INSECT AND PEST CONTROL NEWSLETTER

Joint FAO/IAEA Division
of Nuclear Techniques
in Food and Agriculture and
FAO/IAEA Agriculture and
Biotechnology Laboratory, Seibersdorf

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A. TO THE READER

Letter from the Section Head

It gives me a great deal of satisfaction to see our readers reacting positively to our Newsletter and how the distribution list is getting larger. We are grateful for your interest, and sincerely hope you continue to send us your comments and suggestions to improve this communication tool. I would like to inform you that the book "Areawide Control of Fruit Flies and Other Insect Pests" was published in September 2000 and is available from CABI International (780pp, ISBN 983-861-195-6). This volume is the outcome of two major international meetings held in June 1998 in Penang, Malaysia: the International Conference on Areawide Control of Insect Pests and the Fifth International Symposium on Fruit Flies of Economic Importance. Both events were co-organized by the Joint FAO/IAEA Division and the Universiti Sains Malaysia. A limited number of copies is available cost-free from the Joint Division for interested developing country entomologists.

Recently, as part of the XXI International Congress of Entomology held in Iguassu, Brazil (20-26 August), we co-organized the Symposium "The Use of Genetics and Population Ecology in Successful Areawide Programs to Control Insects". At the Congress an additional symposium on "Areawide Approaches to Insect Population Regulation: the Management to Eradication Continuum" indicates that this concept is starting to gain wider acceptance. There were also references to the areawide pest management approach during conventional IPM sessions. As reflected in the title of one of the above symposia, it is also increasingly being accepted that the areawide strategy is not limited to eradication applications only, but spans a continuum from different prevention and suppression situations all the way to eradication. Even though farmers normally do not cooperate easily, it was recognized that external pressures related to globalization, such as the safe trade of plant and animal commodities, are increasingly forcing them to become organized and to embark on areawide approaches to pest management.

At least in export-oriented agriculture, the forces that are beginning to discourage the conventional uncoordinated pest control approach by growers are the loss of major insecticides due to insect resistance, environmental concerns of the public and trends of decreasing pesticide subsidies, as well as residue and pest levels in international agricultural trade. Legislation such as the Food Quality Protection Act (FQPA) in the USA, which is resulting in the banning of some major insecticides and reducing further accepted dietary intakes of other insecticides to infant residue levels, is also having an impact. New Zealand has passed similar legislation on lower pesticide tolerances, and international supermarket chains are starting to enforce on their foreign suppliers much stricter residue requirements.

These actions are already having significant effects on the international trade of fresh agricultural commodities, with the biggest impact on the export of fruit and vegetables. As there are often no alternative pesticides on the market, this situation represents opportunities for more ecologically based control methods such as the SIT and pheromone mating disruption. They are becoming increasingly attractive, but require integrated areawide application. The potential of using the SIT for suppression rather than eradication and integrated with other methods is great in view of the above described developments. The progress being made in pilot SIT control projects such as the medfly project on table grapes in South Africa, or the codling moth project in British Columbia, Canada, are two positive examples mentioned at the Congress where organized growers have had vision and are therefore much better prepared to cope well with these international developments.

During October 2000, Costa Rica was officially declared free of the New World screwworm, *Cochliomyia hominivorax*, following a similar declaration in Nicaragua in 1999. The United States, Mexico and the Central American Governments are now close to achieving the

objective of eliminating this major livestock pest from nearly half the American continent. As a result, sterile pupae produced at the screwworm mass rearing facility of the Mexico-USA Screwworm Commission in Tuxtla Gutierrez, Chiapas, Mexico, are currently being shipped only to Jamaica, where eradication activities are in progress (IAEA project JAM/5/007 and FAO project TCP/RLA/8927), and to Panama where releases will soon be reduced to maintain only a sterile fly barrier covering the area between the Panama Canal and the Colombian border. In addition, a small pilot SIT program has been initiated in Isla de la Juventud in Cuba (IAEA project RLA/5/044 and FAO project TCP/CUB/6613), with sterile fly releases scheduled to be initiated in the spring of 2001.

Besides Jamaica and Cuba, however, the current distribution of NWS still includes other parts of the Caribbean (Dominican Republic, Haiti, Trinidad and Tobago), and all of South America (with the exception of Chile). In relation to the OWS (Old World Screwworm, *Chrysomya bezziana*), its current distribution extends in an arc from South Africa through the Middle East, then through Southern China, the Philippines, Indonesia and east as far as Papua New Guinea. Recently a Consultants' Meeting on screwworm R&D took place in Vienna as a result of the considerable interest of FAO and IAEA Member States in initiating technical studies to assess the feasibility of similar projects against NWS in the South American countries and against OWS in the West and South East Asian countries. Also the USDA and the Mexico-US Screwworm Commission are greatly interested in the development of genetic sexing for screwworm since the maintenance of the sterile fly barrier in Panama would benefit very much from the development of such strains.

Any expansion of NWS SIT into South America will necessitate that economies are made in the cost of producing and distributing sterile males. Also future eradication or control efforts in South America involving the SIT would require information on genetic variability of the screwworm populations and their distribution, isolation and population levels. For OWS, it is essential to determine first if only one species is present throughout its whole distribution range. The consultants recommended that a new Coordinated Research Project (CRP) be established to address the R & D issues outlined above, seeking to collaborate with other partners and coordinate efforts aimed at generating the information and technology to facilitate controlling screwworms in Member States. Achieving the objectives of the CRP would be of direct benefit to the expansion of the SIT for screwworm by determining divergent populations and in improving the cost/benefit ratio of mass producing sterile males. The three specific objectives of the new CRP are to establish genetic relationships between populations of OWS and NWS, to identify the origins of new outbreaks to improve quarantine regulations, and to develop a genetic sexing strain for NWS. We encourage applications to participate in this new CRP during the first half of 2001. The first Research Coordination Meeting is scheduled for September 2001 in Brazil. As the millennium is drawing to a close, I would like to send season's greetings and our best wishes for the year 2001 on behalf of everyone in the Insect Pest Control Subprogramme

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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)

"Genetic Applications to Improve the SIT for Tsetse Control/Eradication including Population Genetics", 26 – 30 March 2001, Rome, Italy; 3rd RCM.

"Evaluating the Use of Nuclear Techniques for the Colonisation and Production of Natural Enemies", 18 – 23 June 2001, Tapachula Mexico; 2nd RCM.

"Automation in Tsetse Mass-rearing for Use in Sterile Insect Technique Programmes", 7 – 13 July 2001, Addis Ababa, Ethiopia; 4th and Final RCM.

"A Molecular and Genetic Approach to Develop Sexing Strains for Field Application in Fruit Fly SIT Programmes", 10 – 14 July 2001, Sydney, Australia; Final RCM.

"Genetic Sexing and Population Genetics of Screwworms", 3 – 12 September 2001, Campinas, Brazil; 1st RCM and Workshop.

"Quality Assurance of Mass Produced and Released Fruit Flies", 5- 9 November 2001, Mendoza, Argentina; 2nd RCM.

II. Consultants Meetings

"Preparatory Meeting on the Central American Regional Fruit Fly SIT Project", 16 – 19 January 2001; IAEA, Vienna, Austria.

"Review Meeting on the Expansion of the Middle East SIT Medfly Projects", 22 –24 January 2001; IAEA, Vienna, Austria.

"Thematic Planning Meeting on Establishing Tsetse Fly Free Zones through Area-wide Tsetse Intervention Involving the SIT", 29 January – 02 February 2001; IAEA, Vienna, Austria.

"Consultants Meeting on Tsetse Suppression", 5 – 8 February 2001, IAEA, Vienna, Austria.

"Consultants Meeting the Development of International Guidelines for Fruit Fly Trapping", 19 – 23 March 2001; IAEA, Vienna, Austria.

"Consultants Meeting on using Information Communication Technologies (ICTs) for the development of a CD-ROM based information resource on the Sterile Insect Technique, 9 – 13 April or 23 – 27 April 2001, IAEA, Vienna, Austria.

"Consultants Meeting on Olive Fly Rearing and SIT", 1 – 5 October 2001; IAEA, Vienna, Austria.

III. FAO/IAEA Training Courses

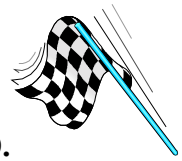
The Interregional Training Course on the "Use of the Sterile Insect and Related Techniques for the Area-Wide Management of Insect Pests", University of Florida, Gainesville, Florida, USA, 11 April – 17 May 2001. (Co-funded by the US Government, FAO and IAEA.). The deadline for applications is 12 January 2001 and they have to be submitted through FAO, Atomic Energy Authorities or Ministries of Agriculture.

IV. Other meetings

7th Committee Meeting of the Programme Against African Trypanosomiases , 3 days in the week 25 – 29 June 2001 (venue to be decided).

