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

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No. 55 July 2000

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ISSN 1011-274X

A. TO THE READER

Letter from the Section Head

It is with great sadness that I inform you of the death of Dr. Edward F. Knipling, who died March 17 at his home in Arlington, Virginia, from cancer at the age of 91. His funeral on March 23 at the Internment National Memorial Park in his native Texas, took place in the presence of his 5 children, 14 grand children, nine great-grandchildren and numerous friends and colleagues. His wife of 66 years, Phoebe Hall Knipling, died in 1998.

For many of us, Dr. Knipling and his outstanding achievements have been a great example and inspiration. His amazing and visionary career was largely dedicated to developing and applying pesticide-free ways to protect livestock and crops from the devastating effects of insects. The work that the entomology group at the Joint FAO/IAEA Division in Vienna and at the Seibersdorf Laboratories carries out in many parts of the world is largely based on his pioneering research.

Together with his USDA colleague Raymond C. Bushland, he pioneered and implemented the Sterile Insect Technique (SIT) to suppress or eradicate insect pests. The technique resulted in the eradication of the wild screwworm population in the United States, Mexico and Central America, saving the North American livestock industry over one billion dollars annually and winning praise from many environmentalists.

Today, with increasing public concern about pesticides, the application of SIT as a replacement for insecticides is increasingly in demand. At the request of Members States of FAO and IAEA this technique is being further developed for use in many regions of the world to control or eradicate outbreaks of other pests such as various fruit fly and moth species, and recently also tsetse flies in Africa.

Dr. Knipling is also considered the "founding father" of the concept of areawide integrated pest management. This is a preventive rather than reactive approach, that takes into account insect movement and therefore addresses the pest populations not only in agricultural areas but also in the surrounding non-agricultural areas. Kept at low levels by such an areawide approach, uncoordinated chemical control by individual farmers become less necessary. Under such conditions, pest populations can often be suppressed using biological controls, integrating natural enemies and other environment-friendly methods such as mating disruption, insect attractants and SIT over broad areas to keep pest populations below the point where they impose a financial burden on farmers and ranchers.

Dr. Knipling also provided the theoretical basis for boll weevil eradication in the United States. When put into practice, the areawide approach provided the basis for this insect pest to be eradicated from millions of hectares of cotton in the eastern United States, resulting in dramatic reductions in pesticide applications.

We were fortunate to have benefited from his advice until recently. He continued writing many stimulating articles, one of which, on integrated tsetse control, just appeared in the 1999 FAO/IAEA edited book on "Animal Trypanosomosis: Vector and Disease Control Using Nuclear Techniques" (see page 24). He also wrote the foreword to the First International Conference on Areawide Insect Pest Control we organized in 1998 in Penang, Malaysia.

The following information is taken from various press releases including ones from FAO and USDA, as well as an article in the Washington Post:

Edward F. Knipling was born in Port Lavaca, Texas, where he worked on his father's farm. Dr. Knipling received a bachelor's degree in entomology from the Agricultural and Mechanical College of Texas (now Texas A & M University) in 1930 and went on to earn his Master of Science degree there, also in entomology. His Doctor of Philosophy degree in entomology was awarded by Iowa State University in 1947.

He began his career with USDA as a field aide in Mexico studying bollworms. Later, while on assignments in Iowa, Georgia and Texas, he conducted research on various pests of livestock. During World War II, he worked on developing insecticides and repellents for the military. From 1953 to 1971, he was the director of USDA's entomology division, and in 1971 he was appointed science advisor for ARS.

He retired from USDA's Agricultural Research Service in 1973 after 42 years with the Department, but continued to work with ARS as a research collaborator. In addition to being a scientist, Dr. Knipling also compiled a distinguished record as an administrator and leader in the U.S. Department of Agriculture's Agricultural Research Service.

For his numerous contributions to science and agriculture, he won praise, awards and tributes from many sources world wide including:

1966 he was selected by Princeton University for the Rockefeller Public Service Award for distinguished public service in the field of science.

1967 President Johnson awarded him the National Medal of Science, the nation's highest recognition for contributions to science.

1971 the President's Award for Distinguished Federal Civilian Service, awarded by President Nixon

1986 he was inducted into the ARS Science Hall of Fame for his research on the Sterile Insect Technique and other technologies to suppress and manage insect pests.

1991 FAO Recognition Award for Research and Leonardo da Vinci medal, presented following the successful eradication of New World screwworm from Libya.

1992 World Food Prize

1995 he was awarded the prestigious Japan Prize from the Science and Technology Foundation of Japan and was honoured at a state dinner hosted by the Emperor of Japan.

November 1999, Progressive Farmer magazine named him among 21 scientific pioneers who most shaped American agriculture in the past 100 years.

FAO's press release stated that "Dr. Knipling was not only a scientist, but also a philanthropist and a man committed to the search for solutions to the problems faced by poor farmers in the developing world". "Dr Knipling will be remembered by many FAO and other colleagues for his invaluable contribution" to the Organization. He rendered great assistance to a "countless number of rural households in developing countries who benefited from the blessings of more effective control of pests and plagues in crops and animals," underlined Louise Fresco, FAO Assistant Director-General Agriculture Department in a condolences message to the family of the late American scientist.

Jorge Hendrichs

Head, Insect Pest Control Section

B. STAFF

The Subprogramme staff, consisting of those in the Joint FAO/IAEA Division located in the Vienna International Centre, those in the FAO/IAEA Agricultural and Biotechnology Laboratory in Seibersdorf Laboratory and field experts, are listed below.

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C. FORTHCOMING EVENTS

I. Research Co-ordination Meetings (RCM)

"Enhancement of the Sterile Male Technique Through Genetic Transformation Using Nuclear Techniques", 14 - 18 August 2000, Sao Paulo, Brazil, 3rd RCM.

"Development of Improved Attractants and their Integration into SIT Fruit Fly Management Programmes", 28 August - 1 September 2000, Sao Paulo, Brazil, 1st RCM.

"Genetic Applications to Improve the SIT for Tsetse Control/Eradication including Population Genetics", Bouake, Côte d'Ivoire; March 2001, 3rd RCM

"A Molecular and Genetic Approach to Develop Sexing Strains for Field Application in Fruit Fly SIT Programmes", Sydney Australia 3-7 July 2001, Final RCM

"Evaluating the Use of Nuclear Techniques for the Colonisation and Production of Natural Enemies", Tapachula Mexico, July 2001, 2nd RCM

"Automation in Tsetse Mass-rearing for Use in Sterile Insect Technique Programmes", July 2001, Addis Ababa, Ethiopia, 4th and final RCM.

"Enabling Technologies for the Expansion of SIT for Old and New World Screwworm", Lincoln, Nebraska, September 2001 1st RCM

"Quality Assurance of Mass Produced and Released Fruit Flies", Mendoza Argentina October 2001, 2nd RCM

II. Consultants Meetings

"Development of cost effective diets for mass production of tsetse flies", 17 - 21 July 2000, IAEA, Vienna, Austria.

"Genetic Sexing and Population Genetics of Screwworm", 7 - 11 August 2000, IAEA, Vienna, Austria.

"Thematic planning for tsetse fly intervention strategies and related research", 4 - 8 September 2000, IAEA, Vienna, Austria.

"Improvement of Codling Moth SIT to Facilitate Expansion of Field Application", 30 October - 3 November 2000, Vienna, Austria.

III. FAO/IAEA Training Courses

Regional training course on Old World Screwworm, 6 - 14 June 2000, Teheran, Iran. A second course will be held in the last quarter of 2000, for details contact U. Feldmann.

