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Contents

Mediterranean fruit fly mass rearing and sterilization facility "El Pino" in Guatemala, with a production of over 2 billion sterile males per week, is the largest facility of its kind.

To Our Readers

The **Second International Conference on Areawide Insect Pest Control** sponsored by FAO and IAEA will be held from **9 to 13 May, 2005** in Vienna, Austria. This conference will provide a forum for the presentation of scientific papers dealing with areawide insect management programmes, including those applying the Sterile Insect Technique (SIT) and will include significant time for plenary discussion. The framework of the conference is being developed and the announcement with details of the Conference can be found under **http://www-pub.iaea.org/MTCD/Meetings/Meetings2005.asp** We would be pleased to consider any suggestions you have as to particular topics that deserve special attention in the programme. It is planned to hold several Research Coordination Meetings in conjuction with this meeting.

The Interregional Training Course on The Use of the Sterile Insect and Related Techniques for the Integrated Areawide Management of Insect Pests, was held from 4 May to 1 June 2004 in Gainesville, Florida, USA. This is a unique course that provides participants with a complete overview of all aspects related to areawide and SIT operational programmes. Both USA and external lecturers participated with an adequate balance between theory

IAEA International Atomic Energy Agency

and practical laboratory and field exercises. The course drew its participants selected from ca. 113 applicants, from all regions of the world (this time 24 Member States were represented) and was instrumental in both raising awareness and improving capacity in the SIT field.

This year more than half of the participants of this course were actively involved in areawide programmes either in the RandD side or in operational activities

The basic technological package for medfly SIT is now very well developed and has been transferred to many operational programmes. This package includes genetic sexing strains, improved diets, filter rearing systems, QC protocols, improved trapping systems and economic models. This has enabled the sub-programme to put in place a gradual shift in activities in order to develop SIT for other key pests. This change will have most impact for the activities of the Entomology Unit in Seibersdorf where medfly work will be significantly reduced in scale and work on other fruit fly species expanded. The quarantine rearing facility will make it possible to work with species of regulatory significance. The Unit will however continue to supply medfly genetic sexing strains to operational facilities on demand and provide training in this area.

Several events have occurred in the recent past that encourage the idea that commercialization of medfly SIT may be closer to becoming a reality. First, in Israel a company that has traditionally been involved in biological control is seriously thinking about the construction of a large medfly rearing facility in that country. This facility would supply sterile male medfly to release programmes initially in Israel, but would have the potential to supply other programmes in the region. Second, a consortium has been formed with support of the European Commission, to promote and develop medfly SIT in the Mediterranean region. This consortium, consisting of both profit and non-profit organizations, will be involved in RandD activities in several countries and hold a series of workshops in the region. Third, the SIT programme in Madeira is in negotiations with a private company regarding some type of partnership to ensure sustainability of the programme when EC funding comes to an end. These developments have been followed very closely by the sub-programme and we have been involved in providing advice, developing collaborative links and interacting at the RandD and technology transfer levels. There will be ample scope for further collaboration when these initiatives become fully realized.

The fifth meeting of the Working Group on Fruit Flies of the Western Hemisphere (WGFFWH) took place in Fort Lauderdale, Florida, from 16 to 21 May 2004 and more than 200 participants attended. The meeting has a very unique format where scientists, action programme managers and the industry interact, greatly encouraging discussions and focusing research to solving practical problems of action programmes and the industry. Poster presentations are key components of the meeting with moderated plenary discussions being held at the conclusion of each poster session. Based on these discussions a prioritized list of research needs is identified. The opening address for the meeting was given by Don Lindquist who, although officially retired for some time from SIT activities, presented a stimulating paper on the future perspectives of SIT. As recognition of Don's major contributions to SIT programmes throughout his working career a special memorial plaque was handed to him at the end of his plenary lecture. The next meeting of the WGFFWH will take place in Salvador, Bahia, Brazil, from 10 to 15 September 2006 in conjunction with the Seventh International Symposium on Fruit Flies of Economic Importance.

The development and implementation of tsetse SIT remains a major component of the sub-programme activities as well as requiring major support and input from other Agency divisions. To aid the Agency in this collaborative endeavour a group of three external experts has undertaken an evaluation of all tsetse activities including visits to various African countries. This involved extensive input in both time and effort from the sub-programme and a series of presentations was held for the group both in Headquarters and at Seibersdorf. A report has now been produced by the group that includes many recommendations to the Agency as to how the delivery of the tsetse SIT programmes to Member States can be improved.

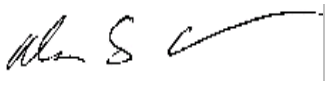
For the past two months, the sub-programme has been involved in the development of its activities for the biennium 2006-2007. It has been agreed that several changes in emphasis will take place to reflect both completion of some activities through effective technology transfer and the changing demands of Member States. Included in the changes will be the development of e-learning modules for several components of tsetse SIT and significant expansion of activities related to invasive species and the potential of SIT and nuclear techniques for the production of biological control agents as technologies for their exclusion. A new project focussing on these topics will start in 2006.

It is with great sadness that we inform you that during the first half of the year the international entomology community lost two very prominent and dear colleagues namely: Doctors **Patrick V. Vail** and **Ronald F. Prokopy**.

Dr. Vail passed away on Sunday, February 8, 2004. He served as head of the Insect and Pest Control Section of the Joint FAO/IAEA Division, Vienna, Austria, from 1975-78 with responsibilities for tsetse fly and tropical fruit fly programmes**.** He was the Director of the USDA-Agricultural Research Services Horticultural Crops Research Laboratory, Parlier, California, from 1982 until he

retired in February 2003. Dr. Prokopy suddenly passed away on 13 May 2004. He was one of the senior world leaders of fruit fly research, and professor at the University of Massachusetts. Ron was not only the leading authority on *Rhagoletis* fruit flies in North America. He also traveled widely throughout all continents, where he had numerous collaborators and former students, carrying out seminal studies on many *Anastrepha, Bactrocera, Ceratitis* and *Dacus* fruit fly pest, and motivating groups of disciples to follow in his approach. We have lost two dear friends and colleagues and our deepest sympathy goes to the families of Pat and Ron.

On behalf of our colleagues at Seibersdorf and Headquarters, I would like to thank you for your continuing interest and support to our activities. We really do appreciate feedback from you regarding the Newsletter and we hope you continue to find it a source of useful information. For all the fruit fly workers, please do not forget to register on tephritid database at www.tephritid.org. The database was launched only a month ago and currently we have over 140 registered users.



Alan Robinson
Head, Entomology Unit

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Forthcoming Events

I. Research Coordination Meetings (RCMs)

1. Quality assurance of mass produced and released fruit flies 18-22 October 2004, Metapa de Dominguez, Chiapas, Mexico. Final RCM.

2. New CRP on Improving sterile male performance in fruit fly SIT programmes 25-29 October 2004, Antigua, Guatemala. 1st RCM.

II. Consultants and Other Planning Meetings

Generic design and technical guidelines for the location of tsetse mass rearing facilities 11-15 October 2004, Vienna, Austria.

III. Other Meetings/Events

1. Tenth Meeting of the Panel of PAAT Advisory Group (PAG) Coordinators, 22-23 September 2004, Accra, Ghana.

2. Second International Conference on Areawide Insect Pest Control, 9-13 May 2005, Vienna, Austria.

3. Seventh International Symposium on Fruit Flies of Economic Importance and Sixth Meeting of the Working Group on Fruit Flies of the Western Hemisphere, 10-15 September 2006, Salvador, Bahia, Brazil.

Participants of the Interregional Training Course on the Use of the Sterile Insect and Related Techniques for the Integrated Areawide Management of Insect Pests, 4 May - 1 June 2004, University of Florida, Gainesville, USA

Past Events (in 2004)

I. Research Coordination Meetings (RCMs)

1. New CRP on Molecular Technologies to Improve The Effectiveness of SIT 19-23 January 2004, Vienna, Austria. 1st RCM.

2. Improvement of codling moth SIT to facilitate expansion of field application 8-12 March 2004, Stellenbosch, South Africa. 2nd RCM.

3. Development of improved attractants and their integration into fruit fly SIT management programmes (in conjunction with Western Hemisphere Meeting on Fruit Flies of Economic Importance), 11-15 May 2004, Fort Lauderdale, Florida, USA. 3rd RCM.

Note: Reports available upon request

II. Consultants and Other Planning Meetings.

1. Workshop on Technical and Environmental Feasibility of Sequential Aerosol Treatment for Tsetse Suppression 1-5 March 2004, Vienna, Austria.

2. Radiation biology studies to optimize sterilization procedures in SIT Programmes 19-23 April 2004, Vienna, Austria.

3. Mass production and pre-release biology of *Anopheles arabiensis* 22-27 March 2004, Vienna, Austria. Report available upon request.

4. Guidelines for emergence, packing and release of sterile flies used in areawide suppression/ eradication programmes 11-15 May 2004, Sarasota, Florida, USA.

Note: Reports available upon request

III. Other Meetings/Events

1. Workshop on Integration of SIT and Other Environment Friendly Methods for the Management of Key Citrus Insect Pests 17 February 2004, Agadir, Morocco, in conjunction with the 10th International Citrus Congress (15-20 February 2004).

2. Fifth Meeting of the National Coordinators of medfly SIT projects in the Near East, 18-19 February 2004, Agadir, Morocco.

3. Fifth Meeting of the Working Group on Fruit Flies of the Western Hemisphere, 16-21 May 2004, Ft. Lauderdale, Florida.

4. Workshop on Areawide Application of the Sterile Insect Technique held in conjunction with the 15th International Plant Protection Congress in Beijing, China (11-16 May 2004).

5. Fourth Meeting of the Coordination Group for Project RLA/5/045 Establishing Options to Export Fruits and Vegetables Through the Creation of Fruit Fly Pilot Low Prevalence and Free Areas Using an Integrated Pest managementApproach, Including the SIT in Central America and Panama 9-11 June 2004 in Guatemala City, Guatemala.

6. FAO/IAEA Interregional Training Course on The Use of the Sterile Insect and Related Techniques for the Integrated Areawide Management of Insect Pests, 4 May - 1 June 2004, University of Florida, Gainesville, USA.

Technical Cooperation Projects

The Sub-programme has currently technical responsibilities for the following technical cooperation projects that are managed by the Technical Cooperation Department. They fall under five major areas, namely:

- Tsetse
- Fruit flies
- Old and New World Screwworm
- F-1 Sterility for the Control of Lepidopteran Pests
- *Anopheles arabiensis* mosquitoes.

Ongoing Operational Projects are:

ALG/5/019 Control of Date Moth Using the Sterile Insect Technique

BOT/5/002 Support of Tsetse Eradication from Ngamiland

BKF/5/003 Applying Sterile Insect Technique to Create Tsetse Fly Free Zones

EGY/5/025 Area-Wide Fruit Fly Control in Eastern Egypt

ETH/5/012 Integrating SIT for Tsetse Eradication

INT/5/145 Promotion of Insect Pest Control Using the Sterile Insect Technique

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

MAG/5/011 Feasibility Study of SIT-Based Integrated Pest Management of Fruit Flies

MAR/5/009 Control of Diamondback Moth by and Integrated Pest Management System Including the Sterile Insect Technique

MAR/5/015 Feasibility Study For Integrated Use of the Sterile Insect Technique for Area-Wide Tephritid Fruit Fly Control

MEX/5/027 Transfer of Genetic Sexing Mass Rearing Technologies for Fruit Fly Production

MEX/5/028 Prevention Against Cactus Moth in Mexico

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

RLA/5/045 Preparation for Pilot Fruit Fly-Free Areas using the Sterile Insect Technique in Central America

RLA/0172 An FAO Technical Cooperation Project entitled "Establishment of Mediterranean fruit fly (*Ceratitis capitata*) free areas in Belize, Costa Rica and Panama"

SAF/5/005 Situation Analysis of the Feasibility and Desirability of Tsetse Fly Eradication

SAF/5/007 Expanding the Use of the Sterile Insect Technique against Fruit Pests in the Western and Northern Cape

THA/5/046 Area-Wide Integrated Control of Fruit Flies

UGA/5/024 Integrated Area-Wide Tsetse Eradication Programme in the Lake Victoria Basin

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

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

Transfer of Genetic Sexing Mass Rearing Technologies for Fruit Fly Production Supported Under MEX/5/027

This project has two components a) the transfer of established medfly genetic sexing technology to the Metapa mass rearing facility and b) the development of genetic sexing strains for *Anastrepha ludens*. The first of these objectives has essentially been achieved with the conversion of the medfly rearing facility to a male only production using eggs produced in the El Pino medfly facility. The eggs are shipped daily from Guatemala to Mexico.

