Joint FAO/IAEA Programme
Nuclear Techniques in Food and Agriculture

Insect & Pest Control Newsletter

No. 79 July 2012

http://www-naweb.iaea.org/nafa/ipc/index.html
http://www.fao.org/ag/portal/age-index.html

ISSN 1011-274X

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IAEA
International Atomic Energy Agency

New administration building of the Moscamed Programme located near Tapachula, Chiapas, Mexico.

To Our Readers

In the second half of 2012, the IAEA's Nuclear Sciences and Applications Laboratories in Seibersdorf will celebrate 50 years of their existence, supporting Member States in many areas of the original 'atoms for peace' initiative. Through the partnership established in 1964 with FAO, the food and agriculture part of the Laboratories evolved into the FAO/IAEA Agriculture & Biotechnology Laboratories. They include the Insect Pest Control Laboratory (formerly the Entomology Unit), which has been contributing its share of nuclear technologies and applications to many successful projects and programmes, as well as of capacity building and services provided to many counterparts. We feel proud of the numerous developments and innovations transferred over the years that are still being applied in many Member States, strengthening animal health and plant protection infrastructure and services, achieving significant outcomes in terms of reducing agricultural losses and insecticide use, facilitating international trade and agricultural exports, and even eliminating outbreaks of invasive pest insects.

One example of continuity and sustainability of technologies transferred since the mid-1970s, which I would like to highlight since I was personally involved, is the Moscamed Programme in Mexico and Guatemala. The Mediterranean fruit fly, *Ceratitis capitata*, invaded Costa Rica in 1955, spreading across Central America, causing devastating losses on fruit production and limiting the development and growth of the fruit industry. In 1976 the fly reached Guatemala and in 1977 it was detected in southern Mexico. By 1979, the fly had spread throughout the Mexican state of Chiapas, reached

Oaxaca and threatened the states of Campeche, Tabasco, and Veracruz. If the pest had advanced beyond the Isthmus of Tehuantepec, the United States government would have closed its borders to imported Mexican fruits and vegetables, and eradication would have been practically impossible. It was estimated that the establishment of the Mediterranean fruit fly in Mexico would amount to annual losses of ca US $2 billion. In addition, thousands of jobs across the production chain would have been lost, and substantial environmental costs would have been generated by the thousands of tonnes of insecticides that would have been sprayed to keep the pest under control.

Recently inaugurated Centre for Packaging and Handling Sterile Mediterranean Fruit Flies of the Moscamed Programme near Tapachula, Chiapas, Mexico.

During that time, the FAO and the IAEA were requested to provide support by helping to launch an area-wide SIT programme under a cooperative agreement between the Governments of Guatemala, Mexico and the USA to avoid the further spread and permanent establishment of this feared pest. This involved training staff for this ambitious undertaking (I was one of the trainees) and the designing, building and operating as fast as possible the first large mass-rearing facility for the Mediterranean fruit fly. This was achieved with significant FAO/IAEA inputs.

Against expectations of most experts, by 1982 the Mediterranean fruit fly had been eradicated from all infested areas in Mexico, after 5 years of intensive operational activities, using an area-wide integrated approach. This was a major achievement considering the difficult topography, poor roads and high ecological diversity. Thereafter, this cooperative programme has for the last 30 years successfully maintained a sterile fly containment barrier preventing the northward spread of the pest into Belize, Mexico and the USA.

Keeping Mexico and the USA free of the Mediterranean fruit fly has not only protected the horticulture in these countries. It has also created an opportunity for Mexico to develop a multi-billion dollar export-oriented industry. Mexico's revenues from horticultural products have grown several-fold under the framework of the North American Free Trade Agreement (NAFTA). According to a study by Walther Enkerlin (2007), the programme's economic return for Mexico over these years is a remarkable US $167 return for each dollar that was invested. The returns are even substantially higher for the USA, where the value of the fruits and vegetables that would be affected by the fly is several times higher than in Mexico. In addition, these returns do not include the social and environmental savings obtained by preventing establishment of this pest.

Working areas in Guatemala, where programme activities have shifted, presently cover an area of 70 000 km^2. Currently the majority of sterile flies are being produced in the largest mass-rearing facility in the world, located in El Pino, Guatemala that has a production capacity of over 2 billion sterile males per week. Presently close to half of Guatemala (north and west) is already free of the Mediterranean fruit fly, allowing growers to export papayas, bell peppers, tomatoes and other commodities from fly-free areas without quarantine restrictions.

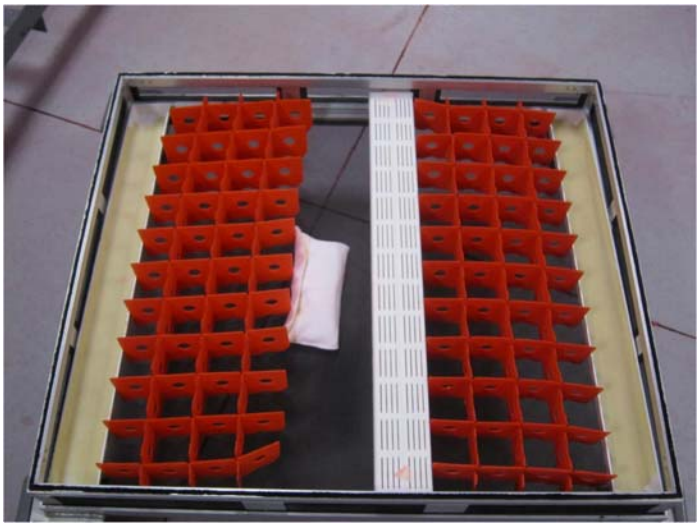
Many of the technologies transferred are still in use, often improved and adapted over the years to large-scale conditions, including a more sensitive female fly-biased trapping system, the filter colony management approach and other mass-rearing techniques, the temperature-sensitive lethal male-only fly genetic sexing strain and internationally harmonized quality control procedures.

While numerous Moscamed managers were trained at FAO/IAEA courses, the Moscamed Programme in Guatemala and Mexico has trained an enormous number of professionals from Latin America and other regions, generously sharing the technology with other area-wide fruit fly programmes integrating the SIT in other parts of the world.

Several months ago the Mexican Government inaugurated a modern 'Centre for Packaging and Handling Sterile Mediterranean Fruit Flies', together with new administrative headquarters (see pictures on first and the left of this page), after investing ca. US $8 million to ensure the continuing effectiveness of the sterile male barrier to protect Mediterranean fruit fly free production areas in Mexico.

This centre is located near Tapachula, Chiapas and replaces the old fly emergence and release facility. The sterile pupae are shipped from the mass-rearing facility to the centre, where the emerged flies are fed a diet including protein, exposed to aromatherapy with ginger root oil, and finally collected by chilling for aerial release. The new centre uses improved tower and feeding systems (see pictures previous and this page).

To have a tour of the Centre please visit: http://148.234.165.201/MOSCAMED/



A successful off-shoot of the Moscamed Programme is the Mexican National Fruit Fly Campaign, which since the early 1990s targets the suppression and eradication of major native *Anastrepha* fruit flies to protect more than one million hectares of fruit and vegetable crops.

Its mass-rearing facilities are also located in Metapa, Chiapas and produce the Mexican fruit fly *A. ludens*, the West Indian fruit fly *A. obliqua*, and parasitoids. FAO/IAEA contributed to the training of geneticists and to the development of a genetic sexing strain for *A. ludens*, which has been undergoing field testing.

This major national campaign against *Anastrepha* flies has also been very successful, achieving in ca. half of Mexican territory either the suppression of fruit fly populations to low-prevalence levels (north-eastern and central Mexico) or their complete eradication (States of Baja California Norte, Baja California Sur, Chihuahua, Sonora, and parts of Sinaloa in north-western Mexico), resulting in substantial economic and social benefits for these regions.

In 2010 the Moscamed Programme was officially recognized as an IAEA Collaborating Centre for the 'Development and Application of the SIT for Fruit Fly Area-Wide Integrated Pest Management' to help transfer the *Anastrepha* SIT technology to other FAO and IAEA Member States in the Latin America region.

Finally I would like to conclude by informing you that Carlos Caceres, a leading researcher and manager from the Moscamed programme in Guatemala returned in mid-2012 to his previous position as research leader of the fruit fly rearing and quality management group at the Insect Pest Control Laboratory at Seibersdorf. We warmly welcome Carlos, who as fruit fly researcher during the period 2000-2007 at the Insect Pest Control Laboratory made significant contributions developing and transferring new technologies for different fruit fly pests to Member States.

Jorge Hendrichs
Head, Insect Pest Control Section

Insect Pest Control Subprogramme

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Forthcoming Events (2012-2013)

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

Third RCM of CRP on Development and Evaluation of Improved Strains of Insect Pests for SIT. 20-24 August 2012, Daegu, Republic of Korea.

Third RCM of CRP on Increasing the Efficiency of Lepidoptera SIT by Enhanced Quality Control. 12-16 September 2012, Phoenix, AZ, USA.

Third RCM of CRP on Development of Generic Irradiation Doses for Quarantine Treatments. 15-19 October 2012, Buenos Aires, Argentina.

Final RCM of CRP on Biology of Male Mosquitoes in Relation to Genetic Control Programmes. 4-8 March 2013, Johannesburg, South Africa.

Final RCM of CRP on Applying GIS and Population Genetics for Managing Livestock Insect Pests. 15-19 April 2013, London, United Kingdom.

First RCM of CRP on Enhancing Vector Refractoriness to Trypanosome Infection. 3-7 June 2013, Vienna, Austria.

Third RCM of CRP on Resolution of Cryptic Species Complexes of Tephritid Pests to Overcome Constraints to SIT Application and International Trade. 26-30 August 2013, Tucumán, Argentina.

II. Consultants and Expert Meetings

FAO/IAEA Consultants Meeting to Explore Mechanical, Molecular, Behavioural or Genetic Methods of Sex Separation in Mosquitoes. 1-5 October 2012, Vienna, Austria.

III. Other Meetings/Events

FAO/IAEA Coordination Meeting of the TC regional project RER5018 on Supporting Fruit Fly Pest Prevention and Management in the Balkans and the Eastern Mediterranean. 2-6 July 2012, Kolymbari, Crete, Greece.

Second International Meeting of Tephritid Workers of Europe, Africa and the Middle East. 3-6 July 2012, Kolymbari, Crete, Greece.

8th Meeting of the Working Group on Fruit Flies of the Western Hemisphere. 30 July - 3 August 2012, Panama City, Panama.

FAO/IAEA Coordination Meeting of the TC regional project RLA5057 on Establishing and Maintaining Fruit Fly Free and Low Prevalence Areas in Central America, Panama and Belize, Using the Sterile Insect Technique (SIT). 30 July-3 August 2012, Panama City, Panama.

PAAT Secretariat Meeting. 25-27 September 2012, Vienna, Austria.

Symposium on Development and Evaluation of Improved Strains of Insect Pests for the Sterile Insect Technique at the XXIV International Congress of Entomology. 19-25 August 2012, Daegu, Republic of Korea.

XXII Curso Internacional Sobre Moscas de la Fruta. 20-31 August 2012, Metapa de Dominguez, Chiapas, Mexico.

FAO/IAEA Workshop on Assessing Quality Management Aspects of Lepidoptera Mass-produced for the Sterile Insect Technique in a Large Operational Setting. 10-11 September 2012, Phoenix, AZ, USA.

VIII Curso Internacional de Capacitação em Moscas das Frutas de Importância Económica e Quarentenária, 26 September - 4 October 2012, Juazeiro (Bahia) and Petrolina (Pernambuco), Brazil.

FAO/IAEA Regional Training Course on Quarantine and Pest Risk Analysis for Balkans and Eastern Mediterranean (under TC Project RER5018). 15-19 October 2012, Vienna, Austria.

2012 Insect Rearing Workshop, 21-26 October 2012, Mississippi State University, Starkville, MS, USA.

Standards Committee Meeting, International Plant Protection Convention, FAO. 5-9 November 2012, Rome, Italy.

FAO Regional Symposium on the Management of Fruit Flies in Near East Countries. 6-8 November 2012. Hammamet, Tunisia.

2012 International Citrus Congress, 18-23 November 2012, Valencia, Spain.

FAO/IAEA Workshop on Morphometry of Cryptic Species of *Anastrepha fraterculus* Complex of the Neotropical Region (under TC Projecs RLA5057 and RLA5058), 19-23 November 2012, Juazeiro, Bahia, Brazil.

FAO/IAEA Regional Training Course on Fruit Fly Detection, Taxonomy and Identification for Indian Ocean (under TC Project RAF5062). 26-30 November 2012. St. Pierre, La Réunion, France.

FAO/IAEA National Meeting on the Status of Tephritid Fruit Flies in China (under TC project CPR5020). 10-14 December 2012, Fuzhou, Fujian, China.

Symposium on Prospects for Enhancing Augmentative Releases of Beneficial Organisms Using Radiation at Fourth International Symposium on Biological Control of Arthropods, 4-8 March, 2012, Pucon, Chile.

FAO/IAEA Regional Training Course on Area-Wide Integrated Fruit Fly Suppression, including MAT and SIT in West Africa (under TC Project RAF5061). 11-15 March 2013. Bobo Dioulasso, Burkina Faso.

FAO/IAEA Regional Training Course on Comparative Morphometric Analyses of Wings of Insect Pests (under TC Project RAF5060). 22-26 April 2013, Seibersdorf, Austria.

Eighth Session of the Commission on Phytosanitary Measures, International Plant Protection Convention, FAO. 8-12 April 2013, Rome, Italy.

Standards Committee Meeting, International Plant Protection Convention, FAO. 6-10 May 2013, Rome, Italy.

Standards Committee Meeting (SC-7), International Plant Protection Convention, FAO. 13-17 May 2013, Rome, Italy.

FAO/IAEA Regional Training Course on Fruit Fly Detection for Balkans and Eastern Mediterranean (under TC Project RER5018). 6-10 May 2013, Adana, Turkey.

FAO/IAEA Regional Training Course on Quarantine and International Standards for Phytosanitary Measures for the Indian Ocean (under TC Project RAF5062). 1-5 July 2013, Maputo, Mozambique.

FAO/IAEA Interregional Training Course (under TC Project INT5151). 29 July - 23 August 2013, Metapa de Dominguez, Chiapas, Mexico.

FAO/IAEA Regional Training Course on Area-Wide Integrated Fruit Fly Suppression, including MAT and SIT for Balkans and Eastern Mediterranean (under TC Project RER5018). 7-11 October 2013, Opuzen, Croatia.

Standards Committee Meeting, International Plant Protection Convention, FAO. 11-15 November 2013, Rome, Italy.

Past Events (2011-2012)

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

Final RCM of CRP on Development of Standardized Mass-Rearing Systems for Male *Anopheles arabiensis* Mosquitoes. 7-11 March 2011, St. Clotilde, La Réunion, France.

Second RCM of CRP on Development of Generic Irradiation Doses for Quarantine Treatments. 11-15 April 2011, College Station, TX, USA.

Second RCM of CRP on Development and Evaluation of Improved Strains of Insect Pests for SIT. 9-13 May 2011, Nanjing, China.

Third RCM of CRP on Biology of Male Mosquitoes in Relation to Genetic Control Programmes. 3-7 October 2011, Bologna, Italy.

Third RCM of CRP on Applying GIS and Population Genetics for Managing Livestock Insect Pests. 10-14 October 2011, Bobo Dioulasso, Burkina Faso.

Second RCM of CRP on Resolution of Cryptic Species Complexes of Tephritid Pests to Overcome Constraints to SIT Application and International Trade. 30 January - 3 February 2012, Brisbane, Australia.

Final RCM of CRP on Improving SIT for Tsetse Flies through Research on their Symbionts and Pathogens. 26-30 March 2012, Vienna, Austria.

First RCM of CRP on Use of Symbiotic Bacteria to Reduce Mass-Rearing Costs and Increase Mating Success in Selected Fruit Pests in Support of SIT Application. 21-25 May 2012, Vienna, Austria.

II. Consultants and Expert Meetings

FAO/IAEA Consultants Meeting on the Role of Bacteria on Nutritional Status and Reproductive Success in Fruit Fly Pests in Support of SIT Application. 7-11 February 2011, Vienna, Austria.

Technical Panel on Pest Free Areas and Systems Approaches for Fruit Flies under the International Plant Protection Convention, FAO. 22-26 August 2011, Recife, Brazil.

FAO/IAEA Consultants Meeting on Enhancing Vector Refractoriness to Trypanosome Infection. 10-14 October 2011, Vienna, Austria.

FAO/IAEA Consultants Meeting on Using GPS Instruments and GIS Techniques in Data Management for Insect Pest Control Programmes. 31 October - 4 November 2011, Vienna, Austria.

FAO/IAEA Consultants Meeting on Diapause Management to Facilitate the Rearing of Temperate/Overwintering Pests. 7-11 May 2012, Vienna, Austria.

III. Other Meetings/Events

Sixth Session of the Commission on Phytosanitary Measures, International Plant Protection Convention, FAO. 14-18 March 2011, Rome, Italy.

Standards Committee Meeting, International Plant Protection Convention, FAO. 2-6 May 2011, Rome, Italy.

Standards Committee Meeting (SC-7), International Plant Protection Convention, FAO. 9-13 May 2011, Rome, Italy.

38th Congreso de Sociedad Colombiana de Entomologia (Socolen). 27-29 July 2011, Manizales, Colombia.

VII Curso Internacional de Capacitação em Moscas das Frutas de Importância Económica e Quarentenária. 11-19 August 2011, Juazeiro (Bahia) and Petrolina (Pernambuco), Brazil.