WHO "First International Course on African Trypanosomoses", 23 October - 10 November 2000, IMTSSA, Le Pharo, Marseille, France. Details from and applications to Francis Lewis, IMTSSA/ASMT, 13998 Marseille Armées, France. Tel: +33 491 15 01 58, Fax: +33 491 15 01 71, E-mail: astm.louis@free.fr Details are also available on the web in English and French http://www.who.int/emc/diseases/tryp/ A limited number of places may be supported by the IAEA, applications should be sent on a standard Training Course form to the Section.

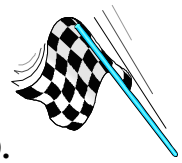
Interregional training course on "Use of the Sterile Insect and Related Techniques for the Area-Wide Management of Insect Pests", 11 April -16 May 2001, University of Florida, Gainesville, Florida, USA. The deadline for applications is the end of December 2000

IV. Other meetings

Regional Forum for Africa on Tsetse SIT, 19 - 20 June 2000, Addis Ababa, Ethiopia.

XXI International Congress of Entomology, Iguassu Falls, Brazil. 20 - 26 August 2000.

PAAT Committee meeting, 21-22 November 2000, WHO, Geneva, Switzerland.



D. PAST EVENTS (1999-2000)

I. Research Co-ordination Meetings (RCM)

"Medfly Mating Behaviour Studies Under Field Cage Conditions", 29 June - 3 July, 1999, Antigua, Guatemala. 4th and final RCM.

"Molecular and Genetic Approach to Develop Sexing Strains for Field Applications in Fruit Fly Sterile Insect Technique Programmes", 12 - 16 July 1999, Tapachula, Mexico, 3rd RCM.

"Quality Assurance of Mass Produced and Released Fruit Flies", 27 September - 1 October 1999, Vienna, Austria. 1st RCM.

"Genetics Application to Improve the SIT for Tsetse Control/Eradication including Population Genetics", 3 - 7 October 1999, Mombassa, Kenya. 2nd RCM.

"Evaluating the Use of Nuclear Techniques for the Colonisation and Production of Natural Enemies", 18 - 22 October 1999, IAEA, Vienna, Austria. 1st RCM.

"Improved Attractants for Enhancing the Efficiency of Tsetse Fly Suppression Operations and Barrier Systems used in Tsetse Control/Eradication Campaigns", 21 - 25 February 2000, Bamako, Mali. 3rd RCM.

The proceedings of these meetings are available on request at the Insect & Pest Control Section's office.

II. Consultants and Other Meetings

"Thematic Planning for Fruit Fly Control Activities", 15 - 19 November 1999, Vienna Austria. The report of this meeting is available on our web site; please follow the link at the bottom of our home page.

The proceedings of this meeting are available on request from the Insect & Pest Control Section's office.

III. FAO/IAEA Training Courses

Second Workshop on Quarantine Procedures needed for the Creation of a Fruit Fly Free Zone in Tacna and Moquegua, Moquegua, Peru, 6 - 9 April 1999

The Interregional Training Course on the "Use of the Sterile Insect and Related Techniques for the Area-Wide Management of Insect Pests", University of Florida, Gainesville, Florida, USA, 14 April - 19 May 1999. (Co-funded by the US Government, FAO and IAEA.)

IAEA/AOAD Regional Training Course on "Techniques Used for Area-Wide Control/Eradication of the Old World Screwworm Fly", Screwworm Fly Laboratory, Institut Haiwan, Malaysia, 31 May to 12 June 1999

Second National Training Course on Integrated Fruit Fly Control, November 1999, Arequipa, Peru.

FAO/IAEA Regional Training Course on "The Sterile Insect Technique as a Component for Integrated Area-wide Tsetse and Trypanosomosis Management", 20 March to 14 April 2000, Tanga, Tanzania.

IV. Other meetings

Third meeting of the Working Group on Fruit Flies of the Western Hemisphere, Guatemala City, Guatemala, July 4-9,1999 which was co-funded by the FAO.

The XIVth International Plant Protection Congress including a symposium on “The Sterile Insect Technique, Past, Present and Future”, July 25-30, 1999, Jerusalem, Israel.

International Scientific Council for Trypanosomiasis Research and Control 25th meeting, 27 September - 1 October 1999, Mombasa, Kenya.

Regional Screwworm Coordinators Meeting, October 1999, Managua, Nicaragua.

Comité de Liaison de L’Agrumiculture Méditerranéenne (CLAM) Annual Meeting, including a special conference on the “Use of SIT to Control and Eradicate the Mediterranean Fruit Fly Within the Mediterranean Region”, 13-15 October 1999, Valencia, Spain.

EU Seminar on “The Sterile Insect Technique as an Environmentally Friendly and Effective Insect Control System”, November 1999, Madeira, Portugal.

Programme Against African Animal Trypanosomosis (PAAT) Committee Meeting, 22 - 23 November 1999, Rome, Italy.

Workshop to review the Agricultural Research Service (ARS) program on exotic pests, fruit flies and quarantine, 24 - 26 January 2000, Honolulu, , Hawaii, USA.

International Screwworm Meeting, Tuxtla, Mexico, 27 - 30 March 2000.

E. 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
- Old and New World Screwworm

Current Operational Projects (1999-2000) are:

ALG/5/017 Control of the Date Moth using SIT/F-1 Sterility Principle

ETH/5/012 Integrating SIT for Tsetse Eradication

INT/5/145 Promotion and Transfer of Sterile Insect Technology

IRQ/5/014 Field Monitoring and Laboratory Rearing of Old World Screwworm

ISR/5/009 Feasibility Study of SIT for Medfly Eradication

JAM/5/006 Eradication of the New World Screwworm: Preparatory Phase

JAM/5/007 New World Screw-worm Eradication

JOR/5/007 Feasibility of Area-wide Control of Medfly by SIT

LEB/5/013 Feasibility of Integrated Control of Medfly Using SIT

MAL/5/023 Feasibility of Old World Screw-worm Control through SIT

MAR/5/009 Control of Diamondback Moth by Sterile Insect Technique

PAL/5/002 Area-wide Application of SIT for Medfly Control

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 Trypanosomosis Management in Africa

RAW/5/008 Preparing to Combat the Old World Screwworm in West Asia.

RLA/5/039 Bi-national Project Chile-Peru: Eradication of the Fruit Fly in Southern Peru

RLA/5/044 Preparing Caribbean Eradication of New World Screwworm.

SAF/5/002 Feasibility Assessment for Fruit Fly Eradication Using SIT

SLR/5/002 Feasibility Study for a Mass Rearing Insect Facility

SYR/5/019 Controlling Codling Moth for Apple Crop Using SIT.

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

TUN/5/019 Control of the Date Moth using Radiation Sterilisation.

UGA/5/021 Integrated Tsetse Control in Buvuma Island - Phase II

URT/5/018 Post Eradication Entomological and Veterinary Monitoring on Zanzibar

URT/5/019 Support to National Tsetse and Trypanosomosis Management

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

New World Screwworm Eradication (JAM/5/007)

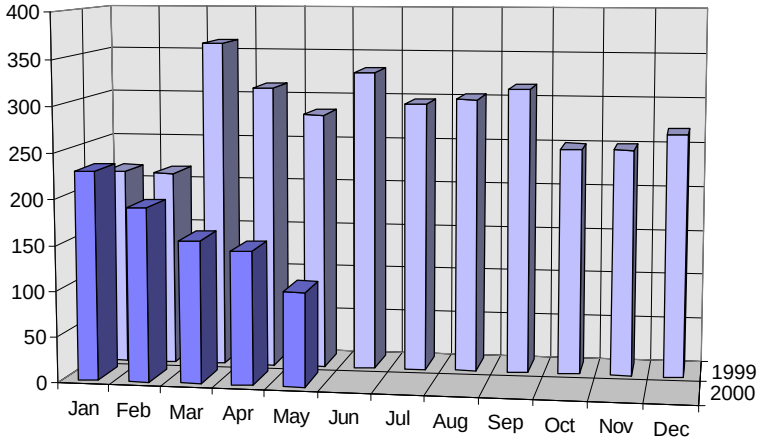
The screwworm eradication on Jamaica is proceeding well. Aerial releases have been conducted since August 1999, with 20 million sterile pupae being shipped from Tuxla

Gutierez, Mexico each week. Pupae shipments were interrupted in November and December 1999 for three weeks by industrial action at the factory, and considerable ground was lost as a result, but since then shipments have proceeded according to plan.

