile insect technique (SIT) has largely been dominated by the public sector, this did not represent a problem for the transboundary shipment of sterile insects. However, the lack of regulatory framework did discourage private investment in the production and shipment of sterile insects.

The revised ISPM No. 3 *Guidelines for the Export, Shipment, Import, and Release of Biological Control Agents and Other Beneficial Organisms* explicitly includes sterile insects as beneficial organisms in the revised standard to facilitate the application of SIT for Member States of the IPPC. It also includes official definitions for sterile insect: "*an insect that as a result of an appropriate treatment, is unable to produce viable offspring*", and sterile insect technique: "*a method of pest control using area-wide inundative releases of sterile insects to reduce reproduction in a field population of the same species*".

Collaboration with IPPC also involved the joint organization of a meeting at FAO headquarters in Rome on Status and Risk Assessment of the Use of Transgenic Arthropods in Plant Protection. The resulting proceedings of the meeting have been used by NAPPO (North American Plant Protection Organization) to develop Regional Standard No. 27 on *Guidelines for Importation and Confined Field release of Transgenic Arthropods*, which provides the basis for the rational development of the use of transgenic arthropods.

More recently, as members of the IPPC *Technical Panel on Pest Free Areas and Systems Approaches for Fruit Flies*, we have been involved in providing technical support and in funding and hosting in Vienna the last annual meetings of this fruit fly panel. This group of experts has been very busy drafting international standards, some of which have in the meantime gone through several rounds of country reviews and have been approved by the Commission on Phytosanitary Measures: ISPM No. 26 *Establishment of Pest Free Areas for Fruit Flies* (2006) and ISPM No. 30 *Establishment of Areas of Low Pest Prevalence for Fruit Flies (Tephritidae)* (2008).

In addition, this panel has drafted an ISPM on *Systems Approaches for Fruit Flies*, and a draft annex to ISPM No. 26 on *Trapping Procedures for Fruit Flies*, which is based on the FAO/IAEA publication *Trapping Guidelines for Area-Wide Fruit Fly Programmes*(English 2003, Spanish 2005), both of which are at different stages of the review and approval process.

The immediate future work programme of the fruit fly panel includes the development of draft guidelines for the confirmation of non-host status of fruit and vegetables to Tephritid fruit flies, a draft annex on establishment of

regulated areas upon outbreak detection in fruit fly pest free areas, and a draft annex on suppression and eradication procedures for fruit flies.

Together with our colleagues from the Food and Environmental Subprogramme of the Joint FAO/IAEA Programme we assisted some years ago in the establishment of ISPM No. 18 *Guidelines for the Use of Irradiation as a Phytosanitary Measure*, and we are currently supporting another IPPC panel: the *Technical Panel on Phytosanitary Treatments*, which has also met in Vienna and which is involved in developing post-harvest treatments, including fruit irradiation treatments for fruit flies.

We have also been supporting IPPC in an open-ended working group on the international recognition of pest free areas, which recently met in Thailand in July 2008 and is also of relevance for fruit fly and other area-wide programmes, as well as in creating capacity in Member States to use the international standards in order to level the playing field in international agricultural trade. Most recently (12-16 October) we organized and funded the *FAO/IAEA Regional Training Course on Pest Risk Analysis as Part of SIT Application* held in Amman, Jordan. Part of the course was based on the use of IPPC pest risk analysis training materials which are available on the International Phytosanitary Portal [https://www.ippc.int/id/186208]. Since these materials focus more on pest risk assessment and less on risk management, jointly developing complementary risk management training materials could be another area of collaboration for the Joint Programme and IPPC Secretariat.

Changing subject, I would also like to call attention to three new Coordinated Research Projects (CRPs), that will be initiated in 2009, 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. Efficiency of SIT application can be enhanced when certain components of the technology are improved, such as the development of superior strains for mass rearing and release. These include genetic sexing strains to produce male insects and strains carrying easily identifiable markers to monitor released sterile insects in the field. Using both classical and modern biotechnology techniques, key insect pests will be targeted, where SIT programmes are being implemented, for the development of these strains. This new 5-year CRP, will develop and evaluate these new strains to a level where a decision can be made as to their suitability for use in large scale SIT programmes. Major beneficiaries will be operational AW-IPM programmes in Member States that apply the SIT against major insect pests.

The second CRP is on *Increasing the Efficiency of Lepidoptera SIT through Enhanced Quality Control*. Pest species of Lepidoptera such as codling moth, false codling moth, diamondback moth, oriental fruit moth, grapevine moth, cotton bollworms, pink bollworm and armyworms are among the most damaging species of food and fibre crops in the world. A previous CRP on Lepidoptera SIT (2002-2007) focused on improvements of codling moth SIT to facilitate field use. Further development of the SIT to target other key Lepidoptera pests will require improvements that increase the quality control of mass-rearing, irradiation, shipping, release and field assessment activities. The new 5-year CRP will contribute to the development and use of improved quality control/management systems for all aspects of the SIT by (1) identifying and characterizing factors and variables that affect quality and field performance of released moths, (2) developing and improving tools and methods to assess, predict and enhance the field performance of released moths based on insect quality, (3) developing new and improved methods for enhancing rearing systems, facilitating the selection for performance traits that improve colony establishment, refurbishment and production, as well as the field performance of released moths.

A third 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*. Regulatory authorities and scientists from many internationally recognised institutions have studied the effectiveness of irradiation as a phytosanitary quarantine treatment against a large range of insect pest species infesting various fruits and vegetables. They have concluded that generic doses are possible, negating the need of having to develop or validate specific irradiation doses tailored to individual arthropod species. This new 5-year CRP will establish and validate irradiation doses for non fruit fly pests of quarantine significance. The project results will strengthen irradiation standards being developed under the IPPC, thereby facilitating international agricultural trade through the use of generic irradiation doses for a wide range of groups of quarantine pests.

Scientists and researchers working in the above areas, and who are interested in participating in any of these new CRPs, can find the forms to submit research proposals under [http://www-crp.iaea.org/] or under our website [http://www-naweb.iaea.org/nafa/ipc/index.html]. Considerable efforts have been invested during the last months to thoroughly revamp and update this website. We encourage your input and feedback to improve its information content and its user-friendliness in order to provide a better service to our customers.

In the name of all my colleagues in Vienna and Seibersdorf, we send you our wishes for a fruitful 2009.

Jorge Hendrichs
Head,
Insect Pest Control Section

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)

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.

First RCM of CRP on Development of Generic Irradiation Doses for Quarantine Treatments. 27-31 July 2009, Vienna, Austria.

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 and Evaluation of Improved Strains of Insect Pests for SIT. 16-20 November 2009, Vienna, Austria.

II. Consultants and Other Planning Meetings

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.

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.

III. Other Meetings/Events

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

PATTEC/IAEA Tsetse Managemenrt Training Course. Three weeks in February – 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 Commission on Phytosanitary Measures, International Plant Protection Convention, FAO. 30 March-3 April 2009, Rome, Italy.

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

Meeting of Programme Against African Trypanosomiasis (PAAT) Programme Committee Meeting. 2nd Quarter 2009, Bratislava, Slovakia.

Meeting of Programme Against African Trypanosomiasis (PAAT) Advisory Group Coordinators. September 2009, Kampala, Uganda.

Thirty Meeting of International Scientific Council for Trypanosomiasis Research and Control (ISCTRC). 14-18 September 2009, Kampala, Uganda.

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 Supporting the Use of the Sterile Insect Technique for Area-Wide Tsetse and Trypanosomosis Management (Phase II). 3rd Quarter 2009, Bobo Dioulasso, Burkina Faso.

Past Events (2008)

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

Second RCM of CRP on Development of Standardized Mass-Rearing Systems for Male *Anopheles arabiensis* Mosquitoes. 17-20 March 2008, Ghent, Belgium.

Third RCM of CRP on Improving Sterile Male Performance in Fruit Fly SIT Programmes. 1-5 April 2008, Valencia, Spain.

Third RCM of CRP on Development of Mass-Rearing for *Anastrepha* and *Bactrocera* Fruit Fly Pests in Support of SIT. 1-5 April 2008, Valencia, Spain.

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.

II. Consultants and Other Planning Meetings

Consultants Meeting to Elaborate the Details of a GIS Training Course Tailored for the Special Needs of Tsetse Control Personnel. 12-14 March 2008, Vienna, Austria.

FAO/IAEA National Planning Workshop on Entomological Baseline Data Collection in Preparation on Integrated Area-Wide Management of *Glossina swynnertoni* in the United Republic of Tanzania. 19 May - 6 June 2008, Monduli, United Republic of Tanzania,

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.

III. Other Meetings/Events

Expert Meeting on Climate Related Transboundary Pests and Diseases, Including Relevant Aquatic Species. 25-27 February 2008, FAO, Rome, Italy.

Second FAO/IAEA/PATTEC Regional Training Course on Principles of Baseline Data Collection for Integrated Area-Wide Tsetse Control. 18 February-14 March 2008, Dakar, Senegal.

Meeting with IRD Delegation from France on Mosquito SIT in Reunion. 25 March, 2008, Vienna, Austria.

First International Meeting of Tephritid Workers of Europe, Africa and the Middle East. 7-8 April 2008, Mallorca, Spain.

Meeting for the Formulation of the TC Programme for 2009-2011 and of Regional Projects on Sterile Insect Technique with Israel and Jordan counterparts. 7-11 April 2008, Vienna, Austria.

Third Commission on Phytosanitary Measures, International Plant Protection Convention, FAO. 7-11 April 2008, Rome, Italy.

Meeting with High Level Delegation from Yemen to Discuss and Plan FAO and IAEA Assistance Against an Outbreak of Old World Screwworm (OWS) Flies. 15-18 April, 2008, Vienna, Austria.

Meeting on Livestock Research within the Africa Livestock Partnership Programme (ALIVE) Platform Framework. 24-25 June, 2008, Rome, Italy.

Binational Planning Meeting for Transboundary Tsetse and Trypanosomosis Management in Mozambique and South Africa. 30 June-2 July, Vienna, Austria.

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.

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 to Start 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
RAS5060	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
RLA5051	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
SUD5031	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 Mujeres, Quintana Roo, Mexico (MEX5029)

On August 21, 2006, Mexico published an official report on the NAPPO Phytosanitary Alert System about the detection of the cactus moth (*Cactoblastis cactorum* Berg) in Isla Mujeres, Quintana Roo, Mexico. The last finding for this pest was reported on March 2007. For 17 consecutive months, there have not been any detections of cactus moth in Isla Mujeres, Quintana Roo.

With the quarantine regulation based on the Tassan model, by March 2008 there were 3 life cycles without cactus moth detections in the area. Therefore, the outbreak is considered eradicated. The official declaration as "eradicated outbreak of the cactus moth" is pending publication.

Eradication of cactus moth in Isla Mujeres is a great achievement for Mexico, resulting from excellent work in the framework of the Bilateral Cooperative Program between SAGARPA and USDA with FAO/IAEA support under project MEX5029. SENASICA implemented an integrated area-wide pest management approach through the Plant Health Directorate, in collaboration with Quintana Roo Plant Health State Committee. This consisted of host suppression, monitoring, trapping with a sexual pheromone, chemical control and sterile insect technique. These measures helped decrease pest populations leading to its eradication in Isla Mujeres, Quintana Roo.

Panama Declares Azuero as Free of Mediterranean Fruit Fly (RLA5045 and PAN5016)

The Panamanian's Ministry of Agriculture declared the Peninsula of Azuero and the southern part of Veraguas Province as a Mediterranean fruit fly-free region in March of this year. Since 2002 this area has been under fruit fly surveillance carried out by the Ministry of Agriculture in cooperation with the FAO/IAEA Programme (Technical Cooperation projects RLA5045 and PAN5016). Results of four years of systematic surveillance demonstrated that Mediterranean fruit fly is absent, allowing this region to qualify for exporting fresh tomato, pepper and papaya without undergoing any quarantine measures. In addition, this is a major step to start the eradication of the West Indian Fruit Fly (*Anastrepha obliqua*) from this area, which would definitively boost this area's ambition to become one of the most important fresh fruit and vegetable exporting areas in Central America.

Private Investment for Controlling the False Codling Moth in South Africa as a Result of SAF5007

X*sit*, a new private company engaged in the integrated application of the sterile insect technique (SIT) to control the False Codling Moth (FCM), was officially launched in the Western Cape Province, South Africa in mid-November 2008.

Endemic to sub-Saharan Africa, where it is considered to be a key pest of citrus and many other crops, the FCM (*Thaumatotibia leucotreta*) is listed as one the most feared invasive species by many regional plant protection organizations. FMC thus carries phytosanitary status for many of the markets to which South Africa exports citrus fruits. In addition, this pest has developed resistance to organophosphate and other insecticides normally used for its control in South Africa.

To address this pest problem, a multi-agency effort started in 2002, including Citrus Research International, the Citrus Growers association, the Agricultural Research Council (ARC) of South Africa, as well as USDA's Agricultural Research Service (USDA-ARS) and the Joint FAO/IAEA Programme. The approach was to develop the SIT, or its derivative for moths, inherited sterility, as an area-wide pest management tactic.

This research led to a pilot-scale SIT field trial in a commercial citrus production area in Citrusdahl, Western Cape, which generated a significant reduction in the FMC-related fruit damage. These encouraging results and the need to rapidly overcome increasing difficulties to export, the citrus industry decided to move towards the building of a mass rearing facility and the commercialization of FMC SIT. Thus, X*sit* was established with 50% of shareholding held by the industry and 50% by a government-funded initiative to support South African biotechnology. This is the first ever project applying the SIT as part of an area-wide integrated approach against a moth pest in Africa.

Sharing Regional Knowledge on the Use of the Sterile Insect Technique within Integrated Area-Wide Fruit Fly Pest Management Programmes (RAS5049)

Under this IAEA Technical Cooperation Project, two training courses took place recently. A Regional Training Course on Protein Bait Technology for Suppression of Tephritid Fruit Flies as part of SIT Application, was conducted in Hanoi, Vietnam from 15 to 19 September 2008. Was attended by 23 participants from 12 countries (see group photo next page).

The Regional Training Course was conducted with the objective to provide information about the latest development and availability of protein bait technology based

on the utilization of local yeast waste products, and training on the use of this technology.

Participants of the Regional Training Course on Protein Bait Technology for Suppression of Tephritid Fruit Flies as part of SIT Application, Hanoi, Vietnam.

