



Insect and Pest Control Newsletter



JOINT FAO/IAEA DIVISION OF NUCLEAR TECHNIQUES IN FOOD AND AGRICULTURE
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I. GENERAL INFORMATION

Retirements

We sincerely apologize for the long absence of the Insect and Pest Control Newsletter. Many of our colleagues have written enquiring whether we had stopped issuing the Newsletter and others thought they had been dropped from the mailing list. To set the record straight, the last issue (No. 48) was issued in February 1993. Over the last four years, the Insect and Pest Control Section has had 5 Acting Head's who ably endeavoured to keep the Section coping with many new programmes and administrative procedures. The Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture office has also experienced replacements in the Director's and Deputy Director's posts. To say that these intervening years have been turbulent would be an understatement. However, that is the simple truth. As you can see from the contents of this Newsletter, the Section's programmes have grown considerably, although our staff has not increased. In the future, we will strive to faithfully publish the IPC Newsletter twice yearly. This will enable us to keep our readers promptly informed of our activities and to share with you new and exciting developments as they occur. We thank you all for your patience and hope to hear from many of you.

During the past few years, a number of our colleagues have retired and left the Joint Division. Losing so many "old hands" in a short time has posed formidable problems for us all:

B. Sigurbjornson retired as Director, Joint FAO/IAEA Division, on 31 January, 1995 and has returned to Iceland where he serves as Secretary General, Ministry of Agriculture, Iceland.

Leo La Chance retired as Deputy Director of the FAO/IAEA Joint Division on 31 March, 1992. He returned to the USA and now works as Editor of the Annals of the Entomological Society of America.

W. Klassen left Deputy Director post in the Joint FAO/IAEA Division in June, 1994 and has returned to the USA where he continues his professional career as Director, University of Florida, Tropical Research and Education Centre, Homestead, Florida, USA.

D.A. Lindquist retired from the Agency in June 1994 (see Special Report).

R.E. Gingrich (former Entomology Unit Head at Seibersdorf Laboratory) retired on 30 November, 1992, and has returned to Texas.

Present Staff

The new Division Directors, as well as entomology staff, consisting of those in the Joint FAO/IAEA Division located in the Vienna International Centre, and those in the IAEA's Seibersdorf Laboratory, are listed below with their nationality and the year they joined the Agency:

J.D. Dargie (UK), Division Director (effective 1 February, 1995)
M.P. Salema (Tanzania), Deputy Division Director (effective 1 January, 1995)

Insect & Pest Control Section's Office

J. Hendrichs (Mexico) 1991	Head (since July 1994, previously at the Seibersdorf Laboratory)
U. Feldmann (Germany) 1988	Technical Officer (Tsetse)
G. Ortiz (Mexico) 1994	Latin American Regional Expert (Fruit Flies)
L. Kruzic (Australia) 1983	Secretary
N. Bielig (New Zealand) 1996	Secretary

Entomology Unit, Seibersdorf Laboratory

A. Robinson (United Kingdom) 1994	Unit Head
G. Franz (Germany) 1989	Medfly Genetics and Molecular Biology
K. Fisher (Australia) 1994	Medfly Rearing Technology
E. Opiyo (Uganda) 1995	Tsetse Rearing Technology
J.P. Cayol (France) 1995	Medfly Behaviour Studies
C. Caceres (Guatemala) 1995	Medfly Genetics and Rearing

The following entomologists serve as Agency experts on project URT/5/016 "Eradication of Tsetse Fly on Zanzibar Island":

Mark Vreysen (Belgium) July 1991

Andrew Parker (United Kingdom) September 1993

Arnold Dyck (Belgium) December 1994

H. Pan (People' s Republic of China) February 1995

Z. Zhu (People' s Republic of China) February 1995

II. THE INSECT AND PEST CONTROL PROGRAMME

A. Operative Co-ordinated Research Programmes

The following seven Co-ordinated Research Programmes are currently operative:

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

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

Expected Duration: 5 years (1995-1999)

Contract Holders: (1) from Greece

Agreement Holders: (7) from Australia, United Kingdom, United States of America (2) and Italy (2).

The First Research Co-ordination Meeting is scheduled for 30 September - 04 October 1996, Vienna, Austria.

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

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

cytogenetic and molecular information on these other species lags considerably behind that of the medfly.

Expected Duration: 5 years (1994-99)

Contract Holders: (7) from Argentina, Bangladesh, Brazil, Greece, Guatemala, Philippines and United States of America.

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

The First Research Co-ordination Meeting was held during 18 - 22 March, 1996, in Mendoza, Argentina.

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

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

Expected Duration: 5 years (1995-00)

Contract Holders: (6) from Austria (2), Czechoslovakia, Burkina Faso, Tanzania and Nigeria.

A Second Research Co-ordination Meeting is scheduled for April, 1997.

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

Objective: Better visual and odour attractants are required to improve the efficiency of pre-SIT-release fly population suppression operations and entomological monitoring of the target tsetse fly species. This will reduce the time and amount of materials required to suppress a tsetse

population to densities that permit the initiation of the SIT. Currently, pre-release population suppression of *G. austeni* involves per km² more than 80 insecticide-impregnated targets for more than 18 months, whereas good attractants available for other tsetse species require only 4 to 8 targets per km² for a period of 3 to 6 months. Moreover, reliable entomological data can be collected with less labour and investment involved. Thus, it will be possible to assess the progress of vector control or eradication operations, including the SIT, more easily and more accurately.

