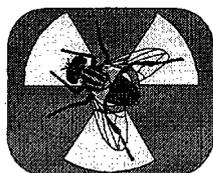




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INIS-XA--322



Insect and Pest Control Newsletter



JOINT FAO/IAEA DIVISION OF NUCLEAR TECHNIQUES IN FOOD AND AGRICULTURE
AND FAO/IAEA AGRICULTURE AND BIOTECHNOLOGY LABORATORY, SEIBERSDORF
INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA

No. 50
October 1997

VIENNA, AUSTRIA

ISSN 1011-274X

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A. TO THE READER

Letter from the Section Head

The last year has again been a very intense and interesting period for the Insect and Pest Control Sub-programme of the Joint FAO/IAEA Division. It has been a hectic time for all of us since the last Newsletter in March, 1996. Many exciting things have happened and outstanding results have been obtained in many projects. The apparent eradication of tsetse fly from Zanzibar is particularly noteworthy, with nearly a year now since the last capture of a wild fly. This is the first time that tsetse SIT (Sterile Insect Technique) was done on an area-wide scale with sterile flies being released by air. The excellent results obtained have proven that eradication of tsetse by integrating SIT with conventional suppression methods, is technically feasible and effective. With the cost of sterile flies continuing to decrease as a result of continuous improvements in rearing and release, this technology will soon be ready for application with other species and over larger areas on the African mainland.

We also report on the completion of new sterile insect rearing factories in Guatemala and Madeira, and the shift to mass production of genetic sexing strains in several Mediterranean fruit fly mass production facilities. In this issue of the Newsletter we report also on other important events and programmes in which we have been directly or indirectly involved.

From the feed-back we received from many

of you, this Newsletter is the best way for you to keep up with what is happening in the field of SIT and related area-wide programmes. In the future there will also be a new way to keep up with our activities. The Joint Division is joining the internet and is presently developing a home page which will also include a calendar of events of the Insect and Pest Control sub-programme. This will be an additional way to stay current with information on upcoming events, such as symposia, training courses, and research co-ordination meetings.

Our staff has been relatively stable in the last year with only few leaving or joining the Insect and Pest Control Sub-programme. There is a new secretary, Ms. Maria Eugenia Guerra Garduño, who has many years of experience working for the Joint FAO/IAEA Division. Also Mr. Pat Gomes has joined the staff at the Section's office as Eastern Mediterranean Regional Officer. To learn a little about his background please see the last section of this newsletter. Gerado Ortiz, our Latin America Regional Officer returned to Mexico in July 1997, after more than three years providing very competent and dedicated support to fruit fly SIT programmes in the region. We will miss him very much! Fortunately he will continue for some time providing backstopping to these projects from Mexico. Mr. David Nadel, an ex-staff member ended a one-year consultancy at Seibersdorf, where he provided support in developing systems to upscale and partially automate tsetse mass rearing. Mr. Carlos Caceres, a Junior Professional Officer who worked in Seibersdorf on medfly genetics and successfully developed inversions in medfly sexing strains, returned to Guatemala to head the recently privatized

new mass rearing facility at El Pino. We wish them all success and good fortune in their new positions.

I would like to call your attention to the upcoming FAO/IAEA International Conference on "Area-Wide Control of Insect Pests Integrating the Sterile Insect and Related Nuclear and Other Techniques", which we are organizing for next year in Penang, Malaysia. The last such event, held in Vienna in 1992, was attended by 83 participants from 36 countries. The 1998 International Conference will be held from 28 May to 2 June in conjunction with the 5th International Symposium of Fruit Flies of Economic Importance, which will also be held at the same location in Penang from 1-5 June 1998. Hopefully this will allow many of you to combine attendance at both events. We hope you will be able to take advantage of this opportunity.

Finally, I would like to take this opportunity, on behalf of myself and all the staff of the Sub-programme, to thank those of you who are involved in one way or another in SIT- related R&D and action programmes, for your collaboration and hard work. With the public becoming increasingly interested in more environment-friendly pest control alternatives, we are certainly looking forward to an exciting and promising future for SIT-related activities.

Jorge Hendrichs

Present Staff

The Sub-programme staff, consisting of those in the Joint FAO/IAEA Division located in the Vienna International Centre, and those in the FAO/IAEA Agricultural and Biotechnology Laboratory in Seibersdorf Laboratory, are listed below with their nationality and the year they joined.

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Medfly Behavior Studies

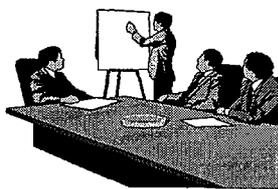
Field experts on project URT/5/016 "Eradication of Tsetse Fly on Zanzibar Island":

Arnold Dyck (Canada) 1994

Project Director

Mark Vreysen (Belgium) 1991

Andrew Parker (UK) 1993



B. FORTHCOMING EVENTS

I. Research Co-ordination Meetings (RCM)

"Medfly Mating Behavior Studies Under Field Cage Conditions", September, 1997, Tel Aviv, Israel. 3rd RCM

"Evaluation of Population Suppression by Irradiated Lepidoptera and their Progeny", May 1998, Penang, Malaysia. 3rd RCM

"Improved Attractants for Enhancing the Efficiency of Tsetse Fly Suppression Operations and Barrier Systems used in Tsetse Control/Eradication Campaigns", May 1998, Penang, Malaysia. 2nd RCM

"Development of Medfly Attractant Systems for Trapping and Sterility Assessment", June 1988, Penang, Malaysia. 3rd RCM

"Enhancement of the Sterile Male Technique Through Genetic Transformation Using Nuclear Techniques", June 1988, Penang, Malaysia. 2nd RCM

"Genetics Application to Improve the SIT for Tsetse Control/Eradication including Population Genetics", January 1999, Vienna, Austria. 2nd RCM.

II. FAO/IAEA Training Courses

National Training Course on "Basic Training on Integrated New World Screwworm (NWS) Control/Eradication

with Emphasis on the Sterile Insect Technique (SIT)", Kingston, Jamaica, 6-27 August, 1997.

Bi-National Chile-Peru Training Course on "Quarantine Procedures and Treatments in Support of the Mediterranean Fruit Fly Eradication Campaign in Tacna and Moquegua, Peru", Lima, Peru, 24-26 September, 1997.

Regional Training Course on the "Use of SIT in Support of Integrated Area-wide Methods to Combat Tsetse and Trypanosomiasis", Zanzibar, Tanzania, Africa - November-December, 1997.

