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The newly inaugurated Mediterranean fruit fly mass-rearing facility in Valencia, Spain.

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To Our Readers

In April 2007, Dr. José M. Sumpsi was appointed as Assistant Director General of FAO, responsible for the Department of Agriculture and Consumer Protection. This is the largest department of FAO, under which the Joint FAO/IAEA Division is also located. Dr. Sumpsi is of Spanish nationality, with degrees in agricultural engineering and statistics, and a doctorate in agricultural economics. He has been professor of economics and agrarian politics at the Politecnical University of Madrid, President of the Institute of Agrarian Reform of Andalucia, member of the European Commission's Integrated Rural Development Programme and the Common Agricultural Programme, rural development expert at the Interamerican Development Bank in Washington, DC and advisor to various Latin American and European governments on agrarian policies. In May 2007 Dr. Sumpsi spent two days at the Joint FAO/IAEA Programme in Vienna and the FAO/IAEA Agriculture and Biotechnology Laboratory in Seibersdorf. We very much appreciate his interest in the Joint Programme's staff and activities, and wish him much success in his new position and the ongoing major reform process of FAO.

During 2007, the IAEA is celebrating 50 years of international service as the world's atoms for peace organization. In 1953, United States President Eisenhower proposed in a speech to the United Nations General Assembly an international atomic energy agency. In 1957, the IAEA came into existence as a specialized agency within the UN system. Its objective was to safeguard nuclear materials and to "devise methods" to serve the peaceful pursuits of mankind. One of the many peaceful applications in agriculture is the sterile insect technique (SIT), which coincidentally was first applied operationally on a large scale also 50 years ago.

The campaign against the New World screwworm in Florida that started in 1957 was very successful, achieving eradication in 1959, and motivating further campaigns against this and other major insect pests. Together with FAO, with which the Joint Division was created in 1964, the IAEA has significantly contributed to the development and expanded application of the SIT against other key pests. The recent 50 year anniversary issue of the IAEA Bulletin features topics affecting our future, and highlights some success stories in nuclear fields over the last half a century. It also includes several short articles on some of the recent successful SIT applications in different parts of the world [http://www.iaea.org/Publications/Magazines/Bulletin/Bull482/pdfs/10MedFly.pdf].

Much visibility was also given in the IAEA website to the world's second largest Mediterranean fruit fly (medfly) mass rearing facility, which was recently inaugurated in April in Valencia, Spain [http://www.iaea.org/NewsCenter/News/2007/medflyspain.html]. It reported that Spain's citrus growers stand to become much more competitive in international markets, thanks to the use of sterile medflies which will be produced from Europe's first large-scale rearing facility. The facility, built at a cost of 8 million Euro, marks a strategic step forward in area-wide pest control for Spain's agricultural community. The rearing facility, established under a cooperative agreement with IAEA, has the capacity to produce 500-600 million sterile male medflies, and paves the way for Spain to suppress, on an area-wide basis, destructive medfly populations. The investment will enable Valencia's fruit industry, which accounts for 80% of the country's citrus exports, to stay competitive in global markets and cut down on the use of insecticides. Spain ranks among the world's top exporters of citrus fruit. Fruit bound for countries free of the medfly - including Australia, Japan, Republic of Korea, and the United States of America- is subject to expensive quarantine measures before it is cleared for export. We wish our Spanish colleagues much success and hope that this environment-friendly approach will motivate similar programmes in other parts of Europe.

In terms of recent normative activities, I would also like to highlight the Cost-benefit analysis model: a tool for area-wide fruit fly management that was recently published (interactive CD, IAEA/FAO). Jointly developed with John Mumford and Adrian Leach of Imperial College over several years, this is an excellent generic tool that assists in economic decision making associated with area-wide control options. Another recent release is the interactive CD on Using GPS Instruments and GIS Techniques in Data Management for Insect Pest Control Programmes (Tutorial CD, IAEA, Vienna). This CD was developed by Micha Silver of the Arava Development Co., Sapir, Israel, and includes step-by-step hands-on lessons on the use of GPS/GIS in support of area-wide pest control operations. Both CDs are freely available upon request.

A considerable effort, with the support of Abdeljelil Bakri [bakri@ucam.ac.ma], has gone into expanding and maintaining the Tephritid Worker Database (TWD) (www.tephritid.org). This site, established at the request of the international fruit fly community, is not only a world-directory of fruit fly workers but also collates information that is made available each year on Tephritid fruit flies. This includes information on recent publications, new technologies, and control methods, new species identified, new outbreaks recorded, and new operational control programmes launched. It includes a powerful search engine and allows Tephritid fruit fly workers to search for colleagues, publications, and other information and to keep up-to-date on the most recent developments. During 2006, the number of TWD members doubled, reaching close to 800 members from 86 countries. Moreover, in 2006 the number of publications on fruit flies in the database has increased significantly reaching ca 1400 and there were 88 557 hits. Your contributions are much appreciated to update your inputs, provide news and to share this information with colleagues you know work in the fruit fly field. The increasing number of subscribers, publications and hits is an indication that TWD is gradually growing and fulfilling its objective. Regional fruit fly working groups are also being established under TWD, starting with TEAM – Tephritid Workers of Europe, Africa and the Middle East. In April 2008, TEAM will hold its first scientific meeting in Majorca, Spain on Current Advances in the Ecology of Fruit Flies from Europe, Africa and the Middle East.

A new text book entitled Area-wide Control of Insect Pests: From Research to Field Implementation is now complete and will be published in late 2007 by Springer. The book is mainly based on papers and posters presented at the Second International Conference on Area-wide Insect Pest Control that was held in Vienna in May 2005. The preparation of this publication has been a lengthy process as it involved two external reviews of each of the 66 chapters and thorough internal editing and formatting. I thank all who have contributed.

Moving on to Coordinated Research Projects (CRPs), the proceedings of the five-year CRP on Quality Assurance of Mass-reared and Released Fruit Flies for Use in SIT Programmes have been published in March 2007 as a dedicated issue of the Florida Entomologist. The issue is freely available upon request, and includes 24 peer-reviewed papers prepared by CRP participants from 16 countries, covering most active programmes in the world against fruit flies that include the release of sterile insects.

The CRP on Enabling Technologies for the Expansion of SIT for Old and New World Screwworm concluded with very good progress in understanding the genetic relationships among different geographical popula-

tions of these two pest species, in developing a framework for potential epidemiological tracking of flies from their population of origin to new areas, and in developing transgenic techniques for screwworms. The results of the CRP will be published as a collection of ca. 20 papers in Medical and Veterinary Entomology.

Also the six-year CRP on Improvement of Codling Moth SIT to Facilitate Expansion of Field Application was recently concluded and knowledge of codling moth genetics, mass rearing, quality control, field monitoring and integration with other control methods has increased significantly in these past six years. The findings are noteworthy from a purely scientific point of view, and each has consequences for the successful application of the SIT against codling moth. The resulting papers are being prepared for publication as a separate issue of the Journal of Applied Entomology.

Concerning staff news, the Subprogramme is currently undergoing an important staff turn-over, starting with Walther Enkerlin, who is unfortunately leaving us in June 2007 on the completion of his 7 year term with the IAEA. Walther has been a great asset to the Subprogramme, responsible for technology transfer on the control of fruit flies to many Member States, including a number of very successful field programmes. In addition, he managed coordinated research activities related to fruit fly surveillance, standard-setting activities in support of IPPC, maintaining the web page, editing the newsletters, and many other normative and publishing activities. His dedication and hard work are much appreciated. Walther is moving to Ottawa, Canada, where a new and promising future awaits him as Technical Director of the North American Plant Protection Organization (NAPPO), an important position in which he will no doubt be very successful. We will miss him much as a friend and colleague, and wish him and his family only the best. We hope that we will be able to continue using his extensive experience for the benefit of FAO and IAEA Member States. Starting in July of this year, Walther can be reached by email at wenkerlin@inspection.gc.ca.

We want also to congratulate and welcome Rui Pereira from Portugal, who is replacing Walther. Rui holds a PhD from the University of Florida, where his doctoral thesis researching the interaction of fruit fly nutrition and hormonal treatment to improve sterile male performance received the Outstanding PhD Student Award. Rui has had numerous interactions over the years with the FAO/IAEA Programme as an expert, consultant, researcher in coordinated research projects, technical cooperation project counterpart, and host and lecturer in regional training courses. He has considerable management experience gained as manager of the Madeira-Med programme. We wish him well in his new position.

Various other professional staff positions have also been advertised during the last months due to staff reaching the end of their seven year term or retirement age. We are currently undergoing the interview and recruitment process for these positions, and will hopefully be able to report in the next newsletter that these positions have been filled with high calibre professionals to assure a carefully managed gradual transition of the Subprogramme to younger generations.

Both past and ongoing activities are accessible in more detail in our website [http://www-naweb.iaea.org/nafa/ipc/index.html]. I encourage you to visit it, and in particular I would like to call your attention to the 2006 Annual Report on R&D activities of the Entomology Unit, which has been recently placed on the web page, as usual together with all previous annual reports and newsletters. Please let us know your ideas, questions and concerns. On behalf of our colleagues at Seibersdorf and headquarters, I would like to thank you for your continuing interest and support for our activities. We really do appreciate feedback and we hope that you continue to find this newsletter a source of useful information.

Jorge Hendrichs
Head,
Insect Pest Control Section

Staff

The Insect Pest Control Subprogramme staff, consisting of those in the Section located in the Vienna International Centre, those in the Entomology Unit at the FAO/IAEA Agricultural and Biotechnology Laboratory in Seibersdorf, and field experts, is listed below.

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Forthcoming Events

I. Research Coordination Meetings (RCMs)

CRP on Improving SIT for Tsetse Flies Through Research on their Symbionts and Pathogens. 1-5 October 2007, Vienna, Austria. First RCM.

CRP on Development of Standardized Mass Rearing Systems for Male *Anopheles arabiensis* Mosquitoes. 3-7 December 2007, Ghent, Belgium. Second RCM.

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

CRP on Development for Mass-rearing for New World (*Anastrepha*) and Asian (*Bactrocera*) Fruit Fly Pests in Support of SIT. 1-5 April 2008, Valencia, Spain. Third RCM.

II. Consultants and Other Planning Meetings

Consultants meeting (1) to evaluate the prospects for incorporating SIT into control programmes for *Aedes* mosquitoes, and (2) to evaluate the prospects for incorporating SIT into control programmes for *Aedes* mosquitoes on the island of La Reunion, 26-28 June 2007, Vienna, Austria

Consultants meeting (1) to refine the guidelines/manual on operational procedures for codling moth rearing and quality control and (2) to develop an outline of a new CRP on Lepidoptera quality control. 3-7 December 2007, Vienna, Austria.

III. Other Meetings/Events

Regional Coordination Meeting of National Tsetse Counterparts, 16-18 July 2007, Vienna, Austria.

Meeting of the Panel of PAAT Advisory Group (PAG) Coordinators, 13-14 September 2007, Luanda, Angola.

Satellite meeting on the Use of Area-Wide Tsetse Fly Suppression Techniques in Preparation of the SIT, 13-15 September 2007, Luanda, Angola.

29th Meeting of the International Scientific Council for Trypanosomiasis Research and Control (ISCTRC), 17-21 September 2007, Luanda, Angola.

FAO/IAEA Regional Training Course on Principles of Tsetse Population Genetic Sampling and Tsetse Morphometrics. November 2007 Tororo, Uganda (exact date to be confirmed).

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

First International Meeting of Tephritid Workers of Europe, Africa and the Middle East, 7-9 April 2008, Majorca, Spain.

Past Events (2007)

I. Research Coordination Meetings (RCMs)

Fourth RCM of the Coordinated Research Project (CRP) on Improvement of Codling Moth SIT to Facilitate Expansion of Field Application, 19-23 March 2007, Vacaria, Brazil.

The Third Research Coordination Meeting of the CRP on Improved and Harmonized Quality Control for Expanded Tsetse Production, Sterilization and Field Application, 7-11 May 2007, Muguga, Kikuyu, Kenya.

II. Consultants and Other Planning Meetings

Workshop on The Development of a Detailed Action Plan for the Collection of Entomological Base Line Data on Tsetse, 21 May-1 June 2007, Dakar, Senegal.

Consultants Meeting on Finalizing the Genome Sequence of the Tsetse Salivary Gland Hypertrophy Virus, 11-13 April 2007, Vienna, Austria.

Consultants Meeting on the Integration of GIS and Population Genetics for Livestock Insect Pests, 16-20 April 2007, Vienna, Austria.

III. Other Meetings/Events

The Leverhulme Trust Tsetse Research Network (LTTRN) European Workshop, 2-4 March 2007, CIRAD/IRD, Montpellier, France.

Meeting of the Commission of Phytosanitary Measures-2 (CPM-2) of the International Plant Protection Convention (IPPC), 26-30 March 2007, Rome, Italy.

National workshop on The Control of the Red Palm Weevil *Rhynchophorus ferrugineus* Oliver, 2-3 April 2007, King Abdulaziz City for Science and Technology (KACST), Riyadh, Saudi Arabia.

