JOINT FAO/IAEA DIVISION OF ISOTOPE AND RADIATION
APPLICATIONS OF ATOMIC ENERGY
FOR FOOD AND AGRICULTURAL DEVELOPMENT

INTERNATIONAL ATOMIC ENERGY AGENCY –
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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INSECT & PEST CONTROL SECTION

NEWSLETTER

AND

INFORMATION CIRCULAR

ON

RADIATION TECHNIQUES AND THEIR

APPLICATION TO INSECT PESTS

No. 34

December 1984

C O N T E N T S

PLEASE NOTE

The summaries of unpublished work often represent preliminary reports of investigations in progress and, therefore, such findings are subject to possible revision at a later date. The contents of this Information Circular should not be published or referred to in articles for publication without obtaining permission from the authors first.

INTRODUCTION TO EDITION NO. 34

(i) Publication Policy of Information Circular

The policy of the Joint FAO/IAEA Division in publishing this Information Circular is to emphasize the results of recent research on the use of radiation and radioisotopes in entomology. Therefore, emphasis is placed on unpublished data. For several reasons, we are unable to edit submitted contributions. These are reproduced by a photographic, process, and therefore reflects faithfully, the authors care in preparing the material.

While emphasis is on unpublished data, we include, whenever possible, summaries of recently published papers. In that case, the material submitted should be no more than one page when typed double-spaced. (A form for submission of contributions is included in each distributed copy of the Information Circular; more can be provided on request).

(ii) Newsletter

Starting with this issue of the Information Circular, we include a new section devoted primarily to news on the programmes and related activities of the Insect and Pest Control Section. The Newsletter is intended to appraise our readers of "what is going on" and provide an indication of "future plans". As far as possible, results or summaries of major activities during the preceding 6 months (e.g. field programmes, meetings etc.) will be provided.

II. GENERAL INFORMATION

A. Professional Staff - Insect & Pest Control Section

Headquarters

D.A. Lindquist	Head, Insect and Pest Control Section
E.D. Offori	
G.C. LaBrecque	(deceased 15 November 1984)

BICOT (Biological Control of Tsetse by the SIT) - PO Box 76, Vom, Plateau State, Nigeria)

W. Takken	Acting Project Director and Supervisor of Field Operations
M. Oladunmade	Project Co-Director
H-J. Hamann	Supervisor of Laboratory and Rearing Operations
S. Tenabe	Co-Supervisor of Laboratory and Rearing Operations
(vacant)	Co-Supervisor of Field Operations

Seibersdorf Laboratory

R.E. Gingrich	Head, Entomology Laboratory
G. Hooper	Mediterranean Fruit Fly Investigations (Terminated Nov. 84)
A. Van der Vloedt	Tsetse Fly Investigations
E. Bush-Peterson	Genetic Sexing of Medflies
J. Kabayo	Tsetse Artificial Diets
R. Fay	Medfly Investigations (Terminated Nov. 84)
D. Haile	Computer (on sabbatical leave from USDA)

B. Entomology Laboratory

The IAEA has an international laboratory located at Seibersdorf, Austria, about 30 km. from Vienna. A part of this laboratory, within the Agricultural Biotechnology Unit, is devoted to the use of atomic energy in entomology.

The primary research objective of the entomology programme at the Agency's Agricultural Biotechnology Laboratory is to support and service the Joint FAO/IAEA Division's programmes on insect control. Thus much of the research is concerned with problems that arise with field programmes.

The main thrust of research in Seibersdorf involves development of the Sterile Insect Technique (SIT) or eradication. Because of the dependence of this technique on efficient, economical mass rearing of insects, much of the research at the laboratory involves rearing. Other major areas of activity include (1) development of methods of radiation sterilization for producing the best possible sterile insect (in terms of sexual competitiveness, longevity and quality), (2) investigation of handling techniques for large numbers of insects, and (3) supplying insects for field programmes.

In general, research is undertaken to:

(1) Develop and improve mass rearing;
(2) Improve radiation techniques;
(3) Develop methodology for "fail-safe" radiation sterilization;
(4) Develop laboratory methods for estimating "fitness" and sexual competitiveness of laboratory-reared, sterilized insects;
(5) Study possible genetic changes taking place during colonization and mass rearing;
(6) Develop methods of shipping insects as pupae, either before or after sterilization;
(7) Develop release methods for large numbers of insects, both aerial and ground.

At the present time, the following species of insects are being reared at Seibersdorf:

(1) Mediterranean fruit fly, Ceratitis capitata (Wiedemann);
(2) Tsetse fly, Glossina palpalis palpalis (Robineau-Desvoidy);
(3) Tsetse fly, Glossina pallidipes, Austen.

The Entomology Laboratory also assists entomologists in developing countries in planning or carrying out projects involving the use of the Sterile Insect Technique (SIT), as well as serving as a training institution for entomologists from developing countries. These trainees are handled under the Agency's fellowship programme and usually spend from one to six months at Seibersdorf depending upon the needs of the country/institution requesting the assistance. In addition, entomologists may be supported under the fellowship programme to undertake scientific visits for up to 4 weeks.

C. Programmes of the Insect and Pest Control Section

1. Medfly

Among the most devastating pests of fruits in the world is the Mediterranean furit fly Ceratitis capitata. Research undertaken on this pest aims to

(a) Develop less expensive larval and adult diets with particular emphasis on locally available ingredients (non-imported) from various parts of the world.
(b) Improve systems of rearing.
(c) Develop laboratory and field quality control techniques.
(d) Improve handling techniques for large numbers (100s of millions) of flies.
(e) Improve methods of releasing sterile flies in the field from aircraft.
(f) Provide emergency supplies of sterile medflies for field programmes.
(g) Develop genetic and mechanical sexing systems.

2. Tsetse fly

The tsetse fly occurs only in Africa and is the sole transmitter of animal and human trypanosomiasis. The Sterile Insect Technique which is currently being used to combat tsetse is supported by research to:

(a) Improve rearing technology with reduced handling of flies.
(b) Develop in vitro and in vivo feeding technology for mass rearing.
(c) Develop methods for preserving blood (freeze-drying).
(d) Use of blood additives for improving tsetse fly performance and offspring quality.
(e) Develop synthetic diet for tsetse fly rearing.
(f) Improve radiation sterilization techniques.
(g) Develop methods of estimating fitness of laboratory-reared, sterilized flies; study possible genetic and/or behavioural changes taking place during colonization and mass rearing.
(h) Conduct cross-breeding experiments with morphological mutants.
(i) Develop laboratory and field quality control techniques.

