The following States are Members of the International Atomic Energy Agency:

<table>
<thead>
<tr>
<th>AFGHANISTAN</th>
<th>ITALY</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALBANIA</td>
<td>JAPAN</td>
</tr>
<tr>
<td>ARGENTINA</td>
<td>REPUBLIC OF KOREA</td>
</tr>
<tr>
<td>AUSTRALIA</td>
<td>LEBANON</td>
</tr>
<tr>
<td>AUSTRIA</td>
<td>LIBERIA</td>
</tr>
<tr>
<td>BELGIUM</td>
<td>LUXEMBOURG</td>
</tr>
<tr>
<td>BRAZIL</td>
<td>MALI</td>
</tr>
<tr>
<td>BULGARIA</td>
<td>MEXICO</td>
</tr>
<tr>
<td>BURMA</td>
<td>MONACO</td>
</tr>
<tr>
<td>BYELORUSSIAN SOVIET SOCIALIST REPUBLIC</td>
<td>MOROCCO</td>
</tr>
<tr>
<td>CAMBODIA</td>
<td>NETHERLANDS</td>
</tr>
<tr>
<td>CANADA</td>
<td>NEW ZEALAND</td>
</tr>
<tr>
<td>CENTRAL AFRICAN REPUBLIC</td>
<td>NICARAGUA</td>
</tr>
<tr>
<td>CHILE</td>
<td>NORWAY</td>
</tr>
<tr>
<td>CHINA</td>
<td>PAKISTAN</td>
</tr>
<tr>
<td>COLOMBIA</td>
<td>PARAGUAY</td>
</tr>
<tr>
<td>CONGO (LEOPOLDVILLE)</td>
<td>PERU</td>
</tr>
<tr>
<td>CUBA</td>
<td>PHILIPPINES</td>
</tr>
<tr>
<td>CZECHOSLOVAK SOCIALIST REPUBLIC</td>
<td>POLAND</td>
</tr>
<tr>
<td>DENMARK</td>
<td>PORTUGAL</td>
</tr>
<tr>
<td>DOMINICAN REPUBLIC</td>
<td>ROMANIA</td>
</tr>
<tr>
<td>ECUADOR</td>
<td>SAUDI ARABIA</td>
</tr>
<tr>
<td>EL SALVADOR</td>
<td>SENEGAL</td>
</tr>
<tr>
<td>ETHIOPIA</td>
<td>SOUTH AFRICA</td>
</tr>
<tr>
<td>FINLAND</td>
<td>SPAIN</td>
</tr>
<tr>
<td>FRANCE</td>
<td>SUDAN</td>
</tr>
<tr>
<td>FEDERAL REPUBLIC OF GERMANY</td>
<td>SWEDEN</td>
</tr>
<tr>
<td>GHANA</td>
<td>SWITZERLAND</td>
</tr>
<tr>
<td>GREECE</td>
<td>THAILAND</td>
</tr>
<tr>
<td>GUATEMALA</td>
<td>TUNISIA</td>
</tr>
<tr>
<td>HAITI</td>
<td>TURKEY</td>
</tr>
<tr>
<td>HONDURAS</td>
<td>UKRAINIAN SOVIET SOCIALIST REPUBLIC</td>
</tr>
<tr>
<td>HUNGARY</td>
<td>UNION OF SOVIET SOCIALIST REPUBLICS</td>
</tr>
<tr>
<td>ICELAND</td>
<td>UNITED ARAB REPUBLIC</td>
</tr>
<tr>
<td>INDIA</td>
<td>UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND</td>
</tr>
<tr>
<td>INDONESIA</td>
<td>UNITED STATES OF AMERICA</td>
</tr>
<tr>
<td>IRAQ</td>
<td>URUGUAY</td>
</tr>
<tr>
<td>ISRAEL</td>
<td>VIET-NAM</td>
</tr>
<tr>
<td>IVORY COAST</td>
<td>YUGOSLAVIA</td>
</tr>
</tbody>
</table>

The Agency's Statute was approved on 26 October 1956 at an international conference held at United Nations headquarters, New York, and the Agency came into being when the Statute entered into force on 29 July 1957. The first session of the General Conference was held in Vienna, Austria, the permanent seat of the Agency, in October, 1957.

The main objective of the Agency is "to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world".

© IAEA, 1963

Permission to reproduce or translate the information contained in this publication may be obtained by writing to the International Atomic Energy Agency, Kemirmer Ring 11, Vienna I.

Printed by the IAEA in Austria
March 1963
BIBLIOGRAPHICAL SERIES
No. 9

RADIOISOTOPES
AND IONIZING RADIATIONS
IN ENTOMOLOGY

INTERNATIONAL ATOMIC ENERGY AGENCY
VIENNA 1963
This bibliography of publications in related discovering particular aspects of entomological work in entomology. A special effort has been made to include full abstracts. The bibliography was compiled by the Scientific and Technical Information Service of Scientific and Technical Information Service, Vienna, Austria.

La présente bibliographie a été rédigée par l'Agence internationale de l'énergie atomique. Elle est destinée à être utilisée dans le domaine de l'entomologie. Elle contient une liste de publications sur les rayonnements ionisants en entomologie. L'Agence a entomologie.
This bibliography on Radioisotopes and Ionizing Radiations in Entomology is the ninth in the "Bibliographical Series" published by the International Atomic Energy Agency. Source material was obtained from the open world literature for the years 1950 to 1960, inclusive. The aim, scope and details of coverage are discussed more fully in the introduction. No claim to completeness is made although every effort has been made to include all pertinent references that could be traced. The bibliography reflects the enormous impetus given to research into various aspects of entomology by the availability of radioisotopes and ionizing radiations. It should be of interest to the specialist in need of a survey of relevant publications in related disciplines, and to workers requiring collected references covering particular aspects of the field. The Agency intends to continue bibliographical work in entomology.

A special effort has been made to present the references in such a way that they will be of the fullest use to readers in developing countries where certain publications may not be easily available. References have therefore been supplied with abstracts. To increase the usefulness of this bibliography a detailed subject index is included, in addition to the usual author index.

The bibliography was compiled by Mrs. M. Binggeli of the Agency's Division of Scientific and Technical Information.

Readers are invited to address their suggestions and other correspondence regarding the "Bibliographical Series" to: The Director, Division of Scientific and Technical Information, International Atomic Energy Agency, Vienna I., Kärntnerring 11, Austria.

La présente bibliographie, consacrée aux radioisotopes et aux rayonnements ionisants en entomologie, est la neuvième de la collection "Bibliographies" publiée par l'Agence internationale de l'énergie atomique. Les ouvrages cités ont été choisis dans la documentation publiée dans le monde entier entre 1950 et 1960. Le but, la portée et le détail de cette bibliographie sont indiqués d'une manière plus complète dans l'introduction. Sans prétendre à une étude exhaustive, on n'a manqué aucun effort pour citer tous les ouvrages pertinents qu'on a pu retrouver. Cette bibliographie reflète l'essor considérable de la recherche dans divers domaines de l'entomologie depuis qu'on utilise les radioisotopes et les rayonnements ionisants. Elle devrait intéresser les spécialistes qui désirent posséder une liste de publications en la matière et les chercheurs qui ont besoin de rassembler des références sur certains aspects particuliers de la recherche entomologique. L'Agence a l'intention de continuer ce travail bibliographique en entomologie.

ENNA, 1963
On s'est efforcé surtout de présenter les listes d'ouvrages de telle manière que les lecteurs des pays en voie de développement, qui peuvent avoir des difficultés à se procurer certaines publications, puissent en tirer le meilleur profit. On a donc fait suivre chaque titre d'un bref résumé. Pour qu'il soit encore plus facile de consulter cette bibliographie, on a complété l'index par auteur habituel par un index détaillé par sujet.

Cette bibliographie a été établie par Mme M. Binggeli, de la Division de la documentation scientifique et technique de l'Agence.

Les lecteurs sont priés d'adresser leurs suggestions et toute la correspondance concernant la collection "Bibliographies" au Directeur de la Division de la documentation scientifique et technique, Agence internationale de l'énergie atomique, Vienna I, Kärntnering 11, Autriche.

Bibliographia по вопросам использования радиоактивных изотопов и ионизирующих излучений в энтомологии является девятой в "Библиографической серии", издаваемой Международным агентством по атомной энергии. Материал, вошедший в нее, был взят из открытой литературы, опубликованной в разных странах за период с 1950 – 1960 гг. Предмет, объем и характерные особенности библиографии подробно изложены во Введении. Библиография не претендует на полноту охвата, хотя было сделано всё возможное, чтобы отыскать и включить в нее все относящиеся к данной теме материалы. В библиографии отражены огромные успехи в исследованиях различных областей энтомологии, стимулированных использованием радиоактивных изотопов и ионизирующих излучений. Библиография представляет интерес как для специалистов, работающих в смежных с данной областях, так и для ученых, нуждающихся в подборе работ, посвященных специфическим проблемам, охватываемым настоящей библиографией. Агентство намерено продолжать библиографическую работу по энтомологии.

Сообщение представляло собой форму представления библиографических данных, с тем чтобы ученые развивающихся стран, где некоторые издания могут оказаться труднодоступными, могли извлечь наибольшую пользу из каждого приведенной ссылки. Поэтому было возможно, библиографические данные сопровождаются аннотациями. Для упоминания ценности данной библиографии, кроме общего авторского указателя, в нее включен также подробный предметный указатель.

Библиография составлена сотрудницей Отдела научно-технической информации Агентства г-жой М. Бинггели.

Esta bibliografía sobre el empleo de radioisótopos y radiaciones ionizantes en entomología es la novena que edita el Organismo Internacional de Energía Atómica en su "Colección de Bibliografías". En ella se recopilan las obras de carácter no confidencial publicadas entre 1950 y 1960 inclusive. En la introducción se describen detenidamente los fines, el alcance y los detalles de las obras recopiladas. Claro está que la bibliografía no resulta completa, aunque se ha hecho lo posible por recoger todas las referencias que se han podido encontrar. Pese a ello, queda perfectamente reflejado el enorme impulso adquirido por las investigaciones sobre diversos aspectos de la entomología gracias al empleo de radioisótopos y de radiaciones ionizantes. La recopilación será de interés para los especialistas que necesiten un análisis de las publicaciones importantes sobre disciplinas afines a las suyas, y para los investigadores que precisen disponer de datos bibliográficos acerca de un aspecto particular de esta esfera. El Organismo tiene la intención de continuar sus trabajos bibliográficos sobre entomología.

Se ha tratado especialmente de confeccionar y presentar la bibliografía de forma que resulte del máximo provecho para los lectores de los países en vías de desarrollo, que quizás tropiecen con dificultades para procurarse ciertas publicaciones. Por eso, con cada obra citada se da un breve resumen de su contenido. Para facilitar el empleo de esta recopilación, además del índice de autores hay un índice detallado de materias.

La bibliografía ha sido preparada por la Sra. M. Bingelli, de la División de Información Científica y Técnica del Organismo.

Se ruega a los lectores que envíen sus observaciones y toda la correspondencia relativa a la "Colección de Bibliografías" al Director de la División de Información Científica y Técnica, Organismo Internacional de Energía Atómica, Kärntnerring 11, Viena I (Austria).
PART I: RADIOISOTOPE

I INSECTS

A Ecology

1 Survey Articles
2 Behaviour
   a Feeding
   b Transmission of
   c General Behavior
3 Population Dynamics
4 Parasites and Predators

B Insect Physiology and Behaviour

1 Carbohydrates
2 Proteins and Amines
3 Nucleic Acids
4 Seeds
5 Elements
6 Virus Diseases
7 Miscellaneous

C Insect Labelling

D Developmental and Genet

E Insect as Disease Vectors

1 Man
2 Animal
3 Plant

II INSECTICIDES

A Survey Articles

B Fumigants

C Halogenated Hydrocarbons

D Organophosphates

E Pyrethrum and related Compounds

F Nicotine, Carbamates and Repellents

H Insecticide Metabolism

1 Insect
2 Mammals
3 Plants

I Insecticide Residues in

1 Mammals
2 Plants
3 Soil

III TECHNIQUES

A Autoradiography

B Dosimetry

C Isotope Dilution

D Labelled Pool Techniques

E Paper Chromatography

F Miscellaneous
## CONTENTS

**INTRODUCTION** ................................................................. 13

**PART I: RADIOISOTOPES** .................................................. 17

1 INSECTS ............................................................................. 19

A Ecology .............................................................................. 19
   1 Survey Articles .............................................................. 39
   2 Behaviour ................................................................. 22
      a Feeding ............................................................. 22
      b Transmission of Food ........................................... 27
   c General Behaviour .................................................... 36
   3 Population Dynamics (Dispersal, Flight Range, etc.) ....... 33
   4 Parasites and Predators ............................................... 45

B Insect Physiology and Metabolism ....................................... 47
   1 Carbohydrates .......................................................... 47
   2 Proteins and Amino Acids .......................................... 52
   3 Nucleic Acids .......................................................... 66
   4 Sterols ......................................................................... 66
   5 Elements ...................................................................... 68
   6 Virus Diseases .......................................................... 83
   7 Miscellaneous .......................................................... 83

C Insect Labelling .................................................................. 85

D Developmental and Genetic Effects Induced through Labelling .. 96

E Insects as Disease Vectors in .............................................. 103
   1 Man ......................................................................... 101
   2 Animals ...................................................................... 102
   3 Plants ......................................................................... 103

II INSECTICIDES .................................................................. 106

A Survey Articles ............................................................... 106

B Fumigants ....................................................................... 106

C Halogenated Hydrocarbons ............................................. 108

D Organophosphates .......................................................... 128

E Pyrethroids and related Compounds ................................. 156

F Nicotine, Carbamates and other Compounds ..................... 159

G Repellents ...................................................................... 165

H Insecticide Metabolism in ................................................ 166
   1 Insects ...................................................................... 166
   2 Mammals .................................................................. 174
   3 Plants ...................................................................... 175

I Insecticide Residues in ..................................................... 183
   1 Mammals .................................................................. 183
   2 Plants ...................................................................... 184
   3 Soil .......................................................................... 187

III TECHNIQUES ................................................................. 189

A Autoradiography ............................................................. 189

B Dosimetry ...................................................................... 190

C Isotope Dilution ................................................................ 190

D Labelled Food Techniques .............................................. 191

E Paper Chromatography ................................................... 192

F Miscellaneous ............................................................... 192
| Table III | Mortality of Irradiated Insects of Medical Interest | 272 |
| Table IV | References for the Synthesis of some Radio-labelled Organic Insecticides and Related Compounds | 273 |
| Table V | Radio-tracer Studies on the Metabolism of Organophosphate Insecticides by Plants | 274 |
| AUTHOR INDEX | | 281 |
| SUBJECT INDEX | | 283 |
GENERAL

A bibliographical survey undertaken to provide a comprehensive bibliography of the isotopes of the Inter. A fully annotated bibliography that it would meet a rework covering the 11-year period before 1950 and this could be completed given in some of the work by the general availability of selected publications. The press and each dealing with a more specialized problem is intended to aid those who are particular and rapid where it is often difficult to achieve. Yet such specialist's own problem.