Expected Duration: 5 years (1994-99)

Contract Holders: (4) from Mali, Burkina Faso, Kenya and Hungary.

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

A Research Co-ordination Meeting is scheduled for 23-27 September, 1996, Nairobi, Kenya.

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

Objective: The major focus will be on field releases of moths given sub-sterilizing doses of radiation. This will require baseline data on field populations. Special attention will be paid to field behaviour of released moths, as well as the development of techniques to assess the impact of the released moths and their progeny in suppressing the native population.

Expected Duration: 5 years (1992-97)

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

Agreement Holders: (1) from the United States of America

The Second Research Co-ordination Meeting is scheduled for 2-6 September, 1996, Vienna, Austria.

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

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

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

Expected Duration: 5 years (1993-98)

Contract Holders: (12) from Argentina, Costa Rica, Greece, Guatemala, Honduras, Mauritius, Mexico, Morocco, Spain, Turkey, United States of America and Portugal.

Agreement Holders: (1) from the United Kingdom

The Second Research Co-ordination Meeting is scheduled for January 1997, Madeira, Portugal.

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

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

Expected Duration: 5 years (1993 - 98)

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

Agreement Holders: (1) from the United States of America

The First Research Co-ordination Meeting was held on 19 - 23 February, 1996, Tapachula, Chiapas, Mexico.

The Second is scheduled for Hawaii in September, 1997.

B. Planned Research Co-ordination Programmes

The following Co-ordinated Research Programmes are scheduled to be initiated in 1997-1998:

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

Objectives: To obtain information for a better understanding of the phylogenetic relationships between different tsetse species, sub-species and strains, and of heritable traits that can be subjected to selection pressure. This knowledge is of particular importance during the planning and the operational stages of area-wide control/eradication campaigns. Data on genetic variation within a target population, and information on the gene flow between neighboring tsetse fly populations, will have implications for conception of control campaigns. The possible development of resistance (physiological or behavioural), based on the selection of particular genotypes, will interact with and influence the type of control measure chosen and its mode of application.

To acquire knowledge on all factors, genetic and microbial, which modulate tsetse-trypanosome interaction. Knowledge of these factors could enable trypanosome refractoriness to be introduced into a target population or a mass-reared tsetse strain.

To develop tsetse strains that are more suitable for mass-rearing and release in tsetse control/eradication campaigns. Particular emphasis is laid on the development of an automated sexing method for immature fly stages (genetic sexing), and on other genetic or related techniques that foster an efficient large-scale application of the SIT. This also includes research directed at a trans-taxon use of laboratory-reared sterile flies for tsetse and trypanosomiasis control or eradication activities.

Expected Duration: 5 years (1997-02)

Note: Four persons have submitted requests for contract proposals from Ghana, Greece, Kenya and Belgium, and four persons have submitted requests for agreement proposals from the United States of America (2), Canada and Italy.

The First Research Co-ordination Meeting is scheduled for early 1997.

2. **Application of Nuclear Techniques for the Colonization and Production of Natural Enemies for the Environment-Friendly Area-Wide Management of Insect Pests**

Objective: Considerable technological advances have been made in mass-rearing of parasitoids, predators and entomopathogens. This large scale availability of natural enemies of key insect pests opens the way for totally biological control systems, where mass releases of natural enemies can suppress pest densities in the field, and so act synergistically with sterile fly releases to control wild fly populations within the context of area-wide integrated pest management programmes. Nuclear techniques can play an important role in the production of natural enemies, as recent research has shown that parasitization rates are increased in irradiated host larvae, the escape of prey or unparasitized adult pest insects is avoided, and artificial diets for mass-rearing of natural enemies can be decontaminated using irradiation. The proposed CRP has the objective of improving the environment by developing reliable and economic area-wide biological control suppression systems for use against major agricultural pests, through the integration of genetic control methods with augmentative biological control components, such as parasitoids, predators and pathogens.

Expected Duration: 5 years (1998-03)

C. Technical Co-operation Programmes

Over the last four years, the Section has had technical responsibility for a total of 31 technical co-operation projects. They fall under four major areas, namely:

1. The Tsetse Fly
2. The Mediterranean Fruit Fly
3. F-1 Sterility for the Control of Lepidopteran Pests
4. Others

Current Operational Projects are:

- * ARG/5/004 Feasibility of Fruit Fly Eradication
 - ARG/5/005 Fruit Fly Eradication in the South Region
 - BGD/5/016 Insect Pest Management by Genetic Manipulation
 - CHI/5/015 Mediterranean Fruit Fly Eradication
 - * COS/5/012 Medfly Research Laboratory
 - CUB/5/012 Control of Borer in Sugar-Cane
 - * ECU/5/013 Control of the Fruit Fly
 - * GHA/5/017 Eradication of Riverine Tsetse Fly (Phase II)
 - GUA/5/013 Genetic Sexing to Control the Medfly
 - INS/5/022 University Research and Teaching in Agriculture
 - KEN/5/020 Control of Tsetse Fly & Trypanosomiasis in Lambwe Valley
 - LEB/5/013 SIT to Control Fruit Tree Pests
 - * MAL/5/020 Nuclear Techniques to Improve Agricultural Production
 - MAR/5/009 Control of Diamondback Moth by Sterile Insect Technique
 - MLI/5/012 Integrated Tsetse Control
 - * NIR/5/021 Preventing Tsetse Fly Re-invasion (Phase II)
 - * PAK/5/018 Sterile Insect Technique
 - PAK/5/027 Integrated Management of Fruit Fly
 - * PAK/5/028 Nesting System of Termites
 - PAK/5/032 Control of Pink Bollworm to Improve Cotton Production
 - PHI/5/022 Feasibility Study of Integrated Control of Fruit Flies
 - POR/5/005 Mediterranean Fruit Fly Programme on Madeira
 - * RAF/5/013 Survey of the Extent of Medfly Infestation
 - * RAF/5/025 TC on Use of SIT in Combatting Tsetse Flies
 - * RAF/5/032 TC on Area-Wide Methods of Tsetse & Trypanosomiasis Mgmt
 - * RAS/5/028 TC on SIT and F-1 Sterility for Insect Control in SE Asia
 - SYR/5/011 Radiation-Induced Sterility for Codling Moth Control
 - THA/5/038 Integrated Control of Fruit Flies
 - * UGA/5/012 Integrated Tsetse Control Programme
 - * UGA/5/015 Integrated Tsetse Control Programme (Phase II)
 - UGA/5/018 Integrated Tsetse Control on Buvuma Island on Lake Victoria
 - * URT/5/007 Tsetse Fly Eradication
 - * URT/5/015 Eradication of Tsetse Fly on Zanzibar Island
 - URT/5/016 Tsetse Fly Eradication
 - ZAM/5/009 Tsetse Fly Control
 - ZIM/5/007 SIT for Tsetse Control Programmes
- * Projects in process of being phased-out or terminated

With such a large number of active Technical Co-operation projects, it is not possible to provide details on all of them. However, in future issues of the Newsletter, we will describe the activities of selected projects. In the meantime, the Technical Co-operation Department of IAEA adopted, in 1994, a "Model Projects" concept for some Technical Co-operation projects. In this issue, we are pleased to inform you about the successful completion of one Regular TC project, one ongoing Regular TC project, and one ongoing Model Project.

Mediterranean Fruit Fly Eradicated From Chile: One More Successful Application of the Sterile Insect Technique

A Sterile Insect Technique (SIT) Mediterranean Fruit Fly (medfly) Eradication Project in Chile, culminated in the eradication of this pest from the country, with benefits to the economy estimated at US\$ 500 million per year. In a ceremony presided over by the former President of Chile, the Minister of Agriculture and many dignitaries from other countries, the country was officially declared Mediterranean fruit fly-free in December, 1995.

Medfly is the most important pest affecting production and trade of fresh fruit in the new world. Its attack has been reported in more than 200 different species of fruit and vegetables. In the American continent, all countries, except the US, Belize, Mexico, Canada, some Caribbean Islands, and now Chile, are infested by this pest and the governments, jointly with the fruit grower organizations, have implemented programmes to control and/or to eradicate it. Presently, more than 50 million dollars a year are invested in these programmes.

By eradicating fruit flies, especially the medfly, and by accomplishing the international certification process of fruit fly eradication, Chile has gained the phytosanitary status of "fruit fly free country", increasing the access of its large fresh fruit industry to the Asian markets/countries considered Medfly free.

Although the Southern and Central regions of Chile were already free of fruit flies and the country had developed a very successful fruit export industry, its produce was still being restricted from certain international export markets because of fear of outbreaks originating from the presence of medfly in the Arica region in Northern Chile. After a decade of unsuccessful attempts to eradicate the fly using insecticides in the Arica region, the Chilean Agricultural Service, with the technical and financial support from the FAO/IAEA, initiated a SIT eradication programme against this pest. Consequently, a 50 million/week medfly mass-rearing facility was completed in 1993 when sterile fly releases were initiated. No wild medflies have been detected in the Arica region since the first half of 1995.

In addition to the eradication of Medfly from Chile, the pest has already been suppressed in Tacna, the southern-most valley of Peru. Future collaboration within an expanded FAO/IAEA bi-national Chile-Peru project, foresees enlarging the eradication and control activities to other fruit-producing valleys in Southern Peru.

Mediterranean Fruit Fly Programme on Madeira

Recently, a Technical Co-operation project (POR/5/005), was approved to assist the Government of Portugal "to establish a permanent field programme to control the Mediterranean Fruit Fly, Ceratitis capitata in the Madeira and Porto Santo Islands, using the Sterile Insect Technique and other phytosanitary activities, in order to improve the production and quality of fruits and vegetables."

Madeira's climate, due to its latitude and topography, is very suitable for the production of fruit trees from sub-tropical regions. The Regional Government has, therefore, been promoting the growing of exotic sub-tropical fruit, for example Chirimoya, as one of the leading areas of development of the regional economy. Since 1978 it has taken a number of actions to restructure and expand the sector.

This expansion of fruit production in Madeira is, however, seriously affected by the high populations of the Mediterranean Fruit Fly, the only fruit fly present on Madeira. This pest attacks on the island more than 50 species of fruit and vegetables and produces annual losses in Madeira of more than \$3.5 million US dollars. Controlling this pest through the application of insecticides alone is becoming increasingly difficult, due to tourism and other environmental concerns.