26th meeting of the OAU International Scientific Council for Trypanosomiasis Research and Control (ISCTRC), 1 - 5 October 2001, Ouagadougou, Burkina Faso.

IV International Meeting Of The Working Group Of Fruit Flies Of The Western Hemisphere, 11 – 16 November 2001; Mendoza, Argentina.



D. PAST EVENTS (2ND. HALF OF 2000)

I. Research Co-ordination Meetings (RCM)

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

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

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

"Review of Screwworm Programmes in the Caribbean", 26 – 28 September 2000, IAEA, Vienna, Austria.

"Rational Supply of Sterile Flies for Medfly SIT in the Mediterranean Basin", 14 – 15 August 2000, IAEA, Vienna, Austria.

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

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

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

III. FAO/IAEA Training Courses

WHO/IAEA "First International Course on African Trypanosomoses", 23 October - 10 November 2000, IMTSSA, Le Pharo, Marseille, France.

FAO/IAEA Regional Training Course on Old World Screwworm, 6 - 14 June 2000, Teheran, Iran.

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

Task Force Meeting, 11 - 15 December 2000, Nairobi, Kenya

Programme Against African Animal Trypanosomosis (PAAT) Committee Meeting, 22 - 23 November 2000, Geneva, Switzerland

Workshop On Peach Fruit Fly (*Bactocera zonata*), 13 – 15 November 2000, Valencia, Spain

Course on Differential Diagnosis of Old World Screwworm and other Myiosis Fly Larvae, 16 – 20 October 2000, Natural History Museum, London, United Kingdom.

Red Palm Weevil and Peach Fruit Fly Study Tour/Workshop, 16-19 October 2000 , Cairo, Egypt.

FAO Regional Workshop on Screwworm Strategies in the Caribbean, 16 September 2000, Panama City, Panama.

"The use of Genetic and Copulation Ecology in successful Areawide Programmes to control Insects", XXI International Congress of Entomology, 20 - 26 August 2000, Iguassu Falls, Brazil.

Course on Differential Diagnosis of Old World Screwworm and other Myiosis Fly Larvae, 17 – 21 July 2000, Natural History Museum, London, United Kingdom.

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

E. TECHNICAL CO-OPERATION PROJECTS

During the new biennium 2001-2002, the Subprogramme has currently technical responsibilities for the following technical co-operation projects. They fall under four major areas, namely:

- Tsetse
- Fruit flies
- Old and New World Screwworm
- F-1 Sterility for the Control of Lepidopteran Pests

Operational Projects (2001-2002) are:

EGY/5/025 Area-Wide Fruit Fly Control in Eastern Egypt
ETH/5/012 Integrating SIT for Tsetse Eradication
INT/5/145 Promotion and Transfer of Sterile Insect Technology
ISR/5/010 Upgrading the Area-Wide Control of the Mediterranean Fruit Fly using the Sterile Insect Technique
JAM/5/007 New World Screwworm Eradication
JOR/5/009 Upgrading the Area-Wide Control of the Mediterranean Fruit Fly using the Sterile Insect Technique
KEN/5/022 Integrated Area-Wide Tsetse and Trypanosomosis Management in Lambwe Valley
MAR/5/009 Control of Diamondback Moth by Sterile Insect Technique
MLI/5/017 Integrated Control of Animal Trypanosomosis through creation of a Tsetse Fly Free Zone
PAL/5/002 Area-wide Application of SIT for Medfly Control
RAF/5/051 SIT for Tsetse and Trypanosomosis Management in Africa
RAF/5/052 SIT Development for Control of Anopheles Mosquito
RAW/5/008 Preparing to Combat the Old World Screwworm in West Asia
RLA/5/044 Preparing Caribbean Eradication of New World Screwworm
RLA/5/045 Preparation for Pilot Fruit Fly-Free Areas using the Sterile Insect Technique in Central America
SAF/5/002 Sterile Insect in Integrated Management of Fruit Fly
SAF/5/005 Situation Analysis of the Feasibility and Desirability of Tsetse Fly Eradication
SLR/5/002 Feasibility Study for a Mass Rearing Insect Facility
THA/5/046 Area-Wide Integrated Control of Fruit Flies
TUN/5/019 Control of the Date Moth using Radiation Sterilization.
TUN/5/020 Establishment of a Medfly Mass-Rearing Facility and Introduction of a Pilot Sterile Insect Technique Control Programme
UGA/5/023 Integrated Sterilie Insect Technique Based Intervention against Tsetse in Buvuma Island
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 project is discussed in this issue:

Date Moth SIT in Tunisia (TUN/5/019)

Dates are a major product of Tunisia. Out of a total of about 75,000 tonnes annual production, over 30% is exported, and is second only to tourism as a foreign currency earner, exceeding the income from citrus. The Government has placed the highest priority on the production of dates, and plans to increase production to boost foreign currency earnings from dates to first place.

The key pest of dates in Tunisia is the carob or date moth (*Ectomyelois ceratoniae*). This moth is found throughout North Africa and the Middle East as far as Iraq and Iran, and has been introduced in California and South America. It attacks a number of hosts, but principally dates, pomegranate, pistachio and walnuts. It develops both in mature dates on the palm and after harvest in the packing houses, where it can complete development and reinfest more dates if not controlled. Before the dates mature on the palm it survives either in alternate hosts in the oasis, usually pomegranate, or in fallen dates on the ground or caught in leaf axils. In South America it attacks principally walnuts, in which crop it jeopardises the use of mating disruption for the control of codling moth (*Cydia pomonella*).

In dates eggs are usually laid under the calyx, and the neonate larvae burrow immediately into the fruit. If the fruit is dry the larva will spin up and pupate inside the fruit, but if the fruit is still moist it will exit the fruit and spin up on any suitable surface. The entry of the larva under the calyx tends to loosen the fruit, and infested fruit often drops early.

Conventionally control has been by cover sprays of organophosphate insecticides, and storage treatment with methyl bromide. Due to increasingly strict insecticide residue limits the Government of Tunisia banned the use of chemical cover sprays three years ago, leaving only Bt for control. However due to the protected location of the egg under the calyx, and the very short time spent on the surface of the fruit, Bt has not proved very effective. At the same time the Government wants to reduce infestation levels in export fruit below 1%.

Ectomyelois ceratoniae male

To try to achieve this the Government requested a Technical Co-operation project, TUN5019 “Control of the Date Moth using Radiation Sterilization”. The counterpart, Dr. Mohamed Dhouibi, has already spent several years studying this pest and its radiation biology under a recently concluded FAO/IAEA Coordinated Research Project on F-1 Sterility in Lepidoptera. He has been rearing this insect on a small scale in the laboratory on dates and identifying indigenous parasitoids.

The project has run since 1999. The most important step towards introducing SIT for this pest is to establish mass rearing on an artificial diet. Several diets have been tested, and we now have a suitable artificial diet which yields better than 65% adults from eggs. Automatic collection of emergent adults has also been established. The remaining problems in rearing are mating and oviposition, and work will start shortly on solving these. Also the radiation biology of the insect must be clarified as results so far have been rather variable.

Initial trial releases this year in a pomegranate orchard have proved very successful, producing as effective control as conventional cover sprays. By the beginning

of next season the project will have the capacity to produce about 500,000 adults per week for large scale trials in date plantations,

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to study survival, dispersal, the wild population dynamics and release techniques

Feasibility study for a mass rearing facility in the Slovak Republic (SLR/5/002)

The use of the sterile insect technique for pest control or eradication is now well established, particularly for fruit flies. So far though most of the SIT programmes have had partial or full Government support. The further development and adoption of the method now depends on commercialising the process.

A first step in this process has been initiated in the project SLR5002 "Feasibility study for a mass rearing insect facility". The study is assessing the feasibility of constructing and operating an insect mass rearing facility in the Slovak Republic to produce commercially sterile medfly for use initially in the Mediterranean basin where there are no medfly factories but a growing demand for sterile medfly males. The study has looked amongst other things at the cost of construction, supplies and labour, the social and environmental implications of such a facility, and the potential market.

The initial results indicate a very favourable commercial prospect. Currently the only possible supplier of sterile medfly is the El Pino factory in Guatemala. For countries in the Mediterranean basin this means a long transport distance, resulting in high transport costs, long periods in anoxia (currently about 54 hours to Israel) and consequently reduced quality. Actually the cost of the sterile males (US$ 214 / million) is lower than the cost of long distance transport. In the case of Israel, the cost of transport is $245 per million pupae, which would reduce to about $50 per million if the supplier is in Slovakia. Labour rates in Slovakia are currently comparable to rates in Guatemala, so the initial cost of sterile insects from the factory would also be competitive. Capacity at El Pino is being expanded, but this will not be available for export as the factory production is already committed for control programmes in Guatemala, Mexico and the USA.