Another Regional Training Course on Pest Risk Analysis as Part of SIT Application, was conducted in Amman, Jordan from 12 to 16 October 2008. It was attended by 23 participants from 16 countries (see group photo below).

Participants of the Regional Training Course on Pest Risk Analysis as Part of SIT Application, Amman, Jordan.

The Regional Training Course was conducted with the objective to transmit knowledge on pest risk assessment and pest risk management. This includes the assessment of the likelihood of a fruit fly pest introduction, establishment and spread, and estimation of its economic and environmental impact using case studies and practices for their application in fruit and vegetable exporting and importing Member States.

The course was held in conjunction with the International Plant Protection Convention (IPPC) Secretariat, using some of the pest risk assessment training materials that have been developed by the IPPC to create capacity in Member States.

Feasibility Study to Assess the Integration of the Sterile Insect Technique into Olive Fruit Fly Suppression Programmes (ISR/5/012)

This Technical Cooperation Project on developing the sterile insect technique (SIT) as a suppression tool for the management of olive fly (*Bactrocera oleae*) in Israel is being carried out by scientists from the Israel Plant Protection and Inspection Services in their laboratories situated at the Volcani Center, Bet Dagan in collaboration with researchers from Bio-Fly Ltd, Sde Eliyahu, with technical assistance from the University of Crete in Greece and the Entomology Unit in Seibersdorf. In the first two years of this project significant achivements have been made in improving laboratory-based rearing of olive fly, sterilisation for optimal emergence, and field release quality and methods to test and analyse field efficacy of sterile insects released into the field. Techniques to assess insect quality for the puroposes of SIT have been developed and incorporated into the pilot scale olive fly rearing facility in Israel and more improvements are expected.

A hybrid olive fly strain has been developed by scientists in the Volcani Center, Bet Dagan, from wild Israeli flies crossed with an established laboratory strain (the Greek Demokritos strain). The objective, here, was to combine the rearing benefits of a high quality laboratory-adapted strain with the mating capability of wild flies in the field. A hybrid strain has been developed and tested in the laboratory and in standard field cages in Israel. The results have shown that the hybrids are of a sufficient mating competiveness index to support their use in SIT programmes. There is, however, a difference in copulation times where Wild ♂ X Wild ♀ pairs mate for a longer time than pairs with whose parents are Demokritos females. It was suggested that this may be due to the fact that the Demokritos strain is a very old laboratory adapted strain and it is common that these strains have been selected for short copulation times due to being caged under high population densities in the laboratory.

Subsequent dissections of females from each pairing type have shown, though, that in all cases normal sperm transfer has been accomplished no matter how long the copulation duration.

Scientists at the Bio-Fly facility in Sde Eliyahu have been working in collaboration with researchers from the Volcani Center and have been rearing olive fly for sterilisation at Bio-Fly for field releases. They have also constructed a series of quality control tests and corresponding olive fly quality parameters for future use in SIT programmes.

Seven test releases of sterile olive flies have been carried out in the Lahav Forest in the Negev region of Southern Israel by researchers from Israel and Greece. Here, in an abandoned olive grove, sterile flies have been released

from a point source near to the centre of the grove. Fruit fly traps have been placed in a series of concentric circles at about 20 m, 35 m and 50 m from the release point with a few other traps at longer distances near the grove borders. Another grove nearby acts as the control (untreated) plot for comparisons of treatment efficacy and trapping tests.

Results from the field release trials of sterile olive flies have shown that the sterile flies do not travel very far and recovery of trapped flies is low. The former is not surprising considering the harsh climatic conditions in these olive groves – hot, very dry and, at times, very windy. Trapping of sterile flies was also low because the researchers did not want to compromise their studies on dispersal distance and direction by using traps continuously that would attract the flies further away from their natural habitat more than necessary.

Two types of trap were used:

- sticky yellow panels
- McPhail traps charged with water and ammonium bicarbonate and borax

The sticky yellow panel proved to be the better as it captured more flies than the McPhail trap as well as being less prone to vandalism by the more highly visible McPhail trap. It was suggested that the very hot and dry conditions surrounding the McPhail trap and the heat that would develop inside the trap may adversely affect the normal elution of ammonia (the fruit fly attractant) from the trap.

A yellow sticky trap in place in an olive tree at Lahav Forest in the Negev of Israel for test SIT releases of Bactrocera oleae *(olive fly).*

The researchers have also studied the direction in which released flies disperse and have found that there is a directional aspect to dispersal. Preliminary analyses suggest that wind direction is a major component in dispersal direction but more studies on topography are being carried out to assess its impact on dispersal direction.

A McPhail trap in place in an olive tree at Lahav Forest in the Negev of Israel for test SIT releases of Bactrocera oleae *(olive fly).*

There have been significant achievements made through this TC project. Olive flies are being successfully reared in laboratories in Israel and quality control testing and reporting procedures have been set up. A hybrid strain has been introduced and has been found to be compatible with wild flies and able to be reared in the laboratory. Test releases of sterile olive fly have been completed and tests on trap types have been conducted. Studies on dispersal distance and direction have demonstrated how important this aspect is to a better understanding of improving the efficiency of sterile insect releases.

SIT Development for Control of *Anopheles* Mosquito (RAF 5052)

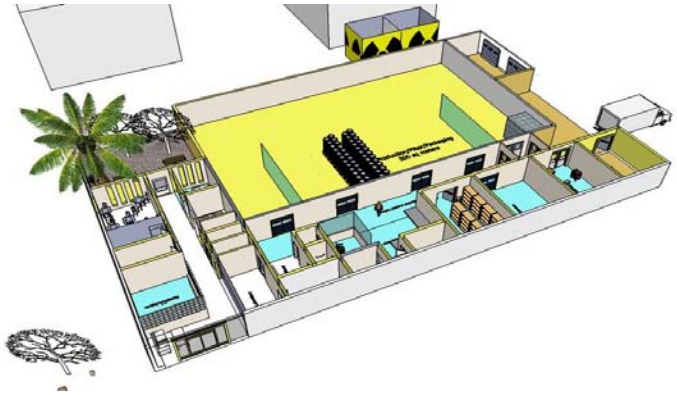
Mark Benedict conducted a training/planning mission to Panama and Guatemala in June of 2008 to observe equipment and methods used for mass production and release of medflies and screwworm. During the trip, he met with several people who are experts in SIT production technology, toured the Panama screwworm and Guatemala El Pino medfly factories and refined plans for a production facility in Sudan. Many of the ideas of those with who he consulted during the trip – especially Mr. Gordon Tween and Mr. Paul Kaiser – strongly shaped the current concepts of production design for mosquitoes.

Our Sudanese counterpart Dr. Badria Babiker ElSayed has continued her excellent work to raise non-governmental funds to support the next phase of mosquito SIT activities in Sudan: facility construction and initial releases for control in the Northern State. She has approached the Islamic Development Bank for funding and the prospects for support are excellent. These funds will be necessary to supplement the generous contribu-

tions from private and national sources, especially the Ministry of Science and Technology.

Creating an environment that promotes happy employees is an important consideration in planning mass-rearing facilities. The El Pino medfly factory provides a model for attaining this with numerous morale-boosting activities and facilities including this seductive area in which employees can take lunch on site.

With the availability of additional support from the Merowe Dam Implementation Unit, the production facility is being designed. Its location, outside of Khartoum in Soba, is on land (donated for this purpose by the Ministry of Science and Technology) adjacent to the ^{60}Co irradiator that will be used for sexual sterilization. The concept of the mosquito rearing facility is being developed in consultation with the counterpart, her staff and Mr. Paul Kaiser, an expert provided under TC project RAF5052.



The concept for the Sudan mass-production facility currently being designed. The total area is approximately 1000 square meters and includes offices, production areas, and production support.

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

Project Number	CRP Title	Scientific Secretary
D4 10.19	The Use of Molecular Tools to Improve the Effectiveness of SIT (2003-2008, concluded)	Gerald Franz
D4 20.10	Improved and Harmonized Quality Control for Expanded Tsetse Production, Sterilization and Field Application (2003-2008, concluded)	Andrew Parker
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
	New CRP to Start in 2009	
D4 10.22	Increasing the Efficiency of Lepidoptera SIT Through Enhanced Quality Control (2009-2014)	Marc Vreysen
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 First Research Coordination Meeting of the CRP on *Biology of Male Mosquitoes in Relation to Genetic Control Programmes,* 14-18 July, Vienna, Austria

Male mosquitoes – the neglected sex – are beginning to attract attention outside of the SIT community. Unlike female mosquitoes, that frequently imbibe blood (every 2-3 days), male mosquitoes are not blood feeders and thus do not transmit disease. They do, however, transfer genes to females during mating and are therefore logical agents for genetic control. Paradoxically, although female biology and behaviour have been intensively studied, relatively little is known about males. In particular, the specific factors that contribute to male reproductive success are virtually unknown. Nevertheless, the success of any genetic control programme will hinge on the sexual competitiveness of the mass-reared released males.

Many research groups are recognizing that their unexplored biology presents an entrée for novel control methods that will complement existing strategies such as indoor residual insecticide spraying and insecticide treated nets.

Attendees at the RCM heard of novel methods to observe male behaviour in the field, identify volatile chemicals released during male swarming and molecular studies of male and female olfaction related to mating behaviour. The RCM on the Biology of Male Mosquitoes was held in Vienna, July 14-18, with 15 participants from 12 countries. Workplans for the CRP were developed and several news-pieces were prepared from the meeting and were

made available for general distribution to English, Spanish and French-speaking audiences.

The First Research Coordination Meeting of the CRP on *Applying Population Genetics and GIS for Managing Livestock Insect Pests,* 18-22 August, Vienna, Austria

Screwworm and tsetse flies cause severe losses to livestock, wildlife and even affect humans. There is broad international consensus that 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) is to be considered as a key complementary tactic in some situations for creating pest-free areas.

In the past years three new tools became available having a big potential to improve the planning and implementation of such AW-IPM-SIT campaigns: a) modelling of pest population dynamics; b) satellite-imagery-derived distribution and prediction maps and data processing by geographic information system (GIS); and c) information on population genetics, providing evidence on isolation or confinement of target pest populations.

This first research coordination meeting was aimed at refining and standardizing these techniques and making them accessible for collaborators in Member States. Seventeen participants from thirteen countries shared information on the status of relevant work done so far, and reviewed research priorities for the coming years.

The Final Research Coordination Meeting of the CRP on *Improved and Harmonized Quality Control for Expanded Tsetse Production, Sterilization and Field Application,* 13-17 October, Addis Abeba, Ethiopia

This fourth and final meeting was hosted by the Southern Tsetse Eradication Project (STEP) (ETH5012) with the arrangements made by Dr Solomon Mekonnen. Twelve participants from eleven countries attended the meeting, together with two observers from Slovakia and four local observers. The meeting was opened by the Deputy Director General of the Ethiopian Science and Technology Agency, Ato Shumu Tefera, who greeted the meeting participants and wished them a fruitful meeting.

Following presentations by each agreement and contract holder on the first two days, the group discussed the outcome of the research and the outputs. Several quality control protocols were drafted and additional ones agreed including aspects of tsetse acoustic behaviour in relation to male quality, feeding sterile males with trypanocidal drugs to prevent them from becoming infected after release and pre-selection of animals at the abattoir for blood collection. Several existing protocols in the tsetse rearing manual were revised or scheduled for revision. The group also discussed the evaluation of the CRP and in general were all in agreement that the CRP was both appropriate and useful with few limitations or shortcomings.

Some of the research contracts will continue for several months yet. During this period the contract holders will continue to provide material for new protocols or to revise existing protocols. Dr Arnold Dyck will collate and edit the final proceedings of the CRP which will be available in 2009.

The Final Research Coordination Meeting of the CRP on *The Use of Molecular Tools to Improve the Effectiveness of SIT,* 18-22 August, Antigua, Guatemala

This final meeting was organized to review the results obtained during the last two years through research activities on developing the molecular tools that are required to construct improved strains for SIT. Eleven participants from eight countries and eight additional observers from five different countries attended the meeting.

Topics discussed were: insect transformation, sex determination, inducible/repressible lethal systems, mating incompatibility via symbionts, the fitness consequences of transgenesis and the creation of refractoriness via symbionts.

Participants of the RCM on The Use of Molecular Tools to Improve the Effectiveness of SIT, Antigua, Guatemala.

In parallel, a Consultants Group Meeting was held to review opportunities for implementing a Coordinated Research Project on assessing the potential for improved strains of insect pests for SIT. Four consultants reviewed the state of the art in the field of molecular biology as applied to the improvement of the SIT and based on this assessment, and demands from operational programmes, formulated recommendations for further research.

Developments at the Entomology Unit Seibersdorf

TSETSE FLIES

Salivary gland hyperplasia

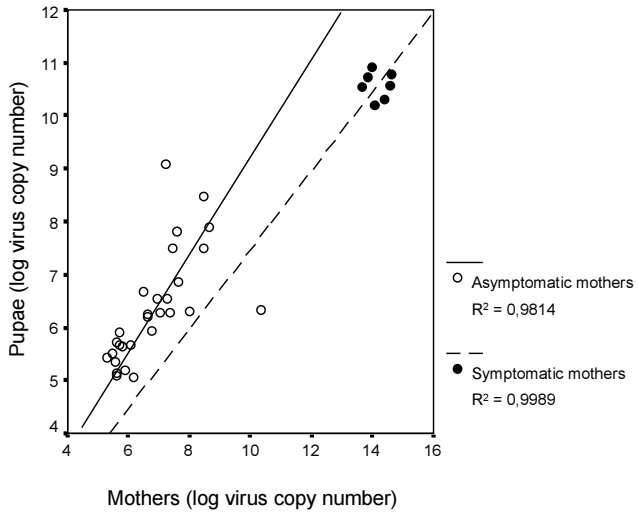
As reported in earlier newsletters, the salivary gland hypertrophy virus (SGHV) has been sequenced and published and it is know available in the GeneBank data base with the accession number (EF568108) http://www.ncbi.nlm.nih.gov/entrez/viewer.fcgi?db=nuccore&id=158906364. In addition, studies to assess the prevalence of the SGHV were undertaken in the *Glossina pallidipes* colony in Ethiopia and the colony originating from Uganda and that has been maintained at the Entomology Unit in Seibersdorf since 20 years. Whereas the prevalence of the SGHV in the colony maintained in Ethiopia is increasing, it has remained stable in the Uganda colony at the Entomology Unit at 10%.