WHO/TRD Meeting on Consultation on Framework for the Transition from Current Activities and Implementation of the New Vector Research Strategy, 23-24 April 2007, Geneva, Switzerland.

11th PAAT Programme Committee Meeting, 24-25 April 2007, Geneva, Switzerland.

First International *Cactoblastis cactorum* Conference, 7-10 May 2007, Phoenix, Arizona, USA.

Note: Reports available upon request

Technical Cooperation Projects

The IPC 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 under five major areas: namely:

- Tsetse flies
- Fruit flies
- Old and New World screwworm flies
- Lepidoptera
- Mosquitoes

Project Number	Title Ongoing Projects	Technical Officer
ALG/5/019	Control of Date Moth Using the Sterile Insect Technique	Marc Vreysen
BGD/5/025	Studying the Feasibility of Integrating the Sterile Insect Technique in Sun-Dried Fish Industry Project	Udo Feldmann
BKF/5/004	Feasibility Study on Applying the Sterile Insect Technique to Create a Tsetse-Free Zone	Marc Vreysen
BRA/5/057	Establishment of Medfly, Fruit Fly Parasitoids and Codling Moth Rearing Facility	Rui Cardoso-Pereira Carlos Caceres
EGY/5/025	Area-Wide Fruit Fly Control in Eastern Egypt	Jorge Hendrichs
ETH/5/012	Integrating SIT for Tsetse Eradication	Udo Feldmann
INT/5/145	Promotion of Insect Pest Control Using the Sterile Insect Technique	Jorge Hendrichs
IRQ/5/016	Field Monitoring and Rearing of Old World Screwworm	Udo Feldmann
JOR/5/010	Strengthening the Capacity for the Area-wide Suppression of the Mediterranean Fruit Fly Using the Sterile Insect Technique	Jorge Hendrichs
KEN/5/022	Integrated Area-wide Tsetse and Trypanosomosis Management in Lambwe Valley	Udo Feldmann
MAL/5/020	Feasibility Study for the Creation of a Zone Free of Tsetse	Marc Vreysen
MAR/5/015	Feasibility Study for Integrated Use of the Sterile Insect Technique for Area-Wide Tephritid Fruit Fly Control	Jorge Hendrichs
MEX/5/029	National Prevention Campaign Against the Cactus Moth	Rui Cardoso-Pereira
MOR/5/028	Assessing the Feasibility of Medfly Suppression through the Sterile Insect Technique	Udo Feldmann
PAL/5/003	Strengthening the National Capacity for the Area-Wide Suppression of the Mediterranean Fruit Fly	Jorge Hendrichs
PAK/5/043	Development of Biological Control for Cotton Pest Management Using Nuclear Techniques	Jorge Hendrichs
RAF/5/051	SIT for Tsetse and Trypanosomosis Management in Africa	Udo Feldmann
RAF/5/052	SIT Development for Control of Anopheles Mosquito	Alan Robinson
SAF/5/007	Expanding the Use of the Sterile Insect Technique Against Fruit	Jorge Hendrichs

	Pests in the Western and Northern Cape	
SAF/5/009	Preparation for the Creation of Zone Free of G. *brevipalpis and* G. *austeni*	Marc Vreysen
SEN/5/029	Feasibility Study to Create a Tsetse-Free Zone Free Using the Sterile Insect Technique	Marc Vreysen
TUN/5/022	Implementation of the Pilot Programme Using Sterile Insect Technique Against the Mediterranean Fruit Fly, Phase II	Rui Cardoso-Pereira
URT/5/022	Assistance to a Feasibility Study for the Use of the Sterile Insect Technique	Marc Vreysen
	New Projects Starting in 2007	
BOT/5/004	Integrating the Sterile Insect Technique into the National Tsetse and Trypanosomosis Control Programme	Udo Feldmann
BZE/5/002	Establishment of a Pilot Fruit Fly Free Area Using an Integrated Approach that Includes the Area-Wide Sterile Insect Technique	Rui Cardoso-Pereira
CRO/5/002	Feasibility Study for the Suppression of the Mediterranean Fruit Fly by Integrating the Sterile Insect Technique on an Area-Wide Basis in the Neretva Valley	Rui Cardoso-Pereira
GUA/5/016	Establishment of Fruit Fly Free or Low Prevalence Areas using the Sterile Insect Technique	Rui Cardoso-Pereira
ISR/5/012	Feasibility Study to Assess the Integration of the Sterile Insect Technique into Olive Fly Suppression Programmes	Jorge Hendrichs Carlos Caceres
MAR/5/016	Feasibility Study for the Suppression of the Melon Fly (*Bactrocera cucurbitae*) in Selected Areas of Mauritius	Jorge Hendrichs
MYA/5/014	Support for a Feasibility Study on Using the Sterile Insect Technique against Diamond Back Moth	Marc Vreysen
PAN/5/016	Capacity Building for Suppression of Fruit Flies of the Genus *Anastrepha* from the Azuero Peninsula using an Area-Wide Pest Management Approach	Rui Cardoso-Pereira
RAS/5/049	Sharing Regional Knowledge on the Use of the Sterile Insect Technique within Integrated Area-Wide Fruit Fly Pest Management Programmes.	Jorge Hendrichs
SEY/5/003	Feasibility of Integrating the Sterile Insect Technique to the Ongoing Area-Wide Melon Fly Eradication Programme	Jorge Hendrichs
TUN/5/025	Use of Inherited Sterility as a Genetic Control Method Against the Carob Moth	Marc Vreysen
UGA/5/027	Feasibility for a *Glossina fuscipes* Free Zone in the Lake Victoria Basin	Marc Vreysen
ZIM/5/012	Feasibility Study on the Use of SIT to Eradicate Tsetse in Zimbabwe	Udo Feldmann

In keeping with our policy to highlight activities of a few of our Technical Cooperation Projects, the following projects are discussed in this issue:

Economic and Social Impact in the Event of the Cactus Moth (*Cactoblastis cactorum*) Establishing in Mexico. Study Prepared under Technical Cooperation Project MEX5029.

The cactus moth, *Cactoblastis cactorum* Berg (Lepidoptera: Pyralidae) is a native insect from Argentina, Peru and Paraguay. The moth attacks several species of cacti of the *Opuntia* genus. Outside its native distribution range, the pest is present in Australia, South Africa, Hawaii, the Caribbean Islands and in the states of Florida, Mississippi and Alabama, USA. A cactus moth outbreak was detected in Mexico in September 2006 in Isla Mujeres, Quintana Roo.

The cactus moth constitutes a major risk for wild and cultivated opuntias in Mexico. This has special importance in view of the high diversity of native opuntias and the approximately 25 thousand families that depend directly on prickly pear cactus production. The nopalitos (vegetable pads) production for 2006 was estimated at 759 065 tons with an expected gross value of US$ 128 million. Also, the tuna (prickly pear cactus fruits) production for 2006 was estimated at 366 381 tons with a gross value of US$ 71 million. This revenue of US$ 199 million represents 3.8% of Mexico's agricultural GDP.

The socio-economic impact of cactus moth in Mexico will be severe due to: a) a significant increase in production costs of nopalitos and tuna for the farmers mainly in the Federal District of Mexico and the states of Morelos, Mexico and Zacatecas. The current production costs for one hectare of nopalitos, ranges from US$ 2800 to 5500 per hectare per year and for tuna between US$ 1400 to 2800 per hectare per year; b) the negative effects on nutrition of the rural poor which use nopalitos and tuna as staple food, c) an increase in the emigration rate to the USA mainly from the states of Mexico, Zacatecas and Morelos where the nopales industry is one of the main economic activities, and d) environment damage as *Opuntia* cactus is considered to be one of the pillars sustaining the fragile arid ecosystems in Mexico.

Nevertheless, some natural factors may limit the distribution of the cactus moth in some areas of Mexico. The factors that require additional research include: a) the effect of altitude and associated climatic conditions on the adaptation of the cactus moth, and b) the genetic variability of the species of *Opuntia*. Currently, populations of *C. cactorum* in Argentina, Australia, South Africa, Hawaii, the Caribbean and in the southern coasts of the USA, are mainly found in areas located below 500 meters above sea level, whereas the areas of prickly pear in Mexico are usually found at altitudes above 500 meters.

The current efforts conducted by the Mexican Ministry of Agriculture (SAGARPA) in collaboration with the United States Department of Agriculture (USDA) and international and regional organizations such as the IAEA and the North American Plant Protection Organization (NAPPO), to contain the pest in the south-eastern USA and to prevent the introduction and establishment of cactus moth in Mexico must be continued.

Source: Hussein Sánchez Arroyo, Juan Cibrián Tovar, Juliana Osorio Córdoba and Cristóbal Aldama Aguilera. Entomología y Acarología, Colegio de Postgraduados, Km 36.5, Carretera México-Texcoco, Edo. de México, 56230.

Integrating the Use of the SIT Against a Complex of Pests on Different Fruit Kinds in the Western and Northern Cape, South Africa. Technical Cooperation Project SAF5007.

Excellent progress is being made under project SAF5007, which encompasses fruit flies, false codling moth (FCM) and codling moth. The most exciting development is taking place with FCM in Citrusdal, a valley in the Western Cape where some 6000 ha of citrus is produced for export. This part of the project is being spearheaded by Hendrik Hofmeyr of Citrus Research International in South Africa.

FCM is the most serious pest on citrus in South Africa. The moth is difficult to control with pesticides, and is a key international phytosanitary pest which restricts the export of citrus. The citrus industry has decided to resolve the problem through the integration of SIT. It has already invested considerable resources in the current FCM SIT project, and has committed itself to launching a commercial SIT-based programme in the near future.

In the preliminary phases of the pilot FCM SIT project, FCM adults were reared in a small facility in Citrusdal, sterilized at the ARC's irradiator in Stellenbosch, and released over 35 ha. This phase included determining the sterilizing dose, and various field tests including mark-release-recapture techniques. After satisfactory results the final phase before full commercialisation of FCM SIT is progressing very well.

A mass-rearing facility covering 2000 m^2, and including an irradiation facility, has been designed and is currently under construction in Citrusdal. The scheduled deadline for the commissioning of the complex is the end of July

Construction of a modern false codling moth rearing and irradiation facility has already started in Citrusdal, South Africa.

2007, and the first commercial releases of sterile FCM adults are scheduled for November 2007. Under project SAF5007, IAEA funding for the FCM project has included equipment for *inter alia* diet preparation, larval rearing and adult collection. It is also currently negotiating the procurement of a ^{60}Co source in a cost-sharing agreement with Citrus Research International. A number of IAEA expert missions have been made and expert guidance received on rearing and field operations, and local scientists have benefited from scientific visits to other Lepidoptera SIT programmes. In the latest of these, two citrus industry scientists are due to visit the codling moth SIR programme in the Okanagan Valley of British Columbia, Canada, in July 2007.

If all goes according to plan, the Citrusdal FCM SIT programme will be the first of a number of such programmes in South Africa. Additional facilities could later be built in the Eastern Cape and Mpumulanga Provinces, where there are also thriving citrus industries.

The codling moth SIT programme in South Africa is smaller but has also made significant strides. The programme comprises two facets; i) rearing and release of a local strain of sterile codling moth in 120 ha of apple orchards, driven by Matthew Addison of the University of Stellenbosch; and ii) the importation of sterile codling moths from the Osoyoos mass-rearing facility in British Columbia, Canada, and release in 35 ha of pear orchards, managed by Tom Blomefield of ARC Infruitec-Nietvoorbij. Both release sites were already under an integrated mating disruption and insecticide programme. The latter project is aimed at determining the feasibility of importing good quality sterile codling moths from a remote rearing facility for local release. This has implications for the global use of SIT for codling moth control, and if successful, these shipments can supplement at short notice any local sterile release programme that has

Experimental releases of sterile codling moth adults in a pear orchard in South Africa, after long-distance transport from Canada.

run into rearing difficulties.

Both projects have delivered valuable results. Bottlenecks in the local rearing programme have been solved. In season production is currently running at 250 000 moths per week. There was no codling moth damage in the majority of apple and pear orchards treated with a combination of SIT and mating disruption. A total of only three orchards reported damage during the 2006/07 season and pre-harvest fruit damage assessments indicated 0.025% of fruit damaged. No insecticides were applied on 30% of the orchards which remained free of codling moth damage. This programme is scheduled to go commercial, and it has been proposed that an insectary capable of producing 2 million moths per week be established during 2008/09. The importation project showed that Canadian and South African codling moth adults are sexually compatible, and that shipments of up to 70 hours duration from Canada can deliver sterile moths in good condition. However, problems with airline schedules and routing can upset the regular delivery of good quality sterile moths.

The combined SIT and mating disruption/insecticide treatment resulted in the lowest codling moth damage in three years – between 0% (75% of the orchards) and 0.8%.

The fruit fly component of SAF5007 involves largely Natal fruit fly, and trials to evaluate a cost-effective egg collection system for this species, which does not lay through gauze screens, started in May 2007.