Ongoing SIT programmes for *A. ludens* would greatly benefit from the development of a genetic sexing strain and Member States have expressed a strong interest in this project. Two approaches are being considered to-achieve this, firstly the use of traditional Mendelian approaches involving the isolation of selectable markers and translocations etc. and secondly the transgenic approach. Fellows from Mexico have been trained in the classical approach at Seibersdorf and cytological training has been carried out in the laboratory of Dr. Zacharopoulou in Patras. The first male linked translocations have been induced and three mutations isolated. This year, fellows will go to Dr. Handler's laboratory in Gainesville for training in transgenesis and the laboratory will be fully equipped to carry out this work later in the year.

Establishing Options to Export Fruits and Vegetables Through the Creation of Fruit Fly Pilot Low Prevalence and Free Areas Using an Integrated Pest Management Approach, Including the SIT, in Central America and Panama Under RLA/5/045 and FAO/TCP 0172

The fourth meeting of the Coordination Group for Project RLA/5/045 was held from 9 to 11 June 2004, in Guatemala City.

The aim of the meeting was to evaluate progress made during 2003 and to plan the activities for the last year of the second project phase.

Participants to the meeting included project counterparts from Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama. Belize participated as an observer.

Other organizations including OIRSA, USDA and FHIA, also were present at the meeting.

The most relevant issues discussed and conclusions drawn were the following:

- After three years of project activities (2001-2003), working in alliance with FAO, IICA, OIRSA and USDA, finally one area in each of the countries participating in the regional project has been officially declared Mediterranean fruit fly (Medfly) low prevalence and/or free areas.

- Now each country is in the process of implementing the same procedures in other areas with the aim of expanding the areas with possibilities for exports of fruits and vegetables without the need for postharvest treatments. Ministries of Agriculture of the Central American countries and Panama have put forward a formal proposal to the Ministry of Agriculture of the USA with the aim of obtaining support from this country for the regional initiative and at the same time have requested to the IAEA the continuation of its technical cooperation support to assure the success of the initiative.

- Based on the progress made in the rest of the Central American countries in developing fruit fly low prevalence and free areas, Belize, which is a Medfly free country, has shown interest in applying the sterile insect technique (SIT) for the suppression and eradication of the Mexican fruit fly, *Anastrepha ludens*, that inflicts losses amounting up to 40% of the yield. During the meeting Belize informed that they will establish communication with the IAEA to explore the possibility of joining the Agency with the aim of having access to the Agency's SIT technology among other interests. The Organismo Internacional Regional de Sanidad Agropecuaria (OIRSA) has formed a Fruit Fly Regional Technical Group integrated by the members of Project RLA/5/045 Coordination Group. The aim of the Group is to assess the problems that fruit fly pests cause in the region and to analyse the alternatives for the development of additional fruit fly low prevalence and free areas based on the progress made under the IAEA and FAO Regional Projects. The creation of this Group is seen as a fundamental step towards assuring the sustainability of the project's outputs and outcomes that have been possible, in a great extent, due to the effective alliance between IAEA, OIRSA, FAO, USDA and the Ministry of Agriculture of Mexico.

- The plans to construct a medfly mass rearing and sterilization facility in Honduras are continuing. The Ministry of Agriculture of Honduras is currently in the process of lobbying for cooperation in training of staff in the management of genetic sexing breeding colonies and management of the irradiation facility as well as for the preparation and publication of the law for use of radiation sources.

- Costa Rica has refurbished a laboratory for the mass production and sterilization of the West Indies Fruit Fly, *Anastrepha obliqua*, the key pest of mango in the region. This laboratory will have a catalytic effect in the near future for control of fruit flies other than the medfly in the Central America and Panama region. This initiative has, apart from the IAEA, direct participation of FAO and the Ministry of Agriculture of Mexico.

Achievements in the Tsetse Programme in South Africa, Supported Under SAF/5/005

Approximately 10,000 cattle died in the N.E. part of KwaZulu-Natal (KZN) in 1990 as a result of an outbreak of trypanosomosis. Emergency measures were undertaken during the period 1990-1992 and the disease was successfully controlled using a combination of cattle treatment with trypanocidal drugs and tsetse control efforts using pyrethroids in the diptanks. Subsequently, the

National Directorate of Veterinary Services (NDVS) contracted the Onderstepoort Veterinary Institute (OVI) to develop a long-term tsetse control strategy for KZN to prevent resurgence of the problem. The current disease situation remains, however, critical as evidenced by the administration of more than 10,000 prophylactic doses of Ethidium Bromide by the veterinary staff in 2003. This does not include the curative treatment of sick animals, which is very often done by the farmers themselves. There are no records available of the number of curative Berenil treatments given per year.

It is obvious that the only sustainable solution to the TandT problem would be the elimination of the two populations of tsetse from KZN. In that respect, the IAEA has supported the tsetse activities in South Africa through TC project SAF/5/005 "Situation Analysis of the Feasibility and Desirability of Tsetse Fly Eradication" and the following provides an overview of the main achievements to date.

Establishment of Experimental Colonies of *G. austeni* and *G. brevipalpis*, Derived From Membrane Adapted Colonies.

A colony of *Glossina austeni* and *Glossina brevipalpis* was established at the Entomology Department of the OVI at Pretoria in 2002 with pupae derived from the membrane-adapted colonies maintained at the Entomology Unit of the FAO/IAEA's Laboratory in Seibersdorf. The *G. austeni* colony at the Entomology Unit, Seibersdorf was eliminated in late 2002 due to lack of space and personnel, and pupae shipments were initiated from the TTRI, Tanga in mid-2003. The shipments of the *G. brevipalpis* pupae from the Seibersdorf colony are being continued. The emergence of the *G. brevipalpis* pupae received from Seibersdorf averaged between 60 and 70%, whereas the emergence of the *G. austeni* pupae has always exceeded 90%. Three rooms of the Entomology Department at the OVI have been converted into an experimental insectary, i.e. one holding room, one feeding room and one handling room. The total tsetse fly holding capacity is estimated at 45,000 producing and pre-producing females. The production parameters of the *G. austeni* colony are excellent and the colony has increased to approximately 30,000 females. The establishment of the *G. brevipalpis* colony has been more challenging and the reasons for these difficulties are being examined.

In addition to the establishment of colonies derived from membrane adapted colonies, attempts have been undertaken to establish experimental colonies of *G. austeni* and *G. brevipalpis* derived from field collected flies in KZN. These efforts have had limited success and have again highlighted a.) the difficulties encountered with the establishment of a tsetse colony from field-derived fly material and b.) the great benefits offered and the valuable time gained by using flies derived from colonies already adapted to laboratory conditions for the establishment of colonies for intervention campaigns. All available evidence suggests that there are no mating barriers between tsetse populations of the same species but from different geographical areas. However, this still needs to be confirmed for the membrane-adapted colonies of *G. brevipalpis* (Kenya origin) and *G. austeni* (Zanzibar origin) species and the native species in KZN. The main purpose of this small experimental colony from KZN is to provide flies for use in field cage studies to assess the absence/presence of mating barriers between the membrane-adapted and the field strains.

Experimental Work on the Efficiency of Insecticide Impregnated Targets

A trial to assess the effect of blue-black insecticide-impregnated targets (IIT) on populations of *G. austeni* and *G. brevipalpis* was initiated in May 1999 at the

Blue-black targets impregnated with insecticides

'Ndolzi Skiereiland' in the St Lucia Park. These trials aimed to assess the efficiency of these IIT as a suppression tool for populations of *G. austeni* and *G. brevipalpis* for use in potential future intervention campaigns. A total of 4 targets per km^2 were initially deployed at random in the study area, but the targets were later concentrated in tsetse predilection areas. The initial results were not very encouraging and consequently, the target density was increased to 8 per km^2 in January 2002 and 12 per km^2 in January 2003. Recently developed H-traps were used to monitoring the tsetse population in the intervention area and in the zones immediately south, which were considered a buffer zone (contained likewise IIT). False Bay Park (situated immediately north of the trial zone) was selected as a 'control' zone to provide comparative population density data from an area without any intervention.

The experimental area in St. Lucia Park

Although many of the data still require in-depth analysis, the trial seemed to indicate that IIT could be effectively used against *G. austeni* in KZN at a target density of 8-12 targets per km^2. No conclusions can be made at this stage on the effect of the IIT on the *G. brevipalpis* population. However, the required target density makes this technology expensive, especially when large areas have to be covered. It is estimated that the tsetse-infested area in KZN covers a total surface area of 15,000 to 20,000 km^2. Restricting the use of the IIT to biologically sensitive areas such as the protected game reserves will likewise create opposition i.e. significant damage will be inflicted on the environment by: i.) the numerous tracks that will have to be cut to deploy the targets, ii.) the need for a large cleared area around the target for it to be effective, iii.) the need for target maintenance, iv.) the potential for soil erosion and v.) the use of the track network by poachers, illegal hunters and loggers.

The use of the Sequential Aerosol Technique (SAT) could be a viable alternative as an efficient suppression method of tsetse in South Africa (Graham Parker, unpublished report to the IAEA). There is a considerable amount of sound eco-toxicological information available that indicates that the environmental impact of the SAT technology is minor and short lived. It is unfortunate that, despite the availability of this information, the decision to apply the SAT is in most African countries hampered by political viewpoints, pressure from the donor community, misinformation spread by opponents, inflation of the perceived risks to the environment and the willingness to be influenced by anecdotal evidence and press reports rather than sound scientific data. (Ian Grant, unpublished report to the IAEA).

Tsetse Distribution Model: a GIS Study

The OVI entomological field team conducted a series of entomological field surveys from 1992 to 1999 in order to map the presence of both *G. austeni* and *G. brevipalpis* in KZN. As part of a study to investigate the feasibility of eradicating both tsetse species from KZN, a satellite derived presence/absence model was developed for both species of tsetse to enhance the obtained field survey results, to highlight potential habitats and assist in the planning of proper vector suppression strategies. A training set (raw and transformed entomological field data) and a set of co-variables of predictor variables (i.e. satellite derived and ground measured) were used to develop the model.

The model suggests a higher level of correlation between abundance and environmental co-variables for *G. austeni* as compared to *G. brevipalpis*. This might be an indication that *G. austeni* is less mobile than *G. brevipalpis* and/or prefers more specific habitats. The model showed that the distribution pattern of G. *austeni* was fairly continuous throughout the central part of KZN but with some major geographical differences, e.g. in the southern part *G. austeni* was mainly observed in or in the vicinity of conservation areas and game farms, whereas in the northern part of its distribution range this species was mainly found in communal farming areas. According to the model, the *G. brevipalpis* population in KZN is restricted to two distinct areas, which were separated by a gap of approximately 90 km. In the south, *G. brevipalpis* was recorded in Hluhluwe game reserve, the northern part of Umfolozi Game reserve and the southern part of Greater St Lucia Wetlands Park at both the western and eastern Lake shore. When both proper vegetation (dens riparian vegetation) and hosts were available, *G. brevipalpis* was also found in the vicinity of these game reserves up to a distance of about 8 km. (AVIA-GIS, report to the Agency).

Socio-economic Study

One of the most important aspects of the presence of the disease trypanosomosis and the vector, the tsetse fly, is their socio-economic impact on the farmer community. In September 2002, an IAEA expert mission was organised to assist the counterparts with the development of such a study. A detailed questionnaire was developed to collect information covering household demography, income sources, access to services and information, livestock inventories, livestock diseases, access to animal health services etc. Enumerators were selected and provided with some basic training. A total of 150 farms were selected using the livestock census of 2001 as a basis. A computer programme in SAS was used to select a random sample of the required number of households to be surveyed. In addition, an Access-based database was developed tailored to the needs of the socio-economic study for easy transfer of the data. The household survey has been implemented and the collection of data finalised. The transfer of the data to the database is still ongoing.

Environmental Impact Assessment

The total land area in KZN infested with tsetse is estimated at 15,000 – 20,000 km^2 and includes communal farming areas, commercial farms and protected areas. There are eighteen protected areas gazetted within the boundaries of KZN. In view of the strong environmental lobby in South Africa and the concerns, which have been raised with respect to the removal of tsetse and the preservation of biodiversity, a study was commissioned (Dr Ian Grant, professor of environmental toxicology) to undertake a situation analysis of the environmental impact of tsetse intervention operations in South Africa. The resulting report provides an outline for an Environmental Impact Assessment (EIA), which would provide an assessment of the potential impact of tsetse control interventions in KZN including: i.) the potential direct and indirect environmental impact, ii.) the impact of roads and tracks used for odour-baited target deployment and maintenance on soil erosion/degradation, on sediment run-off into streams in wet season, on the potential for unplanned or illegal timber cutting, wood gathering,

poaching of endangered species and illegal hunting of wildlife, iii.) the impact of pyrethroids used in cattle dips or aerially (fixed wing or helicopter ULV Sequential Aerosol Technique) on non-target wildlife (mainly arthropods), ecosystems and biodiversity, iv.) the impact of camps (noise, litter, fire risks, pole cutting/wood gathering), v.) the impact of target use, maintenance and monitoring on communal/protected area management activities, tourism and aesthetic quality of targets and their maintenance, vegetation control around targets; disturbance of wildlife and appreciation of wilderness and vi.) the impact of tsetse eradication and reduced selection pressures on resistance of indigenous wildlife, particularly endangered species (e.g. rhino), to trypanosomosis.