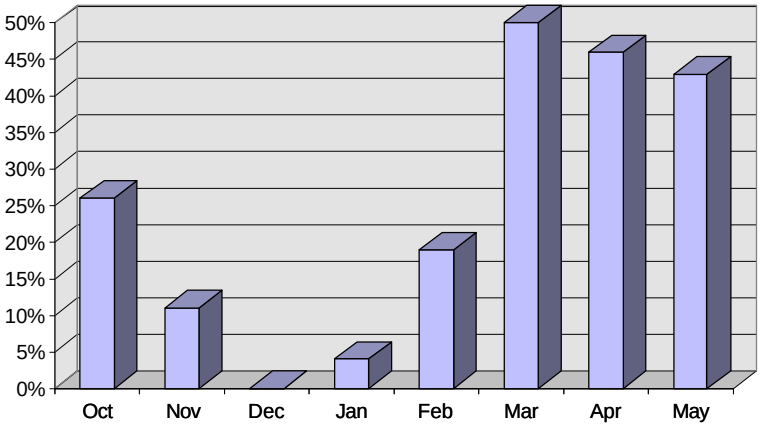
Following the initiation of releases the number of screwworm cases reported per month has fallen from around 320 to about 150. There was a slight increase in the number of case associated with the interruption to the supply of sterile pupae in December, but the numbers have fallen again since then. The effect of the interruption is much more clearly seen in the percentage of sterile egg masses collected, which fell to zero in December, but has now climbed to 45 - 50%.

During May there has been some increase in screwworm activity particularly on the North coast of Jamaica but there has also been some decrease in cases in the Southern part of the country where many extra flies have been released over the major cities. The data shown is the number of cases based on collection date (not ID date) so these numbers continually change. There is about a delay of 14 days (average) before the samples are collected in for identification.

Screwworm cases from Jamaica arranged by collection date



Percentage of sterile egg masses collected from October 1999 through May 2000



The number of cases was dropping 30 to 50 per month, but April was only 10 less than March, and the total cases for May are expected to eventually reach around 140 when all the samples have been checked, which represents a small decrease over April.

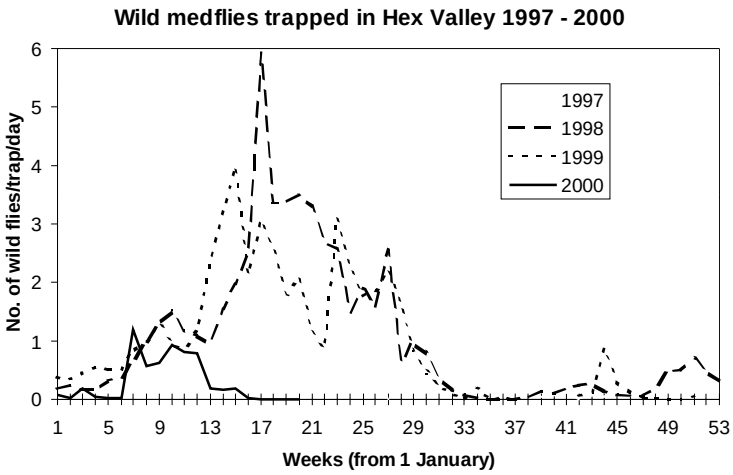
This change can be attributed to one or more of the following:

1) the start of the wet season provides more favourable conditions for the screwworm
2) insecticide for wound treatment is still not available in stores
3) survival of the insects over the week is not as good as anticipated
4) collection and submission of samples in the North has been improved

The situation will be watched very closely through June and if the case rate remains almost constant consideration will be given to the following:

a) releasing more insects (30 million/week) for about 6 weeks, or
b) delaying the emergence of some of the flies (10 million pupae) and releasing them later in the week (Friday or Saturday) or
c) getting 2 shipments of 10 million pupae each week.

The major export fruit industry in South Africa is situated in the Western Cape, where approximately 110 000 hectares of deciduous fruit, table grapes and citrus is under cultivation. The annual export turnover is approximately US$1 billion, with an estimated 73 million cartons to be exported in 2000. The Western Cape is home to two species of fruit flies of economic importance, Mediterranean fruit fly, *Ceratitis capitata*, and Natal fruit fly, *C. rosa*. Control is either by full-cover sprays or toxic bait applications of organo-phosphate insecticides. Annual costs of control and crop losses is estimated at about US$3 million.



The IAEA has been supporting a project to determine the feasibility of control or eradicating fruit flies from the Western Cape of South Africa using the sterile insect technique (Project No. SAF/5/002; 1997 to 2000). A major part of this study has been a pilot SIT project in the Hex River valley, South Africa's main table grape production area covering about 4 000 hectares. Geographically, it is well-suited to an SIT programme, being bounded by high mountains and with a relatively small town and a single trunk road running through it. A Mediterranean climate prevails in the area, with winter temperatures seldom falling below about 5°C. No quarantine controls will be established at this stage as the objective of this pilot project is to reduce rejection of table grape exports due to the detection of fruit flies in export cartons and not to reach eradication.

A 2-year coordinated trapping and baiting programme started in the valley in 1998. Trap counts showed peak populations each year between March and May (autumn). Baiting efficacy was initially compromised by regulatory requirements that the malathion content should not exceed 0.09% a.i. This is too weak to be effective. Special concessions for the Hex River valley later enabled the malathion content to be increased to 10% a.i., after which populations decreased to more acceptable levels. SAF/5/002 was later upgraded by the IAEA to a Model Project.

A pilot medfly mass rearing facility with a capacity of 8 million flies per week was commissioned at the Agricultural Research Council's Infruitec-Nietvoorbij Research Institute in Stellenbosch in April 1999, initially using the Vienna-7/97 *tsl* strain. This was later replaced with Vienna 7/Mix 99, and the first of bi-weekly, aerial sterile releases over the Hex valley started on 25 October 1999. A series of initial problems in this training facility has prevented the production and release target of 8 million steriles per week from being attained. These included insecticide contamination of the bran used in the larval diet, fungal contamination of the larval medium, equipment failure, and finally, early recombination of the *tsl* strain necessitating complete colony replacement. This necessitated supplementing local steriles with steriles imported from the El Pino facility in Guatemala.

During November and December 1999 an average of 632 000 sterile males were released per week. Since January 2000 an average of 5.3 million sterile males have been released, about 66% of the target number. IPMT traps baited with the 3-component lure have been deployed since January 2000 to detect wild females. Despite the setbacks, a measure of success has been apparent. The above graph shows how medfly populations from January 2000 have been drastically reduced compared with the previous 3 years. At the time of

writing, no wild flies have been recorded for 5 successive weeks, during a period when fruit fly populations in the valley are usually at their highest. Furthermore, rejections due to fruit fly of table grapes cartons for export have decreased from approximately 30% during the 1999 season, to 8% this season. Another encouraging sign is that more fruit from backyards in the valley is being enjoyed than previously.