SOURCES

The bibliography was compiled:

(a) Abstracts
    Biological Bulletin
    Chemical Review
    and Bericht
    (Erg)
    Nuclear Excerpt
    Referat
    Index

(b) Reference
    Bibliography
    Agricultural which we
    Among the many sources
    "Annual Review
    1-5 of the AEC
    "Advances in Pe
    York, (1957)
    Radiation Biology...
INTRODUCTION

GENERAL

A bibliographical survey on radioisotopes and radiation in entomology was initially undertaken to provide documentation for an internal study in the Division of Isotopes of the International Atomic Energy Agency. The decision to publish a fully annotated bibliography was taken subsequently, when it became clear that it would meet a real need. The present volume represents a reference work covering the 11-year period from 1950-1960. Relatively little was published before 1950 and this can easily be traced by following the references to earlier work given in some of the review articles cited. The exciting possibilities opened up by the general availability of radioisotopes for research in the field of entomology are reflected in the ever-increasing number of research reports and publications. The present bibliography will be followed up by further surveys, each dealing with a more specialized aspect, to bring the information up to date. It is intended to aid those who are interested in documentation, not only in their own particular and rapidly developing fields, but also in those border-line areas where it is often difficult to get an overall picture of research trends and achievements. Yet such an orientation may have important bearings on the specialist's own problem.

SOURCES

The bibliography was compiled from the open literature. A routine documentation search was conducted by scanning the following secondary sources:

(a) Abstracting journals, including
   Biological Abstracts (BA),
   Chemical Abstracts (CA),
   Bulletin Signalétique (BS),
   Review of Applied Entomology, series A
   and B (RAE-A, -B),
   Berichte der gesamten Biologie, Teil A
   (BgB-A),
   Nuclear Science Abstracts (NSA),
   Excerpta Medica (EM),
   Referativnìj Zurnal (in as far as subject
   indexes were available); and

(b) Reference listings such as those in
   Bibliography of Agriculture (B. Ag), and
   Agricultural Index (A. I.),
   which were followed up.

Among the many surveys, books and reports consulted are:
"Annual Review of Entomology", (Steinhaus, E. A., Smith, R. F., eds.)
1-6 Palo Alto, Calif., Annual Reviews, Inc. (1958/61);
"Advances in Pest Control Research", (Metcalfe, R. L., ed.) 1-3, New
York, (1957/59);
Radiation Biology 1-3;
Annual Report of the Research Committee on the Applications of Artificial Radioisotopes in Japan, 1-3, Jap. Soc. for the Promotion of Science (1951/52);
Selected abstracts of Atomic Energy Project Unclassified Report Literature in the Field of Radiation Chemistry and Bibliography of Published Literature, AERE C/R 1575 (1-6), (1958);
Bibliographies of papers published by United Kingdom Sources on Radio-biological and Allied Subjects;
Archiv für Geflügelzucht und Kleintierkunde: "Titel der im landwirtschaftlichen Zentralblatt 1960 referierten Arbeiten auf dem Gebiet der Kleintierzucht" (with reference to work on bees and silkworms);
Congress and Conference Proceedings (see source references in bibliography) (including the Proc. UN Int. Conf. PUAE, 1955/56).
Books and bibliographies (as listed in the bibliography)

Nevertheless, an essential part of the work consisted in consulting and, where necessary, abstracting original papers, reviews and reports and in following up the references cited there.

ORGANIZATION

The references within any one section have been arranged alphabetically by first author.

Whenever abstracts have not been compiled directly their source has been indicated. The length of an abstract is not a criterion for the importance of the article concerned; thus, a good review article may be dealt with very briefly. A comparative inaccessibility of the source may justify a more detailed abstract.

Some papers which, as far as could be ascertained, have only appeared as abstracts without subsequent publication in full have nevertheless been when their contents would appear of sufficient cited partially or in toto interest.

Some research reports of special interest have been cited and abstracted individually; when publications under the same or similar titles have appeared, reference to corresponding preceding research reports has been limited to a brief comment at the end of the particular abstract.

The bibliography has been broadly divided into two main parts: I dealing with radioisotopes, as applied in research on insects and insecticides, and II dealing with ionizing radiation in research and their possible applications. Occasionally the assigning of categories proved difficult because of a certain overlap; therefore, cross-references are freely cited throughout.

A section (III) on techniques has been included in part I on radioisotopes. Sample papers have been chosen to represent work on autoradiography, dosimetry, isotope dilution techniques, the labelled-pool technique, paper chromatography and others.

For orientation purposes, an attempt was made to head sub-sections by some introductory or survey article(s). General bibliographies and reviews are grouped together in Section IV.

Some difficulties arose in separating research on ionizing radiation effects from applications since present-day research is frequently at a pre-application stage; it may then be taken to mean here "research with a definite application in view". This is true than the screwworm f trolling stored-product.

Particular difficult amount of fundamenta of Drosophila genetics Drosophila. Blooming been neither possible however, it would have author index stressers should read the public.

Catcheside, D. (Lee, D., Actic 1957),
Muller, H. J., (Meinhard, A.,
Müller, Z. M., andworth Scier)
A number of paper mosquito and silkworm genetics research and the significance of this deviation behaviour s age fed feeding behaviour.

Special attention curred through radio devoted to this aspect

Addendum - A sp included.
Appendix - An sp rising data with support
Author index - Th institutions may send the abstracting journals
Subject index - A each entry the radiois

ACKNOWLEDGEMENT

Additional very of pendence with scientific Professor Asta Morphology, Bol'šaja Kaji
Dr. M. Legay, sciences de l périmentale, Dr. Shigematsu
Ministry of the Tokyo, Japan
This is true of the "sterile-male" technique applied to insects other than the screwworm fly as much as of radiation measures envisaged for controlling stored-products infestation.

Particular difficulties were experienced in selecting papers from the vast amount of fundamental work which has appeared on radiation effects in the field of Drosophila genetics (see I.H. Herskowitz "Bibliography on the Genetics of Drosophila", Bloomington, Indiana Univ. Press (1958) 206p.). It would have been neither possible nor justifiable to include more than a slight sampling; however, it would have been equally untenable to ignore this field. Bushland (see author index) stressed that "...anyone planning work on insect sterilization should read the publications by

Catcheside, D.G., Advances in Genetics 2: 271 (1958),
Les, D., Actions of radiations on living cells. (Macmillan, New York, 1957),

A number of papers on genetics (Drosophila, Habrobracon, Mormoniella, mosquito and silkworm) have therefore been included. The importance of genetics research emerges clearly in connection with the sterile-male technique, and the significance of, for example, developing strains allowing sex differentiation according to egg colour for the silkworm industry, and strains with modified feeding behaviour.

Special attention needs to be paid to genetic and developmental effects incurred through radioisotope labelling, and a separate section (I: D) has been devoted to this aspect in the present bibliography.

Appendix - A special section on nematodes of agricultural interest has been included.

Subject Index - A comprehensive subject index was compiled. Alongside each entry the radioisotope or radiation used is indicated, when feasible.

Acknowledgements

Additional very useful references were also obtained through direct correspondence with scientists among them:

Professor Antaurov, Severtsov Institute of Animal Morphology, Academy of Sciences of the USSR,
Bol'shaja Kalougeaska
Dr. M. Legay, Maitre de Conferences, Faculte des sciences de Lyon, Laboratoire de zoologie experimentale, 16, Quai, Claude-Bernard;
Dr. Shigematsu, The Sericultural Experiment Station, Ministry of Agriculture and Forestry, Suginami-ku, Tokyo, Japan;

on silkworm
Professor Tazima, National Institute of Genetics, Siznokaken - Mishima, Japan;
Dr. C.C. Hassett, United States Army Chemical Research and Development Labs.;

Dr. D.F. Heath, Medical Research Council, Toxicology Research Unit, MRC Laboratories, Woodmansterne Road, Carshalton, Surrey, United Kingdom;
Dr. T.L. Hopkings, Assistant Professor of Entomology, Kansas, USA
Professor Dr. K. Gösswald and Privatdozent Dr. W. Kloth, Institut für angewandte Zoologie der Universität Würzburg, Würzburg, Röntgenring 10. Federal Republic of Germany

The compiler of this bibliography is greatly indebted to Mr. Claude H. Schmidt of the Division of Research and Isotopes for active collaboration and advice.

Very useful references and reprints have also been received from a variety of other sources, too numerous to acknowledge individually. These have all been greatly appreciated and of considerable assistance.
on silkworm}
on dispersal and radiation studies of insects

\{ on insecticides

\{ on social insects

\{ indebted to Mr. Claude active collaboration and received from a variety ally. These have all been

\{ PART I

RADIOISOTOPES

2. Ankerbach, S. L. THE SOIL Ecology 39 (1958) 555-558. Weighed samples of tree leaves to various doses of γ-radiation at 30-d intervals up to the surviving anthropods. It differed in gene sensitivity to obtained for 2 pulse species, mede. It was noticed as the control levels at around 30.

3. Dahm 1955 - [800]

4. Dahm 1957 - [806]

5. Day, M. F. APPLICATION a. 45-52 in “Proceedings of Melbourne August 1980.” The author comments on the period of 1930 to 1950, the physiology and ecology, Tl, Zn, Sn, Be, Te, I², etc.

6. Dick, W. E. RADIOACTIVE in Agriculture”, Chapter 4. Radiocliometric tagging and its phenomena. and applications (work is ceded by author no.

7. Dugas, L.-P. L’EMPLOI des radionucléides dans la production des fruits, la viticulture, etc.
1 INSECTS

1-A Ecology

1-A-1 SURVEY ARTICLES


A review article (20 references). Methods for labelling insects, and the doses to be applied are discussed. Dispersal and behaviour of insects, population density, and plant-insect and insect-insect relations are amongst the problems which may be studied by these techniques.

2. Asperen 1958 - [804]


Weighted samples of tree hole substrate containing dense and complex arthropod populations were exposed to various doses of γ-radiation from a Cs137 source, irradiated samples were then maintained in the laboratory at 30-d intervals up to 90 d; a series of these samples was processed through Betisee funnels to obtain the surviving arthropods. It appeared from the data on Collembola and Acarina that related species can differ in their sensitivity to radiation. Evidence of predator-prey differential radiosensitivity was also obtained for 2 spider species, Theridion sp. (a herbivorous, saprophagous mite) and a pedipalp (Neoparasteatata). It was noticed as an increase in number amongst individuals of the irradiated population above control levels at around 300 r.

4. Dahm 1952 - [805]

5. Dahm 1957 - [806]


The author comments on the (then) less than 30 papers which had appeared in the field during the 20-year period of 1930 to 1950. They deal with problems in pharmacology, biodynamics, genetics, biochemistry, physiology and ecology. The isotopes mentioned are C14, Na24, P32, S35, Mn54, Co60, As74, and As76, Mn54, Sr90, Zr90, Y90, and Ba137.


Radioisotope tagging and its use in insect studies (habits, physiology, insecticide action and resistance phenomena), and applications of radiation for killing or the production of sterile males are reviewed. (Work is cited by author and year but no bibliography is included).


Après avoir traité des principes nécessaires pour l'application des radioisotopes, l'auteur donne plusieurs exemples de l'emploi des radioisotopes ou des traceurs ont été employés avec succès dans l'étude d'insectes pour étudier leurs zones de dispersion, l'étiquetage de pucerons et d'autres insectes vecteurs de maladies des plantes par transmission de virus, bactérie, etc.
Haller 1958 - [410]

A very useful review, dealing with insect physiology, insecticide metabolism and distribution, and insect tagging in dispersal and field studies. More than 100 relevant references are cited.

Review. The use of radioisotopes is discussed in studies of insect dispersal, abundance and size of insect populations, the transmission of disease, insect physiology, and the mode of action of insecticides. The bioaccumulation by insects of complex radioactive chemicals from simpler tagged compounds, and the dispersal by spray-packets of labelled insecticides are also covered. The absorption and transmission through plants of radioactive systemic insecticides, and the synthesis by plants grown in an atmosphere of C©2O© of various botanical insecticides, e.g. pyrethrum and nicotine, are discussed. The section on radiation effects on insects considers mutations, growth, physiology, metamorphosis, reproduction, longevity, behaviour, etc. Five tables are included. The comprehensive bibliography contains 178 references.

Lindquist, A.W., RADIOACTIVE MATERIALS IN ENTOMOLOGICAL RESEARCH, J. Econ. Ent. 45 (1952) 964-70.
The possible applications of radioisotopes are reviewed, together with the nature of the problems involved, the results obtained in connection with recent research, and suggestions on how to study studies on the biology and control of insect pests. The need for close collaboration with other disciplines is stressed.