Feasibility Study on the Use of Different Tsetse Suppression Tools

Diptank in communal farming area

A study was undertaken to assess the feasibility of different tsetse suppression techniques in relation to various vegetation types and geographical locations in KZN. The study concluded that:

- The dense network of cattle dips (see figure) available in the communal farming areas could be exploited as a very useful tsetse suppression method, as was demonstrated after the outbreak of Nagana in 1990. Many dips will require basic refurbishment to become operational again and many more cattle dips will have to be established in strategic areas to have the best possible impact on the tsetse population.

- The deployment of insecticide-impregnated targets would not be a sustainable solution for the TandT problem in KZN in view of the high cost involved (deployment, maintenance, personnel etc.).

- The use of the SAT seems technically feasible as the vegetation in the tsetse-infested area is not very diversified and the maximum elevation does not extend beyond 500 m. The topography of KZN does not seem to present logistical and operational problems for an SAT operation, which cannot be easily overcome. Fixed-wing aircraft could therefore be used for the spraying of the non-residual insecticides for most of the tsetse infested territories, except for about 10% (i.e. dense forested areas) where a helicopter would be needed.

Fixed-wing aircraft spraying non-residual insecticides (Photo Ian Grant)

- The entire tsetse infested area in KZN could be covered by an SAT operation (5 cycles) using only two fixed-wing aircraft (see picture) in 4 months, at a total cost of US$ 220 to 260 km^2. The cost of the Botswana SAT operation was estimated at US$ 270 per km^2. The report concluded that an 'aggressive eradication campaign' would be the preferred option as the long term costs using existing control methods would be substantial, especially in view of the likely increase of infestation due the increased influx of cattle crossing the border with Mozambique.

- Despite the technical feasibility and its many advantages of using SAT in South Africa, the implementation of any areawide SAT-SIT programme will be very challenging in view of the many protected areas (e.g. the St Lucia Lake, which has been designated as a World Heritage Site) and the strong environmental lobby.

Conclusions

The data available strongly indicate that a sustainable solution of the TandT problem in South Africa can be found by the creation of a zone free of *G. brevipalpis* and *G. austeni* using an SIT-based areawide IPM approach. KZN has not only high agricultural potential as evidenced by the many communal farming zones, but the tsetse infested zone is situated at the most southern limit of the tsetse distribution, i.e. except for a small extension into Mozambique, the infested zone is completely isolated from the rest of the tsetse belt in Southern Africa. In addition, the total size of the infested area (15,000 – 20,000 km^2) is technically manageable, it has only two species of tsetse, which are already adapted to artificial

rearing conditions and the programme can be conducted in five phases (five fairly isolated blocks). Any areawide intervention however will require a collaborative effort with Mozambique.

Development of a Concept Note for Tsetse Intervention in Burkina Faso and Mali

The international community and the governments of Mali and Burkina Faso have retained the common 'cotton belt' as a 'priority zone' for integrated tsetse intervention in West Africa. In that respect, FAO organized a workshop in Ouagadougou on 25-27 February 2004, to develop a concept note (CN) for the development of integrated tsetse intervention strategies in West Africa. This CN will be used to approach potential donors to request financial support for this initiative.

The workshop was attended by representatives of the Government of Mali and Burkina Faso, the PAAT chairman, representatives of international organizations (FAO and FAO/IAEA) and invited consultants.

The representative of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture presented a lecture on the requirements of SIT-based areawide IPM intervention in a West African context. It was emphasized that lessons should be learned from earlier eradication campaigns in Africa, which have proven to be sustainable, e.g. the cases of Northern Nigeria and South Africa. In addition, it was pointed out that the tsetse situation in West Africa seems to be much more complex than in East Africa where available distribution models indicate that the tsetse belt is fragmented, which will be an advantage for the development of intervention strategies according to the areawide concept. Finally, attention was drawn to the severe paucity of data on tsetse population ecology, dynamics, dispersal etc., which are all very crucial for the development of a sustainable tsetse intervention strategy in West Africa.

The meeting came to a consensus on the following main points:

- Any tsetse/trypanosomosis intervention campaign in West Africa should be considered in the context of Sustainable Agriculture and Rural Development (SARD). Within the common cotton belt of Mali and Burkina Faso, two major river systems have been selected as initial priority areas: the basin of the Bani River in Mali and the adjacent basin of the Mouhoun River in Burkina Faso. Each of these river basins covers a total surface area of approximately 20,000 km^2.

- All available entomological data indicate that the northern limit of the tsetse distribution extends beyond (to the north) the two selected river basins. The elimination of tsetse flies from this area north of the selected priority areas (Bani and Mouhoun) will be a first prerequisite to create a sustainable tsetse free zone in the Bani and Mouhoun River Basin. Any intervention would, therefore, have to start at the northern limit of the tsetse distribution, followed by a shift of the intervention front southwards.

There is a severe lack of critical data on tsetse population ecology and dynamics in the selected priority intervention zones. The availability of these data will be a prerequisite to develop an appropriate integrated intervention strategy.

The following in-depth studies will be required: i.) the development of detailed land use/land cover maps and vegetation classification maps to assist and facilitate the identification of potential tsetse habitat, ii) entomological surveys to accurately assess the distribution of the *glossina* species present, with special reference to the degree of fragmentation of the habitat and iii.) detailed studies on the dispersal and movement potential of these flies in those specific habitats to assess the degree of isolation of these 'potential' fragmented pockets.

The hypothesis or concept of 'the river basin as the unit of operation in area-wide IPM approaches in West Africa' needs to be validated. This will require detailed studies (guided by appropriate GIS assistance) on the efficiency of the watersheds as potential barriers for the various river basins to define the degree of isolation of the various tsetse populations in adjacent river basins. These studies will entail mark-release-recapture studies and extensive sampling for population genetic studies on the gene flow between tsetse populations residing in the different river basins. These data will be a prerequisite to decide whether tsetse intervention campaigns can be launched in West Africa according to the area-wide concept.

The development of an appropriate strategy for tsetse intervention in the cotton belt of West Africa will only be possible when these data will become available.

Reporting on on-going and Planned Coordinated Research Projects (CRPs) and RCMs

Research Coordination Meeting on Insect Transformation, 19-23 January 2004, Vienna, Austria

The first Research Coordination Meeting of the CRP on "Molecular Technologies to Improve the Effectiveness of SIT" was held in Vienna from 19 to 23 of January 2004. This CRP was initiated as a consequence of a recommendation from a Consultants Group Meeting in Capri, Italy, in May of 2003. The consultants recommended that the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture re-examine its activities on the impact that transgenic insect technology can have on the efficiency and further development of the SIT so that it can take advantage of "its position as the ideal coordinating and implementation agency for SIT technology transfer". Twelve scientists from nine participating countries attended this first RCM. The attendees represented countries that both develop technologies for SIT and countries that apply it to insect pests of agricultures. Scientists actively working on fruit fly pests, tsetse, mosquitoes and lepidopterans were present. The breadth of the field of transgenic insect technology as applied to pest insect species was well represented, with all attendees being considered world experts in their respective areas.

The current RCM convenes at a very timely moment in the extension of transgenic technologies to the SIT for use in the field. Transgenic technology has existed for many important insect pests for more than five years and opportunities now exist for the testing of simple applications of this technology, for example the generation and testing of a genetically tagged transgenic SIT strain, both in the lab and, pending regulatory approval, in the field. Furthermore advances in insect genomics, beyond *Drosophila*, will rapidly lead to the identification of many new genes that could be implemented in the development of new genetic sexing strains. Indeed the area of insect sex determination is growing with transgenic technology providing the opportunity to test new genes in combinations with new promoters in SIT species, such as medfly. These developments and achievements serve to augment arguments for the testing of transgenic insects in the field and the SIT, with the requirement for sterilization of the released insects, may well serve to be the first venue for such testing since the risk of transmission of transgenes to subsequent generations is effectively zero. The participants, together with the responsible officers of the Agency, are well positioned to monitor and participate in these research programs aimed at bringing judicious use of this technology for improvement of the SIT. It was in this atmosphere of excitement, measured expectation and caution that the RCM was held.

Research Coordination Meeting on Codling Moth, Stellenbosch, South Africa, 8-12 March 2004

The 2nd RCM of the CRP entitled 'Improvement of Codling Moth (CM) SIT to facilitate expansion of field application' was held at the facilities of INFRUITEC-Nietvoorbij in Stellenbosch, South Africa, from 8 to 12 March 2004. The overall objective of this CRP is to reduce insecticide use in orchards in general and in the rural-urban interface in particular and to facilitate international trade in agricultural commodities by developing a cost-effective and environment-friendly alternative to pest management in pome fruit production. The CRP has the specific objective to improve CM SIT for application in orchard and urban areas internationally.

The RCM was opened by Dr Johan van Zyl, Director General of INFRUITEC, and guest lectures were presented on the history of SIT in SA (Dr Brian Barnes, Manager of the Division of Pest Management of INFRUITEC), on the research activities within the perspective of the Deciduous Fruit Producers Trust Research (Mr Hugh Campell, Director General), and on the planned Codling Moth SIT pilot trial in South Africa (Mr Matthew Addison, entomologist). With the exception of one participant who was absent due to illness, all official CRP participants (from Argentina, Armenia, Brazil, Canada, Chile, Czeck Republic, Syria, Switzerland, US and South Africa) attended the RCM.

The most significant research achievements of the CRP to date can be summarised as follows:

Field ecology - Adequate dispersal of released sterile insects is an important parameter for the efficient implementation of any SIT project, including CM. Studies in Switzerland on flight behaviour and the dispersal capacity of CM indicated that these characteristics are subject to genetic variation with on average about 10% of the encountered genotypes being 'mobile' and the remaining being 'sedentary' insects. Bi-directional selection on mobility was demonstrated in the laboratory with divergence between the two selected strains occurring after only one generation. Some biological traits were correlated with mobility such as body weight, body size and life span. Dispersal studies in Chile showed that native moths were capable of dispersing up to 800 m from commercial orchards whereas the dispersal of reared CM was limited to a maximum of 300 m. In Syria, it was shown that moths irradiated with 250 and 350 Gy dis-

persed significantly less well than untreated moths but their longevity in the field was only impaired after day four.

SIT and Biological Control - Initial data of studies to assess the feasibility of using parasitoids in combination with SIT were encouraging. Releases of the CM egg parasitoids, *Trichogramma nerudai* and *T. cacoeciae* in experimental apple orchards in Argentina showed good 'finding capacity' (4 -58%) of the parasitoids (no. trees with egg traps with parasitism / total trees holding egg traps), regular levels (2 - 31%) of 'parasitism efficiency' (no egg traps with parasitized egg / total egg traps exposed) and a 'field persistence activity' (days of parasitism activity after release) of one week. The study likewise demonstrated that both *T. nerudai* and *T. cacoeciae* were capable of infesting sterile and partially sterile CM eggs, suggesting that there is potential for the integration of biological control methods with SIT against the codling moth.

Quality Control/Assurance/Management - Studies in Canada have shown that rearing through diapause and lowering the dose of radiation from 250 Gy to 150 Gy, significantly increased the field performance of released male moths. In addition, attempts have been made to develop cost effective methodologies to extract pupae from the diet, as a prerequisite for long distance shipment of pupae. Various techniques such as diet re-hydration, agitation, sieving, and pressurized water sprays were used on pupae embedded in the sawdust-based diet. The use of pressurized water sprays proved to be the most effective technique for removing most of the diet solids from the mass of pupal cocoons. These procedures were followed by the application of a de-silking agent to separate pupae from cocoons.

Mating compatibility - Studies were initiated on the mating compatibility of CM originating from different geographical areas. A series of studies were carried out with moths originating from the rearing facility at Osoyoos, British Columbia, Canada, which were shipped as adults and pupae to SA. The studies indicated a complete absence of mating barriers between the moths from SA and from Canada. The fact that the moths used for the studies, originated from two different climatic and time zones makes this finding extremely interesting.