Besides the IAEA's substantial financial support, the pilot project is being funded partly by the Hex valley growers (for operational costs in the valley), and partly by a unique partnership between the Infruitec-Nietvoorbij Institute and the Deciduous Fruit Producers' Trust (for the facility costs). At this stage neither the feasibility study nor the pilot project has financial support from the government.

F. EXISTING AND PLANNED CO-ORDINATED RESEARCH PROJECTS (CRP)

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

The second RCM was held in Penang, Malaysia, 26-27 May 1998, in conjunction with the FAO/IAEA International Conference on "Area-wide control of insect pests integrating the sterile insect technique and related nuclear and other techniques". The participants reviewed the current status in the field of transformation of non-drosophilid insects and recommended research strategies for the remaining period of the CRP.

Since the initiation of this CRP in 1996, dramatic advances have been made in our ability to introduce genes into insects. Specifically, there are now multiple strategies available to routinely generate transgenic insects. So far, three different mobile element systems were used successfully to transform the medfly. Participating laboratories of the current CRP are therefore now in a unique position to incorporate this technology into the SIT and they will continue to develop vectors and identify strategic gene systems for use in the SIT.

The 3rd RCM will be held in August 2000 in conjunction with the XXI International Congress of Entomology in Brazil. Furthermore, the CRP was extended into 2001 and, consequently, there will be four RCMs.

Expected duration: 6 years (1995-2001)

Contract Holders (2) from Greece and New Zealand

Agreement Holders (8) from Australia, United Kingdom, United States (3) and Italy (3).

Medfly Mating Behaviour Studies under Field Cage Conditions (D4.10.14)

The final Research Co-ordination Meeting was held from 29 June - 4 July in Antigua, Guatemala with 25 behaviourists and quality control experts participating. The peer-review and editing of final papers to be published in the Florida Entomologist is being coordinated by J. P. Cayol.

Slow motion video-recordings of the sexual behaviour of wild and/or mass-produced flies have been collected from Argentina, Costa Rica, Greece, Guatemala, Israel, Kenya, Madeira, Mexico and Reunion for centralised analysis. A quantitative analysis (still in process) has shown that no consistent qualitative difference can be found between the courtship behaviour of males from the different wild populations.

Wild female flies exerting mate choice in field cage tests with host trees have been found to be the most reliable tool available to assess mating performance and sexual compatibility of mass-reared medfly males when competing with wild males for wild females. There is clear evidence from the tests and field assessment studies that some quantitative differences in terms of mating performance and sexual activity between mass-reared and wild flies can be detected.

Among the most important outcomes of the CRP it was shown that, for the countries represented in the CRP with the exception of some populations in Kauai, Hawaii, and Madeira, Portugal, no sexual incompatibility was encountered between wild medfly populations from different geographic origins.

Duration: 5 years (1994 - 99)

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

Agreement Holders (1) from the United States.

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

The third RCM was held in Tapachula, Mexico from 12-16 July, 1999.

During the course of the CRP genetic sexing strains have been introduced into mass rearing facilities in Argentina, Guatemala, Chile, Madeira and Crete. In addition Hawaii, South Africa, Peru and Western Australia are preparing to rear genetic sexing strains. The expertise developed in the CRP has been essential in order that this technology transfer meets the needs of the customer. In other fruit fly species, progress towards the development of genetic sexing strains has been made in the areas of polytene chromosome analysis and the isolation of genetic markers. There is also an increasing emphasis on the use of molecular techniques targeted to the cloning of sex determination genes.

The CRP has been extended for a further year, and the final RCM will be held in July 2001 in Sydney, Australia.

Expected duration: 5 years (1995-2001)

Contract Holders (6) from Argentina, Bangladesh, Brazil, Greece, Guatemala, and the Philippines.

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

Genetic Applications to Improve the SIT for Tsetse Control/Eradication including Population Genetics (D4.20.05)

The second RCM was held from 3 - 7 October 1999, in Mombasa, Kenya in conjunction with the 25th OAU/STRC ISCTRC Meeting.

The CRP focuses research on the population genetics of tsetse as a tool in the management of tsetse SIT programmes, using a range of modern techniques, with emphasis on the requirements of the tsetse eradication project in the Southern Rift Valley of Ethiopia.

The 3rd RCM will be held in March 20001 in Bouake, Côte d'Ivoire.

Expected duration: 5 years (1997-02)

Contract Holders (3) from Greece, Kenya and Burkina Faso.

Agreement Holders (6) from Greece, Kenya, Belgium, Canada, United States (2) and Italy

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

Several stages in the mass production of tsetse have been addressed so far. Progress has been good in the automated stocking of production cages, where it is now possible to emerge flies under controlled conditions into production cages to give the desired female to male ratio of 4:1 with less than 0.5% females remaining in the un-emerged pupae, for *G. austeni, G. fuscipes fuscipes, G. brevipalpis* and *G. pallidipes*. The necessary conditions for other species remain to be determined. The procedure was successfully transferred to a large G. pallidipes colony. This system eliminates manual handling of adult flies for sex separation for purposes of mass rearing and release. The major requirements for the system to work are, pupae must be collected daily and incubated and emerged under carefully controlled conditions. Protocol has been distributed to the participating centres.

After emergence of the females, the remaining male pupae have to be handled. Work is now underway on controlling the emergence of these males by manipulating the holding temperature to allow synchronous emergence, and on chill holding of the adult males in preparation for release. At 15°C pupae can be stored up to 3 days without affecting the emergence rate, survival without blood and mating behaviour of males.

Work on an improved system to handle cages for feeding is progressing well (Tsetse Production Unit TPU2). A first fully automated prototype (TPU1) proved to be too complicated and a second prototype is now undergoing trials and shows good promise of reducing the effort of cage handling by approximately ten fold. The system holds 63 large cages on a single trolley that can be moved to feed all the cages simultaneously and then returned to the larval collecting unit. Prototypes of the new system have been supplied to TTRI, KETRI and Addis for field evaluation using existing cages, and the locally available tsetse species. The system has also been further modified to incorporate recommendations resulting from the recent 3rd RCM held in Vienna in April 1999. The third generation TPU 3 has been designed and constructed and is under going evaluation at Seibersdorf. The difference between this system and TPU 2 is that for TPU 3 blood is moved to the flies while the cage holding system is stationary.

Other work has looked at the handling factors affecting flight ability of irradiated males, increasing cage holding density by the use of inserts, energy saving and blood decontamination. This last is a very important factor in the running of large colonies, and the possibility of using pasteurization or UHT sterilization is being investigated.

The 4th and final RCM is scheduled for July 2001 in Addis Ababa, Ethiopia

Expected duration: 6 years (1995-01)

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

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

This CRP aims at alleviating the shortcomings in attractants for a number of important tsetse species where the standard odours used for *Glossina morsitans* and *G. pallidipes* are poor or ineffective, and in general to try to improve attractant effectiveness for a) entomological monitoring, b) tsetse population suppression and c) barrier maintenance.

The 3rd Research Co-ordination Meeting took place in Bamako, Mali, 21-25 February 2000 and was attended by 8 participants and numerous observers. In the months preceding the meeting, molecules that are stereo-isomerically related to known natural tsetse kairomones have been synthesised and tested in laboratory experiments and field trials. In addition, an effort was made to identify locally available inexpensive sources of visual and chemical attractants.