Review article. Entomology is among the scientific disciplines employing radioactive materials in studies on the biology, physiology, toxicology, biochemistry, disease transmission, and effects of radiation on reproduction, habits, longevity, and control of insects. Flight habits, dispersal distances, migration, longevity, and population numbers have been studied with specimens tagged with radioactive materials. Similar are reviewed from studies on the effects of radiation on insects and studies with radioactive insecticides. Applications in the control of insect pests are discussed. (NSA 13: 6531, 1959)

Review article. Application of radioisotopes to studying the biology (dispersal, flight range, etc.) of a particular pest is described, with citations from the literature. The use of radiation effects (lethal) to various insects and the practical feasibility of such measures are discussed. Further possible applications of the sterile-male technique are considered. Tracers may be used to evaluate the effectiveness of control measures, and in insect-physiology studies, in which a labelled chemical is traced during its absorption, metabolism, and excretion. A similar technique is used for tracing the course of a systemic insecticide in animal and plant tissues. Insecticide residue hazards may also be evaluated. (87 references)

Various types of applications are reviewed such as in insect migration studies. The investigations described range from studies on the dispersal of populations of mosquitoes, locusts, barklice, graminipes, and pine weevils to that of the movement of individual cutworms and wireworms in the soil. Automatic recording equipment has been designed for the latter purpose. The dispersal of pollen, also by insects, is discussed. Fractionation of insect pests by sterilization with y-radiation is described.

In tracer studies of insect dispersal, and followed by a host may have a minimal effect on the readily available. Experiments described, together with some a tagged insect is discussed, if性感element carriage with mentioned.

The use of radioisotopes is discussed in studies of insect dispersal, abundance and size of insect populations, the transmission of disease, insect physiology, and the mode of action of insecticides. The bioaccumulation by insects of complex radioactive chemicals from simpler tagged compounds, and the dispersal by spray-packets of labelled insecticides are also covered. The absorption and transmission through plants of radioactive systemic insecticides, and the synthesis by plants grown in an atmosphere of C©2O© of various botanical insecticides, e.g. pyrethrum and nicotine, are discussed. The section on radiation effects on insects considers mutations, growth, physiology, metabolism, reproduction, longevity, behaviour, etc. Five tables are included. The comprehensive bibliography contains 178 references.

The possible applications of radioisotopes are reviewed, together with the nature of the problems involved, the results obtained in connection with recent research, and suggestions on how to study studies on the biology and control of insect pests. The need for close collaboration with other disciplines is stressed.

Entomology is among the scientific disciplines employing radioactive materials in studies on the biology, physiology, toxicology, biochemistry, disease transmission, and effects of radiation on reproduction, habits, longevity, and control of insects. Flight habits, dispersal distances, migrations, longevity, and population numbers have been studied with specimens tagged with radioactive materials. Similar are reviewed from studies on the effects of radiation on insects and studies with radioactive insecticides. Applications in the control of insect pests are discussed. (NSA 13: 6531, 1959)

Application of radioisotopes to studying the biology (dispersal, flight range, etc.) of a particular pest is described, with citations from the literature. The use of radiation effects (lethal) to various insects and the practical feasibility of such measures are discussed. Further possible applications of the sterile-male technique are considered. Tracers may be used to evaluate the effectiveness of control measures, and in insect-physiology studies, in which a labelled chemical is traced during its absorption, metabolism, and excretion. A similar technique is used for tracing the course of a systemic insecticide in animal and plant tissues. Insecticide residue hazards may also be evaluated. (87 references)

The investigations described range from studies on the dispersal of populations of mosquitoes, locusts, barklice, graminipes, and pine weevils to that of the movement of individual cutworms and wireworms in the soil. Automatic recording equipment has been designed for the latter purpose. The dispersal of pollen, also by insects, is discussed. Fractionation of insect pests by sterilization with y-radiation is described.

In tracer studies of insect dispersal, and followed by a host may have a minimal effect on the readily available. Experiments described, together with some a tagged insect is discussed, if性感element carriage with mentioned.

The use of radioisotopes is discussed in studies of insect dispersal, abundance and size of insect populations, the transmission of disease, insect physiology, and the mode of action of insecticides. The bioaccumulation by insects of complex radioactive chemicals from simpler tagged compounds, and the dispersal by spray-packets of labelled insecticides are also covered. The absorption and transmission through plants of radioactive systemic insecticides, and the synthesis by plants grown in an atmosphere of C©2O© of various botanical insecticides, e.g. pyrethrum and nicotine, are discussed. The section on radiation effects on insects considers mutations, growth, physiology, metabolism, reproduction, longevity, behaviour, etc. Five tables are included. The comprehensive bibliography contains 178 references.
"Atomic energy and Agriculture", Association for the Advancement of Science, 1956.


In tracer studies of insect dispersal and behaviour, insects were tagged with a suitable radioactive tracer, released, and followed by means of a suitable radiation detector. The tracer needs to be easily aplicable, have a minimal effect on the insect, be easily recognized, persistent, possess a suitable half-life and be readily available. Experiments on mosquitoes, blackflies, grasshoppers, wireworms and cutworms are described, together with appropriate references. A method for the automatic plotting of the position of a tagged insect is discussed, including a block diagram, and a schematic diagram for interaction of a sensing-element carriage unit of the automatic following device. Work on the white-pine weevil is mentioned.


A review of experimental data covering the application of tracer methodology to basic and practical aspects of entomology (ecology, disease vectors, physiology, toxicology of insecticides, radiation effects on insects, and applications of tracer radiations in insect control). The review contains a comprehensive bibliography, including 30 references to Soviet sources relevant to the present bibliography.


Some reference works are cited, followed by a survey of relevant work in progress in the various laboratories of the Department of Agriculture, and of a number of universities. Work on bees, insect nutrition, the amino acid metabolism of the blowfly and others is mentioned, and other using radioactive tracers are cited also some Canadian publications that have appeared so far.


The use of C-14 and P-32 labelled compounds is described briefly.


18. Mihelev, I. INSECT MARKING WITH RADIO ISOTOPES. Priroda (Sofia) 5, 1 (1958) 81-2. (In Bulgarian)


Applications of radiotrace labelling are reviewed, including their usefulness, hazards, costs, and the choice of isotope to be used for a particular study. One section is devoted to work on insects. The author warns against indiscriminate use of radioisotopes. Literature references cite work after 1945.
I-A-2 BEHAVIOR
I-A-2-8 FEEDING

20 Pitcher, A. LE MASQUAGE DES INSECTES À L'AIDE DES RADIO-ISOTOPEs, Pr. refuge, 64 (1926) 624.

21 Jenkins and Hassett 1955 - [808]


24 Hasing, E. UNTERSUCHUNGEN AM SAUGARYVON APHIS FABAE SCOP. MIT 14C (C14 Studies on the suction process in aphis false Scorps.). Naturwissenschaften 42, 12 (1955) 410-1. (In German)


26 Klopf, W., Eibhard, P., STRUKTURCHENBLAUS LD. ON THE SUCKING ACTIVITY 4B (Bioenergetic absorption W)

27 Klopf, W. WECHSELW. BEROGEN PfANZENZ. best-tissues of the plant. 2. (1966) 42-70 Part II.

28 Klopf, W., Kühler, H. DONC, MIT HILFE DER elucidasion by means of t Congress on Entomology, Museum, Vienna. Vienna

29 Watson, F.R., Locati, G. BY THE GREEN PEACH A Myzus persicaria (Sulz.) excising honeydew on w on which it feeds. In esp


Kloof, W., Bubendorf, P. UNTERSUCHUNGEN ÜBER SÄUERLÄTIGKEIT UND SCHADWIRKUNG DER STREIFENFLÜGELLSUNG LOPHOTAURUS MUCIDUS (WALK.) (NEOMYZUS ARBETINA WALK.) (Studies on the sucking activity and damaging effects of the citrus green louse Lophostyrus abietis (Walk.) (Neomyzus abietina Walk.) Phytopathologische Zeit. 36 (1989) 401-408. (In German)

After dealing with the laboratory rearing of L. abietis, sucking behaviour and sucking effects on leaf tissue, the authors describe work on the secretion and composition of the saliva. L. abietis was labelled with 3H by placing them on larch branches soaked in a Na23H(D2O) solution (specific activity 1 mCi/ml). Maximum activity was reached after 34 h and radioactivity could subsequently be transferred by lice allowed to suck non-radioactive needles. Measurements indicated that the mechanism of saliva excretion is similar to that observed for Myzus camperi, i.e., a phloem-nectar. In order to investigate the influence of sucking on the metabolism and physiology of the needles, variously damaged needles were placed in a 3H-labelled solution. Autoradiography showed that much less 3H was deposited in regions of chlorotic spots than in undamaged portions.


An investigation by means of plant physiological methods was made into the reaction of plant tissue to the penetration by and feeding of plant lice. Results showed that spontaneous primary reactions and long-term secondary reactions must be distinguished. Data on the mechanism of saliva secretion were found by the use of a tracer, 3H. In phloem-feeding aphids (Myzus ascalonicus Donac.), saliva is secreted only with insertion (6-8 min) and retraction of the stylets, and not in the intervening time no matter how long the insect may feed. In contrast to this, panmyzus-feeding scenario occurs more or less continuously and the fundamental differences between the two types of feeding are discussed fully. The mutual effects on plant and aphid, with a panmyzus-feeding species, are illustrated by histochemical and physiological methods. The spread of saliva in the plant is described in detail, using autoradiographic and x-ray techniques. Distribution occurs preferentially along veins of the leaf. On heavy infiltration the saliva is distributed uniformly over the entire leaf surface.


The course of saliva excretion was followed by means of 3H-labelled aphids (see Kloof, earlier work, publ. 1960). The increase in radioactivity of aphids on radioactive Allium schoenoprasum L. was measured in terms of the time elapsed from the penetration of the membrane into the plant. Within 10 min, 5-10% of the aphids already showed appreciable activity. Several hours are required, however, before all sucking aphids show increased radioactivity, thus indicating that they have reached the phloem, and that food uptake has actually started. The interval was measured between tracer uptake via food plants from the plant, and in elimination after recovery by the intentional or by reaccretion from the railway giant, Results are discussed in their bearings on the transmission of plant diseases (VirI) by sucking insects.


Myzus persicae (Sulz.) has recently become an important pest of tobacco in the United States, not only excreting honeydew on which some moulds develop but also causing yellowing and mottling of the leaves on which it feeds. In experiments carried out in N. Carolina in 1954, 3P was used to determine whether
the substances injected by this aphid into living plants are translocated. Aphids that fed on tobacco plants growing in soil treated with an aqueous solution of radioactive phosphoric acid became radioactive, and the tracer was found in their honeydew. It was also found in leaves on which the aphids had fed, into which it was probably injected with the salivary secretions. The P32 introduced into the leaf by the aphid was translocated to other parts of the plant, and part of the injury to tobacco caused by M. persicae may thus be due to translocation of injected salivary secretions. (RAE-A: 43: 306, 1956)


The thistle plant was labelled by placing a solution containing P32 in a hollow cut into the pit of the main stem. The amount of uptake of P32 from the plant by aphids, Aeplophora sp., and other insects was measured. The series of transfers of P32 and the level of labelling of various insects was noted. The metabolism of radioactivity in predators in units roughly equivalent to the average radioactive level of the prey was observed and termed "unit predation concentration". The status of several insects was determined by using unit predation concentration to identify their activities. (RAE-A: 50: 707, 1956)


Adult nymphs of M. persicae were fed on leaves containing P32 after fasting. The weight of sap imbibed by the aphids after varying feeding times was estimated, assuming that P32 is uniformly distributed in the leaf tissues. The results are used in a discussion of the mechanism of sap transmission from plant tissues. (auth. summary.)

Jandl


In experiments on the transmission of the witches' broom disease of beech by Orusia argenticans (Svan) in Australia, transmission was somewhat irregular, and since a similar irregularity had been reported in work with other Jassids, tests were made to determine whether variations in feeding might be the cause and whether feeding was modified by routine procedures in handling. The method adopted was to confine the Jassids in cages on the leaves of young beech plants that had been kept for 24 h with their roots in a culture solution containing tracer doses of sodium dihydrogen phosphate prepared with P32 and to transfer them to a normal culture solution prior to observation, or to feed them on a solution of salt incorporating the radioactive material. O. argenticans ingested P32 incorporated into the plant, and excreted approximately 66% of the amount ingested within 30 minutes after feeding had begun. The total amount ingested increased directly with the feeding period during an experiment lasting 3 days. There was considerable variation in uptake between individual Jassids, but the differences were usually insufficient to account for the observed differences in ability to transmit the virus. No evidence of transmission of P32 as another plant was obtained. Anesthesia by CO2 had little or no effect on subsequent feeding. Survival for about 30 minutes before feeding slightly increased the amount ingested in a 39-minute period. The pH and the sugar concentration of the artificial diet did not significantly alter the amount ingested. (from RAE-A: 41: 404, 1955)

Lygus


Lygus orbiculatus were made highly radioactive by feeding them on sucrose solution to which radioactive phosphorus had been added. Techniques and precautions to avoid contamination are described. On subsequent feeding on bean (Phaseolus vulgaris L.) pods the insects transmitted their radioactivity at the feeding site by chewing and by radiographs. The results offer strong evidence that on feeding oral secretions are injected into the host tissue.


The quantity of saliva injected by Lygus orbiculatus (day) into bean tissue during feeding was determined by the use of P32. Adult male were fed on sucrose solutions containing large amounts of P32 until they had taken up amounts equivalent to about 6 prepared as previously described as soon as possible after feeding of the bean tissue it was then kept at periods of about 20-120 min, length of the feeding period. * the proboscis inserted into p

Nourtte, T., Reish, L. IN HOGS IN WHEAT KERNELS.

In the course of investigations for the feeding of flour (Pulsatilla eberi) was shown to be light in a chamber containing with wheat ears at various stag. L. repugnans. Positive radii at the millary stage and 5 at the the whole kernel, indicating d feeding point. Of the few that activity was strong at the first grains injured at a very early a leaves into the wheat kernels was unsatisfactory results. The cow the background, and this is are that CM was present in the car maximum concentration of pos D. haccame, 1 400, 1


The interaction between fungicides to study the feeding habits of L. repugnans, was unsatisfactory solutions. 0.05 - 0.25 of p of s of cell sap were sucked up. 7 missing units Ag11, and CM3

West African Caso Research in INSTITUTE, APRIL 1952 - MAI

Work described by R.M. Lister means of radioactive phosphorus transmission he said on the crop plants did not pick up P32 and s

West African Caso Research in INSTITUTE, 1965-66. 29, 16

The report contains numerous it facts nympha and adults compar Epidemics of Lygus on cotton and studies populations were found between large males beling to about noon, and move in the cotton fields built by an
Aphids that fed on tobacco plants contain radioactive, and which the aphid had fed. Into which eaten by the leaf by the aphid was said to be caused by H. persicae (may thus be, 1945).