XXI Curso Internacional Sobre Moscas de la Fruta. 15 August - 2 September 2011, Metapa de Dominguez, Chiapas, Mexico.

30th International Scientific Council for Trypanosomiasis Research and Control. 12-16 September 2011, Bamako, Mali.

FAO/IAEA Training Course on Taxonomía, Ecología y Control de Moscas de Importancia Económica (under TC regional project RLA5057). 26 September - 1 October 2011, Panama City, Panama.

International Symposium on Mass-Production & Commercialization of Arthropod Biological Control Agents. 21-24 October 2011, Beijing, China.

FAO/IAEA Worshop on The Integrated Control of *Aedes* Mosquitoes, Including Mass-Rearing for the SIT as well as the Other Approaches Under Development. 8-11 November 2011, Vienna, Austria.

FAO/IAEA Coordination Meeting of the TC regional project RAF5059 on Supporting the Creation of a Tsetse-Free Zone in Southern Mozambique and North-East South Africa. 14-16 November 2011, Pretoria, South Africa.

FAO/IAEA Workshop on Tsetse Wing Morphometrics (under TC regional project RAF5059). 14 November - 2 December 2011, Pretoria, South Africa.

Workshop on Reviewing the Strategic Framework and the Plan of Action of the African Union Pan-African Tsetse and Trypanosomosis Eradication Campaign (AU-PATTEC). 24-25 November 2011, Africa Union Commission Headquarters, Addis Ababa, Ethiopia.

Workshop on Fruit Fly Management: World Perspective and Control Opportunities. 28-30 November 2011, Vacaria, RS, Brazil.

FAO/IAEA Coordination Meeting of the TC regional project RLA5057 on Establishing and Maintaining Fruit Fly Free and Low Prevalence Areas in Central America, Panama and Belize, Using the Sterile Insect Technique. 28 November - 2 December 2011, Guatemala City, Guatemala.

African Union Pan-African Tsetse and Trypanosomosis Eradication Campaign (AU-PATTEC) Partners' Meeting. 9 December 2011, Nairobi, Kenya.

FAO/IAEA Coordination Meeting of the TC regional project RAS5053 on Assessing Feasibility for Area-Wide SIT-Based Control of the Mediterranean Fruit Fly in the Middle East. 12-16 December 2011, Vienna, Austria.

FAO/IAEA Regional Training Course on Standardized Collection and Processing of Tsetse Flies for Molecular Population Genetic and Morphometric Analyses (under TC Project RAF5060). 23 January - 3 February 2012, Muguga-Nairobi, Kenya.

Workshop on Searching for Solutions for the Control of the Avian Parasite, *Philornis downsi.* 31 January - 3 February 2012, Charles Darwin Research Station, Puerto Ayora, Santa Cruz Island, Galapagos, Ecuador.

5th International Meeting on Taxonomy and Natural History of Tephritoidea. 6-10 February 2012, Brisbane, Australia.

FAO/IAEA Regional Training Course on Standardised Entomological Monitoring, Data Collection and GIS-Aided Processing as Needed for AW-IPM of the Tsetse and Trypanosomosis Problem (under TC Project RAF5060). 6-24 February 2012, Bobo-Dioulasso, Burkina Faso.

FAO/IAEA Coordination Meeting of the Indian Ocean TC regional project RAF5062 on Preventing the Introduction of Exotic Fruit Fly Species and Implementing the Control of Existing Species with the Sterile Insect Technique and other Suppression Methods. 13-15 February 2012, Quatre Bornes, Mauritius.

FAO/IAEA Coordination Meeting of the Andean TC regional project RLA5058 on Building Capacity for Suppression of Fruit Flies using an Area-Wide Pest Management Approach. 27 February - 2 March 2012, Lima, Peru.

Seventh Session of the Commission on Phytosanitary Measures, International Plant Protection Convention, FAO. 19-23 March 2012, Rome, Italy.

FAO/IAEA Regional Coordination Meeting / Technical Workshop under the regional TC project RAS5054 on Contributing to the Assessment of the Feasibility of SIT-Based Area-Wide Integrated Management of Old World Screwworm Flies in the Middle East. 19-28 March 2012, Pacora, Panama City, Panama.

FAO/IAEA Coordination Meeting of the Indian Ocean TC regional project RAF5065 on Promoting the Sharing of Expertise and Physical Infrastructure for Mass-Rearing Mosquitoes and Integration of the Sterile Insect Technique (SIT) with Conventional Methods for Vector Control, Among Countries of the Indian Ocean Region. 10-13 April 2012, Port Louis, Mauritius.

Standards Committee Meeting, International Plant Protection Convention, FAO. 23-27 April 2011, Rome, Italy.

FAO/IAEA Regional Training Course on Fruit Fly Surveillance, Taxonomy and Identification in West Africa (under TC Project RAF5061). 28 May - 1 June 2012, Cotonou, Benin.

FAO/IAEA Coordination Meeting of the West Africa TC regional project RAF5061 on Supporting Capacity Building and a Feasibility Study on Control of Fruit Flies of Economic Significance in West Africa. 30 May - 1 June 2012, Cotonou, Benin.

10th Plan of Action of the African Union Pan-African Tsetse and Trypanosomosis Eradication Campaign (AU-PATTEC) meeting. 13-15 June 2012, Accra, Ghana.

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

Country	Project Number	Title National Projects	Technical Officer
Afghanistan	AFG5004	Enhancing Crop Productivity through Mutation Breeding and Pest Control	Rui Cardoso Pereira
Chad	CHD5003	Finalising the Feasibility Study to Assess Whether the Sterile Insect Technique (SIT) Can Be Applied for the Creation of Sustainable Tsetse-Free Zones	Udo Feldmann
China	CPR5020	Integrating the Sterile Insect Technique (SIT) for Area-Wide Integrated Pest Management of Tephritid Fruit Flies	Rui Cardoso Pereira
Costa Rica	COS5030	Supporting Biological Control of Stable Flies (*Stomoxys calcitrans*) through the Use of Parasitoids Reproduced on Fruit Flies	Jesús Reyes
Ethiopia	ETH5015	Creating a Tsetse-Free Zone in the Southern Rift Valley	Udo Feldmann
Ethiopia	ETH5016	Creating Sustainable Tsetse and Trypanosomosis Free Areas for Enhancing Livestock and Agricultural Development	Udo Feldmann Andrew Parker
Guatemala	GUA5017	Using the Sterile Insect Technique (SIT) to Establish Fruit Fly Low Prevalence Pilot Areas and to Assess it as an Alternative for the Control of the Sugarcane Borer in Pilot Areas	Jesús Reyes
Honduras	HON5006	Using Sterile Insect Technique (SIT) to Obtain Recognition as a Mediterranean Fruit Fly Free Area in the Aguan River Valley	Jesús Reyes
Israel	ISR5015	Strengthening the Capacity to Use the Sterile Insect Technique for the Olive Fruit Fly	Jesús Reyes
Israel	ISR5017	Targeting the Olive Fly with SIT in Olive Orchards Located in the North and South of Israel	Jesús Reyes
Israel	ISR5018	Improvement of Artificial Mass-Rearing Systems for the Ethiopian Fruit Fly, *Dacus ciliatus*, and Establishment of Optimal Sterilizing Doses: Towards Small-Scale SIT	Jorge Hendrichs
Jordan	JOR5010	Strengthening the Capacity for the Area-wide Suppression of the Mediterranean Fruit Fly Using the Sterile Insect Technique	Jesús Reyes
Madagascar	MAG5021	Implementing the Sterile Insect Technique (SIT) in Integrated Fruity Fly Control for High Quality Fruit Production	Rui Cardoso Pereira
Mauritius	MAR5019	Supporting a Feasibility Study Using the Sterile Insect Technique (SIT) for the Integrated Control of Mosquitoes	Jeremie Gilles

Mauritius	MAR5022	Reducing Insecticide Use and Losses to Melon Fly (*Bactrocera cucurbitae*) through Environment-Friendly Techniques to Increase Production in Different Areas, Phase II	Jorge Hendrichs
Morocco	MOR5031	Controlling the Mediterranean Fruit Fly Using the Sterile Insect Technique and other Conventional Methods	Jesús Reyes
Morocco	MOR5032	Supporting Control of the Medfly Using the Sterile Insect Technique for Citrus Fruits and Early Fruits and Vegetables to Establish Low Medfly Prevalence Zones	Jesús Reyes
Myanmar	MYA5021	Integrating Sterile Insect Technique with other Biocontrol Tactics to Improve Diamondback Month Control	Rui Cardoso Pereira
Oman	OMA5002	Assessing the Suitability of Sterile Insect Technique (SIT) and Related Techniques for Combating Date Palm Insect Pests	Marc Vreysen
Panama	PAN5018	Maintaining and Operating a Mediterranean Fruit Fly 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
Panama	PAN5020	Strengthening Technical Capacity to Control Mediterranean Fruit Fly Using the Sterile Insect Technique (SIT)	Jesús Reyes
Senegal	SEN5031	Implementing the Pre-Operational Phase to Create a Zone Free of *Glossina palpalis gambiensis* Using the Sterile Insect Technique (SIT)	Marc Vreysen
Senegal	SEN5033	Supporting the Operational Phase of Eliminating *Glossina palpalis gambiensis* from the Niayes Area by Promoting the Development of Integrated Stockbreeding	Marc Vreysen
Seychelles	SEY5005	Enhancing the Melon Fruit Fly Area-Wide Integrated Pest Management Programme Using the Sterile Insect Technique to Improve National Food Security	Rui Cardoso Pereira
Sri Lanka	SRL5044	Supporting a Feasibility Study Using the Sterile Insect Technique (SIT) for Integrated Control of Mosquitoes	Jeremie Gilles
South Africa	SAF5011	Refining an Integrated Application of SIT Against Some Key Lepidopteran Pests of Southern African Agricultural Crops	Jorge Hendrichs
South Africa	SAF5013	Assessing the Sterile Insect Technique for Malaria Mosquitoes in a South African Setting	Jeremie Gilles
Sudan	SUD5032	Investigating the Use of the Sterile Insect Technique for Controlling Mosquitoes in Northern Sudan	Jeremie Gilles
Sudan	SUD5034	Supporting a Feasibility Study on the Suitability of the Sterile Insect Technique as a Strategy for the Integrated Control of *Anopheles arabiensis*	Jeremie Gilles
Tunisia	TUN5026	Assessing the Use of Inherited Sterility as a Genetic Control Method against the Carob Moth	Marc Vreysen
Tunisia	TUN5027	Supporting an Area-Wide Integrated Pest Management Pilot Project for Evaluating the Effectiveness and Economic Feasibility of Using SIT as a Component of Integrated Date Moth con-	Marc Vreysen

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T.T.U.T.J of T. Palestinian A.	PAL5004	Integrated management of fruit flies in Palestinian Territories	Jesús Reyes
Uganda	UGA5031	Assessing the Feasibility of Establishing a Tsetse Free Zone in Lake Victoria Basin	Jesús Reyes
Uganda	UGA5033	Demonstrating the Feasibility of a Sterile Insect Technique (SIT) Component as Part of an AW-IPM Approach against *Glossina f. fuscipes* to Increase Livestock Productivity	Udo Feldmann
Vietnam	VIE5017	Supporting Area-Wide Integrated Pest Management to Improve the Quality of Fruit for Export	Rui Cardoso Pereira
Zimbabwe	ZIM5017	Improving Crop and Livestock Production through the Eradication of Bovine and Human Trypanosomiasis in Matusadona National Park	Udo Feldmann
		Regional Projects	
Regional Africa	RAF5059	Supporting the Creation of a Tsetse-Free Zone in Southern Mozambique and North-East South Africa	Marc Vreysen Rui Cardoso Pereira
Regional Africa	RAF5060	Supporting the Use of the Sterile Insect Technique for Area-Wide Tsetse and Trypanosomosis Management (Phase II)	Udo Feldmann
Regional Africa	RAF5061	Supporting Capacity Building and a Feasibility Study on Control of Fruit Flies of Economic Significance in West Africa	Rui Cardoso Pereira
Regional Africa	RAF5062	Preventing the Introduction of Exotic Fruit Fly Species and Implementing the Control of Existing Species with the Sterile Insect Technique and Other Suppression Methods	Rui Cardoso Pereira
Regional Africa	RAF5064	Supporting Area-Wide Tsetse and Trypanosomosis Management to Improve Livestock Productivity and Enable Sustainable Agriculture and Rural Development	Udo Feldmann
Regional Africa	RAF5065	Promoting the Sharing of Expertise and Physical Infrastructure for Mass-Rearing Mosquitoes and Integration of the Sterile Insect Technique (SIT) with Conventional Methods for Vector Control, among Countries of the Indian Ocean Region	Jeremie Gilles
Regional Asia	RAS5051	Developing Integrated Control of the Olive Fruit Fly	Jesús Reyes
Regional Asia	RAS5052	Sharing Regional Knowledge on the Use of the Sterile Insect Technique within Integrated Area-Wide Fruit Fly Pest Management Programmes	Rui Cardoso Pereira
Regional Asia	RAS5053	Assessing Feasibility for Area-Wide SIT-Based Control of the Mediterranean Fruit Fly in the Middle East	Jesús Reyes
Regional Asia	RAS5054	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
Regional Asia	RAS5059	Supporting Area-Wide Integrated Pest Control of Native and Exotic Flies in the Middle East Subregion Incorporating the	Jesús Reyes

		Sterile Insect Technique (SIT)	
Regional Europe	RER5014	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
Regional Europe	RER5018	Supporting Fruit Fly Pest Prevention and Management in the Balkans and the Eastern Mediterranean	Rui Cardoso Pereira
Regional Latin America	RLA5057	Establishing and Maintaining Fruit Fly Free and Low Prevalence Areas in Central America, Panama and Belize, Using the Sterile Insect Technique (SIT)	Jesús Reyes
Regional Latin America	RLA5058	Building Capacity for Suppression of Fruit Flies using an Area-Wide Pest Management Approach	Jesús Reyes
		Interregional Project	
Interregional	INT5151	Sharing Knowledge on the Use of the Sterile Insect and Related Techniques for Integrated Area-Wide Management of Insect Pests	Jorge Hendrichs Jesús Reyes

Highlights of Technical Cooperation Projects

Creating a Tsetse-Free Zone in the Southern Rift Valley (ETH5015)

Review meetings of the Southern Tsetse Eradication Project (STEP) in Ethiopia

IAEA Deputy Director General Daud Bin Mohamad travelled to Ethiopia for a High Level Meeting (HLM) with the Minster for Science and Technology, Ato Dessie Dalkie, and others on the STEP tsetse project, ETH5016, from 24 to 29 April 2012. The HLM was also attended by Ato Shiferaw Shigute, President of the Southern Nations, Nationalities and Peoples Region (SNNPR), Ato Sani Redi, Director of the Agricultural Bureau of SNNPR, a representative of the Federal Assembly and representatives for other partner ministries and organizations. The HLM was preceded by a two day International Management Advisory Committee (IMAC) meeting that was also attended by an international expert on SIT, Aldo Malavasi. The HLM reviewed the report of the IMAC and endorsed and approved the recommendations of the IMAC after some minor changes.

Participants of the High Level Meeting during a field visit to view livestock being monitored for trypanosome infection (Arba Minch, Ethiopia).

The IMAC reported considerable progress in the STEP project towards the completion of the pre-operational phase by August 2012. The progress includes the introduction of an appropriate mechanism for project oversight, the revision of the managerial set-up and the implementation of recommended actions in several technical areas related to the mass-production of sterile male tsetse flies and to the field operations. Furthermore, weekly aerial releases of sterile *Glossina fuscipes fuscipes* male flies were initiated in early April 2012 over the Deme basin.

The progress made was recognised in recent hearings in the Ethiopian House of Representatives and was broadly conveyed to the Ethiopian public through TV, radio and newspaper articles. Both HE Ato Dessie for the Government of Ethiopia and Mr Daud for the IAEA committed to intensify their support to the project to ensure completion of the remaining pre-operational tasks.

GPS in the aircraft displaying the coordinates of part of the release route.

Following the HLM, the delegation visited the Deme valley where they viewed the aerial releases of sterile tsetse flies in the northwest section of the project area. The participants were able to observe the aircraft releasing boxes of sterile flies over this basin. The delegation then proceeded to Arba Minch where they observed the treatment of livestock with pour-on insecticides and insecticide impregnated targets deployed in tsetse habitat for pre-release tsetse fly suppression.

The visible benefits of the STEP tsetse population suppression activities are already impressive when compared to the initiation of STEP, when livestock in the project area was rare and required continuous protection based on the injection of trypanocidal drugs. The project has transformed the lives of farming communities as a result of the availability of oxen to plough the land, donkeys to pull carts to transport agricultural products to market, and meat and milk to improve human nutrition, creating thriving farming communities with dramatically improved living conditions.

As the rains had just started many farmers were busy ploughing using yokes of oxen or delivering agricultural goods to market using donkey carts, both possible only because of the good level of tsetse suppression already achieved by the project over the past few years in the northern area of the project area. The project is poised to start expanding sterile tsetse fly releases to eradicate tsetse to reach a long term sustainable solution to the tsetse and trypanosomosis problem in the southern Rift Valley of Ethiopia.