Among the odours tested in the coastal region of Kenya for *G. austeni, G. pallidipes* and *G. brevipalpis*, octyl formate and decyl formate proved attractive. Preliminary studies reveal that racemic octenol increases capture rate of *G. brevipalpis* males. Coconut oil increases capture rate of *G. austeni* and *G. pallidipes*.

Preliminary field studies placing electrified grids close to pyramidal traps on Buvuma islands, Lake Victoria, Uganda, revealed that of the synthesised attractants Decylformate and racemic octenol significantly increased the number of attracted (but not trapped) female *G. fuscipes fuscipes*. Alternative trap designs for *G. f. fuscipes* (e.g. the H-trap) will be explored in combination with different odour combinations, in order to combine increased attractiveness with higher rate of trap entry.

The antennal chemoreceptors of *Glossina brevipalpis* and *G. pallidipes* show responses to plant secondary products, as indicated by electroantennogramme assays of essential oils. Preliminary wind tunnel experiments indicate that some plant secondary products also evoke behavioural responses from tsetse.

As conventional PVC or fibreglass leg panels are expensive and heavy to carry, efforts were undertaken to develop lighter and less expensive leg panels for trapping *G. austeni.* The leg panel made from wire framework and royal blue polyethylene (1000 gauge / 150 mm)

appears to meet these requirements and holds Temoocid® (the sticky substance) for sufficiently long placement period (> three months).

Gas-chromatographic and mass-spectrometric analyses of the oxidative degradation process of methyl linoleate, a model for linoleic acid containing vegetable oils, revealed the formation of (±) 1-octen-3-ol, suggesting the use of these oils as low-cost octenol sources in field traps.

Expected duration: 5 years (1995-2001)

Contract Holders (7) from Mali, Burkina Faso, Kenya, Uganda, Tanzania and Hungary.

Agreement Holders (2) from Switzerland and the United States.

Quality Assurance of Mass Produced and Released Fruit Flies (D4.10.16)

The first Research Co-ordination Meeting, to plan and co-ordinate the research, was held 1 - 5 November 1999 in the IAEA, Vienna, Austria. Proceedings of this meeting will be available from the Section or via our web site shortly.

The objective of the CRP is to improve and standardise international 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 behaviourists, physiologists and mass rearing specialists will allow fine-tuning of the internationally accepted standards and procedures as well as developing new tests measuring more representative parameters. 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 produced an updated international manual of standard QC procedures (available for downloading from the internet at http:// www.iaea.org/ programmes/ nafa/ d4/ public/ d4_pbl_5_1.html) and recommended implementing this CRP to address those technical issues that require fine-tuning and those that could not be resolved and therefore require a co-ordinated R&D approach to develop new or better QC tests.

The 2nd RCM will be held in Mendoza, Argentina in October 2001.

Expected duration: 5 years (1999-04)

Contract Holders (12) from Argentina (2), Chile, Costa Rica, Guatemala, Israel, Lebanon, Mexico (2), Peru, Philippines and Portugal.

Agreement Holders (4) from Australia, France, Japan and the United States.

Evaluating the Use of Nuclear Techniques for the Colonisation and Production of Natural Enemies (D4.30.02)

The first Research Co-ordination Meeting, to plan and co-ordinate the research, was held 18 - 22 October 1999 in the IAEA, Vienna, Austria.

Nuclear techniques have considerable potential for various uses in biological control. These applications should provide significant benefits to producing biological control agents and for using them to manage pests, facilitate trade, and protect the environment. The First Co-ordination Meeting focused on developing a research plan for the following potential applications of nuclear techniques in biological control:

a) to provide a non-destructive means for pasteurization/ sterilization of artificial diets. Using ionizing radiation to destroy micro-organisms in artificial media provides a viable method to sterilize media without the damaging effects associated with heat treatment, and allows sterilization to be accomplished after diet dispensing and packaging ("terminal sterilization").
b) to provide non-reproductive supplemental hosts/prey for parasitoids and predator to build-up naturally occurring or augmentatively released natural enemies early in the season when pest populations

are low. Non-parasitized hosts would be sterile, even further contributing to suppress the pest population.

c) to provide sterile pests/hosts as food during commercial shipment of entomophagous insects/mites, thereby assuring quality during transport and that no new pest or pest race is introduced into the regions or countries of customers. Irradiation would also help to fulfil quarantine regulations by avoiding the transport of other hitchhiking pests.

d) to improve the suitability of natural or factitious hosts/prey for use in parasitoid/predator mass rearing, by helping for example to overcome host resistance such as encapsulation of parasitoids. Radiation of hosts during mass rearing would also avoid the emergence of fertile adults of the pest, or the need for costly procedures to separate parasitized from non-parasitized insects.

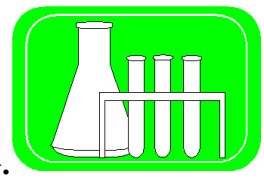
e) to reproductively sterilize exotic beneficial insects that are promising candidates for classical biological control, thus enabling safe field testing of their host or prey specificity on weeds or insect pests. In view that there are many reported cases of natural enemies becoming pests, and the fact that promising natural enemies are eventually not released because doubts persist as to their specificity after detailed assessments under quarantine conditions, safe field testing of specificity is a major use of ionizing radiation not exploited to date.

The 2nd RCM is tentatively scheduled to be held in Mexico in July 2001

Expected duration: 5 years (1999 - 04)

Contract Holders (13) from Argentina, Bangladesh, Bulgaria, China, Guatemala, India, Mexico, Pakistan, Poland, Slovak Republic, Syria and Turkey (2).

Agreement Holders (3) from Austria and the United States (2).



G. DEVELOPMENTS AT THE ENTOMOLOGY UNIT, SEIBERSDORF

TSETSE

Mass rearing design developments

New Tsetse Production Unit (TPU 3)

The first two attempts at automating tsetse production, TPU1 and TPU2 both involve the movement of cages containing flies to the stationary blood source. In TPU3, blood is moved to the flies with the cage holding system stationary. The prototype consists of 6 shelves and on each shelf 9 round cages are held together in a frame. To solve the problem of light distribution, the shelf on which the larvae drop before crawling into the pupal collector is made of transparent perspex sheets. The mobile blood feeding system is moved on a rail, raised to make contact with cages during feeding and lowered to move onto the next set of cages. A complete set has provision to feed two rows of stationary cages at a time on opposite sides of a central isle. The blood is heated by individually controlled elements in aluminium plates, instead of the rubber heating mats. The feeding trays are of the same dimensions as for TPU2, 65cm x 65cm and blood is loaded and fed to flies in the conventional way.

Evaluation of TPU3 using *G. pallidipes* Uganda strain has begun and will include mechanical evaluation as well as fly survival, fecundity and pupal QC. These biological data will be compared with data from an equivalent number of cages maintained on the standard trolley.

Field cage studies.

Field cage tests were conducted using the same cage arrangements as currently used for medfly mating behaviour. The main reason for developing the tests for tsetse flies was to improve procedures for mating behaviour studies as well as QC procedures associated with tsetse mass rearing and sterile male quality assessment. Mating behaviour parameters have traditionally been observed in 20cm Ø x 5cm H production cages or in perspex tubes 20cm Ø x 55cm H, with netting at either end. In these systems flies are restricted to a limited space and lack freedom to make choices. Initial experiments concentrated on determining if flies mate under such arrangements.

After demonstrating that tsetse flies readily mate in the field cage with potted trees, competitiveness tests have been conducted comparing mating behaviour of sterile males emerged from pupae exposed to low temperature with those from the colony. Duration of mating with colony females and mean spermathecal value (MSV) of mated females was observed.