Preliminary work has been undertaken to produce antibodies against the p47 protein to be used in the detection of the virus by serological tools and to evaluate the efficiency of antibodies in neutralizing the virus infection. The antibodies were received and the experimental work to assess the efficiency of the antibodies to neutralize and block the virus infection were undertaken.

An attempt was made to analyse the effect on the virus infectivity by suppressing p74 with RNAi. Three regions of the gene were amplified by PCR to cover 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 38I LITMUS vector and the recombinant plasmid was controlled by a restriction enzyme and transformed into HT115 (DE3) bacteria. The transformed bacteria were fed to the flies and its impact on the virus copy number is currently being assessed.

The study on the impact of antiviral drugs on the viral infection in the fly continued. As reported in the last newsletter, four antiviral drugs were tested for their toxicity on tsetse. Two drugs, acyclovir and valacyclovir were selected for further work. Flies fed on a blood diet that contained valacyclovir for three generations showed lower mortality and higher productivity than those flies fed with a diet containing acyclovir. These preliminary data seem to suggest that there might be options to use this drug in large scale production of *G. pallidipes*. The effect of these antiviral drugs on viral DNA replication is further being analysed using a quantitative PCR.

Other experiments were carried out with the objective to better understand virus transmission. The obtained results show clearly that males with SGH are 95% sterile. Females however with SGH that had mated with males with normal salivary glands (NSG) can produce pupae but with a large virus copy number. The emerged flies from these pupae are however sterile which leads to reduced colony productivity. A linear correlation was found between the virus copy number in the females and their offspring, both for symptomatic and asymptomatic females (see figure).



FRUIT FLIES

Update on the genetics of the *Bactrocera dorsalis* genetic sexing strain (GSS)

The *Bactrocera dorsalis* GSS has been isolated in Hawaii (Department of Entomology, University of Hawaii/ USDA/ARS Pacific Basin Area Research Center) and was transferred to the Entomology Unit in Seibersdorf for further analysis of quality control parameters and for genetic as well as cytological analyses. The strain is based on a Y-autosome translocation and the recessive autosomal white pupae (*wp*) mutation is used as a selectable marker.

The *B. dorsalis* GSS was reared under the same conditions as the Mediterranean fruit fly *Ceratitis capitata* strains, i.e. the cage size was 19 x 20 x 32 cm and the Mediterranean fruit fly adult and larval diet was used. Only the egg collection was different, i.e. an egging bottle was used where the egging net was impregnated with guava juice.

The GSS was maintained for 18 generations under the standard rearing regime also used for Mediterranean fruit fly strains; i.e. for each generation 37 ml of pupae are used to set up the next generation without removing any aberrant flies while a parallel sample of 40 ml of pupae is screened. For a total of 14 generations, 20,241 flies were screened, i.e. 1556 flies per 40 ml of pupae. In compari-

son, 40 ml of Mediterranean fruit fly pupae is equivalent to 2200 and 2500 flies, depending on the strain used. The frequency of half emerged and crippled flies in the *B. dorsalis* strain is relatively high, i.e. 9.5% of the males and 13.8% of the females do not emerge completely or show some form of morphological abnormality. Among the 20,241 flies screened 3 recombinant females (wp^+) and 9 recombinant males (*wp*) were detected. This represents an overall recombination frequency of 0.04% (in VIENNA 8 the recombination frequency is 0.01%). However, the analysis of the 18 generations revealed no accumulation of recombinants. This may be due to the fact that this strain was reared under more relaxed and less selective conditions (i.e. 1440 flies/cage compared to VIENNA 8 with 2300 flies/cage).

In one generation the egg to adult viability was determined and 10 samples with 100 eggs each were either collected for 5 h or 48 h. The viability at different developmental stages was measured by counting egg hatch, the number of pupae and the number of adults (see table). In the Mediterranean fruit fly the shorter egg collection period resulted in a better recovery. However, this was not observed with the *B. dorsalis* strain.

Egg to adult viability of Bactrocera dorsalis *of 10 samples with 100 eggs collected for 5 h or 48 h.*

Parameters (per 1000 eggs)	**Egg Collection**		
	5 h	**48 h**	**Average**
Hatched eggs	649	762	706
***wp* pupae**	259	241	250
***wp*+ pupae**	295	319	307
Females	246	210	228
Males	231	252	242
Overall fertility	47.7%	46.2%	47.0%

These data can also be used to deduce the structure of the translocation and to make some assumptions about its segregation behaviour. The overall egg to adult viability is 47% which indicates that a simple Y-autosome translocation involving only 1 autosome is present. Egg hatch is reduced to 71%. This reduction is caused by the embryonic lethality of the deletion type adjacent-1 karyotypes, i.e. a reduction in egg hatch by roughly 25% indicates that all 4 segregation types resulting from alternate and adjacent-1 segregation occur at equal frequency as it is also the case in most Mediterranean fruit fly GSS.

From the egg hatch data in combination with the data on adult recovery it also follows that the triplication type offspring survive the embryo stage. A large proportion of these karyotypes even reach the pupal stage which is indicated by the high number of brown pupae (i.e. more than the expected 250), the imbalance between white and brown pupae (250 *wp* versus 307 wp^+) and by the significant reduction of emergence of the males from brown pupae (*wp*: 91%; wp^+: 79%). The slight overabundance of males may indicate that a small proportion of the triplication types even reach the adult stage. However, that could be shown more directly if test crosses with a marker located on the long arm of the autosome could be done. In summary, adjacent-1 segregation produces males with a wp^+ phenotype which corroborates the results of the cytological analyses, i.e. in *B. dorsalis wp* is located on the short arm and the translocation breakpoint is also on this arm.

Rearing of Fruit Flies

Over the last six months research and development by the fruit fly rearing group has achieved results in a) improving laboratory rearing techniques for fruit fly species, b) supply of test insects to collaborating research agencies in other parts of the world and c) training for, or assistance from, fellows and visiting scientists from Member States. The objective of this group is to foster research and development into improving the laboratory rearing of insect pests for sterile insect technique (SIT) purposes.

The following fruit fly species and strains are currently being maintained at the Entomology Unit:

- *Anastrepha fraterculus* (South American fruit fly): (1) Peru strain, (2) Argentina strain, and (3) hybrid strains (Peru x Argentina).
- *Bactrocera dorsalis* (Oriental fruit fly): (1) genetic sexing strain from Hawaii, and (2) strain from Thailand.
- *Bactrocera cucurbitae* (Melon fly): (1) genetic sexing strain from Hawaii, and (2) a "wild" strain (7 generations old in the laboratory) from Seychelles.
- *Bactrocera invadens* (Invasive fruit fly): (1) a laboratory strain from Kenya (59 generations laboratory reared in Kenya and a further 4 generations at the Entomology Unit in Seibersdorf) in collaboration with Sunday Ekesi (Kenya) and Anna Malacrida (Italy).
- *Bactrocera oleae* (Olive fly): (1) strain from Greece "Demokritos" (very old laboratory strain); (2) "wild" strain from Greece (about 12 generations laboratory reared; (3) "wild" Israel X Demokritos strain (about 12 generations old), and (4) a "wild" strain from Israel reared from wild-infested olives.
- *Bactrocera carambolae* (Carambola fruit fly): "wild" strain from wild-infested carambola fruit from Suriname in South America in collaboration with Alies van Sauers-Muller.
- *Ceratitis capitata* (Mediterranean fruit fly): (1) VIENNA-8 *tsl* (temperature sensitive lethal, genetic sexing strain), and (2) strain from Argentina (laboratory reared for about 20 generations).

Rearing of *Bactrocera oleae*

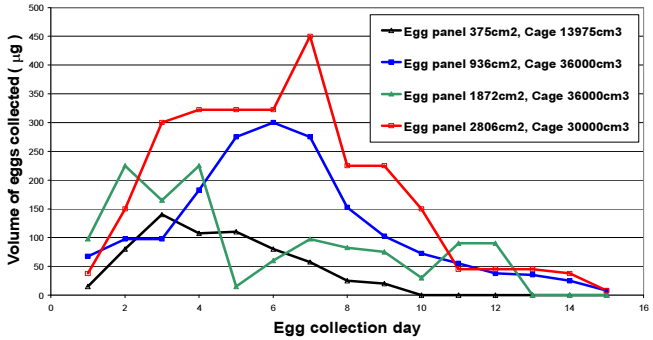
Progress has been made on improving the production of olive fly in the laboratory with the ultimate aim of mass-producing high quality sterile flies for SIT purposes. Improvements have been achieved in streamlining egg collection techniques and in egg and larval handling, which has resulted in a marked improvement in the number of eggs produced per female per day.

Bactrocera oleae *(Olive Fly) male (left) and female (right).*

The following table and figure show preliminary results of a cage design test designed to improve egg production. Preliminary data show that cage type C is more productive in relation to egg volumes collected than the other cage designs, even though it is a smaller cage than cage types B1 and B2. More replication of these experiments is currently underway. Also we are conducting further testing of adult density per cage and per unit area of egging panel in each cage type.

Results from different cage designs and egging panel sizes. Each cage was populated with 15 ml of Olive fly pupae from the Israeli hybrid strain. (Note: these data are from only 1 to 4 cage type replications so should be considered as preliminary results.)

Cage type	Egg panel area (cm^2)	Cage volume (cm^3)	Total egg production (ml)
A	375	13 975	635.0
B1	936	36 000	1 782.5
B2	1 872	36 000	1 252.5
C	2 806	30 000	2 685.0



Daily egg production from different sized egging panels and cage designs. Data are from 15 ml of pupae per cage.

In the following table data for the Greek 'wild' strain show very good recovery rates. This rate has improved considerably from that reported in the last IPC Newsletter (Egg to Pupa Recovery rate of 45%). Trials on the other strains are currently underway.

Laboratory history of the current Greek 'wild' strain colony at Seibersdorf. Data are averages from 3 replicate colonies reared during September and October, 2008.

Egg hatch percentage	87%
No. of eggs seeded onto Standard Olive Fly diet	7006
Eggs/g of diet	5.838
Larvae/g of diet	5.063
No. of larvae	6077.15
Weight of pupae produced	31.41 g
Average weight per pupa	6.6 mg
Total no. of pupae produced	4202
Percentage eggs to larvae	87%
Percentage larvae to pupae	69%
Percentage eggs to pupae (Egg to Pupa Recovery rate)	60%
Adult eclosion rate	86%
Adult fliers (rate)	82%

The average pupal weight for the Israeli hybrid strain is 6.4 mg and for the Greek 'Demokritos' strain it is 6.7 mg. In future experiments we aim to improve average pupal weight by optimising egg seeding density.

A good batch of Bactrocera oleae *(Olive Fly) pupae produced as a result of improvements made to egg handling methods.*

Rearing of *Bactrocera invadens*

A collaborative project has commenced with scientists from Kenya and Italy on the newly described fruit fly pest, *Bactrocera invadens* (Invasive fruit fly). This species, originally from Sri Lanka, has invaded the African continent and has spread over much of Equatorial Africa from East to West and is causing significant economic damage to many fruit crops.

In August 2008, *B. invadens* pupae were received at the Entomology Unit from Sunday Ekesi in Kenya. These

flies were from a laboratory colony that had, at that time, been reared through 59 generations from the wild and so were well adapted to the laboratory.

Bactrocera invadens *(Invasive fruit fly) larvae reared on the standard Seibersdorf diet (which has wheat bran as the bulking agent).*

It was found that the flies readily adapted to the standard Seibersdorf diet based on wheat bran as the bulking agent (see table).

Some data on the first generation of the Seibersdorf laboratory colony of Bactrocera invadens *reared from the Kenyan laboratory colony. (Type of diet: Seibersdorf standard (wheat bran) diet; Egg incubation: 48 hours in aerated water; rearing room temperature: 26°C).*

Parameters	Egg collection date		
	7-10-2008	8-10-2008	13-10-2008
Weight of diet (kg)	4	8	16
Eggs on diet (ml)	3.5	6	14
Eggs per kg of diet	0.875	0.750	0.875
Start of pupation (date)	22-10-2008	23-10-2008	25-10-2008
Pupae collected (ml)	235	810	1460
No of pupae per 5 ml	174	181	195
Weight of 5 ml of pupae (g)	2.751	2.699	4.500
Pupal weight (mg)	15.81	14.91	12.82
No of pupae produced	8 178	29 322	56 940

These flies have proven to be very healthy and robust. Egg hatchability is high as is adult eclosion rate, adult flight ability and adult longevity.

Standard morphological comparisons (such as adult size, colour and markings) between *B. invadens* and a closely-related species, *B. dorsalis* (Oriental fruit fly) are being recorded bearing in mind that adult colour and size are quite dependant on laboratory culture techniques. Now that both species are being reared on the same diet (the standard Seibersdorf diet) under the same environmental conditions, but in different rooms, such comparisons can be attempted.

Studies have commenced on assessing the possibility that *B. dorsalis*, mass-reared for SIT releases, may be used for the suppression of *B. invadens* outbreaks as these two species are closely related. A series of tests starting with forced matings of same-aged male *B. invadens* with female *B. dorsalis* (Genetic Sexing Strain) and the reverse cross, followed by choice tests in the laboratory, which will then be followed by field cage choice tests, has commenced at the Entomology Unit.

In the first part of this experiment 4 crosses were made:

- *B. invadens* ♂ X *B. invadens* ♀
- *B. dorsalis* ♂ X *B. dorsalis* ♀
- *B. invadens* ♂ X *B. dorsalis* ♀
- *B. dorsalis* ♂ X *B. invadens* ♀

All adult flies were of the same age and reared on the same diet and under the same environmental conditions but in separate rooms until the start of the cross mating trials. There were 5 flies of each gender in each of 3 cages per cross and they were fed water, sugar and protein hydrolysed *ad libitum*.

Results show that the two species can be forced, in the laboratory, to cross mate. Eggs were produced from the hybrid pairings. The hybrid eggs produced in these trials hatched and were seeded onto carrot-based diet with the result that normal pupae have formed. Pupae from both hybrid pairings (i.e. *B. dorsalis* ♂ X *B. invadens* ♀ and *B. invadens* ♂ X *B. dorsalis* ♀) appear, on preliminary examination, to be 100% brown with no apparent pupal colour variation. We were interested in pupal colour because the *B. dorsalis* parent strain used in these experiments is a Genetic Sexing Strain based on pupae colour (where the male is brown and the female is white).

We will allow these hybrid pupae to eclose as adults and then we will carry out mating tests to assess the fertility of these hybrids. Further tests in the series, particularly on field-caged host trees, will determine if any sexual isolation exists between the two species.

