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. 35

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CONTENTS

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The summaries of unpublished work often represent preliminary reports of investigations in progress and, therefore, such findings are subject to possible revision at a later date. The abstracts in this Information Circular should not be published or referred to in articles for publication without first obtaining permission from the authors.

I. INTRODUCTION

Publication Policy

The policy of the Joint FAO/IAEA Divsion in publishing the Information Circular is to emphasize the results of recent or on-going 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 Therefore, emphasis is placed on unpublished data.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 reporduced by a photographic process, and therefore reflects faithfully, the author's 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While emphasis is on unpublished data, we include, whenever possible, summaries of recently published papers.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 doubled-spaced. (A form for submission of contributions is included in each distributed copy of the Information Circular; more can be provided on request).

The Newsletter is intended as a medium for informing our readers of "what is going on" and for providing 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	Technical Officer
L.E. LaChance	(on secondment from USDA Metabolism and Radiation Research Laboratory, Fargo, ND)

BICOT

W. Takken	Project Director and Supervisor of Field Operations
M. Oladunmade	Project Co-Director
H-J. Hamann	Supervisor of Laboratory and Rearing Operations (resigned 31 March 1985)
S. Tenabe	Co-Supervisor of Laboratory and Rearing Operations (Resigned 1 April 1985)
U. Feldmann	Technical Advisor, Laboratory Operations
(Vacant)	Co-Supervisor of Field Operations

Seibersdorf Laboratory

R.E. Gingrich	Head, Entomology Laboratory
A. Van der Vloedt	Tsetse Fly Investigations: Mass-Rearing
J. Kabayo	Tsetse Investigations: Artificial Diets
E. Bush-Petersen	Genetic Sexing of Medflies
D. Haile	Computer (on sabbatical leave from USDA until August 1985)
N. Bruzzone (FAO Associate Expert)	Medfly

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 research involving the use of atomic energy in entomological research.

The primary objective of the entomology programme at the Agency's Laboratory is to support and service the Joint FAO/IAEA Divsion'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) for pest control or eradication. Because of the dependence of this technique on efficient, production of the target insect, much of the research at the laboratory involves development and improvement of mass-rearing techniques. Other major areas of activity include (1) development of methods of radiation sterilization for producing quality insects (in terms of sexual competitiveness, and longevity; (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 irradiation techniques;
3. Develop methodology for "fail-safe" radiation sterilization;
4. Develop 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 number 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 (Wied.);
2. Tsetse fly, Glossina palpalis palpalis (Rob.-Desv.);
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). In addition, the laboratory serves 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 some cases, the fellows are supported to undertake scientific visits for up to 4 weeks.

Further information on this and other matters may be obtained by writing to:

The Head
Insect & Pest Control Section
Joint FAO/IAEA Division
P.O. Box 100
A-1400
Vienna, Austria

C. Programmes of the Insect and Pest Control Section

1. Medfly

Among the most devastating pests of fruits in the world is the Mediterranean fruit 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 (100's of millions) of flies.
(e) Improve methods of releasing sterile flies in the field from aircraft.
(f) Provide emergency supplies of sterile medlies 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 Techniques 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 blood additives for improving tsetse fly colony 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 posible 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.

D. 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		Iraq
Guatemala	Ghana		Pakistan
	Tanzania		Algeria
			Libya
			Tunisia

E. Experts and Consultants: Jan - Dec 1984

Name	Nationality	Location of Assignment	Dates and Task Performed
L. Gringorten	Canada	Indonesia	1 Jan-8 June 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.
R. Griffin	U.S.A.	Egypt	23-29 May To inspect work relating to fencing MISR-MED project site.
B.A. Butt	U.S.A.	Pakistan	3-24 February To review proposals submitted to the Agency by the P.A.E. Commission for initiating a SIT project on agriculture pests.

F. Trainees in Entomology 1984 and 1985

(i) Seibersdorf

Name	Country	Date
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
Onah, Jacob Abah	Nigeria	17-05 - 16-08-84
Ochieng, R.S.	Kenya	07-01 - 06-06-85
Obiero, Simon Oluoch	Kenya	26-01-84
H. Banda	Kenya	07-01 - 06-04-85
Y. Claes	Belgium	09-04 - 07-06-85
Makumyaviri M'Pondi	Zaire	09-04 - 09-07-85

(ii) Other locations (1984)

Mexico: Moscamed Project, Tapachula, Chiapas

Name	Country	Date
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

III. NEWSLETTER

A. Special Features and Comments

1. QUESTIONNAIRE ON "ABSTRACTS" OF UNPUBLISHED DATA

A handful of our readers (99 out of over 500) responded to he questionnaire sent with the 34th issue of the Information Circular. Of this number, 93% (92 respondents) would like to see the ABSTRACTS section continued.

Five of the seven negative respondents are "no longer involved in this (radiation and radioisotopes) kind of research...", which is why they would like the abstracts discontinued. Two others are "against presenting unpublished data..." because such material "merely provides an idea of on-going research at differents laboratories..."

One positive respondent echoed the reaction of many others when he wrote: "For those of us no longer directly involved in this area of research, the abstracts constitute a very useful source of information". Another had this to say: "... If we are to wait until the material is published, there would be at least a 6-month (possibly 1 year) delay in getting the information out to those interested in on-going research..."

We wish to express our appreciation to all those who took time to fill out and return the questionnaire. We take the opportunity to remind our readers of the purpose of the abstracts, namely, to inform interested readers and researchers (in the area of radiation and radioisotopes in entomology) of what is going on elesewhere. The "abstracts" should be viewed primarily as a means for announcing recent results and on-going research. They are published with the permission and full co-operation of the authors who are of course aware that the results presented are, in most cases, awaiting journal publication.

We shall endeavour to incorporate into future issues, some of the suggestions we received for improving the quality of the abstracts. We suggest that specific questions on "methods and materials" be addressed to the authors - which is one reason why we request authors to provide their full address. Indeed, if such communication could be maintained between authors and interested readers, the purpose of the Information Circular would be more than served.

Unfortunately, the workload at our office will not permit us to edit and re-type abstracts submitted for inclusion in the Circular. We therefore appeal to our contributors to follow the laid down procedure and present concise, well written, neatly typed abstracts for photographic reproduction.

2. TCDC in Action

The idea of Technical Co-operation among Developing Countries (TCDC) has been translated into action programmes in several countries since the UN Conference on the subject was concluded in Buenos Aires, Agentina in 1978. the MISR-MED project in Egypt is a recent example of TCDC in action.

The project MISR-MED aims to eradicate the Mediterranean Fruit Fly (Medfly) from the entire Nile valley and Delta, as well as other fruit growing areas of Egypt. Through a TCDC agreement, technology developed from a successful Medfly eradication programme in Mexico (PROGRAMA MOSCAMED) is being transferred to scientists and technicians in Egypt, who are preparing for a similar programme using the Sterile Insect Technique.

The terms of the TCDC arrangement include training of Egyptian personnel at the Medfly facility in Tapachula, Mexico and participation of Mexican experts in the Egyptian project.

Since May 1983, 14 Egyptians (including scientists, technicians and administrators) have spent up to 2 months each, at the project in Tapachula. The training programme provides for about 30 Egyptians to have first-hand exposure to activities in Mexico by 1987. In 1982, an ecological and logistic study of Medfly eradication in Egypt was undertaken, with the assitance of two Mexican scientists, in preparation for MISR-MED. In January 1984, Ing. Jorge Hendrichs, formerly in charge of Programa Moscamed, was appointed MISR-MED Co-Director by the IAEA. Other Mexicans have since, served as consultants for various aspects of MISR-MED.

3. CORRECTION

The figure 400 km^2 which appeared on page 11 line 4 of the 34th issue of the Newsletter and Information Circular (December 1984) should be corrected to read 3,000 km^2. This is the size of the area covered by the tsetse SIT project in Burkina Faso.

B. Meeting Reports

1. Integrated Control of Trypanosomiasis

"TRYPANOSOMIASIS CONTROL" was the subject of a 5-day meeting in Harare, Zimbabwe, where our 200 scientists assembled for a week-long discourse on the subject 4 - 8 March 1985. Following closely on a FAO/OAU/WHO tsetse-trypanosomiasis training seminar in which this Section participated, the (International Scientific Council of Trypanosomiasis Research and Control - ISCTRC) meeting emphasized, among other things, the need to view and operate trypanosomiasis control, as an integrated programme involving all relevant disciplines and tested methodologies aimed at eliminating, or at least, minimizing the effect of the parasite and the vector.

Accordingly, the meeting deliberations reviewed the latest results and developments and future direction of research on the biology of trypanosomes, epidemiology and diagnosis of the disease, chemotherapy and chemoprophylaxis of animal and human trypanosomiasis, control of the Glossina species involved in disease transmission and the development, assessment and use of trypanotolerant breeds of livestock in areas of Africa where the use of such breeds would permit livestock production inspite of the tsetse menace.

One obvious point was stressed several times: tsetse control must be undertaken closely with area and land development. Perhaps this is not so obvious after all.

The meeting recognized the potential role of Sterile Insect Technique (SIT) in an integrated tsetse control programme and made recommendations to that effect. The need was expressed for keeping the cost of SIT operations low enough to make the approach attractive to countries wishing to apply the technique.

2. Research Co-ordination Meeting held

Fourteen research contractors and agreement holders were joined by 16 observers at ICIPE's Duduville International Guest Centre, in Nairobi from 6 to 10 May 1985 to discuss progress achieved since the initiation in February 1984 of a co-ordinated research programme on the development of methodologies for the application of the Sterile Insect Technique (SIT) for tsetse eradication or control.

In addition to formal presentations by programme participants, up-to-date information was provided by representatives of the two on-going tsetse SIT projects in Bobo Dioulasso and Vom. Abstracts of some of the papers presented are reproduced in this issue of the Information Circular.

The meeting emphasized the need to adopt an integrated approach to tsetse control including the use of the Sterile Insect Technique, and prepared guidelines for research on tsetse nutrition and mass-rearing, ecological studies and release strategies, as well as trypanosome transmission by sterile male tsetse.