Experimental results appear in the Annual Report, 1999, now available on our web site. In brief tsetse flies readily mate under field cage conditions and observations in the field cage open up prospects of carrying out more meaningful mating compatibility tests between laboratory reared flies and wild populations and of validating laboratory results for application in SIT programmes in a situation that allows more space to the flies. It was however, surprising that no additional cues such as odours or blood source were required. This set up will be used for the tests recommended by the recent consultant (see below).

Consultancy on field cage studies, fly handling and quality issues

Dr. David Dame spent 2 weeks (8-19 May 2000) at Seibersdorf on a consultancy to contribute towards the development of field cage studies to monitor tsetse fly quality, improved emergence procedures and handling of male flies for optimal flight ability and irradiation procedures.

During discussions, Dr. Dame suggested parameters that could be considered for QC in rearing facilities and during field observations. An additional parameter, the flight muscle determination for mass reared flies was suggested to be used as a standard QC procedure. It is now possible to relate flight muscle development with the flight ability of sterile males using the field cage.

MEDFLY

Future developments in genetic sexing strains

The current genetic sexing strains (GSS) in the medfly are based on mutations used as selectable markers and Y-autosome translocations that cause a sex-specific inheritance of this marker. Their construction required a significant knowledge in basic genetics and cytology in this species. This approach has three principle disadvantages:

1. To accumulate the amount of basic knowledge required to generate and analyse these more than 10 years of research in several labs were required. Alone the search for appropriate selectable markers took several years especially as essential genetic tools, like balancer chromosomes, were not available at that time.
2. The use of Y-autosome translocation causes 50% sterility in GSS males, i.e. half of the fertilised eggs will not develop into viable offspring. This effect can be compensated for by increasing the adult colony. However, usually only half of this lethality occurs early enough (embryo stage) to not affect quality control parameters, and therefore the economics, of mass rearing (e.g. percent emergence etc.).
3. The genetic sexing mechanisms available for medfly cannot be transferred directly to other pest species. Only the basic principle could be applied but would require the same investment (time, money) into basic research as it was required in medfly. Some lessons can be learned from the medfly experience to speed up this process but never-the-less it is to be expected that it would take a minimum of several years.

Based on these conclusions, it was proposed to use molecular strategies to construct GSS which led to the establishment of the Co-ordinated Research Project “Enhancement of the sterile insect technique through genetic transformation of arthropods using nuclear techniques”. There are two principle possibilities to approach this problem. Both have in common that a generic system could be developed that could be transferred relatively easily to other species.

1. The manipulation of the sex determination mechanism: This requires the identification, isolation and analysis of the genes involved in the sex determination hierarchy of medfly. Although homologues of several genes known to be involved in sex determination in the model organism *Drosophila* are also found in medfly, their function may not necessarily be the same (e.g. *Sxl*). This is not completely surprising as the overall mechanism to determine the sex in medfly (and other fruit flies and other pest insects, e.g. *Lucilia cuprina*) is different from *Drosophila*. In medfly the Y chromosome carries a dominant Maleness factor while in Drosophila the ratio between X chromosomes and autosomes induces the development of male or female sex. Research in several labs is ongoing to identify those medfly sex determination genes that can be manipulated in order to construct GSS. Research in Seibersdorf

focuses on the cloning of the Maleness factor using microdissected material from the respective region of the Y chromosome.

2. The use of conditional lethals: In this approach genes conferring lethality are linked to inducible and sex-specific promoter constructs. This ensures that females can be eliminated specifically for the male-only production but allows at the same time the rearing of both sexes for the mass production. Recently such an approach was shown to work efficiently in the model organism *Drosophila* (Thomas, Donnelly, Wood and Alphey, *Science* **287** (2000) 2474-2476). The challenge is now to transfer this technique from the extremely well studied model organism *Drosophila* to pest species like the medfly or ones that are even less well characterised than medfly. In addition to the genes used by Thomas *et al.*, other groups are investigating combinations of different lethal genes and promoters. Some of these tests were done in Seibersdorf and future collaborations are planned.

Additional applications for molecular techniques would be the introduction of a marker to distinguish released flies from the wild population or the induction of sterility in the released males. These approaches and the ones mentioned above depend heavily on the availability of appropriate transformation systems. Such systems and the transgene(s) they carry have to be tested whether they are applicable for the scale of mass rearing that is needed today to supply the different medfly SIT projects, i.e. approaching 2000 million males per week. This includes issues like levels of expression and stability. Seibersdorf has the required rearing capacity and will be involved in these tests.

H. SPECIAL NEWS AND REPORTS

Medfly *tsl* strain to be introduced in South America

The *tsl* (temperature sensitive lethal) genetic sexing strain will be introduced shortly in 3 mass rearing facilities in South America. In the Mendoza facility in Argentina and the Lluta facility in Arica, Chile *tsl* GSS will replace the current white pupae colour GSS and in Peru it will be used next year to start the medfly male-only mass rearing production in the recently refurbished La Molina facility in Lima.

In order to continue with the process of technology transfer to facilitate the introduction of the *tsl* GSS in February four fellows from the above three countries began 2 months *tsl* mass rearing training at the Entomology Unit medfly mass rearing laboratory. The objective of the fellowships was to train the facility mangers in all the biological and rearing characteristic of the *tsl* GSS as well as on the genetic fundamentals of sexing mechanisms and strain stability.

The Mendoza facility will have the capacity to produce a maximum of 175 million sterile male-only pupae per week when it changes to the *tsl* later this year, and the Lluta facility will reach 40 million sterile male-only pupae per week next year. La Molina will start production next year with a maximum capacity of 160 million sterile male-only pupae per week. This will bring the world wide capacity for rearing the Vienna produced *tsl* male-only medfly strain to 1100 million, 71% of total world medfly production capacity.

The four fellows are Gustavo Taret, Mendoza facility manager, Hernan Dosno Rifo, Lluta facility manager, Jaime Brabo, Lluta facility technical assistant and Daniel Alama, La Molina facility manager.

California medfly preventive release program review

The Mediterranean Fruit Fly Science Advisory Panel (MEDSAP) met in Bell, California in March 2000 to review the Mediterranean Fruit Fly Preventative Release Program (PRP), University of California at Riverside Medfly research, the joint CDFA-USDA smuggling interdiction effort in the Los Angeles area (CLAMP), and the status of repairs to the CDFA and USDA sterile Medfly rearing facilities in Hawaii.

In relation to the Preventive Release Programme (PRP) it was noted that the capture of single wild Medflies on three separate occasions within the PRP boundaries during the last two years proves the assumptions on which it is based: a) that southern California is under constant threat of Medfly invasion and b) that the PRP can prevent the development of medfly populations from this invasion. After four years of PRP the MEDSAP concluded that there is no more effective, environment-friendly or cheaper method to exclude medfly from southern California than area wide SIT. It was strongly recommended that the funding for the PRP be renewed and that the PRP boundaries be extended to cover the few urban areas of the LA basin not yet under sterile fly releases.

In conjunction with the PRP, the CDFA-USDA fruit smuggling interdiction programme CLAMP (Close the Los Angeles Area Medfly Pathway) has had major success in reducing the smuggling of tropical fruit into southern California. It was recommended that CLAMP be given a stable funding base.