Genetic Sexing - Significant progress has been made in the research to improve the basic understanding of codling moth genetics. The karyotype (2n=56 chromosomes) and the sex chromosome mechanism (W-Z type with females being the heterogametic sex) of CM was determined. Two adapted methodologies: 1.) genomic in situ hybridization (GISH) and 2.) comparative genomic hybridization (CGH) were used to identify the W chromosome. The studies showed that the W and Z sex chromosomes can easily be differentiated making CM suitable for sex chromosome-based genetic sexing. The knowledge of the sex-determining chromosome of codling moth will be of great benefit in the determination of translocation events and localization of transgenes on the W chromosome. The optimal gamma radiation dose (20–30 Gy) for inducing and isolating translocations between the Z and W chromosomes was determined. The appearance of a sex chromatin body in female polyploid nuclei was used to detect T(W;Z) translocations and 20 lines were isolated with suspected T(W;Z) translocations.

Recent developments in the USA have indicated the potential of developing genetic sexing strains through transgenesis. Transgenesis of codling moth has been achieved through the use of the piggyBac transposon and lines with the green fluorescent protein (EGFP) have been in existence for over five years (37 generations), indicating the stability of the transgene in these lines. Preliminary assessment of temperature sensitivity of a truncated form of the *Notch* gene, N60G11, in transgenic codling moth indicated that this dominant temperature sensitive conditional lethal could be useful in the development of genetic sexing lines.

Research efforts in Armenia resulted in the identification of radio-resistance differences in two populations inhabiting different altitudinal environments, alpine and plain zones. The alpine population was more radio-resistant as determined by egg hatch experiments. In preparation for the determination of the inheritance of this radiosensitivity, the alpine population was adapted to plain environmental conditions for one year, and vice versa.

Further research activities of the CRP will focus on:

- The study of the dispersal characteristics and mobility of wild and sterile CM.

- The study on traits correlated with mobile and sedentary characteristics of CM populations with special attention to the relation between CM mobility and mating efficiency, temperature and the response to sex pheromones, the study of the field performance and survival of CM treated with different doses of radiation or under different over-flooding ratios and the assessment of the dispersal capacity of wild CM from refugia (abandoned or urban sites, bins, etc.) into commercial orchards.

- The study on the effects of diapause rearing and irradiation on mobility and general competitiveness of the reared insects using standardised actographs (in the laboratory) and a standardised protocol (in the field).

- The study on pupal recovery methods with emphasis on the development, refinement and improvement of efficient recovery procedures. Key 'life history' parameters of CM adults extracted from the diet in the pupal phase using sodium hypochlorite and water

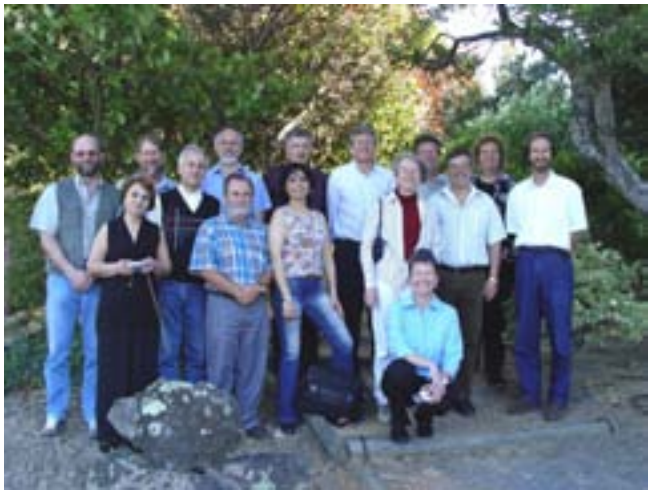
pressure will be compared with those of CM adults emerged from the diet using standard rearing protocols.

- The study of mating compatibility studies will be expanded to moths originating from other geographical areas and the data on the mating studies between Canadian and South African codling moths will be considered as a base line.

- A season-long field study in a selected area in South Africa using imported sterile moths from Canada.

- The study of the combination of biological control methods using parasitoids and SIT under laboratory and semi-field conditions, the effect of host plant removal, SIT, and other appropriate technologies on the bionomics and dispersal of CM from infested areas into un-infested areas and the impact of natural enemies of CM and of refugia on population dynamics and re-infestation.

- The development of genetic sexing strains using dominant conditional lethal mutations as recommended by the consultants meeting, held in Vienna in May 2003.



The participants of the 2nd Codling Moth RCM in Stellenbosch

Research Coordination Meeting on Development of improved Attractants and their Integration into Fruit Fly SIT Management Programes in Fort Lauderdale, Florida, USA 11-15 May 2004

During a previous IAEA/FAO CRP titled "Development of female medfly attractant systems for trapping and sterility assessment" conducted from 1995 to 1998 a female biased medfly trapping system wasdeveloped and validated.

During the first three phases of this CRP (2000-2004) substantial progress in developing and evaluating synthetic food attractants against other fruit flies of economic importance has been made. Results indicate that compared to the conventional protein baits, some of the economic species of the genus *Anastrepha* (*A. ludens* and *A. serpentina*) respond equally or better to low concentrations of Ammonium Acetate (AA) and Putrescine (PT) in a Multilure trap as well as some of the economic species of the genus *Bactrocera* (*B. zonata* and *B. cucurbitae*) to high concentrations of AA in a Multilure trap.

An interesting finding for monitoring of medfly populations, is that the PT can be omitted from the three-componet lure (Biolure) thus a less expensive two-componet lure (AA + Trimethylamine (TMA)) can be used. If trapping is aimed at detection rather than monitoring then sensitivity needs to be enhanced and the three-componet lure is required. Furthermore, other species of the *Ceratitis* genus of economic importance (*C. rosa* and *C. fasiventris*) respond significantly better to the three-component lure than to the conventional lures.

Finally some fruit fly species such as *A. striata*, *A. fraterculus* and *B. oleae* do not respond well to any combination of the synthetic food lures tested so far, thus in the future part of the efforts need to focus on basic population ecology studies aimed at finding clues in nature that can lead us to the development of effective baits for these species.

Based on these findings the Research Protocol for the fourth and last experimental phase of the CRP has been prepared basically with the aim of: 1.) fine tuning the concentration of AA and PT for the *Anastrepha* species, 2.) measuring the effect of adding PT and TMA to the AA based lure for the *Bactrocera* species and 3.) testing the response of *B. oleae* to a Multilure trap with a red base and baited with Ammonium Bicarbonate. In the case of Medfly, given the positive results obtained in the past CRP and almost four years of the current CRP, no more research will be conducted during this last phase on further developing trapping systems and efforts will focus on developing bait stations following the same standard research protocol used for evaluation of trapping systems.

Participants of the 3rd RCM on Development of Improved Attractants and their integration into fruit fly SIT Management Programes held in Fort Lauderdale, Florida, USA 11-15 May 2004.

Developments at the Entomology Unit Seibersdorf

FRUIT FLIES R and D

Detailed Analysis of the New Medfly Genetic Sexing Strain VIENNA 8

During the mass rearing evaluation of the two sexing strains VIENNA 8 and VIENNA 8-Sr, the latter being marked with the Sergeant mutation, exceptional males with a *white pupae* (*wp*) phenotype were detected. In order to determine the nature of these males genetic test crosses were performed. In both cases 28 single of these males emerging from white pupae were crossed with females from a tester strain carrying the eye colour mutation *white* (*w*). This mutation is also located on chromosome 5 and is used to determine whether the Y-autosome 5 translocation is still present in the males, i.e. whether the wild type allele of *w* is still linked to the Y chromosome. This distinguishes type-1 from type-2 recombination as the cause for the exceptional males emerging from the white pupae. Via intra-chromosomal recombination between the two translocated Y-fragments type-2 recombination leads to a reversion of the translocation to a free Y chromosome.

The F_1 males of the above single male crosses were backcrossed with females from the *w/w* tester strain and the F_2 was analysed. In all 56 cases males and females with *w* and wild type eyes emerged, i.e. there was no pseudo-linkage between the mutation *w* and sex. It has to be concluded therefore that the exceptional *wp* males contained a free Y chromosome and were the consequence of type-2 recombination. Currently, experiments are under way to confirm this conclusion cytologically. In the laboratory of Dr. A. Zacharopoulou (University of Patras, Greece) *in situ* hybridisation experiments on mitotic chromosomes will be performed using two different probes. These experiments will confirm the presence of a free Y chromosome and should also identify the approximate region where recombination is taking place. Previous analyses of other genetic sexing strains showed that type-2 recombination occurs between regions that are homologous at the DNA level. In the strains VIENNA-4 and 6 this homology is located along the long arm of the Y chromosome and consists of highly repetitive DNA sequences. In VIENNA 8 however the structure of the Y-autosome translocation is such that these sequences are found only on one of the translocated fragments, i.e. it is unlikely that they can play a role in recombination. However, due to major rearrangements during the construction of this translocation, both fragments carry clusters of genes for the ribosomal RNA. The cytological analyses will determine whether these sequences are also capable of recombining.

The appearance of these males was somewhat unexpected, considering the complexity of the translocation involved in the strain and it only goes to emphasize that a systems approach involving the filter will probably be essential to maintain strain integrity, no matter what the basis of the sexing strain is.

Support for SIT Technology in Brazil

Dr. Raimundo Braga a Cost Free Expert was supported by the government of Brazil to carry out research that will facilitate the establishment of SIT for fruit flies in Brazil. During his sabbatical year at the Unit, Dr. Braga carried out two investigations related to the identification of suitable diets for two fruit flies of relevance to Brazil and which will be targeted for SOT suppression.

Improving Mass Rearing of the South American Fruit Fly *Anastrepha fraterculus*

Studies on diets for adults and larvae of the South American fruit fly *A. fraterculus* were carried out aimed at finding the most appropriate diets for any future large scale mass rearing of this species. The optimal diet for the adults was the combination of corn hydrolysate protein + yeast hydrolysate enzymatic + sugar (3:1:3). This diet resulted in the highest numbers of eggs/female/day, sperm in the spermathecae, percentage egg hatch, the lowest rate of mortality and the highest average mating duration compared with the standard adult diet based on yeast hydrolysate enzymatic + sugar (1:3). Among seventeen larval diets tested, diets based on sugarcane and sugarbeet bagasse plus 7% brewer yeast, 8% sugar, 0.2% sodium benzoate, 0.8% of hydrochloric acid and 60% water (adjusted), yielded the highest percentages of egg hatch, pupal recovery, adult emergence and also pupal weight. There was no statistical difference with the standard larval diet based on wheat germ 3.0%, corncob 15%, cornflower 8%, brewer yeast 6%, sugar 8%, sodium benzoate 0.23%, hydrochloric acid 0.63%, nipagin 0.14% and water 59% (adjusted). The significant performance of these adult and larval diets is very important for the future development of mass rearing of this species in different countries of South America.

Suitable diets for larvae of the Mediterranean fruit fly *Ceratitis capitata*

Studies on availability of suitable and economic diets for Mediterranean fruit fly, *C. capitata*, were undertaken aimed at finding options for larval diet in relation to a possible SIT programme in Brazil. The medfly genetic

sexing strain VIENNA 8 was used for the tests. Diets containing 21% of sugarbeet bagasse, 4% wheat bran and 7% brewers yeast and others with 28 % wheat bran and 7, 9, 14 and 17% of soybean protein were tested with a standard diet based on 28% wheat bran and 7% brewer yeast. Percentage of white and brown pupae and their weight were similar to the standard diet. Diets with sugarbeet bagasse as a bulking agent resulted in high quality pupae comparable with standard diet. Diets based on soybean protein have shown important results regarding pupal recovery, pupal weight and adult emergence. Protein source ingredients are usually the most expensive component in a larval diet. In most cases, sources of protein for a diet are locally unavailable. The source of protein used in this comparative study came from pelletised soybean. This study concludes that soybean protein in the form of pellets with 60% of protein could be a very important substitute for other expensive sources of protein such as brewer or torula yeast. Diets with soybean protein produced high quality pupae in numbers comparable with the standard diet. It is clear from this study that options for low cost and efficient diets are available in Brazil.

TSETSE R and D
Packaging for pupal shipment

One of the important functions of the Unit is to supply live tsetse material to rearing facilities and research workers around the world. The Unit normally ships about 500 000 pupae/year, to about 15 different recipients. Shipments to Europe and North America are sent in padded envelopes by regular mail services, whilst shipments to Africa are normally sent by DHL for more rapid delivery. Frequently however the pupae have been exposed to prolonged periods of raised or lowered temperature of a severity and duration likely to produce significant deterioration in the quality of the pupae.