The egging room of the locally-reared codling moth colony in Stellenbosch, South Africa

This project ends at the end of 2008, and there are plans to submit a proposal for a new SIT project for the 2009-2011 IAEA TC project cycle.

On behalf of all SAF5007 collaborators I would like to take this opportunity of thanking the IAEA for their valuable and continued support of the SIT initiative in South Africa.

Text provided by Brian Barnes, ARC Infruitec-Nietvoorbij, Stellenbosch, South Africa.

Inauguration of the Tsetse Rearing and Irradiation Centre at Kaliti, Addis Ababa, Ethiopia (Technical Cooperation Project ETH5012).

The first two modules of the tsetse rearing and irradiation centre, located at Kaliti, Addis Ababa, Ethiopia of the Ethiopian southern tsetse eradication project (STEP) (supported under technical cooperation project ETH5012) was officially inaugurated on 3 February 2007. The inauguration benefited from being organized subsequently to the AU-PATTEC (African Union-Pan African Tsetse and Trypanosomiasis Eradication Campaign) Special Donors' Conference. Delegates from tsetse and trypanosomosis-(T&T) affected Member States, as well as, donor representatives were impressed by the facility. The event was well organized and numerous heads of delegations, including several ministers and ambassadors, participated in the meeting. As part of the opening ceremony, which was chaired by the Ethiopian Deputy Prime Minister, H.E. Addisu Legesse, Mr. Liang Qu, Director of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture made a brief statement on behalf of the Food and Agriculture Organization of the United Nations (FAO). All invited guests joined a tour through one of the fly production modules.

Transfer of Genetic Sexing Mass-rearing Technologies for Fruit Fly Production. Technical Cooperation Project MEX5027

Significant progress has been made in the last year with the genetics of the Mexican fruit fly *Anastrepha ludens* at the genetic sexing laboratory of the mass-rearing facility Moscafrut of Metapa de Domìnguez, Mexico. Several new mutations were detected, but not all of them proved to be useful as a marker in genetic tests. Some have a difficult phenotype, some have varying degrees of penetrance and some have very complicated genetics. The efforts to identify new mutations is continuing and aim at a minimum of two mutations per chromosome (and even more ideally, one per chromosome arm).

The Tsetse Rearing and Irradiation Centre at Kaliti, Addis Ababa, Ethiopia

The mapping of mutations is continuing through linkage analysis and cytology. A preliminary map for some of the existing mutations is available and will be extended and validated. There are various ways to align the genetical and the polytene maps. One strategy to assign a mutation to a particular chromosome is to use existing Y-autosome translocations to identify those mutations that are located on the translocated autosome. Two consecutive crosses with females homozygous for the mutation in question and translocation carrying males will show either pseudo-linkage or random segregation of the marker, i.e. the mutation is located on that respective autosome or not. If this information is available, the mutation can be localized more precisely by deletion mapping. Males with the appropriate translocation are irradiated to induce deletions. The irradiated males are crossed with females homozygous for the mutation in question. The F_1 is screened for exceptional males that show a mutant phenotype. These have to be analysed cytologically to determine the position and the length of the deletion. Ideally several overlapping deletion are available to localize the marker precisely.

In addition to the screening for mutations that exist already in the mass-reared strain, mutations can be induced

via ethane methyl sulfonate (EMS). This will become necessary if a *temperature sensitive lethal* (*tsl*) for sexing is required. The only mutation currently available for larger scale sexing is black pupae (*bp*). However, experience from medfly shows that pupal colour mutations are not ideally suited as selectable markers for large scale mass-rearing and sex separations. The drawbacks of sexing at the pupal stage are: a) diet is wasted for the rearing of females, b) sorting machines are expensive, c) sorting machines are only 95-97 % accurate, d) setting the sorting machines to high accuracy leads to losses of male material due to missorting, e) the female pupae have to be discarded in a safe manner, and f) sorting can lead to reduced quality of the males (i.e. increased frequency of non-flyers). In principle there are two strategies to identify a *tsl*: a) EMS induction on the *bp*-carrying chromosome and following *bp* in the required crosses, and b) first induction of an inversion on the *bp* chromosome before the EMS treatment. In both cases it is attempted to minimize recombination between *bp* and the induced *tsl*. For the second strategy an additional marker would be required for the detection of the inversion via recombination reduction (however, there are examples where inversions were induced/detected only through cytology).

Although it is envisaged that in the long run *bp* will only serve as a marker in the filter rearing system, it is recommended to induce additional Y-autosome translocations for that chromosome. This will be required to study the genetic behaviour, aid the mapping of *bp* and, if no inversion is available, allow to select the most suitable (i.e. stable) translocation.

The construction of a standard polytene map has progressed significantly especially due to collaboration with A. Zacharopoulou (University of Patras and currently on a sabbatical in Seibersdorf). However, the problem that the Y chromosome cannot be observed in polytene preparations still exists. This aspect has to be addressed because otherwise Y-autosome translocation breakpoints cannot be determined. This is an essential prerequisite for the evaluation of translocations.

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

The Fourth Research Coordination Meeting of the CRP on *Improvement of Codling Moth SIT to Facilitate Expansion of Field Application*, 19-23 March 2007, Vacaria, Brazil.

This last RCM was hosted by the "Empresa Brasiliera de Pesquisa Agropecuaria (Embrapa)" and was attended by contract/agreement holders of Argentina (2), Armenia (1), Brazil (1), Chile (1), Czech Republic (1), Syrian Arab Republic (2), South Africa (1), Switzerland (1), and the USA (2). Two observers (Aldo Malavasi, Director of the Biofábrica Moscamed Brasil and Luis Devotto M., Scientist at the Instituto de Investigaciones Agropecuarias, Chillan, Chile) likewise attended the meeting. The excellent organisation of the meeting and the generous hospitality offered by our host Adalecio Kovaleski, is very much appreciated.

The final presentations by the 12 scientists indicated that the objective of this CRP (i.e. the improvement of codling moth SIT for application in orchards and urban areas internationally) was effectively met as a result of the research outputs achieved, which included: (1) the development and evaluation of parameters that can be used to measure and improve quality of codling moth to be used in an SIT programme, (2) development of complementary control tactics that can be combined with SIT and used in area wide control / eradication codling moth programmes, (3) the establishment of baseline data for global exchange of mass-reared codling moth, and (4) the development of a new paradigm for the creation of a genetic sexing line for not only codling moth, but for Lepidoptera in general.

More specifically, the CRP contributed with research on:

- relevant aspects regarding mass-rearing and trade-off between life history traits, and mobility, radiation and dispersal,
- the development of an agar-free, solid artificial diet,
- field trials with released egg parasitoids (*Trichogramma* spp.), indicating effective attacks of the parasitoids on viable and sterile eggs,
- ways to distinguish adult F_1 progeny of irradiated males from wild males by using staining techniques of the chromatin material in mature eupyrene sperm bundles,
- the use of sterile codling moths in combination with releases of the egg parasitoid *T. cacoeciae*, tree banding and orchard sanitation, providing encouraging results,
- host tree removal in the urban areas in Brazil, showing it to be a very effective control tactic,
- immigration potential of wild moths,
- season-long shipments of codling moth adults from the OKSIR rearing facility in Canada to Stellenbosch, South Africa, indicating that the shipped moths were both active and competitive once released into the orchards,
- the development of a standard flight ability test for codling moths.

Significant progress was likewise made with elucidating the basic genetics of the codling moth and with transgenic experiments:

- the codling moth W chromosome was characterized, a molecular marker of the W chromosome developed, and a Z-chromosome painting probe prepared,
- primers were designed to amplify the *Period* gene from codling moth based on sequences from other Lepidoptera. This period fragment was located on the Z chromosome and as such, this fragment may be useful in determining the sex of embryos. A method was designed to obtain DNA from eggs without killing the embryos, which will facilitate the discovery of early female specific transcripts that may be involved in sex determination,
- efforts were undertaken to find the promoter for cytoplasmic actin in order to substitute the current *Bombyx mori* actin promoter in the transformation cassette with the codling moth actin promoter,

RCM participants. Vacaria, Brazil

- the appearance of the W-chromatin body in polyploid somatic nuclei of F_1 females was used as a cytogenetic marker for detecting radiation-induced aberrations of the codling moth W chromosome,
- a golden-eyed mutant was found in a colony kept in Syrian and a pure mutant line was established. Standard cross-breeding analyses showed that the visible mutation was recessive and not a sex-linked mutation,
- inheritance of the resistance/sensitivity to radiation was examined by comparing heritability of this trait in populations originating from different altitudes,
- entomological and phenological forecasting was attempted using population models, which were constructed using eco-biological data of codling moth in different orchards at three climatic zones (plain, foothill, and mountainous zones).

We would like to thank the participants of this CRP for their scientific contributions that made this 5-year research effort a success.

The Third Research Coordination Meeting of the CRP on *Improved and Harmonized Quality Control for Expanded Tsetse Production, Sterilization and Field Application* 7-11 May 2007, Muguga, Kikuyu, Kenya.

The third research coordination meeting (RCM) of the CRP on Improved and Harmonized Quality Control for Expanded Tsetse Production, Sterilization and Field Application was held at the Trypanosomiasis Research Centre, Kenya Agricultural Research Organization (KARI-TRC), Muguga, Kikuyu, Kenya from 7-11 May 2007.

The meeting was attended by thirteen participants from twelve countries, three external observers and a number of observers from the host institute. The meeting was opened by the FAO Country Representative, Dr Castro Camarada, who recognized the burden caused by trypanosomosis and the role that the sterile insect technique could play in the eradication of tsetse flies for the control of African Human and Animal Trypanosomosis. The following presentations were divided into three groups on tsetse rearing, including blood collection and processing; tsetse development and behaviour; and methods to control the risk of released sterile flies picking up trypanosomes and transmitting the disease.

In the first group, improvements to the standard quality control parameters for rearing were presented and the problems of applying the standards under African rearing conditions were discussed. In particular the collection of sufficiently clean blood for tsetse diet is difficult in many

RCM participants, Muguga, Kenya

locations. In the second group a detailed analysis of the genitalic structures in *Glossina pallidipes* and their relationship to mating behaviour and successful insemination was presented. A second presentation on flight muscle development under colony conditions and how this can be modified by enforced exercise demonstrated the possibility of relatively simple measures to improve the performance of released sterile flies. As part of this work the maintenance of a small population of flies in a greenhouse under essentially free-flying conditions was described; considerable progress has been achieved in this with flies feeding on an artificial lure and surviving for more than 30 days. In the third group of presentations work on the use of Samorin® as a prophylactic to prevent infection of released flies with trypanosomes was presented. The results from Kenya and Belgium differed considerably, and the reasons for this were discussed.

Subsequent group discussion focused on developing harmonized work programmes for the remainder of the CRP. Many of the participants were able to contribute new ideas and insights to other participants and plans were prepared to resolve some of the differences highlighted by the presentations.

The meeting ran very smoothly in the delightful surroundings of KARI-TRC, and we are grateful to the Director of KARI-TRC and her staff for their hospitality and for hosting the meeting.

Developments at the Entomology Unit Seibersdorf

FRUIT FLIES

Development of Marking Technologies for Released Flies

Flies released in an SIT programme are generally marked to allow discrimination of released and wild flies. Currently the pupae are dusted with a fluorescent powder that is picked up by the flies during emergence. This technique is rather costly (materials and labour) and is not entirely accurate. Therefore alternatives are investigated. Today two genetic/molecular strategies are available or are under investigation: a) the use of a particular mitochondrial haplotype that is different from most wild type populations. The drawback of this methodology is that this characteristic is not phenotypically visible, i.e. the fly DNA has to be isolated first followed by a PCR analysis. Furthermore, an enormous knowledge about the polymorphisms present in the different wild populations is required. b) phenotypical marking of the flies either with a classical mutation (e.g. *Sergeant 2*, Sr^2) or through transgenesis using genes expressing a protein that fluoresces under appropriate light conditions.

Comparison of Sr^2 *and its wild type in Mediterranean fruit fly.*

The mutation *Sergeant 2* (Sr^2) was discovered by A. Zacharopoulou (University of Patras). It shows three white stripes on the abdomen. Genetic analyses showed that Sr^2 is a dominant lethal mutation that is located on the right arm of chromosome 5. To determine the exact position a deletion experiment was performed. Pupae were irradiated either with 40 or 50 Gy one day before emergence. To be able to distinguish Sr^2 deletions from the respective wild type a special strategy was required. The irradiated males contain a Y-autosome translocation (CC59) that carries Sr^2. Irradiated males were crossed with *w wp* Sr^2+ females. The progeny was screened for exceptional males with a *w*+ *wp*+ $Sr^2$2+ phenotype. Among ca 6400 flies screened two such flies were detected. A. Zacharopoulou analysed their polytene chromosomes from salivary glands and male trichogen cells. The position of Sr^2 was determined to be at 76A and 60D, respectively, i.e. fortunately very close to *wp* and even closer to *tsl*.