C. Field Programmes

1. BICOT: What the Reviewers Said

A panel of 6 experts in the field of tsetse, trypanosomiasis and related development, constituted by the Federal Government of Nigeria and the IAEA reviewed the project BICOT in the light of a proposal to extend operations beyond 1985.

Impressed by the calibre of work being carried out at BICOT, and convinced of the feasibility of the Sterile Insect Technique (SIT) as a method for eradicating tsetse, the panel urges that the benefits arising from the current project be consolidated by extending operations to cover an additional 12.000 km^2. A five-year programme is envisaged in order to achieve the desired goal, namely to eradicate Glossina palpalis and Glossina tachinoides from the target area, most of which is either already under cultivation or constitutes potential grazing land for livestock.

The panel found no difficulty in supporting the proposition that the project headquarters be equipped to serve as a regional centre for training Nigerian and other nationals in methodologies for developing and applying the Sterile Insect Technique for tsetse eradication.

2. MOSCAMED - PERU: Sterile Medflies for Tacna

Sustained trapping in January and February 1985 (average of 1610 traps per month), aerial bait spraying in February (malathion plus Nu-lure protein mixture) followed by ground spraying in early April resulted in lowering the Medfly population to an average of 0.2 per trap-day.

With the harvesting of Chili pepper soon to be completed, and almost no other host plant available in the area, the natural fly population is expected to decrease further.

In January and February, a total of 21 shipments of sterile flies, representing approximately 32 million per week, were received from the production plant in La Molina for release in Tacna. Currently, about 40% of the infested area of the valley is being treated weekly with sterile flies in ratios of between 4 and 44 to one wild fly. The frequency of release will be increased to 3 per week and the entire valley covered in the operation. The prospects appear good.

3. UNDP/IAEA Project in Indonesia

In September 1982, Indonesia's National Atomic Energy Agency (BATAN) began a joint five-year project with IAEA, under the auspices of the United Nations Development (UNDP), to develop and promote the use of nuclear technology in that country's agricultural programmes. It is being carried out at BATAN's Center for the Application of Isotopes and Radiation, in Jakarta. The project, titled "Applications of Isotopes and Radiation to Increasing Agricultural Production" (code No. INS/78/074), emphasizes research and training, and consists presently of three main components: plant breeding, soil science/plant nutrition and insect control.

The research activities of the insect-control component began in April 1983, and are aimed at improving and developing new isotope techniques which would benefit studies of insect pests of food crops. Present investigations include the application of radioisotopes in feeding-behaviour tests of the brown planthopper (BPH) on different varieties and new mutant lines of rice, and the use of isotopes in ecological studies of BPH, rice gall midge, bean fly and sugar-cane stem borer. A project at BATAN's Research Center for Nuclear Techniques, in Bandung, to study the feeding behaviour of green leaf-hopper on rice, using isotope technology, has also been provided consultative and technical support from this programme.

The research is expected to lead to more effective control strategies by improving the forecasting technology of pest outbreaks and by aiding in the development of new varieties of crops.

4. CRTA/IEMVT: Bobo Dioulasso

LES ACTIVITES DU CRTA DANS LA LUTTE CONTRE LES GLOSSINES *

par D. CUISANCE et J. ITARD

* (prepared for,but not presented at the research co-ordination meeting in Nairobi, Kenya, 6 - 10 May 1985.)

Le centre de Recherche sur les Trypanosomoses Animales (C.R.T.A.) de Bobo-Dioulasso a été créé en 1973 - 1974. Il est financé à part égales par la France et la R.F.A. De 1975 à 1979, sa mission a été de tester, sur le terrain, la lutte génétique par lâchers de mâles irradiés, dirigée contre Glossina palpalis gambiensis, l'un des vecteurs majeurs des trypanosomoses humaines et animales en Afrique Occidentale. De 1980 à 1984, cette technique, associée en alternance avec des écrans imprégnés de Deltaméthrine, a été mise en application dans une zone pastorale de 3000 km^2 située au Sud de Bobo-Dioulasso, pour lutter contre trois expèces de glossines: G. p. gambiensis et G. tachinoides, présentes le long des cours d'eau, et G. m. submorsitans, qui occupe des savanes à Isoberlinia doka dans le tiers sud-est. Après une prospection entomologique effectuée pendant la saison sèche 1983, qui a utilisé plus de 11.000 pièges biconiques de capture le long de 888 km de rivières et 238 km de savane, des barrières d'isolement constituées de pièges et d'écrans imprégnés de deltaméthrine on été mises en place au sud et à l'est sur 7 km, le long des principaux cours d'eau. Depuis 3 ans, elle empêche toute pénétration de glossines immigrantes. Plus de 7.000 écrans insecticides on été mis en place de janvier à mai 1983. Ils ont réduit de 90% la densité des populations naturelles. Après leur retrait environ 300.000 mâles irradiés de G. p. gambiensis et 82.000 mâles de G. tachinoides ont été lâchés entre mai et décembre 1983.

Près de 4.000 écrans insecticides ont été remis en place de décembre 1983 à février 1984, dans des petites formations densément boisées, tandis que les lâchers se poursuivaient ailleurs. Après retrait des écrans en mars 1984, les lâchers se sont poursuivis sur toute la zone, y compris contre G. m. submorsitans. A l'heure actuelle et depuis plus de 10 mois, aucune glossine n'a été capturée dans les pièges de contrôle.

D. WHAT'S ON IN SEIBERSDORF

Supporting research for Medfly eradication project in Egypt has concentrated on mass-rearing. Starter diets in which large numbers of newly hatched larvae develop for 2 days in a small amount of medium (500 larvae/g) before transfer to the finishing bulk medium (25 larvae/g) showed good promise. By allowing the very young larvae to develop on small amounts of media, considerable space can be saved in a mass-rearing project.

In other studies the optimum amounts of various diet ingredients including one obtainable in Egypt, and optimum temperatures for rearing larvae were determined. Genetic means based on temperature sensitive lethals, are being developed to separate the sexe of Medflies. When successful, this technique will allow only males to be produced for sterilization and release in a SIT programme. Double mutant marker stocks have been synthesized, from which homozygous and balanced lethal inversion strains are now being isolated.

A colony of Glossina palpalis, containing 60,000 female, is maintained as a back-up and supplemental colony for the SIT programme (BICOT) underway in Nigeria. Diets, including partially synthetic ones, are being developed to improve rearing. The detrimental effects of microbial contamination in the blood diets have been revealed and methods to prevent or overcome the effects have been developed.

ABSTRACTS OF RESEARCH PAPERS

MASS REARING BEAN FLIES FOR RESEARCH**

A. Rahayu and J.L. Gringorten*

Center for the Application of
Isotopes and Radiation, BATAN,
Keb. Lama, P.O. Box 2,
Jakarta Selatan, Indonesia

The inability to rear bean flies of the species Ophiomyia (=Agromyza) phaseoli under caged conditions has necessitated establishing an open field colony to provide the material needed for our research programme on this insect. This was achieved by planting open plots of soybean (var. Orba) and mungbean (var. 129), allowing natural infestation to take place, and then planting and rotating new plots of host plants within the colony area every 17 days. The planting schedule was timed to coincide with the life cycle of the fly and to synchronize seedling emergence above ground with the emergence of imagos from adjacent plots of infested plants.

During the dry season, 100% infestation was achieved, and the colony reached an estimated 41,000 adult insects on 6932 host plants. During the monsoon season, heavy rains caused a considerable reduction in the insect population -- to about 20-33% of the dry-season infestation rate. A second species of bean fly, Melanagromyza sojae, is also present, but in fewer numbers than O. phaseoli.

Under local ambient conditions, the egg stage lasts 3-5 days and the feeding larval stages last 6-10 days. During the latter period, maximum assimilation of isotope by insects from labelled host plants would be expected.

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** Research financially assisted by UNDP/IAEA Project INS/78/074

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R. L. Harris, R. D. Peterson III,
M. E. Vazquez-Guevara, O. H. Graham,
E. F. Gersabeck, and R. L. Mangan
Veterinary Toxicology and Entomology
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Gelled Media for the Production of Screwworm Larvae

Media for rearing screwworm [Cochliomyia hominivorax (Coquerel)] larvae was solidified by the use of various gelling agents. SGP-147 (starch polymer), Karaya Gum, Norbak® (acrylamide acrylic polymer), Gelcarin HWG®, and casein resulted in good larval production with weights averaging 62-68 mg; Carbopol® (resin), Guar Gum, and Seaspen IN® produced larvae that averaged less than 60 mg/larvae. Larvae reared on heat coagulated media with a portion of noncoagulated media produced larvae that averaged 63 mg. Addition of water or liquid media to the diet as it dried improved larval size and number produced.

Additional tests were conducted to determine if other gelling agents consisting of sodium polyacrylate or polyacrylamide polyacrylate copolymer could be used to solidify screwworm larval rearing media. One formulation of the polyacrylamide polyacrylate copolymer (Water Lock® G-400) was as good or better than the standard meat diet. The gelled media produced the same number of larvae as well as larger larvae. A small scale test on the production floor indicated that the media can be used in large scale production.

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Teresa Badowska-Czubik[1/], Jadwiga Ziemnicka[2/], Jerzy J. Lipa[2/], Zbigniew W. Suski[1/]
[1/]Research Institute of Pomology and Floriculture, Pomologiczna 18, 96-100 Skierniewice, Poland
[2/]Institute of Plant Protection, Miczurina 20, 60-318 Poznań, Poland

Effect of Fungicides Benlate and Bavistin and antibiotic Fumagillin on incidence of Nosema carpocapsae Paillot /Protozoa, Microsporida/ in rearing of codling moth /Laspeyresia pomonella L./

S u m m a r y

Benlate /benomyl 50%/, Bavistin /MBC 25%/ and Fumagillin DCH /fumagillin/ were incroporated into the diet of codling moth /L. pomonella/. No deterimental effects of all chemicals on the development of the codling moth and its survival was observed. The weight of adults, their fecundity and longevity and hatching of larvae were similar on diets containing and not containing chemicals.

Fumagillin reduced the incidence of Nosema carpocapsae in rearing to 11,3% at 200 ppm and 0% at 800 ppm as compared to 52,2% on normal diet.