As a routine for more than a year, temperature data have been collected from certain shipments, principally to TTRI, Tanzania, using small temperature loggers. The main problems that are apparent are low temperatures during most flights, low temperatures on the ground in Europe during the winter, and high temperatures after arrival and during ground transport in Africa. To try to improve the conditions the pupae were packed in expanded polystyrene (EPS, Styropore®) boxes 185x155x85mm internal with 18mm walls. Tests in a temperature controlled cabinet demonstrated that the provision of this insulation makes little difference to the temperatures experienced, due to the low thermal bulk of the pupae being shipped. The addition of sachets of water (500g) greatly decreases the rate of temperature change, but this is still not sufficient to provide adequate conditions for a typical three days transit to TTRI.

To further improve the conditions three changes have been made:

a) Shipments to TTRI are now sent using express air cargo instead of DHL. The normal transit time is now more consistent at about 56 hrs, compared to 72 – 120 hrs for DHL.

b) A much-improved insulated container has now been obtained (AcuTemp®) with insulation approximately three times better than EPS.

c) The water sachets have been replaced by phase change materials (ClimSel®) with a freezing point between 18 and 24°C. The latent heat of fusion holds the temperature at the freezing point for many hours.

The combination of these three changes extends the period that the pupae can be held within acceptable limits (18 – 26°C) from 2-3 hrs up to more than 12 hrs even when the package is placed at an external temperature of 0 or 35°C.

Pupal sexing

Following the successful preliminary trial of the near infrared (NIR) spectrometer for sexing tsetse fly pupae (see Newsletter 62, January 2004), Dr Floyd Dowell, USDA-ARS, Grain Marketing and Production Research Center, Manhattan, Kansas, USA visited the Entomology Unit for two weeks and brought with him an NIR spectrometer. The machine stores spectra of individual pupae to allow further analysis. Large samples of pupae of *Glossina pallidipes* at one-day age intervals from 10 days to one day before emergence were screened. The pupae were then held individually to emerge and the sex recorded for association with the respective spectrum.

The results are very encouraging. The main set of cross-classifications gave results that ranged from about 84 to 97% for pupae one to five days before emergence. This work has revealed a striking difference in the development of the NIR spectrum for males and females. At six days before emergence the spectra are very similar, but at day five a marked change is apparent in the female spectrum. This difference is maintained for about 48 hrs, whereupon the males undergo the same change and the spectra are once again very similar. The cause of this change is not known and will be investigated further as opportunity allows.

Prototype tsetse rearing container

As reported in the last Newsletter, a colony of *G. fuscipes fuscipes* was maintained in a shipping container. The colony started with 1792 females in week 44 of 2003, and no further input was made from outside. The first progeny of this colony emerged in week 51, and the new flies continued to be returned to the colony throughout. Apart from the initial few weeks where the colony structure is not normal, the colony maintained good fecundity and low mortality. The initial number of females was doubled

in 12 weeks, and the number of pupae per initial females was in the range 4.2 – 5.1. This is a very high productivity. The test was terminated in week 17. It is planned to install the TPU3 rearing system in the shipping container later in the year.

Remating in *G. pallidipes*

In the past there have been concerns raised on possible impact of re-mating in female *G. pallidipes* when the sterile insect technique is applied in the field. Previous work had shown some low level occurrence of mating in rearing cages but the scenario in the field is far from clear. The field cage environment offers a good arena to obtain a better indication of fly behaviour than the crowded rearing cages. Sexually mature *G. pallidipes* were offered initial mating opportunities with gamma sterilized sexually mature males in a field cage in 1:1 male to female ratio. After separation the males were discarded and females returned to colony holding conditions, 24°C, 75% relative humidity. Two days later the females that mated with the irradiated males were released in the field cage together with virgin sexually mature unirradiated males in a 1:1 female to male ratio. The females mostly rejected attempts to copulate by males with 0-20% accepting a second mating. The observations in both cases lasted for two hours. Production of pupae was similar for females that mated with unirradiated males only and females that initially mated with irradiated males followed by a second mating with unirradiated males. The fertility of the resultant offspring is still being assessed. During the observation period in the field cage, it was noted that there was a very large number of rejections of second mating by females even with concerted efforts by the males. For the first mating, the females often accepted the male without a struggle. The levels of remating recorded in this restricted environment are unlikely to have significant material effect on a well-planned SIT programme given that very competitive sterilized males will be released in numbers greater that will overwhelm wild males.

MOSQUITO R and D

Mosquito colony development

Due to laboratory renovations in mid 2003, the project has been able to establish colonies of *Anopheles arabiensis* prior to its official launch in January 2004. Currently, three different strains (KGB, originally from Zimbabwe; Sennar, from Central Sudan, and Dongola (from Northern Sudan, see below), are being maintained for a variety of studies. Significant improvements (e.g. membrane bloodfeeding) have led to a dramatic expansion of the colonies, with peak daily production of 5-7 thousand pupae. The project is now geared for a multitude of studies focused on RandD for SIT. A new staff member started in January and is full-time engaged in rearing activities.

Sexing methods for *Anopheles arabiensis*

Studies have been initiated to develop efficient sexing methodology. Female mosquitoes may still transmit malaria after release, so should be removed during mass production. Focus has been on the use of near-infrared spectrophotometry (NIR) and use of sex-specific wing beat frequencies as potential targets for sexing at the pupal and adult stage, respectively. Both methods are showing promise as a means of sexing large numbers of insects in mass production settings. A computerised algorithm has been developed in partnership with Dr Pearson (USA) and is currently being optimized further. A new impetus towards the development of genetic sexing methodology came with the start of Dr. Herve Bossin in January 2004. Dr. Bossin is a molecular biologist with experience in insect transformation and will develop transgenic approaches to sexing in collaboration with Dr. Benedict (USA). A new molecular laboratory facility has been constructed to that effect and is currently being equipped for this purpose.

SIT support for Sudan

The Government of Sudan is interested in implementing a SIT programme in Northern State and is already heavily engaged in preparatory field studies. With support of the Agency and UK consultants, plans are being implemented to study field populations of *Anopheles arabiensis* and dynamics of malarial disease transmission. In February, a national workshop was co-organised in Khartoum with the Tropical Medicine Research Centre (TMRI) and Ministries of Health and Science and Technology. The aim was to bring together all stakeholders working on malaria in Northern State Sudan. This has led to a strengthening of resource capability of the various parties and culminated in an amendment of the SIT steering committee representation, which is now chaired by the Director of the National Malaria Control Programme. Links with WHO have similarly been strengthened.

In the field, near Dongola and Merowe, areas for in-depth studies on vector populations have been selected. A GIS-based surveillance system has been developed and will soon be implemented. Climate data are now being collected by four automated weather stations that were installed in February when a large number of larvae were collected from both areas and mosquito colonies have been established in the recently upgraded facilities at TMRI. Mosquito eggs (from Dongola) have been shipped to the Unit for colony establishment.

Special News and Reports

CONSULTANTS MEETINGS

Consultants Meeting on Improved Rearing Techniques For *Anastrepha* and *Bactrocera* Fruit Flies in Vienna, Austria, 23-27 October 2003

A group of experts reviewed the state of the art of SIT-AWPM applied to fruit flies of major international economic significance. Invasive species that are potential candidates to achieve international distribution were also examined. The rapid spread of several prominent fruit fly species was considered, along with the increased costs for quarantine treatments required for international trade. Major fruit fly species were grouped into three categories according to their mass-rearing status and effective SIT methodologies developed up to the present:

a) Tier I.: Species with advanced rearing technology available in use with successful SIT-AWPM.

b) Tier II:: Species for which rearing methodologies do exist but not to the stage of low cost, high quality procedures required for effective SIT-AWPM.

c) Tier III:: Species for which little or no rearing methodology has been developed so far.

The group agreed unanimously to recommend that a CRP focused on mass-rearing be established for certain exotic fruit fly species of international significance with emphasis on Tier II. The assumption was that by focusing the effort on few species on which considerable effort has been already directed, would elevate them to Tier 1. From this status control action activities can be implemented. Also it was assumed that knowledge acquired so far by the concentration of efforts on species of Tier I. e.g. medfly, melon fly and Mexican fruit fly would greatly benefit the effort on species in Tier II. Member

States with Tier III fruit flies are encouraged to participate in the CRP to develop basic RandD for rearing certain of these species that threaten global agriculture.

This new CRP on "Development of Mass Rearing for New World (Anastrepha) and Asian (Bactrocera) Fruit Fly Pests in Support of SIT" will be initiated in early 2005 and announced in the IPC website. Those researchers that are working in this field are encouraged to submit research proposals. The deadline is 15 October 2004.

Consultants Meeting on Mass Rearing and Pre-Release Biology of Mosquitoes, 22-27 March 2004, Vienna, Austria

In March 2004, a consultants meeting was held in Vienna, with the aim to discuss a **new CRP on Mass Rearing Technology and Pre-release Biology of *An. arabiensis***, to be initiated in 2005. Those researchers that are working in this field are encouraged to submit research proposals. The deadline is 15 October 2004. A fascinating new dimension to classical mosquito rearing technology was provided by two consultants with expertise in shrimp aquaculture (Prof. Sorgeloos, Belgium and Dr Miahle, Ecuador). Mass rearing procedures implemented during the El Salvador SIT trials in the 1970s were reviewed extensively (Dr Dame, USA) and supplemented by new findings on *An. arabiensis* larval feeding (Prof. Spielman, USA). Adoption of new findings, combined with established rearing procedures will form the basis for a wide variety of studies that can contribute to successful SIT development over the coming years.

Consultants Meeting on Optimizing Sterilization Procedures in SIT Programmes 19-23 April 2004, Vienna, Austria.

Large inconsistencies in radiation doses for insect sterilization appear in the literature. This may be due to inaccurate reporting of dose because the neglect of appropriate dosimetry or inconsistencies in experimental parameters. This meeting aimed to identify the physical and biological factors that may influence the reporting of radiation doses, to identify standard conditions for conducting such experiments, and to recommend appropriate research where the necessary background information is inadequate or lacking.

The specific objectives of this meeting are:

1. To assess the advances in all aspects related to insect irradiation for sterilization including the latest status on irradiators, their economics and suitability for insect irradiation.
2. To review different parameters (biological and physical) modifying radiation effects on sterilization and determine the major factors to be considered and how they affect insect radiosensitivity.

3. To advise the Insect Pest Control section of the Joint FAO/IAEA Division whether individual Research Contracts or Agreements should be considered and which topics should be explored to optimize the irradiation methodology and to refine knowledge on the effects of biological and physical parameters on insect radiosensitivity.

4. To describe in detail the research and development methods required.

5. To suggest target insect species and potential cooperating member states and institutions.

6. To make recommendations for the standardization/ harmonization of the technique of insect irradiation for sterilization.

Recommendations made by Consultants:

1. The Joint FAO/IAEA Division has played an important leadership role in promoting the use of SIT for area wide pest management. It should also assume an important role in encouraging active and potential users of this technology to undertake or support research to determine the radiation procedure that optimizes sterility level and competitiveness for use in field programmes. It is the opinion of this Consultants' Group that this is an attainable goal that would lead to significant reductions in SIT programme costs.
2. The Consultants' Group recommends that a thorough, critical review of the radiation sterilization related literature be conducted to identify objectives for future research directed toward SIT optimization. The International Database on Insect Disinfestation and Sterilization (IDIDAS) should be actively maintained and expanded to ensure up to date coverage of relevant technical developments.

3. The Consultants' Group recommends that radiation sterilization research methodology and reporting be standardized and harmonized to enable meaningful and credible comparisons. Part of the research methodology is covered by the SOP for the use of the Gafchromic® dosimetry system, which deserves further dissemination.

4. The Consultants' Group identified priority research areas in irradiation procedure that might lead to significant improvements in SIT. Available resources should be concentrated on Diptera, Lepidoptera and Coleoptera for specific research where there will be the biggest immediate impact. To achieve these research objectives the Consultants' Group advises that individual research contracts be issued.

5. The Consultants' Group recommends that the Insect Pest Control Section, at its next International Conference, arrange a session devoted to dose optimization procedures in SIT. Also, the IPCS should promote the discussion of this approach at other meetings where SIT is discussed.

6. The outcomes of the research and discussion should be presented as a SOP for irradiation procedures in SIT.

7. The IAEA should establish a dosimetry audit scheme and offer it to SIT rearing facilities and researchers.

8. Currently only cobalt-60 and caesium-137 gamma sources are being used. With the present state of the technologies, other options discussed in the report are not practicable. Developments in these technologies should be followed as they may become more attractive if problems with the transportation and disposal of isotopic sources increase. In selecting an irradiator, the availability of accessories such as gas feed systems, turntables, field flatters, etc. should be borne in mind.