Experts and consultants who have worked with the FAO/IAEA Fruit Fly Rearing Group

During the latter half of 2008 the Fruit Fly Rearing Group was host to several international fellows and consultants. Jaime Palma Cabrera from Chile assisted us in setting up biological assessment protocols for the project comparing the effects of gamma rays and X rays on fruit fly quality parameters for SIT purposes. Raza Memon, from Pakistan and fruit fly rearing technicians carried out

the first studies on *Bactrocera cucurbitae* (Melon fly) in the gamma ray vs X ray project, while Thiago Mastrangelo, a fellow from Brazil, completed the Melon fly work and carried out tests on Gamma rays and X rays on *Ceratitis capitata* (Mediterranean fruit fly) and *Anastrepha fraterculus* (South American fruit fly). Ishan ul Haq, a PhD student is working on the effects of semiochemicals on Melon fly physiology and behaviour.

Dina Orozco, an expert from Mexico, has assisted the staff in the FAO/IAEA Fruit Fly Rearing Group in making improvements to the Olive fly rearing and in setting up quality control procedures for Olive fly as well as compiling data records on Olive Fly.

IRRADIATION

X Ray Irradiator

Continuing difficulty in obtaining and shipping isotopic irradiators has made evaluation of X irradiation as an alternative to gamma radiation more pressing. Work on the evaluation of the RS2400 X ray irradiator has continued with the manufacturer supplying us with an improved carousel system and new canisters, as well as making some other minor changes. The new carousel system allows us to more precisely align the canisters with the X ray tube and has made the canisters much more secure so that they should now not be able to become dislodged. The canisters themselves are now made of carbon fibre reinforced resin which is light weight, waterproof and almost transparent to X radiation, with the steel filtration incorporated inside. The length and longitudinal positioning of the canisters has been adjusted to give us a Dose Uniformity Ratio (DUR) of less than 1.3. Also, the control program is being revised to permit the selection of a predetermined energy rather than a fixed power and time and to protect more areas of the program with a password to prevent unintended modification.

During this process the Gafchromic® Dosimetry Standard Operating Procedure (SOP) is being revised for low energy X radiation and the new SOP will be issued in 2009. A new version of the original SOP specifically for gamma radiation using ^{60}Co or ^{137}Cs will also be issued.

The manufacturers have almost completed an additional RS2400 irradiator for delivery in Brazil for project BRA5057. This new machine incorporates all the changes and modifications that have been identified during the testing in Seibersdorf.

Gamma vs X Ray

In partnership with the Tsetse Group trials have been carried out to determine the differing effects, if any, between sterilization of fruit flies with ionising energy sourced from ^{60}Co (gamma irradiation) or from an X ray source. The reason for this project is that world-wide supply and delivery of ^{60}Co and irradiation units which use ^{60}Co has become more difficult in the last years due to increasing concerns about the safety of transport. An alternative source of ionising energy which may be more acceptable is electrically-produced X rays. As the Entomology Unit has both types of irradiator on-site it is in a unique position to test for any differences in the effectiveness of the two systems for use in SIT programmes.

Since mid-2008 fellows have been working with scientists and technicians of the Entomology Unit on assessing the relative effectiveness of the two systems on quality of insects that are the target of SIT. Fruit fly pupae of the same age were irradiated at the same nominal doses in either the X ray machine or a gamma irradiator and then assessed under the same conditions for comparative adult eclosion, survival and sterility rates. Dosimetric procedures conducted after treatment determined actual doses received by the pupae.

Tests on the treated (and untreated) insects that were conducted included mating, in laboratory cages following standard quality control procedures, of sterile and fertile males and females. Eggs from the pairings were than collected, counted and incubated. Egg hatch was assessed and recorded. These data gave a measure of the residual fertility of the insects treated with either gamma rays or X rays. In addition tests were carried out to assess adult emergence rates. Also field cage tests on mating competitiveness between gamma rays and X ray treated males for fertile females were also carried out to test for treatment differences under simulated field conditions.

Three pest fruit fly species are currently being assessed. They are: *Bactrocera cucurbitae* - GSS (Melon fly – Genetic Sexing Strain), *Ceratitis capitata* Vienna-8 *tsl* (Mediterranean fruit fly Vienna-8 temperature sensitive lethal strain) and *Anastrepha fraterculus* (South American fruit fly). These three species were chosen as they represent significant fruit fly pests in Asia, Africa and the Americas. Data from these experiments will assist governments who are interested in the sterile insect technique but who face difficulties to procure radioactive sources.

Preliminary data on the level of residual fertility and normal adult eclosion suggest that there are no differences between gamma rays and X rays in each of the three species. For *B. cucurbitae* and *C. capitata* preliminary data show that there is no difference in mating competitiveness for fertile females when males are irradiated by either gamma rays or X rays. Further replication and biometrical analyses plus field cage tests on mating competitiveness on *A. fraterculus* are currently under way.

MOSQUITOES

The mosquito project will broaden its scope in the new project cycle 2010-2011 to more broadly reflect potential for controlling vectors of diseases other than malaria. The Agency mosquito programme can – depending on available resources – expand its activities to include work on other vectors, e.g. the yellow fever mosquito, *Aedes aegypti* and the Asian tiger mosquito, *Aedes albopictus*. No

immediate activities are planned, however, in this direction as our resources will be entirely devoted to malaria vectors. We hope, however, that successes with anophelines will elicit additional support for expansion.

"Too much to do and too few resources!" is the mantra we've been chanting for the past year, but with the arrival of new scientific staff, Mr. Fabrizio Balestrino and Mr. Jeremie Gilles, this situation is moving in the right direction. Both have strong backgrounds in insect studies of mass-rearing, fitness and diet development. Mr. Balestrino is focusing on mass production and Mr. Gilles on a novel larval diet and larval culture dynamics. We also anticipate a five month visit by a French MSc student in January 2009 who will study marking for release and radioprotection.

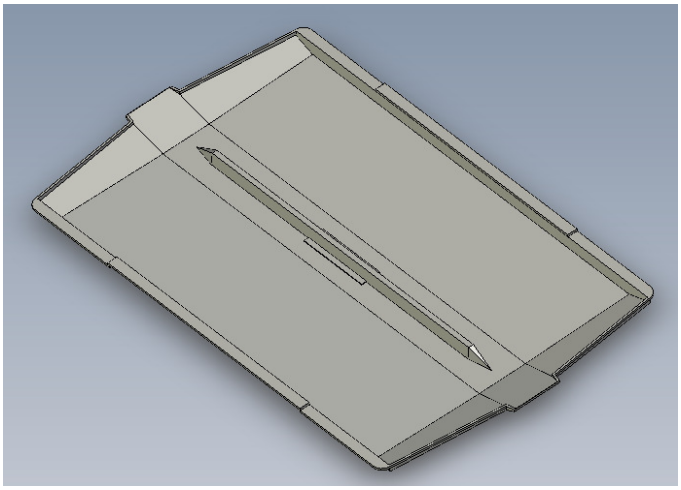
New scientific staff Jeremie Gilles (left), and Fabrizio Balestrino (right) and Sharon Soliban.

Under the leadership of Dr. Andrea Crisanti of the Imperial College, London, the Agency mosquito project became a participant in an EU FP7 project entitled INFRAVEC. This project will develop capabilities including rapid genotyping, screening and transgenesis. Moreover, the project will develop facilities for semi-field testing of mosquitoes being considered for release. The Agency role will be to develop mass-rearing methods and to support culture of large numbers needed for mutation and transgenic screens as well as general mass-rearing support.

Advances in mass-rearing technology

Sudan's efforts to implement an SIT programme against *Anopheles arabiensis* during 2009-10 in the Northern State has meant that the mosquito SIT project must develop suitable technology for mass production, sterilization and release. While we feel we have suitable – although certainly not ideal – methods for sterilization and release, mass production methods are needed that go beyond a scale-up of laboratory methods.

The goal is to create equipment and processes that are efficient and affordable yet accommodate the unique biology of *An. arabiensis*. A production design has been developed that will produce approximately 150,000 mosquitoes per square meter of production floor space. This plan will utilize a custom tray that is now being tested (see figure). This tray was designed to provide a large surface area and shallow depth for high density culture. The trays will not be moved while they contain water but will be filled via a cascade and drained in place by tilting.



Many features distinguish this custom larval tray currently being thermoformed by an Austrian company: size (100 × 60 cm × 3 cm) spouts for pouring, rack mounting adaptations and a centre ridge that provides – among other things – a means to fill an entire stack of trays using a cascade system.

As part of the effort to improve mass-rearing, predicted three dimensional surface response plots of development of *An. arabiensis* reared under different food concentrations (0.5 to 8 %w/v of Koi diet) and different densities (8 to 128 larvae per dish) have been developed. No standard larval diet for mass production is available and tested for SIT-relevant outcomes such as flight performance.

Experiments to determine the effects of diet and larval density on development rate, size, and survival are continued. These experiments will determine the conditions that are appropriate for mass production. They are being conducted, however, with a fairly expensive diet that would not be practical for mass rearing. So a related set of experiments will test several widely available, nutritious yet inexpensive diets for their capacity to support larval development. Conventional components such as beef liver powder and yeast alongside inexpensive commodities such as fish meal and squid liver powder are being tested. This unique experimental design will determine the optimal diet element concentrations for implementation in mass-rearing. In addition, a simple flight measurement protocol for assessing these diets and routine use in production facilities is being developed.

Reports

Meeting of the Open Ended Working Group to Undertake a Feasibility Study on the International Recognition of Pest Free Areas, 14-18 July 2008, Chiang Mai, Thailand

The Commission of Phytosanitary Measures, of the International Plant Protection Convention (IPPC) based at FAO headquarters in Rome, organized this meeting which was attended by 24 participants from 16 countries and three international organizations, FAO, IAEA and OIE. Academics and researchers involved on pest risk analysis were also present.

The working group was specially focused on studying the feasibility of establishing a procedure under the IPPC framework for the international recognition of pest free areas (PFA). It was agreed that the establishment of such a procedure would be useful and that a pilot system should be established for one pest in order to gain experience and confidence.

This initiative, however, needs further analysis and development before implementation. Participation of NPPOs of importing and exporting countries using area-wide integrated pest control against fruit flies is encouraged because the subject has close relationship with their efforts of boosting export of fruit and vegetables.

Meeting of the Technical Panel on Pest Free Areas and Systems Approaches for Fruit Flies, 1-5 August 2008, Vienna, Austria

Participants of the FAO-TPFF held in Vienna, Austria.

The Technical Panel on Pest Free Areas and Systems Approaches for Fruit Flies (TPFF) of the International Plant Protection Convention (IPPC) convened in Vienna from 1-5 September 2008 with the objective to revise the draft International Standard for Phytosanitary Measures Systems Approaches for Pest Risk Management of Fruit Flies (Tephritidae) and to incorporate production sites and places of production.

This standard draft is aimed at providing guidelines for the establishment and use of systems approaches as an option for pest risk management of fruit flies of economic importance to facilitate trade of fresh fruits and vegetables. The final draft prepared will be under further revision by the Technical Panel and its final version is expected to be presented to the IPPC Standards Committee in May 2009.

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

A consultants meeting was held in Antigua, Guatemala (18-22 August 2008) in conjunction with the final RCM of a CRP entitled Molecular Technologies to Improve the Effectiveness of SIT (see summary on page 15). This strategy was specifically chosen in order for the consultants to assess if sufficient progress had been made in developing these molecular technologies to the extent that they could be of direct use in the development of improved strains for SIT. In addition it gave them the opportunity to assess the limitations of the molecular approach as compared to the classical genetic approach.

Participants of the Consultants Meeting, Antigua, Guatemala.

The presentations of the participants, together with recent publications from many other laboratories illustrated the tremendous progress that has been made in the development of these molecular technologies. Genetic transformation is now routine, transgene stability (and hence biosafety) has been considerably increased, sex determination systems are well understood and conditional lethal genes tested in many pest species. Following detailed discussions the consultants identified two areas where

improved strains would make a major contribution to improving the efficiency and effectiveness of operational SIT programmes. These are genetic sexing strains and marker strains and the consultants recommended that both molecular and classical techniques be used and that end-users of any of the research outputs be included in the new CRP (see announcement on page 15).

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

The International Organisation for Biological and Integrated Control of Noxious Animals and Plants / West Palaearctic Regional Section (IOBC/WPRS) Working Group Integrated on Plant Protection in Fruit Crops, 7th International Conference on Integrated Fruit Production was held from 27–30 October 2008 in Avignon, France. It was attended by a record 228 delegates. The number of oral presentations and posters was 200. Three plenary sessions were held and the two disciplines, Entomology and Pathology, were held in concurrent sessions.

This meeting of the whole IOBC/WPRS Working Group is held every 4 years. The group is comprised of 5 subgroups: Pome fruit arthropods, Pome fruit diseases, Soft fruits, Stone fruits and Integrated Fruit Production (IFP) Guidelines.

A brief analysis of the content of the conference shows that most delegates came from the host country, France, with 51 attendees. Italy was second (44) followed by the USA (18), the UK (13), Spain (11), Switzerland (10) and Belgium and Germany (8 each). These comprised the bulk of attendees from a total of 32 countries.

The conference's oral presentations and posters could be divided into three main categories:

1. Broad reviews of Integrated Fruit Production (25 presentations)
2. Pests (121 presentations)
3. Diseases (54 presentations)

Presentations dealing with pests were on the following Insect Pest categories:

1. Lepidoptera (60 – of which 37 were specifically on *Cydia pomonella* (Codling Moth)
2. Aphids (14)
3. Parasites, parasitoids, predators (13)
4. Psyllids, midges (7)
5. Fruit flies (6)
6. Earwigs (5)
7. Coleoptera (5)
8. Pest mites (4)
9. *Thrips* (1)

Entomological topics were:

1. General ecology (30)
2. Parasites, parasitoids, predators (26)
3. Semiochemicals, mating disruption (24)
4. General biological control (14)
5. Insect resistance (13)
6. IPM use of insecticides (9)
7. Baits, traps (5)
8. SIT (1)

The oral presentations and posters demonstrated a high level of basic science and a good level of practicable science. The record number of presentation attests to the level of commitment that scientists and governments in the Western Palaearctic region have to the development of environmentally and economically sustainable fruit production systems. The delegate from the FAO/IAEA noted just one presentation on the sterile insect technique (SIT) for pest insect suppression. It appears that little is known by delegates from this region on the topic of SIT and area-wide integrated pest management. This is despite its current use in many fruit fly and Lepidoptera suppression programmes.