35 Direct-Plant Relationships

In a hollow cut into the pistil of the Phlox sp., ants, and other insects of various insects was noted. The to the average radioactive level in the fruit of several insects was noted. (B.A. 30: 7037, 1985)

36 Persicae (Sulc.) on Radish

25 gesting. The weight of sap inhibited by 4 is uniformly distributed in the leaf transmission tissue of plants

Feeding of the Jasid Crotalus

Feeding by Crotalus crassus (Eben) has been reported to cause the death of young larvae in feeding in the presence of foliar radioactivity. It was found that the leaf and the root tips of the plant incorporated the leaf, and entered approximately 36 hr later. There was some indication that the leaves of the plant had to be removed in order for the leaf tips to reach the plant. In this case, the calculation was based on comparison of the results obtained for the observed 4 of the leaf blades to another plant obtained under the same conditions. The calculation for about 30 minutes before the 45 minute and the sugar concentration (from RFL-A 41: 404, 1985)

37 Host Tissue Through the Oral

38 Increase solution to which radioactive coagulation is determined. On subsequent radioactivity at the feeding site as intensive on feeding oral secretions

39 Quantity of Oral Secretion

40 Type-4 Thompson Inst. 15, 9 (1933)

41 Mass during feeding was determined by measuring of 45P until they had taken up amounts equivalent to about 500,000 cpm, and after a precocious period, transferred to bean tissue prepared as previously described. Saliva was collected from them with a micropipette under the microscope as soon as possible after feeding. From the radioactivity per unit volume of the saliva and the radioactivity of the bean tissue it was calculated that volumes of 0.63G-2.5 ml of saliva were injected in feeding periods of about 20-100 min, but the amount of activity imparted was not directly associated with the length of the feeding period. The insects are apparently not necessarily feeding during the whole time that the proboscis is inserted into plant tissue.


43 In the course of investigations in Finland on the way in which cereal bugs injure wheat grains and reduce the bailing quality of the flour, specimens of Polyommatus hirtus (L.) and Lycus nigripennis (Perg.) (Perg.) (Perg.) (Perg.) were allowed to feed 1-6 days on leaves of Cana inerta. The saliva was removed by exposure to light in a chamber containing CO2, prepared from a compound of C4, and then enclosed in bags with wheat ears at various stages of ripeness. Most injured kernels were obtained from the bags containing L. nigripennis. Positive radioautographs were obtained from 16 of these, 10 of which had been injured at the milky stage and 8 at the yellow stage of ripeness. In all of these, radioactivity was distributed over the whole kernel, indicating distribution of oral secretions, and in two it was relatively greater at the feeding point. Of the few kernels injured by D. bacaccarum, seven gave positive radioautographs. Radioactivity was strong at the feeding points, but evidence of spread of oral secretions was found only in two grains injured at a very early stage of ripeness. The great dilution in radioactive concentration during transfer from the leaves to the wheat kernels resulted in measurements in the kernels difficult, and the C4 counter gave unsatisfactory results. The counts for all wheat samples, including the controls, differed significantly from the background, and this is attributed to the presence of the natural potassium isotope K42. On the assumption that C4 was present in the carbon of the saliva in the same ratio as in the body, it is calculated that the maximum concentration of possible proteolytic enzyme (containing about 50% carbon) in the saliva of D. bacaccarum was 1.40 x 106. (RFL-A 42: 376, 1954)


45 The interaction between fungus spores and certain labelled toxoids was studied. Isotopes were also used to study the feeding habits of Lycus inermis, which does severe damage to crops. Deposition of toxic saliva was suspected and investigated by marking the insect with 45P (feeding treated sugar solution). 0.95 - 0.25 ml of saliva were found to be excreted at each feeding while 0.2 - 0.3 ml of cell sap were sucked up. The quantity of fluid ingested by the insects on feeding was determined using 45P and 14C.

Mealybug


47 Work described by H.M. Lister in this report included the development of a method for determining, by means of radioactive phosphorus as orthophosphoric acid, whether Pseudococcus nagelii used in experimental transmission has fed on the source plant; in turn, some of the mealybugs that had apparently settled on the plants did not pick up 45P and so may not have fed. (see RFL-A 4: 76-82, 1958)


The report contains numerous studies on mealybugs. Observations on their movements showed that first-instar nymphs and adults comprise over 50 and less than 5%, respectively, of the mobile population of Pseudococcus nagelii on cocoa trees. Mobile individuals occurred at all levels, but 85% of both moving and static populations were found in the canopy. Over a period of four months, significant positive correlations were found between numbers of mobile mealybugs and temperature and, to a lesser extent, hours of sunlight, but not with changes in the evaporation capacity of the air. Sunlight begins to penetrate the canopy at about noon, and movement continues from then, probably in response to increased temperature in the canopy tens built by the colony, until about 12 p.m., with a maximum at about 5 p.m.
It was confirmed by the use of metallography rendered radioactive with $^{32}$P that movement occurs from tree to tree through the canopy where the branches intersect.

Mites

Rodriguez 1954 - [301]

Licecesting 1960 - [468]

Mosquitoes

Jenkins and Knight 1950 - [61]

Jenkins and HUEtt 1961 - [120]


In studies at Churchill, Manitoba, various spp. of northern flowering plants took up and retained $^{32}$P when their stems are put in a $^{32}$P solution. Aedes communis males and females visited flowers and ingested plant juices and nectar as shown by their accumulation of $^{32}$P from the activated flowering plants. This fact lends indirect support to the hypothesis that some nocturnal mosquitoes, observed to visit and probe flowers, may be able to produce viable eggs without a blood meal. (auth. - A.S.W.)


Under laboratory conditions Aedes communis males and females visit $^{32}$P-labelled northern flowers and ingest plant juices and nectar as shown by their accumulation of $^{32}$P from the activated flowering plants. Northern mosquitoes have frequently been observed to visit and probe several species of Arctic and Subarctic flowers. Proof in the present study that the mosquitoes ingest plant juices lends indirect support to the hypothesis that some Arctic mosquitoes may be able to produce viable eggs without a blood meal from a mammalian or avian host. (from auth. summary)

Thrips

Klaft, W., Rubandt, P. ZUR FRAGE OBSE SPEICHELEINJUSIONEBT ZIMMERS von THrips tabaci LIND. (THYSANOPTERA, TEREBRANTIA) (The problem of saliva injection during the sucking process of Thrips tabaci Lind. (Thysanoptera, Terebrantia). Naturwissenschaften 46 (1959) 560-7. (In German)

By means of radioactive labelling a glandular secretion was shown to be not intensely a lubricant for the mouth parts but to be released into the plant during sucking. Adults of Thrips tabaci Lind. were left for about 24 hours on cut chives (Allium cepa L.) placed in a radioactive phosphate solution. A measurable quantity was taken up by the thrips which were then transferred to muslin filter paper to get rid of external radioactive contamination. They were then caged in single-layered allium epidermis strips by means of glass rings. The thrips then punctured some cells. After various intervals, the allium epidermis was carefully cleared to remove any radioactive fascia. Subsequent autoradiography showed clearly that radioactive saliva had been injected into the tissue. Individual points and also their distribution were recognizable. A contact-autoradiography is shown of an allium epidermis which had been sucked by Thrips tabaci Lind.

Day and Izykiewicz 1954 - [302]

Varyours


$^{32}$P was added to the river in order to follow its translocation. One section of the report deals with the uptake of $^{32}$P by 7 invertebrates, amongst them the black fly Simulium, the stone fly Pteronarcytes, the caddis fly Brachycentrus, the burrowing may fly Hexagenia and tabanids. Differences and fluctuations in the rate of uptake are described. Corrected counts per min per g are tabulated and discussed.

Ball, R.C., Hooper, F.F. (1959) IN A MICHIGAN TROUT STREAM. (auth. - A.S.W.)

Ball, R.C., Hooper, F.F. (1959) IN A MICHIGAN TROUT STREAM. (auth. - A.S.W.)

Results are compared with the uptake to the amount of $^{32}$P also studied. The work on the

Sorokin, Yu.I., Meshkov A. BESPOK PHOTOFOTOGRAPHAIO. 1201, projected photomicrograph. The new method for making touch prints is being studied. The results are promising. The method is being tested in the field.


A suspension of Bentonite containing matter, and 1.5% of the material was found to be also


Six bees were trained in a dial distribution of radioactive at 62% of the foragers and 16 to 20% of the foragers and 40 to 60% of all ; radioactive than the house bee unmarked cells were radioactive. The bee found this similarity another method which would enable slow-moving bees of a honeybee colony

Cerite, E., Edmondson, R.L., H. HONEY BEES AFTER INSEPTIC

Caged drone honey bees, with a screen to prevent bees from escaping, it can be inferred that the drone for an essential growth factor.
(A report was also published as AECU-5270, Bureau of Entomology and Plant Quarantine, Dept. of Agriculture, 1960, pp.)


In a series of experiments, honey mixed with a radioactive isotope of iodine (Na131) was fed to colonies of several species of ants and the rate of intraspecific transmission of this substance studied. Striking interspecific differences were noted, from very limited, almost negligible exchange in the myrmicine Pogonomyrmex badius (Lat.), to rapid transmission leading to near or complete colony saturation in the myrmicine Cataglyphis bombycina (Say) and species of the formicine genus Formica. An unexpected additional discovery was that the nest queens and larvae were often the last individuals to receive honey and, as a rule, received less than the individual workers. (auth.)


Honey water was labelled with 3H, at a dosage which gave measurable activity even on very wide distribution of the labelled food. Measuring techniques are described. One individual faced food to 8-10 fellow ants, 1/3 of the food being given away within 15 seconds. Group experiments gave varying results, not only depending on the size of the group but of the ants to be fed, the allocation of food being proportional to nest age. In Camponotus ligniperda (Lat.) distribution of essentially rather liquid food was found to be much more rapid which was also the case in Formica pruinata Ratz.


3H was given in food or by injection into the hemolymph. The distribution of food was investigated, particularly in a group of Formica rufa. A worker ant can directly take food from the crop of a fellow ant, the contents of one crop being ultimately distributed between 90-100 animals. Winged and unwinged females, and males participate in distribution. Further problems studied were the speed of distribution, the effect of animal size on allocation, trophallaxis and general behavior. Relations between social parasitic ants and their hosts and also myrmecophytes were also investigated.

51 Gusswald, K., Klopf, W. RADIOBLOGISCHE UNTERSUCHUNGEN AN STAATENBLINDEN INSEKTEN (Radiobiological investigations on colony-forming insects) Tropenwiss. (1957) 137-19. (In German)

Metabolic processes of insects were investigated by which animals in a particular insect colony are maintained as worker or soldier members instead of becoming sexually potential. 3H-labelled worker ants of known activity were placed with 1-200 unfed fellow ants. The radioactive of every insect was measured individually at various intervals. The level of measurable activity made it possible to gauge, both qualitatively and quantitatively, the extremely wide distribution of ingested radioactive food available from one insect. Excess (primary, secondary, etc.) and speed of distribution were a function of temperature. Both imaginal males and workers in developmental stages receive newly ingested food whereas queen larvae are fed with superior gland extract. Winged males also work actively in food distribution. An interchange between nursing ants and larvae (trophallaxis) was confirmed. Queens also release food to workers. Individual food requirements are much greater for bees than for ants; food is quickly stored and distributed throughout the entire organism. Drones also actively participate in passing on food to worker bees. The termite, Calotermes flavissimus, does not show a genuine caste system. The allocation of work by supplying food is described at the different developmental and social levels. Distribution of food brought in by few individuals was relatively rapid, though much slower than among bees or even ants.

52 Gusswald, K. EINFLUSS IM STUDIEN (New data on colony distribution) (Institute for the study of colony distribution) Tropenwiss. (1957) 137-19. (In German)

The paper is a summary of new distribution data in a series of pap individuals as well as with stock, existing in the case o...

53 Gusswald, K. DER AUSBILDUNG. The paper is a review of the the colonies, and different develop parameters, obtained within structure, within an ant colony.


After discussing techniques (of calculation) the data thus obtained in the new species (Polymerus Forskal.) is described. Concentrated in the crop, the high activity was found in the crop on various factors (and ultimately be reached). 3H of food released; the latter is accepted by queens although in food transformation. Some ph...

55 Gusswald, K., Klopf, W. (Radiotrace studies on forest ants) The distribution of 3H-labelled transmission process of the crop (24-30°C) the contents of one transmission to 6-8 workers, a 3H also participate. Given a gland extract. Similarly, the Distribution among workers...

56 Wilson, E.O., Elsner, T. O. ECONOMICS Sociales 9 (1957) 137-19. (In German)

Transmission of honey in seven species between strains of Pogonomyrmex badius): in these most among workers, very it suggests the occurrence of a... (auth. summary)
The paper is a summary of results obtained by means of radioisotopes, and published by the author and his collaborators in a series of papers. They concern the exchange of substances between different castes and individuals as well as development stages in social insects. An analysis is also made of the intercaste relations existing in the case of different types of hosts as well as for social parasites and ants.

The paper is a review of the intercaste exchange of substances which takes place in labelled ants between different castes, and different developmental stages, and also between the ant population and its hosts and social parasites. Results obtained by means of the radio-tracer technique allow further insight into the sociological structure within an ant colony.

The practice even with very wide distribution of individuals was found to be very selective. Various groups of individuals took up labelled food at different rates. Food was more often taken up by workers than by other castes. The amount of food taken up by each caste depended on the amount of food available and the number of workers present.

After discussing techniques (radiation sources, application of radioisotopes, measurements and methods of calculation) the data thus obtained on the distribution of food among ants is described. A number of subfamilies were used in the study. The distribution of labelled food in the individual caste (here, Formica polyctena F.) is described. Inscription only takes place in the mid gut, whilst reaggregated food is concentrated in the crop. Contact-autoradiography was used for following distribution with time; a very high activity was found in the labial gland. Food transmission within a group of workers (speed and extent) depends on several factors including temperature (opt. 20°C) and the size of the group: uniform distribution will ultimately be reached. The polymorphism within the worker caste has a direct influence on the quantity of food received; the larger ones appear better fed both quantitatively and qualitatively. Reaggregated food is accepted by queens although they normally receive gland-secreted food. This males participate actively in food transmission. Some problems of staphylinae are discussed. Uptake of labelled material by nursing ants and vice versa is confirmed. Special characteristics of different types of ants are also studied (independent and social: parasitic types).