Consultants Group Meeting on Developing Guidelines for SIT under the ISPM No. 3, 11-15 May 2004, Sarasota, Florida, USA

A Consultants Group Meeting was held to develop guidelines, in support of the SIT aspects of a revised ISPM No. 3 "Code of Conduct for the Import and Release of Exotic Biological Central Agents". It also reviewed the Discussion Paper on Transboundary Shipment of Sterile Insects, that can be used to harmonize and standardize processes to promote and facilitate the use of sterile insects for current and new SIT programmes against crop pests. This meeting took place in Sarasota, Florida, USA at the USDA-APHIS-PPQ Sterile Insect Facility, from 11-15 May 2004.

Harmonized guidance regarding regulation of consignments of sterile insects will facilitate trade while addressing concerns with regards to possible phytosanitary risks. This document was developed as a set of technical support guidelines for consideration by the Interim Commission on Phytosanitary Measures (ICPM), the governing body for the International Plant Protection Convention (IPPC). One possible result of consideration of these guidelines will be to include them in the revised ISPM No. 3 providing guidance on measures pertaining to consignments of sterile insects. In the interest of harmonization, similar discussions may be needed at the Office International des Epizooties (OIE) and the World Health Organization (WHO) regarding the use of sterile insects for control of human or animal diseases.

The objective of this document is to provide guidance on sterile insect export and import including: first importation, mass rearing procedures, sterilization, packaging, transportation, receipt procedures, and release. Insect strains produced by genetic engineering or other modern biotechnology methods are not covered under this document.

WORKSHOPS AND COORDINATION MEETINGS

Training Course held in Gainesville, USA, from 4 May to 1 June 2004

Twenty-four participants attended the *Interregional Training Course on the Use of the Sterile Insect and Related Techniques for the Integrated Areawide Management of Insect Pests*, jointly funded by FAO, IAEA and the US Government. The Member States represented were: Argentina, Belize, Brazil, Bulgaria, Chile, Ethiopia, Fiji, Guatemala, Honduras, Kenya, Mali, Mauritius, Morocco, Nigeria, Saudi Arabia, Spain, Slovakia, Thailand, Tunisia, Turkey, Uganda, Venezuela, and Vietnam. A total of 32 persons lectured and conducted laboratories, 25 of whom were from the USDA and University of Florida, and the others were from Argentina, Japan, Guatemala, and the FAO/IAEA in Austria. Very positive comments from the students were collected including the following:

Overall course:

Very positive, surpassed expectations, enjoyed it, fantastic, opened eyes, big exposure, helped to understand bigger picture, very useful to start in this field, best course comparing with various other intl. ones attended, very interesting, great overview; great learning and experience; now believe in areawide approach and SIT; want to use knowledge learned; good ideas to take back for implementation; very motivated of what can be achieved; enthusiastic of doing something. Several requested that there should be more of these and also more specific courses in the future.

Some interesting comments to further improve the course included: Course, too concentrated, too compressed, too intensive, time constraints. Not enough time to discuss; need time to study materials; use evening time better for voluntary discussion sessions with lecturers.

Content:

General agreement on great content, good materials, and excellent intellectual/academic level.

Too much on plant pests and fruit flies, more on livestock pests requested; add more on tsetse; add more on fruit flies; include stored pest control. Add lecture on management and financing of projects. Several stated GIS labs very good, but several stated that far too short.

SIT Workshop held in Beijing, China, on 13-14 May 2004 during the International Plant Protection Congress

Eleven entomologists from nine countries described the progress of various plant-related SIT programmes, and discussed the potential of applying the SIT against other insect pests, especially moths. The workshop was led by V.A. Dyck and Lu Daguang. The papers presented are listed below:

- Principles and practice of using the sterile insect technique to control plant insect pests around the world – an update. V.A. Dyck.
- Controlling medfly in South Africa with the sterile insect technique – past, present and future. B.N. Barnes.
- Application of SIT in the Philippines to control fruit flies. G.B. Obra et al.
- Control of Oriental fruit fly with SIT in mango orchards in Thailand. W. Orankanok et al.
- Application of the sterile insect technique against the melon fly and sweet potato weevils in Okinawa, Japan. T. Kohama et al.
- Control of medfly in Western and South Australia. B. Woods and D. Hopkins.
- Sterile insect release of Queensland fruit fly in Eastern Australia. A.J. Jessup et al.
- Feasibility of field application of sterile insect technique for management of red palm weevil, *Rhynchophorus ferrugineus* Oliv. T.K. Dongre et al.
- Deploying the sterile insect technique for Australian painted apple moth eradication in New Zealand. D.M Suckling and J. Kean.
- Mathematical models can improve the efficiency of SIT programmes. H.J. Barclay and V.A. Dyck.
- Criteria that are important for applying the sterile insect technique. V.A. Dyck.
- Potential use of sterile insect technique against codling moth, false codling moth and cactus moth. B.N. Barnes.
- Potential use of the sterile insect technique against the codling moth in China. Zhao Huiyan.
- Rice striped stem borer – status, current control measures and potential for application of sterile insect technique. Zhu Zeng-Rong et al.
- Control of potato tuberworm in storage with sterile insect technique. T.K. Dongre and H.D. Rananavare.
- Potential to control cotton bollworm and diamondback moth with the sterile insect technique. W. Orankanok et al.

In addition, short presentations were made on:

a) Website: International Database on Insect Disinfestation and Sterilization (IDIDAS) (http://www-ididas.iaea.org/IDIDAS/start.htm). A.J. Bakri and V.A. Dyck.

b) Description of the forthcoming book: 'The Sterile Insect Technique. Principles and Practice in Areawide Integrated Pest Management'. V.A. Dyck, J. Hendrichs, and A.S. Robinson (eds.)

The SIT video "The Sterile Insect Technique. An Environment-Friendly Method of Insect Pest Suppression and Eradication" was shown.

5th Meeting of the Working Group on Fruit Flies of the Western Hemisphere

The 5th Meeting of the Working Group on Fruit Flies of the Western Hemisphere was held in Ft. Lauderdale Florida from 16 to 21 of May 2004. Over 200 people from more than 25 countries attended the meeting representing fruit fly action programmes, plant protection national and regional organizations, public and private research institutions, universities and the agricultural related industry. Highlight lectures were presented to open the different sessions and over 100 posters were displayed and discussed covering: basic and applied biological studies, detection methods, control and eradication methods, biological control, sterile insect technique, regulatory procedures and program management. Research priorities of action programmes were discussed and recommendations and conclusions were drawn. The proceedings of the meeting together with the conclusions and recommendations will soon be available on the web.

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Participantsof the fifth Meeting of the WGFFWH 6-21 May 2004 in Fort Lauderdale, Florida, USA.

Other Important News and Reports

Donald Lindquist - A Tribute to His Professional Career

From left to right, Robert Heath, Pedro Rendon, Walther Enkerlin, Don Lindquist, Susan McCombs and Aldo Malavasi.

Today, 16 May 2004, in Ft. Lauderdale, Florida, we honor an esteemed colleague, Don Lindquist, who has worked with many of us through several fruit fly and other programmes. He is a unique leader who has applied his considerable talents to three separate but interwoven jobs in his 40 year career. Don has worked for the USDA, the Joint FAO/IAEA Division, and as a WORLDWIDE CONSULTANT on varied area-wide Sterile Insect Technique (SIT) control programmes.

He started his USDA career in the 1960's working in an ARS laboratory at Texas A & M University. In 1969 he became the first director of the new Insect Attractants and Basic Biology Laboratory in Gainesville, FL. He spent many years working at the ARS headquarters in Beltsville, MD on the National Programme Staff in charge of Insects Affecting Man and Animals. He was associated with research underway in many ARS laboratories and also intimately involved in the area-wide Screwworm eradication programmes then underway in the US, Mexico and Central America. As is typical of Don's *career*, he finished his US government *career* working for APHIS on loan to the Joint FAO/IAEA Division .

Don first joined the Joint FAO/IAEA Division as Section Head of the Insect and Pest Control Section in 1967. His presence was immediately felt and changed the course of IAEA involvement in insect control programmes. The direction of the section immediately changed its focus from conducting small developing country coordinated research and teaching programmes, involving radiation

and radioisotopes in entomology, to involvement in larger scale programmes involving area-wide insect control in developing countries.

Within a year (1968) Don had convinced the UNDP to fund a medfly suppression programme in Costa Rica and Nicaragua, to prevent the further spread of medflies, which had been recently introduced into Nicaragua. Unfortunately this programme was abandoned by UNDP in 1971 because three experts who audited the programme concluded that the medfly posed no serious economic problems for Central America. Within 10 years medflies were in southern Mexico invading the southern State of Chiapas from where it was eradicated in 1982 using the Sterile Insect Technique (SIT). Since then a sterile insect biological barrier has kept medfly populations at the border area between Chiapas and Guatemala preventing its northern spread for 25 years. Nevertheless, medfly has since been established in Central America where it has been a major limiting factor for the development of the fruit and vegetable industry.

Don came back to the States for a short while and returned to the Joint Division in Vienna in 1972 and was Head of the Agrochemical Section for some years before returning to the Insect and Pest Control Section. Again, he became the driving force for area-wide suppression programmes against tsetse flies in Nigeria, and medfly in Egypt, Peru and later the Magrebmed project in North Africa, just to mention a few.

When the New World Screwworm was introduced into Libya in the late 1980's and the FAO was given responsibility for an eradication programme, Don was selected, in view of having the right experience, to head the programme as Co-Director of the Libyan Screwworm Eradication Programme. As most of you know, this was a very successful programme involving immense coordination, and sorting out international and political pro-blems. Thus, screwworms were eradicated from Libya ahead of schedule and for this reason the rest of the African continent remains New World Screwworm free today. This was undoubtedly one of Don's major career achievements.

Another major contribution was his vision and leadership for moving forward the development of genetic sexing strain (GSS) for Medfly. We all know that availability of Medfly GSS strains has made a huge difference in cost-effectiveness of SIT application against this major worldwide pest of fruits and vegetables. Since the early 1980's Don was eager to push the development of GSS and used any opportunity to tell his colleague and dear friend Leo LaChance "I want to talk about medfly genetic sexing strains, how much longer will it take to have usable strains available?"

As a Consultant on area-wide SIT programmes, Don has worked with US State and Federal Agencies on medfly programmes in California as well as international agencies with medfly programmes in Madeira, South America and other SIT programmes too numerous to mention, always continuing to be a passionate supporter of an area-wide approach to insect control.

So much for Don the scientist/administrator. Now for his overwhelming personality. Anyone who has ever worked with Don knows he can be very set in his ways.

He's been known to RANT and RAVE AGAINST HIS COLLABORATORS who fail to see his point of view, but he also has an extremely soft spot in his heart for his friends and esteemed colleagues. Thus (believe it or not!) he is like hard candy with a soft center!! Many of Don's co-workers know that with him there are no "dead end jobs". He is a great supporter of "upward mobility" and has convinced many colleagues to excel and move on upward!!!

When retirement time started to appear on the horizon Don had the vision and ethics to foster the new generation of professionals to take over and carry the SIT flag in the international arena. The team left by Don has since significantly advanced SIT technology. No doubt this is a lesson to be learned. Most of us who are fortunate to be his friends and associates wish him the best and hope he will be able to assist us in the years to come.

In the name of the Fruit Fly Workers of the Western Hemisphere and other fruit fly colleagues around the world, a plaque was presented to Don to honor his: "Outstanding lifetime professional contributions to entomology, in particular for being a driving force worldwide in the field of area-wide pest control, integrating the Sterile Insect Technique against major key insect pests, including fruit flies".

Contributor: Dr. Leo LaChance

Tephritid Workers Database

www.tephritid.org

WHAT IS IT?

The Tephritid Workers Database (TWDB) is an ambitious project whose objective is to fill an informational gap for tephritid workers worldwide. The aspiration is to develop a network of fruit fly workers.

GOALS?

To provide a Directory of tephritid fruit fly workers Worldwide activities/projects on tephritid fruit flies. Updated literature on tephritid fruit flies.

WHY TO JOIN?

To become part of the network and promote your research activities and your know-how on the web.

HOW TO JOIN?

Fill out the Membership Form. Each fruit fly worker can edit and regularly update his/her own information record through his/her username and password.

HOW TO CONTRIBUTE?