Consultants Meeting on Development of Bait Stations for Fruit Fly Suppression in Support of SIT, 30 October-1 November 2008, Mazatlán, Mexico

Until late 1990s the most common attractants available to capture female fruit flies were based on natural protein solutions such as torula yeast and hydrolysed proteins. As a result of an FAO/IAEA Coordination Research Project (CRP) entitled Development of Female Medfly Attractant Systems for Trapping and Sterility Assessment carried out during 1994-1998, the first effective female-biased synthetic food lure was developed for the Mediterranean fruit fly (*Ceratitis capitata*). This lure is now being used worldwide in most large-scale control programmes against this pest.

A follow-up CRP (2000-2005) entitled Development of Improved Attractants and Their Integration into Fruit Fly SIT Management Programmes was conducted with emphasis on three major areas: (i) the development of female-biased trapping system for monitoring other fruit fly species of quarantine and economic importance within the genera *Anastrepha*, *Bactrocera*, *Ceratitis* and *Dacus*, (ii) evaluation of mass trapping as a method for population suppression, and (iii) the development of target lure and kill devices (or bait stations) for fruit fly control. A recommendation, after the analysis of the CRP results, was the need to further develop bait stations as a suppression tool for special situations in support of SIT action programmes.

Based on current knowledge, there are some recent breakthroughs that can facilitate the task to develop a more cost-effective bait station:

- Availability of the synthetic female attractants
- The finding of alternative more environment-friendly insecticides in view of legal and social constrains to the use of organophosphates

- Development of long-lasting bait formulations, active in the field up to six months.

The further development of the bait stations needs to take into consideration that:

- Their cost must be significantly reduced due to the need for using large amounts of these devices to cover organic commercial orchards, backyards, suburban areas, and other sensitive and host bearing areas such as natural parks
- The devices must remain active in the field for long periods to reduce the labour costs associated with their distribution
- The evaluation of cost-effectiveness must focus on fruit infestation and not exclusively on adult population surveys.

The above mentioned CRP produced preliminary data that can be used as a basis to develop a more effective device to be used as a bait station. The consultant meeting discussed the status of development of various alternative bait stations, and the activities required to further develop these devices.

7th Meeting of the Working Group on Fruit Flies of the Western Hemisphere, 2-7 November 2008, Mazatlán, Mexico

The 7th Meeting of the Working Group on Fruit Flies of the Western Hemisphere was successfully held with FAO/IAEA co-sponsorship with the participation of 243 researchers, plant protection officers and fruit fly experts from 14 countries of the Americas, as well as 6 other countries from the other continents. The meeting was extremely well organized and we would like to thank the Mexican hosts from the National Plant Protection Directorate and the Plant Protection Committee of the State of Sinaloa for that efforts and hospitality.

This working group is the forum at which all aspects of fruit fly basic and applied research, area-wide control, and related phytosanitary issues in terms of quarantines, invasive species and international trade of fruit and vegetable commodities are discussed. SIT again played a prominent role at this event, confirming that the area-wide integrated application of the Sterile Insect Technique (SIT) against fruit fly pests is gaining momentum. FAO/IAEA activities in terms of developing and promoting integrated SIT application against fruit flies were very visible as a result of many references to them in 21 oral presentations by invited speakers, 120 posters, and discussions.

Important research results were presented, in many of which the FAO/IAEA Programme is directly or indirectly involved. SIT is currently being applied on an area-wide basis against several fruit fly pests in Argentina, Brazil, Chile, Costa Rica, Guatemala, Mexico, Peru, and the USA. There are also numbers of countries in different preparatory stages of embarking in such integrated area-wide fruit fly management programmes, many technically backstopped by the Agency's TC programme.

Insect Pest Control Subprogramme staff was involved in chairing some sessions, several of the posters, as well with the following invited oral presentations:

- Incipient Speciation Revealed in *Anastrepha fraterculus* by Studies on Mating Compatibility, Hybridization and Cytology, by Alan Robinson.
- Development of Hormone Therapy and Protein Supplements in Improving Efficacy of SIT for Tephritid Fruit Flies, by Rui Pereira.
- Assessment of X ray Irradiation for Fruit Flies Sterilization, by Jorge Hendrichs.
- Development of Worldwide Tephritid Fruit Fly Networks through Tephritid Workers Databases (www.tephritid.org), by Abdejelil Bakri.

Participants of the 7th Meeting of the Working Group on Fruit Flies of the Western Hemisphere, Mazatlán, Mexico.

The ongoing Mexican National Fruit Fly Campaign against various *Anastrepha* pest species was initiated in the early 1990s and is funded by the fruit and vegetables industry (one third), the State Government (one third) and the Federal Government (one third). It has already succeeded in gradually freeing the northern 48% of all of Mexican territory of these fruit flies. This achievement represents major benefits to the Mexican economy in terms of a major expansion of fresh fruit exports without the need of costly post-harvest treatments.

Alone the State of Sinaloa in north-western Mexico, where the meeting was held, exports close to a billion $US of tomato, mango and other fresh fruit and vegetable commodities, mainly to the USA. This State is already two thirds fruit fly free and is therefore at the current front of eradication and quarantine activities. The southern third of the State is under suppression and SIT activities and includes the sterile fly emergence and release facility in Rosario that was visited.

This recently established facility incorporates a number of the findings resulting from the ongoing CRP on Improving Sterile Male Performance in Support of Fruit Fly SIT Programmes, such as the inclusion of juvenile hormones and protein in the diet of immature sterile males. As a result, *Anastrepha* flies reach sexual maturity several days earlier, suffer reduced predation losses and are therefore more effective, and they perform better when competing with wild males for wild females.

During the meeting three fruit fly workers (Aldo Malavasi, Moscamed Brasil, Juazeiro, Bahia, Brazil; Robert Mangan, USDA-ARS, Weslaco, TX, USA; and Jorge Hendrichs, FAO/IAEA, Vienna, Austria) were recognized for the substantial work and leadership on Tephritid fruit flies (see figure).

Awarded Tephritid fruit fly workers during the 7th Meeting of the Working Group on Fruit Flies of the Western Hemisphere: Robert Mangan (left), Aldo Malavasi (centre), and Jorge Hendrichs (right).

Consultants Meeting to Plan a Coordinated Research Project on the Development of Generic Irradiation Doses for Quarantine Treatments, 3-7 November 2008, Vienna, Austria

The purpose of the meeting was to advise the Food and Environmental Protection and the Insect Pest Control Subprogrammes of the Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture (NAFA) on the proposed Coordinated Research Project (CRP) Development of Generic Irradiation Doses for Quarantine Treatments.

Participants of the Consultants Meeting, FAO/IAEA Agriculture and Biotechnology Laboratory, Seibersdorf, Austria.

Development oriented research supported by the FAO/IAEA through Coordinated Research Projects and the Seibersdorf Laboratories has produced many scientific and technical outputs in recent years, including updated knowledge of the optimal post-harvest radiation doses for destroying bacteria, insects and other organisms in foodstuffs and other agricultural commodities that cause spoilage and human diseases, while maintaining wholesomeness, nutritional value and other characteristics important to consumers.

Irradiation is increasingly accepted and applied as a proven and effective phytosanitary treatment for the control of insect pests, including pests of quarantine significance. More than 60 countries now have regulations allowing the use of irradiation in at least one product.

In order to meet the objectives of the CRP, the consultants recommended that:

- The focus should be on generic doses for non-fruit fly groups of arthropods. These include mites, thrips, mealybugs, weevils, leaf miners, aphids and scale insects
- The CRP outcomes should facilitate the finalisation of IPPC treatments and standards that deal with phytosanitary applications of irradiation
- Reducing the generic dose of 400 Gy for all Insecta (except pupae and adults of Lepidoptera) should be investigated

- Research protocols should be developed during the 1st RCM that includes, among other things, definitions of the measure of efficacy for irradiation as a phytosanitary option, for all the arthropod groups that will be studied under the CRP
- A set of guidelines should be developed during the first Research Coordination Meeting (RCM) on the application and reporting of dosimetry to ensure consistency
- A high priority should be given to develop a generic dose for all phytophagous mites
- A generic dose for all weevils should also be developed
- The CRP framework should consider the outputs of previous CRP and synergies with related Technical Cooperation country and regional irradiation projects
- Large scale testing up to 30,000 insects should be considered in confirming that the selected dose is efficacious.

The Bill and Melinda Gates Foundation Sharpens their Funding Knife with Agency help

Mark Benedict attended a Gates Foundation meeting in Seattle, USA in July to which the Foundation had invited about 170 scientists and public health advisors to discuss the agenda for malaria control and particularly the role of entomology and vector control. This agenda will in part shape the future of the Foundation's efforts.

Working groups were formed at the workshop to develop documents or manuscripts on various topics. The one which Mark participated in covered SIT in the broad sense including not only classical SIT but also cytoplasmic incompatibility, RIDL and meiotic drive. A manuscript has been developed from the working groups efforts and will likely appear in a compilation of similar reports from other groups.

Notable was that there was almost no mention of an area-wide insect control strategy in spite of the fact that one of the emphases of the Gates Foundation will be eradication of whole vector populations and not merely control of malaria. Many of the strategies being proposed are merely the application on larger scales of personal protection measures that eliminate only the portion of the vector population that comes into contact with human communities and their surroundings. While these localized measures do reduce transmission, there is no prospect that they will reach all vector individuals to the degree that local elimination of the population is likely. Therefore, political and financial support for such localized measures must be sustained at a high level indefinitely. Numerous historical precedents demonstrate that this is unlikely. Therefore, a larger, more unified perspective at the population level will be essential and should include area-wide control as part of an integrated vector management (IVM) approach.

SIT and many other green technologies are compatible under WHO's emphasis on IVM, but few are as effective as SIT at the low vector population densities that might be necessary for eradication. Comments along this line in one of the sessions brought numerous comments and claps of support. The absence of this approach in a global plan of eradication provides a significant opportunity for the Agency SIT programme to advocate implementation of area-wide approaches in these campaigns.

Aedes albobictus, Italy

Staff of the Entomology Unit visited the SIT pilot programme against *Aedes albopictus* in Crevalcore, Italy. Led by Romeo Bellini of the Centro Agricoltura e Ambiente (CAA), this programme has effectively introduced sterility into wild populations of this dengue and chikungunya vector in two isolated Italian villages. The programme is currently under consideration for expansion. As part of this plan, the Agency team delivered a mass-production cage to the laboratory for testing and development.

Staff also participated in a planning mission related to the EU FP7 programme. Their role was to assist in the design of a facility for testing and semi-field production of mosquitoes for genetic control. The Vienna team anticipates that transgenic mosquitoes may eventually offer improvements for SIT, and locations at which they can be tested safely will be an essential part of determining their value. The facility that is planned will be located in Terni, Italy and is being developed in collaboration with Istituto Superiore di Ricerca e Formazione sui Mater (ISRIM) and the University of Perugia.

Announcements

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/).

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.

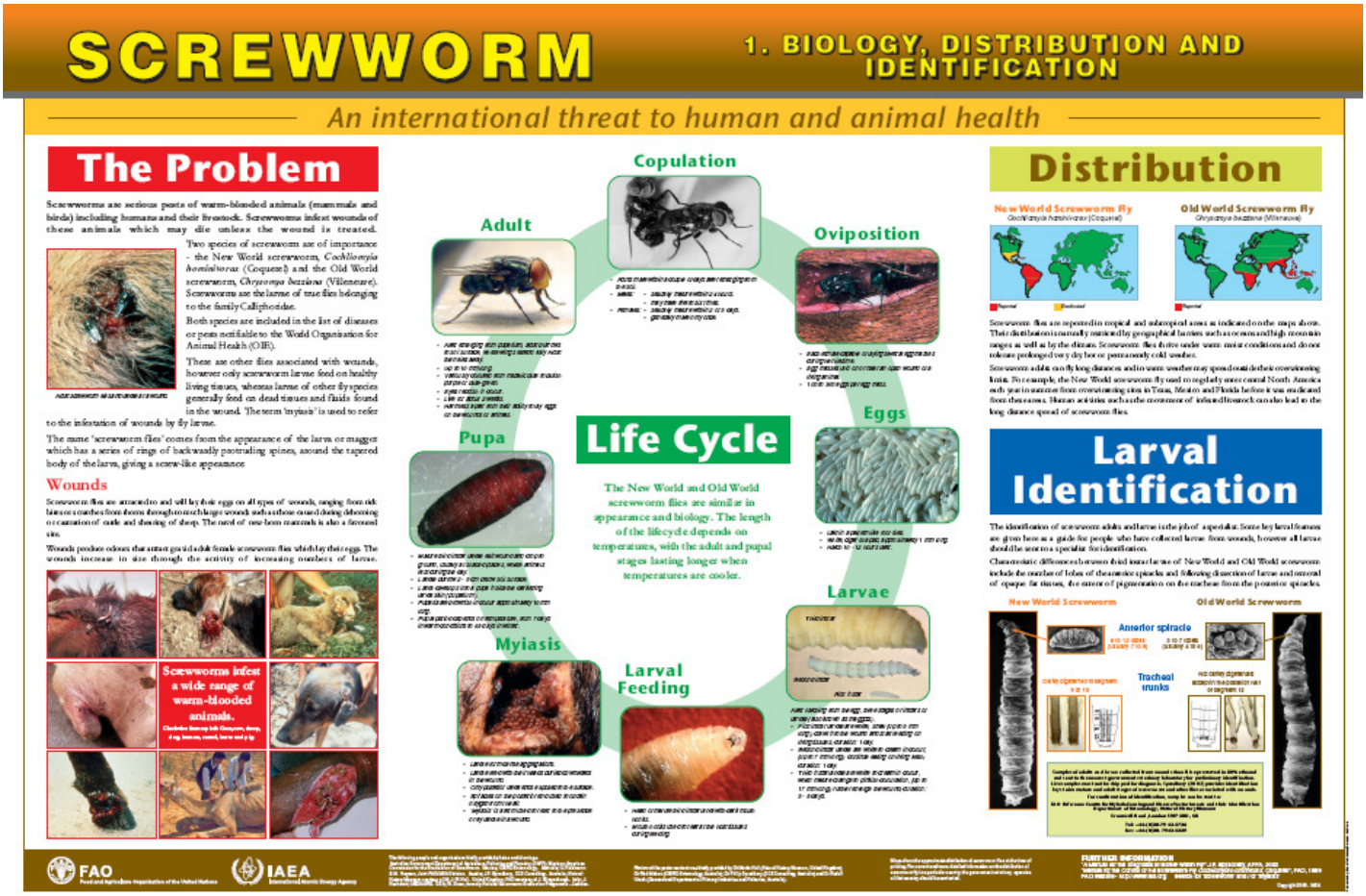
This CRP will be managed by the Food and Environment Protection Subprogramme of the Joint FAO/IAEA Division, in conjunction with technical support from the Insect and Pest Control Subprogramme. Information on the IAEA Coordinated Research Programme and how to apply for research contracts and research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

News

New Screwworm posters

A set of two posters on new and old world screwworm flies (*Cochliomyia hominivorax* and *Chrysomya bezziana*) for use by quarantine and other concerned authorities in infested and endangered countries has been prepared. Poster 1 (below) deals with screwworm fly biology, distribution and identification. Poster 2 (next page) addresses screwworm surveys (adults and larvae) and integrated management of screwworm flies, including the sterile insect technique (SIT).