Benlate and Bavistin even at the highest doses did not reduce the level of microsporidian parasitization.

Teresa Badowska-Czubik[1/], Jadwiga Ziemnicka[2/], Jerzy L. Lipa

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2/ Institute of Plant Protection, Miczurina 20, 60-318 Poznań, Poland

Further studies on effectiveness of antibiotic Fumagillin in controlling Nosema carpocapsae Paillot /Protozoa, Microsporida/ in two rearings of the codling moth /Laspeyresia pomonella L./

S u m m a r y

Studies were conducted on two populations of codling moth /Laspeyresia pomonella L./ kept in laboratory rearing on artificial diet. A population designated "Skierniewice" originated from Poland and was reared for more than 30 generations at the Institute of Pomology and Floriculture at Skierniewice. Second popuiation designated "Montfavet" was received from Station de Zoologie INRA in Montfavet close to Avignon in France.

Several biological parameters of insects from both populations were compared in rearing for six generations. During three first generations /F_1-F_2/ productivity of rearing of "Skierniewice" population was higher than of "Montfavet" population. However, in generations F_4-F_6 this productivity was similar in both rearings.

Parasitization level of larvae and pupae by Nosema carpocapsae was similar in both populations: in "Skierniewice" 73,3% and in "Montfavet" 71,7%. However, the parasitization of adults was lower in "Montfavet" populations /70,1-77,9%/ than in "Skierniewice" /83,2-90,2%/.

Adding of Fumagillin to the diet greatly reduced the incidence of Nosema carpocapsae in larvae and especieally in pupae /8,6% at 800 ppm and 1,7% at 1000 ppm/.

However, the parasite has not been eliminated from the rearing and about 26% of adults was infected. This is due to the fact that Fumagillin affects the vegetative stages of the parasite but does not kill the spores.

In spite of these limitations adding of Fumagillin to the diet of L. pomonella is economically justified as it increases the productivity of rearing.

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PHASE FEEDING OF THE OLIVE FRUIT FLY IMPROVES PUPAL WEIGHT OF HIGH LARVAL DENSITY DIETS.

Larval density is of importance because it affects the cost and the quality of insects. At high densities of the olive fruit fly larval mortality was high, pupal weight low and adult quality greatly reduced. The present study reports the effect of adding at a specific phase of growth a liquid food supplement to high larval density diets upon number of pupae, pupal weight and adult emergence of the olive fruit fly. It has been shown that a good phase of larval growth for adding the liquid supplement would be on the 4th day following hatching of the eggs, during which larval weight and survival was not yet affected by the larval density, and/or at the 7th day, during which larval survival did not differ between the two densities studied (20 and 40 eggs per g diet) but larval weight was statistically different.

Overall consideration of the data of this study showed that larval survival to pupation was not improved by increasing the addition of liquid supplement in high larval density diets on the 7th day or at both the 4th and 7th day. Increasing the ingredient concentration of the supplement per ml water, to offer more nutrients, did not improve larval survival. On the contrary it was clear that supplementation improved pupal weight and adult emergence. It was also evident that nutritional factors play a decissive role up to a point of larval density. Beyond this point many other factors are also involved. In addition the possibility exists that larvae under crowding conditions produce toxic substances which may depress their own growth and survival.

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Effect of Gamma Radiation on Weight Loss in Adults of *Tribolium castaneum* (Herbst)

ABSTRACT

Studies on the effect of gamma radiation in terms of weight loss in *Tribolium castaneum* (Herbst) in fed *vis a vis* starved insects were undertaken in the Laboratory at 30° ± 1°C and 55 per cent relative humidity. Adult insects (8-12 day old) were irradiated with 10 Krad of gamma radiation (nearer to LD-50) from Cobalt-60 at a constant dose rate of 6.67 Krad/min. Two sets of experiments with irradiated and non irradiated groups of beetles were conducted. In each set, one group of insects was provided with sterilized wheat flour as food while the other group was maintained without food. The treatments which were replicated ten times had 10 insects of the same weight and age group per replication. Data on the weight of insects and mortality were recorded after every 48 hours upto 15 days.

Duration (Days after treatment)	% weight loss			% mortality of insects			
	C-S	I-S	I-F	C-S	I-S	I-F	C-F
1	-	-	-	-	-	-	-
3	5.63	6.83	6.13	-	-	-	-
5	10.91	12.57	11.28	5	3	-	-
7	16.28	18.69	21.63	7	5	2	2
9	22.19	24.00	21.63	10	8	5	4
11	25.86	25.95	22.56	19	27	16	4
13	27.04	27.54	23.12	29	42	23	7
15	27.26	27.86	23.30	50	64	43	7

C-S, control-starved; I-S, irradiated-starved; I-F, Irradiated-fed, C-F, control-fed; C-F, insects did not register any loss in weight.

Results revealed that both irradiation and starvation contributed towards weight loss in *T.castaneum* to almost the same degree when these treatments were considered independently. Moreover, when the starvation and irradiation treatments were combined, the pattern of weight loss did not change and was similar to either of the two treatments when given separately. Combination of these treatments, however, affected the longevity of the insects as seen from enhanced adult mortality in irradiated-starved group. Irradiation also appears to have inhibited food intake in irradiated-fed group as weight loss pattern was found to be similar to control-starved group of insects. Further, when starved insects (irradiated as well as non irradiated) are considered, starvation appears to be the main factor responsible for loss in weight in *T.castaneum* as the combination of irradiation with starvation treatment, did not result in any additional reduction in weight of the adults. In control (non irradiated-fed insects), body weight of the beetles remained nearly constant throughout the experiment.

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INFLUENCE OF GAMMA RADIATION ON *Zabrotes subfasciatus* (BOH., 1833) (COL. BRUCHIDAE) ON THE BEAN *PHASEOLUS VULGARIS L.*

Beans constitute one of the basic elements of the Brazilian people, independent of their acquisitive power or social class. The food offering and productivity could be increased of problems related to culture could minimized, among these the incidence of stored grain pests such as the rot *Zabrates subfasciatus*, one of the most important in the state of Pernambuco. An experiment was set up along an entirely casual outline using the confinement test with 8 treatments in 4 repetitions, with a with a witness as a standard of comparison. Each parcel was made up of 40-gran samples of grain packaged in plastic boxes. Over each samples of *Zabrates subfasciatus* were confined, for an egg-lay-ing period of 10 days. Afderwards, each samples was submitted to gamma radiation ^{60}Co, with a 50 Gy dose, and maintained in laboratory conditions, The treatments used were: cutivars IPA 1, IPA 7419, Mulato, Lagoinha, Peixe N' água, Maria do Carmo and Costa Rica, all belonging to the Cereal Project of the IPA Company. Results were obtained such as effects of subsrerility , influencing the decrease of weight-loss and in germination; effects on the occurrence of abnormalities in the size and morfology of the plants; no influence was found on the germinative power or the vigor of the seeds.

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STERILIZATION AND LETHAL EFFECTS OF GAMMA RADIATION ^{60}Co ON/EGGS AND ADULTS OF *Zabrotes subfasciatus* (BOHEMANN, 1833) (COLEOPTERA BRUCHIDAE).

The effects were observed of different doses of gamma radiation coming from a ^{60}Co source on the lethality of eggs and adults, as well as the sterilization of *Zabrotes subfasciatus*, the dry rot of the *Phaseolus vulgaris* L. Bean. Eggs 0 to 24 hours old submitted to doses of 0 (test), 1,2,4,6,and 8 krad showed 100% embryo mortality fron 2 krad and up, while 96 hour eggs irradiated with the same doses only showed total mortality with 8 krad. To determine the sterilizing dose for adult insects, the following doses were used: 0 (test), 4,5,8,10,12,14,16,18 and 20 krad with 10 repetitions of ten insect couples, in two testes. An the first test only the males were irradiated and in the second only the females. The ensuing egg laying of the mating of these irradiated insects with normal ones showed 100% of the eggs to be infertile, when males and females had received the 20 krad dose. As for the lethal dose for adults, it was noted that there was 100% mortality in insects, (DL 100) on the second day after irradiation with 360 Krad.

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INSECT RADIOSENSITIVITY: DOSE CURVES AND DOSE-FRACTIONATION STUDIES OF DOMINANT LETHAL MUTATIONS IN THE MATURE SPERM OF 4 INSECT SPECIES.

Mutation Research 127:49-59 (1984)

Males of 4 species of insects: Musca domestica L. (housefly) (Diptera), Oncopeltus fasciatus (Dallas) (milkweed bug) (Hemiptera), Anagasta kuhniella (Zeller) (mealmoth) (Lepidoptera) and Heliothis virescens (Fab.) (tobacco budworm) (Lepidoptera) were irradiated as adults. Dose-response curves for the induction of dominant lethal mutations in the mature sperm were constructed. The curves were analyzed mathematically and compared with theoretical computer simulated curves requiring 1, 2, 4, 8 and 16 'hits' for the induction of a dominant lethal mutation. The 4 species belonging to 3 different orders of insects showed a wide range in radiation sensitivity and vastly different dose-response curves. The house fly was the most sensitive and displayed a '1-hit' curve. The milkweed bug was intermediate in sensitivity and the curve exhibited '4-hit' kinetics. The mealmoth and tobacco budworm were most radioresistant and the response curves resembled 8-16 hit simulated curves. When the data were analyzed by several mathematical models we found that a logistic response curve gave reasonably good fit with vastly different parameters for the 4 species. Dose-fractionation experiments showed no reduction in the frequency of lethal mutations induced in any species when an acute dose was fractionated into 2 equal exposures separated by an 8-h period. Various reasons for large differences in radiosensitivity are discussed, e.g., (1) differences in repair mechanisms, (2) variation in oxygen concentration, (3) holokinetic versus monokinetic chromosomes and (4) intrinsic differences in mitotic cell cycles which affect the behavior of radiation-induced chromosome breaks.