3. Isotopes and Radiation in Integrated Pest Management

This programme aims to develop techniques for applying isotopes, wherever possible, to elucidate the ecology and population dynamics of major crop pests and disease vectors. Research emphasis has been on the following:

(a) Predator-prey and host-parasite relationships.
(d) Alternate hosts.
(c) Pest population estimates for forecasting.
(d) Pest dispersal and population dynamics.
(e) Training.

D. Current Technical Co-operation and Assistance Programmes for which this Section has responsibility

(a) Medfly	(b) Tsetse	(c) Isotopes	(d) Others
Egypt	Nigeria	Kenya	Sri Lanka
Peru	Zambia	Indonesia	Iraq
Guatemala	Ghana		Pakistan
	Tanzania		

E. Experts and Consultants: July - December 1983

Name	Nationality	Location of Assignment	Dates and Task Performed
G.W. Rahalka	India	IRAQ	18 May - 7 June: Iraqi Atomic Energy Commission Laboratory on design of multipurpose entomological laboratory.
L. Gringorten	Canada	Indonesia	9 May - 31 December: To set up an isotope laboratory and train staff of the BATAN entomology section in the use of isotopes to study ecology of rice insects.
U. Feldmann	FRG	Tanzania	1 July - 30 November: To initiate mass-rearing of *Glossina austeni* using *in vitro* techniques.
D. Turner	U.K.	Tanzania	15 Nov. - 14 Feb.: To conduct tsetse survey of Zanzibar Island.

F. Trainees in Entomology 1983 & 1984

(i) Seibersdorf (1983 - 1984)

Name	Country	Date
El-Abbasi, Talal Salah El-Din	Egypt	03-05 - 23-12-83
El-Zooka, Ahmed Abdel-Moniem	Egypt	01-01 - 03-05-83
Maged, Mohamed	Egypt	09-07 - 13-07-84
Hashem, Abdel-Fattah Gad	Egypt	09-07 - 13-07-84
Mahmoud, Kamal	Egypt	09-07 - 13-07-84
Bayoumy, Bahgat	Egypt	09-07 - 13-07-84
Elrifaai, Mohamed Salah Eldin	Egypt	09-07 - 13-07-84
Saafan, Mohamed	Egypt	09-07 - 13-07-84
Dankwa, Doris	Ghana	05-03 - 17-04-83 17-06 - 07-09-83
Kiwia, Ndeweso	Tanzania	15-02 - 14-05-83
Ajagbona, Banjo Ola	Nigeria	31-01 - 30-04-83
Onah, Jacob Abah	Nigeria	17-05 - 16-08-84
Obiero, Simon Oluoch	Kenya	26-01-84

(ii) Other locations (1983 & 1984)

Mexico: Moscamed Project, Tapachula, Chiapas

Name	Country	Date
El-Abbasi, Talal Salah El-Din	Egypt	04-03 - 02-05-83
El-Zooka, Ahmed Abdel-Moniem	Egypt	04-03 - 03-05-83
Maged, Mohamed	Egypt	11-05 - 08-07-84
Hashem, Abdel-Fattah Gad	Egypt	11-05 - 08-07-84
Mahmoud, Kamal	Egypt	11-05 - 08-07-84
Bayoumy, Bahgat	Egypt	11-05 - 08-07-84
Elrifaai, Mohamed Salah Eldin	Egypt	11-05 - 08-07-84
Saafan, Mohamed	Egypt	11-05 - 08-07-84

Belgium: Institut de Medecine Tropicale
"Prince Leopold"
Antwerpen

Dankwa, Doris	Ghana	05-03 - 17-04-83 17-06 - 07-09-83

Gainesville: Integrated Pest Management with Special Reference to the Sterile Insect Technique, University of Florida Gainesville, USA, 11 June - 3 August 1984

Name	Country
Mr. M.A. Naves	Brazil
Mr. L.-D. Ke	China
Mr. R. Charlin Castro	Chile
Mr. J.-M. Zhu	China
Ms. A.V.A. Eduayah	Ghana
Mr. G. Szocs	Hungary
Mr. M.H. Soemartaputra	Indonesia
Mr. K.C. Khoo	Malaysia
Mr. J. Reyes Flores	Mexico
Mr. M. Oladunmade	Nigeria
Mr. M. Hamed	Pakistan
Ms. L.R. Blanco	Philippines
Mr. P. Kanagaratnam	Sri Lanka
Ms. P. Komson	Thailand
Mr. E. Sekeroglu	Turkey
Mr. P. Einyu	Uganda
Ms. A.L.B. Terra Oyenard	Uruguay
Mr. R. Marcano Brito	Venezuela
Mr. S.S. Kim	Korea
Mr. M. Arura	Papua New Guinea

III. NEWSLETTER FROM THE INSECT & PEST CONTROL SECTION

1. TSETSE SIT SEMINAR HELD IN LUSAKA, ZAMBIA, 25 - 29 JUNE 1984

A 5-day Seminar on the Sterile Insect Technique was held at the Mulungushi Conference Centre, in Lusaka, Zambia (25-29 June 1984), and was attended by 57 participants representing 14 African countries and 3 international organizations.

The technical sessions began with a review of current tsetse control activities in Africa. An introductory lecture entitled: "Planning for National Tsetse Control Operations" was followed by brief oral presentations from country representatives on current and future plans for tsetse control activities in their various contries.

Subsequent discussions brought to light some of the difficulties facing most African countries in their effort to control or eradicate tsetse and trypanosomiasis.

- In almost all cases, lack of funds was cited as the major constraint in planning an effective tsetse control programme. The need for external financial assistance was stressed.

- A major problem related to trained personnel having to vacate their position "for more lucrative jobs."

One lecture was devoted to explaining the Sterile Insect Technique, including the principles involved in inducing dominant lethal mutations in the germ cells of target species exposed to ionizing radiations. The advantages and disadvantages of the SIT were discussed, and the contributions of various laboratories in Europe and Africa in developing the technique for use against tsetse were highlighted and duly acknowledged.

Lectures were presented on subjects relating to laboratory and field activities that need to be undertaken in preparation for, and in support of tsetse eradication programmes involving the Sterile Insect Technique. Development of mass-rearing techniques was emphasized, including the use of artificial feeding methods and synthetic diets.

The use of traps, impregnated screens and other "inexpensive" and non-polluting population suppression techniques was explained and illustrated by means of slides and/or actual models.

The role of trypanosomiasis surveys in tsetse SIT programmes was stressed. It was pointed out that such a survey should always precede any plan or proposal to control or eradicate tsetse in a particular area.