The pdf-files of the posters are downloadable under www-naweb.iaea.org/nafa/ipc/news-ipc.html. Laminated good quality sets of the posters can be ordered from Scientific Advisory Services - Australia www.saspl.com.au (richard@saspl.com.au)



Sterile Light Brown Apple Moth Releases Scheduled in California for Early 2009

California will begin releasing sterile light brown apple moth (LBAM) early next year as yet another tool that California Department of Food and Agriculture (CDFA) and USDA officials hope will eradicate the voracious invasive pest from the state.

Sterile LBAM are being reared at the pink bollworm (PBW) mass rearing facility in Phoenix, Arizona. The first shipment of 500, 000 sterile insects are expected to be released early next year within quarantined areas of California where the LBAM has been trapped.

Typically, it takes at least three to five years to develop and perfect a sterile release programme for a new Lepidoptera pest. However, thanks to an accelerated effort from scientists associated with the PBW rearing and release programme, as well as researchers from Hawaii, New Zealand and Australia where there are LBAM infestations, the technology is being developed for LBAM in less than two years.

Source: *Western Farm Press (17 November 2008).*

Colombia Declares the Country Free of Oriental Fruit Fly and Melon Fruit Fly

During the last 15 years, a permanent trapping survey has demonstrated the absence of the Oriental fruit fly, *Bactrocera dorsalis*, in Colombia, based on which the country has now been declarated free of this pest. This achievement represents the guarantee to export banana (92% of total of fresh fruit exports) to external markets without the need for any fruit fly quarantine treatments.

The south of the Guajira region (municipalities of La Jagua del Pilar, Urumita, Villanueva, el Molino, San Juan del Cesar, Distracción, Fonseca, Barrancas and Hato Nuevo), was also declared free of melon fruit fly, *Bactrocera cucurbitae*.

Additionally, a low prevalence area of Mediterranean fruit fly (*Ceratitis capitata*), and of South American fruit fly (*Anastrepha fraterculus*), was declared in the northern part of Valle del Cauca (including the municipalities of La Unión, Toro, Roldanillo and Zarzal).

Source: web.presidencia.gov.co *(22 August 2008)*

Fruit Fly Invasion Causes Loss of Millions in Namibia Exports

The invasive fruit fly (*Bactrocera invadens*) is infesting fruit and vegetables produced in northern Namibia, causing millions of dollars of losses to exporters.

After the discovery of the fly in Namibia, South Africa has closed its borders to certain agricultural products, including watermelons, butternuts, mangoes and tomatoes. *Bactrocera invadens* originated in Asia, and was first discovered in Africa in 2003 in Kenya.

*Male invasive fruit fly (*Bactrocera invadens*).*

The Etunda Irrigation Scheme, a 600-hectare producer at Ruacana in the Omusati Region, has been hard hit by the closure of the South African borders to its products, with General Manager Vilho Nghipondoka reporting losses in excess of N$4 million as a result.

South Africa will not open the border until obtaining detailed information on the distribution of the outbreak, because this is a very aggressive fruit fly that is becoming a large-scale problem.

These fruit flies are classified as quarantine organisms, which means that no fruit containing larvae may be exported. USDA-APHIS and FAO/IAEA are establishing a collaboration to develop post-harvest treatments against *B. invadens*.

Source: *Namibian (18 November 2008).*

Mexican Fresh Guava Treated by Irradiation Enters the USA for the First Time in November 2008

The US Department of Agriculture cleared the way for imports of fresh guava starting in November 2008. Under this new rule published in the Federal Register, fresh guavas from Mexico must be irradiated with a minimum absorbed dose of 400 gray, and each consignment must be inspected by Mexico's National Plant Protection Organization. Sterygenics, a company that operates an irradiation service for medical sterilization in an irradiation plant near Mexico City, that has now been adapted to also allow fruit irradiation. Benebion, another company, is building a cobalt-based irradiation facility in the state of San Luis Potosi, in central Mexico, that plans to open next year, and that is designed specifically for phytosanitary purposes. In total, Mexico produces about 300,000 metric tons of fresh guavas, which until now were totally consumed in the domestic market due to a lack of a viable post-harvest treatment.

Source: *thepacker.com (15 October 2008).*

Isotron Thailand Certified by USDA

Bravo to Isotron Thailand for their successful certification by the US Department of Agriculture's (USDA) Animal and Plant Health Inspection Service (APHIS). They are now part of the pre-clearance programme allowing the irradiation of litchi, longan, mango, mangosteen, pineapple and rambutan for export into the USA. This increases significantly the ability for American consumers to enjoy more exotic fruits from Thailand.

Isotron Thailand operates a multipurpose pallet irradiator and a continuous tote irradiator at the same site providing services to many industries including medical device manufacturers, foods and food packaging, pet toys, and now fresh fruits. Isotron is capable of delivering wide dose ranges from as low as 400 Gy to a sterilization dose as high as 25 kGy or above.

Since 2002, the US Department of Agriculture has accepted irradiation as a phytosanitary treatment for imported fruits and vegetables to protect against the introduction of plant pests and safeguard American agriculture. According to Alan Green of the USDA, successful irradiation programmes have recently initiated in Thailand and India for tropical fruits and have received outstanding consumer support. On a related note new programmes are ready for start-up in Vietnam and Mexico.

Source: iiA eNewsletter *(Summer 2008).*

Workshop on Agriculture Biosecurity in Australia

This international training workshop based at the Griffith University Fruit Fly Research Program, is conducted by the International Centre for Management of Pest Fruit Flies (ICMPFF). The teaching staff includes R. A. I. Dew and S. Vijasegaran. The workshop covers a wide range of topics like fruit fly identification, biology, quarantine strategies, emergency response and meeting the requirements of the WTO-SPS agreement. The workshops will be offered in March and September 2009. For additional information please contact d.drew@griffith.edu.au

USDA Removes Panama from Lists of Regions where Screwworm is Considered to Exist

The US Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) is advising the public that it is amending the regulations regarding the importation of live horses, ruminants, swine and dogs by removing Panama from the lists of regions where screwworm is considered to exist. It is taking this action because the eradication of screwworm using the SIT from Panama has been confirmed. This action will relieve certain screwworm-related certification and inspection requirements for live animals imported into the United States from Panama.

Source: *USDA-APHIS (28 August 2008).*

USDA Proposes to Implement Risk-Based Process for Certain Fruits and Vegetables from Hawaii and US Territories

The US Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) today announced a proposal to establish a risk-based process for approving the interstate movement of certain fruits and vegetables from Hawaii and the territories in the United States. APHIS also proposes to acknowledge pest-free areas in Hawaii and the territories using a notice-based process.

The proposed process for approving certain fruits and vegetables only would apply to those commodities that can be moved safely interstate, subject to one or more of six designated phytosanitary measures. These measures would include inspection in the first state of arrival; approved treatment; origination from a pest-free area; inspection and certification in the state or territory of origin showing that the commodity is pest-free; limiting the distribution of the commodity to certain states; or, determining that the risk associated with the commodity can be mitigated through commercial practices.

The interstate movement of fruits and vegetables that require additional phytosanitary measures would continue to undergo the full rulemaking process.

The proposed changes would not alter which fruits and vegetables are currently eligible for interstate movement or how the risks associated with those commodities would be evaluated or mitigated. The proposed changes would only make more timely the approval of fruits and vegetables that are safe for interstate movement in the United States.

APHIS also is proposing to make other changes, which include:

- Establishing a "notice-based" process for acknowledging changes in the status of pest-free areas;
- Reorganizing the regulations to consolidate and eliminate redundant requirements;
- Making various non-substantive changes to the regulations to make them easier to use.

If approved, these changes would make APHIS' domestic interstate movement regulations more consistent with its fruit and vegetable import regulations, also known as Quarantine 56.

Source: *USDA-APHIS (16 June 2008).*

USDA Recognizes Pest-Free Areas in Brazil Using Streamlined Process

The US Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) today announced its recognition of 20 municipalities in Brazil as pest-free areas for the South American cucurbit fly, *Anastrepha grandis*, a major pest of melons, under USDA's streamlined process for approving pest-free areas.

In response to a request from the government of Brazil to recognize 7 municipalities in the state of Ceará and 13 municipalities in the state of Rio Grande do Norte as free of the South American cucurbit fly, APHIS evaluated Brazil's survey protocols and its system to establish, verify and maintain freedom from this pest. Based on that information, APHIS has determined that those municipalities meet the criteria for recognition as pest-free areas under the approval process.

In July 2007, USDA implemented revised regulations pertaining to the importation of fruits and vegetables. Under these revisions, APHIS also established the framework of a notice-based process for approving pest-free areas in exporting countries. This process allows the agency to be more responsive in recognizing changes in the pest-free status of foreign areas. In the past, APHIS recognized changes in the pest-free status of countries via rulemaking.

Now, using the notice-based process, a notice announcing that an exporting country has provided information that meets or exceeds the pest-free criteria listed in the regulations and that APHIS officials have completed an evaluation of the request will be published in the Federal Register. At the time the notice is published, APHIS also will provide copies of the available supporting information.

The notice will be available for public comment for 60 days. Once all comments have been considered, APHIS will, if appropriate, publish another notice in the Federal Register stating that APHIS is recognizing the areas as free of specified pests.

To learn more about the revisions made to USDA's fruit and vegetable regulations, visit APHIS' Hot Issues page at www.aphis.usda.gov and click on "more" then scroll to the Quarantine 56 link.

Source: *USDA-APHIS (6 June 2008).*

Chinese Stop Buying Tangerines out of Fear of Infestation

Coming hot on the heels of the melamine contamination in milk products, publicity on larvae in fruit created panic and sent orange sales crashing nationwide.

Retailers and farmers were reduced to tears, even though there was only a limited maggot problem and the bugs are harmless to humans. Orange sales have picked up a bit after three weeks of government clarifications, but images of rotten oranges and weeping farmers were still on TV.

Farmers in orange-producing provinces like Sichuan, Hunan, Hubei and Jiangxi have had to destroy thousands of tonnes of mandarin and oranges. A total loss at over 10 billion yuan (US$2.2 billion) was reported. Orange-dealer Chen Shouyun, in Chengdu, the capital of Sichuan,

said: "Last week, I didn't sell even 1kg of oranges when I used to sell 5000kg a day."

Mr Chao Naipeng, professor of communications in Nanjing University, said: "The panic and anger caused by news of maggots in oranges are strong enough an impetus for people to forward the SMS to others".

The central and local governments have responded by explaining that the maggot outbreak is confined to a particular area and that there is no health threat.

Source: *China Daily (14 November 2008).*

Guest Article

First Record of Fruit Fly, *Dacus longicornis* Wiedemann (Diptera: Tephritidae) from Bangladesh

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Institute of Food and Radiation Biology, Bangladesh Atomic Energy Commission, Dhaka, Bangladesh.

Male (upper) and female (lower) Dacus longicornis.

Summary

The presence of *Dacus (Callantra) longicornis* Wiedemann (Diptera: Tephritidae) was detected for the first time in Bangladesh. An adult male fly was collected on 27th July, 2008 from small kitchen garden of Ganakbari, Savar area, containing various cucurbit crops *viz*., *Cucurbita maxima* (D.), *Trichosanthus cucumerina* (L.), *Luffa acutungula* (L.) etc. using a Mcphail trap baited with cue-lure. The fruit fly specimen were distinguished by the presence of a red-brown scutum, anatergite fuscous, face with a pair of black spots, abdomen petiolate with elongated abdominal tergite-1, cells bc and c fuscous, costal band overlapping R_{4+5}, and absence of fore femoral spines.

Interesting Published Articles

Effect of Irradiation on the Longevity and Reproduction of *Pheidole megacepala* (Hymenoptera: Formicidae) Queens

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Abstract

Irradiation is a quarantine treatment option to control ants and other hitchhiker pests on fresh horticultural products exported from Hawaii. The radiotolerance of the big-headed ant, *Pheidole megacephala (F.),* was studied to determine a dose sufficient for its control. This ant was chosen as a representative species because it is a common hitchhiker and rearing methods in the laboratory have been developed. The desired response with irradiation treatment of ants is sterility of reproductive females. Queens from micro-colonies were irradiated at 60, 90, 120, or 150 Gy or left untreated as controls, then followed for 19 weeks to observe colony growth. In general, queen longevity, and the number of eggs, larvae, and pupae observed in the micro-colonies decreased with increasing irradiation dose. In the 60 Gy treatment, the number of eggs observed was reduced by 89.6% compared with the untreated controls. In the 120 Gy and 150 Gy treatments, the number of eggs observed was reduced by 99.5% and 98.5%, respectively, and no eggs were found after the first observation date at 7 days after treatment. No larvae or pupae were observed in the 90, 120 or 150 Gy treatments, suggesting these irradiation doses sterilized queens. This study suggests the USDA-APHIS-approved generic irradiation dose of 400 Gy is more than sufficient for the Formicidae. Information is needed on the radiotolerance of additional species of ants to confirm our findings.

The full paper was published in: Proc. Hawaiian Entomol. Soc. 39: 43-47 (2007).

Papers in Peer-Reviewed Journals

In Press

ABD-ALLA, A.M.M., F. COUSSERANS, A.G. PARKER, C. JRIDI, M. BERGOIN and A.S. ROBINSON. Quantitative PCR analysis of the salivary gland hypertrophy virus (GpSGHV) in a laboratory colony of *Glossina pallidipes*. Virus Research. (in press).