Supporting the Operational Phase of Eliminating *Glossina palpalis gambiensis* from the Niayes Area of Senegal (SEN5033)

The project, that aims at eradicating the tsetse fly *Glossina palpalis gambiensis* from the Niaysees is ready to enter is operational phase. A feasibility study that included the collection of entomological, veterinary, socio-economic and environmental baseline data, a population genetics study, the development of handling and pupal transport methods, trial releases of sterile male flies, mating compatibility studies etc. has been completed and has ascertained the feasibility of creating a sustainable zone free of *G. p. gambienis* in the Niayes using an area-wide integrated pest management approach with a sterile insect technique (SIT) component.

A group of external tsetse experts visited the project in May 2012 and ascertained that all activities of the feasibility study and the pre-operational phase have been accomplished and that the IAEA can proceed to provide support to the operational phase of the project.

Insecticide impregnated Vavoua trap in the Kayhar area (Senegal).

A fly suppression trial was carried out in Kayhar (northern part of the project area), where a total of 305 insecticide-impregnated Vavoua traps were deployed at an average density of 30 traps/km^2 of 'wet' area (i.e. preferred habitat). The suppression trial was monitored regularly and only 2 wild flies have been sampled in the monitoring traps since Feb 2011. The trial has indicated that the insecticide impregnated traps as a suppression tool have worked very well in this area that had low initial fly densities. It however also demonstrated that the *G. palpalis gambiensis* fly population cannot be eradicated with insecticide traps alone, and hence confirms the need for the SIT as a final eradication component (as was also demonstrated in the Sidéradougou area of Burkina Faso in the 1980s and more recently on the Loos Islands of Guinea).

Shipments of sterile male pupae from the 'Centre International de Recherche-Développement sur L'elevage en Zone Subhumide' (CIRDES) in Burkina Faso to Dakar, Senegal were initiated in 2010 and test adult sterile male releases have been conducted on a weekly basis alternatively in Diaksao Peuhl and in the Parc de Hann. From May 2011 to May 2012, a total of 54 565 and 55 818 sterile males were released in DP (during 34 release sessions) and Hann (during 38 release sessions) respectively, with an average daily mortality rate after the release of 17% and 20%, respectively. Daily mortality was for both sites 3% higher when the flies were released in unfavourable habitat as compared to favourable habitat. Sterile to wild male ratios were higher in Diaksao Peuhl than in Hann but the competitiveness was better in Hann than in Diaksao Peuhl. The competitiveness of the sterile males was for both sites better in the rainy season as compared to the dry season. Overall, the performance of the sterile flies, shipped as chilled male pupae from Burkina Faso to Dakar and released in two different eco-systems in the target area was very acceptable.

Operational suppression activities will start in Diaksao Peuhl immediately after the external review in May 2012. The sites for the deployment of the insecticide impregnated Vavoua traps have already been selected using GIS.

Trial ground releases of sterile male Glossina palpalis gambiensis*, transported as chilled male pupae from Burkina Faso to Senegal and released as adults in the Niayes project area.*

The new release machine, developed for chilled aerial tsetse male releases by a Mexican company (Mubarqui), has been tested with fruit flies and screwworm flies in Mexico and seems to work fine. It now needs to be shipped to Dakar for trials with *G. p. gambiensis*. Thereafter, operational aerial releases will start in the Kayhar area.

Supporting the Use of the Sterile Insect Technique for Area-Wide Tsetse and Trypanosomosis Management in Africa (Phase II) (RAF5060)

Regional Training Course on Standardised Entomological Monitoring, Data Collection and GIS-Aided Processing as Needed for AW-IPM of the Tsetse and Trypanosomosis Problem

Thirty four participants from 17 tsetse and trypanosomosis affected African Member States attended this FAO/IAEA Regional Training Course. The course was held at the IAEA Collaborating Centre 'Centre International de Recherche-Développement sur L'elevage en Zone Subhumide' (CIRDES) in Bobo-Dioulasso, Burkina Faso, 6–24 February 2012.

Distribution of certificates at the end of the Regional Training Course (Bobo-Dioulasso, Burkina Faso).

The training course involved lectures, laboratory and field activities, exposing the participants to (a) using tsetse presence / absence risk prediction maps for planning of entomological surveillance; (b) the principles of stratified sampling of tsetse target populations, and designing and implementing routine entomological monitoring; (c) using GPS instruments for geo-referenced data collection; (d) working with data bases for storing geo-referenced information gathered from entomological monitoring; (e) processing entomological monitoring information stored in databases using GIS software; and (f) using the collected and processed information for decision making in area-wide integrated pest management (AW-IPM) campaigns against the tsetse and trypanosomosis problem, possibly involving a tsetse SIT component.

Regional Training Course on Standardised Collection and Processing of Tsetse Flies for Molecular Population Genetic and Morphometric Analyses

Twenty three participants from 13 tsetse and trypanosomosis affected African Member States attended this FAO/IAEA Regional Training Course. The course was held at the Kenya Agricultural Research Institute - Trypanosomiasis Research Centre (KARI-TRC) in Nairobi, Kenya, 23 January to 3 February 2012.

Participants of the FAO/IAEA Regional Training Course (Nairobi, Kenya).

The training course involved lectures, laboratory and field activities, exposing the participants to (a) using GPS instruments for geo-referenced data collection; (b) working with databases for storing geo-referenced information gathered from entomological monitoring; (c) collecting tsetse samples for genotyping analysis using morphometric and molecular methods; (d) using geometric and morphometric applications in support of tsetse population genetic analysis; (e) using polymerase chain reaction (PCR) and sequence data in genotyping tsetse symbionts and pathogens; (f) using the collected and processed information for decision making in area-wide integrated pest management (AW-IPM) campaigns against the tsetse and trypanosomosis problem, possibly involving a tsetse sterile insect technique (SIT) component.

Contributing to the Assessment of the Feasibility of SIT-Based Area-Wide Integrated Management of Old World Screwworm Flies in the Middle East (RAS5054)

Participants visiting the Methods Development Facility at COPEG (Pacora, Panama).

A Regional Coordination Meeting / Technical Workshop under this Regional IAEA TC project was organized at Pacora, Panama City, Panama, 19–28 March 2012, hosted by the Panama–US Commission for the Eradication and Prevention of Screwworm (COPEG; Comisión Panamá–Estados Unidos para la Erradicación y Prevención del Gusano Barrenador del Ganado).

The meeting was attended by seven collaborators from Iraq, Oman and Yemen and by two observers from Columbia. The meeting exchanged information on (a) the current status of old world screwworm (OWS) fly infestation and measures taken to control OWS in the participating infested Member States in the Middle East; and (b) measures taken or planned to prevent OWS introduction into participating endangered Member States. Thanks to the openness and very friendly hospitality by COPEG and its staff from the Panamanian Ministry of Agriculture and the US Department of Agriculture, the participants got acquainted with the principles of planning, managing and implementing a large area-wide new world screwworm (NWS) fly eradication and prevention programme and discussed how the demonstrated and explained NWS programme may be applicable in the Middle East region to suppress, eradicate and prevent OWS. Participants had the opportunity to visit and tour the Pacora Sterile Fly Production Plant, the Tocumen Sterile Fly Release Facility and observe field operations regarding the inspection and regulatory control of animal movement.

Participants visiting the COPEG sterile fly dispersal centre (Tocumen, Panama).

Supporting a Feasibility Study on the Suitability of the Sterile Insect Technique as a Strategy for the Integrated Control of *Anopheles arabiensis* (SUD5034)

A meeting was convened from 27 to 28 February 2012 in Khartoum (Sudan) with the different stakeholders of the SIT mosquito project in Northern State, Sudan including the Islamic Development Bank (IDB), the Government of Sudan (GoS) and the IAEA during which the technical cooperation projects SUD/5/032 and SUD/5/034 on a feasibility study for the integrated use of the Sterile Insect Technique against *Anopheles arabiensis* in Northern Sudan were discussed. The meeting resulted in a set of recommendations on the implementation of the project.

The coordination meeting emphasized that project implementation must adhere to the phased conditional approach. Therefore it was agreed that the project would focus initially on conducting a pilot trial (3-4 years) over an area of at least 20 km^2 to assess feasibility of the integrated use of the SIT against mosquitoes in the field in Northern Sudan. Only on successful implementation of the pilot trial will the larger proposed area-wide project be considered. It was also agreed that the mosquito mass-rearing facility be developed according to a modular concept that allows for the addition of future modules depending on the numbers of sterile male mosquitoes needed for a future large eradication programme in Northern State.

Most importantly, it was recommended that the mass-rearing facility be constructed near Merowe rather than in Khartoum in view of several developmental, economic and technical considerations. Among those considerations, the quality of the released sterile insects was the main concern, and by choosing Merowe as the facility site, the quality of the sterile males produced will be higher due to much shorter transport periods. Not having to transport sterile mosquitoes all the way from Khartoum will significantly reduce logistics and transport costs and will shorten the lifespan of the eradication efforts due to higher quality insects.

Collection of water samples for survey of mosquito larvae and pupae in northern Sudan.

Constructing the mass-rearing facility in Merowe will in addition contribute to the overall development of the target area and will result in more ownership of the project by the human population in the Northern State. Full cooperation and support from local stakeholders will be critical for such an ambitious area-wide project, including from the dam project infrastructure in terms of stable power and water supply, which will be essential for such a facility. Furthermore, the mass-rearing facility should be built in an ‘isolated’ location and outside of a big city like Khartoum to avoid any perceived risk of increased malaria transmission due to any accidental escapes of mosquitoes from the factory.

Promoting the Sharing of Expertise and Physical Infrastructure for Mass-Rearing Mosquitoes and Integration of the SIT with Conventional Methods for Vector Control, among Countries of the Indian Ocean Region (RAF5065)

The kick-off meeting of this Regional TC project RAF 5065 took place in Mauritius from 9-13 April 2012. The countries of the Indian Ocean Region such as Mauritius, Seychelles and Madagascar were represented and other countries (France, South Africa, and Trinidad & Tobago) were also present to share their expertise with the group.

During this first National Coordinators Meeting (NCM), the countries of the region agreed on the work plan and identify the main actions to be taken for the 2 coming years. Among those, special attention was given to the colonization of wild *Aedes albopictus* into the laboratories and the necessary collection of baseline data by establishing mosquito surveillance in pilot sites. The next NCM will take place in Seychelles (28 Oct - 2 Nov 2012) and the progress made by the participating countries will be evaluated.

Preventing the Introduction of Exotic Fruit Fly Species and Implementing the Control of Existing Species with the SIT and Other Methods (RAF5062)

The National Coordinators Meeting (NCM) of this Regional Technical Cooperation Project RAF5062 was held at the Entomology Division in Reduit, Mauritius from 13 to 15 February. This NCM was attended by 10 participants from 6 Member States (France, Madagascar, Mauritius, Mozambique, Seychelles, and United Republic of Tanzania).

Participants of the National Coordinators Meeting (Reduit, Mauritius).

The objective of the NCM was (1) to present the national activities related to tephritid fruit fly control implemented in the participating Member States, (2) to develop a Memorandum of Understanding (MoU) on sharing resources and information among participating Member States, and (3) to review the work plan of RAF5062 based upon the needs of each Member State.

The NCM compiled and updated the existing information on fruit fly species, primary fruit hosts and ongoing fruit fly activities in each of the participating Member States. The compiled data will be part of the NCM report and will serve as baseline information for future national or regional approaches to detect and suppress fruit fly populations.

The national project plans to expand melon fly control activities (sanitation, bait sprays and male annihilation technique (MAT)) to other areas of Mauritius island, in combination with the SIT. A genetic sexing strain consisting of the white pupae strain developed in Hawaii was recently backcrossed with the wild flies from Mauritius at the Insect Pest Control Laboratory (IPCL) in Seibersdorf, and transferred to Mauritius for evaluation.

Supporting Capacity Building and a Feasibility Study on Control of Fruit Flies of Economic Significance in West Africa (RAF5061)

Regional Training Course on Fruit Fly Surveillance, Taxonomy and Identification in West Africa

This Regional Training Course (RTC) was attended by 14 participants from 7 Member States (Benin, Burkina Faso, Ghana, Libya, Niger, Nigeria, and Senegal) and was held at the International Institute for Tropical Agriculture (IITA), Cotonou, Benin from 28 May to 1 June 2012.

The RTC addressed the following aspects:

- Technical lectures and training to field operations staff on surveillance and baseline data collection to plan integrated fruit fly management activities including SIT application in some situations;
- Surveillance techniques used in fruit fly detection and control programmes, including trapping materials for adult surveys, as well as levels of infestation by fruit fly larvae;
- Lectures on basic taxonomic information that will be useful on the identification of the fruit fly specimens;
- Discussion on protocols used for collection and shipment of live and dead fruit fly specimen;
- Fruit fly identification of the genera *Bactrocera* and *Ceratitis*;
- Laboratory exercise involving identification skills developed during the training.

The evaluation of the RTC showed a significant increase of the knowledge of the course participants from 3.1 (prior) to 4.4 (after) the training (in a scale of 1 to 5).

National Coordinators Meeting

This National Coordinators Meeting (NCM) held at the IITA from 30 May to 1 June 2012, was attended by nine participants from Benin, Burkina Faso, Cote d'Ivoire, Ghana, Libya, Niger, Nigeria, Mali and Senegal.

Participants of the National Coordinators Meeting and the Regional Trainning Course (Cotonou, Benin).

The objective of the NCM was (1) to present national experiences on fruit fly status and activities in the respective Member States; (2) to plan RAF5061 project activities and (3) to identify key actions to be taken by each participating country to achieve the project outputs.

During the NCM data on fruit flies and their relative importance, the major economically important hosts and the on-going control activities were compiled in tables. The need for harmonization among the participating Member States was agreed, mainly in the following areas:

- Use of a common protocol for fruit fly monitoring, such as presenting the data as 'fly per trap per day' (FTD);
- Relative importance of the different flies for a specific host should be obtained by fruit sampling using as indices: (a) percentage of fruit infestation and (b) larvae per fruit or larvae per kg of fruit;
- GPS should be used to geo-reference trap, sample and host sites; data should be integrated on a GIS database;
- The potential use of locally produced beer waste protein as a bait should be explored;
- Control measures should be integrated to maximize the impact; female flies should be the main target of population suppression.

Building Capacity for Suppression of Fruit Flies using an Area-Wide Pest Management Approach in the Andean Region (RLA5058)

The first Regional Coordinators Meeting under project RLA 5058 was attended by twelve people: four were the project counterparts from Bolivia, Colombia, Ecuador and Peru, three officers represented the Inter-American Institute for Cooperation on Agriculture (IICA), which is the IAEA's partner is this project, two representatives of the Community of Andean Nations (CAN), three technical counterparts from the countries involved in the project, and the FAO/IAEA Project Technical Officer, Jesus Reyes.

Participants of the Andean Coordinators Meeting (Lima, Peru).

Each counterpart gave a comprehensive report of the status of fruit flies as pests of fresh fruit and vegetables in their respective country. Each talk included the activities each country is carrying out to control these pests and the opportunities they have to overcome quarantine regulations from international markets to be able to export fresh fruit commodities.

The IICA and CAN representatives presented a report on the activities of these regional organizations in the Andean Sub-Region against fruit flies and how these actions are complementary to the activities planned through this regional project. There was much discussion on the project work plan and budget and participants provided important feedback and comments.

Detailed suggestions made were recorded in a document. Major new actions are to:

- Incorporate inputs related to training in taxonomy of exotic fruit flies like *Bactrocera* spp, and the management of the local species *Anastrepha grandis*;
- Support to the IAEA coordinated research project on the resolution of the *A. fraterculus* complex for Latin America, by sending fruit flies of different populations to the Insect Pest Contriol Laboratory (IPCL) in Seibersdorf, participation of one person from Peru and Colombia in the mating compatibility tests to be performed at the IPLC, organize a *Anastrepha fraterculus* morphology training course in Brazil, and to send specimens to the appropriate taxonomists of immatures and adults of *A. fraterculus* from each country;
- Have a meeting to interchange experiences with the counterparts of the successful Central America project RLA5057 in Panama, in July of this year.

Assessing Feasibility for Area-Wide SIT-Based Control of the Mediterranean Fruit Fly in the Middle East (RAS5053)

A meeting was held in Vienna, 10-14 December 2011 attended by 12 participants representing Israel, Jordan and the Territories under the Jurisdiction of the Palestinian Authority. Each counterpart presented a comprehensive report of the activities carried out during the last two years in relation to the control of the Mediterranean fruit fly using an area-wide integrated pest management approach in selected areas of these three countries.

Citrus groves where sterile Mediterranean fruit fly releases are occurring (North Valley, Jordan).

They also presented the monitoring activities of the olive fly in Jordan and Palestine and the progress on a pilot test using sterile olive flies produced in Israel to suppress the olive fruit fly. Finally the steps taken to prevent the entry of exotic fruit flies into the region were also presented.

Expanding the fly emergence facility in the Jordan River Valley so that it can accommodate up to 15 million pupae/week is still required (currently it is emerging and releasing 1.5 million pupae/week for the pilot area of north Shuna). These flies are purchased by the Jordanian Government from Biofly through a cost sharing agreement with the IAEA.

Fruit fly emergence and release facility (North Valley, Jordan).

In the Territories under the Jurisdiction of the Palestinian Authority 1 000 hectares of citrus were successfully treated with sterile Mediterranean fruit flies produced in Israel from February 2010 to November 2011, released by ground at a rate of 3 million/week. The population densities were reduced from a level of 16 FTD at the beginning of the project to 0.5 FTD and fruit infestation rates were reduced in Clementine from 32.1% to 2%. Sanitation measures were implemented effectivelly as an important part of the project activities.