Sr^2 was also mapped genetically in relation to some of the other mutations on chromosome 5. Male and female recombination frequency was determined in both reciprocal crosses. In addition the recombination frequency was measured in males carrying the Y-autosome translocation T(Y;5)101. Furthermore, in most cases the recombination frequency was also determined in the presence of the inversion D53. It was attempted to screen large numbers to obtain reliable results especially when the male recombination frequency was determined. The results can be summarized as follows:

- The genetic distances between the markers used are generally in agreement with their physical distance on polytene chromosomes.
- As expected the recombination frequency in males is significantly lower than in females.
- The presence of the inversion D53 reduces the frequency of recombinants significantly; however not to zero. The reduction of detectable recombinants resulting from exchange in the *y-wp* interval (completely covered by the inversion) rages from 87.6 to 99.8 %.

Bactrocera cucurbitae and Juvenile Hormone Analogues

Ihsan Ul Haq, a PhD student at the University of Vienna has been conducting studies on enhancement of mating success and acceleration of sexual maturity of male melon flies (*Bactrocera cucurbitae*). The studies are focussed on the evaluation of the effect of adding protein supplements to the adult diets and the topical application of an analogue of juvenile hormone, methoprene (M). Preliminary results have shown that males fed protein (P) without methoprene (P+M-) and protein-fed males with methoprene (P+M+) have accelerated and enhanced male sexual maturity and activity. Sugar-fed males are sexually mature on day 14 but P+M- or P+M+ are sexually mature after 6 days. However, preliminary results show that flies with both treatments (P+M+) achieve significantly more matings when compared with protein-fed 6-day old males (P+JH-) or fully mature 14-day old males fed only with sugar. In collaboration with Peter Teal (USDA-ARS, Florida), additional experiments are ongoing to assess the effect of survival, pheromone composition and pheromone gland development (size). These results indicate that juvenile hormone therapy and protein supplement could improve current SIT technology for the melon fly.

Improving Sexual Performance in *Anastrepha fraterculus*

Dr. Diego Segura from INTA Clastelar, Argentina has carried out field cage tests to elucidate the effect of juvenile hormone analogue treatment on the rate of sexual

maturation of males of the South American fruit fly *Anastrepha fraterculus*. Previous laboratory tests in Argentina and field cages test in Seibersdorf have shown that 7-day old treated males are fully competitive when compared with 10-day fully mature males. A series of experiments were conducted to verify these preliminary data and to identify at which age treated males are fully mature. Treated males 5, 6 and 7 days old were compared with fully mature untreated 10-day old males. Results have shown that 6 and 7-day old treated males compete equally with sexually mature males. This information is important as it would enable sterile males to be closer to sexual maturity when released.

The efficiency of the SIT for *Anastrepha* spp. could improve by the release of only male insects but currently there is no sexing strain available for these species. A series of experiments was conducted to assess whether or not juvenile hormone treatment induces early sexual maturity in both sexes. If early sexual maturity is induced mainly in males, then this treatment can mimic the effect of a sexing system as the released treated males would not mate with the released females and instead would largely mate with wild females. Results have shown that hormone treatment does not accelerate female sexual maturity and in the field cage tests a larger proportion of mature untreated females mated with young treated males than the treated young females.

Sex Pheromone Analysis

Dr. Peter Teal a consultant from ARS-USDA, Gainesville, USA has been advising the Entomology Unit on the utilization of juvenile hormone treatment to improve male sexual performance of *Anastrepha fraterculus* and *Bactrocera cucurbitae*. During a recent consultancy he established a protocol for pheromone collection for both species. Samples of pheromone from treated and untreated males have been sent to his laboratory for analysis. Pheromone analysis will be the first step to understand the physiological changes that occur in the treated insects and which accelerate sexual maturity of males of both species.

Characterization of Medfly Transgenic Lines

Mass-rearing characterization of two medfly transgenic lines is ongoing. Both strains carry a genetic construct that expresses a fluorescent protein. A fluorescent marker has the potential to be used as to identify released insects in SIT programmes. The objective of this characterisation is to establish the production, quality profile and measure genetic stability of each strain under mass-rearing conditions and also to carry out mating compatibility and competitiveness test in field cages.

Field cage tests were carried with a VIENNA 8 genetic sexing strain (GSS) carrying the fluorescent maker (developed at the Entomology Unit, Seibersdorf with Al Handler, USDA-ARS, Florida) and two wild type strains from Argentina and Hawaii. In all tests the transgenic VIENNA 8 GSS was competed against the untransformed parental strain. In all experiments males from the transgenic and non-transgenic VIENNA 8 GSS performed equally well but as expected less well than their wild counterparts. Mr. Neil Morrison a cost free intern who is carrying out a PhD at the University of Oxford will expand these studies to other transgenic medfly strains.

Olive Fly Mating Compatibility

Previous field cage tests done in Seibersdorf have shown that a well established laboratory strain of this species is sexually fully compatible with a wild strain established from a field population obtained from A. Economopoulos, Heraklion, Crete, Greece. These studies have now been expanded to include populations from Israel and they have shown some degree of incompatibility. More studies will be carried out to verify these observations and to extend them to other populations throughout the Mediterranean and elsewhere.

TSETSE FLIES

Colony Status

The improved performance of the *Glossina pallidipes* colony has continued through the first part of this year. The target colony size of 15 000 females was reached by week 13 and since week 11 a total of 12 000 surplus females have been put onto the tsetse production unit (TPU3.2) (see below). The rate of salivary gland hypertrophy observed in the colony has fallen to about 7.5% from the peak of 11% seen late last year.

The colonies in Bratislava have also continued to grow since the beginning of the year. The *Glossina pallidipes* colony continued to decline for the first five weeks, but has now recovered to 10 692, 1300 higher that in week 1. The *Glossina fuscipes fuscipes* and *Glossina morsitans* have both grown continuously since the beginning of the year, such that the total holding in Bratislava exceeded 67 000 females by week 15. The colonies could now support some shipments to Ethiopia, but due to problems with the electrical installation in the Ethiopian rearing facility they have not been able to receive any material this year.

The improvements in the colony in both Seibersdorf and Bratislava have been attributed to the use of a new batch of blood late in 2006. Chemical analysis of the previous batch however has not revealed any significant contaminant and the actual cause of the improvement remains unknown.

TPU3.2

An initial test with one frame, holding 9 cages of *G. pallidipes* was started in week two, and when this reached 3.27 pupae per initial female (sufficient to ensure a growing colony) a number of frames of *G. pallidipes* were placed on the TPU3.2 from week 11, totalling 12 000 females. A number of problems continue to be encountered, but the most important issue of successful feeding now

seems to be solved. Careful alignment of the feeding tray and membrane with the cages ensures that the cages all fit down flat on the membrane surface, coupled with adjustment of the feeding plate temperature, this has lead to effective engorgement of the flies.

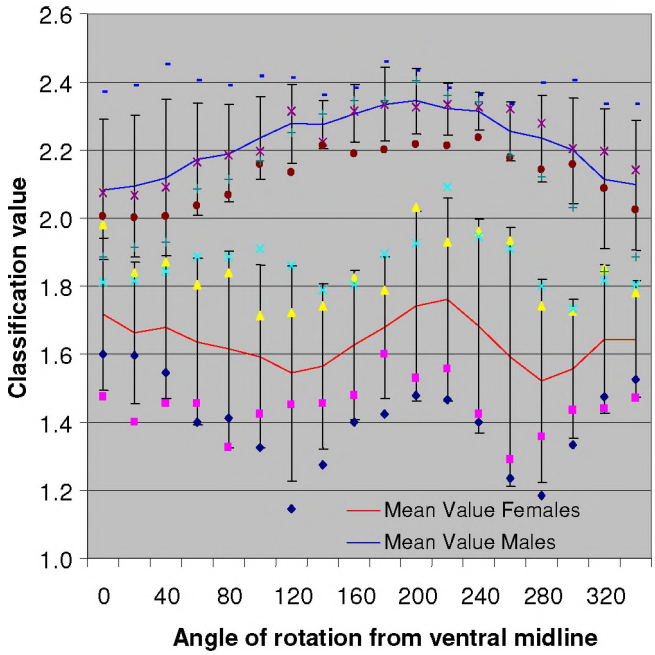
We continue to make small adjustments to the design to improve the ease of use and efficacy of the system. The problem of aligning the feeding membranes with the cages is mostly due to the progressive shrinkage of the membranes with repeated washing and heat sterilizing. The membranes, which start at 640 x 640 mm, shrink by 20-25 mm over a period of three months. This shrinkage means that it is difficult to ensure that the cages (600 x 600 mm) will fit completely on the membrane. Increasing the membranes to 660 x 660 mm will ensure that sufficient tolerance is still available, even after the membranes have shrunk 25 mm. Some variation in the shrinkage was also noted with different types of netting bedded into the silicone to reinforce the membrane, leading to asymmetric shrinkage, but this is not enough to cause a problem once the large membranes are used. Other changes that have been made include changing the material for the cage arms to improve stability and for the pupal collection slopes to improve the strength and reduce weight, and providing an easier system for releasing the lock to allow the feeding trolley to move. Further improvements will be implemented as the opportunity arises.

Sexing of Pupae

As reported in the last newsletter, successive readings with the NIR (near infrared) spectrometer from a single pupa, vary considerable. To try to understand this variability we positioned pupae in the scanner in such a manner that we could rotate the pupa through a known angle about its long axis whilst keeping it in the spectrometer focal point. The pupae were mounted by gluing the anterior end to a metal rod in a holder with an index mark. This was mounted in a plate with an engraved scale, allowing the pupae to be repositioned for repeat readings.

The attached figure shows the result from four male and four female pupae, with readings taken every 20 degrees. Each point represents the average of two readings from one rotation angle. The blue line is the mean of the four male readings and the red line the mean of the four female readings, with the bars showing the 95% confidence interval for individual readings. The large variation in individual readings coupled with the variation with rotation means that randomly aligned pupae will sometimes misclassify, with female pupae sometimes giving higher values than male pupae. However in certain specific orientations (around 140 degrees in this case) the values for males and females are well separated.

Determining the position of pupae in relation to the dorsoventral axis would be very difficult. The breathing lobes (apneustic lobes) are deflected towards the ventral aspect and in principle this could be used to determine the orientation, but the deflection is small and will be difficult to observe automatically at speed during the sorting. An alternative would be to take the reading from the anterior end of the pupa rather from the girth; this would avoid the rotational asymmetry, and it should be relatively simple to determine if the pupa is oriented with the anterior or posterior uppermost. Work will continue to determine the best conditions under which to run the sorting.



Effect of pupal rotation on the classification value during NIR sorting of Glossina pallidipes *pupae. One type of symbol represents values from individual pupae; lines and bars show means of four pupae per sex and 95% confidence interval*

Salivary Gland Hyperplasia (SGH)

As reported in the last newsletter (no. 68), sequencing of the salivary gland hypertrophy virus (SGHV) was approached using two techniques; the shotgun method by fragmenting the genome with EcoRI restriction endonuclease resulted in 415 clones being sequenced totalling 60-90 kpb and the pyrophosphate sequencing by 454 Life Science in the USA, which gave more than 34 000 reads, assembled into 402 contigs. Intensive work has continued to combine these sequences with additional sequences extracted from the 454 data and new sequences from targeted PCR reactions, which has resulted in determining that the genome is circular with a sequence of 189 571 nucleotides. Final checking of the sequence is expected to be completed in the next few months, and the draft sequence has been submitted to GenBank (EF568108).

Two consultants group meetings were held on the analysis of the genome sequence, the first on 18-20 December 2006 under the title Genome Characterisation of the Tsetse Salivary Gland Hypertrophy Virus and the second on 11-13 April 2007 under the title “Finalizing the Genome Sequence of the Tsetse Salivary Gland Hypertrophy Virus”. During the meetings the sequence data were discussed and the repeat regions found in the sequence were analyzed.

Also a phylogenetic analysis of the DNA polymerase was carried out. The results of the phylogenetic analysis indicate that the predicted amino acid sequence of the DNA polymerase of SGHV was aligned with selected DNA polymerase of other large dsDNA viruses using Clustal W in BioEdit. Subsequently, a phylogenetic analysis (NJ) was performed using MEGA3.1 software.

The generated tree shows that the SGHV DNA polymerase does not cluster with the Baculoviruses or Nudiviruses, but with Iridoviruses, Herpesviruses and Phycodnaviruses. The bootstrap values for this position is very high (95%). Therefore it can be excluded that the SGHV DNA polymerase is phylogenetically closely related to Baculoviruses or Nudiviruses. SGHV might represent a new virus family. The virus has some genes which have homology with other insect viruses, especially the genes involved in the early infection steps like p74, pif-1 pif-2 and pif-3 of baculoviruses. Preliminary work has been undertaken to clone the p47 gene into baculovirus expression vector to produce this protein as a first step towards producing antibodies against this protein.