The field application of the SIT for tsetse eradication was illustrated by a detailed description of laboratory research at Seibersdorf, mass-rearing and field operations at the Agency-supported project (BICOT) in Vom, Nigeria. Results of sterile male releases undertaken during the past 18 months indicated complete eradication of the target species in several forest patches within

the 1500 km^2 project area. In the discussions that followed, participants were informed of a similar SIT project in Bukina Faso involving the rearing of 3 species of tsetse for release in a 400 km^2 area.

The technical sessions culminated in panel discussions on three main topics:

(i) Tsetse Population Management in relation to the SIT.

(ii) Integrating the SIT into national and regional tsetse control programmes.

(iii) Research and training needs in support of tsetse SIT.

Presentations by panelists were followed by comments and questions from participants. The Session concluded with general discussions out of which several pertinent points were raised regarding application of the SIT for tsetse eradication. The following points emerged:

(i) Tsetse Population Management in relation to the SIT.

Participants agreed on:

a. The need to develop and standardize different sampling methods including traps, in order to facilitate comparison of results on the various species of tsetse by different workers.

b. Continued research for improving the efficiency of existing traps and screens, and the need to develop simple trapping devices that would require very little maintenance and can be easily operated by village people.

c. The need to integrate trypanosomiasis control, (through both prophylaxis and drug treatment) with tsetse eradication using the SIT. In this connection, it was emphasized that trypanosomiasis surveys should be considered as important as tsetse surveys undertaken before applying the SIT.

d. Evaluating screens, both for their effectiveness as tsetse population suppression agents and possible effect on other non-target insects.

(ii) Integrating the SIT into national and regional tsetse control programmes.

On the role of the SIT in tsetse eradication programmes, Seminar participants stressed that:

a. Efforts should be made to integrate the technique with national programmes as a first step to integrating it into regional programmes. In this regard, it was stressed that governments should be made aware of the potential of the technique and urged to make budgetary provisions accordingly.

b. As a concrete step towards regionalization of SIT programmes, consideration should be given to setting up tsetse mass-rearing centres which would supply puparia to various countries. The facilities in Burkina Fasso and Nigeria could serve the West African region, and the one in Tanga, Tanzania, and another possibly in Zambia, could serve East and Central Africa.

(iii) Research and training needs in support of tsetse SIT

Panelists and participants, in acknowledging the efforts of the Joint FAO/IAEA Seibersdorf Laboratory in training tsetse workers from Africa pointed out:

a. The need to train more gradute level personnel in SIT related disciplines.

b. The importance of exposing trainees to all aspects of tsetse and trypanosomiasis control, wherever possible.

c. That all trainees should be given opportunity to spend some time at on-going SIT field projects.

d. That training programmes should be designed to include other activities that would enable trainees to undertake simple repairs of rearing and other laboratory equipment.

Finally, it was suggested that the Joint FAO/IAEA Division should consider procuring a well-equipped vehicle that could be used for conducting tsetse SIT workshops. The idea would be for the "mobile workshop" to tour interested African countries for the purpose of conducting training in each country.

2. BICOT: 1979 - 1984

YAKI DA KUDAN TSANDO, the Hausa language expression for "Combat the Tsetse Fly" is the sub-title of a "Public Relations and Information Poster" currently displayed in many villages in the Lafia/Adogi area of the Plateau State, Nigeria. The caption also summarises activities currently in progress to eliminate Glossina palpalis from the 1500 km^2 of the BICOT project area.

The BICOT Project became operational in 1979. After initial difficulties relating mainly to the rearing of the target species, considerable progress has been made, especially during the past 2 years of operations. Highlights:

- the laboratory in Vom is producing over 10 000 surplus male G. p. palpalis weekly from a 100 000 strong colony for sterilization and release.

- A colony of 50 000 in Seibersdorf Laboratory makes available 20 000 puparia every month as back-up for the BICOT operations.

- Through a combination of biconical traps and insecticide-impregnated screens, the population of the target species has been reduced to the point where sterile males released at weekly intervals have completely eliminated G. palpalis palpalis from several forest patches originally constituiting the "hot spots" of fly infestation.

The achievements to date of BICOT have been so encouraging that the Federal Nigerian Government is considering extending the project into 1985 and to cover at least the 10 000 km^2 Lafia Agricultural Development Project area.

3. MISR-MED

The Mediterranean fruit fly, Ceratitis capitata, is one of the most serious pests of citrus, stone fruit and other fruits in the Mediterranean Basin. At the request of the Government of Egypt, the International Atomic Engery Agency through the Joint FAO/IAEA Division initiated activities in 1981 to determine the feasibility of eradicating the Mediterranean fruit fly (Medfly) from Egypt using the Sterile Insect Technique (SIT).

On the 16 October 1983 (World Food Day) the project MISR-MED was officially initiated. The Headquarters and a mass-rearing facility capable of producing one billion Medflies per week will be located in El-Amriya, about 30 km west of Alexandria.

MISR-MED will use the same technology as used in Mexico where this pest was eradicated. The approach will be to reduce the initial wild population with bait sprays, when required, and then follow with the release of sterile Medflies to achieve eradication.

The overall work plan of the project involves a detailed survey of Medfly population host sequence, mapping, fruit sampling, development of bait spray technique, etc. Based on the results of these activities, the strategy for eradication will be devised. During this period the Medfly mass-rearing facilities will be constructed. When this is accomplished and the factory in operation, the release of sterile flies will begin, probably in the southern part of the country, working northward.

The isolation of the agricultural areas of Egypt, provided by extensive deserts and the Mediterranean and Red Seas, are important features of the project. Thus once the Medfly has been eradicated, reinvasion from neighbouring countries will not be a serious problem.

The project will require 4 to 5 years to complete and cost from US$ 40 to 50 million. It will involve most of the agricultural areas of Egypt, which totals about 34,000 km^2. A staff of 500 to 600 people will be involved in the various activities of the project.

After the Medflies have been eradicated from Egypt, MISR-MED will sell sterile flies to other Mediterranean countries for similar projects. The income from these sales will enable MISR-MED to be

self sufficient by covering the cost of operating the Medfly mass-rearing facility at El-Amriya and providing an excess of US$ 2 million per year for the Government of Egypt.

4. MOSCAMED-PERU

The objective of this 1.5 million dollar project is to eradicate the Mediterranean fruit fly from Tacna and Moquegua Valleys in Southern Peru. The project supported by funds provided by the Government of Italy, became operational in May 1983.