Consequently, Madeira plans to implement the Sterile Insect Technique (SIT), in order to control the medfly populations in an environment-friendly way. In a ca. 5-6 million ECU project, Portugal is sharing the cost of the programme with the EU, to construct and operate the first mass-rearing facility in the Mediterranean region with a capacity of approximately 50 million males per week. The Agency, under a four-year project POR/5/005, is providing the technology transfer and technical backstopping to design the mass-rearing facility and specialized rearing equipment, to plan and organize field monitoring, control and release activities, and to train professional staff for mass-rearing of sterile flies, quality control, maintenance and field operations.

The project is proceeding on schedule. The drawings of the mass-rearing facility, designed to produce a "male-only" genetic sexing strain, was completed in the spring of 1995, a contract was awarded after selection of bids in June 1995, and construction was initiated in July, 1995. At this moment in early 1996, the completion of the construction of the medfly mass-rearing

facility is nearing completion. Construction of the fly emergence and packing facility, as well as a nearby helicopter landing site, have also been initiated. A large portion of the rearing and environmental equipment has been ordered and should be delivered by the third quarter of 1996, when the inauguration is scheduled. It is anticipated that by July 1996, a small-scale production should be initiated, by early 1997, a 10 million males/week production reached, and by mid 1997, the full 50 million males per week production achieved.

In relation to the field operations, public information materials should be ready by mid-1996, and a Public Relations Campaign is scheduled to start in the second half of 1996. Since early 1995, the following field activities/studies have been ongoing to collect base-line information: medfly population dynamics, medfly presence at various altitudes throughout the year, confirmation of medfly primary and secondary hosts, medfly host phenology, medfly infestation levels on primary indicator hosts, preparation of sterile insect release and monitoring system protocols and training of field personnel.

From January to December 1997, the pest should be drastically reduced in all target areas of the island through the timely application of integrated control measures to reduce the high population pockets of the pest in some areas from 0 to 400 meters elevation. Cultural control over specific medfly hosts, will be a complementary control activity to reduce pest populations and finally, the massive release of sterile males will reduce the reproductive cycle of the remaining medflies. A continuous evaluation of these activities will be carried out using a sterile male monitoring system and a special fruit sampling system. This whole population suppression phase will be supported by a strong public information campaign.

A consolidation phase is scheduled to start in January, 1998. During this phase, the remaining medfly populations should be suppressed by the continuous release of sterile males over the entire target area. Specific pest surveys will permit the detection of hot spots, in which a strong cultural control, supported with the release of high densities of sterile males, will be carried out to eliminate the danger of pest dispersion and reproduction. With the establishment of a sustainable phytosanitary control programme, using an effective detection system and a timely contingency plan to suppress the hot spots, medfly will, hopefully starting in 1999, be permanently controlled below the economic thresholds of damage.

D. MODEL PROJECTS

Tsetse Fly Eradication Project on Zanzibar

On January 1, 1994, a model project was initiated, using funds from Belgium, Canada, Sweden, the UK and the USA, in which sterile tsetse fly males are being released from the air on Unguja Island, the main island of Zanzibar in the United Republic of Tanzania. Only one species, *G. austeni*, is present on the island and its attack is confined to wild and domestic animals.

Zanzibar is an excellent location for the project: It is an isolated location and gives an opportunity to conduct research, as well as refine techniques on all aspects of SIT, and (2) as it is an isolated island, the eradication would have a lasting impact on livestock development in Zanzibar as trypanosomiasis would no longer be a problem. This should facilitate farming systems which employ draught animals in farm operations and transport. The island of Unguja comprises 1600 km² and is 86 km at its longest and 35 km at its widest point. Up to 80% of some herds are now infested with trypanosomiasis.

The operational format was to build upon prior tsetse suppression programmes on the island. These programmes used cattle insecticide (pour-on) treatments and artificial attractant devices (blue screens treated with insecticide). Pour-ons are used if the density of cattle is greater than 10/km² and screens (50/km²) if the density of cattle is less. The plan involved continuation of these activities when and where needed and to introduce the release of sterile males when the production of sterile males had been increased in the rearing facilities in Tanga and Seibersdorf. Rural communities would assist in the placement and maintenance of the blue attractant targets.

In August 1994, the facility in Tanga was producing about 15,000 sterilized males per week for release, and an additional 15,000 per week were provided by the IAEA Laboratory in Vienna. In spite of an army ant raid which nearly destroyed the colony, and other problems, in February, 1996, the production had increased to 45,000 in Tanga and so production in Seibersdorf was reduced to 10,000 males/week. In the early phases of the programme sterile males were released by ground. On 24 August, 1994, the first releases of sterile male tsetse flies by aircraft began. Two aerial releases per week have continued up until the present time. Aerial releases guarantee more even dispersal of flies and permit releases over otherwise inaccessible areas or impenetrable vegetation found on some parts of the island.

Results have been very encouraging. By December 1994, nearly one fourth of all tsetse females captured in the entire southern part of the island already showed signs of induced sterility.

The situation in February, 1996, looks even more promising. Because of increased production of tsetse flies in the Tanga facility, over 50,000 sterile males are available for weekly releases. The ratio of sterile males to fertile wild males in the field has ranged from 60:1 to 70:1 for some months now, the level of sterility in the wild female population is over 50%, and the wild population captured is rapidly decreasing. Hopefully, these encouraging trends will continue.

(Readers interested in more information on this project can request copies of "Tanzanian Tsetse Brief" issued approximately every 6 months, by writing, faxing or E-mailing the Section).