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Effect of gamma radiation and fumigants on Tribolium castaneum (Herbst)

ABSTRACT

Combined effects of gamma radiation and four commonly used fumigants (EDCT, ethylene dibromide, carbon disulphide and methyl bromide) were studied by subjecting the larvae and adults of Tribolium castaneum (Herbst) to: (a) irradiation followed by fumigation and (b) fumigation followed by irradiation. It was observed that the larvae and adults exposed to 5 and 10 Krad doses of gamma radiation (nearer to LD_{50}), respectively, if fumigated within 6 hr of exposure to radiation, required higher doses of fumigants at LC_{50} level but when the fumigation was performed 7 days after irradiation, comparatively lower doses of fumigants were needed to achieve similar results. On the other hand, fumigation of the larvae and adults at their respective LC_{50} doses, followed by irradiation with different doses of gamma radiation did not affect their susceptibility. These studies revealed that if irradiation preceded fumigation it affected the susceptibility of the insects. However, no change in the susceptibility pattern was seen when the survivors of the fumigation treatments were exposed to gamma radiation.

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EFFECT OF DIETARY CHOLESTEROL ON THE DEVELOPMENT OF CERATITIS CAPITATA (Wied.) AND ITS SUSCEPTIBILITY TO GAMMA RADIATION. - ISOTOPE & RAD.RES., 16,1,49-53 (1984).

The effect of cholesterol when added to food of adult Ceratitis capitata (Wied.) at two concentrations 0.1 and 0.2 % was studied in normal and irradiated groups. Results showed that adult emergence increased in cholesterol-fed groups while pupal weight, sex ratio and female fecundity were not affected.

When applying three radiation doses (4,8,10 Kr.) to adults receiving no cholesterol, 0.1 % and 0.2 % cholesterol in their diet it was possible to conclude that cholesterol when added to food of C. capitata seemed to induce tolerance to radiation effects especially at lower dose (4 Kr.).

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EFFECT OF GAMMA RADIATION ON THE IMMATURE STAGES OF THE MEDITERRANEAN FRUIT FLY, CERATITIS CAPITATA (Wied.) IN EGYPT. ISOTOPE & RAD. RES., 15, 2, 121-129 (1983).

The radiosensitivity of Ceratitis capitata eggs to gamma rays decreased by increasing its age. Egg hatching was prevented by doses ranged between 2 Krad for the newly laid eggs (2.20-4.35 hr-old) and 36 Krad for the oldest ones, (45-49 hr-old). Pupation was arrested by doses from 1 Krad in the newly laid eggs to 24 Krad in the oldest ones. Finally the dose of 1.5 Krad prevented adult emergence from the irradiated oldest eggs (45-49 hr-old).

Each larval stages is progressively radiosensitive. The development of the next instar which followed the irradiated one was prevented by a dose of 36 Krad and above, according to the treated age.

Doses which prevented the emergence of adults were 2000 r and above, depending on the irradiated larval age.

Pupation was arrested by doses between 24 Krad when larvae were irradiated during their first day and 100 Krad when they were irradiated during their 5th day of life.

A dose of 140 Krad of gamma-rays killed all larvae outright after irradiation, but it seems that this dose was harmful to fruits. Thus for quarantine purposes a dosage of 84 or 90 Krad is suggested for the treatment of fruits infested with Medfly larvae.

R: 30

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Mating Efficiencies of Variable Sex-Ratio, Sterilized Populations of the Mediterrean Fruit Fly (Diptera: Tephritidae) in the Laboratory

ABSTRACT

Variable sex-ratio sterilized populations of the Mediterranean fruit fly, Ceratitis capitata, were evaluated in the laboratory to assess their abilities to suppress a standard population of non-irradiated flies (20 ♂♂ and 20 ♀♀). New fly competitiveness formulae were devised which include terms for fecundity and fertility of non-irradiated females mixed with bisexual and unisexual (♂♂-only and ♀♀-only) sterile flies. A separate competitiveness formula for sterile females indicated that these had 2-4% of the efficiency of sterile males. Average fly competitiveness ranged from 0.006 ± .001 (♀♀-only at a 9 sterile:1 normal ratio) to 0.58 ± .10 (♂♂-only at an 18:1 ratio).

Some evidence for sterile fly interference of oviposition and competition for food or space is presented. Possible implications of these factors for various potential field release strategies and random mating conditions are discussed.

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R E S U M E :

ACTIONS DES IRRADIATIONS AUX RAYONNEMENTS GAMMA CHEZ *Sesamia nonagriades* Lef., Lepidoptère Noctuidae; EFFETS DES DOSES SUBSTERILISANTES SUR LA DESCENDANCE.

Ce travail est destiné à préciser l'influence du rayonnement gamma et plus particulièrement l'action de différentes doses substérilisantes, en vue d'une éventuelle application à la lutte antocide.

Dans cette étude, les doses d'irradiation ont été de 5000, 7000, 10.000, 15.000, 20.000, 25.000, 30.000 et 40.000 rad pour les chrysalides mâmes et de 1500, 3000, 5000, 7000, 10.000, 25.000 et 40.000 rad pour les femelles.
Les imagos issus de chrysalides irradiés ne sont pas l'objet de malformations externes et que leur vitalité demeure normale.
La fécondité et le taux d'éclosion des oeufs pendus par des femelles elles-mêmes stériles ou accouplées avec des mâles stériles ont été précisés.
La dose de 7000 rad (pour les parents mâles) paraît être la dose requise permettant d'obtenir des individus substériles.
Les mâles F_1 descendant de parents substériles présentent une stérilité supérieure à celle de leurs parents et on ne relève ni réduction de compétitivité sexuelle ni diminution dans la fréquence des accouplements.
L'action de différentes doses substérilisantes observée sur 3 générations sucessives a entraîné une modification du sex ratio ainsi qu'une forte stérilité résiduelle.

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Codling Moth: Effects of Gamma Irradiation in a Nitrogen Atmosphere on Longevity, Mating, Fecundity, and Fertility

The codling moth, Cydia pomonella (L.), responded differently when irradiated in an atmosphere of nitrogen than when irradiated in air. Fecundity of females irradiated in air declined as the dose increased. In an atmosphere of nitrogen, fecundity was similar at all dose levels. Although the fecundity was substantial when the females were irradiated in either atmosphere, all eggs were sterile. When males were similarly irradiated in either atmosphere, fertility declined as the dose increased. Sterility was effected at a lower dose in an atmosphere of air than in one of nitrogen. Longevity was sex and dose dependent; when females were irradiated the longevity tended to increase as the dose increased. When males were irradiated and crossed with normal females, the males lived longer than nonirradiated males and females. Longevity of irradiated males was similar when treated in an atmosphere of either air or nitrogen. Irradiated males produced fewer spermatophores than normal males regardless of the atmosphere, but the effect was more pronounced when irradiated in a nitrogen atmosphere. Irradiated males produced more small spermatophores than nonirradiated males. In an atmosphere of air, the reduction was dose dependent, but it was similar at all doses in a nitrogen atmosphere. These tests provided evidence that codling moths irradiated in an atmosphere of nitrogen were not as dose responsive, were more difficult to sterilize, and were no more competitive than those irradiated in an atmosphere of air.

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ISOZYME VARIATION AMONG BACTERIAL ISOLATES ORIGINATING FROM THE SCREWWORM FLY (DIPTERA: CALLIPHORIDAE)

Environ. Entomol. 12:1773-1781 (1983)

Isozyme surveys were used to compare genetic variation within and among strains of the bacterium, Proteus rettgeri (Hadley, Elkins, and Caldwell). One strain was a standard American Type Culture strain (ATCC 9250), whereas eight other strains were recovered from larva or pupa of the screwworm fly, Cochliomyia hominivorax (Coquerel), of varied geographic or animal host origins. Observations of 16 different enzyme systems of each bacterial isolate revealed extensive inter- and intrastrain variation in the numbers or positions of enzyme bands recorded among samples from different phases of culture growth or from different growth media. Similar differences were likewise noted among strains when they were sampled at the same growth phase. Hierarchial clustering and multidimensional analyses of the data produced groupings of the bacterial strains which suggested that their enzyme patterns were influenced by factors related to their geographic distribution or their animal host origins.

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HOUSE FLY (DIPTERA: MUSCIDAE) GENETICS: FIELD STUDIES OF MALES FROM A MALE-PRODUCING STRAIN

Ann. Entomol. Soc. Am. 76:333-338 (1983)

Male house flies (Musca domestica L.), which produced only male progeny when mated with wild-type females were released on a dairy farm in Minnesota during the fly breeding seasons of 1978 and 1979. The progress and mating interactions of the released flies (designated as the PM strain) were monitored by recording sampling frequencies of 1) allozyme variants at an enzymatic marker locus, 2) all-male progenies produced by females fertilized in the field, and 3) all male progenies resulting from matings between field-sampled males and laboratory-reared wild-type females. Also, sex-ratios were recorded from all individual cultures produced by field-collected females. Mortality of the PM males was measured in cages placed at the test location. In addition, PM males marked with flourescent pigments were released on two occasions during 1978 to determine recapture frequencies. Mark-release-recapture experiments using field-collected flies were used to estimate population sizes. The combined data indicated that the PM males failed to compete for mates during 1978. However, there was significantly higher number of all-male cultures produced by field-collected females during 1979. Mating competitiveness values of 0.21 and 0.12 were calculated for the PM males during 1978 using two methods of calculation. Corresponding values for 1979 were 0.45 and 0.42, respectively.

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HYBRID STERILITY IN HELIOTHIS SUBFLEXA X H. VIRESCENS (LEPIDOPTERA: NOCUTIDAE) CROSSES: EXPRESSION AFTER INJECTION WITH ANTIVIRAL AGENTS, HEAT SHOCKS, AND REARING AT EXTREME TEMPERATURES.

Ann. Entomol. Soc. Am. 76:104-109 (1983)

When female Heliothis subflexa (Guenée) and H. virescens (F.) males are crossed, the female hybrids are fertile and the male hybrids are sterile. Continuous backcrossing of the hybrid females to H. virescens males produces fertile female (BC) and sterile male (BC) progeny indefinitely. We attempted to alter the sterility of the BC males by: (1) injecting the fourth- to fifth-stage larvae with the antiviral agents rifampin, 5-iodo-2'-deoxyuridine (IUdR) and alcide; rearing the egg, larval, and pupal stages at temperatures of 16.7, 20, 29, and 32°C; or by administering 30-min or 24-h heat shocks (36 to 43°C) to either the egg, larval, or pupal stages. The results indicate that the sterility of the BC males is extremely stable and is unaffected by the treatments described. These findings indicate that a cytoplasmic microorganism is probably not involved in the sterility found in these interspecific crosses.