Regional Latin American Training Course on the "Use of the Sterile Insect Technique in Support of Area-Wide Integrated Fruit Fly Control/Eradication Programmes", Tapachula, Mexico and Guatemala City, Guatemala, October, 1997.

Regional Training Course on "Use of SIT and Related Methods for the integrated Area-wide Fruit Fly Control/Eradication in the Near East and the Mediterranean Basin", Madeira, Portugal, November, 1997.

National Training Course on "Integrated Area-wide Control of Fruit Flies", Pattaya, Thailand, June 1998.

Interregional Training on the "Use of the Sterile Insect and Related Techniques for the Area-Wide Management of Insect Pests", Gainesville, Florida, October 1998.

Application Procedure: Nominations should be submitted on the standard IAEA nomination forms for regional and inter-regional training courses. Completed forms should be endorsed by, and returned through the official Government channels established. They have to be received three

months before the respective course. Nominations received after the three month deadlines or applications sent directly by individuals cannot be considered. It is suggested that advance information of the nominations be submitted by fax to enable preliminary evaluations of the candidates.

III. 5th International Symposium on Fruit Flies of Economic Importance to be held in June 1998 in Penang, Malaysia

The first announcement for this symposium to be held in Penang, Malaysia, **1-5 June 1998** has been made by the University Sains Malaysia in conjunction with the international community of fruit fly workers (*see internet =*

<http://www.bio.usm.my/bio/fruitfly>
as well as

<http://www.bio.usm.my/bio/fruitfly/1announ.htm>).

The 1st (1982) and 2nd (1986) International Symposia were held in Europe and the 3rd (1990) in Latin America. The 4th International Symposium, held 1994 in Clearwater, Florida, was very successful, attracting ca. 300 fruit fly workers from over 45 countries. This 5th symposium will be the first International Fruit Fly Symposium to be held in Asia. Penang is a center of academic, research and control activities for fruit flies in Malaysia and therefore provides an excellent background for the meeting. The response to the initial announcement has been very positive. The symposium will be held at the Penang Park Royal Hotel of Batu Ferringhi Beach on the Straits of Malacca. This hotel is large enough to facilitate communications and interactions of the participants as has been the tradition in the past. The international community of fruit fly workers has traditionally been very strong and we encourage all fruit fly workers to continue

with this tradition by participating in the symposium. There will be limited funds to support the attendance of some participants from developing countries. Please contact Patrick Gomes (at P.J.Gomes@iaea.org), Chairman of the International Steering Committee for the 5th Symposium for more details.

IV. FAO/IAEA International Conference on "Area-Wide Control of Insect Pests, Integrating the Sterile Insect Technique and Related Nuclear and Other Techniques" to be held from 28 May - June 2 in Penang Malaysia

In view of the excellent response to the area-wide symposium held in Florence during the International Congress of Entomology, the Joint FAO/IAEA Division will organize an International Conference on this topic from 28 May - 2 June in Penang, Malaysia. It will address the area wide management of insect pests in general, as well as new developments and techniques in the fields of SIT, F-1 sterility, genetics, biotechnology, mass rearing, ecology and behavior, augmentative biological control, quarantine, etc. The International Conference will be held in conjunction with the above International Fruit Fly Symposium (28 May - 2 June at the same location and site) to strengthen the attendance to both international meetings. There will be limited funds to support the attendance of participants from developing countries. For more information on the International Conference please contact **J o r g e H e n d r i c h s** (at J.Hendrichs@iaea.org).



C. PAST EVENTS (1996-1997)

Research Co-ordination Meetings (RCM)

"Medfly Mating Behavior Studies Under Field Cage Conditions", 19-23 February 1996, Tapachula, Chiapas, Mexico. 2nd RCM.

"A Molecular and Genetic Approach to Develop Sexing Strains for Field Applications in Fruit Fly SIT Programmes", 18-22 March 1996, Mendoza, Argentina. 1st RCM.

"Evaluation of Population Suppression by Irradiated Lepidoptera and their Progeny", 2-6 September 1996, Vienna, Austria. 2nd RCM.

"Improved Attractants for Enhancing the Efficiency of Tsetse Fly Suppression Operations and Barrier Systems used in Tsetse Control/Eradication Campaigns", 23-27 September 1996, Nairobi, Kenya. 1st RCM.

"Enhancement of the Sterile Male Technique Through Genetic Transformation Using Nuclear Techniques", 30 September - 4 October, 1996, Vienna, Austria. First RCM.

"Development of Female Medfly Attractant Systems for Trapping and fertility Assessment", 20-24 January 1997, Madeira, Portugal. 2nd RCM.

"Automation in Tsetse Mass-rearing for Use in Sterile Insect Technique Programmes", 27 February- 4 March 1997, Tanga, Tanzania. 2nd RCM.

"Genetic Applications to Improve the Sterile Insect Technique for Tsetse Control/Eradication Including Genetic Sexing", 10-14 February 1997, Addis Ababa, Ethiopia. 1st RCM.

"Molecular and Genetic Approach to Develop Sexing Strains for Field Applications in Fruit Fly Sterile Insect Technique Programmes", July, 1997, Guatemala City, Guatemala. 2nd RCM.

Proceedings are available on request at the Insect & Pest Control Section's Office.

II. Consultants Meetings

"Economic, Strategical and Operational Considerations on the Use of Medfly Genetic Sexing Strains in SIT Programmes". 22-26 March 1996, Mendoza, Argentina.

"Potential Practical Applications of Genetic Engineering and Molecular Biology to Aid Genetic Control of Insect Pests". 30 September- 2 October, 1996, Vienna, Austria.

"Use of Nuclear Techniques in Biological Control: Managing Pests, Facilitating Trade and Protecting the Environment". April 14-18, 1997, Vienna, Austria.

"International Standardization of Quality Control Procedures and Parameters for Mass Reared and Released Fruit Flies", 5-9 May, 1997, Vienna, Austria.

Proceedings are available on request at the Insect & Pest Control Section's Office.

III. FAO/IAEA Training Courses

National Training Course on "Medfly Eradication Procedures and the Use of SIT in the Patagonia Region", Rio Negro, Argentina, March 1996.

Interregional Training Course on the "Use of the Sterile Insect and Related Techniques for the Area-Wide Management of Insect Pests", Gainesville, Florida, USA, 8 May-June, 1996.

National Training Course on "Methyl Bromide Fumigation Technology for Quarantine Treatments Against Fruit Flies", Concordia Entre Rios, Argentina, February, 1997.