Activities at the project headquarters in La Molina, Lima, include Medfly mass-rearing and sterilization, quality control and project management. The sterile insects will be taken by airplane to Tacna where they will be packaged and released. Activities in Tacna include surveys for Medflies, studies of fly infestation of fruits, population reduction using bait sprays, release of sterile flies, and evaluation of the efficacy of the bait sprays and sterile flies.

Mass-rearing and irradiation procedures have been developed and preliminary shipment of sterile Medfly pupae to Tacna initiated. It is anticipated that full-scale release of sterile flies will begin about January 1985.

An important features of this project is the great interest shown by the Government of Chile to purchase sterile Medflies from Peru for release in Nothern Chile, to ensure total eradication of the Medfly from their common border.

5. Co-ordinated Research Programme on Rice Insects

With the final Research Co-ordination Meeting held in Vienna, 26 - 20 March 1984, the programme on "the Use of Isotopes and Radiation in Integrated Pest Management with Emphasis on Rice Insects" was terminated.

The programme was run for 5 years (1980-1984) and had the long-term objective of harmonizing the maximum use of natural biological agents, maintenance of pest populations below the economic threshold, minimum use of insecticides and reduction to a minimum of damage to the ecosystem.

Participants in the programme were drawn mainly from South-East Asian countries and were involved in developing isotope techniques for

- studying the dispersal and population dynamics of pests and their host-plant relationships;
- understanding the nutritional requirements and feeding habits of major pests of rice;
- elucidating the epidemiology of plant pathogens transmitted by insects and other arthropods;
- exploring the relationships between major crop pests and their natural enemies, and
- determining the effectiveness of various pest control measures.

Major achievements of this programme include development of methodologies for:

(i) isotope labelling of rice insects, notably the brown planthopper Nilaparvata lugens.

(ii) ecological and behviour studies of rice stem borers and gall midges

(iii) dispersal studies of tungo virus vector Nephotetrix virescens

(iv) studies on pest-predator and predator-parasite relationships in various agricultural ecosystems.

In addition, investigations were undertaken, involving the use of autoradiographic techniques to determine the feeding patterns of both the brown planthopper (BPH) and the green leafhopper (GLH), with a view to establishing the causes of resistance of rice varieties to these pests. It has been shown that in both cases, resistance is caused by inhibition of feeding.

The following scientists participated in the programme.

Name and address	Title of Research Project
M.A. MIAH Sugarcane Research and Training Institute Ishurdi Pabna Bangladesh	Studies on the dispersal of tungro virus vector Nephotettix apicalis and N. virescens. Studies on the determination of predators & parasites of Pyrilla perpusilla pusana Dist, a sucking pest of sugarcane.
G.W. RAHALKAR Biology Division Bhabha Atomic Research Centre Trombay, Bombay 74 India	Studies on the control of the yellow stem borer Tryporyza incertules a serious pest of paddy.
M.H. T. THAYIB National Atomic Energy Agency CAIR, P.O. Box 2 Kebayoran Lama Jakarta Selatan Indonesia	The application of isotopes in pest manag. (with special ref. to Nilaparvata lugens
A.N. KUSWADI same address	Several aspects of the rice plant brown plant hopper (Nilaparvata lugens) relationships
KYU HOI CHUNG Korea Atomic Energy Research Institute P.O. Box 7 Seoul Korea	Studies on te resistance of leaf and plant hoppers in rice.
S. SASTRODIHARDJO Research Centre for Nuclear Techniques Tamansari 71 Bandung Indonesia	Radioisotope 32-P for the assessement of host preference of of important rice pests, especially the brown plant hopper Nilaparvata lugens Stahl

K.C.MATHUR Central Rice Research Institute Cuttack - 753006 India	Studies on the ecology of the rice gall midge Orseolia oryzae (W&M) by the use of isotopes.
P.A.C.R. PERERA Coconut Research Institute Bandirippuwa Estate Lunuvilla Sri Lanka	Biological control of Eupatorium odoratum using the defoliator insect Ammala insulata.
L. SZALAY-MARZO Dept. of Zoology Research Institute of Plant Protection Budapest, P.O. Box 102 Hungary 1525	Study of pest-predator interactions in agricultural ecosystems by using neutron activation.
L. ANWAR Atomic Energy Agric. Research Centre Tandojam Pakistan	Studies on the ecology & behaviour of rice stem borers by using radioisotopes with part. ref. to pest manag. systems.
M.A. CHOWDHURY same address as above (Anwar)	Studies of the rate of dispersal predator-parasite & prey relationships of rice stemborer (Tryporza incertulus Walter) & leaf hopper (Nephotettix virescens Distant) fed on P-32 labelled rice plants.
K. RUSS Arbeitsgemeinschaft für Pflanzenrschutz 1020 Wien Austria	The use of radioisotpes in IPM Studies on host-parasite relationship with Laspeyresia pomonella & Ascogaster - quadridentatus.
H.L. CROMROY University of Florida Dept. of Entomology & Nematology Gainesville F. 32611 USA	The use of radioisotopes in IPM & in part. the problems of "wild"insect labelling.
W.J. KLOFT Institut für Angewandte Kunst Zoologie Universität Bonn An der Immemburg 1 D-5300 Bonn West Germany	Significance of the phenomenon of regurgitation as hitherto neglected mechanism of quick transfer of disease agents through rice insects
R.A. WAHID Research Centre for Nuclear Techniques Tamansari 71 Bandung Indonesia	Radioisotope 32-p for assessment of host preference of important rice pests, especially the green leafhopper Nephotettix spp.

6. Lambwe Valley in the news

At recent outbreak of trypanosomiasis has focussed attention on the need to eradicate Glossina pallidipes, the sole vector of the disease in this 300 km^2 area of western Kenya. A staff member of the Insect and Pest Control Section participated in a mission to the Lambwe Valley, end of May 1984 to review the situation and assess the feasibility of integrating the Sterile Insect Technique into tsetse and trypanosomiasis control programmes in Lambwe Valley.

The mission's recommendations called for immediate action to eradicate G. pallidipes from Lambwe Valley using the SIT in conjunction with other environmentally acceptable methods. Accordingly, a project proposal calling for a 5-year programme was prepared for consideration by the Government of Kenya.

1

Mironiudes Scaglia-Pacheco de Almeida and Julio Marcos Melges Walder

CENA (Centro de Energia Nuclear na Agricultu ra) USP/CNEN - C. Postal 96
13.400-Piracicaba, SP. - BRAZIL

Use of gamma irradiation and inert gases in the sterilization of *Ceratitis capitata* (Wiedemann, 1824) (Diptera-Tephritidae) with the objective of using the sterile insect technique.