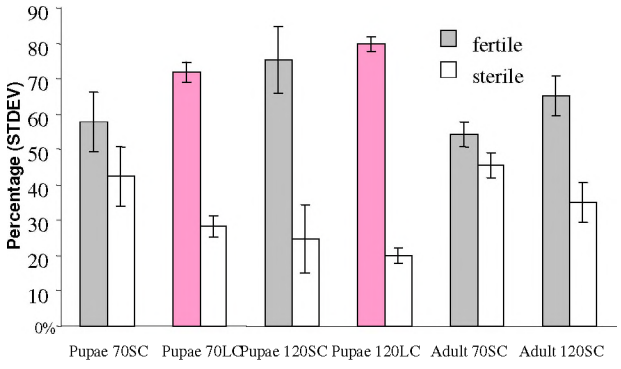
Another important aspect is the study of the impact of antiviral drugs on viral infection in the fly; four antiviral drugs were tested to determine their toxicity effect on tsetse. From this preliminary screening two drugs, Acyclovir and Valacyclovir, were selected for further work, the other two drugs being too toxic for use in tsetse feeding. To analyse the effect of the antiviral drugs on viral DNA replication a quantitative PCR test was established by choosing two primers and a preliminary test to quantify the number of viral DNA copies made. Work will continue on this aspect, principally using Valacyclovir.

MOSQUITOES

Germline Transformation as a Supporting Technology for Genetic Sexing

The production of six separate lines of transgenic *Anopheles arabiensis* carrying a *piggyBac*-derived construct was reported in the previous newsletter. The construct is designed to express DsRed in the eyes and central nervous system of both sexes, and green fluorescent protein (GFP) in the testes. The six lines derive from at least three separate germline transformations. Despite repeated attempts, only one line has been selected to homozygosity. In the other lines apparently homozygous phenotypes don't develop beyond fourth instar. Molecular characterisation of the insertion events using inverse PCR has been completed for three lines: two carry the same insertion at position 17946953 on chromosome arm 2L, the third which is the homozygous line has an insertion at position 21832348, also on 2L.

(upper) Field cage tests for male mosquitoes, Dongola, Sudan and (lower) construction of cages (Seibersdorf).



Competition at 1:1 ratio sterile vs normal males in Small (SC) and Large (LC) cages

Radiation Biology

Experiments to assess the competitiveness of radiosterilized males have been initiated using routine rearing cages (30 x 30 x 30 cm) and large cages (1.2 x 1.7 x 1.2 m (h x l x w). Previously reported problems associated with working with the large cages were resolved by a change of room. Irradiated males were placed in competition with normal males for normal females at a ratio of 1:1:1. Two irradiation doses are being tested; a high, almost fully sterilizing dose (>98% sterility) of 120 Gy, and a lower, semi-sterilizing dose (>80% sterility) of 70 Gy applied either to pupae or to recently emerged adults. Competitiveness is

determined from egg hatch data from females inseminated by males irradiated as pupa or adult.

The data collected to date show as expected, that sterile males perform consistently worse than normal males, particularly at the higher irradiation dose and in the larger cages.

Work on scaling up the experiments has started with the initial field cage releases in Sudan (see figure). Male mosquitoes were reared and irradiated by staff at the Tropical Medical Research Institute in Khartoum. These were transported with minimal mortality to Dongola (>500 km) and released into the field cage with wild mosquitoes where they survived over 24 hours. Some minor practical problems prevented assessment of the competition experiments, but mating between laboratory males and wild females was confirmed.

Mass-Rearing of Mosquitoes

Most of the evaluation of the second prototype of the mass production cage has now been completed resulting in further modifications. As reported previously a central feature of the cage is to supply blood, pupae and sugar water and to collect eggs via series of tubes running from one side of the cage to the other so that there is no need to access the cage.

In general mating, longevity, blood feeding and egg production are comparable with the small standard cages, but there are still further improvements under development. The cage has been designed to be flat packed and self assembled (see picture, lower). Two cages have been sent to the TMRI in Khartoum for evaluation there.

Special News and Reports

Opinion of the EFSA Scientific Panel on Plant Health on the Pest Risk Analysis made by Spain on *Bactrocera zonata*.

The European Commission requested the European Food Safety Authority (EFSA) to provide a scientific opinion on the Pest Risk Analysis (PRA) made by Spain on the peach fruit fly *Bactrocera zonata* (Saundrers), a fruit fly listed in the quarantine list of the European Community (EC) plant health legislation (Council Directive 2000/29/EC). In particular, it was requested to consider the threats posed by *B. zonata* to the whole EC, to identify the fruit species at risk, and to determine whether the management measures proposed are appropriate.

The peach fruit fly attacks ripe fruit of many species, especially mango, peach and guava, rendering them inedible. It is common in many tropical and sub-tropical countries of Asia, especially the Indian sub-continent, and has invaded Egypt since the early 1990's. It is absent from the EC and listed in Annex I Part A Section I of the Council Directive 2000/29/EC under the synonym *Dacus zonatus* as a harmful organism whose introduction into, and spread within, all Member States shall be banned. In 2005, Spain detected *Bactrocera* larvae, assumed to be *B. zonata*, in two consignments of citrus from Egypt and conducted a pest risk assessment and an analysis of risk management options following the 1997 version of the European Plant Protection Organisation (EPPO) pest risk analysis (PRA) scheme. The Spanish PRA concluded that *B. zonata* poses a serious threat to fruit production in the Mediterranean countries of Europe and that appropriate management measures should include phytosanitary treatments before export, targeted entry inspections and the prohibition of fruit carried by passengers.

The EFSA Scientific Panel on Plant Health with FAO/IAEA participation conducted a detailed review of the Spanish PRA and concluded that the PRA does provide sufficient evidence to support the listing of *B. zonata* in Annex I Part A Section I of the Council Directive 2000/29/EC. The additional work required to determine the threat to the whole EC, identify the fruit species at greatest risk and select the most appropriate management options is outlined.

The Panel found that, although the Spanish pest risk assessment could be improved, it did provide sufficient evidence to justify an analysis of risk management options. It confirmed that *B. zonata* is capable of entering, establishing, spreading and causing significant impacts on fruit production in and exports from southern EU member states. However, the pest risk assessment could be improved, principally by (a) clearly defining the PRA area, (b) updating, extending and analysing data on the different pathways *B. zonata* could enter the EC, (c) conducting a detailed assessment of the climatic suitability of the EC for *B. zonata*, (d) defining which Member States and areas are most endangered, (e) identifying the fruit species that are most at risk, (f) further exploring the potential impacts on export markets, and (g) summarizing the key uncertainties.

The Spanish analysis of risk management options could also be enhanced since it (i) follows an old EPPO standard that contains a number of ambiguities and inconsistencies, (ii) does not analyse a key pathway (fresh fruit carried by passengers) in detail, (iii) rejects or fails to recognise several management options that, while insufficient on their own, could, when combined with others, form part of a systems approach, (iv) overlooks measures, such as surveillance trapping, the male annihilation technique and insecticides, that can be very effective in eliminating outbreaks in the importing country, and (v) does not determine the extent to which the measures identified interfere with trade, are cost-effective and have no undesirable social or environmental consequences.

Text based on: http://www.efsa.europa.eu/en/science/plh/plh_opinions/ej467_bactrocera.html

Host Tree Removal in Four Urban Areas of Brazil – an Effective Control Tactic for Reducing Codling Moth (*Cydia pomonella*) Populations.

The codling moth, a pest insect of pome fruits in most temperate regions of the world, was first detected in Brazil in 1991, and since then, its distribution has remained limited to the urban areas of four municipalities: Bom Jesus, Vacaria and Caxia do Sul in the state of Rio Grande do Sul and in Lages in the state of Santa Catarina. A campaign to control the moth and to prevent it spreading to commercial orchards was initiated in 1997. The campaign consisted of an extensive detection trapping programme, an initial "lure and kill" component, which was followed by a host-tree removal programme that was started in 2001 in Lages and in 2002 in Vacaria. Since then, a total of 89 829 trees have been removed and replaced with non-host trees. An estimated 23 500 host trees are remaining.

The host tree removal programme has been a big success as can be judged from the apparent densities (no. of male moths/trap/season) of codling moth in the pheromone traps: from 1997 to 2006, codling moth apparent density was reduced from 13.7 to 0.14, from 39.5 to 0.02, from 6.1 to 0.0 and from 3.0 to 0.009 in Vacaria, Lages, Bom Jesus and Caxias do Sul, respectively. Codling moth catches in 2006/2007 were very low (Lages: 37 males in

1700 traps, Vacaria: 170 males in 1200 traps, Caxias do Sul: 11 males in 1200 traps and Bom Jesus: zero in 400

Fruit tree removal in a backyard in the urban area of Caxia do Sul, Brazil.

traps) but the danger of codling moth invading the commercial areas remains acute.

In spite of the successes obtained with the host-tree removal programme, it will be very difficult to remove the last host tree in this challenging urban setting. In addition, the purchase of fruit trees by individuals cannot be banned, which creates continuous opportunities for non-collaborators to plant new host trees in their backyards. Moreover, as the urban areas are expanding, the distance to the commercial orchards is decreasing, which would facilitate the migration of the codling moth to the commercial orchards.

The sterile insect technique is considered to be the most appropriate control tactic to permanently remove the codling moth relic populations in these urban areas before they migrate to the commercial orchards. From the various options available (i.e. purchase of sterile moths or eggs from the OKSIR facility in Canada, purchase of sterile moths from Argentina, establishment of a facility in Brazil with codling moth seed material from Argentina), it appears that the establishment of a Brazilian (multi-purpose) facility would be the preferred approach.

The wild codling moth population in Brazil is now too low to provide sufficient material to establish a mass-rearing colony. Therefore, seed material will need to be imported from another mass-rearing facility, and the most logical option seems to be the importation of seed material from Argentina, where a new codling moth rearing facility was inaugurated in September 2006 (see IPC Newsletter 68, pp. 22-23). Mating compatibility studies, carried out at the Entomology Unit of the FAO/IAEA Agriculture and Biotechnology Laboratory in Seibersdorf, Austria, with codling moths originating from different geographical regions provided, no evidence for the presence of mating barriers.

The three remaining infested urban areas constitute isolated entities with respect to codling moth, and an eradication campaign could progress in a phased way (e.g. one area per season), which would limit the required number of sterile moths, making a future eradication campaign more cost-effective.

SIT Stands to Boost Spain´s Citrus Markets - Second Biggest Sterile Insect Mass Production Facility Opens in Valencia for Medfly Suppression.

Spain´s citrus fruit stands to become more competitive in international markets, thanks to expanded use of a pest control technology rooted in applications of nuclear science. A new pest-control facility – Europe´s first such large-scale plant – opened in Valencia in late April that experts say will cut the use of pesticides and protect citrus fruit from the destructive Mediterranean fruit fly (medfly).

The Valencia facility is the latest to incorporate the sterile insect technique (SIT), a method often described as biological birth control for insects. The plant is built to rear and sterilize millions of male medflies that are released into targeted areas as part of medfly suppression and prevention campaigns. The industrial production of sterile male medflies follows a protocol for mass-rearing based on a genetic sexing strain developed through the Joint Programme of the IAEA and Food and Agriculture Organization (FAO) and provided to the regional government of Valencia, together with the rest of the SIT package, under an ongoing Memorandum of Understanding that also included facility design and staff training.

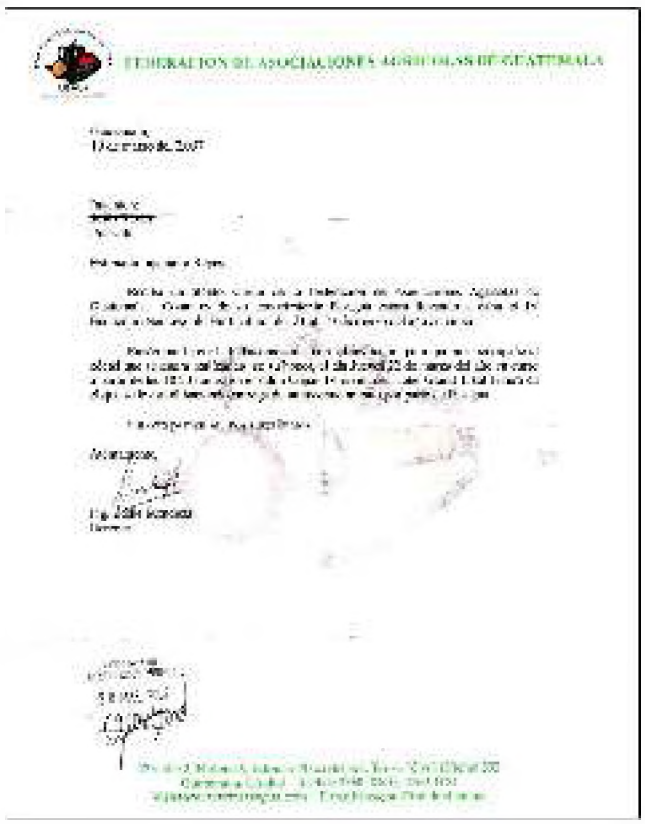
"The role that the IAEA has played in transferring the sterile insect technique to the Generalitat Valenciana has been of fundamental importance to the adoption of this technology," said Mr. Juan Cotino Ferrer, counsellor for the Generalitat Valenciana food and agricultural authority.