National Workshop in conjunction with SENASA on "Advances in Research Support for the National Fruit Fly Programme", Buenos Aires, Argentina, 27-29 May, 1997.

Workshop in conjunction with SENASA on "Area-Wide Integrated Control of Fruit Flies in the Litoral Citrus Region", Concordia, Entre Rios, Argentina, 23-25 June 1997.

IV. Area-Wide Internal Pest Management (IPM) Symposium at XX International Congress of Entomology, Florence, Italy, August, 1996

A symposium on "Area-Wide Integrated Pest Management" was organized by the Joint FAO/IAEA Division at the XX International Congress of Entomology, held in Florence, Italy during August, 1996. The response to this symposium was very good, with more speakers and topics available than the time assigned for the symposium. Papers presented included the area wide integrated management

campaigns against screwworm, bollweevil, codling moth, fruit flies, corn rootworm, cotton bollworm, tobacco budworm, pink bollworm, cassava mealybug, silverleaf whitefly and tsetse flies. These area-wide campaigns integrated many different technologies including in some cases SIT and F-1 sterility, as well as augmentative releases of natural enemies, etc. This symposium, which showed that the effectiveness of pest control increases drastically when applied on an area-wide basis (at a local, regional or transboundary level), was an opportunity to highlight this approach to an international audience. Most IPM underestimates insect movement and is applied on a field by field or orchard by orchard level, with no coordination of control actions with neighbors.

V. International Workshop on "The South American Fruit Fly: Advances in Artificial Rearing, Taxonomic Status and Biological Studies", November 1-2, 1996, Viña del Mar, Chile

This workshop on the South American fruit fly, *Anastrepha fraterculus* (Wied), was organized by the Joint FAO/IAEA Division with the support of the Agriculture Service (SAG) of Chile. The objectives of the event were to assemble scientists and plant protection experts from throughout the American continent working on this fruit fly or other related *Anastrepha* species in order to analyse, discuss and exchange information on the present knowledge of this pest and to promote integration and coordination among participants to joint efforts oriented to improve control techniques. Analysis focused on the potential use of the Sterile Insect Technique as well as other biological and integrated pest management methods of control. The main issues discussed were: species status,

advances in rearing on artificial diets, biological and ecological studies and current control methods of *Anastrepha fraterculus*. The workshop was attended by 67 professionals from 11 countries of the American continent. The event was a great success due to the high number of participants. It was concluded that the South American fruit fly is a very important pest in this region of the continent and that more attention should be given to this pest by plant protection agencies, research institutes and international organizations in order to strengthen coordinated research and methods development activities to improve the control techniques. The proceedings of this meeting are currently being edited and will be printed in late 1997. They will be available upon request.



D. TECHNICAL CO-OPERATION PROJECTS

Over the last four years, the Section has had technical responsibility for over 35 technical co-operation projects. They fall under four major areas, namely:

- Tsetse
- Fruit Flies
- F-1 Sterility for the Control of Lepidopteran Pests
- Screwworm and Others

Current Operational Projects are:

- ARG/5/005 Fruit Fly Eradication in the South Region
- *BGD/5/016 Insect Pest Management by Genetic Manipulation
- *CHI/5/015 Mediterranean Fruit Fly Eradication
- ETH/5/012 Integrating SIT for Tsetse Eradication
- GRE/5/01 Control of the Mediterranean Fruit Fly in Crete
- GUA/5/013 Genetic Sexing to Control the Medfly
- IRQ/5/014 Field Monitoring and Laboratory Rearing of Old World Screwworm
- ISR/5/009 Feasibility Study of SIT for Medfly Eradication
- JOR/5/007 Feasibility of Areawide Control of Medfly by SIT
- KEN/5/020 Control of Tsetse Fly & Trypanosomiasis in Lambwe Valley
- LEB/5/013 Feasibility of Integrated Control of Medfly Using SIT
- MAR/5/009 Control of Diamondback Moth by Sterile Insect Technique
- MLI/5/012 Integrated Tsetse Control
- *PAK/5/032 Control of Pink Bollworm to Improve Cotton Production
- **PAN/5/012 Control of Fruit Fly in the Chiriqui Province Using SIT
- *PHI/5/022 Feasibility Study of Integrated Control of Fruit Flies
- PHI/5/026 Integrated Control of Oriental Fruit Fly on Guimaras Island
- POR/5/005 Mediterranean Fruit Fly Programme on Madeira
- RAF/5/040 SIT for Tsetse and Trypanosomiasis Management in Africa
- RLA/5/039 Binational Project Chile-Peru: Eradication of the Fruit Fly
- SAF/5/002 Feasibility Assessment for Fruit Fly Eradication Using SIT
- SYR/5/016 Preparation for Codling Moth

Management Using SIT

*THA/5/038 Integrated Control of Fruit Flies

THA/5/044 Extension of Areas Under Integrated Fruit Fly Control

UGA/5/018 Integrated Tsetse Control in Buvuma Island on Lake Victoria

URT/5/016 Tsetse Fly Eradication

*ZAM/5/009 Tsetse Fly Control

ZIM/5/007 SIT for Tsetse Control Programmes

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Projects in process of being phased-out or terminated

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Projects awaiting funding from extra budgetary sources

In keeping with our policy to highlight a few of our Technical Co-operation projects in each Newsletter the following projects are discussed in this issue.

Joint Jordan-Israel Medfly Project.

A joint Jordan-Israel Mediterranean Fruit Fly project is being initiated in the isolated Arava Valley that lies between the State of Israel and the Hashemite Kingdom of Jordan. During 1997, the IAEA is providing US\$113,000 to Israel as part of a Technical Co-operation Project. The Government of Israel and local producers are also contributing approximately US\$500,000. The USA is contributing another \$110,000 for Jordan in 1997. The objective is to complete eradication of the pest using sterile flies procured from other rearing facilities and the establishment of fruit fly free areas within the Arava Valley. This would drastically reduce pesticide applications and enable these countries to export host fruit and vegetables from the Arava without post-harvest

treatments.

Present efforts focus on the pilot SIT release project in the Arava Valley, and if successful, will be expanded to Gaza and Southern Israel, and in the future to all of Israel, the Palestinian Authority and Jordan. Medfly eradication from the region could provide producers and consumers with many benefits including significantly reduced production and control costs of at least 1/3 per year as well as reduce the use of pesticide which is approximately 194 tons per year. Crop yields would also increase as would the potential to produce a greater variety of high quality Medfly host commodities.