The distribution of P32-labelled food (honey water) among workers of the red forest ant was studied. The transmission process of the crop contents is a function of time and temperature. At optimal temperature (24–20°C) the contents of one single crop may be distributed amongst 80 workers, with a direct primary transmission to 5–9 workers, at most. Distribution is Gaussian. Winged and descended queens, and males also participate. Given a sufficiently large number of workers, the queens are fed with high-quality gland extracts. Similarly, larvae destined for a sexually active life are also given preferential treatment. Distribution amongst members of different species of Formica was also studied.

The transmission of honey in several species of ants was studied using 14C as tracer. Great variation in transmission rates between species was noted, ranging from negligible transmission over a 10-day period (in Pogonomyrmex barbatus) to complete colony saturation within 20 h (in Formica ssp.). The honey was passed mostly among workers, very little being given to the queens or larvae. Indirect evidence is cited which suggests the occurrence of chain transmission beyond the primary donations given by the original forager.

(data summary)
I-A-2-c GENERAL BEHAVIOUR

Termites

Albin, H. LES ÉCHANGES TROMPHALLACTIQUES CHEZ LE TERMITE À COU JAUNE (CALOTERMES FLAVICOLLIS FABR.) ÉTUDES À L'AIDE DU PHOTONPHÈRE RADIOACTIF (Tromphallactique exchanges in the yellow-nosed termite Calotermes flavicollis fabr., studied by means of radioactive phosphorus).


By means of feeding filter paper soaked in 32P to homogeneous groups of termites, all larvae and nymphs from the third instar onwards could be shown to feed independently. First stage larvae and soldier termites absorb no food, and second stage larvae only very small quantities. Three-year-old, sexually potent adults are able to feed independently, but only after having been separated from the larvae for 55-75 h. Tromphallactic exchange takes place surprisingly slowly. When radioactive termites in the ratio of 1:10 are added to normal colonies then the level of radioactivity found in the insects is 40% after 12 h, 30% after 72 h and only reaches 100% after about 36 h. The older larvae and young nymphs play the most important part in tromphallaxis, in the sense of "chewing the cud".


Laboratory and field experiments are briefly recorded in which radioactive labels in the form of sodium sulphate were attached to late stage larvae, thus permitting their detection at a distance of about 2 ft. Positions of larvae were recorded at intervals of several days. They are able to travel as much as 31 feet in 2 days. It is tentatively concluded from these preliminary experiments that ladybird larvae, while capable of making a thorough search of their surroundings, may be insufficient in finding their prey, which may be an important contributory cause of the high mortality suffered by the early-stage larvae.


For studies on the behaviour of small newly-hatched Coccinellidae on plants, the radioactive material is too small to suit for external application as small labels, yet have a sufficiently high specific activity for easy detection with a G-M counter from about 1 ft away. Radioactive labels are too large to see on first instar coccinellid larvae, and tantalum (Ta-180) was used instead, which has a half-life of 18.4 d, and emits a high-energy γ-radiation. The method and apparatus used for attaching labels to larvae are described, and experimental details (dimensions, etc.) given. Labels of two levels of radioactivity were used on 1st instar larvae of Coccinella septempunctata L. (250 μc/mg and 42 μc/mg). In the first case, the larvae became less and less active, ceased feeding and after 2-3 d died without molts. The lower activity caused no noticeable effect on growth and behaviour, nor did the approximately 24% increase in weight due to the Ta-strip.


As the survival of a larva depends primarily on the ability of its 1st instar to find aphids, observations were made on larvae recently dispensed from their egg shells. The species studied, Adalia bipunctata L., Coccinella septempunctata L. and Propylaea quatuordecimpunctata L., are common predators of plant aphids and others. Larvae were either labelled with metal foil discs containing sodium sulphate or with strips of radioactive tantalum (Ta-180). The behaviour of the larvae appeared to be rather random in their search for food, and it is considered likely that in areas of low prey density many larvae, especially newly hatched ones, die of starvation because they do not find food. Larvae which encountered aphid colonies tended to remain near them, because after feeding they made small running movements from side to side, which increased the chance of meeting another aphid colony. This behaviour differed from that before feeding. Larvae, especially the 1st and 2nd instar, took a comparatively long time to consume aphids and, in the field, one of them was prevented from feeding on an aphid colony by the attacks of their attending ants.

Fuller et al., 1961. - [388]
ECOLOGICAL SURVEY OF THE MOSQUITOES OF GREAT WHALE RIVER, QUEBEC.
Jenkins, D. W., Knight, K. L.

Fifteen species of culicids were collected from tundra, alpine, and northern conifer forest habitats. The breeding habitats, dates, adult activity and biting habits are presented for each species. The most important pest species were Aedes communis, A. pullatus, and A. exorectus. Radioactive (95) C-test pools were used and acquired radioactivity measured in the mosquitoes. Odonata nymphs and some cubital adults were observed exiting larvae of A. pullatus in the field. Dytiscid and greatleaf larvae were observed pursuing larvae of A. pullatus and A. communis in the field, and eating them in the laboratory. Large dytiscid larvae showed a radioactivity of 8.5 mCi/m in a radioactive pool which indicated that they fed on radioactive A. pullatus and A. communis larvae.

Kawano, P. E.
Fifty widely-separated groups of larvae of this hypogaeus ant were studied in a swamp in South East Michigan. Honey mixed with 32P was placed in a mound of each group to determine whether or not each mound represented a separate colony. The honey was quickly fed upon by workers of these mounds and passed to other members of each colony. Within 6-8 h food had spread throughout each colony. Sampling of adjacent mounds indicated the presence of radioactive ants in some of them. Occurrence of radioactive ants in nearby mounds indicated that some mounds are interconnected by tunnels. Thus, a colony may occupy one or more mounds. (Auth.)

WIREWORM BEHAVIOR IN RESPONSE TO CHEMICAL SEED TREATMENTS.
Long, W. H., Libby, J. H.
Orientation reactions of the wireworm, Melanotus communis Gyll., to various insecticide seed treatments were studied by following the movements of individual larvae tagged with Cr51 in the soil. It was found that the repellency of certain insecticide seed treatments to wireworms apparently has two components: (1) inhibition of the feeding reaction, and (2) orientation of the insects away from treated seeds. For conveniences these are referred to as type one and type two repellency, respectively. Type two repellency does not preclude exclusive with treated seeds, and varies in degree depending on the insecticide used. Aldrin, Dieldrin, endrin, heptachlor and Lindane seed treatments all proved to possess considerable type one repellency. Type two repellency was most pronounced with Lindane-treated seeds, and with Aldrin-treated seeds where this insecticide was not used in excess of 1 oz of nuclear toxoids per bushel of seed. Dieldrin, endrin and heptachlor seed treatments showed a degree of type two repellency intermediate between Lindane and Aldrin on the one hand and untreated control seed on the other. (Auth.)

RESULTS FROM STUDIES ON THE ENGELMANN SPRUCE BEETLE (PENTOCRUMUS ENGELMANNI) IN 1955.
Nagel, R. M., Davis, J. M.
The device described here was used in the treatment of about 10,000 beetles with 14C-1. The beetles were treated in batches of about 1000 each, and the entire lot treated and released in about 2 hours' time. Mortality, as indicated by those remaining in the trays the following day, was about 1%. This loss was not considered excessive as many were in poor health when treated. The treated beetles were fairly easily located beneath the boughs of trees, by use of portable illumination, and killed a period of about 6 weeks following the treatment. At this time the radioactivity of the isotope was only about one fourth of its original value. About 8% beetles (ca. 0.56) were later relocated by their radioactive tag. A few tagged beetles were examined by peeling the bark from over them. They appeared to be making typical galleries and laying eggs in typical numbers. Indicating that little adverse effect had resulted from their treatment.

FRUIT INSECT BEHAVIOUR STUDIES AIDED BY RADIOCCITOPES.
Rings, B. W., R. E., Ohio State Exp. Sta., 729 (1966) 50-60.
A solution of at least 50 µg/ml of 32P was required for labelling peach terminals. Plum curculios (C. fructicola nemophilus) then reached an activity of 5 mCi/ml within 3-4 d, 32P being present nearly throughout the body. No mass movement of the curculios into the centre of the orchard from the outside rows bordering woodland was indicated. The greatest proportion of hibernating curculios can be found in the orchard rather than in the adjoining woodland.

Laboratory-reared Malathion-resistant flies (Goudey) were tested for any behavioural resistance in terms of an avoidance reaction to Malathion and Dipersent baits. The baits, which contained 3% toxicant, and the plain sugar standards were mixed with P₂O₅-phosphate acid. Mortality was determined at 24 h. The Malathion bait killed 80% of the Goudey females, 80% of the Goudey males, and 100% of the normal flies. All the flies of both colonies were killed by the Dipersent bait. No mortality was observed with the sugar control. Both physiological and behavioural reactions to Malathion were involved in the survival of the Goudey females. The results of the test with Dipersent bait ran on female flies only, showed no such evidence. The laboratory experiments are not strictly comparable with field conditions.

I-A-3 POPULATION DYNAMICS (DISPERSEL, FLIGHT RANGE, ETC.)

Cockroach


87 Rings 1964 - [263]

Cockroach


Studies of this type have assumed increasing importance since the cockroach has been proved to be a potential vector of several human diseases (among them poliomyelitis). Its capacity for transmission needs evaluation under varied field conditions. Movements of Periplaneta americana from sewer manholes were studied by a trap, mark, release, and recapture technique using print and Po³² (about 1000 c.p. of 500 c.p. per group of roaches released). In experiments where only the resident manhole population was marked, very limited emigration was observed, only 4 of 600 marked cockroaches being recovered by intensive trapping in yards, lobbies and neighbouring manholes. However, when 1200 marked roaches were super-imposed on a resident manhole population of 300, 71 tagged individuals were recovered within 15 min: 1 in a home, 5 in yards, and 65 still in the sewer system at distances up to 380 ft. from the release point. This suggests that a sudden increase in population over that of the carrying capacity of the environment may dictate emigration from the centre of pressure.


Cockroaches are known to be capable of harboring Salmonella for several days, the collection of Periplaneta americana (L.) contaminated with 3 species of Salmonella, from sewer manholes in Texas was reported by R.S. Bihler and C.B. Williams (1946, and J.T. Syversen and others (1950) recorded the isolation of 4 strains of poliomyelitis virus from P. americana, Bipolaris americanum (L.) and Syncarpa coelocistum (Sow.) caught on the premises of patients ill with paralytic poliomyelitis. The movements of P. americana in and from city sewerage systems, which might affect its importance as a transmitter of disease, was studied at Phoenix, Arizona, in Oct, 1963. Surveys at 39 manholes for 7 weeks had shown a weekly average of 92-143 cockroaches, all of this species, whereas the predominant cockroach in dwellings were S. coelicocilium and B. germanica. Some 500 individuals of P. americana were trapped in several manholes, marked with radioactive phosphorus by spraying with a solution containing 5% radio- and 10 mc P₂O₅/ml, and released in 4 manholes. During the next 81 weeks, traps at 8 of the release sites yielded 929 cockroaches, of which 90% were radioactive; 34 traps in other manholes of which most were less than half a mile and the others up to one mile from the release sites yielded 18,921 cockroaches, of which none was radioactive, and 10 traps on premises 8 blocks adjacent to the release sites yielded only one cockroach which was radioactive and was caught 60 ft. from the nearest release site. The lack of evidence of movement was surprising in view of an observed tendency of the species to disperse and the likelihood of induced population pressure at the points at which the cockroaches were released. (RAE-B 43: 150, 1965)

Nagel, R.H. INFLUENCE OF THE GERINGMANN SPRIGS ON THE RATE OF MIGRATION OF DROSOPHILA MELANOGASTERS. By means of flight mills, rigid tubes, adverse effects of tagging on flight in the case of insects was studied. There is circumstantial evidence to rule out the possibility of the method being used in the case of insects. (RAE-B 48: 32, 1960)

91 Hartwell, W.V., Gart, S.F. HOSTS; A MECHANISM FOR ENSURING PICKEREL FISHES FOOD SUPPLY. There is circumstantial evidence to rule out the possibility of the method being used in the case of insects. (RAE-B 48: 32, 1960)

92 Haines, W. A STUDY OF TRICHOPUS DOMESTICUS L. (1868) 279-72.

The following is based on the (Musca domestica L.) we are in 1964 to investigate the effect whether houseflies dispersed I tagged by feeding of P₃₂ in a indicated that houseflies on farmstead to another in approximated the need for community studies.

93 Jankowski, D.W. A CHEQUE AT 95-162.

Although some results are presomitive, the article is readily present in research on diseases.

94 Lindquist, A.W., Yabes, W.P. SPECIES OF FLEAS TARGETED W THOSE SPECIES OF FLEAS WERE RELEASED. A total of approximately 1,260 Phlebotomus regius (Meig.) were caught in the traps: P. regius. P. regius comprised 100% of flies caught. Most negative release point. Traps set in haygrass fields. The use of radioactive
Nagel, B. H. 

By means of flight mills, flight performances with captive beetles were recorded and compared for (1) possible adverse effects of tagging solutions used earlier in dispersal studies; and (2) the influence of nematodes on flight in the case of infected specimens. (See Davis and Nagel, 1956)

**Flea**

Hartwell, W. V., Quan, S. F., Scott, K. G., Kurten, L. 