Both Israel, which currently imports from Guatemala, and Spain which wants to start SIT suppression trials in the Valencia citrus producing region, are interested in purchasing from a nearby source. Once a facility is established in Europe the demand for sterile flies, as an environment friendly alternative to insecticide applications to control medfly, is expected to rise quickly, in view that potential interest in SIT has been stifled until now by the lack of a convenient and reliable supplier.

Significant commercial interest has already been shown in the proposal. A UK based company wishes to establish the rearing facility, through a Slovak subsidiary, and the project will continue in 2001 with preparing a detailed business plan and looking for investors.

As part of the efforts to encourage the construction and operation of the Slovakia insect mass rearing and sterilization facility, a consultants meeting on "Rational Supply of Sterile Flies for Medfly SIT in the Mediterranean Basin" took place in Vienna, Austria, during August 14 and 15, 2000. Participants included representatives of the plant protection and fruit industry organizations from France, Israel, Portugal, Morocco and Spain, as well as the European Unit and interested investors.

Interest in adopting the SIT technology is high among all these Mediterranean countries. It is clear that the driving forces to consider the SIT for medfly control in the Mediterranean Basin (MB) are insecticide residues and environmental problems (frequently regarding the incompatibility of tourism and intensive insecticide use).

The constraints preventing the immediate use of SIT are lack of confidence in and the perceived high cost. Neither of these constraints can be eliminated without the availability of large numbers of sterile male

medflies for areawide SIT demonstration projects in the MB. The numbers of sterile medflies required in the MB will be market driven. Several billion per week will be eventually required. However, the initial numbers needed will depend on the size and number of demonstration projects planned. It was agreed that in order to achieve economies of scale in the cost of sterile males, as well as for demonstration purposes the required initial numbers would be from 100 to 300 million/week on a continuous basis with increased production as the market expands.

Future SIT programs in the Mediterranean must be well planned and executed to produce acceptable results. Even though SIT, as a suppression tool, is cost effective in comparison to conventional applications, funding from governments will be required during the transition from insecticide to SIT control. Technical, managerial and social expertise is required; much of this is not available in the MB, thus extensive training is needed. A source of sterile male medflies, such as the Slovakia medfly factory, is essential to develop the SIT for medfly control in the MB.

Potential for the Integrated Control of Animal Trypanosomosis through creation of a tsetse fly free zone (MLI/5/017)

The peri-urban zone of Bamako in Mali is a heavily cultivated area of ± 2,000 km^2, situated at the northern edge of the tsetse fly belt in West Africa. The area contains an estimated number of 40,000 cattle, which are under constant threat of becoming infected with the disease animal trypanosomosis (nagana). The presence of this disease, which is cyclically transmitted by the only tsetse species present in the area, i.e. *Glossina palpalis gambiensi*s, severely hampers the development of intensified and diversified integrated livestock and agricultural systems. Most cattle are of the Zebu type or have been upgraded through cross-breeding programmes with better performing Montbéliard breeds, and are highly susceptible to the disease. Moreover, the importation and rearing of improved breeds with higher yields of milk is virtually impossible. Recent sporadic screening of cattle for the presence of trypanosomes revealed a prevalence of > 30%. Efforts to control the disease in the past were limited to the indiscriminative treatment of cattle (up to 6 times a year) with trypanocidal drugs, resulting in the development of drug resistance of the parasite. The removal of the tsetse fly from the peri-urban area of Bamako could have a significant impact on the productivity of the livestock and on agricultural development.

The IAEA is supporting the Mali government under TC project MLI/5/017, in preparation for the creation of a tsetse free zone by the integrated use of vector control tools such as traps/targets followed by the release of sterile male flies. The sterile flies will be provided by the government of Burkina Faso, which has a colony of 100,000 producing females (adapted to *in vitro* feeding) at Bobo Dioulasso. In 2001, the insectaries will be upgraded and equipped with the semi-automated feeding and holding systems TPU3 developed at the Seibersdorf Laboratory to expand the colony.

Entomological surveys were initiated in the peri-urban zone of Bamako in November 2000 by a team of the Central Tsetse Control Unit supported with staff from the Central Veterinary Laboratory and assisted by an IAEA expert. Unbaited biconical traps were deployed in the vegetation along tributaries of the Niger river on the left and right bank. Flies were sampled in all 10 river systems. Average apparent density of the fly populations of the tributaries on the left bank varied between 3.3 and 29.1 flies/trap/day, whereas the Koba river, a tributary of the right bank was the most heavily infested with an average apparent density of 84.4 flies/trap/day. Traps were also deployed on 6 of the numerous islands of the Niger river.

Flies were sampled in 4 of the islands but at apparent densities below 1 fly/trap/day.

The entomological surveys will continue in the remaining tributaries of the right bank, the left and right bank of the Niger river and on the remaining islands. In addition, trial releases of sterile males are planned both during the dry and rainy season of 2001, to assess the efficiency of the Bamako city barrier and to get baseline data on sterile fly behavior, survival and competitiveness among others.

F. ONGOING AND PLANNED CO-ORDINATED RESEARCH PROJECTS

The following Co-ordinated Research Project (CRP) has recently been approved and is scheduled to be iniciated in 2001. We encourage applications for participation until May 2001:

Genetic Sexing and Population Genetics of Screwworms

A very successful area-wide programme for the eradication of the New World Screwworm (NWS) has been carried out in North and Central America. A Thematic Plan for both NWS and OWS (Old World Screwworm) identified several technical constraints for the further expansion of SIT for these two species and these form the core of this new CRP. Any expansion of the NWS programme into the Caribbean and South America will require information on the target populations in that large area where very little is known concerning the distribution and levels of population isolation. In addition, the size of the populations to be targeted and the area over which they are distributed will require that economies be made in fly production and release costs. One way to achieve this would be to develop a genetic sexing strain. For SIT to be effectively developed for the OWS much data is needed on distribution and the genetic relationships of populations from S. E. Asia to the Middle East. The CRP will address these high priority areas.

Expected duration: 5 years (2001 – 2006)

1st RCM and Workshop: 3 – 12 September 2001, Campinas, Brazil;.

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

The third RCM was held in Sao Paulo, Brazil on 14-18 August 2000. The meeting was attended by 8 participants of this CRP and three observers. The group presented the results of the research conducted over the last 18 months and discussed the developments and opportunities for future work.

Since the last RCM, the participating laboratories have been very successful in generating a range of novel vectors, genes, regulatory elements and approaches which have the potential for incorporation into the SIT. Medfly remains the essential model for the development of the transgenic technology for the SIT. However, it is foreseen that the major impact and opportunities for exploiting this technology will be the development of genetic sexing systems for other key pest species that are the target for SIT and where the background knowledge in genetics/cytology is lacking.

Over the forthcoming period, the participating laboratories will be well placed to begin the move from laboratory-based research to consider the more applied aspects of using transgenic technology to the benefit of the SIT. This will include studies on the genetic behavior of transgenic insects, e.g. stability of transgenic strains over extended periods of time and under less favorable rearing conditions.

It is planned to hold the last RCM in the first half of 2002. Dr. D. Haymer (University of Hawaii) has agreed to serve as local organizer for this final meeting.

Expected duration: 7 years (1995-2002)

Contract Holders (2) from: Greece and from New Zealand

Agreement Holders (8) from: United Kingdom, United States (4) and Italy (3)

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.

Development of Improved Attractants and their Integration into Fruit Fly SIT Management Programme (D4.10.17)

The first Research Coordinated Meeting (RCM) for development of improved attractants for female fruit flies and their integration into fruit fly SIT management programmes took place from August 28 to September 1, 2000, in Sao Paulo, Brazil. Eighteen professionals from 13 countries and 4 subregions participated in the meeting most of them as contract holders and some as observers. A consensus was reached on a standard protocol for the core experiments and on the side experiments that will be carried out during the first phase of this CRP following protocols developed by the participants. Lists of materials required for the first year experiments were prepared and delivery schedules for supplying them. Participants will be presenting the results of the first experiments as well as a progress report of the second year experiments by April 2002 in the next RCM to be held in South Africa. All the relevant documents and papers that were presented during the meeting have been compiled in this single document for consultation. Technical details including the standard research protocol, fruit fly conditions in each country, species being addressed, list of participants and material requirements can be found in this report.

Expected duration: 5 years (1999-2003)

Agreement Holders (3) from: United Kingdom, Portugal and France

Contract Holders (15) from: Argentina, Brazil (2), Colombia, Costa Rica, Greece, Honduras, Israel, Mauritius, Mexico, Pakistan, Spain (2), USA (2),

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 2001, at FAO, in Rome, Italy.