Medfly Project on Madeira

In October 1996, the President of the Autonomous Region of Madeira, accompanied by representatives of the European Union and the IAEA formally opened the Mediterranean fruit fly facility in Madeira which has a capacity of producing ca. 50 million sterile males per week. The purpose of this Madeira-Med Project is to establish a permanent field programme to control the Mediterranean fruit fly in the Madeira and Porto Santo Islands, using the Sterile Insect Technique and other phytosanitary activities, in order to improve the production and quality of fruits and vegetables.

The Regional Government has been promoting the growing of exotic subtropical fruit. This expansion of fruit production in Madeira is, however, seriously affected by the high populations of the Mediterranean fruit fly, the only fruit fly species on Madeira. This pest causes annual losses in Madeira of more than \$3.5 million US dollars. Controlling this pest through the application of

insecticides alone is becoming increasingly difficult due to tourism and other environmental concerns. Consequently, Madeira plans to implement the SIT in order to control the medfly populations in an environment-friendly way. This is a control or suppression programme and not an eradication programme.

Portugal is implementing the programme to operate the first mass-rearing facility in the Mediterranean region. The European Union is contributing \$5-6 million and the Agency, under a four-year project (POR/5/005) has provided the technology transfer and technical backstopping for the mass-rearing facility and specialized rearing equipment. It has also assisted with planning and organizing the field monitoring and control and release activities, as well as training the professional staff for mass-rearing of sterile flies, quality control, maintenance and field operations, etc. This has been done and the factory is now operational. The mass-rearing facility, was designed to produce a "male-only" genetic sexing strain, and the "tsl" (temperature sensitive lethal) strain has been selected and is under production.

Releases of sterile males have been made for several months in 2 tests areas. All the releases have been made from the ground but aerial releases in a pilot area will begin by October 1997. Sometime during early 1999, the medfly should be drastically reduced in all target areas of the island through the application of cultural control and SIT. With the establishment of a sustainable phytosanitary control programme, an effective detection system and a timely contingency plan to suppress the hot spots, medfly should be controlled permanently below economic thresholds of damage from the above dates on.

Mediterranean Fruit Fly Eradicated From Chile

As reported in the last Newsletter, the Mediterranean fruit fly project in Chile achieved the eradication of this pest from the country, with benefits to the economy estimated at US\$ 500 million per year. By eradicating fruit flies, especially the medfly, and by accomplishing the international certification process of fruit fly eradication, Chile has gained the phytosanitary status of "fruit fly free country" increasing access for its large fresh fruit industry to Asian markets and other countries that are medfly free.

In 1997 a new binational Chile-Peru project (RLA/5/039) has been initiated, in conjunction with IICA, to support a Chile-financed project, with the objective to enlarge the eradication area to fruit-producing valleys in southern Peru. Medflies are still reared in the Arica production facility and about half are released along the northern border to ensure that the medfly does not re-invade from adjacent Peru. The remaining flies are released in the Tacna valley in southern Peru in an effort to eradicate the population there and in the future also in the neighboring valley of Moquegua.

II. MODEL PROJECTS:

Tsetse Eradication on Zanzibar

On January 1, 1994, this model project was initiated using funds from Belgium, Canada, Sweden, the UK, the USA, and IAEA in which sterile tsetse fly males were to be released on Unguja Island, the main island of Zanzibar in the United Republic of Tanzania. Only one species, *G. austeni*, was present on the island. The Tsetse

Eradication Programme progressed slowly at first because of production and logistical problems but over time these were solved and now we are happy to report that a wild fly has not been found in ca. 11 months. We believe that eradication is essentially complete but releases will continue until at least the end of 1997 to ensure eradication.

All releases of sterile flies were made by air after August, 1994 to ensure good dispersal over the target area. Before July 1996 all releases were confined to the southern 1/3 of Zanzibar (heaviest infested area) but since that date the entire Island has been under release. Production of flies started at less than 20,000 per week in the early months of the programme but has reached over 100,000 sterile males per week. The staff of the Tanga mass rearing facility has truly done a remarkable job in rearing insects for this project. They can feel a great deal of accomplishment based on the apparent success of the programme.

The incidence of trypanosomiasis transmission among 37 sentinel herds has also virtually been zero for over 10 months based on the MHCT/DG-BCT parasite detection technique. The island of Unguja comprises 1600 km² and is 86 km at its longest and 35 km at its widest point. Up to 80% of some herds were infested with trypanosomes before the programme. Therefore this has been a good test of SIT for tsetse and no claim of unfavorable weather can be made for the apparent eradication. The ratio of sterile males to fertile wild males in the field in the last 18 months has ranged over 60:1 to infinite now since wild flies have not been captured. After releases of sterile males are discontinued in December 1997 the situation will be followed by a year of continuous monitoring. A "blue ribbon panel" will be formed to review the

situation and to determine the final criteria for a declaration of eradication. This has been a remarkable project and is the first apparent sustainable eradication of a tsetse population.

In connection with the Zanzibar programme, at the invitation of the Commissioner of Research and Training, Tanzania, the Special Program for African Agricultural Research (SPAAR) Secretariat staff participated in an IDA (World Bank)-led mission to review progress in the implementation of the National Agricultural and Livestock Research Project (NALRP). This mission stated that they were impressed by the work of the Tsetse Research Institute (TTRI) in Tanga. They further stated that the "TTRI had managed to assemble a colony of nearly a million tsetse flies for its research and control programmes. It has succeeded in virtual eradication of the tsetse fly population in Unguja Island, in Zanzibar". Congratulations Tanga and Zanzibar!

Mr. Khalfan Saleh has been selected to present a paper on the Zanzibar eradication programme at the 24th Meeting of the Scientific Council for Trypanosomiasis Research and Control (ISCTRC) to be held 29 September to 3 October, 1997 in Maputo, Mozambique. Congratulations Mr. Saleh.

2. Fruit Fly Eradication in the South Region of Argentina

In 1994, this Model Project (ARG/5/005) and in 1995 the FAO funded TCP/ARG/4452 were started with the aim of supporting national efforts oriented at eradicating the Mediterranean fruit fly from the Patagonia and Cuyo regions in southern and western Argentina. The purpose is to create "Fruit Fly Free Zones" and to

strengthen the phytosanitary and quality aspects of fruit and vegetable production. The assistance requested by Argentina under this project has been oriented towards strengthening local infrastructure and technical and managerial aspects of the medfly eradication sub-programmes in the cited regions. Specifically the project has provided technical assistance to achieve the best understanding of the area-wide concept in pest management in order that staff can apply the SIT in the most efficient manner.