BROWN, P.J.E., K.J. KOMATSU, P.P. ABILA, A.S. ROBINSON, L.M. OKEDI, N. DYER, M.J. DONNELLY, M.A. SLOTMAN and A. CACCONE. Polymorphic microsatellite markers for the tsetse fly *Glossina fuscipes fuscipes* (Diptera: Glossinidae), a vector of human African trypanosomiasis. Molecular Ecology Resources. (in press).

CÁCERES, C., D.F. SEGURA, M.T. VERA, V. WORNOAYPORN, J.L. CLADERA, P. TEAL, P. SAPOUNTZIS, K. BOURTZIS, A. ZACHAROPOULOU and A.S. ROBINSON. Incipient speciation revealed in *Anastrepha fraterculus* (Diptera: Tephritidae) by studies on mating compatibility, sex pheromones, hybridization and cytology. Biological Journal of the Linnean Society. (in press).

CANCINO, J., L. RUIZ, J. HENDRICHS, and K. BLOEM. Evaluation of sequential exposure of irradiated hosts to maximize the mass rearing of fruit fly parasitoids. Biocontrol Science and Technology. (in press).

GARCIA-MARUNIAK, A., A.M.M. ABD-ALLA, T.Z. SALEM, A.G. PARKER, V-U. LIETZE, M.M. VAN OERS, J.E. MARUNIAK, W. KIM, J.P. BURAND, F. COUSSERANS, A.S. ROBINSON, J.M. VLAK, M. BERGOIN and D.G. BOUCIAS. Two viruses that cause salivary gland hypertrophy in *Glossina pallidipes* and *Musca domestica* are related and form a distinct phylogenetic clade. Journal of General Virology. (in press)

GARCIA-MARTINEZ, V., E. HERNANDEZ-ORTIZ, C.S. ZEPEDA-CISNEROS, A.S. ROBINSON, A. ZACHAROPOULOU and G. FRANZ. Mitotic and polytene chromosome analysis in the Mexican fruit fly, *Anastrepha ludens* (Loew), (Diptera: Tephritidae). Genome. (in press).

HENDRICHS, J. and A.S. ROBINSON. Sterile Insect Technique. *In* V.H. Resh and R.T. Carde (eds), Encyclopaedia of Insects 2nd Edition, Academic Press (in press).

HENDRICHS, J., K. BLOEM, G. HOCH, J. E. CARPENTER, P. GREANY, and A. S. ROBINSON. Improving the cost-effectiveness, trade and safety of biological control for agricultural insect pests using nuclear techniques. Biocontrol Science and Technology. (in press).

PEREIRA, R.., SIVINSKI, J. and P.E.A. TEAL. Influence of methoprene and dietary protein on male *Anastrepha suspensa* (Diptera:Tephritidae) mating aggregations. Journal of Insect Physiology (in press).

PEREIRA, R.., SIVINSKI, J. and P.E.A. TEAL. Influence of a juvenile hormone analogue and dietary protein on male *Anastrepha suspensa* (Diptera:Tephritidae) sexual success. Journal of Economic Entomology (in press).

ROBINSON, A.S., B.G.J. KNOLS, M.Q. BENEDICT, A. BOUSSAHA, G. VOIGT, P. ANDREO, Y. TOURE, and J. HENDRICHS. Development of the sterile insect technique for African malaria vectors. I. Conceptual framework and rationale. Malaria Journal (in press).

ROBINSON, A.S., M.J.B. VREYSEN, J. HENDRICHS and U. FELDMANN. Enabling technologies to improve area-wide integrated pest management programmes for the control of screwworms. Medical and Veterinary Entomology. (in press).

SCHETELIG, M., C. CÁCERES, A. ZACHAROPOULOU, G. FRANZ AND E.A. WIMMER. Conditional embryonic lethality to improve the Sterile Insect Technique in Ceratitis capitata (Diptera: Tephritidae). BMC Biology (in press).

SEGURA, D.F., C. CÁCERES, M.T. VERA, V. WORNOAYPORN, A. ISLAM, P.E.A. TEAL, J.L. CLADERA, J. HENDRICHS and A.S. ROBINSON. Enhanced mating performance after juvenile hormone treatment in *Anastrepha fraterculus* (Diptera: Tephritidae): a differential response in males and females acts as a physiological sexing system. Entomologia Experimentalis et Applicata. (in press)

2008

ABD-ALLA, A.M.M., COUSSERANS, F., PARKER, A.G., JEHLE, J.A., PARKER, N.J., VLAK, J.M., ROBINSON, A.S., BERGOIN, M. (2008). Genome analysis of a Glossina pallidipes salivary gland hypertrophy virus (GpSGHV) reveals a novel large double-stranded circular DNA virus. Journal of Virology. 82 (9): 4595-611.

ABILA, P.P., M.A. SLOTMAN, A. PARMAKELIS, K.B. DION, A.S. ROBINSON, V.B. MUWANIKA, J.C.K ENYARU, L.M. OKEDI, S. AKSOY and A. CACCONE (2008). High levels of genetic differentiation between Ugandan *Glossina fuscipes fuscipes* populations separated by Lake Kyoga. PLoS Neglected Tropical Diseases 2: e242.

BENEDICT, M.Q. and A.S. ROBINSON (2008). Impact of technological improvements on traditional control strategies, pp. 84-90. *In* Aksoy, S. (ed.), Transgenesis and management of vector-borne diseases. Landes Bioscience, New York, USA.

CÁCERES, C. and P. RENDÓN (2008). The FAO/IAEA interactive spreadsheet for design and operation of insect mass rearing facilities, pp. 307-312. *In* Sugayama R. L. et al. (eds.), Fruit Flies of Economic Importance: From Basic to Applied Knowledge, Proceedings of the 7th International Symposium on Fruit Flies of Economic Importance. SBPC, Salvador, Bahia, Brazil.

CORE WORKING GROUP ON GUIDANCE FOR CONTAINED FIELD TRIALS (multi-authored including Benedict, M.Q) (2008). Guidance for contained field trials of vector mosquitoes engineered to contain a gene drive system: recommendations of a scientific working group. Vector-Borne and Zoonotic Diseases 8 (2):127-166.

CORONADO GONZALEZ, P.A., S. VIJAYSEGARAN and A.S. ROBINSON (2008). Mouthpart structure and feeding mechanisms of adult *Ceratitis capitata* (Wied) (Diptera: Tephritidae). Journal of Insect Science. 8:73.

DYER, N.A., S.P. LAWTON, S. RAVEL, K.S. CHOI. M.J. LEHANE, A.S ROBINSON, L.A. OKEDI, M.J.R. HALL, P. SOLANO and M.J. DONNELLY (2008). Molecular phylogenetics of tsetse flies (*Diptera: Glossina*) based on mitochondrial (*COI*, *16S*, *ND2*) and nuclear ribosomal DNA sequences. Molecular Phylogenetics and Evolution 49: 227-239.

ENKERLIN W.R. Análisis costo-beneficio del manejo integrado de plagas, pp.263-287251. *In* J. Toledo and F. Infante (eds), Manejo Integrado de Plagas. Trillas, México DF, Mexico.

ENKERLIN W.R. and D.A. LINDQUIST. Manejo integrado de plagas en áreas extensas, pp.237-251. *In* J. Toledo and F. Infante (eds), Manejo Integrado de Plagas. Trillas, México DF, Mexico.

FARIA, M.J., PEREIRA, R.., DELLINGER, T., and P.E.A. TEAL. Influence of methoprene and protein on survival, maturation and sexual performance of male Ceratitis capitata (Diptera:Tephritidae). Journal of Applied Entomology, 132: 812-819.

HELINSKI, M.E.H., R.C. HOOD, and B.G.J. KNOLS (2008). A stable isotope dual-labelling approach to detect multiple inseminations in un-irradiated and irradiated *Anopheles arabiensis* mosquitoes. Parasites & Vectors 1: 9.

LIEDO, P., W.R ENKERLIN and J. HENDRICHS. La técnica del insecto estéril, pp.202-213. *In* J. Toledo and F. Infante (eds), Manejo Integrado de Plagas. Trillas, México DF, Mexico.

PARKER, N.J., and A.G. PARKER (2008). Simple tools for assembling and searching high-density picolitre pyrophosphate sequence data. Source Code for Biology and Medicine 3 (1): 5.

2007

ABD-ALLA, A., H. BOSSIN, F. COUSSERANS, A. PARKER, M. BERGOIN, and A.S. ROBINSON (2007). Development of a non-destructive PCR method for detection of the salivary gland hypertrophy virus (SGHV) in tsetse flies. Journal of Virological Methods 139: 143-149.

ALEMU, T., B. KAPITANO, S. MEKONNEN, G. ABOSET, M. KIFLOM, B. BANCHA, G. WOLDEYES, K. BEKELE, and U. FELDMANN (2007). Area-wide intervention against the tsetse and trypanosomosis problem: the Ethiopian experience in the Southern Rift Valley, pp. 325-335. *In* M.J.B. Vreysen, A.S. Robinson, and J. Hendrichs (eds.), Area-wide control of insect pests. From research to field implementation. Springer, Dordrecht, The Netherlands.

BRICEÑO, R.D., W.G. EBERHARD, and A.S. ROBINSON (2007). Copulation behaviour of *Glossina pallidipes* (Diptera: Muscidae) outside and inside the female, with a discussion on genitalic evolution. Bulletin of Entomological Research 97:1-18.

CÁCERES C., E. RAMÍREZ, V. WORNOAYPORN, S.M. ISLAM, and S. AHMAD (2007). A protocol for storage and long-distance shipment of Mediterranean fruit fly (Diptera: Tephritidae) eggs. I. Effect of temperature, embryo age and storage time on survival and quality. Florida Entomologist 90: 103-109.

CÁCERES C., D. MCINNIS, T. SHELLY, E. JANG; A.S. ROBINSON, and J. HENDRICHS (2007). Quality management systems for fruit fly (Diptera: Tephritidae) sterile insect technique. Florida Entomologist 90: 1-9.

GARCÍA, R., L. MÉNDEZ, E. SERRANO, and M.J.B. VREYSEN (2007). Insecticidal wound treatment of livestock on Isla de la Juventud, Cuba: an efficient suppression method of New World screwworm *Cochliomyia hominivorax* prior to the release of sterile males, pp. 393-403. *In* M.J.B. Vreysen, A.S. Robinson, and J. Hendrichs (eds.), Area-wide control of insect pests. From research to field implementation. Springer, Dordrecht, The Netherlands.

GARIOU-PAPALEXIOU, A., G. YANNOPOULOS, A.S. ROBINSON, and A. ZACHAROPOULOU (2007). Polytene chromosome maps in four species of tsetse flies *Glossina austeni, G. pallidipes, G. morsitans morsitans* and *G. m. submorsitans* (Diptera: Glossinidae): a comparative analysis. Genetica 129: 243-251.

HELINSKI, M.E.H., R. HOOD-NOWOTNY, L. MAYR, and B.G.J. KNOLS (2007). Stable isotope-mass spectrometric determination of semen transfer in malaria mosquitoes. Journal of Experimental Biology 210: 1266-1274.

HENDRICHS, J., P. KENMORE, A.S. ROBINSON, and M.J.B. VREYSEN (2007). Area-wide integrated pest management (AW-IPM): principles, practice and prospects, pp. 3-33. *In* M.J.B. Vreysen, A.S. Robinson, and J. Hendrichs (eds.), Area-wide control of insect pests. From research to field implementation. Springer, Dordrecht, The Netherlands.

HENDRICHS, M.A., V. WORNOAYPORN, B.I. KATSOYANNOS, and J. HENDRICHS (2007). Quality control method to measure predator evasion in wild and mass-reared Mediterranean fruit flies (Diptera: Tephritidae). Florida Entomologist 90: 64-70.

HOOD-NOWOTNY, R. and B.G.J. KNOLS (2007) Stable isotope methods in biological and ecological studies of arthropods. Entomologia Experimentalis et applicata 124: 3-16.

KAPPMEIER GREEN, K., F.T. POTGIETER, and M.J.B. VREYSEN (2007). A strategy for an area-wide control campaign with an SIT component to establish a tsetse-free South Africa, pp. 309-323. *In* M.J.B. Vreysen, A.S. Robinson, and J. Hendrichs (eds.), Area-wide control of insect pests. From research to field implementation. Springer, Dordrecht, The Netherlands.

KNOLS, B.G.J., H.C. BOSSIN, W.R. MUKABANA, and A.S. ROBINSON (2007). Transgenic mosquitoes and the fight against malaria: managing technology push in a turbulent GMO world. American Journal of Tropical Medicine and Hygiene 77: 232-242

KNOLS, B., R.C. HOOD, H. BOSSIN, G. FRANZ, A.S. ROBINSON, W.R. MUKABANA, and S.M. KEM (2007). GM sterile mosquitoes – a cautionary note. Nature Biotechnology 24: 1067-1068.

MAMÁN, E., and C. CÁCERES (2007). A protocol for storage and long-distance shipment of Mediterranean fruit fly (Diptera: Tephritidae) eggs. II. Assessment of the optimal temperature and substrate for male-only production. Florida Entomologist 90: 110-114.

M'SAAD GUERFALI M., A. RAIES, H. BEN SALAH, F. LOUSSAIEF, and C. CÁCERES (2007). Pilot Mediterranean fruit fly *Ceratitis capitata* rearing facility in Tunisia: constraints and prospects, pp. 535-543. *In* M.J.B. Vreysen, A.S. Robinson, and J. Hendrichs (eds.), Area-wide control of insect pests. From research to field implementation. Springer, Dordrecht, The Netherlands.

NESTEL, D., E. NEMNY-LAVY, A. ISLAM, V. WORNOAYPORN, and C. CÁCERES (2007). Effect of pre-irradiation conditioning of medfly pupae (Diptera: Tephritidae): hypoxia and quality of sterile males. Florida Entomologist 90: 80-87.

PARKER, A.G., and K. MEHTA (2007). Sterile insect technique: dose optimization, dosimetry, and irradiation for improved sterile insect quality. Florida Entomologist 90: 88-95.

PEREIRA, R., N. SILVA, C. QUINTAL, R. ABREU, J. ANDRADE, and L. DANTAS (2007). Sexual performance of mass-reared and wild Mediterranean fruit flies (Diptera: Tephritidae) from various origins of the Madeira Islands. Florida Entomologist 90: 10-14.

PEREIRA, R., N. SILVA, C. QUINTAL, R. ABREU, J. ANDRADE, and L. DANTAS (2007). Effect of acclimation to outdoor conditions on the sexual performance of mass-produced medflies (Diptera: Tephritidae). Florida Entomologist 90: 171-174.