Expected duration: 5 years (1997-2002)

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 (Tanzania), KETRI (Kenya) and Addis (Ethiopia) 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 (1995-2001)

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.

The 4th and Final RCM is scheduled for the spring of 2002.

Expected duration: 5 years (1995-2002)

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 from 5 – 9 November 2001.

Expected duration: 5 years (1999-04)

Contract Holders (12) from: Argentina (2), Chile, Costa Rica, Guatemala, Israel (2), 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 scheduled to be held in Mexico in June 2001.

Expected duration: 5 years (1999 - 04)

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

Agreement Holders (4) from: Austria (2) and the United States (2).

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

The final Research Co-ordination Meeting was held from 29 June - 4 July 1999 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 -1999)

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

Agreement Holders (1) from: the United States.

G. DEVELOPMENTS AT THE ENTOMOLOGY UNIT, SEIBERSDORF

MEDFLY R & D

Quarantine Developments

In preparation for new activities on exotic fruit flies at Seibersdorf, preliminary quarantine modifications to the mass rearing facility have been completed. Bio-secure double door systems have been installed and a computerized locking and access system has been purchased. This represents the first phase of the conversion, as a new personnel and office entrance has also been designed. Funds for the second phase have not been identified. A request for authorization for the importation of a colony of *Anastrepha* will be made to the Austrian plant protection authorities early next year.

Medfly tsl Strain to be Introduced in Metapa Facility in Mexico.

The medfly rearing facility at Metapa, Mexico has decided to replace its bisexual colony with a *tsl* (temperature sensitive lethal) genetic sexing strain (GSS). Metapa is currently the only large rearing facility not using a sexing strain and is producing 500 million sterile pupae per week. The strain to be transferred to Metapa is undergoing evaluation and consolidation and two fellows are currently being trained in the use of the technology. A new module will be built in Metapa to house the *tsl* colony and filter.

Experimental Shipment of Eggs to South Africa

In order to provide extra support to the medfly SIT programme in South Africa, shipments of eggs from a genetic sexing strain have been successfully implemented. The eggs are sealed in thermos flasks in water at 15°C and shipped by courier. If the shipment is completed within 24 hours then there is very little detrimental effect on egg hatch. The use of egg shipments to facilities where only the release generation is reared could prove to be a very efficient strategy for future commercialization of SIT.

Induction and Analysis of Inversions to Suppress Type 1 Recombination in Genetic Sexing Strains (GSS) Males

One type of recombination in Genetic Sexing Strains (GSS) males leads to an eventual loss of genetic sexing capability and two interventions can reduce the frequency of this recombination. Firstly, the reduction of the physical distance between the Y-autosome breakpoint and the selectable markers which has been shown to reduce recombination by over 60%. Secondly, the addition of a pericentric inversion, covering the region between the breakpoint and the markers. This reduces the occurrence of recombination and in addition reduces the survival of any recombinants. In a collaborative project with Carlos Caceres (then of Moscamed, Guatemala) and Antigone Zacharopoulou (Univ. of Patras) an attempt was made to induce and isolate such inversions. So far only inversions have been detected that include the *white pupa* (*wp*) locus but not the *temperature sensitive lethal* (*tsl*) locus. Inversion D53 has a breakpoint on the right arm of chromosome 5 between *wp* and *tsl* and is viable as a homozygote. D53 significantly reduces

recombination from 40.5% to 0.06% in females and in males from 0.11% to 0.002%. When incorporated into a GSS, recombination between the translocation breakpoint and *wp* was reduced by 89%. D53 also reduces recombination in adjacent regions outside of the inversion, including *tsl*, and thus could be used in *tsl*-based GSS. Attempts are ongoing to induce inversions that include the entire region.

Molecular Studies on Genetic Sexing Strains

Attempts are ongoing to clone the Maleness gene of medfly using several parallel approaches: i) Micro-dissection of the relevant region of the Y chromosome followed by PCR-based subtraction of repetitive sequences, ii) Construction and screening of a genomic library made with DNA from a strain with a severely deleted Y chromosome, and iii) PCR-based subtraction of mRNA of relevant developmental stages. Progress continues to be made but as yet no candidate genes have been identified. Transformation is also a key component of these studies and several transformed lines of medfly are now are being evaluated for stability and fitness. In collaboration with several European groups, a research proposal for an extensive study on the genetic stability and molecular characteristics of transgenic medfly strains, has been submitted to the EU for funding.

TSETSE R & D

Hybrid Sterility

A series of crosses between the morsitans group of tsetse flies has been completed. It involved *Glossina morsitans morsitans*, *G. m. centralis* and *G. swynnertoni*. One combination of mating types was identified which lead to full and permanent sterility in the female. In other crosses initial sterility was not retained and females tended to recover with time. There was also a strong asymmetry in the level of fertility of reciprocal crosses suggesting that non-nuclear factors might be involved in the phenomenon. Re-mating studies revealed that in certain combinations, mating a female with a male from a different taxon had a significant suppressive effect on her subsequent likelihood to re-mate with a male of her own taxon. DNA has been extracted from most of the flies used in these studies and it will be analyzed to try to clarify some of the observations described above.

Blood Diet

In view of the increasing demand for sterile male tsetse and uncertainty of obtaining high quality decontaminated blood in Africa, R and D activities need to be identified to ensure availability of inexpensive, standard quality diets. A consultants meeting on this topic was held in Vienna, Austria from 17 to 21 July 2000. The meeting noted that commercially available products are used to prepare standard diets for screwworm mass production and that these products have not yet been adequately evaluated for tsetse. Possibilities of utilizing commercially available dietary ingredients should also be explored. The following activities were recommended for future R and D, improvement and optimization of the current blood collection and processing, use of additives for enhancing and increasing the nutritional value of processed diets and the development of artificial diets to reduce/eliminate dependence on fresh blood.

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It is currently not possible to export irradiated quality tested bovine blood to Uganda in order to develop a large *G. fuscipes* colony. An assessment was made of the use of porcine blood alone as a diet source for *G. fuscipes*. This diet is not suitable for this

species as a reduced number of flies feed and the productivity of the females is seriously compromised.

New Colonies

The following new colonies have been established

a) *G. m. centralis* from field collected pupae from the Okavanga Delta, Botswana.
b) *G.m. centralis* from a laboratory population from KETRI, Kenya, origin Tanzania
c) *G. swynnertoni* from a laboratory population from Alberta, Canada, origin Tanzania

In the *G. brevipalpis* colony, two males have been identified with red eyes, this suggests that the mutation could be X-linked. These males have been mated and progeny obtained. It hoped that a homozygous strain can be established. In *G. palpalis* a body colour mutant, *tan*, is currently being maintained

H. SPECIAL NEWS AND REPORTS

IDIDAS, International Database on Insect Disinfestation And Sterilization

1. History

SIT is based on the sterilization of pest insects using radiation. However, data on dose of radiation for sterilization of insects and mites are not readily available and often not accessible to scientists from developing countries. There is a real need for the development of a database compiling the data on pest radiation sterilization and more importantly for setting standards on radiation doses and dosimetry to achieve good quality sterile insects.

Reviews of sterilizing doses for insects were compiled in the sixties by various authors[1-6][1]. The first recent effort to compile doses of radiation, for phytosanitary treatment was carried out by Neil Heather (University of Queensland Gatton College, Australia) in 1998. In 1999, the 1st FAO/IAEA Research Coordination Meeting (RCM) on Irradiation as a Phytosanitary Treatment of Food and Agricultural Commodities highlighted the growing importance of irradiation as a phytosanitary treatment of agricultural commodities in trade. The RCM participants requested that the Joint FAO/IAEA developed a web-based database to compile this information and assist researchers and regulators dealing with phytosanitary treatments. In late 1999, the Insect and Pest Control Section and Food and Environmental Protection Sections of the Joint FAO/IAEA Division agreed to develop a single database, which could provide information on both doses for sterilization and disinfestation. This database was named International Database on Insect Disinfestation And Sterilization (IDIDAS).