The sterilization of *Ceratitis capitata* (Wied., 1824) (Dip. Tephritidae) using gamma irradiation (γ) was studied under laboratory conditions at Center for Nuclear Energy in Agriculture (CENA), Piracicaba, São Paulo, Brasil. Living conditions for Med fly are optimum in this country and its biological cycle is completed in less than 30 days. There is a large number of varying host fruits for larvae development, which makes this pest very harmful, especially to citrus crops. The sterile insect technique (SIT) is a type of physical control of pests, which does not cause any harm to other insects. Pupae with different ages were initially submitted to 0, 30, 40, 50, 60, 70, 80 and 90 Gy doses. Sterility was determined from fertility of eggs resulting from crosses of irradiated male x normal female and normal male x irradiated female. Later, pupae with 72 ± 12 hrs before emergence were submitted to 70 and 90 Gy doses with carbon dioxide, nitrogen and oxygen fluxes. The sterilizing dose for the males was 90 Gy. Activity, of irradiated with and without gas flux and normal male, was evaluated with an activity-meter, and the dose least harmful to their behaviour was found to be 90 Gy with nitrogen flux.

2

P. T. McDONALD & D. O. McINNIS
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Oviposition of Radiation-Sterilized Mediterranean Fruit Flies (Ceratitis capitata)

The oviposition behavior of radiation-sterilized Mediterranean fruit flies was observed in 25 cubic centimeter cages. Groups of laboratory strain flies that ranged in age from 2 days preemergence (-2) through 2 days postemergence (+2) were irradiated at 15 kilorads under nitrogen. The flies were allowed to mate and were observed when 6 to 8 days after emergence. Flies were offered either grapes, plums, peaches, or apples.

In 2-hour observation periods, the (-2) irradiated flies were less than one-fourth as likely to land on fruit and less than one-tenth as likely to engage in oviposition behavior compared with their non-irradiated counterparts. In 24-hour exposures, the number of stings (puncture wounds) in the fruits left by the (-2) irradiated flies was less than 50 percent of the control value.

Flies irradiated at -2, -1 and 0 were equally affected with respect to oviposition behavior. The (+1) irradiated flies were less affected by the radiation treatment. The (+2) irradiated females were normal in oviposition behavior although they oviposited 50 percent less eggs than the non-irradiated controls in the 24-hour exposure.

STANISLAW IGNATOWICZ

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Reproduction of the mold mite, Tyrophagus putrescentiae (Schrank) (Acarida: Acaridae), treated with fast electrons; Irradiation of adults

Methods. Adult males and females (I-2 day old) were irradiated with 5-80 krad of fast electrons, and the inert deutonymphs of intermediate age were given only 20 and 40 krad doses. The source of radiation was the lineal accelerator of electrons LAE I3/8 installed at the Department of Radiation Chemistry, Nuclear Research Institute, Warsaw-Zeran, Poland. On the same day as the radiation treatment, the treated mites (T) were paired with unirradiated opposites (U). One of the following pairing patterns was used: T♀xT♂, T♀xU♂, U♀xT♂, and U♀xU♂ (control). The irradiated inert deutonymphs were allowed to mold to adults, and the females and males that emerged were paired. Every 7 days the number of eggs laid by females was determined. The mite fecundity was recorded by counting the eggs until the female death. Ca. 300 eggs were chosen radomly from rearing cages and placed in three glass cells. After week, eggs that did not hatch were counted, and the viability of these eggs was determined. In the other test, eggs were placed in rearing cages supplied with wheat germ. The emerged larvae were allowed to develop to the adult stage, and productivity of parental females was determined.

Results.

(A) Irradiation of both sexes.

It was found that some treated pairs laid no eggs. The percentage of infecund mite pairs increased with a dose increase. Only ca. 4% of the pairs treated with I0 krad produced no eggs whereas 38.5% pairs irradiated with 80 krad were infecund. Number of eggs laid by treated females and paired with treated males decreased with the increase of the dosage. A reduction in fecundity ranged from 90 to I00% when the mites were irradiated with a dose 20 krad or higher. Viability of eggs laid during the first week after irradiation of mites was very low. Only ca. 8% eggs hatched when pairs were treated with a 5- or I0-krad dose of fast electrons. During the next weeks, the mortality of eggs decreased gradually. All eggs laid by the mites irradiated with a 40 krad or above were sterile. Not only was the viability of eggs greatly reduced by fast electrons, but also the productivity. Only from 27.3%, I5.5%, and 0.9% eggs laid during the first two weeks by pairs treated with 5-, I0-, and 20-krad, respectively, originated the adults. Although the productivity was low during the first weeks after the treatment with 5-20 krad, later it was recovered to some extent. In a typical case with mites treated with I0 krad of fast electrons, I5.5% and 67.0% eggs laid during I-I4 day and I5-28 day periods after the treatment, respectively, developed to the adult stage. The lower the dosage, the more pronounced was the recovery of productivity. No reproduction occurred when both sexes had been treated with 30-krad or above. Also, no recovery of the productivity in these mites was recorded.

(B) Irradiation of either females or males.

When females were treated and mated to normal males, the reduction in their fecundity was slightly lower than that for the pairs in which both sexes were irradiated. At all doses, the untreated females mated to the treated males laid significantly more eggs than the irradiated females mated to either treated or untreated males. Generally, the percentage of females that produced no eggs was lower in the U♀xT♂ than in the other combinations. Mortality of eggs laid by females from U♀xT♂ and T♀xU♂ pairing patterns was high during the first week after a treatment. It ranged from 90 to I00%, when a dose of 20 krad or above was applied. At a 20-krad dose and below, the recovery of egg viability was observed during the next weeks. The recovery of egg viability was more pronounced in the U♀xT♂ pairs than in the others. The same relationships were found for a productivity. Again, the productivity of irradiated adults mated with untreated opposites was reduced by fast electrons. Later on, the productivity was recovered completely (I0-krad) or partially (20-krad). The recovery was more pronounced in the U♀xT♂ pairs than in the others. At a 40-krad dose there was no recovery of productivity in the T♀xU♂ pairs whereas the productivity reached 9.5% in the opposite combination. Thus, females were clearly more radiosensitive than males, as shown by the differences in reproductive abilities of irradiated adults of the mold mite mated with untreated opposites.