PEREIRA, R., G. J. STECK, E. VARONA, and J. SIVINSKI (2007). Biology and natural history of *Anastrepha interrupta* (Diptera: Tephritidae). Florida Entomologist 90: 389-391.

REYES, J.X. CARRO, J. HERNANDEZ, W. MENDEZ, C. CAMPO, H. ESQUIVEL, E. SALGADO, and W. ENKERLIN (2007). A multi-institutional approach to implement fruit fly-low prevalence and fly free areas in Central America, pp. 627-640. *In* M.J.B. Vreysen, A.S. Robinson, and J. Hendrichs (eds.), Area-wide control of insect pests. From research to field implementation. Springer, Dordrecht, The Netherlands.

SIVINSKI, J., T. HOLLER, R. PEREIRA, and M. ROMERO (2007). The thermal environment of immature Caribbean fruit flies, *Anastrepha interrupta* (Diptera: Tephritidae). Florida Entomologist 90: 347-357.

VREYSEN, M.J.B., A.S. ROBINSON, and J. HENDRICHS (eds.) (2007). Area-wide control of insect pests. From research to field implementation. Springer, Dordrecht, The Netherlands.

VREYSEN, M.J.B., J. GERARDO-ABAYA, and J.P. CAYOL (2007). Lessons from area-wide integrated pest management (AW-IPM) programmes with an SIT component: an FAO/IAEA perspective, pp. 723-744. *In* M.J.B. Vreysen, A.S. Robinson, and J. Hendrichs (eds.), Area-wide control of insect pests. From research to field implementation. Springer, Dordrecht, The Netherlands.

2006

BARNES, B.N., A. TARGOVSKA, and G. FRANZ (2006). Origin of a Mediterranean fruit fly, *Ceratitis capitata* (Wiedemann), outbreak determined by DNA analysis. African Entomology 14: 205-209.

BOURTZIS, K. and A.S. ROBINSON (2006). Insect pest control using *Wolbachia* and/or radiation, pp. 225-246. *In* K. Bourtzis and T. Miller (Eds.), Insect Symbiosis II. CRC Press, Boca Raton, Florida, USA.

BRAGA SOBRINHO R., C. CACERES, A. ISLAM; V. WORNOAYPORN, and W. ENKERLIN (2006). Diets based on soybean protein for Mediterranean fruit fly. Pesq. Agropec. Bras. 41: 705-708.

CHANG, C. L., R. VARGAS, C. CACERES, E. JANG, and IL KYU CHO (2006). Development and assessment of a liquid larval diet for *Bactrocera dorsalis* (Diptera: Tephritidae). Annals of the Entomological Society of America 99: 1191-1198.

FRANZ, G. (2006). Transgenic arthropods and the sterile insect technique, pp. 37-44. *In* Status and risk assessment of the use of transgenic arthropods in plant protection. IAEA-TECDOC-1483, IAEA, Vienna, Austria.

GOOSSENS, B., H. MBWAMBO, A. MSANGI, D. GEYSEN, and M.J.B. VREYSEN (2006). Trypanosomosis prevalence in cattle on Mafia Island (United Republic of Tanzania). Veterinary Parasitology 139: 74-83.

HELINSKI, M.E., A.G. PARKER, and B.G. KNOLS (2006). Radiation-induced sterility for pupal and adult stages of the malaria vector *Anopheles arabiensis.* Malaria Journal 5: 41.

HELINSKI, M.E., B. EL-SAYED, and B.G.J. KNOLS (2006). The sterile insect technique: can established technology beat malaria? Entomologische Berichten 66: 13-20.

HOOD-NOWOTNY, R.C., L. MAYR and B.G.J. KNOLS (2006). Use carbon-13 as a population marker for *Anopheles arabiensis* in a sterile insect technique (SIT) context. Malaria Journal 5: 6.

IAEA (2006). Status and risk assessment of the use of transgenic arthropods in plant protection. IAEA-TECDOC-1483, Vienna, Austria.

KNOLS, B.G.J., and C. LOUIS (Eds.) (2006). Bridging laboratory and field research for genetic control of disease vectors. *In* Proceedings volume of the joint WHO/TDR, NIH/NIAID, IAEA and Frontis workshop on bridging laboratory and field research for genetic control of disease vectors, 14-16 July 2004, Nairobi, Kenya. Springer/Frontis, Volume 11, pp 225.

KNOLS, B.G.J., and H. BOSSIN (2006). Identification and characterization of field sites for genetic control of disease vectors, pp. 203-209. *In* B.G.J. Knols, and C. Louis (eds), Bridging laboratory and field research for genetic control of disease vectors. Springer/Frontis, Volume 11, Chapter 20. The Netherlands.

KNOLS, B.G.J., R. HOOD-NOWOTNY, H. BOSSIN, G. FRANZ, G. ROBINSON, W.R. MUKABANA, and S.K. KEMBOI (2006). GM sterile mosquitoes — a cautionary note. Nature Biotechnology 24: 1067-1068.

MUKABANA, W.R., K. KANNADY, G.M. KIAMA, J. IJUMBA, E.M. MATHENGE, I. KICHE, G. NKWENGULILA, L.E.G. MBOERA, D. MTASIWA, Y. YAMAGATA, I.M.C.J. VAN SCHAYK, B.G.J. KNOLS, S.W. LINDSAY, M. CALDAS DE CASTRO, H. MSHINDA, M. TANNER, U. FILLINGER, and G.F. KILLEEN (2006). Ecologists can enable communities to implement malaria vector control in Africa. Malaria Journal 5: 9.

MUTIKA, G.N., and A.G. PARKER (2006). Induced sterility of *Glossina pallidipes* Austen males after irradiation in a nitrogen atmosphere: Entomological Science 9: 47-53.

NJIRU, B.N., W.R. MUKABANA, W. TAKKEN, and B. G. J. KNOLS (2006). Trapping of the malaria vector *Anopheles gambiae* with odour-baited MM-X traps in semi-field conditions in western Kenya. Malaria Journal 5: 39.

SCHOLTE, E.-J., B.G. J. KNOLS, and W. TAKKEN (2006). Infection of the malaria mosquito *Anopheles gambiae* with the entomopathogenic fungus *Metarhizium anisopliae* reduces bloodfeeding and fecundity. Journal of Invertebrate Pathology 91: 43-49.

VAN DEN BERG, H., and B.G.J. KNOLS (2006). The Farmer field school: a method for enhancing the role of rural communities in malaria control? Malaria Journal 5: 3.

VAN DEN BOSSCHE, P., K. AKODA, B. DJAGMAH, T. MARCOTTY, R. DE DEKEN, C. KUBI, A. PARKER, and J. VAN DEN ABBEELE (2006). Effect of isometamidium chloride treatment on susceptibility of tsetse flies (Diptera: Glossinidae) to trypanosome infections. Journal of Medical Entomology 43: 564-567.

VERA, M. T., C. CÁCERES, V. WORNOAYPORN, A. ISLAM, A.S. ROBINSON, M.H. DE LA VEGA, J. HENDRICHS, and J.P. CAYOL (2006). Mating incompatibility among populations of the South American fruit fly *Anastrepha fraterculus* (Wied.) (Diptera: Tephritidae). Annals of the Entomological Society of America 99: 387-397.

VREYSEN, M.J.B., H.J. BARCLAY, and J. HENDRICHS (2006). Modelling of preferential mating in area-wide control programs that integrate the release of strains of sterile males-only or both sexes. Annals of the Entomological Society of America 99: 607-616.

VREYSEN, M.J.B. (2006). Prospects for area-wide integrated management of tsetse flies (Diptera: Glossinidae) and trypanosomes in sub-Sahara Africa. Revista de la Sociedad Entomologica Argentina 65: 1-21.

VREYSEN, M.J.B., J. HENDRICHS and W.R. ENKERLIN (2006). The sterile insect technique as a component of sustainable area-wide management of selected insect pests of fruits. Journal of Fruit and Ornamental Plant Research 14: 107-131.

Priced and Unpriced Publications

2008

FAO/IAEA. 2008. Model Business Plan for a Sterile Insect Production Facility. IAEA, Vienna, Austria. 386 pp. (unpriced)

2007

ENKERLIN, W. (ed.). 2007. Guidance for Packing, Shipping, Holding and Release of Sterile Flies in Area-Wide Fruit Fly Control Programmes. FAO Plant Production and Protection Paper 190, Rome, Italy. 134 pp. (unpriced)

FAO/IAEA. 2007. Cost-Benefit Analysis Model: A Tool for Area-Wide Fruit Fly Management. CD ROM, Vienna, Austria. (unpriced)

FAO/IAEA. 2007. Proceedings of an FAO/IAEA Co-ordinated Research Project on Quality Assurance of Mass-Reared and Released Fruit Flies for use in SIT Programs. Florida Entomologist 90: 1-179. Freely available on http://www.fcla.edu/FlaEnt

IAEA. 2007. Development of Improved Attractants and their Integration into Fruit Fly SIT Management Programmes. IAEA-TECDOC-1574, ISBN 987-92-0-109407-0. IAEA, Vienna, Austria. (unpriced)

VREYSEN, M.J.B., ROBINSON, A.S., HENDRICHS, J. 2007 (ed.). Area-Wide Control Insect Pests. From Research to Field Implementation. Springer, Dordrecht, The Netherlands. 789 pp. (unpriced)

2006

FAO/IAEA. 2006. Using GPS Instruments and GIS Techniques in Data Management for Insect Pest Control Programs. Tutorial CD produced by Arava Development Co. for FAO/IAEA. IAEA, Vienna, Austria. (unpriced)

IAEA. 2006. Designing and Implementing a Geographical Information System. A Guide for Managers of Area-wide Pest Management Programmes. Non-serial IAEA publication. IAEA, Vienna, Austria. (unpriced)

IAEA. 2006. Status and Risk Assessment of the Use of Transgenic Arthropods in Plant Protection. IAEA-TEC-DOC-1483, ISBN 92-0-113005-8. IAEA, Vienna, Austria. (Euro 15)

2005

DYCK, V.A., HENDRICHS J., ROBINSON A.S. 2005 (eds.). Sterile insect technique. Principles and practice in area-wide integrated pest management. Springer, Dordrecht, The Netherlands. 787pp. (unpriced)

Environmental Benefits of Medfly SIT in Madeira and Their Inclusion in a Cost-Benefit Analysis. IAEA-TEC-DOC-1475, ISBN 92-0-110505-3. IAEA, Vienna, Austria. (Euro 15)

IAEA. 2005. The Cactus Moth *Cactoblastis cactorum*: An Economic, Social and Ecological Threat. CD ROM, Video NTSC available in English. IAEA, Vienna, Austria. (unpriced)

2004-1995

ZIMMERMAN, H., S. BLOEM, AND H. KLEIN. 2004. Biology, History, Threat, Surveillance, and Control of the Cactus Moth, *Cactoblastis cactorum*. Non-serial publication, ISBN 92-0-108304-1. IAEA, Vienna, Austria. (Euro 30)

IAEA. 2003. Automation for Tsetse Mass Rearing for Use in Sterile Insect Technique Programmes. IAEA-TECDOC-1353, ISBN 92-0-104303-1. IAEA, Vienna, Austria. (Euro 15)

IAEA/FAO. 2003. Trapping Guideline for Area-Wide Fruit Fly Programmes. Non-serial publication (English and Spanish versions). IAEA, Vienna, Austria. (unpriced)

IAEA. 2003. Improved Attractants for Enhancing Tsetse Fly Suppression. IAEA-TECDOC-1064, ISBN 92-0-110403-0. IAEA, Vienna, Austria. (Euro 15)

FAO/IAEA. 2002. Proceedings of an FAO/IAEA Research Coordination Project on Medfly Mating. Florida Entomologist 85: 1-181. Free available on http://www.fcla.edu/FlaEnt

IAEA. 2002. The Sterile Insect Technique. An Environment-Friendly Method of Insect Pest Suppression and Eradication. Video (NTSC, PAL format) – CD (English, Spanish and French). IAEA, Vienna, Austria. (unpriced)

IAEA. 2002. Evaluation of Lepidoptera Population Suppression by Radiation Induced Sterility. IAEA-TECDOC-1283, ISSN 1011-4289. IAEA, Vienna, Austria. (Euro 15)

TAN, K. H. (ed.). 2000. Proceedings: Area-Wide Control of Fruit Flies and Other Insect Pests. International Conference on Area-Wide Control of Insect Pests, and the 5th International Symposium on Fruit Flies of Economic Importance, 28 May-5 June 1998, Penang, Malaysia. Penerbit Universiti Sains Malaysia, Pulau Pinang, Malaysia. ISBN 983-861-195-6. (unpriced)

IAEA. 1999. Development of Female Medfly Attractant Systems for Trapping and Sterility Assessment. IAEA-TECDOC-1099, ISSN 1011-4289. IAEA, Vienna, Austria. (Euro 15)

IAEA. 1999. The South American Fruit Fly, *Anastrepha fraterculus* (Wied.) Advances in Artificial Rearing, Taxo-

nomic Status and Biological Studies. IAEA-TECDOC-1064, ISSN 1011-4289. IAEA, Vienna, Austria. (Euro 15)

IAEA. 1998. Genetic Engineering Technology for the Improvement of the Sterile Insect Technique. IAEA-TECDOC-993, ISSN 1011-4289. IAEA, Vienna, Austria. (Euro 15)

IAEA. 1997. Evaluation of Genetically Altered Medflies for Use in Sterile Insect Technique Programmes. Proceedings of Symposium, 92-0-103897-6. (Euro 29)

IAEA. 1997. Control of the Mediterranean Fruit Fly in the Near East Region Using the Sterile Insect Technique. Non-serial publication STI/PUB/1020. IAEA, Vienna, Austria. (unpriced)

IAEA. 1996. Standardization of Medfly Trapping for Use in Sterile Insect Technique Programmes. IAEA-TECDOC-883, ISSN 1011-4289. IAEA, Vienna, Austria. (Euro 15)

IAEA. 1996. A Farewell to Tsetse 1996. Video (English - PAL, SECAM). IAEA, Vienna, Austria. (unpriced)

IAEA. 1995. EASTMED A Proposal for Medfly Control or Eradication with the Sterile Insect Technique. Non-serial publication STI/PUB/982. IAEA, Vienna, Austria. (unpriced)

IAEA. 1995. Economic Evaluation of Damage Caused by, and Methods of Control of, the Mediterranean Fruit Fly in the Maghreb. IAEA-TECDOC-830, ISSN 1011-4289. IAEA, Vienna, Austria. (Euro 15)

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