III. MEETINGS

Research Co-ordination Meetings, Workshops and Seminars Held

1. The Second FAO/IAEA Research Co-ordination Meeting on "Development of Practices for Area-Wide Tsetse Eradication or Control with Emphasis on the Sterile Insect Technique", 20 - 24 September, 1993, Tanga, Tanzania.
2. Final FAO/IAEA Research Co-ordination Meeting on "Laboratory and Field Evaluation of Genetically Altered Medflies for Use in Sterile Insect Technique Programmes", from 11-13 June, 1994, in Clearwater, Florida, USA.
3. First FAO/IAEA Research Co-ordination Meeting on "Medfly Mating Behaviour Studies Under Field Cage Conditions", 4 -7 October, 1994, Vienna, Austria.
4. Final FAO/IAEA Research Co-ordination Meeting on "Genetic Engineering Technology for the Improvement of the Sterile Insect Technique", 21 - 25 November, 1994, Vienna, Austria.
5. First FAO/IAEA Research Co-ordination Meeting on "Evaluation of Population Suppression by Irradiated Lepidoptera and their Progeny", from 24-28 April, 1995, and related Workshop on Lepidoptera Mass-Rearing, 17-22 April, 1995, Jakarta, Indonesia.
6. First FAO/IAEA Research Co-ordination Meeting on the "Development of Female Medfly Attractant Systems for Trapping and Sterility Assessment", 22 - 26 May, 1995, Guatemala City, Guatemala.
7. First FAO/IAEA Research Co-ordination Meeting on "Automation in Tsetse Mass-rearing for Use in SIT Programmes", 16 - 20 October, 1995, Vienna, Austria.

8. **Second FAO/IAEA Seminar for Africa on "Animal Trypanosomiasis: Vector and Disease Control Using Nuclear Techniques", 27 November - 1 December, 1995, Zanzibar, Tanzania, and Final FAO/IAEA Research Co-ordination Meeting on the "Development of Practices for Area-wide Tsetse Eradication or Control with Emphasis on the Sterile Insect Technique".**
9. **Second Research Co-ordination Meeting on "Medfly Mating Behaviour Studies Under Field Cage Conditions", 19-23 February, 1996, Tapachula, Chiapas, Mexico.**
10. **First Research Co-ordination Meeting on "A Molecular and Genetic Approach to Develop Sexing Strains for Field Applications in Fruit Fly SIT Programmes", 18 - 22 March, 1996, Mendoza, Argentina.**

Research Co-ordination Meetings Planned

1. **First Research Co-ordination Meeting on "Improved Attractants for Enhancing the Efficiency of Tsetse Fly Suppression Operations and Barrier Systems used in Tsetse Control/Eradication Campaigns", 23 - 27 September, 1996, Nairobi, Kenya.**
2. **Second Research Co-ordination Meeting on "Evaluation of Population Suppression by Irradiated Lepidoptera and their Progeny", 2 - 6 September 1996, Vienna, Austria.**
3. **First Research Co-ordination Meeting on "Enhancement of the Sterile Insect Technique Through Genetic Transformation using Nuclear Techniques", 30 September - 4 October 1996, Vienna, Austria.**
4. **Second Research Co-ordination Meeting on "Development of Female Medfly Attractants Systems for Trapping and Sterility Assessment", in January, 1997, Madeira, Portugal.**
5. **Second Research Co-ordination Meeting on "Automation in Tsetse Fly Mass-Rearing For Use in Sterile Insect Technique Programmes", in April, 1997.**
6. **First Research Co-ordination Meeting on "Genetic Applications to Improve the SIT for Tsetse Control/Eradication Including Genetic Sexing", in 1997.**
7. **Second Research Co-ordination Meeting on "Medfly Mating Behaviour Studies Under Field Cage Conditions", in September, 1997, in Honolulu, Hawaii.**

Consultants Meetings Held

1. "Economic Evaluation of Damage Caused By, and Methods of Control of, the Mediterranean Fruit Fly in the Maghreb", Vienna, Austria,
2. "The Potential for Genetic Control of Malaria-Transmitting Mosquitos", Vienna, Austria, 26 - 30 April, 1993.
3. "The Potential for Tsetse Flies to Develop Resistance to Insecticides", Vienna, Austria, 15 - 19 November, 1993.
4. "EASTMED - A Proposal for Medfly Control or Eradication with the Sterile Male Technique", Vienna, Austria, 24 - 27 May, 1994.
5. "Plans for Eradication of the Mediterranean Fruit Fly with the Sterile Insect Technique - Proposals for Cyprus-Med, East-Med and Egypt-Med Projects", Vienna, Austria, 23 January - 4 February, 1995.
6. "Economic, Strategical and Operational Considerations on the Use of Medfly Genetic Sexing Strains in SIT Programmes", Mendoza, Argentina, 18 - 26 March, 1996.

The results of these Consultant Group Meetings have been published and are available upon request.

IV. TRAINING COURSES

Past

1. FAO/IAEA Regional Training Course on the Use of the Sterile Insect Technique in Combatting Tsetse Flies", from 23 August - 17 September, 1993, in Tanga and Zanzibar.
2. FAO/IAEA Interregional Training Course on "The Use of Radiation and Isotopes in Insect Control and Entomology", Gainesville, Florida, USA, 04 May - 15 June, 1994.
3. FAO/IAEA Regional Training Course on "Fruit Flies in Latin America with Special Emphasis on the Sterile Insect Technique", 3 October - 4 November 1994, Tapachula, Mexico.