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THE GENETICS OF NATURAL POPULATIONS IN MODERN INSECT CONTROL METHODS

The Diverse Roles of Genetics in Entomology, Stock, M.W. and M.H. Ross, eds. Proc. Symp., Natl. Meeting of Entomol. Soc. Am., Toronto, Ontario, Canada, 1982. Forest, Wildlife and Range Exp. Sta., Univ. of Idaho, Moscow. 58 pp

Examples of morphological, chemical, chromosomal, physiological and behavioral polymorphisms found within and between insect species are presented. The effect that such polymorphisms may have on the efficiency of several insect control and detection methods is discussed.

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HELIOTHIS BACKCROSS STERILITY: A NEW APPROACH TO GENETIC CONTROL. (Abstract)

Proceedings NC Branch Meeting of Entomological Society of America (1984)

Imterspecific crosses between Heliothis subflexa and H. virescens yield fertile female and sterile male hybrid progeny. When the fertile females are backcrossed to H. virescens males they continue to produce fertile female and sterile male backcross progeny indefinitely. After a number of consecutive backcrosses of the hybrid females to H. virescens males, a line of backcross insects is derived that are genetically H. virescens but possess H. subflexa cytoplasm. The sterility of the backcross (BC) males is due to their inability to inseminate females with eupyrene sperm, although they mate and transfer apyrene sperm to females. Studies of the backcross males have shown that they produce normal numbers of eupyrene sperm bundles in the testis but that significantly fewer eupyrene sperm bundles reach the duplex region of the male reproductive tract. Scanning and transmission electron microscopy studies reveal a number of abnormalities in the eupyrene sperm of the BC males. Experiments with antibiotics, anti-viral agents, heat shocks and altered developmental times indicate that BC sterility is extremely stable and is not altered by such treatments. Models projecting the effects of releasing BC insects to suppress native H. virescens populations, the field behavior of BC insects and field experiments conducted to assess the potential of BC sterility in population suppression programs all indicate that BC sterility would be an efficient and economical genetic control mechanism.

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HYBRID STERILITY: EUPYRENE SPERM PRODUCTION AND ABNORMALITIES IN THE BACKCROSS GENERATIONS OF INTERSPECIFIC HYBRIDS BETWEEN HELIOTHIS SUBFLEXA AND H. VIRESCENS (LEPIDOPTERA: NOCTUIDAE).

Ann. Entomol. Soc. Am. 77:93-101 (1984)

Sterile males from the backcross generations (BC) 40-49 and 72-79 of Heliothis subflexa (Guenee) females x Heliothis virescens (F.) males (fertile females crossed to H. virescens males each generation) were studied to determine the basis of sterility. BC males produce normal numbers of eupyrene sperm bundles in the testis, but in 50 to 90% of the BC males no eupyrene bundles descend from the testis to the duplex region of the reproductive tract. BC males that do have eupyrene sperm bundles in the duplex have significantly fewer than fertile H. virescens males. Electron microscope studies of the BC duplex bundles showed frequent rupture of the bundle exposing the individual sperm tails with swollen areas or blebs located along the tail region. These swellings were characterized by enlargement and rupture of the extracellular sheath, enlarged mitochondrial derivatives, sloughing off of the membrane associated with the mitochondrial derivatives, and the appearance of tubular aggregates. Absence of eupyrene sperm bundles in the duplex or abnormalities in the sperm tails most likely account for the sterility of BC males.

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FUNCTIONS OF ACCESSORY GLANDS IN FEMALE INSECTS (Abstract)

XVII Intern. Congress of Entomology, Hamburg, West Germany, August 1984.

Secretions of the accessory reproductive glands of female insects are typically used to provide protection for the eggs at the oviposition site. With many insects, the production of the accessory secretion represents a considerable metabolic investment which otherwise could be directed towards the production of additional progeny. Thus, it is not surprising to observe that in higher orders the accessory glands are often either reduced, absent or modified to include other functions ancillary to the reproductive process. The milk gland of ovoviviparous dipterans and the poison glands of stinging hymenopterans are conspicuous examples of accessory reproductive gland modification. In Musca domestica and in certain other muscid and calliphorid flies thus far examined, the accessory gland secretion facilitates the fertilization of eggs. Fertilization in Musca is a complex process whereby secretions of the accessory gland and the egg micropyle interact with sperm to aid its entry into the egg. An overview of the function of female accessory glands with special emphasis on aspects of the sperm egg confrontation and its correlation with other animal systems will be presented.

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CHARACTERISTICS OF AMINOPEPTIDASE ACTIVITY OF FEMALE HOUSEFLY REPRODUCTIVE ACCESSORY GLANDS

Int. J. of Inver. Reproduc. 6: 93-98 (1983)

Proteolytic activity was detected in crude extracts of female reproductive accessory glands and the following characteristics of the principal aminopeptidase activities were determined: substrate specificity, pH optima, molecular weights, and effects of inorganic salts. The greatest aminopeptidase activities were found with the β-naphthylamides of: alanine at pH 7.5 and 9.5, leucine at pH 8.0, and methionine at pH 6.5. The methionine-specific activity in the crude extract was stimulated 3 times by 100 mM $MgCl_2$, $CaCl_2$, NaCl, or KCl. Inhibition was noted, and ID_{50} was determined for each of the other principal substrates with the following salts: $CdCl_2$, $CaCl_2$, $ZnCl_2$, $MgCl_2$, and $MnCl_2$. Molecular weights, estimated on Sephadex G-200 and on Sepharose-6B, were found to be around 210000 for each of these principal aminopeptidase activities in the crude extract.

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EFFECTS OF 20-HYDROXYECDYSONE ON SPERM RELEASE FROM THE TESTES OF THE MEDITERRANEAN FLOUR MOTH, Anagasta kuehniella (ZELLER)

J. Insect Physiol. 28: 1013-1019 (1982)

Abdominal injection of 1 μg aqueous 20-hydroxyecdysone into Anagasta kuehniella, anytime prior to the initiation of sperm release from the testes, prevents the impending release of eupyrene sperm bundles. Apyrene sperm release is not prevented and there is complete recovery of eupyrene release by the following cycle 24 hr later. If 20-hydroxyecdysone is administered on consecutive days, no eupyrene bundles are released and although apyrene sperm release continues, it diminishes with time. The effect of 20-hydroxyecdysone in preventing eupyrene release is dose dependent. Administration of decreasing 20-hydroxyecdysone dosages results in increasing numbers of eupyrene bundles released. When a single injection of 20-hydroxyecdysone is administered to isolated abdomens, reocvery time of eupyrene sperm release is slower than in whole moths and total recovery is not seen even by 5 days after administration. Apyrene sperm release is also affected to a greater extent than in whole moths, and in some cases, no apyrene release was detected at all. Treatment with 20-hydroxyecdysone prevents eupyrene bundles from passing through the testicular basilar membrane into the vasa efferentia, thus causing a build up of bundles near the basilar membrane but no disintegration of these eupyrene sperm bundles.

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Amino acid synthesis in adult Dacus oleae (Gmelin) (Diptera Tephritidae) determined with glucose-U-^{14}C.

ABSTRACT

The ability of adult Dacus oleae for amino acid synthesis from glucose-U-^{14}C was investigated. The relatively high specific activity radiometric measurements indicated that both sexes were able to synthesize the amino acids: alanine, aspartic acid, cystine, glutamic acid, glycine, hydroxyproline, proline and tyrosine; therefore, these amino acids are considered as nutritionally dispensable for D. oleae. On the other hand, the amino acids: arginine, histidine, leucine, isoleucine, lysine, phenylalanine, serine, threonine, and valine, showed a very low specific activity and therefore are considered as nutritionally indispensable. It was not possible to conclude about tryptophane, since the acid hydrolysis destroyed this amino acid.

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MONITORING THE POPULATIONS OF CERATITIS CAPITATA (WIED) (DIPTERA: TEPHRITIDAE) BY HOST FRUIT SAMPLING.

The populations of the Mediterranean Fruit Fly C. Capitata (Wied) in the state of Chiapas from july 1983 to january 1984, had an infestation of 1 % in larvae per kilograms of fruit. This is attributed to the efficiency of the - Sterile Insect Technique (S.I.T.).

Considering this very low levels of infestation and the great diversity of real and potential host that grow wild in this subtropical region, the fruit - sampling which is one the methods used to detect this pest becomes very relative and is necessary to improve this method by making it more sensitive.

This study was conducted to determine whether the probabilities to detect larvae of C. Capitata with this population levels are increased by collecting - susceptible fruits from the ground or directly from the tree.

The fruit sampling was done covering an area of approximately 300,000 Ha. besides the border with Guatemala country, where the pest is actually limited, collecting mainly fruits from primary hosts. The fruits from the tree were cut with a hookbag which makes the collecting method more simple, than cutting the fruit by hand.

The fruit that was not complete ripened, was stored in holding cages waiting for the incubation of possible eggs or development of small larvae. Both types of fruits, from the tree and from the ground, were analyzed by dissecting them in search of larvae, after storing.

10,017 samples were collected directly from the tree equivalent to 14,989 kilograms of fruit, detecting 77 larvae of Ceratitis capitata and 103,921 of the genus Anastrepha.

The amount of samples collected from the ground was 7,720 equivalent to - 11,396.6 kilograms of fruit, detecting 25 C. Capitata larvae and 51,830 larvae of the genus Anastrepha.

This results showed that their was a significant difference (P=95 %) between the number of medfly larvae per kilograms of fruit collected directly from the tree and the ones collected from the ground, obtaining a 3.1:1 ratio in favour of larvae detected on fruit from the tree. In the case of Anastrepha spp., high infestation, their was not a significant difference.