The SIT facility, built at cost of Euro 8 million marks a strategic step forward in pest control for Spain´s agricultural community. The factory has the capacity to produce 500-600 million sterile male medflies and paves the way for Spain to suppress destructive medfly populations using a biologically based method. The investment enables Valencia´s fruit industry, which accounts for 80% of the country´s citrus exports, to stay competitive in global markets and cut down on the use of insecticides to fight medflies.

Text provided by L. Wedekind, Head News and Information Section, IAEA.

Special Recognition to IAEA in Partnership with USDA and other Stakeholders.

The Federation of Agricultural Associations of Guatemala, in a special ceremony during the IV National Horticultural Encounter, gave a special recognition to IAEA (team effort between the IAEA Departments of Nuclear Applications and Technical Cooperation) in partnership with the United states Department of Agriculture (USDA) and other organizations, for the development of fruit fly low prevalence areas, thereby overcoming phytosanitary barriers and opening markets in the US for the export of fresh peppers and tomatoes from Guatemala.



This facilitation of regional agricultural trade, under regional project RLA/5/045, is resulting in significant investment by the private sector to expand these areas and the production of these horticultural commodities. Most importantly, the outcome is the creation of many jobs in poor rural areas and the reduction of insecticides applications, thereby reducing residues on these commodities and benefiting farm worker and their families, as well as the environment.

Meeting of the Commission of Phytosanitary Measures-2 (CPM-2) of the International Plant Protection Convention (IPPC), 26-30 March 2007, Rome, Italy.

The Second Meeting of the Commission of Phytosanitary Measures (CPM-2) was held from 26 to 30 March 2007 at FAO Headquarters in Rome. The meeting was opened by FAO's Director General, Mr. Jacques Diouf. He noted that the international environment associated with agricultural and food production is undergoing remarkable changes. He also noted that the movement of pests through trade and other pathways had increased. He said that the International Plant Protection Convention (IPPC) is recognized as the international body with the mandate to address phytosanitary measures and as a standard setting body under the World Trade Organization - Agreement of the Application of Sanitary and Phytosanitary Measures (WTO-SPS). He also pointed out that FAO's budget had decreased with 25% during the period 1999-2006, but its core funding for the IPPC has not decreased given the relevance of the Convention in facilitating safe international trade of agricultural products. The budget of the IPPC for the 2006-2007 biennium is USD 1.8 million, which is insufficient to properly address the activities identified under the Strategic Directions of the CPM. To alleviate to a certain extend the budget deficit, in-kind and financial extra-budgetary contributions have been provided by Canada, the European Union, New Zealand and the USA.

The CPM considered the draft standard on Phytosanitary Treatments for Regulated Pests and the draft standard for Establishment of Areas of Low Pest Prevalence for Fruit Flies (Tephritidae) for consideration as new International Standards for Phytosanitary Measures (ISPMs), which are of special relevance to the Joint FAO/IAEA Programme.

The ISPM on Phytosanitary Treatments for Regulated Pests was adopted by the CPM-2. It was noted that irradiation treatments were not mentioned under the group of physical phytosanitary treatments. This will be corrected in future revisions of the standard. In relation to the ISPM on Establishment of Areas of Low Pest Prevalence for Fruit Flies (Tephritidae), will incorporate as agreed changes and be resubmitted to the Standards Committee (SC). The CPM recommended that the SC handle this draft as a priority in their work plan. The draft ISPM will be resubmitted for adoption at CPM-3 in March 2008.

The CPM-2 requested that no new topics be put on the work programme until the CPM considers the outcome of the focus group working on the standard setting process. This affects the procedures to work on the development of phytosanitary treatments, although treatments on fruit flies and also irradiation treatments have already been established as priorities in previous CPMs.

Other issues related to CPM-2

During the Session, discussions were held with various regional plant protection organizations on the possibility to co-sponsor a regional workshop on the use of irradiation as a phytosanitary treatment for the Americas, to be held in Mexico City from 1-5 October 2007. The representatives of the Comite de Sanidad Vegetal del Cono Sur (COSAVE), the North American Plant Protection Organization (NAPPO), and Organismo Internacional Regional de

Sanidad Agropecuaria (OIRSA) confirmed their willingness to co-sponsor this regional workshop. The Inter-American Institute for Cooperation in Agriculture (IICA), and the United States Department of Agriculture (USDA) are also willing to participate in this workshop as well as the FAO Regional Plant Protection Office for Latin America and the Caribbean. The organization of this regional workshop is in line with needs identified at CPM-2, as it was agreed that one of the priorities should be to provide training, for the implementation of IPPC standards.

FAO Seminar on Transboundary Pests and Diseases and other Disasters: from Prevention to Building Back Better, 2 April 2007, Rome, Italy.

The seminar took place at the FAO Headquarters on 2 April 2007. It included discussions on four themes: 1) early warning, 2) rapid response to recovery and rehabilitation, 3) risk reduction, and 4) from prevention to building back better.

The seminar was an encounter between FAO and delegates of Member States to debate in an informal setting about things that could have been done more efficiently and ways to help FAO satisfy its mandate. The format of the seminar was effective in allowing Member States and FAO staff to openly and in a transparent manner discuss problems, lessons learned and to propose possible solutions.

It was established in the seminar that within the context of transboundary pests and diseases and natural disasters, the scope of FAO's mandate is being greatly expanded to include natural disasters. Expanding FAO's role from a preventive approach through an early warning system to a function of rapid response, recovery and rehabilitation, is a major task that requires major financial and human resources. According to the chart presented in the seminar's background note, the number of recorded disasters has increased from 50 in the 1970's to 450 in 2005. This includes highly pathogenic diseases (e.g. Avian Influenza, Rift Valley Fever), as well as natural disasters such as hurricanes, tsunamis and earthquakes.

The problems caused by these disasters are big, diverse and complex and need to be addressed through an alliance of international organizations including FAO, WHO (World Health Organization), WFP (World Food Programme), OIE (World Organization for Animal Health), IPPC, CBD (Convention on Biological Diversity), etc., as well as non-governmental organizations. FAO has been very active in strengthening its links with other organizations to articulate efforts and also in lobbying for financial and in-kind contributions from Member States and donor organizations.

Given the increasing frequency and impact of these disasters and despite the alliances built between relevant organizations, the obvious question remains whether the FAO is prepared structurally and financially to face this situation and to take on this new expanded role? During the seminar, the Ambassador of Pakistan praised FAO for its active and useful participation in the recovery and rehabilitation efforts after the 2006 earthquakes.

The Leverhulme Trust Tsetse Research Network (LTTRN) European Workshop held 2-4 March 2007 at CIRAD/IRD in Montpellier, France.

The Leverhulme Trust Tsetse Research Network (LTTRN) was formed in 2004 as an association of research scientists and control personnel with common interests in promoting activities in support of initiatives to control tsetse and interrupt the transmission of African trypanosomosis. The network has an underlying theme of promoting collaborative research and training to improve understanding of the biology and control of tsetse, and in support of control and surveillance activities directed against the disease and its insect vectors – especially in association with the PATTEC (Pan African Tsetse and Trypanosomiasis Eradication Campaign) initiative of the African Union.

The inaugural workshop of the LTTRN was held at the African Union (AU) Headquarters, Addis Ababa, Ethiopia, 5-6 February 2005, immediately followed by the 4th meeting of the AU-PATTEC Policy Committee during which the LTTRN was formally welcomed and adopted as the research and technical support arm of the AU-PATTEC initiative.

The network holds periodic meetings, the most recent of which was held in CIRAD/IRD Montpellier, France. The objectives of the meeting were:

- To inform about current activities based in Europe that have actual or potential relevance to tsetse and trypanosomosis control (especially within the context of AU-PATTEC).
- To consider preparation of a summary paper for European funding organizations, particularly in relation to development of FP7 within the European Commission.
- To make best use of available knowledge and expertise to suggest areas of Africa where tsetse and trypanosomosis elimination might be operationally feasible, and recommend what additional research would be of significance for refining such concepts.
- To clarify the types of control interventions that are likely to be of greatest applicability over a large scale.

The meeting was attended by researchers from France, Belgium, the UK, Germany, Burkina Faso, Thailand and representatives from AU-PATTEC, TDR/WHO (Special Programme for Research and Training in Tropical Dis-

eases of WHO) and the FAO/IAEA. Three commercial participants also attended.

Following the formal presentations several topics were discussed. Principal amongst these were: considering biological and physical conditions only in which areas was eradication most likely to be achieved; in which areas would eradication be most difficult; what effect do seasonal factors have on tsetse control, and where would these have most effect; which control techniques have the greatest applicability over the geographical scales envisaged by AU-PATTEC; in practical terms, what is the maximum area that can be controlled by the various available techniques within one season/year; what are the main geographical features that contribute to population structuring in tsetse, and if a population was removed to what extent would it be replaced by a neighbouring population; if tsetse can be eliminated from an area, how can this be confirmed; is there any evidence for genome erosion in tsetse; and given that reinfestation after local control has frequently occurred in the past, what would be the most informative markers to identify the likely source of immigration?

Amongst the results of these discussions, it was generally agreed that: isolated populations need to be identified if eradication is to be successfully maintained; isolation will be caused by topographic barriers or low rainfall areas; the scale of operation possible in one season with any technique will depend on the specific situation; the practical maximum area of an operation utilizing insecticide treated cattle would only reach the order of 10 000 km^2 in areas with good dipping infrastructure and veterinary services but could be as little as 1000 km^2 without this infrastructure; coordination and monitoring of community based control is likely to be practicable only over areas of 1-2000 km^2; and it is not clear that the necessary climatic, topographic and vegetation conditions for sustaining the effects of sequential aerial spraying, as formerly applied in Zimbabwe and recently in Botswana/Namibia/Zambia/Angola, would be found further north in Africa.

AfDB/AU-PATTEC Special Donors Meeting 1-2 September 2006, Addis Ababa, Ethiopia.

The African Union-Pan African Tsetse and Trypanosomiasis Eradication Campaign (AU-PATTEC) organized a special donors meeting on 1-2 September 2006 in Addis Ababa, Ethiopia. AU-PATTEC and AfDB (African Development Bank) estimate that the total funding required to free 37 sub-Saharan countries from the tsetse and trypanosomosis (T&T) problem within the next fifteen years would amount to about US$ 3150 million, of which AfDB has made available for the six 'list-1' countries (Burkina Faso, Mali, Ghana, Ethiopia, Kenya and Uganda) loans amounting to US$ 80.2 million and has earmarked for the twelve 'list-2' countries some additional US$ 76 million.

At the meeting, the WHO highlighted their intensified efforts in providing relevant training and in stepping-up sleeping sickness surveillance, drug supply (with the support and donations from the private sector) and respective treatments, which resulted in a decline of new cases of human African trypanosomosis (HAT) by 57%. Colleagues from WHO also covered in their report relevant activities under its special programme for research and training in tropical diseases (TDR).

Project counterparts presented summary reports on the status of activities under the six 'list-1' projects, and also on the work done by some of the twelve 'list-2' countries, which are preparing for sub-regional AfDB supported T&T intervention campaigns under the AU-PATTEC initiative. Particularly impressive was the presentation on the joint work already done by Angola, Botswana, Namibia and Zambia. Following the 2001/2001 sequential aerosol technique (SAT) campaign in the Okavango Delta, Botswana's aerial spraying operations were expanded in mid 2006 to cover the remaining tsetse habitats in Botswana (some 5700 km^2) and adjacent tsetse-infested areas in the Namibian Caprivi strip and in Southern Angola (4700 and 200 km^2, respectively). During the next three years the four countries envisage an expansion of the transboundary SAT operations into some 16 000 km^2 tsetse-infested areas of southern Angola and southwest Zambia, thus attempting to free in total some 40 000 km^2 of land with open vegetation from the tsetse-transmitted trypanosomosis problem. Other tsetse-infested areas in northern Angola, where sleeping sickness is wide-spread, are scheduled to be treated as of 2011. More north, the fly habitats are denser than in Botswana and complete eradication of tsetse flies may not be achievable as easily as this appears to have been possible as a result of the 2001/2002 SAT operations in the Okavango Delta.

The Vice-President of AfDB, Dr. Zeinab El Bakri, requested Heads of Delegations of T&T affected countries, as well as, donor countries and organizations represented at the Special Conference to make announcements on intended national and international contributions. Besides a) the envisaged US$ 76 million of AfDB loans to the 12 'list-2' countries; b) some countries' re-confirmation of national contributions to planned T&T interventions; and c) assured continued support from the mandated UN organizations, no major additional pledges were made at the meeting.