In Israel the area covered by the integrated application of the SIT for routine suppression purposes has been increased and currently stands at 7 500 hectares, with growers and the Government sharing the supression cost.

Developing Integrated Control of the Olive Fruit Fly (RAS5051)

A summary of the activities carried out in Jordan against this pest are the preparation of three pilot areas in the Burma, Jaresh, and Aleina areas where a monitoring trapping was established to monitor the seasonal fluctuation of the olive fly as a preliminary step before releases of sterile flies.

In Palestine, Frutec and yellow sticky traps to detect olive fly were tested at ten different districts throughout the West Bank, showing that there is no significant difference between these traps when used in rain-fed areas. Peak population densities, as determined by trapping, showed up to four peaks during the year (end of June, mid-August, early September and mid-November).

In Israel three locations for pilot studies were selected at Lahav, Shaar Hagai, and Makura to monitor the wild olive fly populations. Preliminary results showed clear phenological patterns with two main increases in the population density, one in the spring and a higher one in the fall.

Ongoing field work at an olive pilot study area (Lahav, Israel).

Phenology is mainly related to temperature parameters. In an intensive, commercial irrigated and organic plot of 10 hectares, in Bet Shaan, ca 40 000 sterile olive flies were released per week from October 2010 to December 2011. Initial results showed high ratios of sterile/wild flies, and an acceptable level of control for commercial purposes, but further and more complete tests are planned.

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

Project Number	Ongoing CRPs	Scientific Secretary
D4.20.12	Improving SIT for Tsetse Flies Through Research on Their Symbionts and Pathogens (2007-2012)	Adly Abd Alla
G3.40.02	Biology of Male Mosquitoes in Relation to Genetic Control Programmes (2008-2013)	Jeremie Gilles
D4.20.13	Applying Population Genetics and GIS for Managing Livestock Insect Pests (2008-2013)	Udo Feldmann
D4.10.22	Increasing the Efficiency of Lepidoptera SIT Through Enhanced Quality Control (2009-2014)	Marc Vreysen
D6.20.08	Development of Generic Irradiation Doses for Quarantine Treatments (2009-2014, managed with Food and Environmental Protection Subprogramme)	Andrew Parker (co-secretary)
D4.20.14	Development and Evaluation of Improved Strains of Insect Pests for SIT (2009-2014)	Gerald Franz
D4.10.23	Resolution of Cryptic Species Complexes of Tephritid Pests to Overcome Constraints to SIT Application and International Trade (2010-2015)	Jorge Hendrichs
D4.10.24	Use of Symbiotic Bacteria to Reduce Mass-Rearing Costs and Increase Mating Success in Selected Fruit Pests in Support of SIT Application (2012-2017)	Rui Cardoso Pereira
Project Number	**Planned New CRP**	**Scientific Secretary**
D4.20.15	Enhancing Vector Refractoriness to Trypanosome Infection (2013-2018)	Andrew Parker

Second RCM of CRP on *Resolution of Cryptic Species Complexes of Tephritid Pests to Overcome Constraints to SIT Application and International Trade*. 30 January 3 - February 2012, Brisbane, Australia

The second RCM took place at the EcoCentre of Griffith University in Brisbane, Australia. It was attended by 41 scientists from 20 Member States and was hosted by Richard Drew of Griffith University. The continued high interest by Member States in resolving the issues surrounding the existence of cryptic Tephritid species complexes is evident as reflected by the very large number of participants attending at their own cost.

Very good progress is being made under this CRP by the three working groups: on the *Anastrepha fraterculus* complex; the *Bactrocera dorsalis* complex and the group covering *Bactrocera cucurbitae* and the *Ceratitis* FAR complex.

Participants of the Research Coordination Meeting on Resolution of Cryptic Species Complexes of Tephritid Pests to Overcome Constraints to SIT Application and International Trade (Brisbane, Australia).

In terms of *A. fraterculus* the increasing morphological, genetic, chemical and behavioural evidence accumulated

indicates that the complex contains seven morphotypes that appear to represent different species.

On the other hand for the *Bactrocera dorsalis* complex all evidence currently suggests that *Bactrocera dorsalis* sensu stricto, *B. philippinensis* and *B. papayae* do not represent different species.

In the case of *B. cucurbitae* the study of all populations available has been conclusive, confirming that they clearly belong to one species and no complex is involved.

Finally, for the *Ceratitis* FAR complex population genetic structure results revealed five clearly distinguishable clusters: *C. anonae*; *C. fasciventris*: Cf1 and Cf2; *C. rosa*: Cr1 and Cr2. In addition, consistent morphological differences were found to distinguish male *C. fasciventris* (Cf1 and Cf2) and *C. rosa* (Cr1 and Cr2).

The RCM was held in conjunction with the 5th International Meeting on Taxonomy and Natural History of Tephritoidea (6-10 February 2012), which was attended by leading fruit fly taxonomists, evolutionary biologists and behaviourists. It covered speciation, evolution, classification, natural history and other technical issues very relevant to the implementation of this CRP. Detailed discussions were held on species boundaries and the relative value of morphological, behavioural, genetic, cytogenetic and chemical approaches.

Final RCM of CRP on *Improving SIT for Tsetse Flies through Research on their Symbionts and Pathogens*. 26-30 March 2012, Vienna, Austria

The fourth RCM was held at IAEA headquarters in Vienna. Twenty-two participants from fifteen countries attended the meeting together with two consultants from the USA and France, and four observers (from Austria, Kenya, Italy and USA).

Participants of the Research Coordination Meeting on Improving SIT for Tsetse Flies through Research on their Symbionts and Pathogens (Vienna, Austria).

The first two days of the meeting were devoted to presentations whereas during the remainder of the meeting the participants discussed the major achievements and the recommendations in two working groups on tsetse pathogens and tsetse symbionts.

During the discussion it was concluded that the CRP had been very productive, with a much better understanding of the many aspects of the physiology of the tsetse fly, including its fecundity, that are influenced by the fitness of its symbiotic fauna. However, correlations and interactions between the presence of virus, disease symptoms and the occurrence of bacterial symbionts (*Wigglesworthia*, *Sodalis* and *Wolbachia*) need to be further explored. These will be addressed by the new CRP being announced.

The group discussed and emphasised the adoption of the virus management strategies which have been designed and partially validated to mitigate / manage the disease. These strategies are based on: (i) monitoring viral loads for colony quality control; (ii) blocking transmission using specific antibodies, specific oligopeptides and/or clean feeding practices; and (iii) applying the drug valacyclovir to inhibit virus replication. The group also recommended strategies designed to: (i) monitor prevalence and loads of tsetse symbionts and pathogens; (ii) augment current feeding regimens to improve tsetse fecundity; (iii) improve the application of SIT by harnessing tsetse symbionts to develop pathogen resistant fly lines and to introduce natural sterility.

The CRP has resulted in some important achievements which will help in improving tsetse mass-production for SIT programmes. These achievements include the following:

- Potential improvement of tsetse mass-rearing through dietary supplementation (yeast extract);
- Discovery of various *Sodalis* genotypes in natural populations;
- Discovery of the functional role of *Wolbachia* in inducing high Cytoplasmic Incompatibility (CI) and development of a mathematical model to use CI for paratransgenic application to derive desirable phenotypes;
- Identification and characterization of the causal agent (SGHV) of salivary gland hypertrophy and identification of its mode of transmission in tsetse colonies;
- Analysis of the prevalence and genetic diversity of salivary gland hypertrophy in natural tsetse populations;
- Development of strategies to manage the virus infection in tsetse mass-rearing facilities;
- Dissemination of these discoveries to endemic countries and interested parties in Member States through the RCMs and two workshops;
- Research being published in a special issue of Journal of Invertebrate Pathology.

First RCM of CRP on *Use of Symbiotic Bacteria to Reduce Mass-Rearing Costs and Increase Mating Success in Selected Fruit Pests in Support of SIT Application*. 21-25 May 2012, Vienna, Austria

The first RCM was held at IAEA headquarters in Vienna. Twenty-five participants from sixteen countries attended the meeting. The first two days of the meeting were devoted to presentations, whereas during the remainder of the meeting the participants discussed the work plan for the next 18 months, and the 5 years CRP.

Participants of the Research Coordination Meeting on Use of Symbiotic Bacteria to Reduce Mass-Rearing Costs and Increase Mating Success in Selected Fruit Pests in Support of SIT Application (Vienna, Austria).

The efficacy of the SIT is determined by the quality of insects mass-reared and irradiated in production facilities, and released in the field. Constraints on the quality of these insects are manifest at every stage of production and major efforts have been made to assure quality within reasonable economic limits. Indeed, the increased use of the SIT is frequently limited by cost-benefit considerations, as the mass-rearing of target insects, their delivery and release in prime condition may in some situations be too expensive. Accordingly, efforts to streamline the SIT process, combining improved quality of sterile insects with reduced production costs should enable the increased application of this approach.

Three groups discussed and prepared work plans on the 3 different areas of this new CRP:

Larval diet: Under natural conditions, fruits used by larvae have extremely low amino acid contents. Ovipositing females inject their eggs into fruit along with bacteria that most probably fix atmospheric nitrogen and others that break down the fruit to produce nutrients essential for larval growth. The mass-rearing process frequently disassociates the reared insects from their native microflora, allowing the proliferation in larval media of opportunistic microorganisms that may not be beneficial. Yeasts to provide nourishment, and chemicals to suppress opportunistic microorganisms, represent by far the largest cost of larval diets.

Adding endogenous symbiotic bacteria to the artificial larval diet may significantly:

- Reduce mass-rearing costs by decreasing, replacing or eliminating the need for yeasts and chemicals;
- Prevent the growth of competing microorganisms;
- Improve mass-rearing efficiency and quality of the insects produced.

Probiotics: Symbiotic bacteria are ubiquitous in tephritid fruit flies. In the various genera of these flies similar microbial communities are generally found. A number of studies suggest that microorganisms contribute to the fitness of their insect host including the reproductive success of males.

Many studies have shown that mass-reared sterile males are clearly disadvantaged compared to wild males in both survival and sexual competitiveness. Therefore, there is a real need to improve the competitive ability of the released sterile males in SIT operations.

The complement of bacteria present in released males following mass-rearing and irradiation may differ from their wild counterparts enough to impede their performance. There is evidence that inoculating symbiotic bacteria, prior to release, can significantly improve male sexual performance. Thus, restoring key bacteria to mass-reared sterile flies prior to their release is a valid approach to improve the efficacy of the SIT. It is worthwhile to validate this approach at an operational level and to extend it to other insects targeted by the SIT.

***Wolbachia*, other reproductive symbionts and novel control tools:** Certain symbiotic bacteria are known to manipulate the mating behaviour and reproduction of their hosts. These include *Wolbachia* and other symbiotic bacteria such as *Cardinium, Arsenophonus, Spiroplasma* and *Rickettsia.* There is a need to characterize these symbionts, to determine their phenotypes and their fitness effects on hosts, and their interactions with other microorganisms.

There are two potential approaches. First, the incompatible insect technique (IIT) employs cytoplasmic incompatibility, which is induced by insect symbionts such as *Wolbachia*. In a *Wolbachia*-based IIT strategy, female sterility is artificially sustained in pest populations by repeated releases of cytoplasmically incompatible mass-reared males. Secondly, *Wolbachia* and other reproductive symbionts could be used to manipulate host population fitness (a) to reduce/block the capacity to transmit pathogens such viruses through life span reduction and interference with pathogens, (b) to modulate the behaviour (feeding behaviour, mating behaviour) and (c) to impact abiotic stress resistance (thermotolerance, dessiccation resistance, dormancy).

Some of these approaches have already been tested in the laboratory and in the field, e.g. pathogen transmitting mosquitoes. It is worthwhile to explore their potential application against tephritid pests.

Developments at the Insect Pest Control Laboratory (IPCL), Seibersdorf

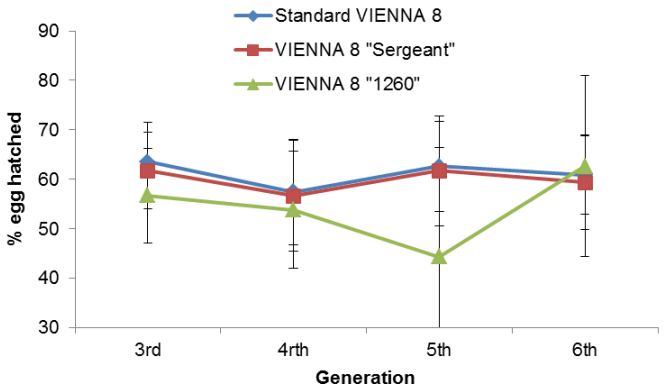
FRUIT FLIES

Fruit Fly Rearing and Quality Control Activities

Evaluation of Mediterranean fruit fly strains that carry a morphological marker

Sterile fruit flies released in SIT programmes are usually marked with a fluorescent powder, to enable discrimination between wild and sterile insects in monitoring traps. As this marking has its limitations and is not fail proof"', efforts have been under way to develop strains with morphological markers. A trial is currently carried out at the Insect Pest Control Laboratory (IPCL) to assess the productivity, stability and mating competitiveness of new marker strains of the Mediterranean fruit fly *Ceratitis capitata* under semi-mass-rearing conditions.

The strains that are being evaluated are (1) the standard VIENNA 8 genetic sexing strain that is currently used in most mass-rearing facilities in the world for eradication or suppression programmes, (2) the VIENNA 8 'Sergeant' strain that carries a morphological mutation that is expressed as three visible abdominal stripes (*Sr*^{2}) and (3) the VIENNA 8 '1260' strain that is a genetically transformed strain that expresses a fluorescent body (red) and sperm (green) marker. All strains carry the *tsl* (*temperature sensitive lethal*) mutation which is lethal to the female eggs when incubated at higher temperatures.

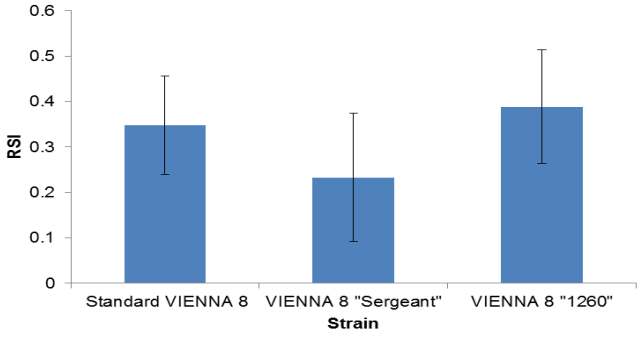


Comparison of egg hatch of the three Mediterranean fruit fly strains during generations F_3 to F_6.

The evaluation of the marker strains was carried out following standard protocols and all essential quality parameters (strain productivity, egg hatchability, egg-pupa recovery, pupal weight, emergence and flight ability) are being assessed for the first 10 generations under semi mass-rearing conditions (see egg hatch in previous figure).

Field cages setup into greenhouse, used for Mediterranean fruit fly mating competitiveness study.

Furthermore, mating competitiveness studies were conducted in field cages (see figure above) using a wild-type Mediterranean fruit fly strain as a reference. The results from the first two rounds of field cage experiments showed adequate competitiveness of the new marker strains (see figure below).



Relative sterilityiIndex (RSI) values obtained from male mating competitiveness study, testing each of the three strains against a wild-type Argentinean Mediterranean fruit fly population. Cumulative results from two studies, using insects from F_3 and F_6 generation are presented. RSI ± standard deviations are presented for each strain (0.5 denotes equal competitiveness of wild and tested males).

Advances with the rearing of olive fly and mating compatibility among strains originating from different geographical areas

The research and development effort to improve the mass-rearing of olive fruit fly *Bactrocera oleae* for SIT continues to yield valuable results. The adoption of mass-rearing cages with normal cloth mesh proved to be effective in egg production of hybrid olive fly strains, a significant advance towards easier egg collection. Currently new designs of larval diet trays are being tested, with the aim to enhance pupal recovery from the larval medium. In contrast to the Mediterranean fruit fly, olive flies do

not 'pop out' of the diet as mature larvae, but rather crawl out of the diet and drop on the pupation medium (sawdust or vermiculite). Depending on the relative humidity conditions, a significant proportion of the larvae pupate in the diet, making it very laborious to recover them.

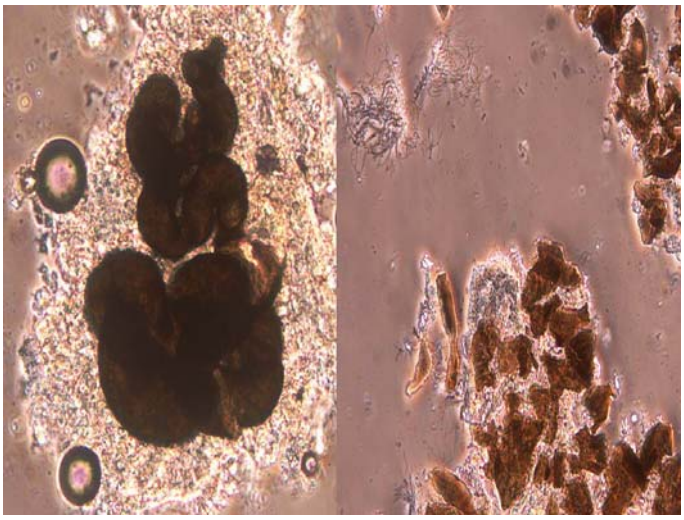
A new tray, consisting of many parallel narrow grooves (see figure below) allowing the mature larvae to abandon the used diet more easily, is under evaluation.