The programme in Cuyo (Mendoza and San Juan Provinces) region is one of the largest eradication programmes in the world to be directed at control/eradication of the medfly. By mid 1995 the programme had achieved excellent results in eradicating the pest from approximately 250,000 hectares within the Province. During the 1995-96 campaign, due to financial problems, sterile insect releases were discontinued in the second half of 1995 in Argentina, resulting in the re-invasion of the pest in freed areas. A total of 880 million sterile medflies were then released over 300,000 hectares of Mendoza Province during the period January to May, 1996, but this was not enough to suppress the pest. The campaign had clearly started too late in the season and did not cover enough area to be effective.

In 1996, the Argentine institutions involved in the project followed the technical protocols and implemented the area-wide strategies as planned, as well as solving some of the financial problems. During 1996-97 the project activities were upgraded and the timely release of sterile flies was carried out. A total of 2820 million flies were released over 400,000 hectares of cultivated land. This was an increase of 3 fold compared with the previous season. Monitoring and detection

included the installation and weekly servicing of 4456 medfly traps and the technical and operational indexes obtained were higher than the international standards, except in the case of pupae weights.

By the end of the 96-97 season, the pest had been suppressed by over 99% compared to 1996 in the four valleys of Mendoza province, totalling about 500,000 hectares. This important achievement in suppressing medfly populations to extremely low levels should allow its eradication during the 1997-98 season, provided quarantine activities are strengthened, no further financial crisis develops and sterile fly production and release are done continuously with no stop in production during the winter.

One of the most important accomplishments of this programme was the success of the Mendoza fly production facility in changing from the usual bi-sexual strains of medfly to the genetic sexing strain that is based on pupal color. The new "color strain" is proving to be more effective under field conditions and will be the only strain released from the Mendoza facility during the coming season. Technical assistance is being provided by the staff of the Seibersdorf Laboratory in an effort to support the technology transfer to the Mendoza facility.

3. Tsetse Project in Ethiopia

Based on the success in Zanzibar a new Model Project has been started in Ethiopia. Tsetse transmitted animal trypanosomiasis is one of the most important livestock development problems in Ethiopia. Estimates of the tsetse-infested land mass in Ethiopia range between 100,000 and 150,000 km² and a total of about 10 million cattle are under threat by tsetse and

trypanosomosis. It is estimated that the livelihood of some 5 million people is directly or indirectly negatively affected by the presence of the tsetse fly and the disease it transmits to livestock. This programme will be a 10 year effort that will eventually cover an area of 25,000 km² in the Southern Rift Valley. The SIT is envisaged to supplement on-going efforts in Ethiopia on tsetse and trypanosomosis management, using an area-wide eradication approach against the resident fly species in the Rift Valley, *G. pallidipes*, (apparently the only species of tsetse in the area). The area appears to be isolated by high altitude and dry climate from other tsetse belts in the country. Any risk zones of possible re-infestation will be identified and, if necessary, taken care of by adherence to basic quarantine procedures. It is envisaged to start with a pilot zone of 5,100 km² during the first 5 years and, during the second five year period, to cover the remaining area of the valley in two 10,000 km² blocks.

Tsetse fly and trypanosomosis surveys covering the entire prospective eradication area will start before the initiation and expansion of fly suppression activities. The project has 2 main implementation components: (i) establishment of a sterile insect production plant for provision and dispersal of sterile tsetse; this component will be centrally located and operated and (ii) the actual field operation of the fly eradication process which will be implemented on a district level. A major part of the work in the field is planned to be undertaken by the target community with technical supervision and back stopping from programme staff. The total expenditure of this long term project is estimated now at US\$ 43.8 million. The project is in the planning stages now as many changes will be made as additional

data and information are obtained.

A Technical Contract has been awarded to Drs. Knight and J. Mumford (Imperial College of Science and Technology, Ascot, UK) for the development of a decision support model on the feasibility of using the Sterile Insect Technique as a component of integrated areawide tsetse control/eradication in tsetse affected areas. Given specific conditions in any tsetse affected Member State (input parameters to the model), it is expected that the economic feasibility of an SIT component (as part of an integrated tsetse/trypanosomosis intervention effort) can be more easily assessed. Furthermore, shortcomings for specific control/eradication scenarios will be identified and serve as guidance for methods selection in field operations and for identification of priorities in research and methods development.



E. EXISTING AND PLANNED CO-ORDINATED RESEARCH PROJECTS

Enhancement of the Sterile Insect Technique (SIT) through Genetic Transformation Using Nuclear Techniques (D4. 10.12)

Objective: To support and encourage research to discover and develop efficient genetic transformation systems for major insect pests, and make the sterile insect method more reliable, more suitable and less costly.

Expected duration: 5 years (1995-1999)

Contract Holders (1) from Greece

Agreement Holders (6) from Australia, United Kingdom, United States (2) and Italy (2).

A Molecular and Genetic Approach to Develop Sexing Strains for Field Application in Fruit Fly SIT Programmes (D4.10.15)

Objectives: (1) To optimize existing medfly strains in their genetic composition, productivity and application; (2) to advance the development of third generation strains using nuclear and molecular methods, and (3) to initiate the development of sexing systems in other fruit flies. The first objective will address the economic and operational consideration of large-scale use of the best strains available, the optimal procedures to maximize their productivity and efficiency, the potential for deploying them under different field conditions and geographical locations, and the isolation and evaluation of improved sexing genes. The second objective will incorporate molecular and biotechnology approaches into the development of genetic sexing strains. Current sexing strains are based entirely on classical genetic principles, and are, therefore, much more limited in their possibilities for manipulating the insect genome. The third objective will address the considerable interest generated in developing similar genetic sexing systems for other important fruit fly pests, particularly *Anastrepha* species in Latin America, and *Bactrocera* species in Southeast Asia. At present, genetic, cytogenetic and molecular information on these other species lags considerably behind

that of the medfly.

Expected duration: 5 years (1994-99)

Contract Holders (6) from Argentina, Bangladesh, Brazil, Greece, Guatemala, Philippines and United States of America.

Agreement Holders (3) from Australia, Italy and the United States.