TAGGING AND STERILIZATION OF SUGAR-CANE STEM BORERS WITH ^{32}P**

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Adults of the sugar-cane stem borer, Chilo auricilius were tagged with ^{32}P by rearing newly emerged larvae in artificial diet containing an initial activity concentration of 0.5 µCi/g medium. Insects were counted live in specially-made "dry vials" with a liquid scintillation counter, and the bioelimination rate of the isotope from males and females determined.

Males emerged with an average of 9409±1387 (95% C.L.) cpm and lost approximately 28% of the label during their 2-day life span. Females emerged with an average of 27178±3114 cpm. Females mated to unlabelled males lost approximately 73% of the label (33% through oviposition) during a 3-day life span. The ^{32}P was readily detectable in the eggs, all of which failed to hatch. The label was not detected in the eggs of unlabelled females mated to labelled males and no reduction in egg viability was observed.

The results indicate that with the present detection system, the initial activity concentration of ^{32}P in the diet could be reduced to 0.05 µCi/g and still provide adequate tagging, although this amount may be below the sterilizing dose for females.

In the absence of significant beta self-absorption by samples ("photon quenching"), the counting efficiency of the detection system for ^{32}P is approximately 78%, but the counting efficiency with the moths has not yet been determined.

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Effects of microwave exposure on pupae and adults of Ceratitis capitata Wied. (Diptera:Trypetidae).

Effects of microwave radiation on insects, have been studied on pupae and adults of Ceratitis capitata Wied.(Dip.:Trypetidae).

Three groups of experiments were performed :

a)Pupae and adults of several ages were treated at 9 GHz in a rectangular waveguide applicator (WR90) with different power densities (up to 23 W/cm2) and exposure times (from 11 s. to 4 h.).

For pupae, four styrofoam blocks supporting 48 of them in the center line of the waveguide, were used.For adults, 8 males and 8 females were irradiated each time in a plastic base.

b)4 and 13 days-old adults were irradiated near the aperture of a pyramidal horn with a density power of about 0,27 W/cm2 at 9 GHz and exposure times ranging from 10 to 40 mi.A glass jar was used to support insects during the treatment.

c)1 day-old pupae were treated at 1 GHz in a coaxial cable with a density power of 0,39 W/cm2 and exposure times from 2 to 4 h.Styrofoam blocks supporting 24 of them were used.

Influence of radiation in several biological parameters was examined: fecundity ; fertility ; longevity ; sex ratio ; reproductive system ; and teratological effects.

Not any significant difference (at the 5% level) between both treated and control insects was recorded.Neither, not any morphological abnormality was observed.

Results of experiments carried out, suggested that lethal effects of exposure to microwaves, in our conditions, were primarily thermal effects.

Influence of age was examined in adults of 2 and 9 days-old and in pupae of 1-4 and 8 days-old of this fly.A frecuency of 9 GHz and a density power of 8,6 W/cm2 was employed.

The susceptibility to microwave exposure was higher in adult flies.The sequence of tolerance was :

Pupae				Adults		
4	> 8 >	1	>	2	>	9

The TL50 extreme values in minutes were : 0,155 to 9 days-old adults and 1,089 mi to 4 days-old pupae.

Pupae sensibility to microwave was related to weight loss during the treatment.The high weight loss was recorded on 1 day-old pupae, which were the most susceptible to radiation in the pupal stage.

Reciprocity law (same effect if power x time = cte) was studied on adults of 2 and 9 days-old irradiated at 9 GHz and a power density of 4,3 and 8,6 W/cm2.In C.capitata we found that high power densities and short exposure times were the most effectives.

RESEARCH CO-ORDINATION MEETING

Joint FAO/IAEA Division of Isotope and Radiation Applications
of Atomic Energy for Food and Agricultural Development

Co-ordinated Research Programme on
Development of Methodologies for the Application
of the SIT for Tsetse Eradication or Control

Nairobi, Kenya

6 - 10 May 1985

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AUTHOR(S): Peter Einyu

ORGANIZATION: Uganda Trypanosomiasis and Malaria Research Organization
P.O. Box 96, Tororo (Uganda).

TITLE OF WORKING PAPER: MASS REARING OF GLOSSINA PALLIDIPES (AUSTEN) FED ON LIVE OXEN ALONE

SHORT SUMMARY OF PAPER

Glossina pallidipes has been implicated as a vector for both animal and human trypanosomiasis in Uganda. This species of Glossina was originally confined to the northern shores of lake Victoria where it played a major vectorial role during the first epidemic of sleeping sickness in that area. This habitat has now been penetrated by peasant farmers and as a result, G.pallidipes has receeded into the islands on lake victoria. This restriction can now be used to eradicate this species of Glossina using the SIT. However the problems of rearing large numbers of G.pallidipes are well documented elsewhere.

At UTRO a colony of G. pallidipes fed on oxen stood at 3775 mated females at the beginning of January 1984. It increased to 5239 during the month of February and then decreased steadily through the months of March to August. It increased again slightly and by the end of the year there were 2528 mated females. Production of puparia (>0.5) and pupal weights(>39.5mg) remained satisfactory. Mean daily mortality percent per month remained high (>20%)

This paper outlines the rearing methods and the performance of the colony of Glossina pallidipes maintained at UTRO.

AUTHOR(S): C.S. Tarimo, N.E. Kiwia, F.W. Makishe, M.V.P.Msoffe

ORGANIZATION: Tsetse & Trypanosomiasis Research Institute

TITLE OF WORKING PAPER: The Sterile Insect Technique against Glossina austeni Newstead in Tanzania.

SHORT SUMMARY OF PAPER

An *in vitro* fed colony of *Glossina austeni* Newstead was established in August, 1983 at the Tsetse and Trypanosomiasis Research Institute, Tanga, using materials from an *in vivo* fed colony.

Females were mated on day two or day three of their adult life with at least 7-day old males in a 1:1 (male:female) ratio. The sexes were separated on day four or day five of the females adult life. The flies were maintained in a room with a constant climate of 24.5 ± 1°c and 75±5% RH. Dim lighting was employed in the rearing room during daytime except during handling and feeding periods, and, a 12-hour scotophase was employed beginning at 19:00 hours. The flies were fed everyday on a mixture of frozen/fresh bovine blood and reconstituted lyophilized porcine blood.

The performance of the colony and the problems experienced are discussed in the report.

Field survey, using different sampling techniques, to determine the distribution of *Glossina austeni* in Zanzibar was completed. The distribution and problems associated with sampling *Glossina austeni* in Zanzibar are discussed.

AUTHOR(S): J. A. ONYIAH
ORGANIZATION: NIGERIAN INSTITUTE FOR TRYPANOSOMIASIS RESEARCH, KADUNA, NIGERIA.

TITLE OF WORKING PAPER: DEVELOPMENT OF MASS-REARING TECHNIQUES FOR GLOSSINA TACHINOIDES

SHORT SUMMARY OF PAPER

One of the important prerequisite to the use of Sterile Insect Technique for control/eradication of Glossina is that the target species can be mass-reared in the laboratory. Contractual agreement was signed with the IAEA to provide rearing equipments needed for the development of mass-rearing techniques for Glossina tachinoides at NITR, Kaduna. This colony when it is fully established is expected to act as a back-up colony for BICOT II Programme.

Structural modification of the existing tsetse rearing facility at NITR, Kaduna is now carried out to provide two holding rooms and a large central handling/feeding room. Two out of the four sets of defensor humidifiers and humidisfats received recently from IAEA have been installed. A host animal population of 300 guinea pigs is established in readiness for the initiation of the G. tachinoides colony. Arrangement is now in progress to collect wild puparia of this species from Yankari Game Reserve. It is expected that preliminary data emanating from this exercise will be discussed during the meeting in May 1985.

AUTHOR(S): **S.A. Ajayi; J. A. Onah** and U. Feldmann**
ORGANIZATION: *National Vet. Res. Institute, Vom Nigeria **Biological Control-Unit, Vom, Nigeria.

TITLE OF WORKING PAPER: Nutritional Quality of Protein-Deficient, Anaplasma marginale and Theileria mutans infected bovine blood as diet for Glossina palpalis palpalis(ROB - DESV-)

SHORT SUMMARY OF PAPER

A B S T R A C T

Glossina palpalis palpalis were artificially fed for 25 days on protein - deficient blood from cattle which was previously made anaemic by co-infection with Anaplasma marginale and Theileria mutans. The effects of this diet on the survival rate, fecundity and mean pupal weights on the Glossina flies were evaluated in comparison with those flies which were fed on normal bovine blood.

Flies fed on protein-deficient blood diet had mean puperia per initial female as 0.63 and mean pupal weight as 25.8 mg while control flies had values of 0.7 and 27.0 mg respectively.

The mean pupal weight of the control flies was statistically significant at the 0.05 level in comparison with the value obtained in the test group. However, the survival rates and fecundity of both groups did not differ significantly.

The significance of this preliminary finding is discussed.

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AUTHOR(S): [1] J.P. Kabayo, [2]J.R. Deloach, [2]G.E. Spates, and [2]G.M. Holman

ORGANIZATION: [1]Entomology Unit, FAO/IAEA Agricultural Biotechnology Laboratory, Seibersdorf, [2]USDA Veterinary Toxicology and Entomology Research Lab. College Station, Texas.

TITLE OF WORKING PAPER: Studies on the biochemical basis of the nutritional quality of tsetse diets.

SHORT SUMMARY OF PAPER

Batches of freeze-dried pig and cow blood, whose nutritional value to Glossina palpalis palpalis ranged from low to near optimum, were analysed for amino acid, triglyceride and cholesterol content. The results of the chemical analyses were compared with the nutritional quality observed when each batch of blood was fed to Glossina palpalis palpalis in an attempt to establish a chemical basis for the nutritional quality of diets for Glossina. In general, those pig or cow blood diets that had higher nutritional quality parameters also had a significantly higher amino acid content than the suboptimal diets. There were significant differences between the triglyceride and cholesterol content of pig and cow blood, with pig blood having more triglyceride but less cholesterol than bovine blood. There was no apparent correlation between the triglyceride and cholesterol content and the nutritional quality of blood.