New olive fly larval diet trays under evaluation (left with straight grooves and right with curved grooves). In the middle, the standard diet tray.

The elimination of antibiotics from the adult diet, thus simplifying the mass-rearing, continues to be assessed with no apparent negative effects so far.

Attempts to establish new wild strains of the olive fruit fly have been pursued. These new colonies will be used as a valuable source of material for behavioural and molecular studies, and to investigate the effect of geographic isolation in reproductive behaviour of the insect. If olive fly strains from different areas prove to be sexually compatible and when tested versus a mass-reared hybrid strain, this will enhance the potential for one productive and competent strain to be used in SIT programmes for suppression or eradication efforts in many areas of the world (as was done for the Mediterranean fruit fly).

Currently, four new colonies have been established successfully, originating from wild flies collected in Italy, France, Spain and Croatia. The first field cage results from compatibility tests using the Italian and French strain showed a high rate of mating compatibility. Furthermore, the analysis of the dissected spermathecae from the mated females proved that in all mating combinations, effective sperm transfer had occurred (see figure next column).

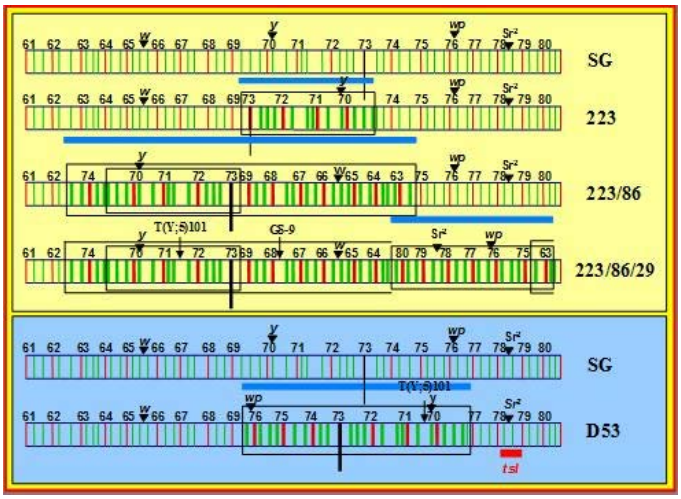


Intact (left) and crushed (right) spermathecae of olive fly as observed under phase contrast microscope. The sperm is clearly visible in the upper left corner of the second image.

Fruit Fly Genetic Sexing Activities

Construction and analysis of a Mediterranean fruit fly genetic sexing strain based on a Y-autosome translocation involving a balancer chromosome

Strain GS-9 is based on a balancer chromosome for autosome 5, i.e. a chromosome with three overlapping inversions. This balancer was induced by A. Zacharopoulou of Greece and is based on the pericentric inversion #223 with its breakpoints at 69B and 73A on the salivary gland polytene map (see figure below).



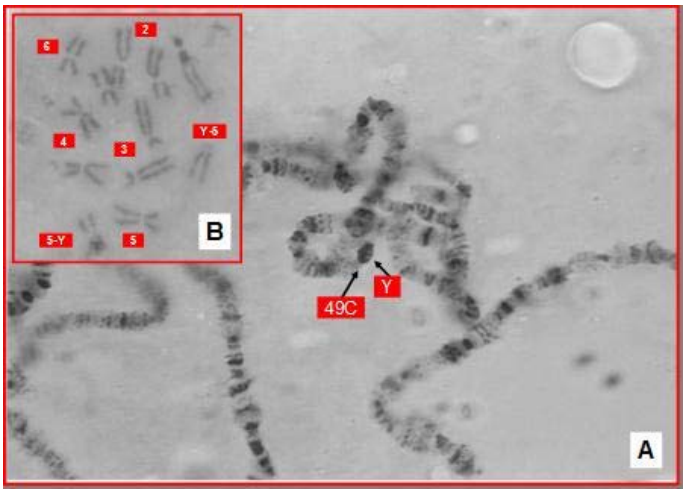
Construction of the balancer chromosome for autosome 5. For comparison also the inversion D53 is shown. SG salivary gland map (Sr2= Sergeant-2;wp= white pupae, y= yellow body, w = white).

Inversion #223 was irradiated and the offspring was screened cytologically for newly induced inversions. In one family (#86), a second pericentric inversion was detected that completely includes #223, i.e. the breakpoints are at 62B and 74C. This double inversion chromosome was irradiated and a third inversion was induced (#29; 64C to 80B). The resulting balancer chromosome exists in several versions with respect to the markers it carries. However, all versions carry the mutation Sr^2 (Sergeant)

and therefore the balancer is lethal in a homozygous condition.

Such chromosomes are very useful genetic tools because in a heterozygous condition single and all uneven numbered recombination events occurring within the inverted regions lead to unbalanced and therefore lethal offspring (while double and even numbered recombination events do not cause lethality in the offspring). This characteristic would also be very useful to increase the stability of sexing strains. Because of the homozygous lethality of the balancer it has to be linked to the Y chromosome.

To induce a Y-autosome translocation on the balancer, male pupae were irradiated one day before emergence, either with 40 or 50 Gy. The irradiated males were mated with *w wp* females. Single F1 males were crossed with *w wp* females and out of a total of 100 single male crosses one showed pseudo-linkage between the markers and sex (= GS-9). The breakpoint of the translocation was mapped by A. Zacharopoulou on polytene chromosomes isolated from male trichogen cells (see figure below). The breakpoint is located at 49C (equivalent to 68A on salivary gland chromosomes).



A: Strain GS-9 polytene chromosomes isolated from Mediterranean fruit fly male trichogen cells. B: Mitotic chromosomes.

GS-9 males were backcrossed twice with homozygous *y* (yellow body) *wp* females. These markers were chosen to determine whether adjacent-1 offspring can be detected. For that two mutations are required; one for each translocated autosome fragment. The mutation *y* is located on the autosomal translocation fragment with the autosomal centromere (A-Y), while *wp* is located on the translocation chromosome with the Y chromosomal centromere (Y-A). The latter would be present in adjacent-1 offspring, i.e. the expected phenotype for adjacent-1 offspring should be *y* wp^+ Sr^2.

In total ca. 10 000 flies were screened and no such flies were detected. Most likely the reason is that the triplicated region with this translocation is very long and adjacent-1 individuals die before reaching the adult stage.

With the translocation GS-9 two different sexing strains were constructed: in one strain the translocation was combined with the *wp tsl* chromosome and the second one with the D53 inversion chromosome (*wp tsl*). These strains were reared at our standard level for 51 generations of which 46 generations were screened for recombinants. Due to the complex structure of the balancer chromosome it is very difficult to assign recombination frequencies in the intervals between the three markers used, i.e. the translocation breakpoint, *wp* and Sr^2.

In principle the physical order of these markers on the balancer chromosome is: breakpoint-Sr^2-*wp* and all three are on the same chromosome arm. Based on this order one could argue that an exchange in GS-9/*wp tsl* between the breakpoint and Sr^2 should lead to Sr^2 wp^+ females (none detected) and Sr^{2+} *wp* males (3 detected). One would expect a second class of recombinant, i.e. Sr^2 *wp* males and Sr^{2+} wp^+ females due to recombination events between Sr^2 and *wp* (none detected). Instead, 5 recombinants were found where only Sr^2 was exchanged.

In GS-9/D53 the situation is even more complicated. However, following the same logic as above the following results were obtained: recombination between breakpoint and Sr^2: 4 detected, recombination between Sr^2 and *wp*: 2 detected, exchange of only Sr^2: 11 detected. In general it can be concluded that the presence of the balancer does not reduce the recombination frequency to zero. In fact, if one considers that at least a double crossover is needed to produce these recombinants, then the frequency is rather high.

In case of GS-9/*wp tsl* the recombination frequency is at a very similar level as in other strains. Combining D53 with GS-9 even increases the number of recombinants detected. Probably the best way to compare strains with *wp* and Sr^2 is to look at the total number of recombinants observed. Here GS-9/*wp tsl* (79 recombinants/million flies) is very similar to CC59/*wp tsl* (75/million flies) despite the fact that this strain does not include an inversion. Adding D53 to GS-9 produces 181 recombinants per million flies screened. This is more than observed with T(Y;5)101/D53 (143/million) or T(Y;5)101-Sr^2/D53 (92/million). Overall GS-9 is very stable and no accumulation of recombinants was observed during 60 generations of rearing at our standard level.

The productivity of both GS-9 strains is very similar. Compared to T(Y;5)101 the male production is slightly lower, while female production is the same. The fraction of partially emerged/crippled males is relatively high.

LEPIDOPTERA

Dose response studies with the carob moth

The carob or date moth, *Ectomyelois ceratoniae* (Lepidoptera: Pyralidae), is known as one of most economically damaging pests of the date industry. Found in many regions around the world, it also damages many other high value nut and fruit commodities such as almonds, pistachios, macadamias, pomegranates, stone and pome fruits. The application of the SIT against it could be an environmentally friendly addition to existing control

methods, which all have their limitations. That requires a thorough knowledge of the effect of gamma irradiation on the fertility, fecundity, and longevity of the parental individuals and their F_1 offspring.

Adult of the carob moth Ectomyelois ceratoniae.

In relation to the activities supported under TC project TUN 5026 "Assessing the Use of Inherited Sterility as a Genetic Control Method Against the Carob Moth" the IPCL hosted Ms Salwa Chakroun, a fellow from Tunisia for three months (February-April 2012) with the aim to define the optimal irradiation dose for effective application of an inherited sterility program for the carob moth. The experiments evaluated the effect of several irradiation doses (ranging from 100 to 350 Gy) on the reproduction and longevity of the moths. The results indicate that the sterilizing dose for female and male moths was 250 Gy and 300 Gy respectively.

TSETSE FLIES

Salivary gland hypertrophy virus

Attempts are continuing to develop a strategy to manage the salivary gland hypertrophy virus (SGHV), which can hamper the development of *Glossina pallidipes* colonies due to reduced productivity. The virus management strategy is based on four approaches: (1) blocking virus replication using commercial antiviral drugs, (2) neutralizing the virus infection using virus specific antibodies, (3) modifying the feeding system using clean blood feeding and (4) impeding the SGHV infection using a peptide similar to SGHV ORF005 that could possibly bind to the gut epithelium.

Impeding SGHV infection, using a peptide similar to the SGHV ORF005, was mentioned previously as a new potential strategy to control SGHV (this work is being carried out in collaboration with Bryony C. Bonning from Iowa State University, Ames, USA). One polypeptide sequence similar to the amino acid sequence used by B. Bonning was found on SGHV ORF005. An oligopeptide was synthesized from this sequence and its impact on virus infection was tested. The preliminary results indicate a significant reduction in the virus load in flies fed on virus infected blood with the oligopeptide as compared to flies fed on blood containing the virus alone. Further studies to optimize and assess the impact of long term use of this approach are under way. Also, additional work is on going to screen the phage display library to select more strains that bind to the tsetse fly mid-gut or the brush-border membrane vesicles (BBMV) to develop other oligopeptides.

To extend our knowledge of SGHV biology, we studied the structure of the virus particles in collaboration with Just Vlak and Henry Kariithi of Wageningen University. The preliminary results indicate that the GpSGHV particle has four morphologically distinct structures: nucleocapsid, tegument, envelope, and helical surface substructure. In addition to the identification of 45 GpSGHV-encoded proteins distributed within the virus envelope, nucleocapsid and tegument components, 51 host/cellular proteins were identified in the purified virions. Identification and localization of the proteins associated with the virus are essential to develop antiviral strategies to manage GpSGHV infections in tsetse colonies. In this regard envelope and tegument proteins, as well as host-derived proteins, are most significant as they have been shown in numerous studies to play critical roles in various steps of viral life cycles.

Drion Boucias from the University of Florida, USA, has been studying other aspects of the virus biology during a sabbatical at the Insect Pest Control Laboratory. Preliminary results indicate that tsetse flies injected with the virus, although they show a significant increase in virus load, did not develop hyperplasia. Hyperplasia develops only in the later progeny of injected females (from the fourth larva on).

The correlation between virus infection and the symbionts *Sodalis*, *Wolbachia* and *Wigglesworthia* is also being investigated. Preliminary results indicate a strong correlation between the presence of symbiotic bacteria and the prevalence of the virus in F_1 progeny. When adults flies injected with SGHV are fed on blood supplemented with ampicillin, there is a significant reduction in the virus load and SGH prevalence in the F_1 progeny compared to the progeny of flies fed on ampicillin-free blood. As the ampicillin treatment removes the bacterial symbionts it is suggested that the presence of the symbionts plays an important role in the virus infection process in the progeny. Further studies on the role of symbiotic bacteria in the virus infection process are continuing.

The dynamics of tsetse symbionts in hybrid crosses between the *Glossina morsitans* subspecies *G. m. morsitans* and *G. m. centralis* and between these subspecies and *Glossina swynnertoni* are being studied in collaboration with Wolfgang Miller and Daniella Schneider of the

Medical University, Vienna. Preliminary results indicate a significant increase in the *Wolbachia* titre in F_1 pupae produced by the crossing test comparing the *Wolbachia* titre in the female parent, suggesting a loss of control by the hybid host over *Wolbachia* replication. The raised symbiont levels may explain the post-mating barriers (partial sterility) observed in these crosses.

MOSQUITOES

Rearing of *Aedes albopictus* larvae with stable isotopes for marking studies

Stable isotopes can be used for various studies requiring individual marking, for example, when investigating paternity (multiple mating, competitiveness tests) and dispersion of released insects. Marking with stable isotopes can be done at the larval stage by rearing the larvae in a marked solution. It is essential to assess the quantity of stable isotopes needed for efficient marking, but this does not affect developmental parameters.

Aedes albopictus larvae were provided with solutions of glucose-^{13}C or $^{15}NH_4Cl$ at 2 different concentrations. Larval and pupal survival rates did not differ significantly for the different treatments, though a tendency of higher larval survival occurred when larvae were reared with 15 mg/L of a solution of ^{15}N. However, overall the rearing of *Ae. albopictus* with these stable isotopes at the concentrations tested did not affect their development or survival.

Further studies will focus on an analysis of body isotopic content of virgin females and males and on an analysis of the spermathecae of females mated with marked males.

Sperm production of *Anopheles arabiensis* in relation to genetic manipulation, dieldrin application for sex separation and irradiation

Before their release, *An. arabiensis* males undergo several harsh treatments. First, a genetic sexing strain (Ano IPCL1) was created from the original wild type strain that is based on a dieldrin resistant mutation using a translocation. Second, treating Ano IPCL1 eggs with dieldrin will completely eliminate all female mosquitoes mostly at the L1 stage. The absence of female larvae and pupae in the rearing process reduces costs, space and labour requirements. Finally, before being released, the male pupae need to be irradiated with a dose of 70 Gy. The individual and combined effects of the genetic manipulation, dieldrin treatment and irradiation on sperm number and sperm production in male *An. arabiensis* were investigated.

Two day old Dongola (wild type) and Ano IPCL1 males had a similar number of mature sperm cells and sperm production increased with age. The irradiation and dieldrin treatments alone each reduced the initial sperm stock. Indeed, there was no further sperm production for the irradiated males; on the contrary, the number of sperm decreased with age. Although the dieldrin treated mosquitoes had a lower number of sperm in their initial stock, their sperm production increased with age. Also, sperm production in dieldrin-treated/irradiated males was higher at day 6 as compared to males who were only irradiated.

These findings would suggest that the dieldrin treatment, aimed at eliminating females, might have an unexpected radiation protectant effect on *An. arabiensis* germinal cells. This observation, if confirmed, could be very useful for a control programme integrating the release of sterile males allowing the production of sterile males with an adequate sperm complement. However, it needs to be ascertained whether this sperm production is possibly accompanied with a recovery of fertility. Moreover, with respect to SIT, the effect of lower quantities of the initial sperm complement of sterile males on mating ability, as measured by the amount of sperm transferred per female and the number of females inseminated, must also be assessed.

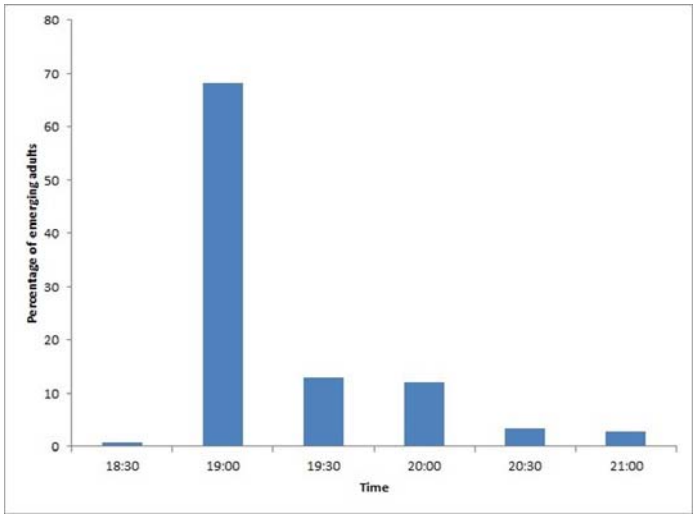
Anopheles arabiensis pupae management: pupal stage duration and pupa cold storage

To minimize somatic damage due to irradiation, pupae must be irradiated as close to emergence as possible. However, to develop adequate protocols, the pupal duration and emergence dynamics must be known. In addition, in some countries such as Sudan, pupae will be irradiated at the production site, before being transported to the field site(s) for release. Transport from the production site to the release sites could take up to 6 hours by truck, and pupa could start emerging during the journey. To prevent emergence during transport, the development of the pupae could be delayed by storing the pupae at low temperatures. The effects of cold storage on pupa duration, adult male mosquito survival, and male reproductive abilities were studied.