4. **FAO/IAEA Regional Training Course on the "Sterile Insect Technique (SIT) and F-1 Sterility for Control or Eradication of Noxious Insects in Southeast Asia", 6 November - 1 December, 1995, Okinawa, Japan & Manila, the Philippines.**
5. **FAO/IAEA Regional Training Course on "Area-wide Methods of Tsetse & Trypanosomiasis Management", 18 November - 15 December, 1995, Zanzibar, Tanzania.**

Future

1. **FAO/IAEA Interregional Training Course on the "Use of the Sterile Insect and Related Techniques for the Area-wide Management of Insect Pests", Gainesville, Florida, USA, 8 May - 19 June, 1996.**
2. **FAO/IAEA Regional Training Course on the "Use of SIT in Support of Integrated Area-wide Methods to Combat Tsetse and Trypanosomiasis", Africa, 1997.**
3. **FAO/IAEA Regional Training Course on "Use of SIT and Related Methods for the Integrated Area-wide Fruit Fly Control/Eradication in the Near East and the Mediterranean Basin", second semester of 1997.**
4. **FAO/IAEA Regional Training Course on "Use of SIT in Support of Integrated Area-wide Methods for Fruit Fly Control/Eradication in Latin America", October 1997.**

V. RECENT DEVELOPMENTS AT THE SECTION'S LABORATORY UNIT, SEIBERSDORF

Medfly

- (a) *Transfer of Genetic Sexing Strains to Mass-Rearing Factories in Argentina and Guatemala*

The second half of 1995 has seen an acceleration in the utilization of genetic sexing strains in medfly SIT programmes. The two systems developed at Seibersdorf, pupal colour and temperature sensitivity, have been introduced into mass-rearing facilities in Argentina and Guatemala, respectively. The successful completion of these transfers has entailed considerable commitment from the laboratory in terms of strain production and the training of local staff. It is clear that the transfer of these strains to managers, schooled in the rearing of

conventional strains, requires considerable preparation and continued interaction. Both facilities will start releases of males only in 1996 and the experience gained will enable a realistic assessment to be made of the benefits of these strains to SIT programmes.

(b) Analysis of the Male-Determining Factor

Future genetic sexing strains will be constructed, using techniques adopted from molecular biology. The recent development of medfly transformation makes this possibility much closer. Direct manipulation of the sex-determining mechanism requires an understanding of that process and the gene responsible for maleness in medfly has been mapped to a region encompassing 15% of the Y chromosome. Genomic libraries made following dissection of this region, have yielded clones which could contain the *Maleness* factor. The screening of these clones is continuing. Chromosome analysis of species closely related to medfly have shown that these species carry Y chromosomes many times smaller than the Y chromosome of medfly. This observation opens up alternative possibilities to clone the Maleness factor from medfly.

(c) Genetic Transformation

Recently, genetic transformation of the medfly has been achieved for the first time by a group in Crete, using the specific genetic element *Minos*, initially isolated by Seibersdorf staff member G. Franz. Related experiments carried out in the Seibersdorf laboratory, with the help of a consultant, have indicated that a second element also has properties consistent with transformation ability. These developments are very exciting and will be actively pursued.

Other research topics being carried out include:

- induction of chromosomal inversions to stabilize genetic sexing strains;
- detailed analysis using slow-motion video recording of mating behaviour in medfly strains to assess whether there are differences in courtship behaviour, due to genetic, geographic or rearing background;
- development of genetic sexing strains based on a slow development mutant, in collaboration with scientists at INTA, Buenos Aires, Argentina;
- integration of pupal parasitoid rearing with the rearing of genetic sexing strains.

Tsetse Fly

(a) Automated Mass-Rearing Procedures

Expansion of the SIT to large areas on mainland Africa is impossible without a major improvement in rearing techniques. To this end, a concerted effort has been made, firstly to improve production parameters with the current rearing

system, and secondly, to develop automated rearing methodologies for use under African conditions. Remarkable improvements have been made in the current system as a result of the introduction of several small changes. These changes have been tested in the laboratory and then introduced into the mass-rearing facility at Tanga. With the help of a consultant, a completely new approach to tsetse rearing is being developed, including the construction of a machine which will hold a large number of cages and which will also bring them for blood feeding at the required intervals. Further automation of the tsetse rearing progress will be actively pursued.

(b) DNA Analysis of Glossina austeni Populations

Several *G. austeni* populations have been analysed, using Random Amplified Polymorphic DNA. This is a PCR based approach and is being used to assess the degree of relatedness between *G. austeni* populations from different geographical areas. Based on an initial survey, very few differences could be found between *G. austeni* populations from Zanzibar and mainland Tanzania and encouragingly, the strain being mass-reared and released in Zanzibar showed few differences from the target population. This indicates that the genetic variability in the colony has not been seriously degraded following long-term colonization. It also suggests that the quality of the flies for release should be high.

(c) Tsetse Pupal Parasitoids

Following initial laboratory studies on several candidate tsetse pupal parasitoids, a field trip was undertaken to Zimbabwe to assess parasitization rates in the field and to collect material to initiate a laboratory colony of parasitoids. Field populations of tsetse were very low and hence very few parasitoids could be found. Many areas were surveyed with the same result. Insufficient parasitoids were collected to initiate a laboratory colony and after some discussions, it was decided to terminate the project.