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AUTHOR(S): J. P. Kabayo and M.E. Ruhm

ORGANIZATION: FAO/IAEA Agricultural Biotechnology Laboratory, Seibersdorf.

TITLE OF WORKING PAPER: Utilisation of ingested ^{14}C- labelled amino acids by in utero larvae of G. p. palpalis.

SHORT SUMMARY OF PAPER

12-day old pregnant G. p. palpalis females were fed on diets supplemented with individual ^{14}C- labelled amino acids. At the black polyneustic lobe stage the larvae were removed by dissection and the radio-activity recovered in the lipid and non-lipid fractions of individual larvae was determined for each labelled amino acid ingested during pregnancy. The extent of incorporation of each of 15 amino acids into the lipid and non-lipid fractions of the larva was studied as a basis for determining the relative importance of each amino acid for larval nutrition and in the context of synthetic diets engineering.

AUTHOR(S): J.P. Kabayo and M. Taher

ORGANIZATION: FAO/IAEA Agricultural Biotechnology Lab, Seibersdorf.

TITLE OF WORKING PAPER: Effect of dialysing diet components on the reproductive physiology of G.p. palpalis.

SHORT SUMMARY OF PAPER

The reproductive performance of groups of mated G. p. palpalis females fed control (whole blood or synthetic) diets was compared with that of flies fed diets containing dialysed components. Flies fed the latter type of diets failed to reproduce and examination of their reproductive systems revealed signs of aberrant physiological phenomena, including multiple oocyte maturation, double ovulation and apparent inhibition of hatching. These abnormalities were corrected if the affected flies were fed control diets and prevented if the flies were fed control diets or dialysed diets supplemented with a freeze-dried preparation of the yellow diffusate obtained during dialysis. The nutritional importance of specific, small-molecular weight substances in the diet of Glossina is discussed in terms of the relationship between the nutrition and reproductive physiology of the insect and in the context of artificial diets formulation.

Study of the mycetome in tsetse flies (*Glossina* spp.): I. Structural changes in starving *Glossina palpalis palpalis* females

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Abstract. A research programme on the mycetome in the tsetse fly, *G. p. palpalis* was initiated with the objective of assessing the effect of experimental diets on symbionts and fly reproductive performance.
In a first series of experiments, teneral flies from puparia produced in a colony fed on a mixture of processed defibrinated porcine and bovine blood were starved.
Semithin sections and scanning electronmicrograms of mycetomes of 1, 5, 9 and 12 day-old starving females showed spontaneous degenerative changes, accelerating before the death of the flies. In young females (1 and 5 day-old) mycetocytes are closely contiguous with well apparent nuclei and fully filled with endosymbionts arranged in the direction of the longitudinal axis. In the older ones (9 and 12 day-old) vacuolisation of mycetocytes, partial karyolysis and loss of contacts with the peritrophic membrane were observed. Endosymbionts loose their regular orientation and their number is gradually reduced; some of them degenerate. Those structural changes, especially in mycetomes of 12 day-old females, are comparable to changes described after application of some antibiotics or lysozyme.

AUTHOR(S): A. Van der Vloedt, H. Barnor, D. Luger, J. Kabayo

ORGANIZATION: FAO/IAEA Agricultural Biotechnology Laboratory, Seibersdorf

TITLE OF WORKING PAPER: EFFECTS OF TRYPANOCIDES ON Glossina palpalis palpalis

SHORT SUMMARY OF PAPER

As part of a programme to investigate the possibility of using trypanocides added to blood meals as means of interrupting development of trypanosomes in tsetse flies or affording some protection of released flies against infections, the effects of standard trypanocidal drugs on G. p. palpalis were determined.

During in vivo trials, clean guinea pigs (GP) were given a single dose of diminazene (Berenil) or isometamidium chloride (Samorin) at therapeutic or curative dosages of 3.5 mg kg^{-1} and 0.25 mg kg^{-1} respectively by intramuscular injection. Freshly emerged female flies (n=100) received the first drug-treated blood meal within 1-2 h after GP-treatment and subsequently were fed 6 days per week on the respective treated animals for 55 days. A similar procedure was followed using 9-day-old female flies, after one week feeding on untreated animals. Arrangements for mating consisted in introducing 40 sexually mature males into 10-litre containers holding 100 female flies. In further experiments synchronized female flies which had successfully completed their third reproductive cycle, were switched for feeding from untreated animals to treated animals within 1-2 h of administration of the drugs and were fed 6 days per week for the next three cycles.

During in vitro trials, the experimental diet was defibrinated porcine or defibrinated bovine blood stored at -28°C post collection. Aliquots of 700 ml blood of nutritionally excellent blood (quality factor > 1.25) were supplemented with the following trypanocides: (i) Berenil (7%) 0.50 ml and 1.00 ml, (ii) Samorin (4%) 0.25 ml and 1.00 ml, (iii) Trypamidium (alternative trade name for Samorin) 0.25 ml and 1.00 ml, and (iv) Ethidium bromide 1.0 mg and 3.0 mg. Batches of 30 freshly emerged female flies from the routine in vitro production colony (on 50:50 mixture of FPB and FBB) were fed 6 times per week on thawed control and treated blood for 25 days. Those females were mated at a 1:1 ratio.

Analysis of the effect of various treatments on relevant biological parameters (e.g. survival, abortion rate, fecundity, puparial weight and emergence rate) indicate that:

1) None of the trypanocides administered to guinea pigs had a detrimental effect on survival and reproductive potential. However, with equivalent insemination rate (94%), females fed on Berenil-treated animals produced significantly fewer puparia (2.57 and 2.94 P/initial female vs. 3.22 to 3.40 for control

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flies and 3.10-3.64 for flies on Samorin-treated animals). With a slight increase of puparia belonging to the lowest weight category, the emergence rate remained above 90%.

2) A more pronounced mortality during reproductive cycles 5 and 6 and a reduction in weight of 5th cycle puparia was observed, when older producing females (i.e. after the first three cycles) were transferred from untreated to Berenil-treated animals. A similar transfer to Samorin-treated animals had no noticeable effect.

3) Whereas Samorin is not at all interfering with the flies' reproductive biology, Berenil at therapeutic level seems to have a very short and reversible effect. This gives indirect evidence for an extensive metabolism of the drug and a rapid initial fall of blood concentration.

4) The addition of the various types of trypanocides did not significantly change pH and osmolarity values, but Berenil, Samorin and Ethidium bromide when added to porcine blood, drastically reduced the flies' feeding response (i.e. the proportion of flies taking a full or partial blood meal during the first 2-3 days following emergence).

5) Drastic effects on both survival and fecundity were observed when Berenil, Samorin or Trypamidium and Ethidium bromide were added at lower and higher concentrations to porcine blood used for in vitro feeding. Similar effects resulted from Berenil-treated bovine blood.

6) Female flies fed repeatedly Samorin-treated or Trypamidium-treated bovine blood performed very satisfactorily. No significant adverse effects on fecundity and quality of the offspring were observed inspite of the high concentration of unmetabolized drug in the in vitro bloodmeals (between 53.4 and 43.1 $\mu g\ ml^{-1}$ in samples taken from the 1.00 ml Samorin (4%)/700 ml blood treatment series).

The above results provide a basis for further in vitro studies on the effects of a limited number of trypanocide-treated blood meals on the establishment and development of particular types of trypanosome infections in the tsetse fly.

Authors: G.H. HESSE & W.J. KLOFT

Organization: Institute of Applied Zoology, University of Bonn /FRG

Title of working paper: Analysis of the influence of different nutritional sources on hemolymph composition and vitellogenesis in hematophagous arthropods.

For hematophagous arthropods R. GALUN et al.(1978) proposed three biological groups according the use of host blood. Most of our experiments have been performed with the soft tick (Argasidae) Ornithodoros moubata (MURRAY, 1877) sensu WALTON, 1962 which belongs to the oligophagous type according to GALUN (1978) and is moderate total monotropic according to the types of host preference (HOOGSTRAAL & AESCHLIMANN (1982)). FÜr O. moubata could be shown that for different bloodtypes (pig-blood, bovine-blood - defibrined and offered through parafilm membranes), the uptake of blood (and in comparison of a simple holidic diet) was nearly linear in relation to time, but with distinct differences in the amounts taken up. Our 2 labratory strains (pig-blood strain and bovine -blood strain, i.e. reared for at least two complete generations on this nutrional sources) revealed significant differences in body weight. The ticks of the pig-blood strain are heavier (due to uptake of larger amounts of blood), the preoviposition time is shorter, the whole oviposition period is shorter and the egg-numbers are higher-always in comparison to the bovine-blood strain. Together with the analysis of the hemolymph composition during the gonotrophic cycle we worked out, using the indirect ^{14}C-Inulin-dilution method, the absolute hemolymph (HL) Volume. Volume changes (increasing post repletionem, peak, decreasing to a new level) have been worked out for both strains in correlation to the parameters of the gonotrophic cycle. In relation to this cycle and the HL-volume, also the changes of total lipid concentration and of the different lipid classes have been worked out. Like in other Chelicerata and also in the Crustacea phospholipids were the main transport units of the lipids in the HL, conjugated to special carrier-proteins, the so-called lipoproteins or lipophorins. The differences between the two strains according to the lipid metabolism are not significant. So to our opinion the major blood component, the proteins, play the effective role. Similar experiments are ongoing with Stable flies, however here we have only preliminary results.

GENETIC BASIS OF STERILITY IN MALE HYBRIDS OF G. M. MORSITANS AND G. M. CENTRALIS.

R. H. Gooding, Department of Entomology, University of Alberta, Edmonton, Alberta, Canada.

Females of Glossina morsitans centralis (Experiment 1) and Glossina morsitans morsitans (Experiment 2), marked at the loci oc, sal, and Apk on the X chromosome and at the loci Ao and Xo in linkage group II, and Mdh in linkage group III were mated with appropriately marked males from the other subspecies. F_1 females were backcrossed to genetically marked G. m. centralis and their male progeny were tested for their ability to fertilize two females from each parental line. The origin of chromosomes in hybrid males was determined by electrophoresis and by scoring visible traits.