2. Description

Objectives, target and resources

The purpose of IDIDAS is to aid retrieval of information on the doses of radiation used in the control of pest insects and mites. It collates scattered information on the use of radiation for control of pest insects and mites. The system provides information on a species basis for both disinfestation and sterilization, with dosage levels and conditions with the relevant references. Information is readily retrievable using the IDIDAS search form. Search lists indicate the availability of disinfestation and sterilization data allowing users to use IDIDAS as a "screening" tool. IDIDAS adds value to existing information by performing a quality assurance check on existing data and by making the information more accessible. Because many of the regulatory officers do not have direct connections to the Internet the system is also distributed on CD-ROM. IDIDAS shares common Joint FAO/IAEA Division resources including: glossary, reference and picture databases. Like EcoPort[77] (operated under the auspices of University of Florida, Food and Agriculture Organization of the United Nations and Smithsonian National Museum of Natural History), hyperlinks may be created to the “Resources”, which include “User’s tutorial” and a “Manual of Nuclear Techniques in Insect Sterilization”. The manual, which is still under development, provides information related to:

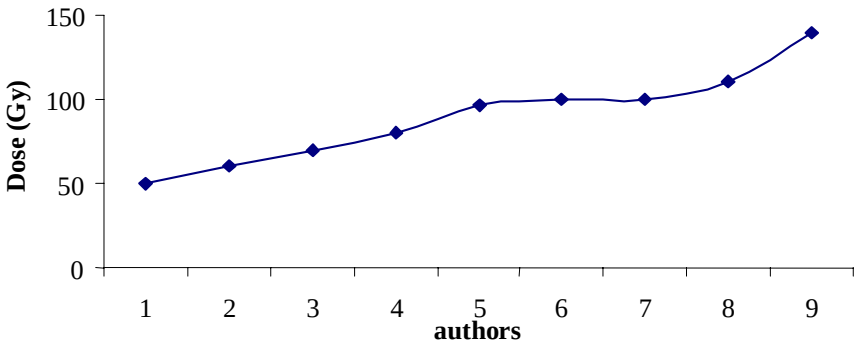
-Product Quality Control, Irradiation and Shipping Procedures for Mass-Reared

[1] Lachance et al.1967. In: Pest control (Kilgore & Doutt), NY: Academic Press
[2] Mandle A.M. 1964. Biol.Rev., 39:288-371
[3] Virkki N.1965. Agric. Sci. Rev. 3:273-322
[4] Von Borstel R.C. 1963.IAEA. 367-385
[5] Evans H.J. 1962. Int. Rev.Cyt.13:221-321
[6] Grosch D.S. 1962. Ann.Rev.Ent. 7:81-106

[7] http://www.ecoport.org/

Tephritid Fruit Flies for Sterile Insect Release Programmes.
-Dosimetry Standard Operating ProcedureConsultants are playing a key role in the development of IDIDAS. Data are being reviewed and collated by Abdeljelil Bakri (Sterilization) and Neil Heather (Disinfestation). Programming was done by Marco Marsella.

3. *Example of conflicting data on doses of radiation for sterilization*: In the literature, radiation doses for sterilization often differ for the same species (see Fig.). For example in the grain weevil *Sitophilus granarius* L., the effective doses causing sterility for 4-week old adults and 3d old adults are 70 Gy and 100 Gy respectively (Aldryhim



The grain weevil, *Sitophilus granarius* , sterilization doses of radiation according to different authors

(1) Ismail et al.1987; (2) Cornwell & Bull 1960; (3,6) Aldryhim &Adam 1999; (4) Franco et al.1997; (5) Tuncbilek 1995; (7) Brown et al. 1972; (8,9) Zhoo & Chen 1994

and Adam, 1999) with younger adults being more tolerant. For Franco et al. (1977) 80 Gy is the sterilizing dose for adults while Zhoo and Chen (1994) concluded that the effective sterilizing dose is 110 Gy for males and 140 Gy for females. Ismail et al (1997) claimed that 50 Gy caused complete sterility in adults with females more sensitive than males and older adults were more sensitive than younger adults. For Brown et al (1972) 50 Gy reduced the reproductive ability and 100 Gy induced complete sterility.

Cornwell and Bull (1960) reported 40 years ago that 60 Gy is the dose required for achieving 98-99% sterility. Tuncbilek (1995) reported that the lethal and sterilizing dose range from 97 Gy at 30^0C to 180 Gy at 15^0C Differences may arise from experimental procedures peculiar to sites, researcher skills, dosimetry standards, dose-rates, radiation types (electromagnetic and particulate radiations), temperature, life stages and sex of the pest tested, statistical analysis procedure and even accidents such as reinfestation of samples after treatment. Also the sterilization concept is not well defined in the reported works. Sterilization might be achieved by three kinds of process: Dominant lethal mutation in the sperm, inability of male to transfer the sperm or sperm immotility. Also, when authors report about the percentage efficacy of the sterilization or the female fertility, the ratios of sterile males to feral males and females is often not comparable. Also, the dose depends of the aim to be achieved, full sterility or F1-sterility that requires lower dose. The IDIDAS sterilization database tries to provide the minimum dose that results in the highest efficacy of sterility bearing in mind the insect flight ability, reproduction and mating competitivity. In this regard, most of published papers (back to sixties and sometimes fifties) on a specific species are reviewed, data compared and when possible a range of doses of radiation for sterilization is adopted. However, the reference list used is not assumed to be exhaustive and inputs are welcome to continue adding to it.

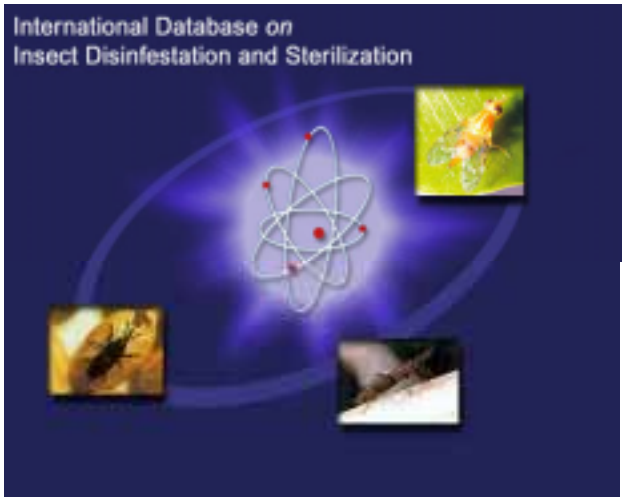
4. Radiosensitivity:

Because of cytological similarities within genera, possibly the same dose of radiation may apply and thus there is no need to develop a database for all insects and mites species. However, sensitivity among insect families and in particular orders, varies tremendously with Lepidopetra requiring the highest sterilizing dose, followed by Hemiptera, Coleoptera and Diptera. Many hypotheses have been advanced to explain differential sensitivity among them whether the structure of the chromosome centromer is diffuse or not. But there are exceptions that disprove these hypotheses.

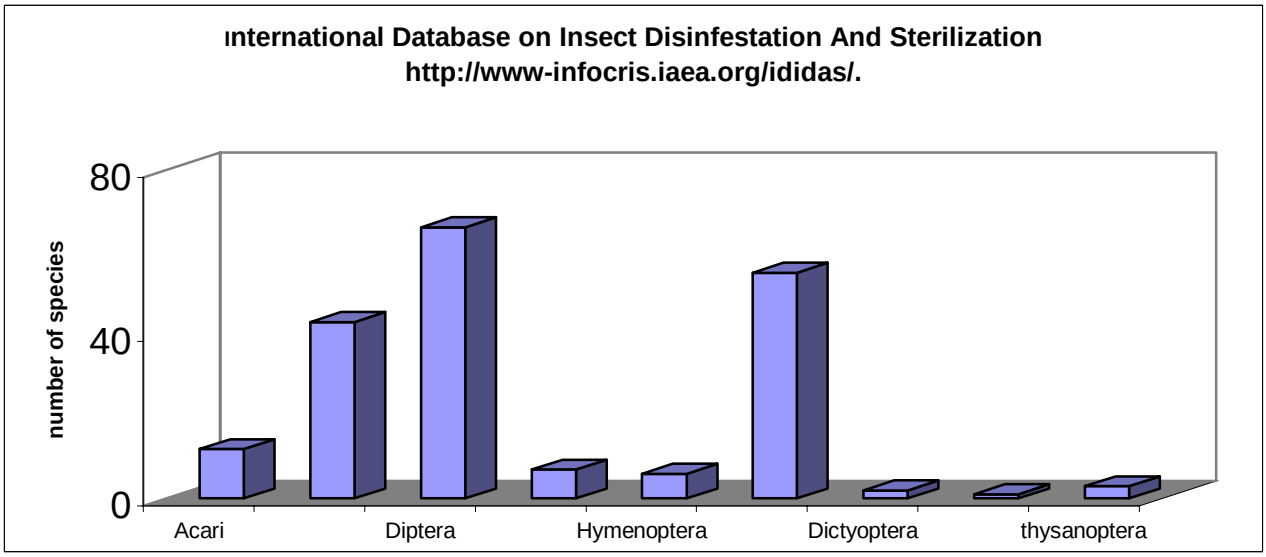
5. Insects and Mites Subjected to Sterilization

Over 215 species have so far been included in IDIDAS, although considerable work is still to be done. The database indicates that research on radiosterilization of plant and animal pests has concentrated on Diptera and Lepidoptera species. The following graph shows the number of species subjected to sterilization with radiation for the past 40 years.