Automation in Tsetse Fly Mass-rearing for Use in Sterile Insect Technique Programme (D4.20.06)

Objective: To improve and up-grade tsetse mass-rearing by the development and utilization of automation and other methods. Emphasis will be placed on automation of moving materials, such as the blood used to feed tsetse flies, the pupae produced by tsetse flies and the male tsetse flies which are introduced into cages with females and then removed when mating has been completed. In addition, the automation of separating male from female tsetse flies may be possible, provided one of more methods of determining the sex of tsetse fly pupae can be developed.

Expected duration: 5 years (1995-00)

Contract Holders: (5) from Austria (2), Czech Republic, Burkina Faso, Tanzania and Nigeria.

Improved Attractants for Enhancing the Efficiency of Tsetse Fly Suppression Operations and Barrier Systems Used in Tsetse Control/Eradication Campaigns (D4.20.08)

Objective: To improve the efficiency of

pre-SIT-release fly population suppression operations and entomological monitoring of the target tsetse fly species by developing better visual and odor attractants. This will reduce the time and amount of materials required to suppress a tsetse population to densities that permit the initiation of the SIT. Currently, pre-release population suppression of *G. austeni* involves more than 80 insecticide-impregnated targets per km² for more than 18 months, whereas good attractants available for other tsetse species require only 4 to 8 targets per km² for a period of 3 to 6 months. Moreover, reliable entomological data can be collected with less labor and investment. Thus, it will be possible to assess the progress of vector control or eradication operations, including the SIT, more easily and more accurately.

Expected duration: 5 years (1994-99)

Contract Holders (5) from Mali, Burkina Faso, Kenya and Hungary.

Agreement Holders (3) from the United Kingdom, the United States and Switzerland.

Evaluation of Population Suppression by Irradiated Lepidoptera and their Progeny (D4.10.11)

Objective: To carry out field releases of moths given sub-sterilizing doses of radiation and to assess their impact in suppressing target pests in combination of augmentative releases of natural enemies. This requires baseline data on field populations. Special attention has been paid to field behavior of released moths, as well as the development of techniques to assess the impact of the released moths and their progeny in suppressing the native population.

Expected duration: 5 years (1992-98)

Contact Holders: (20) from Bangladesh, Brazil, Bulgaria, People's Republic of China (2), Cuba, Czech Republic, India, Indonesia, Iran, Malaysia, Mauritius, Pakistan, Philippines, Romania, Russian Federation, Syria, Tunisia, and Vietnam (2).

Agreement Holders (1) from the United States of America

Development of Female Medfly Attractant Systems for Trapping and Sterility Assessment (D4.10.13)

Objective: To develop a trapping system for female medflies which will be used in practical SIT programmes using a genetic sexing strain, i.e. where only sterile males are released.

A second objective is to develop a female trap from which eggs of wild females can be obtained to estimate sterility which has been induced into the wild medfly population.

Expected duration: 5 years (1993-98)

Contract Holders (13) from Argentina, Costa Rica, Greece, Guatemala, Honduras, Mauritius, Mexico, Morocco, South Africa, Spain, Turkey, United States and Portugal.

Agreement Holders (1) from the United Kingdom

Medfly Mating Behavior Studies under

Field Cage Conditions (D4.10.14)

Objective: To conduct research to develop standard reproducible tests of medfly mating behavior under field cage conditions. Once developed, the validity of these tests will be confirmed by a series of specifically designed tests to be conducted at different locations under different conditions. Once the test has been standardized and confirmed, it is anticipated that the test will be incorporated into the standard medfly quality control tests currently being used throughout the world. The field test will be backed up by detailed video recording of medfly courtship mating behaviors, and the subsequent analysis of the observations utilizing computer software. Thus, when completed, the test will be fairly simple and straightforward to utilize and the results can be quantified.

Expected duration: 5 years (1993 - 98)

Contract Holders (8) from Argentina, Costa Rica, Greece, Guatemala, Israel, Mexico, Reunion and Kenya.

Agreement Holders (1) from the United States.

Genetic Applications to Improve the SIT for Tsetse Control/Eradication Including Genetic Sexing (D4.20.06)

Objectives: To obtain information for a better understanding of the phylogenetic relationships between different tsetse species, subspecies and strains, and of heritable traits that can be subjected to selection pressure. This knowledge is of particular importance during the planning and the operational stages of area-wide control/eradication campaigns. Data on genetic variation within a target population

and information on the gene flow between neighboring tsetse fly populations will have implications for planning and implementation of control campaigns. The possible development of resistance (physiological or behavioral), based on the selection of particular genotypes, will interact with and influence the type of control measure chosen and its mode of application. A second objective is to acquire knowledge on all factors, genetic and microbial, which modulate tsetse-trypanosome interaction. Knowledge of these factors could enable trypanosome refractoriness to be introduced into a target population or a mass-reared tsetse strain. A third objective is to develop tsetse strains that are more suitable for mass-rearing and release in tsetse control/eradication campaigns. Particular emphasis is laid on the development of an automated sexing method for immature fly stages (genetic sexing), and on other genetic or related techniques that foster an efficient large-scale application of the SIT. This also includes research directed at a trans-taxon use of laboratory-reared sterile flies for tsetse and trypanosomiasis control or eradication activities.

Expected duration: 5 years (1997-02)

Contract Holders (3) from Greece, Kenya and Italy.

Agreement Holders (5) from Greece, Kenya and Belgium, Canada, United States, Italy

The following Co-ordinated Research Programmes are scheduled to be initiated

in 1998 or 1999 and we encourage applications for participation:

Evaluating the Use of Nuclear Techniques for the Colonization and Production of Natural Enemies

Objective: The proposed CRP has the objective of evaluating the use of nuclear techniques in improving the production, shipping and deployment of biological control agents to manage pests, facilitate trade and protect the environment. Considerable technological advances have been made in mass-rearing of parasitoids and predators for augmentative biological control. This large scale availability of natural enemies of key insect pests opens the way for totally biological systems of pest control, where mass releases of natural enemies can suppress pest densities in the field and so act synergistically with sterile fly releases to control wild fly populations within the context of area-wide integrated pest management programmes. Nuclear techniques can also play an important role in the production of natural enemies, as recent research has shown that parasitization rates are increased in irradiated host larvae. They also can avoid the escape of prey or unparasitized adult pest insects and artificial diets for mass-rearing of natural enemies can be decontaminated using irradiation. (See one page summary of Consultants Report in this Newsletter as a guide for preparation of research proposals).