Guest Article:

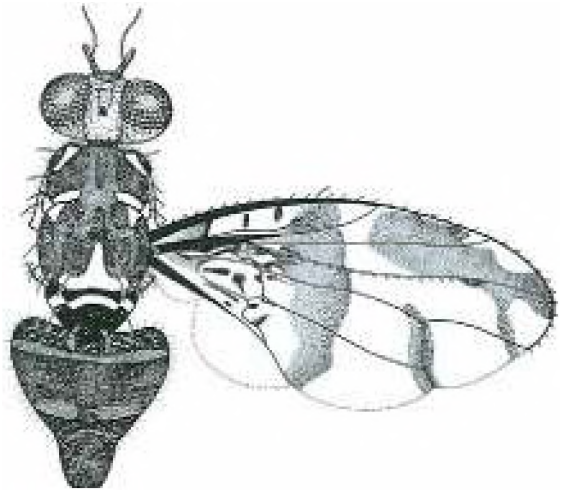
Response of *Ceratitis manjakatompo* (Diptera : Tephritidae) to trimedlure and BioLure in Madagascar.

Jeannette Claudine Yolande RAOELIJAONA
Soanjanahary RAHARIMALALA
Service de la Protection des Végétaux, Nanisana Antananarivo, Madagascar

Introduction

Madagascar belongs to the Afro-tropical region. Fruit flies are important pests of fruits and vegetables in Madagascar and since 1984 8 new species have been recorded. One of them *Ceratitis manjakatompo* has been described by D.L. Hancock and has now been studied in a citrus plantation located in Antananarivo. The orchard contained different host plants for *C. manjakatompo* like peaches, kumquat, guava, and wild host plants.

The objectives of this study were: (1) to assess the response of *C. manjakatompo* to trimedlure and BioLure, which are attractants used for the trapping of other *Ceratitis* species, (2) to assess fluctuations in population density, and (3) to assess the host sequence of this species in Madagascar.



Ceratitis manjakatompo *(Hancock) (Diptera : Tephritidae)*

Materials and Methods

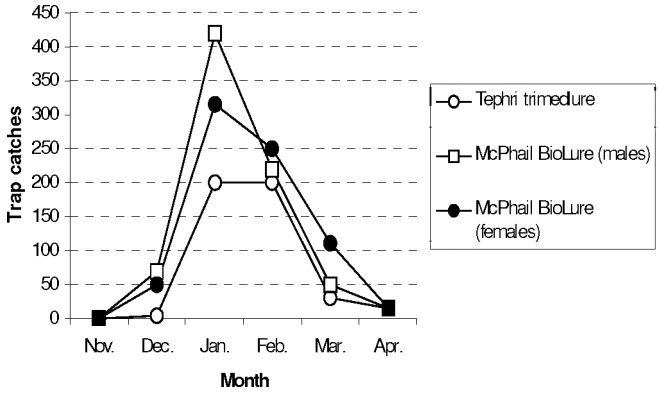
The studies were conducted in an orchard located in Ambohijafy (Analamanga Region/Antananarivo). Two types of trapping systems were tested, i.e. (1) Tephri trap baited with the male specific attractant trimedlure, and (2) plastic McPhail type traps baited with the female biased attractant BioLure. Fruit fly captures were recorded every week and the results are presented each month.

Results and Discussion

Trap catches indicate that *C. manjakatompo* responds positively to traps baited with trimedlure, BioLure and torula yeast (which is a conventional food bait). The traps were deployed in November (the flowering season for peaches) when population levels are still low because peach is not considered to be a host of this fruit fly species.

The population density of this pest begins to increase in early December and reaches its highest peak in January. December is the beginning of the fructification season of citrus and in January there are many host plants such as guava and some plants which belong to the family Solanaceae. It was observed that during this time, there are a lot of males which were captured in trimedlure and BioLure-baited traps that are placed on orange and guava trees.

February to April is the maturation stage for orange and the beginning of the fructification of mandarin. During this time the numbers of male flies captured in BioLure-baited traps decreased rapidly, while the female captures decreased more gradually. The numbers of males caught in the trimedlure-baited traps remained high before decreasing in March and April.



Trap catches of Ceratitis manjakatompo *with trimedlure baited-Tepri traps and BioLure-baited McPhail traps from November to April.*

Conclusions

The data indicate that this fruit pest can be monitored using available trapping and bait systems. These results obtained will assist in the development of improved integrated control measures against this pest in Madagascar. The information is also relevant for trading partners from the regulatory point of view.

Reference

Hancock, D. L. 1984. Ceratitinae (Diptera: Tephritidae) from the Malagasy subregion Journal of the Entomological Society of South Africa 47: 284 - 285

Tephritid Workers Database (TWD) [www.tephritid.org]

The tephritid Workers Database (TWD) is a free, non-commercial web based database, providing information service to fruitfly workers worldwide on:

- The Directory of fruit fly workers (Who's who)
- Who's doing what
- The Virtual Fruit Fly Library
- News and Events
- Links

The philosophy of this service is that you MEMBERS ARE THE MAIN DEVELOPERS OF THE DATABASE by adding/updating regularly your TWD data including your publications related to tephritid fruit flies. TWD welcomes your continuous contributions and receiving information about upcoming events, news, job offers, research opportunities for students, URL of fruit fly web site you know, and any good ideas you would like to share with other fruit fly workers. TWD welcomes you to use its services and looks forward to be of interest and use to your activities. The database will continue expanding to meet your expectation and we look forward receiving your feedbacks.

How to Join

1. Already a member:

You are heartily invited to update your profile and particularly, ADD REFERENCES of your publications on fruit flies to help build the Virtual Tephritid Library. Just LOG IN and then click on UPDATE PUBLICATIONS. Let me know if you do not remember your username and password.

2 . New member:

You need to create your profile (5 min!).

- Enter www.tephritid.org
- Click on Membership — fill out the form, enter your ANY username and password, then submit. Remember to save your password and username in a safe folder.
- Return to the main page of TWD and click on Log in and enter your username and password.
- New forms will appear at the left hand frame. Fill out each form and submit.
- Congratulation! You became a TWD member. No more forms to fill out! Next time you would like to add/update your profile just LOG IN. Your profile will hold your current contact information, background and skill, activities, and PUBLICATIONS.

Prof. Abdel Jelil Bakri
TWD Database administrator
University Cadi Ayyad, Marrakech, Morocco
Email: bakri@ucam.ac.ma

Announcements

Cost-Benefit Analysis Model (CD ROM and Procedures Manual).

A new generic Fruit Fly Cost-Benefit Analysis Model has been developed and is now available as a CD. The model assists in economic decision making associated with area-wide fruit fly control options.

The economic returns of different control options (suppression, eradication, containment and prevention) are presented in a pay-off matrix which compares basic economic indices including benefit to cost ratios, net-benefits, internal rate of return and pay-back period. The flow of costs, benefits and economic indices are presented in tables and graphs that allow visualization of trends throughout a given time horizon.

The model is user-friendly and thus largely self-explanatory. Nevertheless, it includes a procedures manual that has been prepared to guide the user and thus should be used together with the software.

Ideally the model should be used as a support tool by working groups. The working group should include professionals in agriculture with experience in area-wide implementation of IPM programmes, an economist or at least someone with basic knowledge of economics, and, if relevant, an entomologist with some background in the application of the sterile insect technique (SIT).

For free copies of the CD, please contact: Insect Pest Control Sub-programme, Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture, IAEA (http://www-naweb.iaea.org/nafa/index.html)

Computer Based Training Package in Support of GIS (Geographic Information System).

The package (Using GPS Instruments and GIS Techniques in Data Management for Insect Pest Control Programs) includes a set of 'flash' presentations demonstrating use of the various software applications covering GPS (Trimble Pathfinder Office), GIS (ESRI Arcview) and database (MS Access). The examples shown during the presentations focus on pest control programmes. In addition a small set of sample data for trainee practice are included with the presentations.

Free copies of the tutorial CDs are available at the Insect Pest Control Section.

First Announcement and Call for Papers: Maintaining Worldwide Connections for Quality Assurance in Arthropod and Nematode Rearing.

Joint Meeting in Montreal, Canada of: Association of Natural Bio-control Producers, IOBC Global Working Group on Arthropod Mass Rearing and Quality Control, ASTM subcommittee E35.30 on Natural Multi-Cellular Biological Control Organisms, International Biocontrol Manufacturers Association Invertebrate Biocontrols Group.

Hosted by: Biocontrol Network of Canada, Montreal, Canada, October 28 - November 1 2007

Registration and Venue: Colleagues interested in attending the meeting or in presenting an oral or poster paper are requested to complete the pre-registration form on-line at www.anbp.org/joint_meeting.htm Or you may print and complete the form and fax or mail a copy to: Maclay Burt, Executive Director ANBP, maclayb2@aol.com, 2230 Martin Drive, Tustin Ranch, CA 9278, USA, Phone and Fax: 714-544-8295

The conference will be at the DoubleTree Plaza Hotel in the City Center, where a block of rooms has been reserved at the conference rate of Canadian Dollars 115 per night (514-842-8581).

Programme: The workshop will focus on all issues related to the rearing of entomophagous and phytophagous insects and mites and entomophagous nematodes, and to principles and practices of quality assurance. The program will consist of invited papers presenting an overview of selected topics (to be announced later) and contributed presentations on the different aspects of arthropod and nematode rearing as it relates to quality control. Papers will serve as a basis for discussion and exchange, with the final aim of improving collaboration among scientists and practitioners.

The registration fee is estimated at US$ 425 and includes a conference packet, welcome reception, banquet, tour of locations that use biological control, plus lunches, and coffee breaks.

Exhibitors and Sponsorships: Institutes or companies that wish to sponsor events or reserve display space should also contact Maclay Burt at the same addresses above.

Financial Assistance for Young IOBC Members: IOBC AMRQC has the funds to award assistance to young scientists who are IOBC members and are presenting a paper at the meeting. Please check the financial assistance box on the pre-registration form and submit letter of recommendation from your major professor to Maclay Burt via his contacts listed on the application form.

All upcoming information on the program, registration and accommodation will be available on the ANBP website (www.anbp.org) and the AMRQC (www.AMRQC.org) and Biocontrol Network (www.biocontrol.ca) websites. A circular for final registration will be sent in spring 2007 to all who have pre-registered.

Organizing Committee:

Carol Glenister, Conference Co-chair; ANBP Board; ASTM Subcommittee E35.30 Chair, IPM Labs, Inc., USA
Simon Grenier, Conference Co-chair; IOBC AMRQC Co-chair; INRA, France
Jean-Louis Schwartz, Conference Host, BioControl Network Leader, University of Montreal, Canada
Karel Bolckmans, Koppert, The Netherlands
Jacques Brodeur, Canada Research Chair in Biocontrol, Université de Montréal
Patrick De Clercq, AMRQC Co-convenor, Ghent University, Belgium
Marshall Johnson, IOBC NRS President, University of California, USA
Norman Leppla, AMRQC Co-convenor, University of Florida, USA
Joop van Lenteren, IOBC Global President, Wageningen University, The Netherlands
Shimon Steinberg, Bio-Bee, Israel
Douglas Streett, Supervisory Research Entomol., USDA ARS Bio. Control Res. Unit, USA
Richard Ward, Association of Natural Bio-control Producers, President, BioBest, Canada

Insect Rearing Workshop on Principles and Procedures for Rearing Quality Insects sponsored by the Mississippi State University, 21-26 October 2007, Mississippi, USA.

In 2000, the Department of Entomology and Plant Pathology at Mississippi State University (MSU) initiated formal education for those who rear insects under laboratory conditions. The idea of such formal education was conceived by USDA/ARS and MSU researchers who had spent many years rearing insects professionally. Not only did they recognize a need for insect rearing education in this country; but based on their extensive international travels, they recognized a global need for such education. Thus, an intensive five-day workshop titled Principles and Procedures for Rearing Quality Insects designed to cover all the important areas of laboratory rearing was born.

The first Insect Rearing Workshop was held in the fall of 2000. Attendance was limited to 24 students primarily to allow hands-on laboratories as part of the educational experience. Because the demand for the workshop was so great, a second workshop was scheduled that same fall. The 9th workshop was completed in October 2006.

Overview of the fall 2007 Workshop: The next Insect Rearing Workshop will be held 21-26 October 2007. It will begin on Sunday afternoon and continue through noon on Friday. The programme will consist of a series of lectures delivered by the following instructors:

Dr. Michael Caprio (Mississippi State University) Genetics
Dr. Louela Castrillo (Cornell University-USDA/ARS) Diseases & Contamination
Dr. Muhammad Chaudry (USDA/ARS) Diets
Dr. Frank Davis (USDA/ARS, retired) Rearing Systems
Dr. William Fisher (BASF) Insectary Design & Mngmt
Dr. Norman Leppla (University of Florida) Quality Control
Dr. John Reinecke (USDA/ARS, retired) Safety
Dr. John Schneider (Mississippi State University) Environmental Biology

This team of experts includes several who have more than 30 years experience in rearing a wide range of insect species. While presentations contain pertinent basic scientific information, instructors are encouraged to stress the applied side of rearing because problem solving is essential to successful rearing. On occasion, special presentations will be given by invited speakers (e.g. air filtration as a means of managing harmful microbes). To enhance the oral presentations, each student will receive a manual or book containing the lectures presented, plus pertinent scientific reprints.