In hybrid (F_1) females, intrachromosomal recombination rarely occurred in the X chromosome but occurred at a nearly normal rate between the loci Ao and Xo in linkage group II.

Backcross males from both experiments were sterile if they carried an X chromosome from G. m. morsitans and a Y chromosome from G. m. centralis. Similarly backcross males were sterile or had low fertility if they inherited a recombinant linkage group II from their (F_1 hybrid) mothers. Among the descendants of G. m. centralis females, those males which were not sterilized by either of the above two mechanisms were usually able to fertilize both G. m. centralis and G. m. morsitans. However, backcross males descending from G. m. morsitans females were able to fertilize G. m. morsitans but not G. m. centralis. This is interpreted as indicating the presence of a maternally inherited sterility factor (MISF) which prevented these males from fertilizing G. m. centralis.

On the basis of the results obtained it is proposed that, by virtue of MISF, an inbred line of hybrid flies could be established and used for genetic control of G. m. centralis. Such a line was started by mating G. m. morsitans females with G. m. centralis. Females from F_1 and subequent generations are being backcrossed to G. m. centralis. About 40% of the males from the second backcross generation were able to transfer motile sperm during copulation. All inseminators were able to fertilize G. m. morsitans but only one of 13 were able to fertilize G. m. centralis. Preliminary evidence indicates that G. m. centralis females which first mate to "anti-centralis" produce fewer offspring than do control G. m. centralis females.

AUTHOR(S): Dr. P.A. Langley

ORGANIZATION: Tsetse Research Laboratory, Langford, UK

TITLE OF WORKING PAPER: Recent research at the Tsetse Research Laboratory, Langford.

SHORT SUMMARY OF PAPER

Work at the Tsetse Research Laboratory has expanded to include trypanosomes as well as their vectors. A genetic basis for infectibility of the fly has been established in G. morsitans and both refractory and susceptible strains of fly have been colonised. Attempts to determine the physiological basis of infectibility in the fly are being made. Serum factors are important in preventing establishment of trypanosome infections in the fly gut. Thus flies destined for release as sterile males might be fed on a special diet before release to minimise the risk of them becoming vectors.

Large scale rearing of G. pallidipes has been implemented at TRL; the colony is now approaching 600 breeding females and increasing.

The study of tsetse behaviour in relation to sex pheromones, host odours and visual stimuli continues both in the laboratory and in the field in relation to improving sampling methods and developing methods of automatically sterilising, or killing flies as a control measure, using suitable traps or targets.

Computer modelling has demonstrated the advantage of sterilising both sexes of tsetse over killing both sexes or sterilising males alone. a low cost device to automatically sterilise and re-release trapped flies is being developed.

A laboratory based service has been established at TRL to provide a unique combination of data on the nutritional state and chronological age of individual flies caught in the field. It is hoped to extend this service to include information on the mated status of female flies. The service will be invaluable to those engaged in planning and following the progress of tsetse control campaigns in the field.

AUTHOR(S) : W. TAKKEN, M.A. OLADUNMADE, L. DENGWAT, H.U. FELDMANN & S.O. TENABE

ADDRESS : BICOT, PO. BOX 76, VOM, NIGERIA.

TITLE OF WORKING PAPER : TSETSE POPULATION MANAGEMENT USING TRAPS, INSECTICIDE IMPREGNATED TARGETS AND THE STERILE INSECT TECHNIQUE IN CENTRAL NIGERIA.

SHORT SUMMARY:

Optimal use of sterile males for the eradication of Glossina p. palpalis in central Nigeria required efficient means of population suppression prior to the release of sterile insects. Blue biconical traps and insecticide impregnated targets were found to be highly effective for this purpose. In addition detailed ecological information about the composition of the tsetse population to be eradicated was obtained from trap catches. The impact of traps, targets and sterile males on a G.p. palpalis population is discussed. Where relevant, data on G. tachinoides are discussed as well.

AUTHOR(S): David J. Rogers & Sarah E. Randolph
ORGANIZATION: Department of Zoology, University of Oxford, U.K.
TITLE OF WORKING PAPER: The distribution and abundance of *Glossina palpalis*

SHORT SUMMARY OF PAPER

There are two approaches by which we can comprehend the distribution and abundance of tsetse species.

The first correlates the observed continental distribution of the fly with various climatic or other variables. Strong correlations suggest a dependence of fly demography on the variable(s) in question and, with care, can be used to predict distribution on a local scale. They cannot, however, be used to make any predictions about fly abundance.

The second approach seeks correlations between fly birth and/or death rates in a relatively restricted area and the same climatic variables. This understanding of the fly's relationship with its external environment leads to better predictions not only of local and possibly even continental distribution, but also of regional fly abundance. Since disease transmission rates depend crucially upon fly numbers, this second approach is the more desirable. It does, however, require a careful study of changes in tsetse populations over a fairly long period of time (one to two years or more).

The two approaches are, to some extent complementary, the first working from a continental to a local scale, the second working in the reverse direction. We describe how a combination of these approaches has increased our understanding of the distribution and abundance of *Glossina palpalis* in West Africa, and contrast it with what we already know about *G. morsitans*.

AUTHOR(S): L. Chuka Madubunyi Ph.D.

ORGANIZATION: Dept of Vet Parasitology & Entomology, University of Nigeria, Nsukka.

TITLE OF WORKING PAPER: Aspects of the ecology & epizootiological/epidemiological importance of peridomestic Glossina species in southeastern Nigeria.

SHORT SUMMARY OF PAPER

Only two species of Glossina, namely G. palpalis R.D. and G. tachinoides Westw., occur in Nsukka area with the latter comprising 99.6 - 100% of all tsetse trapped in the peridomestic habitats sampled. Peridomestic G. tachinoides is strictly diurnal and showed either a unimodal or bimodal daily activity pattern depending on season, location and sex. Its apparent density varied with locations and in each location fluctuated with seasons, being consistently higher during dry season months (November - February) than during wet season months (April - September). Populations of peridomestic G. tachinoides displayed sex ratio distortions which varied with location, season and proximity of traps to pig enclosures. At all locations, females produced their smallest-sized eggs (1.16-1.28 ± 0.02 mm; $\bar{x}$ ± SE) in August indicating nutritional stress around this time of year. Pregnancy rates were generally high (85-100%) throughout the year except in June when only 64-82% of all females trapped in the various locations were pregnant. Abortions occurred at variable rates throughout the year with the highest rates (15-20%) being observed at all locations in June. Virgins, teneral and young parous flies were either rarely or very poorly represented in the weekly biconical trap samples throughout the year. Apart from mating scars, no other cuticular lesions have been observed to date in peridomestic G. tachinoides from Nsukka area.

G. tachinoides apparently transmits only Trypanosoma congolense Broden and T. brucei Plimmer and Bradford in Nsukka area. The infection rate of flies with these trypanosomes did not seem to differ between seasons and/or sex of fly.

AUTHOR(S): DR. A. SANNUSI
ORGANIZATION: AHMADU BELLO UNIVERSITY, ZARIA, NIGERIA.

TITLE OF WORKING PAPER: THE VECTORIAL CAPACITY OF GAMMA IRRADIATED STERILE MALE GLOSSINA PALPALIS REARED AT BICOT, VOM, FOR TRYPANOSOMA VIVAX.

SHORT SUMMARY OF PAPER

Two hundred of 400 freshly emerged male Glossina palpalis were rendered sterile by gamma irradiation using a dose of 12 Krad at BICOT Laboratory, Vom. One hundred and twenty of such sterile males and 120 non-sterile male flies of similar origin were used in transmission studies using a local isolate of Trypanosoma vivax (Zarkwai/84/NITR/1.1). The remaining 80 sterile males plus 80 other non-sterile males were used as negative controls for the experiment. All flies used were held at 25°c and R.H. of about 85%.

Experimental goats obtained from a tse tse-free area were conditioned for five weeks and examined routinely for trypanosomes and confirmed negative. Transmission studies showed that transmission characteristics of T. vivax such as 5 days minimum development time, fly-proboscis as development site and about 8 days prepatent period in cyclical transmission to goats were unchanged in both irradiated and non-irradiated flies. However, infection rates for irradiated tse tse was 25.84% and 9.68% for non-irradiated males. This difference may be due to the secondary effect of irradiation on the tse tse bacterial microflora. It is recommended that mass chemotherapy or chemoprophylaxis against animal trypanosomiasis should be considered as an integrated package at the sterile-male release site.

AUTHOR(S): Gordian O.C. Ekejindu

ORGANIZATION: Nigerian Institute for Trypanosomiasis Research, Vom

TITLE OF WORKING PAPER: Trypanosomiasis Surveillance in assessing Sterile insect technique for control of tsetse fly (Glossina) in Nigeria

SHORT SUMMARY OF PAPER

Three surveys were conducted in March, July and November of 1984 for animal trypanosomiasis in the sterile-male-tsetse-fly-release area within Lafia local government, Plateau State, Nigeria. Infection rates of 12.5, 14.1 and 18.5% were recorded respectively for the months listed, with a range of 5.3 - 40% among flocks resident in the various separated settlements. These figures show an overall variation of 6% between the end of one dry season and the beginning of another, pointing to the possibility of increased transmission activities during the rainy season. Infections were suspected to be due to Trypanosoma vivax.

A localised epidemic due to mixed infection caused by T. brucei, T. congolense and T. vivax was discovered in a herd examined in November when 40% of the sampled animals were found infected, although in the same herd 13.8 and 5.3% were recorded for March and July respectively. The infection was complexed by concurrent diseases such as Streptothricosis ("Kiriche"), helminthiasis, supurative otitis and pedal oedema. All identified cases were treated and no relapses have been reported in the treated herds.

Since some drug resistance has been reported earlier in the trypanosome isolates from this area, the effectiveness of the curative dose of berenil used in controlling the epidemic is significant. Suggestions are made as to the origins of the parasites isolated from these herds and to the contributions of wild Glossina tachinoides in the area in promoting such infection. The possible role of sterile male Glossina palpalis palpalis released in this area is also considered. Cloned stabilates of some of these isolates have been obtained in our laboratories for further drug and infectivity studies.