There is circumstantial evidence that fleas of ground-squirrels can transmit plague bacilli from wild rodents to rats in rural areas of the western United States, and the development of a method for tagging fleas with radioactive colloid (Co-54) made possible the direct investigation of the transfer of fleas from host to host. One male and two female voles (Microtus californicus), marked by clipping their toes, were placed in one of a number of experimental plots simulating field conditions, in which they could establish nests; 10-40 radioactive fleas (M. scutulata (Boisduval), I) were put on each of them. The animals caught in traps set each day were lightly anesthetized and any fleas were removed, examined for radioactivity and returned to the hosts. Fleas were found to have transferred from one vole to another in all of five trials and were found in nests from the three trials in which nests were established. In a second type of experiment, none of 30 tagged fleas on three voles transferred to three rats (Larinae norejopeus), kept in an adjacent enclosure, while the voles were alive. After the latter had been killed, seven fleas moved to rats that were allowed to enter the area with the dead voles, but no transfers were noted on three new voles put in the enclosure after the rats had again been removed to the adjacent cage. Of 50 tagged fleas put on the new voles, 16 moved to rats in the same area. None of the 60 fleas was found in the nests of the voles. Radioactivity was twice detected in the Microtus faces and once in rat faces. (RAE 848: 92, 1976)

Haner, W. 
**A STUDY OF THE ENVIRONMENTAL FACTOR AFFECTING THE DISPERSION OF HOUSE FLEAS (MUSCA DOMESTICA L.) IN A DAILY COMMUNITY NEAR PORT WHYTE, MANITOBA.** Canad. Ent. 88, 6 (1956) 577-578.

The following is based on the author’s summary and conclusions. Two releases of radioactive houseflies (Musca domestica L.) were made in a dairy community near Port Whyte, Manitoba, during the summer of 1953 to investigate the effect of wind direction and wind-borne odours on dispersal and to determine whether houseflies dispersed from one farm unit to another within the experimental area. The flies were tagged by feeding on Na-23 in aqueous solution saturated with sucrose. The captures from the two releases indicated that houseflies orientate themselves wind-borne odours from farmlands, and migrate from one farm unit to another in appreciable numbers even in weather that is not optimal for flight. This suggests the need for community rather than individual attempts at control.

Jenkins, D. V. 
**UN DISTANCE UNE MOUCHE PEUT-ELLE VOLER?** Naturelisme Canadien 62, 6 (1954) 99-106.

Although some results are presented on the dispersion of flies and mosquitoes marked with radioactive isotopes, the article is mainly a summary of the use of these isotopes in marking insects, fleas and mites and in research on disease vectors and disease organisms. (BA 33: 7816, 1969)

Lindquist, A. W., Yares, W. W., Hoffman, R. A., Kaitz, J. S. 

These specimens of flies were tagged by feeding them solutions of P-32 labelled phosphoric acid and then released. A total of approximately 38,000 Musca domestica (L.), 15,000 Phaenicia sericata (Meig.), and 1,500 Phaenicia regina (Meig.) flies were released, of which the following ratios of tagged to untagged flies were caught in the traps: 1:11 for Musca domestica, 1:70 for Phaenicia spp., and 1:258 for P. regina. P. regina comprised approximately 20%, Phaenicia spp. 15%, and M. domestica 65% of the total number of flies caught. Most of the tagged flies were caught the first day in the traps 0.5 miles from the release point. Tagged flies had moved outward 4 miles in each cardinal direction the first 24 hours after release. Traps set in hayyards caught several times as many houseflies and Phaenicia as those set in open fields. The use of radioactive P-32 as a means of tagging flies has proved satisfactory and reduced the
amount of work in examining large catches of flies over that necessary when pigment dusts are used to colour insects. (from auth. summary)


In a field study of adult populations (unnumbered) it was found that the males emerge slightly before the females and that the emergence period may cover at least 3 weeks in late June and early July. Although the number of males may exceed the number of females at first, the females predominate later in the season due to the shorter life span of the males. The numbers of flies on the wheat fluctuate appreciably throughout the day. During the 1st week of the emergence period the number of flies taken increased steadily throughout the day. After the date of population peak, however, the max. numbers occurred in the crop in the very early morning and the late evening, which suggested a daily flight dispersion followed by a general or localized reman of the flies to the crop. Further study of the data showed that the daily temperature rhythm was only partly responsible for this daily flight dispersion, and that there appeared to be an active return flight to the crop in the evening. Generally the males were more active than the females and did not settle so deeply in the crop. Recaptures of PIII-labelled flies indicated that the extent of the sometimes rapid dispersions was not very great. The females dispersed more than the males, and were somewhat isolated by the occurrence of wheat in flower. Frequently flies were found to have congregated on the lee side of the crop, but other preferred regions had been observed which could not be attributed to wind influence. (from auth. summary)


The use of laboratory-bred blowflies for experiments on release and capture of marked flies is briefly discussed. In an experiment to test the possibility of a rhythmic protein hunger cycle complicating the results when flies with a uniform history of protein hunger are used, no difference was observed in the response to carrion-based traps of groups of flies from whom protein had been withheld for 3, 2, 1 and 0 days. In release experiments the rate of marked to unmarked flies in trapped samples differed irregularly between laboratory-bred and wild flies, apparently depending on whether the climatic conditions at release were markedly or only slightly different from those of the insectary. (auth.)

Hartmann et al, 1988 - [406]

Files

Freeden et al, 1980 - [334]


Four different methods of marking insects are described in detail. Although they have been applied by the present authors only to the British Calliphoridae, they should be of value in ecological studies of mobile invertebrates in general. These methods are: individual marking with paint, mass powdering with dye, radioactive labelling with PIII, and a combination of the last two. A fifth method in which the emerging fly labellates itself with fluorescent dust, is briefly described. The circumstances affecting the choice of method are outlined. Technical details are given concerning the supply and diffusion of PIII, given in a subsequent section. Alternatively, it was added to the drinking water instead. Experiments were made using the following flies: C. erythrocephalus, C. vomitorius L., Lucilia spp.


Employing as marking agents a combination of radioactive chemicals (PII, CaO, and P14) incorporated in their food and a variety of dyes dusted on them before release, dispersal habits of the common species of flies in urban areas were studied. CaO, used as calcium chloride, proved unsuitable since causing considerable mortality among flies marked with it. It was also rapidly excreted, and no dispersal data was obtained for flies marked with it. The iodine caused considerable mortality among male flies. Flies marked

with phosphorus and iodine w continuous and independent c were recovered in vacant or breeding near the city were f an abatior and a garbage on it. From the relation between genus Lucilia (Phaenicia), C. Panius pubis (Wied.) and Jan city-wide and should in some production, from arch, ann


Dispensal tests were conducted by trapping adult fl feeding them with PI4-label, caught. To minimize the ef after it had become too dark in another test in late time, with PI4 to mark the test fl for 24 hours after release, ' unconvincing. The higher per the average belief that it is f at random over an area 8 to from the release point. With where food and breeding may prevent large numbers of file large area is a normal pattern.


In studies of the dispersal of 1951, 51,000 flies marked w from bailed traps distributed 384 marked flies, of which t proportion of radioactive file except that more were taken some flies travelled a m. The number of marked flies the fact that 10% of the in the October were taken two miles practical importance. The o in practice was very high it depends of attraction to the inflitina a part of a community fly cc 1950.


Release of about 3000 marks in Virginia, during 1951 and 15 in 3 d and just over 10 mi within 5 miles of the site of susctation to all parts of the ridge 400-600 ft high or by maximum reduction of E. or prolific breeding 3-4 miles 1 flies was to feed them on
with phosphorus and iodine were separated by the differences in types of emissions. Dispersal was rapid, continuous and independent of direction. Large numbers of Callitroga maculata (P.) and some of all species were recovered in vacant areas considerably removed from major fly-breeding foci. Sources of heavy breeding near the city were found to contribute substantially to the city's fly population. Flies from dairies, an abattoir and a garbage dump situated outside the city moved into all parts of the city and right across it. From the relation between the release and trapping points for Musca domestica L., blowflies of the genus Lucilia (Phaenicia), C. maculata, L. cuprina cuprina (Wied.) (Pollenca shawii J. L. sexes (M.) Fannia pagesi (Wied.) and Sarcophaga ventralis Wulp. It was concluded that municipal fly control should be city-wide and should in some instances include the most important of the immediately currying goals of production. (from auth. summary)


Dispersal tests were conducted with natural populations of wild house flies and Callitroga maculata, obtained by trapping adult flies on the rural premises used as the release points. They were marked by feeding them with 3H-labelled milk. The marked flies were released where they had originally been caught. To minimize the effects of temporary caging, the release of the marked flies was made at dusk after it had become too dark for them to migrate. In a test in early May, only one release point was used. In another test in late June, five release points were used simultaneously. Dyes were used in combination with 3H to mark the test flies. Houseflies were recovered up to 5 miles from the release point in less than 24 hours after release, with a range and pattern of flight apparently quite similar to those of Callitroga maculata. The higher percentages of C. maculata taken in the recovery traps tend to substantiate the general belief that it is the more migratory of the two species. In both tests the flies appeared dispersed at random over an area 8 to 10 miles in diameter, with a few individuals being trapped up to 10 miles from the release point. Within the general dispersal area, the flies tended to aggregate more at premises where food and breeding materials were favourable. The availability of these materials, however, did not prevent a few flies from leaving any given location, indicating that movement over this relatively large area is a normal pattern of fly activity. (from auth. summary)


Dispersal studies of the dispersal range of flies, principally Musca domestica L., made at Phoenix, Arizona, in 1951. A series of 14,000 flies marked with 3H were released in June and 3,000 in September. Catchers made subsequent from baited traps distributed over the metropolitan area in concentric rings of 1,000 traps. A total of 227 and 284 marked flies of 20% and 31% respectively were found within a mile of the place of release. The proportion of radioactive flies in the catches varied inversely with the distance from the place of release, except that more were taken at one mile than 0.5 mile in June and about equal numbers in September. Some flies travelled a mile within 24 h, three miles within 48 h and four miles within 72 h. The numbers of marked flies collected there, four and five miles from the release point were small, but the fact that 10.1% of the marked flies recovered in June-July and 13% of those recovered in September-October were taken two miles from the release point indicates that movement to this distance may be of practical importance. The importance to a community of an area of fly production estimated a mile or more away from it depends on the sources of attraction in the surrounding area. In view of the influence of attractants on the utilization of Musca domestica into an area, removal of these substances is an important part of a community fly control programme or the elimination of breeding media. (from JAE-3 41: 62, 1963)


Release of about 9000 marked adults of Phoria regina (Mg.) from each of two sites in Charleston, West Virginia, during 1951 and 1952, and subsequent trapping revealed dispersal for distances up to nearly 10 miles in 9 d and just over 10 miles on the 4th d, though most of the marked flies recaptured were taken within 5 miles of the site of release. It was shown that flies moved from one zone with a low standard of sanitation to all parts of the city, and that their migration was not prevented by the presence of wooded ridges 400-500 ft high or by watercourses. The findings supported the recommendation that to effect the maximum reduction of P. regina within a community, control operations should be extended to areas of possible breeding 3-4 miles beyond the boundaries of the urban area. The method adopted to mark the flies was to feed them on radioactive milk (containing 1 mc/100 g as phosphoric acid) and then to
dust them with a red or green dye. They were detected in the trap catches by their radioactivity and then treated with aceton to expose the dye characteristic of the points of release. (RAE-B 41: 172, 1956)


The relative importance of five major sources of houseflies (Musca domestica L.) near Phoenix, Arizona, on the control programme in operation in the town was studied in 1953. Flies marked with 234mNa and a dye characteristic of the site were released simultaneously from the 5 sites, and catching stations were operated at the release sites themselves, 0.5 and 1 mile from each site in all directions and 2.5 and 4 miles from each site in the direction of the centre of town. The recaptures are discussed in some detail. The following is based on the authors' summary of the findings. Flies from three sites, two on the periphery of the town and one 0.8 mile away, mostly infiltrated into the town itself, but comparatively few flies from sites 1.5 and 2 miles away did so. Flies from 0.5 to 1.5 miles of the marked flies recovered were taken within 1 mile of the release points and from 1.6 to 2.1% of the distance away that flies moved. Maximum recovery of marked flies occurred at release sites on the first day after release and at other sites on the fourth day. Available evidence indicates that although house flies can travel 5-30 miles, the dispersive capacity of the town population is extended within 0.5-1 mile because of the randomised, nonpalatable type of meandering that characterises housefly movement. One mile is the distance to which it is recommended that fly control operation should be extended outside most communities. (RAE-B 45: 156, 1958)


In continuation of investigations carried out in the summer of 1952, about 147,000 radioactive houseflies (Musca domestica L.) were liberated as a primary release site at Phoenix, Arizona, on 30th Oct. For the next two days, 15 fly traps were operated at three secondary sites half a mile from the primary release point. The flies collected at each secondary site were then dusted with a characteristic dye and liberated. catches at 60 collection stations within 0.5 mile of the primary release point indicated that, although fly dispersion from that site followed a general random design, radioactive flies were captured at a higher rate in one sector of the recovery zone than in the other two. In all, 106 radioactive houseflies were caught. Movement from each of the secondary release sites was random; some individuals reversed their initial path of migration and returned to the general direction of the primary release site. The findings indicate that M. domestica is essentially a species of migratory habits. The flies apparently spend most of their lives moving from site to site not only in search of suitable places in which to feed and breed but also from an inherent instinct to wander. (from auth.)


The report covers a number of fly dispersal studies conducted by investigators in Arizona, Oregon, West Virginia and Georgia. Flies were tagged by feeding on 234mNa-labelled meal-moist or sugar solutions (1 mc/m) of treating for a 24-h period. Dispersal from each site proved random in pattern. Specimens congregate in areas or sites having suitable feeding or breeding sites. In some studies, flies liberated from several sites were dusted with different dyes. It was concluded that flies can move rapidly from site to site; overall movement of the population is from 1-3 miles for Musca domestica. Maximum dispersal distance for this species is 36 miles. Flies generally migrate faster and more rapidly than houseflies. Maximum dispersal distance for Phormia regina is 28 miles. Other species investigated were Callitroga macellaria, Ophyra leucotricha, O. argentesa, Phanecia cuprina, P. sericata, P. casinovittata, P. fasciata, Sciropogon mete, S. bullata, Musca stabulans. In some instances, dispersal measures 0.5 to 1 mile around the periphery of a municipality for housefly control. With slow flies, control treatments 3 to 4 miles beyond the city may be necessary.