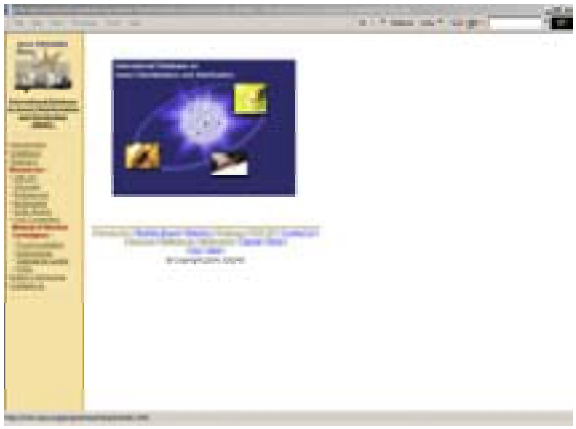
Forward this information to those that might benefit from being a member.

TARGET AUDIENCE?

National/international plant protection authorities, fruit fly control programmes, universities and other research institutions throughout the world.

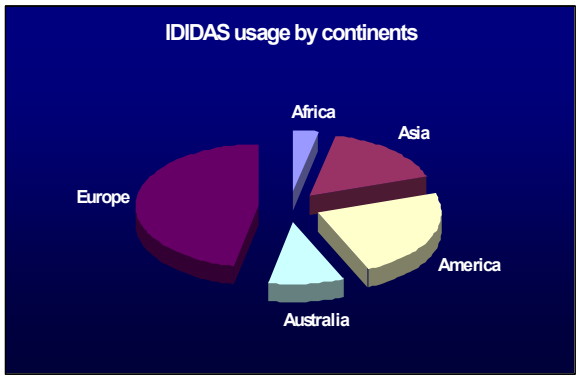
International Database on Insect Disinfestation and Sterilization (IDIDAS)
http://www-ididas.iaea.org/IDIDAS/

New look



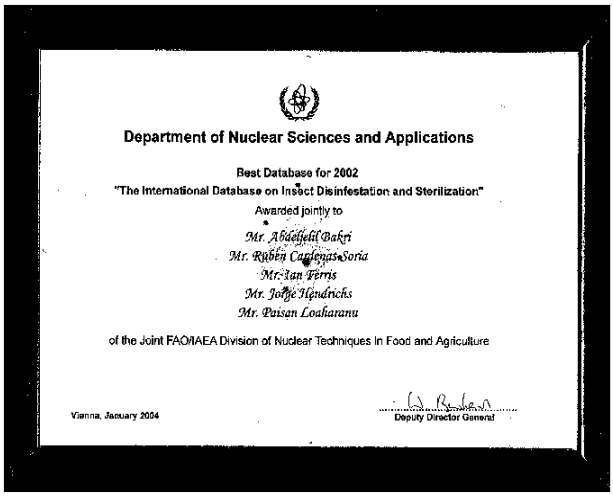
International Atomic Energy Agency, its Departments and Divisions have implemented changes in their website. IDIDAS look was adjusted accordingly. The logo and link to the Join FAO/IAEA Division of Nuclear techniques in Food and Agriculture was added to help users access to other IAEA programmes related to food irradiation and sterile insect techniques.

Number of hits/ month was 14,000 in August 2003 and reached 52,262 in March 2004. Users are from all over the world.



Award

At the 2004 Departmental meeting on 30 March**,** the IAEA's DDG of the Department of Nuclear Application Mr. Werner Burkart presented Departmental Award Certificates of best database to the IDIDAS team.


Department of Nuclear Sciences and Applications

Best Database for 2002
"The International Database on Insect Disinfestation and Sterilization"
Awarded jointly to
Mr. Abdelfelil Bakri
Mr. Rubén Cavlegas-Soria
Mr. Ian Ferris
Mr. Jolfe Hendrichs
Mr. Paisan Loaharanu

of the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture

Vienna, January 2004

Deputy Director General

Guest Article:

Revision and Correction of the Status on *Anastrepha ludens* (Loew) in Colombia

In 1972, the Colombian Agricultural Institute–ICA, under consultancy with Dr. Henry Martin, from FAO, began the first recognition of fruit flies within the country with the objective to detect the presence of the Mediterranean fly, *Ceratitis capitata* Wiedemann, and to determine the presence of other Tephritidae species.

The results of samples from McPhail and Steiner trap-detection were sent to Dr. J.C. Steyskal from the System-

atic Entomology Laboratory within the United States Department of Agriculture in Washington D.C.

Up until 1978, there were 976 samples analysed which came from 55 municipalities within 15 Departments (States) of sites located between 0 and 2,130m above sea level, in which were found 25 species belonging to five genera of the Tephritidae family.

The species belonging to the *Anastrepha* genus found at this stage of the study were the following: *A. fraterculus*. *A. striata*, *A. obliqua*, *A. distincta*, *A. serpentina*, *A. rheediae*, *A. nunezae*, *A. leptozona*, *A. pickeli*, and *A. ludens* and these results were published in the Revista ICA (ICA Magazine), Bogota, Colombia, Vol. XVI No. 4 pp. 173-179 of December 1981.

The European Plant Protection Organization, EPPO, included the report on the presence of *A. ludens* in Colombia within its database. The report remained there until, in the 2002 version, it was determined as absent due to being an ¨unreliable report¨.

In 2003, ICA sent Dr. Allen L. Norrbom a countersample that had been preserved within an entomological collection since 1975 and which sample had been determined by Dr. Steyskal as being *A. ludens*. The new analysis gave a undescribed species similar to *A. ludens*, *A. schultzi,* and *A. distincta*, thus, the determination made by the EPPO was asserted and corroborates the negative results for *A. ludens* over the last 28 years of fruit-fly detection in Colombia.

Francisco González R.
Centro de Excelencia Fitosanitaria-CEF
(Center for Phytosanitary Excellence-CEF)
Bogotá-Colombia

Selection of Optimum Treatment Dose for the Sterile Insect Technique

Contribution by Kishor Mehta

The Sterile Insect Technique depends on the fact that a sterile male will not produce any viable offspring following mating with a wild female. Thus, it is superficially intuitive to believe that the success of the project depends on the sterility level of the male insects that are reared and released. Complete (100%) sterility will then be the objective of any SIT programme. However, there is a confounding factor that negates this intuition; the radiation not only reproductively sterilises the males but also it affects the insect quality adversely, such that their competitiveness against the wild males for the wild females is reduced. Because of this negative effect of radiation, it is not true that higher sterility is always 'good' for an SIT project.

An attempt is made here to mathematically model the theory of SIT as described in IAEA Report TRS 336 (IAEA, 1992) with the purpose of finding the optimum treatment dose, given these two effects (sterility and insect quality). The following assumptions are made for this analysis:

- The objective of the SIT programme is to achieve the smallest value of F_1 (number of insects expected in the next generation).
- Fertility decreases with log(dose) following an integral-normal (S-shaped) relationship.
- Insect fitness (competitiveness) decreases with log(dose) following a similar relationship.
- Both these relationships are expressed in terms of the same σ value.
- Thus, the fertility curve and fitness curve are parallel, and
- The separation (δx) between these two curves on the y axis is the difference in response to a given dose in terms of σ (see Figures).

The results of the analysis are shown in Figures 1-3 and Table 1 for different situations. Even though the analysis is based on an idealised situation, several lessons can be learned regarding the interplay between the two effects, the optimum dose for various situations and the effect of dose distribution in the canister filled with insects.

These three figures simulate three different conditions (or three different types of insects); the difference is the location of the two response curves with respect to each other on the response-axis. This difference (δx) increases from 1σ to 3σ to 5σ from Figure 1 to 2 to 3. The x-axis in all figures represents log(dose) where 0 is the dose that gives 0.5 residual fertility, and the units are in σ so that a log(dose) of 1 represents a response 1σ below the response at log(dose) 0. Each figure shows the response curves for the two effects (fertility and fitness vs dose) and how these two effects influence the size of the next generation (F_1). The optimum dose for the SIT programme under these conditions is that corresponding to the minimum value of F_1. Table 1 lists the minimum F_1 values, and the corresponding values of dose, sterility level and quality level for three values of δx. **These results clearly show that the optimum dose would not be necessarily that for the highest sterility level (meaning 100%).** However, the sterility level corresponding to the optimum dose increases as δx increases; it reaches to about 99.9% when the two curves are 5σ apart. In a practical situation, one cannot deliver the optimum dose to all the insects in a canister, since dose will always vary throughout the canister because of the nature of radiation. Thus, the value of F_1 will also vary within a canister, and the objective then would be to deliver a dose so as to have the mean (or effective) value of F_1 at the minimum. It is clear from the figures that this would be achieved

when the mean dose in the canister (and not the minimum dose) is set at the optimum dose.
Source: IAEA. 1992. Laboratory Training Manual on the use of Nuclear Techniques in Insect Research and Control (Third Edition) Technical Report Series 336. Vienna, Austria.

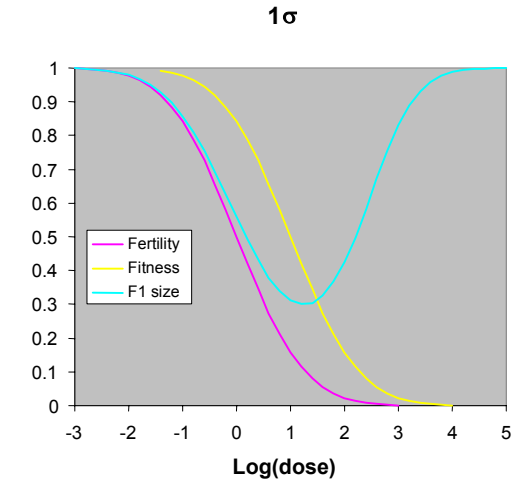


Figure 1.

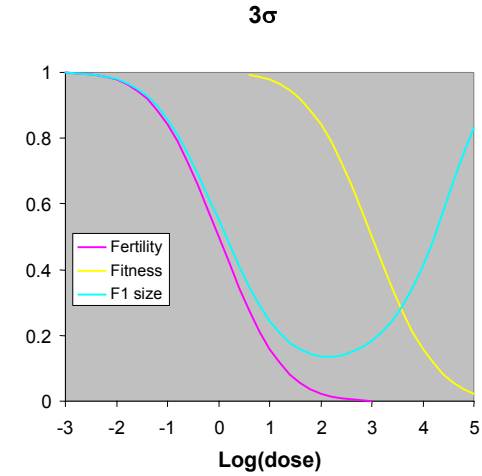


Figure 2.

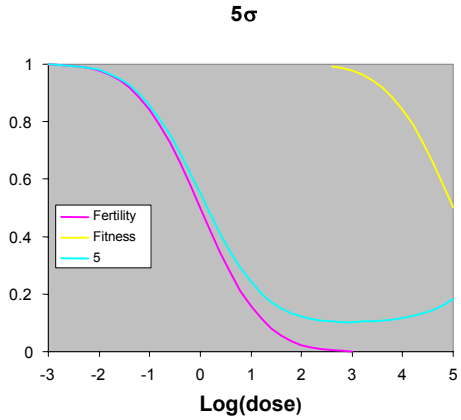


Figure 3.

δx/σ	F_1	Optimum dose	Fertility level	Quality level
1	0.30	1.2	0.12	0.42
3	0.14	2.2	0.014	0.79
5	0.10	3.0	0.001	0.98

Table I Results of the analysis for three values of δx

Introduction of *Bactrocera cucurbitae* in the Seychelles and Eradication Programme

In November 1999, the presence of *Bactrocera cucurbitae* (Diptera: Tephritidae – EPPO A1 list) was first observed on Mahé Island in the Seychelles. It is suspected that the melon fly was introduced by an aircraft meal containing fresh fruits and vegetables which had not been properly disposed of at the International airport. The melon fly soon became established on Mahé Island and spread to other islands of the archipelago. An eradication programme has been set up. A trapping network is being established on the basis of a 1 km² grid, with one trap placed in the centre of each unit, to delimit the extent of the infestation. These traps contain a parapheromone and an insecticide.
This trapping phase will be followed by an eradication phase using the male annihilation technique with blocks of wood soaked in methyl eugenol and insecticide. The eradication campaign will start at the beginning of the dry season in April 2004. According to the EPPO Secretariat this is the first report of *B. cucurbitae* in the Seychelles.

The situation of *B. cucurbitae* in the Seychelles can be described as follows: **Present, first found in 1999, under eradication.**

Source: Knight, J. (2003). Trouble in paradise – the eradication of an alien invader. AAB News, no. 52, 89. EPPO Reporting Service 2004/048.