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Reproduction of the mold mite, Tyrophagus putrescentiae (Schrank) (Acarida: Acaridae), treated with fast electrons; Irradiation of inert deutonymphs

(C) Irradiation of inert deutonymphs

Unsexed, intermediate-aged deutonymphs were used, and the sex ratio was about I:I in the emerging untreated adults (control). Also, no difference in sensitivity between the sexes was indicated in the adults that emerged from treated deutonymphs.

Adults that emerged from treated deutonymphs were mated, and production of eggs, their viability and productivity were recorded. As compared to the control, the fecundity of the mold mite developed from deutonymphs irradiated with 20- and 40-krad was reduced by 70.0% and 88.4%, respectively. Thus, these mites produced significantly more eggs than the mites treated as adults.

The mites originated from 20-krad irradiated deutonymphs produced eggs of lower mortality than the mites treated as adults. Also, the recovery of fertility was more pronounced in the adults from irradiated deutonymphs. The productivity, however,was significantly lower in these mites than in the mites treated as adults. No pairs reproduced after treatment of deutonymphs with a dose of 40-krad or more.

The inert deutonymphs were found to be more resistant (higher fecundity, more pronounced recovery of fertility) than the adults. It means that the cells of reproductive tissue of deutonymphs are more radioresistant than the gametes of adults.

Mortality of Tyrophagus putrescentiae (Schrank) females exposed to a high ratio of gamma-irradiated males as an index of radiation impact on sexual vigor of males

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Standard tests for male sexual vigor involve either constant observations of mating activity, egg-mass hatch records, or examination of female spermathecae. Because these procedures are time consuming and laborious, Baumhover (I965) developed a convenient technique for measuring the sexual activity of male screw-worms, Cochliomyia hominivorax (Coquerel), based on mortality of females exposed to a high male ratio. He named his technique the sexual aggressiveness test (SAG test).

It was noted by Boczek (I974) that the longevity of Tyrophagus putrescentiae (Schrank) females that were molested by several males was much shorter than of females kept with one male. Also, females that were mated several times lived a shorter time than either unmated females or females mated once. Thus, the effect of accelerated female mortality owing to harassment by males may be utilized in the SAG tests in order to determine if the radiation doses reduce sexual activity in T. putrescentiae males.

The following is a description of trials with the SAG test made to evaluate the influence of 40, 60, and 80 krad of gamma radiation from cobalt-60 on sexual activity of adult males of T. putrescentiae.

Material and Methods.

Inert deutonymphs were taken from the stock culture and placed in rearing cages supplied with food. After the adults emerged they were sexed. Two day old males were irradiated, and after 24 hours 5 treated males were confined in a cage with a single female. It is known that the lower the fecundity of the acarid mite females the longer their lifespan. To eliminate this factor, the females treated with 40 krad of gamma radiation were used. They laid occasionally a few eggs when paired with males irradiated with 0-80 krad doses. Each test consisted of 30-40 cages. Mortality counts were taken at I- to 3-day intervals.

Results.

Distinct differences in females mortality occurred already by 35 days after the test was initiated. At that time, mortality of females confined with males given 40-80 krad was similar and it ranged from 0 to 6% compared with 20% for the controls. These reduced female mortalities were demonstrated also at the subsequent 7 day intervals. At 63 day, the mortality of the control females was 57% whereas those kept with males irradiated with 40, 60, and 80 krad was 43%, 33%, and 36%, respectively.

Apparently, a dose of gamma radiation higher than 40 krad lowered sexual vigor of males, and because of relief from harrassment by these males, the females confined with them lived much longer than the control females. The results obtained show also that the Baumhover's SAG test can be applied to compare sexual activity of mite males treated with different dosages of gamma radiation. It seems probable that more efficient tests for male sexual vigor could be obtained by using a male ratio higher than 5:I.

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Gross effects of gamma radiation on the mold mite, Tyrophagus putrescentiae (Schrank) (Acarida: Acaridae)

Eggs, larvae and nymphs of the mold mite were irradiated with gamma radiation from cobalt-60, and allowed to develop to the adult stage. The females and males obtained were paired with untreated mites as follows: (I) untreated females and untreated males (control), (2) treated females and treated males, (3) untreated females and treated males, (4) treated females and untreated males. The data on fecundity, fertility and longevity of the males and females are reported here.

When the eggs were treated with a dose of 30 krad gamma radiation some larvae emerged but soon they died. At the lower doses (7.5-I5 krad) of radiation the sterile adults were occasionally obtained. The sensitivity of eggs to gamma radiation seems to be dependent on their age. Eggs irradiated at 2 days were the most susceptible, having the longest mean hatch time and the greatest mortality.

No adults developed from larvae irradiated with 40 krad and higher doses, but some sterile adults did develop from treated protonymphs. These females and males lived much shorter than the controls.

The treated mobile deutonymphs of the mite transformed to the adult stage at all dosages used. However, deutonymphs treated with 80-I00 krad molted with a difficulty, and the adults emerged appeared to be weak and moving slowly. The survival of these mites was shorter at all dosages. The eggs were laid only by untreated females paired with males treated as mobile deutonymphs with a 40-krad dose; these eggs were sterile.

The inert deutonymphs appeared to be less sensitive to gamma radiation than the younger developmental stages. Only pairs of the females and males originated from the quiescent deutonymphs treated with 60 krad were infecund. Male deutonymphs were more resistant to the radiation than female deutonymphs: the percent of infecund $T_{\varphi}xU_{\sigma}^{\sigma}$ pairs was much higher as compared with the $U_{\varphi}xT_{\sigma}^{\sigma}$ pairs. The fecundity of females was much lower in the $T_{\varphi}xT_{\sigma}^{\sigma}$ combinations than in the others. When treated females and treated males were paired, the laid eggs were sterile, and only occasionally the F_1 adults were developed. In the $U_{\varphi}xT_{\sigma}^{\sigma}$ combination all eggs were dead whereas in the opposite pairings some eggs hatched, and a few F_1 adults were obtained.

The adults are more resistant to the gamma radiation than the developmental stages. The egg-laying, although much reduced, was noted at all tested combinations. The percent of fecund pairs decreased with the increase of the dose of radiation. The females appeared to be more susceptible to radiation than the males. The sterile eggs were obtained in all pairing patterns involving the females and/or males irradiated with a dose 60-I00 krad. When a dose of 40 krad was applied, the treated females paired with untreated males laid 6% viable eggs. Females mated to males irradiated with a 40 krad dose were sterile completely. Thus, the sterilizing dose has been established as 40-krad for males and 60-krad for females.