The range of dispersal of flies from a garbage dump situated about half a mile from densely inhabited districts of Leningrad was studied between 22nd June and 25th July 1954. Identification of 1500 adults taken on the dump in June showed that Phormia (Protophormia) reginae R.-T., constitutes 52.3, 12.3, 2.9 and 0.5% of the population. Plates of a bait consisting of a liquid mixture of sugar, yeast, flour and water, with the addition of 195 m 1.8 mc/m were exposed 4 x 2 were rendered radioactive. Radioactive example of P. reginae was released. Maximum recovery of flies occurred for up to 20 cm. (In Russian)

86 Shaul-Bura, B. L. EMPLACEMENT DES MOUCHES. J. Hyg.

Cess pools in a town were found to be radioactive. The town was found to be infested in another epizootic populated area, up to 10. (In Russian) (production built around 3 of the stumometry types Violex remained had already been destroyed and results th)

87 Shaul-Bura, B. L., Shalakov SUR LE CARACTERE DE L'EMPLOI DE LA MISE EN LIBERTE.

87 000 exemplaires de mouches de la famille Sciropogon remises en liberté, sans les reprendre en zone de basse densité et 2 000 exemplaires de la espèce Phormia regina en zone densément peuplée. C'est ainsi que la mouchette est la seule espèce récoltée en 3 km par h. (In French)

88 Smith, A. H., Boake, R. C. M. HOW FAR WILL FOURTH INSTAR Nymphs OF MEASLES CRAWL THROUGH TOWS?

The results were obtained suspending 10 second instar n

89 Walder, E. H., Peck, R. C. PROGRAM, Mod. Sust.

754 labelled flies were placed in an additional feeding with d levels of sanitation extinct both communities under the city.

90 Yezer, W. W., Lindquist, RADIOACTIVE PHOSPHOSOLAR

This further study into flies shows, select, and Phormia sp., thus equipped with a thin-wall of traps are given, and the capacity for long flight, a noted for Musca domestica.
with the addition of 1% meat meal and enough \( \text{NaH}_{2}\text{PO}_{4} \) as sodium phosphate to give a radioactivity of 1.0 mCi/h were exposed for 4 d on the dump, and it was found that about 8% of the first two species were radioactively labelled at different distances from the dump, and radioactivity examples of P. terransulae, Musca domestica, Musca nebularis and L. canus were taken at distances ranging up to 2.8, 2.4, 1.3 and 2.86 miles, respectively. Dispersal occurred in all directions, but inhabited districts were the most attractive. It was mainly due to active flight, though many flies were carried up to about five miles on vehicles. (Rae et al. 1986: 510, 1987)


This study further into flight habits was made on laboratory-reared flies which were fed radioactive phosphoric acid. Details are given. The investigation was made on Phorbas pyralis (Holmg.), Musca domestica (L.) and Phorbas spp., their activity ranging from 200 to 6000 cpm/insect. A standard laboratory monitor equipped with a thin-walled Geiger-Mueller tube was used for testing. Details of the type and spacing of traps are given, and the results of the various collections. Both sexes of Phorbas were shown to have the capacity for long flights; a maximum of 8 miles was observed. The remarkable flight range of 20 miles was noted for Musca domestica.
Fruit flies


About 19% of a naturally occurring population of Rhagoletis mavis completa Cress, in a 5-acre walnut grove in California, were labelled within 24 h by spraying small areas of foliage on 15 trees with a water solution including 0.5% of liquid wine protein hydrolysate, containing 0.05 mc NaI/mg. The recovery of radioactive flies in traps situated distances from the labeled trees showed that populations redistributed themselves fairly rapidly through the grove, and that the comparatively mature population there contributed almost 5% of the individuals in the surrounding area, to a distance of 0.19 km, and about the same proportion in an orchard 0.3 km away. At labelled trees were caught almost 1 km away in the third week after baiting, it is concluded that the species may easily spread a few miles in a season under reasonably favorable conditions. In treated orchards, 50% of the females contained eggs, and radioactive eggs were readily collected from the walnuts. (R.A.E-A 48: 518, 1950)

92 Christensen, L. D., Poole, R. H. BIOLOGY OF FRUIT FLIES. Annu. Rev. Ent. 5 (1960) 171-92.

General review article covering representative fruit flies. Mention is made of a radiocontrol study on the movement of female pupae. A naturally emerging male tagged with 32P was recovered more than 20 miles away, with the distance traversed including at least 3 miles or more of open sea.


Investigations in Oregon in 1950 showed that 32P-labeled phosphorus acid could be combined with sucrose as a food for adults of Rhagoletis cingulata (L.) without shortening their life. The flies ingested the food readily, and those with an initial radioactivity of 6000 cpm could be detected for 8 weeks with a portable survey meter. There were considerable variations in the amount of radioactivity retained by individual flies, but 90 selected at random after feeding on radioactive sucrose for 2-4 days showed an average of 3923 cpm. Females that received heavy doses of radioactive phosphorus acid failed to oviposit in cherries, and their excreta and the juice and pulp of the cherries caged with them became radioactive. On 15th July 1951, 2400 radioactive adults were released in a cherry orchard, and captures in traps containing ether-alcohol-water extracts of freshly eaten cherries with an insecticide or insecticides sprayed with phosphorus acid were made until 4th August. All, 98 radioactive individuals were recovered, including 10 from the point of release, 700 ft away and one each 600 and 940 ft away; one was taken in another cherry orchard on the far side of a beet field, 680 ft from the release point.


Three tests were carried out at Edinboro and Fairmont, Texas, in 1951 to determine the extent to which Drosophila migrated from privy pits into houses, using flies marked with 32P. In the first test, treated houses in the pits of 10 privies and marked flies were subsequently recovered in 8 of the 10 adjacent houses. In the second test, flies were trapped, marked, and released in a privy pit; during the following 4 nights marked specimens were recovered in houses and privy pits as far as 500 ft from the release point. In the third test approximately 1000 marked D. melanogaster were released into one privy pit, 5000 marked D. repleta were released in another privy pit 300 ft away. Subsequent trapping indicated that both species dispersed rapidly from the release privies to other privies and houses in a nearby area. Drosophila melanogaster were recaptured as far as 500 ft from the release point and D. repleta almost 1000 ft from the release point. The three tests demonstrated there was extensive migration of Drosophila from privy pits to houses in the area studied. The indications were that a major portion of the Drosophila which were found in the houses had, at one time or another, frequented privies. (sum. summary)


Various methods of marking Diptera with radioactive phosphorus for field-movement studies were tested for use on Drosophila melanogaster Meigen, in the first test, potassium dihydrogen phosphate containing 32P was added to the carrot medium used for routine rearing of the larvae at the rate of 0.1 or 0.3 mc/mg, and 500 eggs were placed on 200 ml of the mixture. Differences due to the two concentrations of 32P were not sufficient to distinguish between individuals from different sources. However, the fruitflies were sufficiently radioactive to permit their identification in releases made at time intervals of the half-life of

96 Rings 1950 - [60]

97 Steiner, L. P., Mitchell, W. C. STUDIES WITH TAGGED FRU. 32P was used for labeling ser, Mediterranean Fruit Fly Ceratitis capitata revealed flight up to 0.6 miles from male occurred with methyl e. Females spread as far as male (Work to be published in near 1960)


99 Geisow, P. A., Jaynes, H. A. WEEVILS IN SMALL PLANTS.

The overwintering females of their hibernation quarters and are conflicting, and as its afo appearance, 1900 adults were and liberated under pine tree to the occurrence of direct union of the plant, and total in shall be separated from states and then the infected ones to never appears in act as a mechanism

100 Jaynes, H. A. SOME OBSERVINGS Bull ent. Soc. Amr. 2, 3 (1931)

Spring emergence of white-pits pine, can now be predicted by plantation has been recorded t

Nagel and Davis 1868 - [64]
TTED POPULATION AND FLIGHT

**C. A. Denno and R. G. Denno**


**Summary:** The authors describe a study of the emigration and flight behavior of Diaphorina citri, a citrus pest. They used radioactive phosphorus-32 to track the movement of adults from infested trees to new locations. The results showed that diaphorina adults can travel long distances, sometimes over 50 miles, to find new hosts. This information is crucial for developing management strategies to control this important pest. The study also highlights the importance of understanding pest biology to effectively manage agricultural pests.

Since radioactive cobalt (Co-60) has a long half-life and emits gamma rays, a method was devised for tagging adults of *Prosopis montana* (Feak) with it so as to facilitate studies of their behaviour during periods of their life when ordinary observation is difficult. The amount of Co-60 applied per individual was found to be about 50 mCi per g for 47 of them, and about 400 for the rest. A plantation of white pine (Pinus strobus), 136 ft x 172 ft, in Ontario was divided into 9 ft squares, since it was calculated that the amount of Co-60 applied would be sufficient for detection at a distance of 6 ft, and the 86 weevils were liberated on the even date of 21st August and 1st September 1951. Two were removed after a week because of peeling of the cobalt, and on 1st November, 21 of the remainder were alive and had entered hibernation quarters; among the rest, 45% had died from unknown causes, as compared with 43.9% mortality among the controls. In spring, only 12% of the adults that entered hibernation were still alive, though the survival percentages among untagged adults caged in the open and in a closed group of white pines were 85 and 55, respectively. It is therefore concluded that the amount of Co-60 used was excessive. The cellulose cement adhered well until spring, when peeling occurred. In subsequent tests, cellulose acetate was combined with or replaced by Glyptal, with satisfactory results. (RAE-A 43: 76, 1953)

Grasshopper


A method is described for tagging grasshoppers with P-32 in the form of H3P-O3. Nymphs and adults of *Cruella pellucida* (Scudd) had previously been found to disperse for up to 249 yd in 8 d when released on bare, cultivated fields but to be unable to orientate themselves towards a food supply. In 1952, tagged *Melanoplus biguttatus* (Wlk.) (*periplaneta* apt.) were released at the centre of a 10-acre field, 1000 in the 4th and 8th instar, and later 7500 adults. Adequate food was available. The range of movement under those conditions was found to increase to 30 yd in 3 weeks. The findings are discussed with respect to earlier experiments.


P-32 was shown to be a useful tag for field studies of grasshopper movement and dispersal over a relatively short period. About 16 000 - 20 000 individuals were conveniently tagged at a time by feeding on wheat seedlings, growing in an area of 4 ft² that had been sprayed with 50 cc solution containing 0.5 mCPM. About 14% of the applied radioactivity was taken up and retained by the grasshopper. (RAE-A 44: 110, 1956)

Malaria


The mealybug migration from infected slabs is discussed, as are the results from tests on P-32-labelled mealybugs at various ages.


An examination was made of the movements of *Pseudococcus nigerensis* L., the dominant vector of swollen-shoot disease, on cacao in Ghana. The mobile population is composed almost entirely of first-instar nymphs (P-32). Movement is initiated at about 21, 3°C and activity becomes more pronounced at higher temperatures. Movement is maximal during mid-afternoon when many hundreds of insects become mobile on heavily infested trees. The density of mobile mealybugs increases from the base of the trunk and reaches a maximum at a few feet below the top of the canopy. Under experimental conditions, nymphs walked at least 25 ft in search of favourable feeding sites and their dispersion increased proportionately with the number of canopy bridges. On cacao, adults are occasionally carried by the air, *Pseudococcus spicatus* Emery. Using insects labelled with P-32, the assumption was confirmed that *P. nigerensis* is capable of walking from tree to tree via the canopies of farmers' cacao. In a plantation of 8-year-old Amelonado cacao, 40% of the branches were in contact with were in contact, where the tree between the number of mobile : about 5:100, this ratio being the number of movement of mealybugs : vector dispersal by pruning, with importance of a closed canopy i


Article includes a brief review of *Pseudococcus nigerensis* that mealybugs were placed on agar indicated that the preliminary p unequal percentages of reasonable experiments. The results were c with their route in radioactive H was used in 1953-54 to assist in slant from felled diseased cacao P-32 in cacao trees were five trees in the tree-cane. APP (RAE-A 47: 831, 1959)

Aragon, M.B. UTEZACAO (Use of radioactive mosquitoes 1 Larvae were raised in a 11600 1.5 burned and the ashes tested with all catching stations. The longe


Mosquitoes were produced by co to oviposit on roll media. Radio approx. 3 million radioactive A. 19% were c. c, were recovered. Locations 18-21 miles. However, release point, the number of rec bite most likely prior to their departure at maximum distances of 12 mi hence occurred near the area in given for A. willistoni.

Bruce-Chwatt, L.J. RADDIAO Health Org. 12, 2-5 (1969) 403

Review article. The application particularly in connection with *Aedes aegypti*, the larvae half-lives of 93.3 and 8 days, various mosquitoes have been used with radioisotopes are described, mentioned. The use of radior dispersing use of tracers would have a great advantage by means of isotop.
of the branches were in contact at 4 ft spacing and about 20% at spacings between 5 and 7 ft. No branches were in contact, where the trees were spaced more than 13 ft apart. At the closest spacing, the ratio between the number of mobile myelocytes that reached adjacent contact trees and those that did not was about 9:1,000; this ratio being reduced to 1 in 2:1,000 amongst trees growing 6 in 7 ft apart. The significance of the movement of myelocytes in the canopy in relation to virus spread is emphasized. Methods of preventing vector dispersal by pruning, wide spacing and interplanting with a secondary crop are discussed. The importance of a closed canopy in preventing attack on the trees by *A. vitripennis* is stressed. (auth. summary)


Article includes a brief review of the uses to which radioisotopes have been put to studies of the myelocytes (Pseudococcus graminis) that transmit the wheat-nudor virus disease of cacao in Ghana. In 1963, the myelocytes were placed on agar containing **p**32, to estimate the interval between feeding begins. The results indicated that the preliminary feeding period was long and variable, which possibly explains the low and unequal percentages of transmission obtained when initial insects myelocytes were artificially transferred to experiments. These results were confirmed in 1965, when myelocytes were allowed to feed on cacao seedlings with their roots in radioactive solution. The isopes used in these first two **p**32 and then **p**32. The latter was used in 1965-66 to assist in discovering the distances travelled by myelocytes dispersing from piles of slash from killed diseased cacao trees; the distance proved to be short. The spread and localization of **p**32 in cacao trees was also investigated, in connection with attempts to label myelocytes in their normal habitat in the tree-canopy. Application to the soil resulted in the most even distribution of radioactivity. (RAE-A 47: 511, 1959)


Larvae were raised in a **p**16:00 solution of thorium nitrate. The abdomens of captured mosquitoes were burned and the ashes tested with **p**32 (Ebeta) nuclear track plates. Radioactive specimens were captured in all catching stations. The longest flight recorded was 900 m. (RAE-A 48: 487-8, 1962)


Mosquitoes were produced by collecting mosquito-egg - Infested soil samples or by inducing captive *Aedes taeniorhynchus* near Savannah, Georgia, 480 marked specimens, of which 396 were *Aedes aegypti* were recovered. Recapture of tagged was made at the maximum distances of trap locations (18-21 miles). However, most of the radioactive **p**32 were collected within 6 miles of the release point, the number of recoveries decreasing as the distance increased. Females were observed to bite readily prior to their departure from the release site. Radioactive of *Aedes taeniorhynchus* were recovered at maximum distances of 10 miles and for periods of 12 to 20 days after release. The majority of the *A. taeniorhynchus* captured near the release point, but recoveries were made at 2, 4, 8, 10 and 12 miles. Some results are also given for *A. aegypti*.