(d) Tsetse Fly Production for Tanga

During the second half of the year, approximately 1.3 million pupae were shipped to Tanga in support of the tsetse fly eradication programme on Zanzibar, (URT/5/016). This is a major effort in the laboratory and support for the programme will continue as long as it is necessary. The improvements described above will only make themselves really felt in the mass-rearing colony during the first three months of 1996.

VI. SPECIAL NEWS AND REPORTS

Area-Wide Pest Management Symposium

A Symposium on "Area-Wide Integrated Pest Management" has been organized as part of the up-coming XX International Congress of Entomology, to be held in Florence, Italy, from 25-31 August, 1996. The organizers of the Symposium are A. Malacrida (Italy), J. Hendrichs (Austria) and J. Coppedge (USA), and the invited speakers will cover both SIT and non-SIT Area-Wide Programmes against the following pests: screwworm fly, bollweevil, codling moth, fruit flies, corn root worm, cotton bollworm, tobacco budworm, pink bollworm, cassava mealybug, silverleaf white fly and tsetse flies. Unfortunately, time assigned to the Symposium is very limited and other successful area-wide pest management cases had to be left out.

Genetic Transformation in the Medfly

The 22 December 1995 issue of SCIENCE (Vol. 270) carried 3 articles of utmost importance to all medfly researchers. Among the headlines were such titles as: Medfly Transformed: Official!, Gene Transfer into the Medfly, *Ceratitis capitata*, with a *Drosophila hydei* Transposable Element, and The White Gene of *Ceratitis capitata*: A Phenotypic Marker for Germline Transformation. These articles written by scientists in laboratories in Greece, Italy, the UK, Germany and the USA, were good news indeed. After many, many years of research, genetic transformation for this important pest was finally accomplished and the future applications are promising indeed. More recently, Dr. O'Brochta from the USA visited the laboratory at Seibersdorf (December 1995) and working with Drs. Franz and Willhoeft, was able to demonstrate that the transposable elements *Hermes* could also be used in medfly genetic transformation. This work will be continued at the laboratory in May 1996. All of these recent "breakthroughs" bring us much, much closer to the use of genetic transformation techniques, formerly available only in *Drosophila*, with medfly and possibly other fruit fly species. Stay tuned!!

Retirement of Dr. Don A. Lindquist:

Dr. Lindquist retired from the Joint FAO/IAEA Division in June, 1994. Over many years, Dr. Lindquist worked with well-known dedication and vigour in a number of posts.

1967 - 1969 Head, Insect and Pest Control Section

1971 - 1975 Head, Insect and Pest Control Section

1980 - 1982 Head, Agrochemicals and Residues Section

1982 - 1990 Head, Insect and Pest Control Section

1990 - 1992 Field Project Director, SECNA, Screwworm Eradication Programme in North Africa, stationed in Tripoli, Libya.

1993 - 1994 Head, Insect and Pest Control Section

During his many years of service, both in the Joint FAO/IAEA Division, and in the Agricultural Research Service of the USDA, Don made many, many friends in the entomological community ALL OVER THE WORLD. A complete listing of all his accomplishments is beyond the scope of this report, however, his outstanding contributions to area-wide pest management and the application of the Sterile Insect Technique, have to be pointed out. All of us who had the privilege of working with him will remember his total dedication to "getting the job done", and the sharp insight he brought to our work. In addition, many entomologists in foreign countries were influenced by his guidance and activities in such projects as the very early medfly projects (1967 - 1969) in Costa Rica and Nicaragua, before the medfly was allowed to invade all of Central America and Southern Mexico, the early medfly programmes in Procida and Capri in Italy. He was also actively involved in the Moscamed Medfly Project in Mexico, the Screwworm Eradication Programme in the USA, Mexico, and Central America, and the Misrmed Medfly Project in Egypt. He directed the highly successful Screwworm Eradication Project in Libya, which achieved complete screwworm eradication from North Africa. Don continues to live in Vienna, Austria.

Eradication of Screwworm From North Africa Completed

Previous issues of the Insect and Pest Control Newsletter (No. 46 in August 1991 and No.47 in May 1992), presented highlights of this Project. Even though this is old news, the last Newsletter 48 did not report full eradication. Therefore, a short summary of the project and its successful outcome are reported here. The New World Screwworm, *Cochliomyia hominivorax* (Coq.) was discovered in Northwest Libya in the fall of 1988 by Libyan veterinarians. Positive taxonomic identification of the presence of this pest was made by British scientists. The Government of the Libyan Arab Jamahiriya implemented a large-scale control and containment programme in mid-1989. In 1990, plans to eradicate this pest from North Africa were developed by IAEA in Vienna, which were then supported by the Government assisted by FAO, UNDP, IFAD, and IAEA. A large number of donor governments were eventually involved. The only proven technology available was the SIT, combined with intensive surveillance, animal treatment and animal movement control. Don Lindquist from IAEA moved to Libya where he co-directed all programme operations. The aerial release of sterile NWS was initiated on 18 December, 1990. Sterile flies were produced in the only screwworm mass-rearing facility in the world located in Tuxtla Gutierrez, Chiapas, Mexico, and shipped to Libya. The sheer size of sterile fly shipments and the complexity of the entire programme involving scientists from several continents and different organizations, makes this one of the most complex SIT projects ever executed. The final proof of the efficacy of the SIT approach is that the last animal with a screwworm infested wound was found on 7 April, 1991, and the last fertile screwworm fly captured was on 27, April 1991. Area-wide dispersal of sterile screwworm flies continued for six months after the last case was found and continued

surveillance since then has not revealed more cases of screwworm infestations. If you are interested in the full details of this fascinating scientific achievement, you should read "The New World Screwworm Eradication Programme--North Africa 1988-1992", published by FAO in 1992 (M-27, ISBN 92-5-103200-9).