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Fecundity of untreated females of the mold mite, Tyrophagus putrescentiae (Schrank) (Acarida: Acaridae), successively mated with the same male treated with fast electrons

In order to point out differences in radiosensitivity of stages during spermatogenesis the "brood pattern technique" was used in these preliminary tests. The irradiated males were allowed to mate with young virgin females periodically. As the spermatogenesis proceeded sperms of varying quality, originating from different irradiated stages of spermatogenesis, were used for insemination.

Material and Methods

Inert deutonymphs of the mold mite were taken from the laboratory culture. They were isolated separately in glass cells. After 2 days, the emerged adults were sexed, and the males were irradiated with 20 or 60 krad of fast electrons. Irradiated males were allowed to mate for 7 days with virgin females. After each week the males were transferred to new rearing cages with a virgin female each. There were 5-6 such transfers. At the end of each test, the number of infecund females and the number of eggs laid were recorded.

Results

In successive weeks, the percentage of infecund females mated to males irradiated with a 20-krad dose increased gradually. Only I5.8% males were completely sterile after the treatment whereas 62.5% females mated to irradiated males laid no eggs during the 5th week after the treatment. However, fecundity of females mated to 20-krad treated males increased in successive weeks after irradiation. The highest fecundity of pairs was noted during the 3d week after the treatment.

Females mated during the Ist week to males irradiated with 60-krad dose of fast electrons laid a few eggs. During the 2nd, 3d, and 4th week after the treatment these females were not laying eggs. At the 5th and 6th week, one female of I7 laid 79 and 3I eggs, respectively.

The results of these preliminary tests show evidently that the stages of spermatogenesis were differently damaged at the time of irradiation, and the quality of sperm originating from these stages and utilized for fertilization showed some differences. Partial return of fertility of males treated with a 20-krad dose during the post-treatment weeks could be the results of such changes. The recovery of fertility of males irradiated with a 60-krad dose was not so pronounced as in the tests with 20-krad treated males. It is of interest that males treated with high doses of ionizing radiations were found to sire some eggs of low viability only during the first week, being completely infertile later on.

Dosage (krad)	Matings of male	No. of pairs	Infecund pairs (%)	Number of eggs per female	
				fecund ♀♀ only	all ♀♀
20	Ist	I9	I5.8	32.I±3.6	27.0±4.I
	2nd	I7	23.5	56.6±6.6	43.3±6.7
	3d	I6	37.5	II5.8±II.I	72.4±I0.2
	4th	I6	3I.3	63.6±5.8	43.8±6.4
	5th	I6	62.5	-[a]	-[a]
60	Ist	23	I7.4	I5.2±4.2	I2.5±4.I
	2nd	22	I00.0	-	0
	3d	20	I00.0	-	0
	4th	I9	I00.0	-	0
	5th	I7	94.I	79	4.6±4.4
	6th	I7	94.I	3I	I.8±2.7

[a]) not recorded.

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Reproduction of the bean weevil (Acanthoscelides obtectus Say, Col., Bruchidae) in the presence of males and females treated with gamma radiation

Cornwell et al. (I966) suggested that protection of grain from reinfestation might be provided by the presence of large number of sterile pests that remained in the grain after it was irradiated for pest disinfestation. The experiments were initiated in order to test the above proposal for the case of the bean seeds as a stored product and the bean weevils (Acanthoscelides obtectus Say) as a pest.

All tests were conducted at temp. 20°C and 65-70% R.H. Both untreated and treated with gamma radiation beetles were put into a jar (375 ml) with the bean seeds variety "Biala Wyborowa" at the ratio I0:I00. After six weeks, the progeny was counted, and the increase of population (ΔN) was determined using the following formula: $\Delta N = N^t/N^o$, where N^t = number of progeny, N^o = number of untreated weevils.

Experiment I.

Females and males of the bean weevil of different age were treated with 0 (control), I0, I5, and 20 krad of gamma radiation. Treated and untreated beetles were added to the bean seeds.

Results collected after six weeks show that the population increase was low in both control and treatments. Probably, the weevils involved in the test were too old, and their productivity was low. However, it is seen that the lowest increase of population was in a I0-krad combination whereas the other combinations were similar to the control.

Experiment II.

The bean weevils were I-I4 days old at the treatment. They were irradiated with 0 (control), I5 and 20 krad of gamma radiation. Next day, I00 treated and I0 untreated beetles were put into jar with I50 g of the bean seeds.

Data presented in Table show that the population increase in the 20-krad combination was similar to the control. However, the population increase of the bean weevils kept together with I0-krad treated males and females was ca. I6 times lower than the control.

The high dosages of gamma radiation affect the fertility and/or longevity of treated beetles. Because of this, the females fertilized by untreated males were laying viable eggs despite of presence of males treated with 20 krad. In view of the results presented here, the proposal that sterilizing a resident population of the bean weevil would achieve some measure of protection against reifestation by the same species of pest appears to be practical.

Table: Increase of population of the bean weevils in the presence of males and females treated with indicated dosage of gamma radiation.

Experiment	Dose (krad)	Population increase (ΔN)
Exp.I: beetles at different age	0	0.95
	I0	0.2
	I5	0.8
	20	I.35
Exp. II: I-I4 day old beeltes	0	I6.6
	I5	0.9
	20	I7.7

Literature

Cornwell P. E., J. O. Bull, and P. B. Pendlebury. I966. Control of weevil populations (Sitophilus granarius (L.))wwith sterilizing doses of gamma radiation. pp. 7I-95. In P. B. Cornwell (ed.), Entomology of Radiation Disinfestation of Grain. Pergamon Press, New York, 236 pp.

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Status of Gamma Irradiation as a Quarantine Treatment for Codling Moth Control in Horticultural Crops

The use of gamma irradiation has been proposed as a technique to reduce or eliminate infestations of codling moth larvae in host commodities, including walnuts, apples, pears and other deciduous fruits. Codling moth, Cydia pomonella (L.), overwinters as mature, cocooned, diapausing larvae. Occasionally such larvae may spin cocoons and attempt to overwinter on or inside the host, although usually they do so under the tree bark or in other external sheltered locations.

Exposure of codling moth larvae to gamma radiation at doses of up to 160 GY resulted in delayed development and emergence of adults as well as reduction in percent of larvae developing to the adult stage. As the dose increased, there was an increase in percent of malformed adults, as well as in the ratio of males emerging as adults, with a concurrent increase in percent of females remaining as pupae.

When mature larvae were exposed to 93 Gy, diapausing larvae were more sensitive to the effects of irradiation than non-diapausing larvae. When surviving moths that had developed from irradiated larvae were paired, they did not produce eggs. When such males were paired with normal females, the eggs produced did not hatch.