Announcements

Second International Conference on Areawide Insect Pest Control, 9-13 May 2005, Vienna, Austria

This International Conference follows the one held in Penang, Malaysia from 28 May to 2 June 1998. The Conference will provide a forum for the presentation of scientific papers dealing with this topic and will include significant time for plenary discussion. The Conference will address the areawide management of insects pests in general, as well as new developments and techniques in the field of SIT, F-1 sterility, genetics, biotechnology, mass rearing, ecology and behaviour, augmentative biological control, regulatory control and programme management. The Conference will be held in conjuction with a number of Research Coordination Meetings. Within the next few weeks the framework of the conference will be developed and the information will be placed on-line in our web site for your consultation.
http://www.iaea.org/programmes/nafa/d4/index/html

A New Book on the Sterile Insect Technique available in 2005

The first textbook on the Sterile Insect Technique will be published soon. The 28 chapters, written from a generic perspective by more than 50 authors from around the world, review all aspects of the SIT. The book is divided into eight sections: Introduction, Principles of the SIT, Technical Components of the SIT, Supportive Technologies to Improve the SIT, Economic and Environmental Considerations, Application of the SIT, Impact of SIT Programmes, and Future Development of the SIT. More information on this new book will be provided in the January 2005 edition of this newsletter.

Regional Cactus Moth (*Cactoblastis cactorum*) Forum from 27 to 30 July 2004, Mexico City, Mexico.

The cactus moth, *Cactoblastis cactorum* (Pyralidae), known as the best example of successful biological control of weeds in Australia and elsewhere, it was detected in Florida in 1989 and has been rapidly expanding its range along the Atlantic coast and the Gulf of Mexico. *C. cactorum* is now considered a serious threat to the high diversity of *Opuntia* species throughout the world, both native and cultivated. Its presence in the Caribbean and its rapidly expanding range in the southeastern USA represents an imminent threat to areas in the southwestern USA, Mexico, and Central/South America where Opuntia cacti are regarded as extremely important plants, especially in arid and semi-arid regions. These plants

play a role in subsistence and commercial agriculture, in maintaining ecological balance in these unique ecosystems, and in soil conservation.

As a result of worldwide increases in *Opuntia* cultivation and increased reliance on *Opuntia* as a source of food and income from its products, the invasion by *C. cactorum* has the potential to impact thousands of subsistence farmers in Central and South America, the Mediterranean, North Africa and other countries. Furthermore, impacts on biodiversity and ecosystems where *Opuntia* are dominant components of the vegetation, including the center of *Opuntia* radiation, Mexico, also loom large. The critical nature of this threat, and the timing and scale of the likely responses needed, requires immediate action. Although the emphasis of an intervention campaign may initially focus on Mexico, Cuba, other Caribbean islands and the USA, this does not mean that the threat is less important in other countries. Any effective contingency/control programme will need to be approached on a regional or even interregional scale.

In order to analyse the problem from a regional perspective and explore the possibilities of regional collaboration, the Mexican Government through the Plant Protection Authorities (Direccion General de Sanidad Vegetal), and in collaboration with the Joint FAO/IAEA Division has decided to hold a Regional Cactus Moth Forum from 27 to 30 July 2004 in Mexico City.

The objectives being: 1.) To discuss the importance of the *Opuntia* species in Mexico and Latin America and the potential consequences to commercial *Opuntia* cultivation and to the environment in case the moth is introduced and established in the region, 2.) to discuss the possibilities of integrating the sterile insect technique with other possible control methods against cactus moth to eliminate populations and prevent its further spread, 3.) to discuss the risks and implications of biocontrol use against cactus moth in cultivated and natural ecosystems , 4) to inform major stakeholders and action agencies about the cactus moth problems and about available survey and control methods and 5) to elaborate a regional strategy for preventing the spread of cactus moth and for eliminating populations from its current location in South East USA and the Caribbean.

The Regional Forum is aimed at national and regional plant protection and environmental organizations in Latin America, the Caribbean and USA, and stakeholders such as commercial producers and shippers of *Opuntia* leafs

and fruit (prickly pear) and the tourist industry. The countries that have been officially invited are: Argentina, Belize, Brazil, Cuba, Costa Rica, Dominican republic, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, Salvador, United States of America and Uruguay.

The programme includes lectures on state of the art knowledge in taxonomy, biology, survey, control and environmental and economic impact of cactus moth. It also includes presentations by countries on the importance of *Opuntia* and the cactus moth current situation.

Seventh International Symposium on Fruit Flies of Economic Importance and Sixth Meeting of the Working Group on Fruit Flies of the Western Hemisphere, September 10-15, 2006, Salvador, Bahia, Brazil

These two very prominent events will take place in the city of Salvador Capital of the State of Bahia in the north east of Brazil from 10 to 15 of September 2006. The State of Bahia is where most tropical fruit growing areas are located. The State is centrally located and is a synthesis of the old and modern world the melting pot of African, native American and European culture.

Planned conferences will address the most advance topics not only on fruit fly biology, ecology and behaviour, but also on general entomology. Visits to some projects will be organized including quarantine treatment for mangoes, systems approach for papayas, *Anastrepha grandis* free area for cucurbits, IPM for apples and citrus, and the Medfly mass rearing and sterilization facility that is expected to be in operation by then.

For more information see: www.fruitfly.com.br

Aldo Malavasi, Chair -- Organizing Committee

In Memoriam

Dr. Patrick V. Vail

It is with great sadness that I inform you that Dr. Patrick V. Vail died on Sunday, February 8, 2004. Pat served as head of the Insect and Pest Control Section of the Joint FAO/IAEA Division, Vienna, Austria, from 1975-78 with responsibilities for tsetse fly and tropical fruit fly programmes from 1982 until he retired in February of 2003.

Dr. Vail was the Director of the USDA-Agricultural Research Services Horticultural Crops Research Laboratory, Parlier, California.

Pat received his BA and MS degrees from California State University, Fresno, and his Ph.D. from the University of California, Riverside in 1967 and was among the first graduate students in Entomology. Pat had been with the USDA since 1962.

Pat was a nationally and internationally recognized authority in the fields of entomology, insect pathology, microbial control of production and post-harvest pests, entomogenous viruses, mass rearing, in vivo virus production, basic insect biology, pest management, and insect ecology. He personally conducted research on alternative methods of insect control such as induced sterility, pheromones, and cultural practices as they might be used in pest management systems in pre- or post-harvest situations. He discovered the nucleopolyhedrovirus isolated from the alfalfa looper in 1966 while a staff member of the USDA-ARS Boyden Entomology Laboratory on the U.C. Riverside campus. His research on this virus changed classical views about the specificity of baculoviruses. He also developed in vitro methods for its production and plaque assay. The virus is used in agriculture research and as an expression vector for the production of unique biologically active compounds of importance to human and veterinary medicine and biology. Gross annual revenues from the baculovirus based expression system exceed $1 billion dollars annually.

Pat was a research scientist and programme manager, serving as a Research Leader and Laboratory Director at several ARS locations during the 41 years of his professional career. He published over 200 articles in scientific journals and other media. Pat provided technical leadership for complex, comprehensive and productive research programmes on vegetable, cotton, and post-harvest insects (fresh fruits and vegetables and dried fruits and nuts). Under his direction and leadership, outstanding accomplishments and progress were made in developing new non-chemical alternatives for insect control in both the pre- and post-harvest areas.

Pat was often invited to present the results of his research, as well as provide technical advice regarding the needs, development and initiation of research programmes by international organizations, such as the United Nations International Atomic Energy Agency and Food and Agriculture Organization, the International Center for Insect Physiology and Ecology in Nairobi, as well as the Entomological Society of America (national and branch), American Association for the Advancement of Science, National Science Foundation, U.S.-Israeli Binational Agreement for Research and Development, industry and private agricultural groups, commodity marketing orders, Environmental Protection Agency, USDA-Animal and Plant Health Inspection Service, U.S. Department of Energy, California Department of Food and Agriculture, Department of Defense, National Cotton Council and Cotton Incorporated, post-harvest groups, and universities.

Pat held many positions in regional and national societies and was the President of the Pacific Branch of the Entomological Society of America in 1989. In 1992, Dr. Vail was one of three USDA scientists to be assigned to the Methyl Bromide Technical Options Committee of the United Nations Environmental Programme (UNEP).

Pat was the instrumental force in gaining support of the agricultural community for the new ARS San Joaquin Valley Agricultural Sciences Center as well as the construction of the 80,000 square foot state-of-the-art facility. He saw his dream of a new Center come to fruition

in 2001 when the laboratory on Peach Avenue was closed and moved into the new facility in Parlier.
For his efforts on behalf of research and agriculture, Pat received the USDA-ARS Distinguished Scientist of the Year Award in 1995 for first isolating and then conducting basic and applied research on a virus exceedingly important to insect pathology/ microbial control, genetic engineering, and human and veterinary medicine and the United Nations Environmental Programme Certificate of Appreciation in 1995. In 1996 he received the United States Department of Agriculture Award for Personal and Professional Excellence for "Sustained international contributions to entomology, insect pathology/microbial control, and human and veterinary medicine" from the Secretary of Agriculture. In 1997 Pat received the School of Natural Sciences Distinguished Scholar Award from California State University, Fresno. As a member of The Japan Varietal Testing World Trade Organization Group, Pat received the Secretary of Agricultures Honor Award for Personal and Professional Excellence for exceptional performance, creativity, and perseverance in successfully challenging, in the World Trade Organization, Japans long-standing varietal testing trade restrictions, June 1999

In his spare time, Pat enjoyed traveling with his wife Susan, and visiting his three daughters who live in Miami, Lake Tahoe and Los Angeles. Pat was well known for his excellent tennis prowess, fishing, and construction of large-scale radio controlled airplanes. He will also always be remembered for his dry wit and optimistic outlook on life.

Antoinette A. Betschart /s/
USDA/ARS
Director, Pacific West Area

Dr. Ronald J Prokopy

It is with great sadness that we inform you that Ronald J. Prokopy, one of the senior world-leaders of fruit fly research, and professor at the University of Massachusetts, suddenly passed away last May 13, 2004, apparently as a result of a heart attack during his sleep. Ron enjoyed an excellent health at the age of 68 years, not only because of his tough constitution, but also his frugal and disciplined life-style, starting every morning with jogging at dawn, and continuing each day with an intensive schedule, that his much younger assistants and students could barely keep up with.

Besides his exemplary academic career, involving teaching and research, resulting in hundreds of widely cited publications, he invested also considerable time in extension work, advising fruit growers and agriculture authorities throughout New England to manage their fruit pests in a more environment-friendly way to reduce the use of insecticides. All this advice he provided was not only based on thorough experimental research, but also on extensive testing of new control methods in his own apple orchard on his farm in the mountains near Conway, Massachusetts.

Ron was not only the leading authority on *Rhagoletis* fruit flies in North America. He also traveled widely throughout all continents, where he had numerous collaborators and ex-students, carrying out seminal studies on many *Anastrepha, Bactrocera, Ceratitis* and *Dacus* pest species and motivating groups of disciples to follow in his parsimonious approach. This was based on direct observation to understand the insect's biology under natural conditions, followed by simple experiments in order to develop control methods adapted to the specific pest biology and easy to implement.

Many of these findings and methods, largely targeting fruit fly and other pest management at the orchard level, are currently widely in use, resulting in significant decreases of pesticide applications. However, they also had their impact in complex integrated area-wide programmes, some of which also integrate the SIT for suppression, exclusion or development of pest-free areas.

According to the major recent book on Fruit Flies by Aluja and Norrbom (2000), the pioneering behavioral work of Ron Prokopy has undoubtedly had the strongest influence on the direction that tephritid fruit fly experimental research has taken. Over the last 35 years, he and his collaborators have studied and deciphered many of the mechanisms regulating fruit fly mating and oviposition behavior, visual and olfactory orientation and fruit fly learning processes.

During the last decade he shifted his research efforts towards understanding behavior in a more holistic and integrated fashion, taking simultaneously into account abiotic and biotic factors of the environment, as well as

the physiological state and learning experience at the level of individual fruit flies. His key advise to his many students was: “think like a fly that has to address all its safety, nutrition, communication and reproductive needs, to really understand the biology and behavior of the species being studied”.

Ron was not only an outstanding scientist and extensionist. He was involved in social and charity activities in his community and cared deeply about his friends and students, actively supporting them in finding good positions after graduation. Furthermore, he was also much concerned about poverty and human rights both at home and abroad, and was an active critic of the Vietnam War. As expected, in a recent letter to friends, he was equally deeply distressed over actions of the current US Government.

Ron and his wife Linda had just become grandparents in January, and had bought a house in the nearby village of South Deerfield, where they were looking forward to retire in 2005 at the time of Ron’s 70th birthday. Of course he still planned to continue part time at UMass, doing the things he liked best, and was even considering planting a new orchard next to their new home in South Deerfield.
We have lost a dear friend and colleague. Our deepest sympathy to Ron’s family in the name of the world fruit fly worker community, for whom Ron’s career has been exemplary, and whose legacy and influence in the fruit fly world has and will continue to be enormous.

Good-bye Ron.

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