Pupa development time: To assess the pupa development time of *An. arabiensis*, pupation of larvae from the same batch of eggs reared in a climate-controlled room was observed hourly and the following day, the pupae were again observed hourly to assess emergence of adult mosquitoes. The mean duration of the pupa stage was 1717.5 ± 58.1 minutes, which corresponds to 28 hours and 35 minutes. Aside from the intrinsic duration of the pupa stage, the great variation in pupa duration was probably due to the fact that 80% of the mosquitoes emerged the following day during the artificial dusk period (see figure next page), irrespective of the time at which larvae pupated the previous day. This is most likely related to the decreasing light intensity in the laboratory that mimics the dusk that triggers the emergence between 19:00 and 20:00 h.

This information is very useful for the management of the pupae and for the development of adequate irradiation schemes, e.g. removing the pupae forming at night from the trays in the morning and collecting the rest of the pupae at the end of the day and irradiating them the next day just before dusk will ensure an optimal sterilization

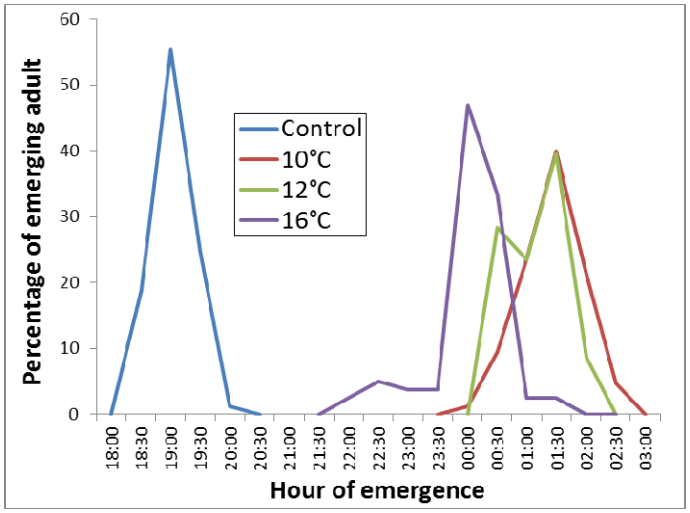
with limited damage. Irradiated pupae can then be transported to the release site or stored in climatic chambers.



Percentage of emerging Anopheles arabiensis *adults according to the time of the day following the day of pupation.*

Work will continue to assess the dynamics of emergence of larvae that have pupated during the night.

Pupae cold storage: Twenty-four hours old pupae were exposed in dark climatic chambers at either 16°, 12°, or 10°C for six hours. Control pupae were exposed to rearing temperature (28°C) and distribution of emergence after treatments was observed. Also, to assess the impact of cold during larval storage on adult male quality, 100 male mosquitoes from each treatment were placed in a cage with 100 virgin females. Emergence of adults from pupae maintained at 16°C started during the cold storage period, whereas the time of emergence was delayed for pupae maintained at 10°C and 12˚C (see figure below). There was no significant difference in mortality for the four treatments with average mortality at emergence of 3.3±3.3, 4.4±1.9, 7.7±8.4 and 10±5.8% for control, 10, 12 and 16˚C, respectively.



Percentage of Anopheles arabiensis *adult mosquitoes emerging according to the time of the day following 6 hours of pupal storage at 16, 12 and 10˚C. The cold storage period took place between 17:00 and 23:00.*

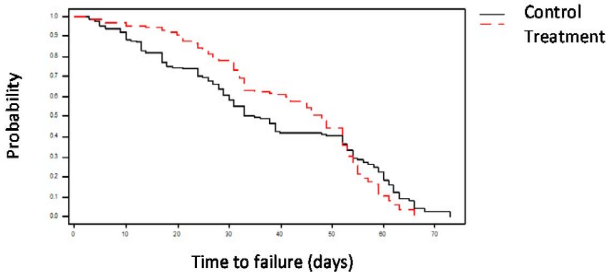
The total number of eggs produced by females mated in the laboratory with males, which had been chilled for six hours at 12˚C, was similar to egg production of females mated with control males (10 300 and 10 666 eggs, respectively). Storing pupae for six hours at 10 ˚C negatively affected the mating abilities of the male mosquitoes, as females mated with these males produced only 1967 eggs during the same period. The mortality of the adult males did not differ between treatments.

These results seem to indicate that storing *An. arabiensis* pupae for 6 hours at 12˚C sufficiently delays adult emergence without negatively affecting viability or reproductive ability. More experiments are needed to assess under field cage conditions the impact of chilling pupae on the competitiveness of the males. In addition, it needs to be assessed whether the cumulative effect of the other treatments given to the male mosquitoes (dieldrin treatment and irradiation) negatively affects adult male competitiveness.

Effects of dieldrin treatments at larval stage on adult male longevity (*An. arabiensis, IPCL1 strain*)

The effect of dieldrin treatments of larvae of the genetic sexing strain of *An. arabiensis* (Ano IPCL1) on adult male longevity was assessed. L3 larvae from the same family and generation reared under standard colony conditions were split into two groups: the first group was treated with a 0.1 ppm dieldrin solution for 1 h, and in the second group the larvae were not treated.

Both the Log-Rank test and the Wilcoxon tests showed that treatment of L3 larvae with dieldrin did not significantly affect the longevity of the Ano IPCL1 males (see figure below).



Non-parametric survival plot showing the comparison of survival times of dieldrin treated (red dotted line) vs. untreated (black solid line) IPCL1 male adults.

Further testing will be done to assess the impact of dieldrin treatment at the egg stage on the competitiveness of the adult males using the same general protocol.

Reports

Inauguration of CIRDES as the first IAEA Collaborating Centre in Africa, 24 February 2012, Bobo-Dioulasso, Burkina Faso

The Centre International de Recherche-Développement sur l'Élevage en zone Sub-humide (CIRDES) in Bobo-Dioulasso, Burkina Faso was inaugurated on 24 February 2012 as an '*IAEA Collaborating Centre on The Use of Sterile Insect Technique for Area-wide Integrated Management of Tsetse Fly Populations*'.

The formal inauguration of the first IAEA Collaborating Centre in Africa took place in the presence of Dr Valentine Gnapi Yaoré, Director General of CIRDES, Mr Liang Qu, Director of the Joint FAO/IAEA Division and representatives from Burkina Faso and from neighbouring CIRDES and IAEA Member States.

Inauguration of CIRDES as the first IAEA Collaborating Centre in Africa (Bobo Dioulasso, Burkina Faso).

The event coincided with the last day of the regional training course hosted from 6-24 February 2012 by CIRDES on 'Standardized Collection and Processing of Tsetse Flies for Molecular Tsetse Population Genetic and Morphometric Analyses'. The course was carried out in support of the Pan African Tsetse and Trypanosomosis Eradication Campaign (PATTEC), following close consultations with PATTEC, FAO, WHO and several national PATTEC coordinators.

The Centro Agricoltura Ambiente 'G. Nicoli' was inaugurated as a new IAEA Collaborating Centre, 11 May 2012, Crevalcore, Italy

The Centro Agricoltura Ambiente 'G. Nicoli' (CAA) was inaugurated on 11 May 2012 as a new '*IAEA Collaborating Centre for the Development and Implementation of a Sterile Insect Technique Package for* Aedes albopictus *Mosquitoes*'.

Inauguration of IAEA Collaborating Centre, Centro Agricoltura Ambiente "G. Nicoli" (Crevalcore, Italy).

The inauguration ceremony was opened by the President of the CAA, Mr Paolo Ceccardi and statements were given by several local and national dignitaries. Mr Liang Qu, Director of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture made a statement on behalf of the IAEA emphasising the importance of the research done at the CAA with respect to the development of the SIT package for the disease transmitting mosquito *Aedes albopictus.* The importance of this research is exemplified by the increase in outbreaks of diseases like dengue and chikungunya in the last decade, mainly due to the expansion of the distribution of this important invasive mosquito pest species.

Ongoing field work in surveillance of mosquitoes in the surroundings of Bologna (service of the mosquito ovitraps).

The CAA is the only institute worldwide that has been releasing gamma sterilised male *Aedes albopictus* as part of pilot projects during the last several years. The release programme, albeit small and experimental, has clearly demonstrated a significant reduction of the mosquito populations in the trial areas, giving strong indications that the SIT can be integrated as a tool to suppress mosquito vector populations.

The only other institute that is developing the SIT package against disease transmitting mosquitoes is the FAO/IAEA Insect Pest Control Laboratory. The designation of the CAA as an IAEA Collaborating Centre is very opportune and will enhance the collaboration between the two institutes and advance the development of the SIT for mosquito control for the benefit of Italy and other countries who face outbreaks of these important diseases.

Consultants Group Meeting on *Diapause Management to Facilitate the Rearing of Temperate/Overwintering Pests*. 7-11 May 2012, Vienna, Austria

Meeting participants reviewed the progress being made internationally in understanding insect dormancy phenomena, and prepared a proposal for a CRP on 'Dormancy management to enable the mass-rearing and increase the efficacy of sterile insects and natural enemies.'

Participants of the consultants group meeting on Diapause Management to Facilitate the Rearing of Temperate/Overwintering Pests (Vienna, Austria).

Dormancy is an integral component of many insect life cycles, wherein insects enter a state of developmental or reproductive arrest to avoid adverse conditions and synchronize their populations with favourable conditions.

Dormancy responses are an obstacle to the effective implementation of mass-rearing in many cases for biological control applications using sterile insects and/or natural enemies. The ability to manage dormancy could facilitate the development of new pest control programmes that are currently constrained by species dormancy characteristics.

Dormancy management could also offer opportunities to carefully time the supply of mass-reared insects upon demand and to enhance product quality. Specifically, dormancy management could enable effective mass-rearing of insects that require dormancy, the ability to stockpile and mobilize them upon demand, maintenance of the genetic integrity of strains, and mitigating the stresses of sterilization, product shipment, and release.

However, there is a clear gap in knowledge of the roles and mechanisms of dormancy on life cycle synchronization or stress resistance in sterile insects and natural enemies.

The objectives of this CRP proposal are: (1) to generate new knowledge about the induction, maintenance, and termination of dormancy in insects, (2) to disseminate and apply that knowledge to improve the efficacy of current biological control programmes using sterile insects or natural enemies, and (3) to develop new programs for select insect pest species where dormancy has been a barrier. Furthermore, understanding dormancy responses may lead to novel pest management tools, such as dormancy disruption in the field.

The proposal will be submitted to the IAEA Committee for Coordinated Research Activities on Nuclear Sciences and Applications (CCRA NA) and if approved will be announced for submission of research proposals in 2013.

Annual Meeting and Steering Committee of the SIT Mosquito Project in La Réunion, 4-6 April 2012, St Denis de La Réunion, France

Together with the local authorities and representatives of the Ministry of Health, the four work package leaders presented the progress made during the last three years of the project and discussed the achievements and the orientation of the current project. Whereas little progress was made with *Anopheles arabiensis* due, to difficulties in establishing a colony of this mosquito species in the laboratory, tremendous work has been done on *Aedes albopictus*.

Mosquito ovitrap for egg collection in the field in La Reunion.

The collection of baseline data demonstrated the possibility for the current project to move to the next phase for this species. The current feasibility study on the development of the SIT has been extended for a year until the end of 2013. During 2013, social and economic studies will be carried out especially regarding the perception of the local population on the releases of sterile males. The French Ministry of Health has requested a complete study and report before doing any field releases, even experimental ones. A grant proposal will be written in parallel for phase 2.

Workshop on Searching for Solutions for the Control of the Avian Parasite, *Philornis downsi.* 31 January-3 February 2012 Puerto Ayora, Santa Cruz, Galapagos, Ecuador

Many Galapagos bird species, including the world-famous Darwin's finches and the very rare Mangrove finch, Floreana mockingbird, and Medium tree finch, are at risk from the presence in the archipelago of a non-native parasitic fly, *Philornis downsi,* whose larvae cause very high mortality among nestlings. In addition to direct nestling mortality (up to 100%), studies have confirmed that surviving nestlings often have deformed beaks, reduced growth rates, and anemia. The high mortality and long term impacts on finch populations from this fly species are of grave conservation concern, especially for endangered and declining species.

Participants of the Workshop on Searching for Solutions for the Control of the Avian Parasite, Philornis downsi *(Galapagos, Ecuador).*

Currently there are no techniques available to mitigate the impacts of *P. downsi* on Galapagos birds. Substantial gaps in the understanding of the life history and ecology of *P. downsi* has hindered the development of methods to reduce fly numbers. In addition, research on *P. downsi* and potential control methods are being conducted by scientists around the world with little communication occurring between research teams. Because of this there is duplication of effort and considerable gaps in what we know about this invasive fly.

This workshop provided the opportunity to share information and identify the steps that need to be taken to reduce the impact of this parasitic fly. In addition, it helps to raise awareness about *P. downsi*. In spite of the high number of species severely affected by *P. downsi*, the parasitic fly has a very low profile.

The first day of the workshop was taken up with presentations by the main participants. These covered the present knowledge of the distribution and frequency of *P. downsi* in Galapagos, the host range, its impact on the hosts and the biology and bionomics of *P. downsi*.

Workers from the Charles Darwin Research Station checking a medium ground finch nest for nestlings and Philornis downsi *using a small digital camera on the long pole.*

During the last session of the day a presentation entitled 'Prospects for the control of *Philornis downsi* using the sterile insect technique' was done. Throughout the first day the sessions were open to the public and were attended by workers from the research station, the National Parks Authority, local government, local environmental groups and the local press.

Two finches' chicks that have died due to Philornis downsi *infestation.*

For the remainder of the workshop the participants divided into four groups. Two groups worked on better measurement of the impact on the native passerines, in particular the finches, and how to develop action plans to rescue the most severely affected species. The other two groups worked on the entomological problems, including investigating attractants and control methods, and expanding knowledge of the fly's biology with a view towards developing captive breeding.

IAEA Fact-Finding Mission for Initiation of Technical Cooperation Projects in Palau, 19-23 March 2012, Koror, Palau

An official IAEA delegation visited Palau in the Pacific Ocean in March 2012 to contact the local authorities and project counterparts of this new IAEA Member State and to inform on IAEA technical cooperation activities.

IAEA officials with the President of Palau H.E. Mr. Johnson Toribiong (second from right), during the National Seminar on the contribution of nuclear techniques to the development programme of Palau, held in Koror, Palau, 19 March 2012.

One of the main areas identified for future collaboration is the agricultural production of fruits and vegetables. Currently the island's production is suffering from fruit flies belonging to the genus *Bactrocera*, which are causing heavy losses, in some crops exceeding 90%, and interfering with exports to neighboring countries.

During the mission, an initiative was established with the Bureau of Agriculture on capacity building for developing an area-wide pest management approach against these insect pests, with the combined use of male annihilation, protein mass-trapping and possibly the sterile insect technique.

*Star fruit tree (*Averrhoa carambola*), with fruits protected with paper bags. Due to high fruit fly infestation, farmers are using this laborious method for the protection of fruits until ripening, or they are spraying with insecticides. Palau has the potential of producing tropical fruits of good quality and high market value for export, but the establishment of several* Bactrocera *fruit fly pests is hampering the development of the horticultural sector.*

Seventh Session of the Commission on Phytosanitary Measures, International Plant Protection Convention, FAO. 19-23 March 2012, Rome, Italy

The Deputy Director General (DDG) of FAO Ms. Tutwiler, welcomed Commission on Phytosanitary Measures (CPM) members to FAO. She strongly linked the International Plant Protection Organization (IPPC) work with the global challenges to fight hunger and to protect the environment. She noted that some countries had difficulties implementing the International Standard for Phytosanitary Measures (ISPMs) due to a lack of capacity.

The CPM finally adopted the ISPM 35 on *Systems Approaches for Pest Risk Management of Fruit Flies.* This draft ISPM was developed by the Technical Panel on Pest Free Areas and Systems Approach for Fruit Flies (TPFF) some years ago, with much technical input from the Joint FAO/IAEA Division. During the CPM, the draft document was discussed at the evening section on 20 March and finally consensus was reached on outstanding issues in order to be able to present a final document for adoption to the CPM.

On the other hand, the four pytosanitary treatments (Cold treatment for *Ceratitis capitata* on *Citrus paradisi*; Cold treatment for *Ceratitis capitata* on *Citrus reticulate* cultivars and hybrids; Cold treatment for *Bactrocera tryoni* on *Citrus sinensis*: Cold treatment for *Bactrocera tryoni* on *Citrus reticulata* x *C. sinensis*) were sent back to the Technichal Panel on Phytossanitary Treatment (TPPT) due to a formal objection by China, the European Union and the USA.

Commission on Phytosanitary Measures meeting (FAO Headquarters, Rome, Italy.

In line with the Member States' needs presented during the CPM, the Joint FAO/IAEA Division was requested to continue developing technically and scientifically sound reference manuals, thereby providing its Member States with useful guidance to apply international standards and to conduct certain phytosanitary activities. Additionally, it was requested to continue to actively support capacity building and the implementation of ISPMs in developing countries through regional courses and field projects, in coordination with other international organizations.

Standards Committee Meeting, International Plant Protection Convention, FAO. 23-27 April 2012, Rome, Italy

Twenty-five officially nominated members, representing FAO's seven regions, participated in the Standards Committee in April 2012, which reviewed three draft fruit fly International Standards on Phytossanitary Treatments (ISPMs). One was returned for further work and the other two were approved for member consultation, which will begin 1 July and end 20 October 2012.