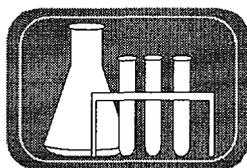
Expected duration: 5 years (1998-03)

Quality Assurance of Mass Produced and Released Fruit Flies

Objective: To improve and standardize internationally quality control procedures for mass produced fruit flies. There are

now over ten fruit fly mass rearing facilities in the world that produce sterile flies for SIT programmes. With international trade in sterile insects becoming a reality, it is important that producers and users apply standard international quality control procedures. A CRP involving all parties involved, will allow fine-tuning and updating internationally accepted standards and procedures. A Consultants Group Meeting on the International Standardization of Quality Control Procedures for Mass Reared and Released Fruit Flies was held in May 1997 in Vienna. It recommended implementing this CRP to address those technical issues that could not be resolved and therefore require a coordinated R&D approach.

Expected duration: 5 years (1999-04)



F. DEVELOPMENTS AT THE ENTOMOLOGY LABORATORY, SEIBERSDORF

Medfly

Provision of Genetic Sexing Strains

During the last half of 1996, genetic sexing strains were re-supplied to mass-rearing facilities in Guatemala and Argentina for use in operational programmes. The strains were successfully colonized and are producing the numbers of males required for release. Initial field data from both programmes are very encouraging. Following a six-month training at

Seibersdorf by the Medfly Rearing Manager from the Arica facility, Chile, colonies of three different genetic sexing strains are now being reared at the Arica plant. The *tsl* (temperature sensitive lethal) genetic sexing strain has also successfully been introduced into the new Madeira, Portugal facility. A back-crossing programme is now being carried out in Seibersdorf with Madeira field material from the target population to prepare a backup *tsl* strain for this programme.

Development of a Filter System to Maximize the Integrity of Genetic Sexing Strains

Experience over the last two years has indicated, as expected, that a slow build up of recombinants occurs during large scale mass-rearing of these strains, and a "filter system" has been developed in order to counteract this. The filter, in essence, provides "recombinant free" material as needed for the colony. The system has been introduced into Guatemala, Argentina and Madeira and is being fine tuned in Seibersdorf. In view of its benefits to maintain a strain stress-free, it should eventually be put in place in all production facilities, independent of whether bisexual or genetic sexing strains are being reared.

Induction of Inversions to Eliminate Recombinants in Genetic Sexing Strains

Inversions can be used in genetic sexing strains to eliminate the survival of recombinants and hence improve strain stability. From the five putative inversion lines that were initially isolated in the first half of 1996 following a large radiation experiment, two have been cytologically confirmed. The inversions, isolated at Seibersdorf by the current manager of the Guatemala facility, are the first two inversions that have been isolated in medfly despite repeated attempts in various laboratories, and it represents a major step

onward in the improvement of genetic sexing strains.

Genetic Transformation

The results of the first series of injections using a *Hermes* vector did not produce any transgenic individuals. A total of 2,479 eggs were injected and 205 F-1 progeny screened, and no transformants could be identified. It is not clear why the experiment failed, considering that studies in 1995 clearly demonstrated that this vector exhibited a high mobility in the medfly background. Material from this experiment is still being analyzed and based on these results, a new set of experiments will be carried out in 1997.

Analysis of Mating Behavior

Mating compatibility studies on field-caged host trees using wild flies from Madeira, Guatemala, Kenya, Israel and Peru, as well as different genetic sexing strains have so far identified no major barriers to interpopulation mating. Compatibility studies with medflies from Australia, Argentina and South Africa are in preparation. So far, no dramatic differences have been observed between wild-type strains from different origins. This augurs well for the widespread application of genetic sexing or bisexual strains without necessarily having to back-cross strains to the target population.

Tsetse

Evaluation of the Tsetse Production Unit (TPU)

Extensive work has been carried out on the evaluation of this unit, which moves mechanically fly cages to the blood feeding membrane. Initial adult mortality was very high. Continuous movement of the cages with flies on the machine was identified as the major cause of the mortality. The flies

are now only moved during the feeding cycle. Flies from each generation are kept separately to monitor adaptation to the new rearing process and F3 flies are now being reared. Despite the improvement in adult survival, pupal production is still unsatisfactory and the TPU colony has still to be supplemented from the standard colony. Attention is now being focused on the improvement of cage design and size.

Development of Self-Stocking Production Cages

At present all cages, including those on the TPU, are stocked by hand following chilling with a known number and sex of flies. This procedure will have to be eliminated in future large scale rearing. A system based on the weight of pupae has now been developed and tested. The system looks very promising and will be further evaluated in Tanga as well as Seibersdorf. There is some confidence that this system will indeed replace the chilling procedure.

Colony Maintenance and Supply of Flies

G. pallidipes field material from Ethiopia is now being received on a regular basis in order to establish a large *in vitro* fed colony. A small colony has now been established using membrane feeding; the flies feed and mate satisfactorily and are producing pupae of the required quality and quantity. The speed of the build up of this colony will now largely depend on an increased supply of flies from Ethiopia. During the last half of 1996, shipments of *G. austeni* to Tanga were discontinued as the colony there had reached the required size. The increased productivity of the colony in Tanga was due partly to the technical improvements developed at Seibersdorf. The Seibersdorf *G. austeni* colony was reduced in size and is now maintained at a level to provide experimental material for automation

development.

DNA analysis of G. pallidipes from Ethiopia

During a two month consultancy in the laboratory (A. Cockburn, USDA, Gainesville), a start was made on the analysis of *G. pallidipes* field material from Ethiopia, as well as laboratory colonies of *G. pallidipes* from Uganda and Zimbabwe. Very few differences were found at the DNA level between the laboratory colonies suggesting that there might have been some cross-contamination of the colonies. This will be confirmed in later studies carried out in Gainesville. A DNA analysis of the Ethiopian flies showed characteristic variation and this type of analysis will be used to determine the population structure of the *G. pallidipes* in the target area.



G. SPECIAL NEWS AND REPORTS

Inauguration of the New Moscamed Factory in Guatemala

The Moscamed Programme in Guatemala (Joint-Guatemala/Mexico/USA/Commission) inaugurated its new production facility at El Pino in June 1996. This facility was largely built from the sale of sterile medflies to the California medfly SIT program. The facility has four modules, each with the capacity to rear 250 million sterile medflies per week or other insects. The Moscamed programme produces both the genetically sexed *ts1* (temperature sensitive lethal) strain developed by the FAO/IAEA at the Seibersdorf Laboratory, and the standard

bisexual strain. It continues delivering sterile flies for the preventive medfly SIT programme in the Los Angeles Basin, as well as the sterile fly barrier along the border with Mexico and Guatemala. Recently it has initiated sending sterile flies to Florida in support of the medfly eradication programme around Tampa. The California SIT programme (1994-96) was successful in eradicating medfly, and since then in the implementation of the Preventive SIT Release Programme (July 1996), in preventing the establishment of new infestations in the Los Angeles Basin.