Three laboratories will be held. Two are hands-on labs dealing with insectary pathology. The first of the pathology labs is microbiology-oriented and covers identification of various disease agents. The second pathology lab deals with methodologies to solve disease and contamination problems. The third lab session is computer-based and concerned with the development and utilization of a computer model for assisting in the management of insect production.

During the workshop, tours will be made of MSU's Insect Rearing Center and a local USDA/ARS rearing laboratory to observe their rearing systems for various insect species including facilities, equipment, supplies, and standard operating procedures.

For further information, contact Frank Davis, Insect Rearing Workshop Coordinator, by e-mail (fdavis@entomology.msstate.edu) or by phone [(662) 325-2983].

3rd European Meeting of the IOBC/WPRS Working Group on Integrated Protection of Olive Crops, 10-12 October 2007, Bragança, Portugal.

The International Organization for Biological Control of Noxious Animals and Plants (IOBC), West Palaearctic Regional Section (WPRS) will be organising the 3rd European Meeting of the IOBC/WPRS Working Group: Integrated Protection of Olive Crops in Bragança, in the north-east of Portugal, from 10 to 12 of October 2007. The meeting is aimed at updating the knowledge of pests, diseases and weeds of olive groves. The main topics of the meeting are:

- Biology, ecology and behaviour of arthropods associated to the olive grove
- Population detection and assessment of pests and their natural enemies
- Monitoring systems: attractants and traps
- Integrated control strategies
- Biological and biotechnical control methods
- Chemical control: efficacy, selectivity, resistance and side effects
- New problems in integrated pest, disease and weed management of olive crops
- Spatial and data analysis of pests and diseases
- Pathogens (viruses, bacteria, phytoplasma, and fungi) of olive grove
- Epidemiology of olive diseases
- New strategies in olive diseases control
- Diagnosis and certification

The meeting will include oral presentations and poster sessions. Proceedings of the meeting will be published in the IOBC/WPRS Bulletin.

The registration fee (220 € before 15 July 2007, 270 € after 15 July) includes programme and abstracts, conference bag, coffee breaks, three lunches, technical visits, transportation from hotels to meeting place and Gala dinner. Deadline for registration: 30 August 2007. All this information and more on: www.esa.ipb.pt/olive2007

Fruit Fly Pests of the World Posters — Available now in Spanish and Portuguese.

The two posters set – Fruit Fly Pests of the World 1 and 2, which was first produced in English in 2002, is now available in Spanish and Portuguese. The Joint FAO/IAEA Programme has provided funding and technical input to assist Scientific Advisory Services Pty Ltd of Australia to produce these posters. Regina Sugayama and Walther Enkerlin kindly provided the Portuguese and Spanish translations for the poster text.

A number of new photographs of adult flies have been included on the new versions of the posters where better quality photographs have been obtained. *Bactrocera invadens* a species fast becoming important throughout Africa has been added to the posters which include 64 economically important species.

The two posters are intended to provide a pictorial guide to fruit fly pests for use by quarantine officials and to increase awareness among the travelling public of the potential risks of moving fruit pests in infested fruit. Information provided for each species includes a photograph of the adult (generally a live adult), lures used for monitoring purposes, major hosts and a map showing the

world distribution.

The posters can be obtained by contacting Scientific Advisory Services info@saspl.com.au.

Source: Richard Piper. Scientific Advisory Services PTY Ltd. Queensland, Australia.

Dr. Thomas J. Henneberry, Research Entomologist and Center Director for the Arid Land Agricultural Research Center, has retired.

Our congratulations to Dr. Thomas J. Henneberry, Research Entomologist and Center Director for the Arid Land Agricultural Research Center, who has retired on 3 January 2007 after more than 55 years service in the Federal Government.

Dr. Henneberry was born in 1929 in Milford, Massachusetts. He attended local grade and high schools and received a B.S. Degree in Entomology at the University of

Massachusetts in 1951. He received his M.S. and Ph.D. Degrees in Entomology at the University of Maryland in 1956 and 1960. He began his career in 1951 in the U.S. Dept of Agriculture, Bureau of Entomology and Plant Quarantine, Orlando, FL working on mosquito, mite and tick control research. In 1953, he entered the U.S. Army and served in the Chemical Corps as a Biological Research Assistant at Dugway Proving Ground, UT doing microbiology research. He returned to ARS as a Research Entomologist in 1955 doing ornamental insect and vegetable research in Beltsville until 1963. He continued his vegetable insect research as Investigations Leader at Riverside, CA until 1966. When he returned to Beltsville as Assistant Branch Chief for the Fruit and Vegetable Insect Research Branch and became Branch Chief of the Ornamental, Vegetable and Specialty Crops Research Branch in 1969. In 1972, he became the Area Director for the Northern Arizona Area, Phoenix, AZ and served as an Agricultural Administrator for multidiscipline research on cotton, soil and water, and rangeland programmes. He became Laboratory Director and Research Leader of the Western Cotton Research Laboratory, Phoenix, AZ in 1974. He was appointed to the Senior Executive Service in 1989 and in 2005 he was appointed to the Senior Scientific Research Service. In February, 2006 he became the Center Director for the Arid Land Agricultural Research Center, Maricopa, AZ. Research areas at the Center support sustainable agricultural crop production systems, protect natural resources, and support rural communities in arid and semi-arid regions through interdisciplinary research.

Dr. Henneberry's research contributed to efficient management of bollworms, sweetpotato whitefly, glassy-winged sharpshooter and other insects. He provided entomological leadership and expertise for environmentally-acceptable, multi-discipline approaches to pest management. Dr. Henneberry has published more than 500 scientific articles. He has received numerous awards and recognition throughout his career, including induction into the ARS Hall of Fame in 1998, two Presidential Meritorious Awards and the National Cotton Council's Miles Recognition Award for outstanding contribution to the cotton industry.

We all wish Dr. Henneberry and his family well in his retirement.

Information provided by Marla J. Lawrence, USDA-ARS, Arid Land Agricultural Research Center, 21881 North Cardon Lane, Maricopa, AZ 85239, Phone: (520) 316-6313, Fax (520) 316-6329, email: mlawrence@wcrl.ars.usda.gov

Dr. Walther Enkerlin: New Technical Director of NAPPO.

Walther Enkerlin, who has been a staff member of the Insect Pest Control Subprogramme since March 2000, has ended his seven year term at the IAEA, and is becoming the new Technical Director of the North American Plant Protection Organization (NAPPO) as of July 2007. We would like to thank Walther for his dedication and his excellent contribution to the Subprogramme, and we wish him much success in his new position. Walther can be reached by email at wenkerlin@inspection.gc.ca. Below is an excerpt of the NAPPO Newsletter of March 2007.

NAPPO Newsletter Page 1

NAPPO New Technical Director

Walther Enkerlin was born in Monterrey, Mexico. He finished his Bachelor Degree in Agronomy Engineering in 1983 and in 1987 a Masters Degree in Plant Protection, both at the Antonio Technological Institute of Monterrey (ITESM).

In 1987, he finished a PhD at Imperial College in England, in Applied Entomology. He worked for the Plant Protection General Directorate (DGSV) of the Government of Mexico from 1983 to 1985, from 1987 to 1994 and from 1997 to 1999, and for the Joint FAO/IAEA Program of the International Atomic Energy Agency (IAEA) from March 2000 to June 2007. His professional experience included managing the Moscamed Program and coordinating the Mexican National Fruit Fly Campaign; entomology courses to import corn comes using area-wide IPM in FAO and IAEA Member States in Africa, Asia, Europe and the Americas; participation in Technical Panels of the International Plant Protection Convention (IPPC) of the FAO, as well as a brief participation with NAPPO, developing regional and international fruit fly phytosanitary standards and treatment papers. He was Head of the Medfly Development Department of the Moscamed Program and has acted as Scientific Secretary of cooperative research projects for the FAO/IAEA Joint Programme. He has been trainer in classes in biometrics and various training courses, seminars and symposiums. He has been consultant for IAEA, FAO, USDA/APHIS and the OIRSA of the governments of Mexico. He is author and co-author of 81 peer reviewed papers, book chapters and reports. Walther has coordinated research in area-wide integrated pest management as well as in economic and regulatory aspects of pest control. Walther will begin his position with NAPPO in July 2007.

List of Publications of the Insect Pest Control Subprogramme

Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture

Title	Year	Type of Publication	Reference number (ISBN/ISSN)	Price (Euros)
EASTMED A Proposal for Medfly Control or Eradication with the Sterile Insect Technique	1995	Non-serial publication	STI/PUB/982	free*
Economic Evaluation of Damage Caused by, and Methods of Control of, the Mediterranean Fruit Fly in the Maghreb	1995	IAEA-TECDOC-830	ISSN 1011-4289	€15
Standardization of Medfly Trapping for use in Sterile Insect Technique Programmes	1996	IAEA-TECDOC-883	ISSN 1011-4289	€15
A Farewell to TSETSE	1996	Video Available in English PAL format in Cassette		free*
Evaluation of Genetically Altered Medflies for Use in Sterile Insect Technique Programmes	1997	Proceedings of Symposium	92-0-103897-6	€29
Control of the Mediterranean Fruit Fly in the Near East Region Using the Sterile Insect Technique	1997	Non-serial publication	STI/PUB/1020	free*
Genetic Engineering Technology for the Improvement of the Sterile Insect Technique	1998	IAEA-TECDOC-993	ISSN 1011-4289	€15
Development of Female Medfly Attractant Systems for Trapping and Sterility Assessment	1999	IAEA-TECDOC-1099	ISSN 1011-4289	€15
The South American Fruit Fly, *Anastrepha fraterculus* (Wied.), advances in Artificial Rearing, Taxonomic Status and Biological Studies	1999	IAEA-TECDOC-1064	ISSN 1011-4289	€15
Proceedings: Area-Wide Control of Fruit Flies and Other Insect Pests. International Conference on Area-Wide Control of Insect Pests, and the 5th International Symposium on Fruit Flies of Economic Importance, 28 May-5 June 1998, Penang, Malaysia.	2000	Published by Penerbit Universiti Sains Malaysia, Pulau Pinang, Malaysia	ISBN 983-861-195-6	free*
Evaluation of Lepidoptera population suppression by radiation induced sterility	2002	IAEA-TECDOC-1283	ISSN 1011-4289	€15
Proceedings of an FAO/IAEA Research Coordination Project on Medfly Mating. Florida Entomologist. March 2002, Vol. 85, No. 1.	2002	Special issue in Scientific Journal	ISSN 0015-4040	free*
The Sterile Insect Technique An Environment-Friendly Method of Insect Pest Suppression and Eradication	2002	Video – CD (English, Spanish and French - (NTSC and PAL format)		free*
Trapping Guideline for Area-Wide Fruit Fly Programmes	2003	Non-serial publication (English and Spanish versions)	IAEA/FAO-TG/FFP	free*

Improved Attractants for Enhancing Tsetse Fly Suppression	2003	IAEA-TECDOC-1064	ISBN 92-0-110403-0	€15
Automation for Tsetse Mass Rearing for Use in Sterile Insect Technique Programmes	2003	IAEA-TECDOC-1353	ISBN 92-0-104303-1	€15
Biology, History, Threat, Surveillance, and Control of the Cactus Moth, *Cactoblastis cactorum*	2004	Non-serial publication	ISBN 92-0-108304-1	€30
The Cactus Moth, *Cactoblastis cactorum*: An Economic, Social and Ecological Threat	2005	Video Available in English NTSC format in Cassette and CD		free*
Environmental Benefits of Medfly SIT in Madeira and Their Inclusion in a Cost-benefit Analysis	2005	IAEA-TEC-DOC-1475	ISBN 92-0-110505-3	€15
Status and Risk Assessment of the Use of Transgenic Arthropods in Plant Protection	2006	IAEA-TEC-DOC-1483	ISBN 92-0-113005-8	€15
Designing and Implementing a Geographical Information System. A Guide for Managers of Area-wide Pest Management Programmes.	2006	Non-serial publication Printed by the IAEA		free*
Guidance for Packing, Shipping, Holding and Release of Sterile Flies In Area-Wide Fruit Fly Control Programmes	2007 (in press)	Printed by the FAO		free*
Using GPS Instruments and GIS Techniques in Data Management for Insect Pest Control Programs	2006	Tutorial CD produced by Atrava Development Co. for FAO/IAEA		free*
Proceedings of an FAO/IAEA Coordinated Research Project on Quality Assurance of Mass-Reared and Released Fruit Flies for use in SIT Programs	2007	Florida Entomologist, Volume 90, no. 1, pp. 1-179.		free available on http://www.fcla.edu/FlaEnt/
Cost-benefit Analysis Model: A Tool for Area-wide Fruit Fly Management	2007	CD		free*

* For free copies of the publications, please contact the Insect Pest Control Subprogramme, Joint FAO/IAEA Programme of Nuclear Techniques in Food and Agriculture, IAEA (http://www-naweb.iaea.org/nafa/index.html).

For further information on priced-IAEA publications please contact *sales.publications@iaea.org* or visit the website *http://www.iaea.org/books*

Peer-Reviewed Publications

In Press

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

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

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

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

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