The draft ISPMS for member consultation are:

- *Determination of Host Status of Fruits and Vegetables to Fruit Fly (Tephritidae) Infestation*
- *Establishment of Fruit Fly Quarantine Areas within a Pest Free Area in the Event of an Outbreak*

The draft annex to ISPM 26: *Phytosanitary Procedures for Fruit Fly (Tephritidae) Management* was returned to the steward of this draft ISPM, and Standards Committee members were requested to provide additional comments.

The ISPMs developed specifically for fruit flies have provided additional phytosanitary options for exporting and importing countries, thereby facilitating international trade of fresh fruit and vegetables.

Announcements

IAEA
International Atomic Energy Agency
Atoms for Peace

50th Anniversary of the
Agency's Nuclear Sciences and Applications Laboratories in Seibersdorf

Believe it or not: the Agency's Nuclear Sciences and Applications (NA) Laboratories in Seibersdorf have just completed half a century of dedicated support to Member States in their efforts to optimally exploit 'atoms for peace'. It seems to be an appropriate time to celebrate the completion of these five decades in a fitting manner.

Throughout these many years, the activities of the NA Laboratories in Seibersdorf have continuously evolved, also through their partnership with FAO, in response to the ever changing landscape of nuclear technologies and applications, and to the multitude of expectations of national and international organizations for cooperation in nuclear research and technology transfer. In this process, the Laboratories have consistently remained at the forefront of assisting Member States in fostering the use of nuclear science and technology wherever these offer unique opportunities or provide added value.

The Laboratories have indeed come a long way. Starting with a mere 1736 m^2 of combined laboratory, office and corridor space in 1962, the original U-shaped building housed 14 professional and 24 general service staff. Today, it covers an area of more than 13 000 m^2 and is a dynamic hub for nearly one hundred scientists, technicians, fellows, visitors, interns and students from all over the world that are engaged in a wide range of activities dedicated to supporting global development and cooperation. These dedicated and concerted efforts have led to a myriad of success stories in the many areas of work in the Laboratories, which is both satisfying and enthusing.

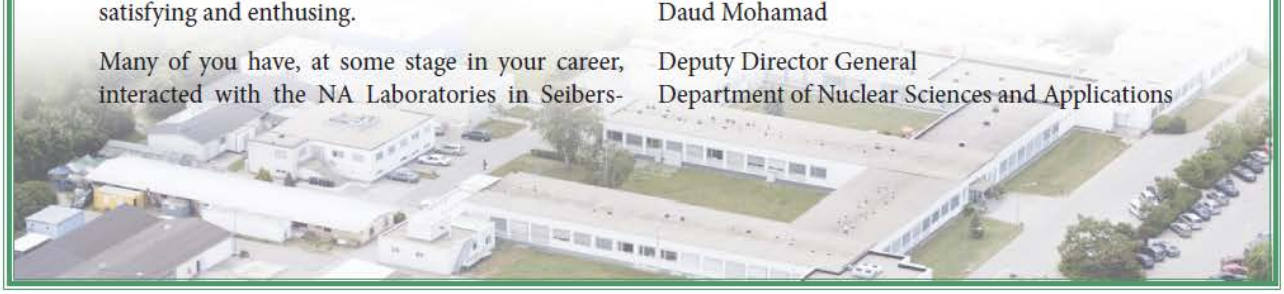
Many of you have, at some stage in your career, interacted with the NA Laboratories in Seibersdorf and contributed to these successful projects and programmes, which are glowing examples of success stories that fully justify the mandate of these Laboratories. We are very grateful to all of you for seamlessly working with us, as we realize that it is only through the dedication, the enthusiasm and the numerous ideas of our many internal and external stakeholders, that it has been possible for the Laboratories to consistently remain at the forefront in our numerous and very diverse endeavours.

Nonetheless, this is not the time to lay back in satisfaction but a time to look forward to further enhance the performance of the Laboratories and to improve our outreach. While the NA Laboratories in Seibersdorf have served the Member States well over the last half century, they need to be modernized and upgraded to cater to growing demands and to keep pace with increasingly rapid technological developments. The planned 50 year anniversary celebration of the Laboratories is an apt time to look back and feel proud of the numerous achievements, as well as to plan the future road map that will enable the Laboratories to retain the high level and quality of service that Member States have come to expect.

So, when we celebrate the 50th anniversary of the NA Laboratories in Seibersdorf, it is really you we are celebrating. We sincerely hope to see as many of you as possible during this year of celebration or maybe even at the actual event in late November 2012 at the Laboratories.

Daud Mohamad

Deputy Director General
Department of Nuclear Sciences and Applications



Call for Submission of Research Proposals for a new FAO/IAEA Coordinated Research Project on Enhancing Vector Refractoriness to Trypanosome Infection

The SIT relies on the release of sterilized male insects to mate with virgin wild female insects. In the case of disease vectors, such as tsetse, the sterilising dose that the insects receive does not reduce their vectorial capacity. It is therefore critical when large numbers of sterile male vectors are released, that the risk of transmission of the disease is minimized or eliminated. In the case of tsetse flies, disease transmission has in the past been minimized by holding sterile males after emergence and adding trypanocidal drugs to the blood meal when feeding them before release. The development of strains that would be refractory to the transmission of trypanosomes would, however, be a much simpler and hopefully more effective method of ensuring that released sterile flies do not transmit the disease. In that way, the SIT for trypanosome vectors could be significantly improved.

Tsetse flies (Diptera: Glossinidae) are the only cyclical vectors of African trypanosomes, protozoan parasites that cause sleeping sickness in humans (HAT) and African animal trypanosomosis (AAT). HAT is endemic to 36 countries in sub-Saharan Africa with about 70 million inhabitants at risk. In 2009, the annual number of new cases of HAT reported to WHO dropped below the symbolic number of 10 000. However, given that the disease affects remote and hard to reach rural populations, the disease prevalence numbers are undoubtedly a gross underestimation. The related disease, AAT, causes estimated losses to African agriculture of at least US $4.5 billion per year and has a profound effect on food security and the development of the continent.

Most economically important African trypanosomes are transmitted during the bite of the tsetse fly. Humans are only infected by *Trypanosoma brucei rhodesiense* and *T. b. gambiense*. The 'nagana' causing related trypanosomatids *T. vivax, T. congolense* and *T. brucei brucei* are major pathogens of livestock. The natural transmission of the major medically and veterinary important trypanosome species (*T. brucei* ssp., *T. congolense* and *T. vivax*) relies on the specific biological relationship between the parasites and the blood feeding insect vector, the tsetse fly. Indeed, depending on the trypanosome species, the parasite has to go through an obligatory developmental cycle that varies from a short cycle in the mouthparts of the fly (*T. vivax*) to a longer, more complex life cycle in the tsetse fly midgut and mouthparts (*T. congolense*) or the midgut, mouthparts and salivary glands for the *T. brucei* subspecies. For both *T. congolense* and *T. brucei*, the molecular interplay at different stages of development will determine the success of parasite development in the fly to the final infective stage. A better understanding of the vector-trypanosomes-symbiont tripartite association is essential to develop methodologies that could result in the enhancement of refractoriness of the vectors to trypanosome infection.

Tsetse flies also harbour three maternally transmitted bacterial endosymbionts that presumably assume different roles with respect to their host's biology. *Wigglesworthia*, an obligate mutualist, is found in all tsetse flies examined to date. Tsetse's second symbiont, *Sodalis*, is a commensal bacterium found in all lab-colonized tsetse lines and some natural populations. Finally, some tsetse populations are colonized with *Wolbachia*. This bacterium is restricted to tsetse's germ line, and exhibits a parasitic phenotype in its host. All three of these symbionts are potentially exploitable for the purpose of reducing trypanosome transmission through tsetse. Interestingly, while only these three bacteria are found in laboratory colonies of tsetse, field caught flies house a taxonomically diverse bacterial population that further manipulates their host's biology.

The elucidation of these interactions is essential to understand the determinants of tsetse vector competence for a given trypanosome population and how they can be affected. This knowledge will help to develop tools to enhance refractoriness to trypanosome infection. In this context a new CRP will be initiated focusing on various aspects of this tripartite association. It will offer a unique opportunity to bring together different research groups working on vectors of trypanosomes from different continents that are active in this scientific field stimulating inter-disciplinary discussions and collaborative work.

Four main research questions to be addressed:

- Can the elucidation of tsetse-trypanosomes molecular interactions help to reduce or eliminate the transmission of trypanosomosis?
- Can the characterization and harnessing of the tsetse symbiome and pathogens help to improve the SIT?
- How are tsetse symbionts affected by radiation?
- Can tsetse symbionts be used to develop novel vector and disease control tools, complementary to the SIT?

A combination of the following priority topics will be targetted:

- Diversity in midgut, natural populations (symbiome), comparison lab-natural tsetse;
- *Sodalis*, *Wolbachia*, *Wigglesworthia* and others;
- Impact of host blood on symbiont populations;
- Sex differences in symbiont population (quantitative/qualitative);
- Environmentally acquired gut-microbiota;
- Vector microorganisms interactions (virus; limitations for mass-rearing);
- Effect of irradiation on symbiont populations;
- Effect of irradiation on trypanosome infection;
- Symbiont-based control strategies;
- Paratransgenesis: maternal transmission, optimization;
- Driving systems.

The expected duration of the CRP is 5 years (2013-2017) and the first Research Coordination Meeting is planned for June 2013 in Vienna, Austria. Scientists and researchers who are interested in collaborating in this new CRP should contact Andrew Parker (A.G.Parker@iaea.org).

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/. Applications should be submitted by 30 November 2012 to: Official.Mail@iaea.org.

Announcement of FAO/IAEA Interregional and Regional Training Courses

Regional Training Course on *Quarantine and Pest Risk Analysis* for Eastern Europe and Balkans (under TC Project RER5018). 1-5 October 2012, Vienna, Austria (**Deadline for nominations: 31 July 2012).**

Regional Training Course on *Fruit Fly Detection, Taxonomy and Identification for the Indian Ocean* (under TC Project RAF5062). 3-7 December 2012. St. Pierre, La Réunion, France (**Deadline for nominations: 30 September 2012).**

Regional Training Course on *Area-Wide Integrated Fruit Fly Suppression, including MAT and SIT in West Africa* (under TC Project RAF5061). 11-15 March 2013. Bobo Dioulasso, Burkina Faso. (**Deadline for nominations: 31 December 2012).**

Regional Training Course on *Comparative Morphometric Analyses of Wings of Insect Pests* (under TC Project RAF5060). 22-26 April 2013. Seibersdorf, Austria. (**Deadline for nominations: 31 January 2013).**

Regional Training Course on *Fruit Fly Detection for Balkans and Eastern Mediterranean* (under TC Project RER5018). 10-14 June 2013. Antalya, Turkey. (**Deadline for nominations: 30 March 2013).**

Regional Training Course on *Quarantine and International Standards for Phytosanitary Measures for the Indian Ocean* (under TC Project RAF5062). 1-5 July 2013. Maputo, Mozambique. (**Deadline for nominations: 30 March 2013).**

Interregional Training Course on *The Use of the Sterile Insect and Related Techniques for the Integrated Area-wide Management of Insect Pests* (under TC Project INT5151). 29 July - 23 August 2013, Metapa de Dominguez, Chiapas, Mexico (**Deadline for nominations: 30 March 2013).**

Regional Training Course on *Area-Wide Integrated Fruit Fly Suppression, including MAT and SIT for Balkans and Eastern Mediterranean* (under TC Project RER5018). 7-11 October 2013. Opuzen, Croatia. (**Deadline for nominations: 31 July 2013).**

Application procedure: Nominations should be submitted on the standard IAEA application form for training courses/workshops (downloadable from: http://www-tc.iaea.org/tcweb/participion/astrainee/default.asp).

Completed forms should be endorsed by and submitted through the official channels established (either the Ministry of Foreign Affairs, the National Atomic Energy Authority, the Office of the United Nations Development Programme, the Office of the FAO Resident Representative or the Ministry of Agriculture).

The completed forms must be submitted to the International Atomic Energy Agency, Vienna International Centre, P.O. Box 100, 1400 Vienna, Austria. Advance nominations by facsimile (+43-1-26007) or email (official.mail @iaea. org) are welcome.

Principles and Procedures for Rearing Quality Insects. 21-26 October 2012, Mississipi State University, Starkville, MS, USA

In 2000, the Department of Entomology & Plant Pathology at Mississippi State University (MSU) initiated formal education for those who rear insects under laboratory conditions. The idea of a workshop devoted to insect rearing was conceived by USDA/ARS and MSU researchers who had spent many years rearing insects professionally. They recognized a global need for insect rearing education. Thus, an intensive five-day workshop entitled Principles and Procedures for Rearing High Quality Insects designed to cover all the major areas of laboratory rearing of insects was born.

This course will be offered once more in 2012 (21-26 October). It will include classroom and laboratory instruction, an insect rearing manual/CD, the book Principles and Procedures for Rearing High Quality Insects, facility tours, social events and refreshments. The cost of the course will be, US$1 050. The entire amount may be paid with the registration form, or a deposit of US$275 may be paid and the balance when arriving at the workshop. Registration will be limited to 26 individuals on a first come first serve basis. Cancellation after 20 September 2012 will result in forfeiture of the registration deposit. Confirmation of registration and MSU and Starkville area information will be mailed to each participant.

For additional information, please contact Frank Davis (fdavis@entomology.msstate.edu), or visit: http://www.irc.entomology.msstate.edu/workshop/

Interregional Training Course on *The Use of the Sterile Insect and Related Techniques for the Integrated Area-wide Management of Insect Pests* 29 July - 23 August 2013, Metapa de Dominguez, Chiapas, Mexico

Context: Food insecurity is inherently linked to pests and diseases. The losses caused by diseases and pests at both the pre- and post-harvest levels average of 30-40% of the agricultural outputs. This is a very inefficient use of agricultural investments in land, seeds, water, fertilizer, animal feed, labour and other inputs available to feed the growing human population.

Current reliance on pesticides and drugs is not sustainable, impairing the natural balance and causing outbreaks of secondary pests, contaminating the environment and leaving residues on food commodities, and leading to the development of resistance to pesticides used.

In addition, as a result of increasing crop and animal movement and trade, as well as climate change, there is an unprecedented increase of invasive animal and plant pests with dire socio-economic consequences.

An area-wide integrated approach that targets the management of populations of major pest insects, although management-intensive and logistically more complex, can contribute in some situations to a more effective and sustainable control.

Purpose of the Course: The purpose of this four week interregional course is to provide a broad overview on the application of nuclear-related techniques, within the context of area-wide integrated insect pest management programmes, to managers of insect control programmes, animal health and plant protection officials and applied research entomologists.

The course will include radiation-induced sterility, the sterile insect technique (SIT), F-1 sterility, other methods of insect control, integration of control methodologies for area-wide insect management, the biology, ecology and dynamics of pest insect populations subjected to control, economic analysis of area-wide programmes and reviews of successful and ongoing area-wide programmes with an SIT component.

The aim is to widen the knowledge and horizon of current and future decision makers to a broader list of major insect pest problems, including pests or vectors of diseases that are currently not yet established in the participants' countries.

Participants: The course is directed at top-level vector disease and pest control management personnel that are or will likely become high level decision makers and senior managers of pest control programmes or campaigns. A key aspect of this training is to develop good pest control managers in Member States with the broad background and skills required to conduct complex area-wide programmes. There is a need to transfer technology while also developing the required managers of projects to effectively integrate the SIT. Future decision makers need to be made aware of upcoming risks, develop a sense of preparedness and be trained on preventive and management strategies against potential new major pests and disease vectors.

Application Procedure: Nominations should be submitted on the standard IAEA application form for training courses/workshops (downloadable from: http://www-tc.iaea.org/tcweb/participion/astrainee/default.asp). Completed forms should be endorsed by and submitted through the official channels established (either the Ministry of Foreign Affairs, the National Atomic Energy Authority, the Office of the United Nations Development Programme, the Office of the FAO Resident Representative or the Ministry of Agriculture). (**Deadline for nominations: 30 March 2013).**

Participants' Qualifications: The course is open to about 22 participants from IAEA and FAO Member States in all geographical regions. Preference will be given to qualified candidates from developing countries. Applicants must have at least a Bachelor of Science degree or equivalent in entomology or a related biological field. As the course will be conducted in **English**, participants must have an adequate working knowledge of that language.

Preference will be given to those in pest control policy-formulating positions or involved in preparing applied pest control programmes, or who have had at least several years of practical experience in applied research or teaching on pest control. The key criterion is the candidate's actual participation in operational area-wide pest control programmes or the potential when he/she has returned home to provide leadership in area-wide pest management and the use of the SIT in future programmes.

In Memoriam

Joe Stewart (1947-2012)

I was saddened to hear of Joe's fatal accident during a boat race in the Pacific Ocean. I was awakened late in the evening by my wife, Geri, with the tragic news. John Worley had sent us an email, just in the event we had not yet heard. We had not. I did not sleep well the remainder of the night, thinking of my good friend.

Joe Stewart, former Director of the Sterile Medfly Release Facility in Sarasota, Florida, USA.