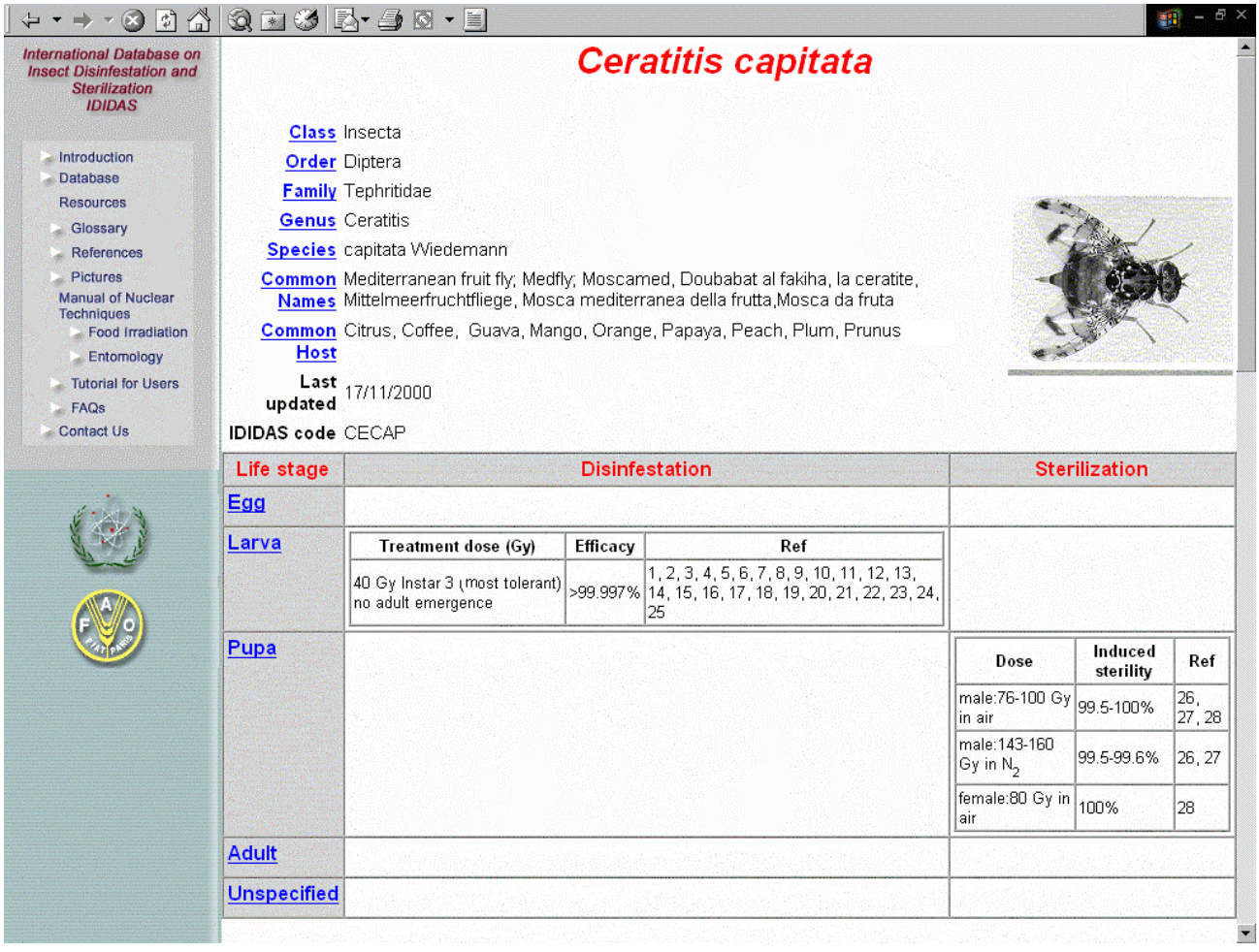
In addition to original papers, references have been drawn from abstract and other databases including those of the Federal Research Centre for Nutrition, Karlsruhe, Germany; Agricola and CABI London and the International Nuclear Information System (INIS)[2], Vienna. Nonetheless, the IDIDAS is far from being a complete survey of all the works on radiation for sterilization of insects. In this regard, the users are kindly requested to contact the IDIDAS Webmaster[3] to provide comments and or suggestions. Your feedback will help us to improve this service.



[2] http://www.iaea.org/inis/index.html
[3] infocris.feedback@iaea.org



6.Example of IDIDAS record



International Database on Insect Disinfestation and Sterilization IDIDAS

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- Pictures
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  - Food Irradiation
  - Entomology
- Tutorial for Users
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Ceratitis capitata

Class Insecta
Order Diptera
Family Tephritidae
Genus Ceratitis
Species capitata Wiedemann
Common Names Mediterranean fruit fly; Medfly; Moscamed, Doubabat al fakiha, la ceratite, Mittelmeerfruchtfliege, Mosca mediterranea della frutta,Mosca da fruta
Common Host Citrus, Coffee, Guava, Mango, Orange, Papaya, Peach, Plum, Prunus
Last updated 17/11/2000
IDIDAS code CECAP

Life stage	Disinfestation	Sterilization
Egg		
Larva	Treatment dose (Gy): 40 Gy Instar 3 (most tolerant) no adult emergence; Efficacy: >99.997%; Ref: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25	
Pupa		Dose / Induced sterility / Ref: male:76-100 Gy in air / 99.5-100% / 26, 27, 28; male:143-160 Gy in N_2 / 99.5-99.6% / 26, 27; female:80 Gy in air / 100% / 28
Adult		
Unspecified		

Peach Fruit Fly (*Bactrocera zonata*, Saunders) in Egypt

At the request of Egyptian Ministries of Agriculture and Electricity and Energy a pre-project mission was carried out in preparation for the new IAEA Technical Co-operation Project (EGY5025) on fruit flies in Eastern Egypt. This was done through presentations and discussions of the IAEA's project proposal and interviews with relevant persons of the Ministry of Agriculture and Ministry of Electricity and Energy and the Plant Protection Research Institute (PPRI).

Peach Fruit Fly (*B. zonata*) adult populations were observed co-existing with Mediterranean fruit fly *(Ceratitis capitata*, Wied) populations in semi-commercial and backyard orchards. Adults of both species (mainly females) were observed feeding on juices of fallen figs and resting on the leaves of the fig trees. *B. zonata* adults outnumbered those of medly. Field observations and studies done by students doing research for the PPRI indicated that *the B. zonata* has already displaced *C. capitata* in some areas. Fruit sampling has revealed that significantly more *B. zonata* adults emerge from mango fruits than *C. capitata* adults. This has special importance considering that mango production in Egypt is extensive (23,500 ha; 230,000 tonnes/year) and export volumes to neighboring countries in the Mediterranean are substantial.

There have been some claims that the fly has been present in Egypt since 1924 (based on a *B. zonata* adult specimen collected in 1924 and recently found in the insect collection of the PPRI) and that it is a minor pest which has been kept under control for years through the cover sprays used against *C. capitata*. However, this is doubtful since, as explained above, field observations indicate massive amounts of adult *B. zonata* co-existing with *C. capitata* populations. These observations were never done during the 1980's when extensive trapping and fruit sampling was carried out as part of the IAEA sponsored Mediterranean fruit fly SIT project.

The hypothesis of the presence of the PFF in Egypt, as explained by its proponents, is as follows: Since 1992, the Egyptian Government banned the use of cover sprays for medfly control due to the pesticide residue problem in Egyptian fruit which was threatening exports. The control strategy was then shifted to spot treatments based on a mixture of malathion, hydrolysate protein and a form of trimedlure. This selective bait treatment was effective for medfly control but did not control de *B. zonata* populations, which have since then increased to economic damage levels.

This hypothesis does not take into account that *B. zonata* is also killed by bait sprays and that normally the backyard fruit and low input fruit production is not subjected to repeated cover sprays and never before observations of the presence of *B. zonata* in low or high numbers had been evident as it is now. An alternative hypothesis would be that the introduction and establishment of *B. zonata* in Egypt is much more recent (probably during the mid-90's) and that it has taken some 3 to 5 years to fully establish and start colonizing the geographical distribution and host range of medfly.

Nevertheless, at this stage trying to put the pieces of this puzzle together is of little use. The fact is that *B. zonata* is present in large numbers in most of the country and already displacing medfly in certain areas and hosts. Spreading of the pest to current suspected free areas in Egypt is a matter of time. For example, during a field trip to the city of El-Arish in Northern Sinai and as a result of trap relocation, *B. zonata* adults where captured in high numbers in traps placed on fig trees. El-Arish is just around 50 km away from the Gaza Strip in the Palestinian Territories where the IAEA has been transferring SIT technology for the past three years and the implementation phase is due by January next year. The Egyptian staff was urged to increase the trapping efforts throughout the Sinai in order to assess with certainty the current *B. zonata* distribution.