An experiment is underway to determine if there are any differences in response of codling moth larvae to irradiation delivered at a high rate (270 Gy/min) vs. a low rate (2.3 Gy/min). Results of this experiment will not be available for at least 2 months.

An experiment recently was initiated to compare the effects of irradiation on younger larvae (1st-3rd instar), older larvae (3rd-5th instar) and mature cocooned larvae. Results of this experiment will not be available for several months.

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LA PRISE EN CHARGE DE LA LUTTE CONTRE LA TRYPANOSOMIASE HUMAINE PAR LES COMMUNAUTES RURALES

En secteur pré-forestier ou forestier, la lutte contre les glossines vectrices de la maladie du sommeil par les méthodes classiques est soit peu efficace, soit très onéreuse. Au moment où l'importance de la trypanosomiase humaine est sous-estimée et où des difficultés d'ordre économique freinent la mise en place de campagnes de lutte, il est nécessaire de fournir aux pays en voie de développement les moyens d'agir eux-mêmes, rapidement, efficacement et à moindre frais.

C'est dans ce but qu'à a été lancée, fin 1983, une campagne pilote de lutte dans le foyer de maladie du sommeil de Vavoua (Côte d'Ivoire). Cette campagne allie une méthodologie nouvelle et un protocole original. Dans une région vouée à la culture du caféier et du cacaoyer, seuls les planteurs sont capables de s'occuper de leurs plantations, gîtes à *Glossina palpalis* où la transmission est active. C'est pourquoi, après une campagne de sensibilisation et de mobilisation de la population, plus de 15500 écrans bleus imprégnés de deltaméthrine (150 mg M.A. par écran) ont été distribués aux planteurs et installés par eux-mêmes dans leur propriété. Les principales voies de communications et les lisières de villages ont été pulvérisées par nos soins avec de la poudre mouillable de deltaméthrine (12 g M.A./ha) et les galeries forestières ont été traitées par des pièges biconiques.

Près de 8600 hectares ont été ainsi protégés et les opérations n'ont duré que 6 jours.

Au bout d'un mois, dans les zones traitées uniquement par écrans, les populations de *G. palpalis* ont été réduites de 98,99 %. Ce répit a permis de mener dans de bonnes conditions le dépistage exhaustif de tous les malades.

Le coût de la protection d'un hectare s'élève à 1702 francs CFA (soit 4 dollars US).

Les populations seront mobilisées de nouveau en février et mai 1984 pour une redistribution de doses d'insecticides dilué, doses nécessaires à la réimprégnation des écrans.

La lutte contre la maladie du sommeil en secteur forestier est donc possible même avec un budget réduit, à condition de mobiliser la population qui comprend les risques qu'elle encoure et participe pleinement aux opérations de traitement. Il sera possible dans un proche avenir de diminuer encore le coût des campagnes de ce style grâce aux améliorations du piégeage lui-même.

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Synthesis of ^{14}C-labelled propoxur and Metabolic studies on Anopheles stephensi from south coast of IRAN

^{14}C- propoxur (Baygon) was synthesized through the reaction of o-iso-propoxyphenol with methyl isocynate - ^{14}C.
The product was isolated chromotographically on Florisill and crystalized from carbontetrachloride. The purity and structure was confirmed using infrared spectra, melting point, co-chromatography on Florisill column and silica-gel G thin-layer chromatograms. The purity was found to be at least 99%.

The rate of absorption and other characteristics of ^{14}C-propoxur resistance in Anopheles stephensi from south coast of Iran was investigated. The mortality of strain adult was 100% after a one hour exposure when 10-ppm ^{14}C-propoxur was used. Moreover the mortality was not changed when lower concentration (5ppm) was used. On the other hand the absorbance of ^{14}C-propoxur on several strains of A. stephensi have been determined. The identity and T L C characteristics of products formed after 1 and 2 hour exposure, respectively, to ^{14}C- propoxur have also been investigated.

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The Probability of Detecting the Caribbean Fruit Fly, Anastrepha suspensa (Loew), (Diptera: Tephritidae) Populations with McPhail Traps

A trapping study was conducted to determine the probability of detecting moderate to low populations of the Caribbean fruit fly, Anastrepha suspensa (Loew), in citrus groves in central Florida in June and July 1982. Flies were released at rates of 9, 90, and 900 per 0.4 ha and were retrapped in a gridwork of 168 McPhail traps (18.2 traps/0.4 lha). The percent recovery of flies released in the two tests was 14.4 and 12.9%, respectively. The sex ratio of flies recovered averaged 0.35 males per female from a release ratio of 1:1. From the percentage of traps that contained flies of each population, we determined the probability of detecting different population levels of a uniform distribution and age-class with various knumbers of traps per unit area.

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The use of rapid quality control in determining mating propensity and flight ability of irradiated oriental fruit fly, Dacus dorsalis Hendel

This study was conducted to reveal the quality of mass-produced insects and some radiation effects of sterilizing dose on mating propensity and flight ability of flies. Oriental fruit flies were irradiated with 80 Gray of gamma radiation from a cobalt-60 source as pupae 2 days before eclosion and irradiated pupae were marked with signal green dye. The mating propensity test was conducted in a 30 x 30 x 40 cm. plastic cage. During the 10th-14th days, twenty five pairs of the different group (unirradiated males + unirradiated females, irradiated males + irradiated females, irradiated males + unirradiated females and irradiated females + unirradiated males) were released into plastic cages. The result indicated that there were no significantly different (P = 0.05) in mating propensity between both sexes of unirradiated flies and irradiated flies, unirradiated males and irradiated males, and unirradiated females and irradiated females. In addition, the mating propensity increased with age of both unirradiated and irradiated flies. The flight ability test was conducted by placing 100 pupae in a 13 x 13 cm. cylindrical plastic container for emergence. Then, 1-day-old flies were released from plastic container. The result showed that there were no significantly different (P = 0.05) in flight ability between unirradiated and irradiated flies.

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A black-pupae mutant of the Mediterrannean Fruit Fly (*Ceratitis capitata*)

A morphological mutant (BLACK PUPAE) in *Ceratitis capitata* was isolated from our laboratory culture. A few dark pupa were separated and were placed in an ovipositional cage, provided with sugar, water and protein hydrolysate, and allowed to mate. The result of F_1 progeny was almost all pupae of the normal phenotype. The dark pupae were separated again and put to mate. This methodology was repeated every generation. After nine successive generations we got 100% of black pupae. Studies are underway to determine the biology of the black pupae flies and also different types of genetic crosses.