When I first met Joe, I was assigned by APHIS-PPQ to assist in the support of the Mediterranean fruit fly emergence and release facility in Tampa, Florida at McDill air base. It was suggested that Joe could be - at times - "tough to work with". Of course, the same had been said of me. The more we worked together, the more comfortable we became with one another. We grew working on such assignments as establishing pre/post quality control of aerial released flies, aerial distribution/release of sterile flies (with Danny Gates) and recapture - or the lack of - in south/southwest Florida. Likewise, using McDill as our work base, we collected treated foliage and conducted LD 50 efficacy studies to evaluate each bait spray application. These activities could not have initiated/completed without Joe's guidance and his staff's assistance.

Due to the 9-11 event, PPQ was ultimately asked to vacate their facilities at McDill due to potential vehicle security into the base. Thus, Joe took on the responsibility of locating an alternate site to receive, emerge, and release the sterile flies. Obviously, this was a major undertaking. After successfully contracting space in Sarasota, Florida he next had to come to agreement with the city and local airport authority to establish an area where the release plane could conduct it's contracted release responsibilities. As we now know, Joe "made it happen" without any interruption to fly release. Joe even found space in the fly emergence and release facility for myself and two technicians he kindly provided to me to complete our tasks!

As in Tampa, our personal/professional growth continued to flourish working on such projects as implementation of the Worley Towers, the addition of ginger-oil, i.e. position of oil/type of dispenser in/under the tower and with the assistance of Joe's tech's and guidance from Todd Shelly, evaluated mating propensity of flies subjected to the oil. Soon after the tests, this method was added to the fly emergence SOP in Tampa and presumably in California and Guatemala. Another first for Joe and his staff!

As in Tampa, Joe provided technicians to continue standard quality control (QC) observations under my directions, providing more than adequate space/equipment. In addition to these duties, Joe provided technical help in my trap type/bait formulation studies - in cooperation with Eric Jang, ARS Hawaii. Much of this study involved Mediterranean fruit fly, with some attention to Caribbean fruit fly. Much of our success is due in large part to Joe's willingness to listen to our needs and help from his personnel.

In closing, there is no doubt that Joe was a significant contributor to fruit fly SIT. I believe his legacy will live long into the future. One only needs to walk into a fly emergence and release facility anywhere in the world and see Joe's trademark. So easily we forget. In Joe's case, I truly believe this will not be the case. Of course, I will primarily remember Joe as a great friend. A few months ago I met Joe for lunch on the Manatee River. What a memorable time! When there again, I will raise my glass to you and thank you for your friendship. I will miss you.

Source: Tim Holler, USDA (Retired)

Other News

Ethiopia: House Urges Ministry to Strengthen Efforts to Control Trypanosomiasis

Addis Ababa — The House of Peoples' Representatives called on the Science and Technology Ministry to further strengthen ongoing efforts to control tsetse fly and trypanosomiasis through implementing integrated technology.

At its 24th regular meeting held on Thursday the House heard eight months' performance reports of different offices under the Ministry's domain and also discussed and referred to pertinent standing committees six draft bills for further scrutiny.

Tsetse fly, vector of trypanosomiasis.

The House lauded activities of the Ministry to control tsetse flies and trypanosomiasis in South Ethiopia's Rift Valley of Oromia and South Ethiopia Peoples' States.

The Ministry has carried out activities to control the flies through spraying chemicals and applying the sterile insect technique.

The House appreciated activities of the Ministry to award outstanding teachers and students in science and mathematics.

Minister Dessie Dalke on the occasion expressed commitment of the Ministry to register better results in the future.

Meanwhile, the House referred to the budgetary and financial affairs standing committee draft bills providing for avoidance of double taxation and preventing tax evasion. The House also referred the loan agreement signed between the Ethiopian government and the International Fund for Agriculture Development to the same standing committee.

The draft bill to approve the amended African Charter on Maritime Transport was also referred to the Transport Affairs Standing Committee of the House.

Source:All Africa, Ethiopian News Agency, http://allafrica.com/stories/201204060465.html (5 April 2012).

Cotton: Tweaks Under way in Pink Bollworm Eradication: Changes Due to Suspect Moths in Traps

Continued efforts to rid cotton fields in the west and southwest (USA) of the pesky pink bollworm (PBW) insect, *Pectinophora gossypiella*, are moving the industry closer to eradication, but an issue with 'suspect moths' has industry leaders tweaking the process.

The PBW is the most damaging, profit-stealing pest in cotton. Female PBW moths lay eggs on bolls. The emerging larvae damage the boll by feeding on the seed; damaging the lint in the process. The damaged boll creates a potential pathway for other insects and fungi to enter.

State based PBW eradication programmes in California, Arizona, New Mexico, and west Texas, plus northern Mexico, are working in harmony toward the ultimate goal of eradication.

These efforts include increased planting of *Bt* (insect resistant) upland cotton varieties, sterile moth technology, pheromone rope mating disruption placed throughout non-*Bt* cotton fields, and Delta insect traps for detection.

The sterile moth component is a major weapon in the war against the PBW. At the USDA-APHIS sterile moth breeding lab in Phoenix, Ariz., PBW moths are reared on a diet including red dye. The moths are irradiated to sterilize the insect's reproductive system.

Sterile moths are transported to drop-off sites in California, Arizona, New Mexico, West Texas, and northern Mexico as part of bi-national eradication activities. Small aircraft drop an equal mix of male and female sterile moths over cotton fields daily.

Once they reach the ground, sterile and native (non-sterile) moths attempt to breed, but fail to reproduce since one insect is sterile. Delta sticky insect traps can capture a mixture of native and sterile PBW moths.

The sterile moth component is a proven success story in reducing native moth numbers across the western cotton belt. For example in Yuma County, Ariz., native moth trap captures have plunged from 61 000 moths in 2007 to zero moths last year.

This year, about 14.5 million sterile moths will be released daily over the cotton growing areas through state conducted eradication programmes.

In cotton fields, traps containing insects are gathered weekly and sent to identification labs in each state for analysis. The insects are placed under a microscope with 70 to 100 times magnification to determine whether PBW moths are present and whether the moths are

natives or steriles, based on the presence or absence of red dye.

Arizona Cotton Research and Protection Council (ACRPC) leaders were surprised last year when traps at the lab for microscopic evaluation contained PBW moths apparently without red dye, the trademark of reared sterile PBWs. This suggested the insects could be background native populations.

At least one moth was found in each of the western cotton belt states (except New Mexico) and northern Mexico, although laboratory tests on live captured moths indicated the insects were sterile and could not reproduce.

*Damage caused by pink bollworm (*Pectinophora gossypiella*) in cotton.*

The USDA rearing lab has increased by a total of 30 per cent (in 10 per cent increments) the amount of red dye fed to moths compared to the early days of the sterile moth program. In addition, advanced testing technology has been installed at the USDA Center for Plant Health Science and Technology lab in Phoenix to more accurately check captured moths for red dye.

USDA has also placed a second elemental marker in reared moths. "The two marker system will provide higher diagnostic certainty to more precisely examine the moths," Liesner said.

The concept of PBW eradication began in the late 1960s in California when the pest was first found in San Joaquin Valley cotton. The insect first established itself in Mexico in the early 1900s and proceeded through Texas, New Mexico, Arizona, and finally California to become a serious pest of cotton in the west and southwest.

"If it wasn't for the California Pest Control Board, we would not be where we are today in PBW eradication," said Robert Staten, retired USDA-ARS entomologist, Phoenix, Ariz.

Staten has 42 years in sterile moth technology including his first job working on the PBW sterile moth effort in the Coachella Valley, California.

Credit for the evolution of sterile moth technology to fight native insect populations began with E.F. Knipling, who Staten calls "the father of sterile moth programs." Knipling first applied the sterile moth process in the battle against screwworms.

For 40 plus years, California has utilized PBW steriles and other methods to reduce native moth numbers. Today, California follows a maintenance programme to manage low native numbers.

In the entire USA-Mexico, PBW-affected cotton growing region last year, a single larva was found in an experimental Pima cotton field in Mexico. No larvae were found within the programme areas in the U.S.

Reduced PBW counts have increased the opportunity for profitability in cotton production through the reduced use of insecticides.

At one time, Arizona cotton growers averaged nine sprays per season, but the number today is about 1.5 sprays for insects.

Arizona cotton growers now pay the lowest insecticide control costs in history — more than $388 million saved cumulatively through 2011. In addition, nearly 19 million pounds less insecticide active ingredient enters the environment (or 1.7 million pounds annually).

Peter Ellsworth, University of Arizona IPM specialist said, "On average, 23 per cent of Arizona cotton acreage is never sprayed for arthropods anymore. That's something we never thought possible on a single acre 20 years ago."

Source: Western Farm Press, http://westernfarmpress.com (20 April 2012).

Anastrepha ludens (Mexican Fruit Fly) Eradicated in the USA

Effective January 3, 2012, the Animal and Plant Health Inspection Service (APHIS) removed Hidalgo County, Texas, as a Mexican fruit fly (Mexfly) quarantine area. As a result, there are no remaining Mexfly quarantine areas in the United States.

Since 1927, portions of the Lower Rio Grande Valley (LRGV), including Hidalgo County, have been designated as a fruit fly quarantine area, which placed restrictions on the interstate movement of regulated articles from those areas in order to prevent the spread of Mexfly.

In 2007, APHIS changed its strategy from pest suppression to eradication and began working with the Texas Department of Agriculture and the Texas citrus industry to eliminate Mexfly populations from the LRGV. Through this cooperative effort, APHIS conducted various control activities, including the application of the sterile insect technique by releasing sterile male Mexflies in the LRGV, including Hidalgo County, and using foliar bait sprays near detection sites.

Eradication was concluded in Hidalgo County, the remaining infested county in the LRGV, after sufficient

time had passed without finding additional Mexfly populations in those areas. Specifically, an intensified fruit fly trap surveillance system was deployed and monitored for one year based upon international standard criteria.

Adult Mexican fruit fly, Anastrepha ludens *(Photo by Yeudiel Gomez).*

Accordingly, APHIS removed Hidalgo County as a Mexfly quarantine area on January 3, 2012. This removal of the quarantine area is reflected on the following designated website, which contains a description of all the current federal fruit fly quarantine areas: (http://www.aphis.usda.gov/plant_health/plant_pest_info/fruit_flies/quarantine.shtml).

APHIS anticipates following this action with the publication of a notice in the Federal Register informing the public of this change.

Under IPPC Standards, *Anastrepha ludens* is considered to be a pest that is now **absent: pest eradicated** in the USA.

Source: Wayne Burnett, APHIS Exotic Fruit Fly Director, Fruit Fly Exclusion and Detection Programs (11 January 2012).

New Rearing System May Aid Sterile Insect Technique against Mosquitoes

A new tray and rack system is expected to be able to successfully rear 140 000-175 000 adult mosquitoes per rack.

The requirement for efficient mosquito mass-rearing technology has been one of the major obstacles preventing the large scale application of the sterile insect technique (SIT) against mosquitoes.

However, according to a new article in the next issue of the Journal of Medical Entomology, scientists at the Untited Nations Food and Agriculture Organization (FAO) and the International Atomic Energy Agency (IAEA) have developed a larval rearing unit based on the use of a stainless steel rack that is expected to be able to successfully rear 140 000 000 adult mosquitoes per rack.

In 'A New Larval Tray and Rack System for Improved Mosquito Mass-Rearing' the authors report that the new mechanized rearing unit is simple to handle, maintains minimal water temperature variation and negligible water evaporation, and allows normal larval development. The mosquito mass-rearing tray was designed to provide a large surface area of shallow water that would closely mimic natural breeding sites, and the trays stack into a dedicated rack structure which fills and drains easily. Furthermore, the low amount of labour required to operate the system also reduces costs.

"Our larval rearing unit could enhance any mosquito control strategy in which large-scale releases of mosquitoes are needed to suppress or replace natural populations," said lead author Fabrizio Balestrino.

Source: Entomological Society of America (7 May 2012).

Eradication Programme Wins out Against Destructive Boll Weevil (*Anthomonus grandis*)

Perhaps it's fitting that the boll weevil's last stand is taking place in the Lower Rio Grande Valley, since it was here, near Brownsville, Texas, in the 1890s that a little pest with a big appetite first crossed into the continental USA from Mexico.

The bug is now on its last legs, thanks to a sustained, coordinated boll weevil eradication programme overseen by the US Department of Agriculture, but aggressively prosecuted on the ground by state and local weevil fighters. The Texas Boll Weevil Eradication Foundation is divided into 16 zones, with Cameron County and surrounding counties part of the Lower Rio Grande Valley Zone. Texas is the last USA state and the Lower Valley the last zone in Texas to lick the boll weevil scourge.

Adult boll weevil, Anthonomus grandis.

Brad Cowan, a Texas AgriLife Extension Service agent whose job description includes teaching growers how to grow cotton, said the boll weevil has been public enemy number one for cotton growers for a long, long time. Not native to the United States, the boll weevil

nevertheless spread throughout the 'Cotton Belt,' wreaking utter devastation on the industry.

In the old days, boll weevils were so bad you either sprayed insecticide or you didn't have a cotton crop, Cowan said. Now the critters are becoming scarcer and scarcer. Texas, meanwhile, is the country's largest cotton producer, he said. Last year Cameron, Hidalgo and Willacy counties produced 200 000 acres of cotton, said Webb Wallace, executive director of the Cotton and Grain Producers of the Lower Rio Grande Valley.

Before area-wide coordination, growers voluntarily sprayed their own fields on their own schedules, with no discernable effect on the general boll weevil population. Though eradication efforts began in the southeastern USA in the late 1970s, the Lower Valley didn't launch its programme until 1995. It was the first eradication programme in Texas, and it was an unmitigated disaster. A combination of poorly timed sprayings causing an outbreak of secondary caterpillars led to widespread crop failure that year, Cowan said, and disgusted Valley growers voted themselves out of the programme.

In 2005, however, encouraged by eradication successes elsewhere in the state and the southeast, the growers voted themselves back in. The rest is that the boll weevil is almost history. "It convinced our guys that it could be done here," Cowan said. "It just needed to be managed in a different way."

"Texas is the only state still dealing with boll weevils," he said. "They've been pretty much eradicated from the northern half of the state." While Texas doesn't grow as much cotton as it once did, Cowan said, it's still a very important commodity for the state, and beating the weevil, finally, is a major event in the annals of cotton growing. "No question, it's a historic achievement," he said.

Source: The Brownsville Herald, www.brownsvilleherald.com/articles /perhaps-135865-program-weevil.html. (15 January 2012).

First ASEAN Fruit Fly Meeting: Research and Bionomics

We have just hosted the First ASEAN Fruit Fly Research and Bionomics Meeting at Mahidol University, Bangkok, Thailand, on 9 March 2012. There were delegates from Indonesia, Malaysia and Thailand.

Participants of the First ASEAN Fruit Fly Meeting (Bangkok, Thailand).

We also had participants from the Ministry of Foreign Affairs (international economics and ASEAN) and the Ministry of Commerce (fruit trade and ASEAN) that provided us international, regional, and fruit trade perspectives.

We drafted a collaborative research network for regional funding of fruit fly research.

Source: Sujinda Thanaphum

Relevant Published Articles

Conversion of the chill susceptible fruit fly larva (*Drosophila melanogaster*) to a freeze tolerant organism

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Abstract

Among vertebrates, only a few species of amphibians and reptiles tolerate the formation of ice crystals in their body fluids. Freeze tolerance is much more widespread in invertebrates, especially in overwintering insects. Evolutionary adaptations for freeze tolerance are considered to be highly complex. Here we show that surprisingly simple laboratory manipulations can change the chill susceptible insect to the freeze tolerant one. Larvae of *Drosophila melanogaster*, a fruit fly of tropical origin with a weak innate capacity to tolerate mild chilling, can survive when approximately 50% of their body water freezes. To achieve this goal, synergy of two fundamental prerequisites is required: (i) shutdown of larval development by exposing larvae to low temperatures (dormancy) and (ii) incorporating the free amino acid proline in tissues by feeding larvae a proline-augmented diet (cryopreservation).

The full paper was published in: PNAS (2012) 109 (9) 3270-3274.

Strategy for enhanced transgenic strain development for embryonic conditional lethality in *Anastrepha suspensa*

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Abstract

Here the first reproductive sterility system for the tephritid fruit fly pest, *Anastrepha suspensa*, is presented, based on lethality primarily limited to embryos heterozygous for a conditional lethal transgene combination. This tetracycline (Tet)-suppressible system uses a driver construct having the promoter from the newly isolated embryo-specific *A. suspensa* serendipity α gene linked to the Tet-transactivator. This was used to drive expression of a phosphomutated variant of the pro-apoptotic cell death gene, hid, from *A. ludens*, that was isolated, based on its identity to *A. suspensa* hid. The AlhidAla2 variant was shown to have the highest cell death activity in an in vitro *A. suspensa* cell death assay compared to the orthologous genes Ashid, Dmhid, and the variant DmhidAla5. These cell death assays also allowed a determination of the most-efficient driver-effector cassette combinations for use in *A. suspensa* transformants, resulting in two hybrid strains exhibiting 100% lethality. One strain was 96% lethal in embryos in the absence of tetracycline, with none surviving past the first larval instar, which is critical for pests that are most damaging in late-larval stages. We demonstrate that the isolation and in vitro validation of species-specific promoters and lethal effector genes can greatly improve the efficiency of creating high-performance conditional lethality strains that may be extended to other insect pest species.

The full paper in early edition: PNAS. 1203352109.

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Insect Pest Control Newsletter No. 79

The IPC Newsletter is prepared twice per year by the Insect Pest Control Subprogramme
Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture

International Atomic Energy Agency
Vienna International Centre, PO Box 100
1400 Vienna, Austria.

Printed by the IAEA in Austria
July 2012

12-25681