If this pest gets established in the Mediterranean countries, the economic impact to the domestic and export market fruit production could be in the order of billions of USD per year as a consequence of increased direct damage, insecticide use, quarantine

restrictions, cost of certification programmes (including post harvest treatments), and environmental impact costs.

Red Palm Weevil and Peach Fruit Fly Study Tour/Workshop, Cairo, Egypt, 16-19 October, 2000

A workshop was organized by FAO and the Egyptian Ministry of Agriculture in collaboration with the FAO/IAEA Joint Division. Dr. Mahmoud E. El-Naggar, Director of the Plant Protection Research Institute (PPRI), of the Agriculture Research Centre (ARC) in Egypt, in his opening speech addressed the importance of these two insect pests to Egypt's agriculture production and acknowledged the support provided by the FAO and the FAO/IAEA Joint Division for organizing the event. Participants included Plant Protection and Quarantine Specialists (most postgraduate levels) from: Algeria, Egypt, Iraq, Jordan, Lebanon, Libya, Morocco, Sudan, Syria and Tunisia. The FAO Plant Protection Specialist for North Africa (Dr. Khaled Alrouechdi) pointed out the need to approach these new pest problems on a regional basis and suggested to have follow-up meetings to exchange information on the prevailing pest situation. The first two days of the workshop (16 and 17 of October) covered biological and control aspects of the Red Palm Weevil including a field visit to see pest damage *in situ*. On the following days (October 18 and 19), the Peach Fruit Fly (*Bactrocera zonata*) problem was addressed. Lectures included the current pest situation in Egypt and some basic data on life cycle and host range. A first class lecture by Dr. Allan Allwood (consultant hired by the FAO/IAEA Joint Division) covered general information on world economic fruit fly species and on a holistic approach to fruit fly control (including SIT) with emphasis on the application of the male annihilation technique (MAT). A field visit to demonstrate the utilization of trapping and MAT control revealed the extent of the Peach Fruit Fly (PFF) damage in Egypt. On the last session the organizational structure and flow of critical activities required to set up a National Vigilance and Emergency Response System against exotic pests was presented and discussed. Based on this a scheme for a regional (North Africa and Middle East) task force was proposed that is aimed at detection and emergency response to *B. zonata* and other exotic fruit fly outbreaks.

Workshop On Peach Fruit Fly (*Bactocera zonata*), Valencia, Spain, 13 – 15 November 2000

The Peach Fruit Fly (*Bactrocera zonata*) is native from South East Asia where it infests a number of commercial fruit and vegetable crops including: citrus, peach, mango, guava and tomato. The level of damage that this fruit fly species can inflict to fruit and vegetable crops is comparable to that caused by the Mediterranean fruit fly and the Oriental fruit fly. Recent information of its presence and establishment in Egypt triggered the organization of a workshop in Cairo, Egypt, during the month of October 2000, with the participation of plant protection officials from the North African and Middle East countries. Furthermore, a second workshop was organized by the Comité de Liaison de L'Agrumiculture Mediterraneenne (C.L.A.M.) in close collaboration with the FAO/IAEA Joint Division in Valencia, Spain, during November, 2000, with the participation of the citrus industry and plant protection officials from the Mediterranean Region. The FAO/IAEA Joint Division sponsored participation of Peach Fruit Fly (PFF) specialists to lecture on its biology, taxonomy and damage and on monitoring and control methods. Awareness of the current PFF situation in Egypt and the threat of its potential introduction and establishment in the Mediterranean region were created among workshop participants. This resulted in immediate interest in creating a PFF Regional Task Force with active participation of the industry, plant protection organizations of the

Mediterranean countries and international organizations (FAO and FAO/IAEA Joint Division). The Workshop also served the purpose of further strengthening ties with the FAO Plant Protection Regional Officer for North Africa with whom agreement was reached on taking specific actions to continue the efforts towards creating a PFF Regional Task Force in the region

Training on Old World Screwworm (OWS)

Regional Training Course on OWS in Tehran, Iran, 5 – 14 June 2000

A Regional Training Course on "Old World Screwworm Fly: Monitoring, Identification and Preparation for Intervention" was organized in close collaboration with the Veterinary Organization of Iran. 13 participants from 6 countries in the region were selected for the course, which included lectures, laboratory work and field excursions relevant to Old World Screwworm (OWS) identification/diagnosis, veterinary and entomological field surveys, as well as, principles of quarantine and control / treatment of OWS.

Group training on differential diagnosis of OWS larvae

Two group training events on "Differential Identification of Old World Screwworm Fly Larvae" were held at the National History Museum at London, U.K., from 17 to 21 July and 16 to 20 October 2000. 5 participants from 4 countries (Jordan, Lebanon, Syria and Yemen) were sponsored to attend the course, supervised by Dr. Martin Hall. The possibility of holding similar follow-up courses on differential OWS larvae diagnosis in the West Asia region in 2001 is currently being investigated.

First International Course on African Trypanosomoses

First International Course on African Trypanosomoses was organized by WHO, with the support of IAEA and other partners at the I.M.T.S.S.A., Le Pharo in Marseilles, France from 23 October to 10 November 2000. 22 participants, including medical doctors, veterinarians and entomologists from 17 countries, thereof 14 African, were selected for the three week intensive and comprehensive course. The course aimed at raising awareness on African trypanosomosis among doctors, veterinarians and scientists, on the impact of this disease and its importance as an obstacle to the development of the rural population of Africa. The course provided the trainees with an in-depth understanding of the disease and its epidemiology and prepared them for future work in trypanosomosis surveillance, intervention and research.

Standard Operating Procedure for Gafchromic Dosimetry

In all programmes utilising radiation sterilization, both for full sterility and F1 inherited sterility, the dose of radiation given to the insects is important to ensure that the insects are correctly sterilised and the level of somatic damage is not excessive. A review of the dosage reported by different rearing facilities indicates that, for any one species, there is considerable variation, reflecting both the experience of the local programme and issues of security and public relations. It is clear though that the measurement of dose at different facilities can often not be compared, and it is rare even in research reports to see confidence intervals for the stated dose. This makes comparison of work at different locations impossible, and it is difficult to reach agreement on "standard" doses.

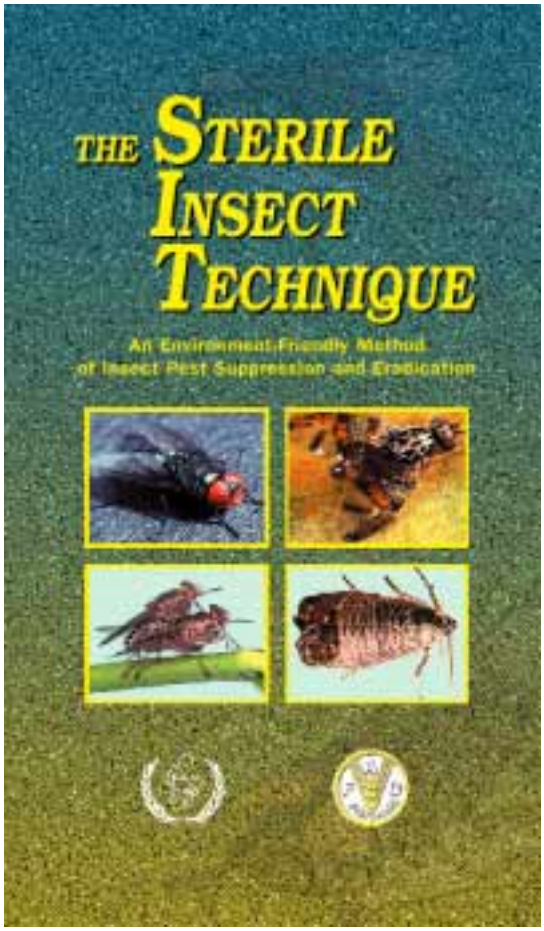
In an attempt to resolve this, the FAO and IAEA have recommended a standard dosimetry system and produced a set of Standard Operating Procedures (SOP) under the Co-ordinated Research Project D4.10.16 "Quality assurance of mass produced and released fruit flies". The dosimetry system is based on the Gafchromic® radiochromic film HD-810 which provides a reasonable compromise between cost, accuracy and ease of use, and the Far West Radiachromic® reader. Calibration of the field is achieved through the International Dose Assurance Scheme (IDAS) alanine secondary transfer dosimeters, calibrated against a primary standard in the UK.

The SOP cover all the steps necessary to set up and calibrate the dosimetry system, and to calculate confidence intervals for the readings. One of the most important steps for the calibration is ensuring that the standard alanine dosimeters and the Gafchromic dosimeters are exposed at the same point in the field, and designs for suitable holders to ensure this are provided for both self contained irradiators (such as the GammaCell 220) and panoramic irradiators. The procedures also provide instructions for field mapping and routine dosimetry, forms for recording results and guidance on dose auditing.