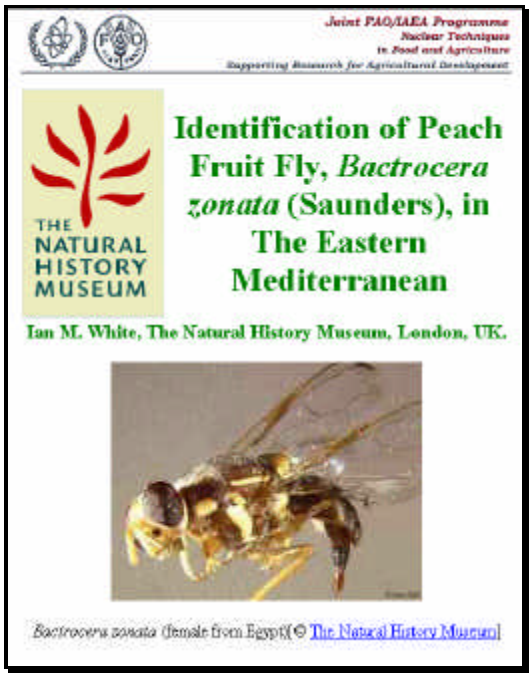
Also it was recommended within all the PRP that some of the Jackson traps baited with Trimedlure be exchanged for IPMT traps baited with the three component food lure developed with ARS during an IAEA CRP. This will reduce the unnecessary capture and

identification of sterile males, and will maximize the potential of detecting wild females of medfly and other exotic tephritids under the preventive release program.

In relation to the status of the CDFA and USDA medfly rearing facilities in Hawaii MEDSAP noted that genetically sexed Medfly strains like *tsl* (temperature sensitive lethal) are more effective and represent the future of SIT (sterile insect technique) against the pest. Most of the medfly mass rearing facilities in the world are moving to use them. The MEDSAP concurred with the decision by CDFA and USDA to change to rearing *tsl* sexing strains in their Hawaiian rearing facilities but however pointed out that CDFA/USDA must recognize that using *tsl* causes significant changes in rearing protocols that require better staff training, facilities operation, etc.

Peach Fruitfly *(Bactrocera zonata)* identification guide

Following the recognition of the danger posed by the recently identified infestation of the Peach fruit fly in Egypt (see Newsletter No. 54 p. 20), the Section is organising a regional workshop on the pest together with the Regional FAO office in Cairo which will be held later in the year in conjunction with the annual meeting of the Comité de Liaison de l'Agrumiculture Méditerranéenne (CLAM), the regional citrus growers association. As a tool for this workshop and to assist those not able to attend, Ian White of the Natural History Museum, London, prepared an identification guide to the commercially important species of fruit flies in the Eastern Mediterranean area. The guide is available on our web site (follow the link at the foot of our home page) or on disk which can be obtained from our office.



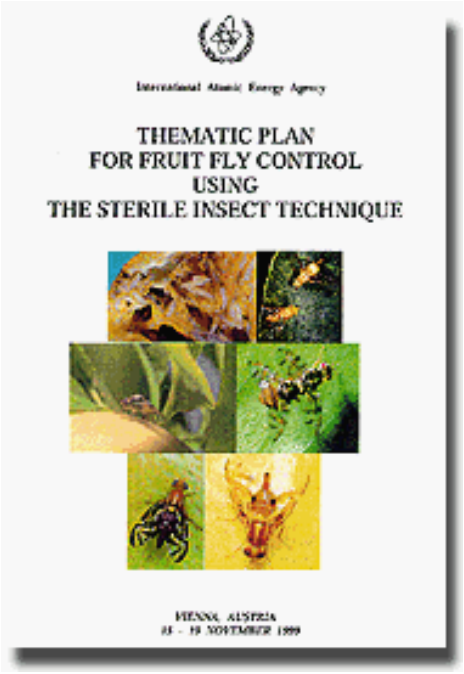
Teaching video on the Sterile Insect Technique

A new video "The Sterile Insect Technique, An Environment-Friendly Method of Insect Pest Suppression and Eradication" will be available soon. This thirty minute video was developed for university students, and describes the principles and application of the SIT. The video, a 'first of its kind', is free to teaching, research and extension institutions. Contact the Section for copies.

Nauru declared free from Oriental fruit fly and melon fly

Under and FAO/ACIAR supported project, the Pacific Island of Nauru was declared free from Oriental fruit fly and melon fly on 6 December 1999 following an areawide male-annihilation campaign. In addition, *Bactrocera xanthodes* has not been recorded for over six weeks. Mango fly still persists in small pockets.

Thematic plan for fruit fly control using the Sterile Insect Technique



The Insect Pest Control Section together with the Technical Cooperation Department of the IAEA convened a consultants group meeting in November 1999 to produce a plan for future work on fruit flies. The group consisted of fruit fly program managers and workers, stakeholders from the affected industry, a commodity specialist from the FAO, and technical, planning and policy specialists from the IAEA and the FAO. The resultant Thematic Plan document provides strategic guidance and direction on how and where the Sterile Insect Technique (SIT) can most effectively be applied to control or eradicate fruit flies in the future.

The presence of certain fruit flies in a country can pose a significant barrier to trade in fresh fruits and vegetables. SIT can play a major role in facilitation of trade through the development of fruit fly free zones and low prevalence areas, that facilitate new and expanding market opportunities.

One of the driving forces for using the SIT in the future will be the need to protect and preserve the environment. Use of SIT for purposes of control, not just eradication, could significantly reduce pesticide use, residues, pollution, and associated costs. Solid evidence suggests that benefit-cost ratios are increasing for the Mediterranean fruit fly, *Ceratitis capitata* (medfly) SIT as an alternative to insecticides, and as a mitigating technique for environmental and human health concerns about insecticide use. In fact, the cost of medfly control in Israel with SIT is the same as control with insecticide applications.

Increased use of the SIT and other biological insect management systems will result from additional government restrictions on pesticide use. These biologically-based systems will meet the demands of regulatory agencies and the public with regard to pollution, insecticide residues, and effects on non-target organisms. Of particular concern is the imminent reclassification of malathion, one of the most widely used insecticides today for fruit fly control, as a potential carcinogen by the United States Environmental Protection Agency. Other countries are sure to follow suit with similar legislation further limiting the tools available for fruit fly control. As a result, the market for sterile medflies for pest control programmes is expected to expand dramatically.

Major breakthroughs from FAO/IAEA R&D, particularly the development of genetic sexing (male only) strains and improved rearing systems, serve to increase the efficiency of the SIT and lower operational costs. This also addresses other constraints, such as sterile female stings on fruit that reduces market value of the crop. Commercial application of the SIT will drive operational costs even lower with improvements in sterile fly production, handling and release methods.

The group also recognised the need for continued investment in R&D. FAO and IAEA, through their Joint Division, are the global leaders in SIT technology for fruit fly control by virtue of their international position, technical competencies and capabilities, and following among plant protection specialists. Based on this high level of expertise, these efforts must continue together in partnership with others who share a common interest in protecting the environment, in facilitating global trade of agricultural commodities and in increasing farm productivity and sustainability to address both food safety and food security needs of IAEA and FAO Member States.

The expert group identified Central America, Southern Cone of South America and the Mediterranean Basin as regions where the greatest gains in using the SIT for fruit flies can occur in the short and medium term. These areas were chosen because of the high level of interest by industry and governments together with strong plant health infrastructures that lend themselves toward area-wide implementation of the SIT. In addition, the state of technological development against specific species of fruit flies, primarily medfly, were a major consideration. Medfly serves as a model for development of SIT for other fruit flies species. Since the SIT package for medfly is the most advanced and demonstrably cost-effective, it should be the initial technology package for building new partnerships between the IAEA, FAO and the private sector. Thus, a major strategic objective of the SIT programme for fruit flies is to complete a commercial technology package for medfly over the next ten years.