Esna Meeting in Varna, Bulgaria, 1994

For those readers who are interested, we have reproduced below the Summary of the Pest Management Working Group from the last European Society for Nuclear Applications (ESNA) Meeting in Varna, Bulgaria, 12 - 16 September, 1994:

*Report of Working Group Chairman, Prof. S. Ignatowicz, Agric. Univ. Warsaw, Poland
- WG6 - Pest Management*

Two sessions of the ESNA Working Group 6 "Pest Management" were organized. The following papers were presented during two sessions:

- (1) K.Banasik (Poland) - "Detection of Irradiated Insects - Pests of Stored Products: Locomotion Activity of Irradiated Adult Beetles".
- (2) L.A.Ieradi, F.Pasqualucci, D.Urbani, F.Verse, M.Cristaldi (Italy) - "Investigations on the Improvement of Use of Electronic Systems for the Rodent Pest Control".
- (3) S.Ignatowicz and B.Wesolowska (Poland) - "Potential of Common Herbs as Grain Protectants: Repellent Effect of Herb Extracts on the Grain Weevil, *Sitophilus granarius* L. ".
- (4) S.Ignatowicz and I.H.M.Zaedee (Poland) - "Radiation Disinfestation of Used Packagings: Irradiation Trials with Electron Beams".
- (5) M.Mansour (Syria/IAEA) - "Possibilities of Eradicating the Codling Moth, *Cydia pomonella* L., from Syria by Releasing Gamma Irradiated Sterilized Males".
- (6) I.Rosca and A. Barbulescu (Romania) - "Status and Potential of F1 Sterility for Control of European Corn Borer, *Ostrinia nubilialis* Hb. ".
- (7) M.Szczapanik (Poland) - "Identification of Irradiated Insects. Changes in the Midgut of the Confused Flour Beetle, *Tribolium confusum* DuV., Induced by Gamma Radiation".
- (8) A.S.Tuncbilek (Turkey) - "The Effects of Different Rearing Diet Media on the Irradiated Eggs and Larvae of Flour Beetle, *Tribolium confusum* DuVal. ".

Additionally, the abstract of the paper of R.J.Wood et al. on "Population Genetics of T:Y (WP+) 30 C. Sexing Strains of *Ceratitis capitata* (Wied.)", was presented by the Chairman of WG 6.

Summary of Working Group 6 - Pest Management of Varna Meeting:

The Sterile Insect Technique is considered for the codling moth control in Syria, and the F1 Sterility Technique is evaluated for controlling the European Corn Borer in Romania. The implementation of these genetic methods into practice requires a thorough knowledge of the life history, biology and ecology of the target pest species. Therefore, M. Mansour (Syria) and I.Rosca (Romania) presented their results on the bionomy of the target pests, and discussed in detail the status and potential of the genetic methods of pest control in their countries. Trials of radiation disinfestation of used bags were presented by S.Ignatowicz (Poland). Control of insect and/or mite infestation of the repeatedly used packagings may be secured by ionizing radiation applied at 2-3 kGy doses. Gamma rays and X-rays penetrate the treated products easily, but electron radiation penetrability is much lower, depending on the electron energy employed. The results of this study indicate that bags made of polyvinyl chloride may be disinfested with electron beams when they are created as separate units or batches up to 50 bags. The jute bags should be irradiated with electrons as batches containing no more than 30 bags. K.Banasik (Poland) presented results of her study on locomotion activity of irradiated beetles, pests of stored products, and suggested that the locomotor test may be used as an identification method of irradiated insects. A more accurate method for the detection of irradiated insects was presented by M.Szczepanik (Poland). She confirmed that regenerative cells of the midgut of the Confused Flour Beetle are very sensitive to radiation. Damage of them results in loss of the midgut epithelium in irradiated insects. The degenerative changes in the midgut are positively correlated with both dose and the time elapsed after irradiation exposure. A pathological syndrome of irradiation effects on the insect midgut may be used for a rapid and efficient identification of irradiated insects. The next paper dealing with radiation disinfestation of agricultural products was presented by A.S.Tuncbilek (Turkey). Results of this study indicated that eggs of the Confused Flour Beetle were more susceptible to gamma radiation than larvae. Values LD99.9 and LD50 were presented for each stage reared on various diets. In the section on diverse methods for controlling pests of economical importance, two papers were given. L.A. Ieradi (Italy) presented a paper on two electronic devices (the Rodent Monitoring Unit, and the Rodent Detection System), for scoring the rodent presence in open and enclosed spaces with the aim to acquire more information on the murine infestation level. S.Ignatowicz (Poland) presented results on the possible repellent effects on the Grain Weevil of water extracts of five common medicinal herbs. A small group of scientists attended the WG.6 of ESNA during the XXIVth Annual Meeting in Varna. However, the presentations given are of great value for the further development of new methods of pest control.

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