As a companion to the SOP a Microsoft Excel workbook is also available to perform all the calculations required, together with a set of sample data from the Agency's Seibersdorf laboratories.

Anyone interested to receive a copy of the SOP, workbook and examples may request a set from our office (E-mail J.Hendrichs@iaea.org)

Sterile Insect Technique video



The teaching video "The Sterile Insect Technique, An Environment-Friendly Method of Insect Pest Suppression and Eradication" mentioned in the last Newsletter is now available cost free. The video will be distributed to teaching institutions world-wide, and may be requested from the section. It is available in PAL, NTSC and SECAM formats and can be requested from:

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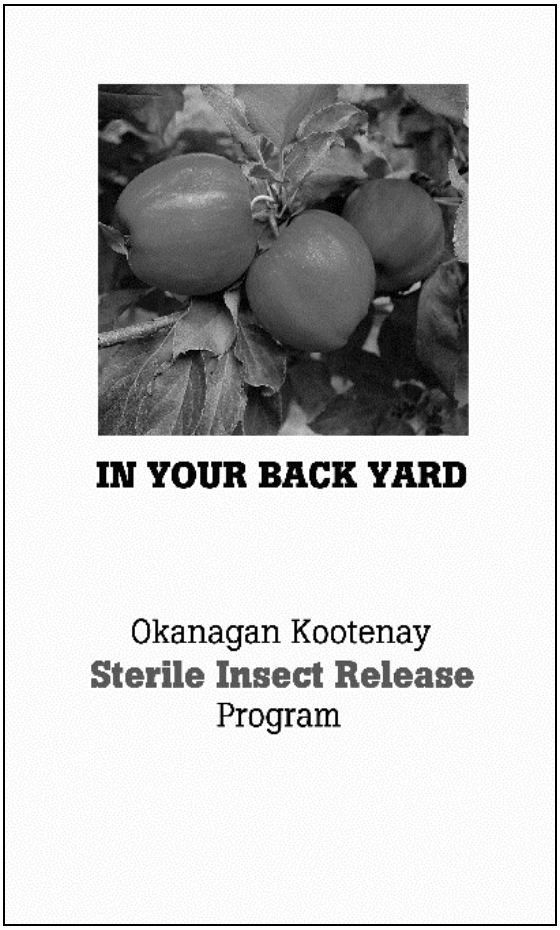
Codling Moth SIR Program video



The codling moth SIT control program in British Columbia, Canada, has produced an excellent new video of the programme.

SIR will supply the first video free of charge and will charge $10 Canadian for additional copies. The video is available in NTSC, PAL and SECAM formats from:

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Information Officer
Okanagan-Kootenay SIR Program
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Pan African SIT Forum

The idea to form the Pan African SIT Forum originated from the desire by many African tsetse experts seeking to exchange views and compare experiences relevant to the development and application of the Sterile Insect Technique and related tools for tsetse control and eradication. The proposal to formally establish the Forum was initiated and spearheaded by the government of Ethiopia, through a request to the Organisation of African Unity (OAU) to host a meeting of experts to discuss the matter.

A meeting of delegates from Botswana, Burkina Faso, Cameroon, the Democratic Republic of Congo, Ethiopia, Ghana, Kenya, Mali, Sudan, Tanzania, Uganda and Zimbabwe took place (19 – 20 June 2000) at the OAU Headquarters in Addis Ababa.

The delegates adopted a constitution and elected an Executive Committee comprising 9 members, with Dr Assefa Mebrate from Ethiopia as the committee's first Chairman. Within the provisions of the constitution, the Forum's major aims and objectives include the development and promotion of technologies relevant to the area-wide approach to tsetse eradication as well as the mobilization of African expertise to the technical challenges of implementing tsetse eradication programmes.

Pan African Tsetse Eradication Campaign (PATEC)

Widespread reports of escalating levels of tsetse fly infestations and increasing incidences of trypanosomosis, and their devastating effect on the health and productivity of man and livestock in Africa are being viewed against a background of deteriorating socio-economic circumstances. Faced with the increasing problems of trypanocidal drug resistance and availability and the futility of unsustainable approaches in tsetse and trypanosomosis control, Africa's attention has now been drawn to intervention methods that are directed at eradicating the vector of the disease.

The African Heads of State and Government meeting at the OAU Summit in Lome, Togo reviewed and decried the great negative impact of trypanosomosis on the history and development of Africa. They identified and declared tsetse eradication as Africa's collective responsibility in a decision that made it the objective of a continental campaign.

The Decision of the African Heads of State and Government on tsetse eradication is quoted below:

"Decision Made By The Assembly Of The African Heads Of State And Government During The Thirty-Sixth Ordinary Session, 10-12 July 2000, Lome, Togo On The Proposal For The Eradication Of Tsetse Flies From The African Continent

Takes Note the report presented by the Government of Uganda, and *commends* the efforts undertaken to highlight the problem caused by tsetse flies in Africa

1. *Commends* those African countries that have initiated the application of Sterile Insect Technique (SIT) for their pioneering effort;
2. *Recognizes* the seriousness of the problem as one of Africa's greatest constraints to socio-economic development severely affecting human and livestock health, limiting land use, causing poverty and perpetuating underdevelopment on the continent;
3. *Urges* member states to act collectively to rise to the challenge of eliminating the problem through concerted efforts in mobilizing the necessary human, financial and material resources required to render Africa tsetse-free within the shortest time possible.

4. *Acknoledges* the trans boundary nature of the problem, *Welcomes* the establishment of the *Pan-African SIT Forum* as a mechanism through which sustainable area-wide tsetse eradication can be achieved and *Calls Upon* the Secretary General to provide support to the *Pan African SIT FORUM.*
5. *Declares* the year 2001 as the year of the control of tsetse fly, to mark the beginning of renewed effort in the campaign for the eradication of tsetse flies in Africa;
6. *Requests* the Secretary General to undertake all necessary consultations with a view to initiating the campaign from all possible partners and seek their support and co-operation in the implementation of *the Pan African Tsetse Eradication Campaign.* The Secretary General should submit an annual progress Report to the OAU Summit, through the Current Chairman

While the long term objective of tsetse eradication, as recorded in the Decision by the African Heads of State, is the collective responsibility of African countries, the campaign to achieve this objective will be initiated and co-ordinated by the Secretary General of the Organisation of African Unity. In the context of this obligation, the Pan African Tsetse Eradication Campaign (PATEC) has been set up under the office of the Secretary General of OAU to co-ordinate and organize the eradication campaign.

The first activity of PATEC will be the convening and management of a meeting of a Task Force, comprising experts drawn from different African countries, whose task will be to formulate a Plan of Action for the implementation of the Decision by the Heads of State. The Task Force will hold its meeting (11-15 December 2000) in Nairobi, Kenya. The Plan of Action, which the Task Force will prepare, will help guide and organize the efforts of the tsetse eradication campaign.

I. ANNOUNCEMENTS

Staff Changes

Andrew Parker leaves Section

Andrew Parker is leaving the Section after two and a half years as a technical officer working on tsetse flies and moths. Apart from his many duties as technical officer, Andrew, was the editor of this newsletter, and also helped everyone in the Section solve computer-related problems. Having made major contributions he will be sorely missed, but we hope that before long he will return to play a significant role again. Before joining the Section in 1998, Andrew was involved in IAEA Technical Cooperation and supported tsetse activities in Nigeria. Starting in 1994, Andrew spent 4 years in Tanga, Tanzania, assisting in the development of the Tsetse and Trypanosomosis Research Institute and helping the staff to produce the millions of tsetse flies that were released in the successful tsetse SIT eradication programme in Zanzibar. More recently, Andrew was instrumental in assisting the Southern Tsetse Eradication Project (STEP) in Ethiopia to develop specifications and plans for the tsetse production factory to be constructed at Kaliti, Addis Ababa.

Carlos Caceres and Gratian Mutika join the Seibersdorf Unit

Mr. Carlos Caceres (Guatemala) has joined the Unit from the medfly rearing facility in El Pino, Guatemala and he is in charge of the fruit fly rearing, quality control and strain evaluation activities. Mr. Caceres was previously the Director of El Pino, developing it into the largest medfly rearing facility in the world, producing currently over 800 million sterile males each week.

Mr. Gratian Mutika (Zimbabwe) has been recruited to strengthen the tsetse R & D. He will join the Unit in January 2001 to further develop quality control protocols for sterile male tsetse behaviour. During his previous period at the Entomology Unit, Mr. Mutika successfully adapted a fruit fly mating compatibility test on field-caged host trees to tsetse behavioral assessment under greenhouse conditions.

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