Member States in other areas cannot be ignored, however, but in many cases this will require a long term commitment toward R&D before minimum requirements to use the SIT effectively for other fruit fly pests can be met. Genetic transformation and other biotechnology approaches could potentially shorten the time required to develop new fruit fly strains in the future. Therefore, an operational objective of the SIT programme for fruit flies is to develop technology packages for other fruit fly species over the next ten years.

The fact that SIT can be used for “control”, and not solely for eradication, was emphasised throughout the discussions. This, more than any other development, will open the doors to greater acceptance and use of the SIT in the future. Out of necessity, it also will lead to increased commercial use and sustainability of SIT technology. It eliminates the criticism often directed at the SIT that eradication is unrealistic, and unsustainable in many cases, for lack of adequate quarantines.

Present day public fly-production facilities cannot meet current market demand for sterile medflies and other fruit fly species needed for control. The group recognises that the involvement of the private sector is essential for expanded success in applying the SIT to fruit flies. The obvious profit centre is the production of sterile fruit flies for control activities. Commercialization of fly production is the only practical solution for meeting the increasing demand for sterile flies and would undoubtedly result in greater efficiencies in production and provide commercial incentive for further research and development efforts. Such collaboration would benefit all stakeholders from farmers to fruit consumers.

Commercial investment in SIT for medfly will accelerate if IAEA and FAO emphasise activities that minimise investment risk: pursuing research and development activities that improve production efficiency and operational effectiveness; building technical competency to manage field operations; and disseminating best practices and lessons from successful field programmes to stakeholders.

The report is available on our web site as an Adobe Acrobat pdf file, or can be requested from our office.

Economic analysis of tsetse and trypanosome research

The overseas aid organisation of the British Government, the Department of International Development (DfID) and its predecessor ODA, have a long history of work in tsetse and trypanosomosis control and eradication. Recently they commissioned a review of the impact of this research on development issues over the 18 year period from 1980 to 1998. The resultant report indicated the benefit of a more detailed economic analysis to include cost:benefit scenarios and an independent economist was commissioned to produce this.

The analysis was conducted mainly as a desk exercise, using innovative methods of interpreting the data. During the study it became clear though that the contribution of the British Government programmes could not be separated from the contribution of all the other countries, workers and institutions that have been working in this field during this period, and so the analysis was extended to cover all work in the selected countries (the "International Research Programme").

After an introductory chapter, the report starts with a chapter on the 'Benefits of Tsetse and Trypanosomosis Control', and then one each on strategies for trypanosomosis control and tsetse control. Then follows 'Tsetse Control - Cost Benefit Analysis', 'The Feasibility of Tsetse Control', 'Counterfactual', 'Secondary Factors' and 'Human Sleeping Sickness' and finally 'Returns to Research'.

Although the report was commissioned by and written for DfID, its coverage is much wider and will be of interest to everyone involved in tsetse or trypanosomosis control. Copies can be obtained from Livestock Production Programme, Natural Resources International Ltd, Chatham Maritime, Kent ME4 4PU, UK.

NWS successes in Central America

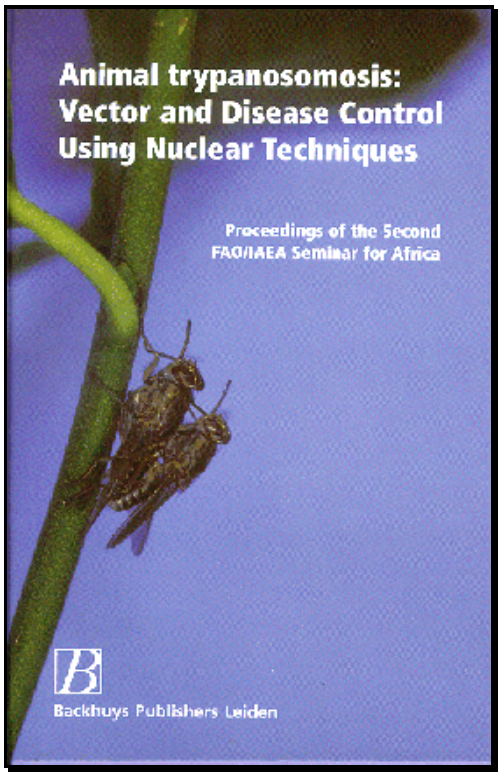
A review of the screwworm eradication programmes in all Central American countries held in Tuxtla Gutierrez, Mexico (26-31 March) showed the dramatic effect this programme has had on animal health in the Central American region. All countries except Panama are now screwworm-free and even in Panama, this pest has been eradicated to the Panama Canal. The last cases are being detected in the Darien Gap between the Canal and the Colombian border, where a permanent barrier of sterile flies will be established. Even though there is currently no intention to expand the programme to South America, both Venezuela and Uruguay sent representatives to the meeting, who expressed their strong interest in initiating screwworm programmes in their countries in view of the economic losses currently suffered as a result of this pest.

Animal trypanosomosis: Vector and disease control using nuclear techniques

***Animal trypanosomosis: Vector and disease control using nuclear techniques*. Proceedings of the Second FAO/IAEA Seminar for Africa, 27 November - 1 December 1995, Zanzibar, United Republic of Tanzania.** Backhuys Publishers, Leiden, The Netherlands. ISBN 90-5782-048-X. (1999) 311pp.

After a Foreword and Summary, the main part of the book is divided into eight sessions: Tsetse attractants, Situation Reports, Tsetse - trypanosome interactions, Tsetse genetics, Tsetse biology and biochemistry, Prospects for tsetse SIT, Tsetse SIT projects and Disease diagnosis.

The Tsetse biology session includes an extended paper by E. F. Knipling entitled "Analysis of the suppression characteristics and efficiency of various methods of tsetse control (Diptera: Glossinidae), and the Tsetse SIT projects session a number of papers on the status of the eradication programme on Unguja Island, Zanzibar.



Copies can be ordered from the publisher. Tsetse workers in Africa may also request single copies, free of charge, from the Section.

I. ANNOUNCEMENTS

Abdeljelil Bakri to rejoin Section

Abdeljelil Bakri, who worked in the Section last year on the EcoPort pages for medfly and South American Fruitfly (www.ecoport.org) rejoins the Section on 1 August for 6 months to work on the IDIDAS database (International Database for Insect Disinfestation and Sterilisation). This is a database of irradiation doses and conditions for disinfestation of goods in storage and for sterilising insects for SIT programmes. The database is being established jointly with the Food & Environmental Protection Section of the Joint FAO/IAEA Division.

Walther Enkerlin joins Section

Walther Enkerlin joined the section as a fruit fly expert in April. Previously he worked for the Mexican Dirección General de Sanidad Vegetal, DGSV/SAGAR, in SIT based area-wide fruit fly control programs for 11 years. For seven years he was a member of the DGSV group responsible for bilateral negotiations of phytosanitary issues with the United States, Canada and Chile. In 1999, he chaired the Fruit Fly Panel for the North American Plant Protection Organization (NAPPO), having developed standards for area-wide fruit fly management.

On twelve occasions in the past he has served as a consultant for the FAO/IAEA joint division in SIT economic feasibility assessments, technology transfer and program implementation. He holds a Ph.D. in applied entomology from the Imperial College, University of London.

Patrick Gomes leaves Section

After three and a half years at the Section managing very effectively all fruit fly projects in the Mediterranean basis, Pat Gomes has left the Section to return to the USDA APHIS in its Regional Office in Guatemala City. He will work there as Deputy Regional Director of the Medfly Program with fruitfly control and SIT. We would like to thank Pat for his significant contribution to the subprogramme and we look forward to a continuing fruitful collaboration with him.

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Printed by the IAEA in Austria
July 2000