Old and New World Screwworm Flies

A lot of things have been happening with screwworms in the last year. This includes both the Old World (OWS) and New World (NWS) species. Following an emergency request by Iraq, the FAO and the IAEA sent a joint mission to Baghdad in order to assess the problem of OWS fly in the country and advise on action to be taken. A large number of OWS cases have been found throughout central and southern Iraq, causing significant problems for the livestock industry. Training will be provided for several scientists at screwworm research/eradication sites in Mexico, Nicaragua and Malaysia to help Iraq learn to deal with the situation. Quarantine to protect OWS free countries and direct treatment are the only alternatives at this time but SIT may be considered for the future. The OWS has been reported from several different countries in the region, including some areas in Iran and along the Persian Gulf.

All of this OWS activity comes at a time when the Australian Government, under an agreement with the Government of Malaysia, has completed the construction of a OWS fly rearing facility on the Institute Haiwan, near Kluang, Malaysia. It

is part of the Australian's OWS fly preparedness programme. The official opening ceremony took place on 28 April 1997. The factory has a capacity of 10 million flies per week and will initiate production for pilot tests in late 1997.

With the NWS eradication campaign being close to achieving eradication in Nicaragua, and having initiated sterile fly releases in Costa Rica, collaboration between FAO and IAEA on control/eradication of the NWS in the Caribbean is being intensified for the benefit of affected Member States in the region. Jamaica, Cuba and Hispaniola (Haiti and Dominican Republic) remain NWS infected, representing a threat to the livestock industries of the USA, Mexico and most of Central America. Preparations are under way to initiate an eradication programme in Jamaica to assess the situation in Cuba, the Dominican Republic and Haiti. Since the technology is completely developed and the large NWS facility in Tuxtla, Mexico is due to close around the year 2001, this is a good time for the Mexico-US Commission on NWS to work with the FAO and IAEA toward the goal of freeing the Caribbean of NWS.

More on the North Africa New World Screwworm Eradication Programme

As you may know, a number of critics have stated that weather and not SIT was the cause of the successful eradication campaign conducted in 1990-91 in Libya. Drs. Krafur and Lindquist have recently published a paper in which they analyze the effects of weather in the Libya NWS eradication programme. Their paper was published in the Journal of Medical Entomology, vol. 33:877-87, 1996 and utilized weather data collected from Libya as well as historical data from Texas and the Southwestern United States. They concluded that based on the reordered

temperatures, no kill of NWS pupae or adults was likely as a result of temperatures in the winter of 1990-91. Evidence of NWS overwintering in the same winter was also demonstrated by the detection of a natural infestation after winter in April and numerous captures of adult females in February, March and April. Earlier, similar ideas were advanced about eradication in Florida after 1958 and in the Southwestern US after the eradication in 1966. These ideas have no scientific basis after all the subsequent successful NWS eradication programmes in the tropics of Mexico and Central America. This paper now confirms that we can also be sure that these ideas are not scientifically supported for the Libyan SIT programme. Reprints of the paper are available upon request.

Patrick J. Gomes Joins Staff

Pat joined the Insect and Pest Control Section in September 1996 and is backstopping SIT projects in the Eastern Mediterranean. He brings with him a wealth of technical and managerial experience gained by working in plant pest control and eradication programmes within the United States, Mexico, Central America and South America. He also served as an expert for FAO in Brazil and the Joint FAO/IAEA in Morocco. As a former USDA employee for over 20 years, he served as a plant protection officer, plant pest identifier, national survey coordinator, co-director of the Mexico/US Cooperative Medfly programme in Mexico, Assistant Area Director of Plant Health Programmes in Central America and Area Director of Plant Pest Programmes in Northwestern Mexico including the Sonora pest free area. He has a strong background in preparing environmental assessments, economic benefit/cost analysis, pest risk analysis and programme planning. He now serves as the Chairman of the Steering

Committee for the 5th International Fruit Fly Symposium that will be held in Penang, Malaysia 1-5 June 1998. Pat will focus his efforts on implementation of proposed subregional SIT projects aimed at control of the Medfly in the Eastern Mediterranean. Technical Co-operation Projects are underway in Israel, Jordan, Lebanon, Syria and Crete.

H. PUBLICATIONS

Special items (1995-1997)

Control of the Mediterranean Fruit Fly in the Near East Region Using the Sterile Insect Technique.

Subregional Proposals to Eradicate the Medfly and Establish Fruit Fly Free Areas in Cyprus, Egypt, Israel, Jordan, Lebanon, The Syrian Arab Republic and The Territories Under The Jurisdiction Of The Palestinian Authority. Document based on a FAO/IAEA Experts Meeting. STI/PUB/1020, IAEA Vienna (1997).

Tanzanian Tsetse Brief, Newsletter No. 4 (1996)

Standardization of Medfly Trapping for use in Sterile Insect Techniqe Programmes. Final Report. IAEA-TECDOC-883, Vienna (1996)

Economic Evaluation of Damage Caused by, and methods of control of, the Mediterranean Fruit Fly in the Maghreb.

An analysis covering three options, including the sterile insect technique. Report of an expert group organized by the IAEA and FAO. IAEA-TECDOC-830, IAEA, Vienna (1995).

French version: IAEA-TECDOC-830/F, Vienna (1995)

Proceedings of Consultant and Advisory Group Meetings

The Potential of the Sterile Insect Technique and Other Genetic Methods for Control of Malaria-Transmitting Mosquitoes. Consultants' Meeting, Vienna, 29 July - 2 August, 1996. IAEA, Vienna (1996).

Manuals and Booklets

Required Quality Control Tests, Quality Specifications, and Shipping Procedures for Mass-Produced Tephritid Fruit Flies for Sterile Insect Control Programmes. (in preparation)

Publications in Scientific Journals and Conference Proceedings (1996-1997)

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Insect and Pest Control Newsletter Joint FAO/IAEA Division
of Nuclear Techniques in Food and Agriculture
International Atomic Energy Agency
Wagramerstrasse 5, P.O. Box 100
A-1400 Vienna, Austria

Printed by the IAEA in Austria