Review article. The application of radioisotopes to studies concerned with Anopheles control is discussed, particularly in connection with ecological problems which cannot be solved by other means. Larvae of *Aedes aegypti* and *S. albopictus* were labelled by immersion. Both **p**32 and **p**32 were readily absorbed: in view of their half-lives of 86, 3 and 64 days, **p**32 is preferable because of its slower rate of decay. The flight ranges of various mosquitoes have been determined by means of radioisotopes (references included). Methods of labelling with radioisotopes are described, and observations on physiological and biological effects of radiation mentioned. The use of radioisotopes in the study of insecticides is discussed, with numerous examples. A promising use of tracer would appear to lie in the determination of the area of dispersal seen from aircraft by means of isotopes with strong radiation incorporated into the insecticides.

41

The dispersal and flight range of Aedes communis (Deg.), a mosquito characteristic of the northern coniferous forest, were studied at three locations: Churchill, Manitoba, during the summer of 1956. Four million larvae were collected and reared in four shallow wooden tanks containing a total of 1900 l of water, and 8 m in the form of a solution of 14C-CH3CH2CHO was added at a total rate of 2000 3 mc. P32 (0.05 μC/larva) as soon as the larvae reached the late 4th instar. About 3 million adult were released into the radioactivity per day was 770 cpm and dispersed in the Wainwright area. Of the 461 radioactive mosquitoes recovered in the course of 6 weeks, 53 had dispersed 1000 - 4000 ft., the average dispersal being 500 ft. A possible variable results from the presence of one or two of Aedes communis in the Churchill area; the latter was dispersed further than the more numerous smaller ones. The effective dispersal (Dispersion in number sufficient to constitute a pest) was determined to be about a quarter of a mile. This study indicates that Aedes communis is a relatively sedentary mosquito and has a limited flight range in the northern coniferous forest in comparison with arctic tundra species. It is in vegetation and does not attack man during the daytime. Additional data are given on the habits of this and other northern species of mosquitoes. (RA-49 154-158. 1950)


Radioactive Aedes taeniorhynchus adults were produced by exposing the larvae to P32. The subsequent dispersal from Sable Island, Florida, was studied from the time and space distribution of marked mosquitoes. Other collecting methods were used but only light traps yielded significant numbers of recoveries. Migration, as a species, non-potential migration, occurred from 1-4 d after emergence. This initial exodus carried females to the limits of the collecting area, 20 miles, and probably beyond. The males probably did not migrate beyond 2 miles. This main flight was deflected to the northeast, possibly by prevailing southeast winds, and by the NW-SE alignment of the coastline and topography. Light traps collected females on a 5-6 cycle of numbers, the last one caught 11 d after emergence. Males entered light traps the first 3 d only after emergence. There is some indication that females may migrate early in each of the 5-6 progenitive periods. Dispersion of female Aedes taeniorhynchus appears to be random, omnidirectional, and opportunistic, periodically repeated from fast established by a previous migratory channel, non-opportunist.' Rice accompanied the females on the initial exodus but probably drop out of the migration within a mile or two and thereafter settle down to a sedentary life characterized by swarming during twilight periods for 3-5 weeks. (From author summary)


A technique was developed for producing large numbers of Aedes taeniorhynchus in the field under controlled conditions. The embryos in egg-laden wrasse was cut out and transported to a "nest" pool where it was immediately pumped in and the soil flooded. A yield of 500,000 mosquitoes was obtained. Larvae were then transferred to a "nest" to wood rats for P32 introduction. 1/1 million radioactive mosquitoes were then allowed to disperse freely from the middle of Sable Island. Females were recovered up to 10 miles away and until the 30th night after emergence. Only a few males were recovered, all within 8 mi. The dispersal was generally of wind. It was considered that migration occurs within the night of departure of the twilight departure. Tissue distribution of occupation by a broad band about what is established by the migration.


Two field studies of the migratory exodus in the salt-marsh mosquito, Aedes taeniorhynchus, in Florida are described. Techniques described from the P32 study were: (1) inducing mosquitoes in nature to lay their eggs where they can be gathered, in this case 3 million eggs, were laid on 1280 ft of rod; (2) production of larvae by flooding egg-laden wrasse placed on the bottom of shallow dreg pools; (3) marking the larvae, and resultant adults, with radioactive phosphorus, emphasizing the inter-relationship of larval feeding and P32 dosage in affecting degree of marking; and (4) recovery of dispersing mosquitoes in the direction, directionless area to learn direction and angle of migratory exodus. The Vero Beach study involved the following described techniques: (1) sampling the netting population at the emergence site for determination of age, sex, stage, feeding stage; (2) sampling the dispersing mosquitoes by sticky nets and bymmone nets. In the Vero Beach experiment emphasis is placed on the coordination of field observational techniques, field collecting techniques, and laboratory examination techniques. (auth.)

114 Quarterman, K. D., Jen IN ARKANSAS. J. eco Using field-collected on males were made on th Arkansas. Efforts at it 4m were only partially male release points, but not all traversed steadily within the release site, but the significant information:


About 246,000 larvae of May 1952, kept in lake average radioactivity of habitant. The batches c collected with hand net 22 tagged mosquitoes In June 6, and at distance. The average radioactivity respectively, indicating for by decay of the P4, treatment to acquire ad confirmed by a laboratory pond water containing 3 1520 (131 0.05). Of larv d 4 d, while control most 3 d, but did not apply


117 Jura-Kura, I. E., On in Zeitschr. 2 (11)

В статье освещаются важнейшие вопросы лабораторных исследований и возвращение к сокращению активности, особенно миграционных процессов.

Shara-Barr, E. L. TT TECHNIQUE. ING. 8

Possible effective means Data are given on migrant habitats were studied by 1 passing through the

118 Thomas, D. C., Halb With Radioisotopes

Large scale tagging of 2 540,000 mosquitoes also recovered by means of tagged mosquitoes were between 1 and 2 miles.
SUBJECTIVE MOSQUITOES MARKED
(1933) 178-87.

... a characteristic of the northern coniferous
forests of Russia and Canada. Studies were made on
the flight habits of these mosquitoes, Physopyx. sp., in
the Grande Prairie section of Manitoba. Efforts at
man-mimicking of field-collected early instar Physopyx
larvae for tagging with FM were only partially success-
ful. Massed field collections dispersed in many directions
from the release point, but tended to move mostly with the
wind. Physopyxcontinued to travel at least 6 miles
and traversed heavily wooded areas over 1 mile in width.
[Author name] [ Missing ] recovered up to 1.5 miles
from the release site, but the number of specimens of this
species, tagged and recovered, was too low to provide
significant information on their flight habits. ( Auth. Sum-)
The species studied were Psama sp. (Psama sp.), and dock imagines hatched from cocoons in a much greater surface. Both larval death-rates, dispersal in many cases of insects.

126 Lawes, D.V. STUDY ON: 58-7. (In Russian)

126 Muzi, M., March, R.B. EYE Gnat, Hyphesodes chartarum

Gnats tagged with 14C released in California, generally dispersed conditions existed for their food but were found to half a mile c and downwind, but the gnat was with the wind. In one case were found resting at night on o and on foliage of low-growing

127 Stein, V.M., Schlinger, E.L. PERKINS USING RADIO-ACTIVITY

Triachogromas fasciolatum is a fly studied by feeding individuals to a second test ten million and

128 Walker, D., Harwood, R. Ga BY THE USE OF PH. Bull. ent. Res. 60 (1960) red flour beetles, in empty grain bins which were recovered from 10% of the 30 ha of insects originally in the bin recovered to the total number of insects and the various species

129 Banks 1957 - [69]

129 Banks and Nixon 1956 - [21] A -

129 Ahmed et al. 1954 - [732]

129 Auerbach 1953 - [2]

129 Baldwin, W.P., James, N.G., WITH A RADIOACTIVE TRACE

The prey-predator relationship was investigated by 14C Lava, the larval density in the trays b pond water to rid themselves of of pond animals were found to 1 was evident from the numbers of corydalis and Limonitis, both Lanthania stenodonta was, and on the mosquitoes. The total increase in the density of the p

The species studied were *Panaxia dominula* and *Arctia caja*. The food plants selected for them were dead nettles (*Lamium spp.*) and dock (*Rumex spp.*) respectively, and these were treated with *Sr*. The radioactive isotope labelled gave counts far in excess of those observed from the larvae and pupae, probably due to a much greater surface. Methods are discussed possibly useful for monitoring mortality, total populations, larval death-rates, dispersal activity, and other aspects of population dynamics as well as pigment chemistry in many orders of insects.


126. Mull, M.S., March, R.F. FLIGHT RANGE, DISPERSAL PATTERNS AND POPULATION DENSITY OF THE 5TH GTA, *HEPHELATES COLUMBOS*. *Ann. ent. Soc. Amer.* 92 (1959) 641-6. Grau tagged with *P*5, released in the Palm Desert and Indio areas of the Coachella Valley in southern California, generally dispersed into agricultural areas and adjacent residential sections where favorable conditions existed for their feeding and breeding activities. They avoided virgin donors and barren hills, but were found to half a mile of desert to suitable habitats on the face. Dispersal occurred both upward and downward, but the greatest distance travelled in both experiments (4.1 and 4.8 miles, respectively) was with the wind. In one experiment, the population density was estimated at 3-5/5000 grau/ac. Grau were found resting at night on dry or damp ground, on soil clods, on dried mutton protruding above ground, and on foliage of low-growing plants. (auth.)

127. Steyn, V.M., Schilinger, E.I. A STUDY OF THE DISPERSAL HABITS OF TRICHOPHAGA PASCALII PERKINS USING RADIO-ACTIVE P5. *Bull. ent. Soc. Amer.* 6 (1967) 163, abstr. 56. *Trichogramma fasciata* is a key parasite of certain field crop pests in California. Its dispersal habits were studied by feeding individuals *P5* mixed in honey. One test with two million individuals was released and the second test with ten million individuals.

128. Waller, D., Hanwood, S., Groves, K. DETERMINING INSECT POPULATIONS IN EMPTY GRAIN BINS BY THE USE OF P5. *Bull. ent. Soc. Amer.* 2 (1959) 25, abstr. 5. Lots of 109 red flour beetles, *Tribolium confusum*, each tagged with *P5*-labelled phosphorus were released in empty grain bins which were subsequently sprayed with DDT as a residual spray. Tagged insects were recovered from 19 of the 35 bins so treated in 1965 and from 9 of the 34 bins in 1956. The actual numbers of insects originally in the bins were calculated on the basis of the ratio of the number of radioactive insects recovered to the total number of insects recovered. Considerable variation was found in the numbers of insects and the various species in different bins.

"Banks 1957 - [66]"

"Banks and Nixon 1958 - [21]"

I-A-6 PARASITES AND PREDATORS

* Abraham et al., 1954 - [322]*

* Auerbach 1958 - [5] *

129. Baldwin, W.F., James, W.G., Welch, H.E. STUDY OF PREDATORS OF MOSQUITO LARVAE AND PUPAE WITH A RADIOACTIVE TRACER. *Canad. Ent.* 17 (1955) 260-4. The prey-predator relationship of *Anopheles stimulans* (Wlk) and *Aedes trivittatus* (Oton) at Chatsworth, Ontario, were investigated by *P5*. Larvae and pupae were made radioactive by placing them in *H5P04* at 0.06 µc/ml, the larval density in the trays being ca. 200 larvae/litre. The larvae were left for 2 more days in fresh pond water to rid themselves of radioactive excreta, then examined or returned to the ponds. Several species of pond animals were found to be predators of larvae and pupae. The importance of these predators in control was evident from the numbers that became radioactive, and also from the high radioactivity of certain species, *dipsides* and *limnephilids* being the most important. Three new records of mosquito predators were obtained, *Limenius indusius* Wlk., amongst them. At the generation of pond animals developed, more predators fed on the mosquitos. The resulting decrease in the population density of the mosquitos coincided with the increase in the density of the predator.

A species of mite, P. podapolipodophagus, was found to be parasitic rather than commensal in habit when the flies became radioactive after feeding on radish which had been fed on radioactive salt. The use of radioactive salts in studying the host-parasite relationship is described. Its relationship to the liased mite is discussed. P. tritannus, from Triticum infraflora, Calve, is new; brief diagnoses are given for P. podapolipodophagus and P. homoei. The relationship of Hirstella to Pimeliaphilus is discussed. H. bakeri from lupins, Calif. California, and H. homoei from Cucumeris multipliata, Nebraska, are new; brief diagnoses are given for H. bakeri, H. homoei, H. poliacei, and H. tenueipes. Keys to the spp. in both genera are given.


P13 was applied to turnip seedlings. Brachyrynchus brassicaceae feeding on them became radioactive. Parasites bred through the aphids also became radioactive. On subsequent breeding to other aphids no counts were obtained. The experiment was designed to test the specificity of aphid parasites. It was concluded that at the existing level of contamination by radu-aphadis insufficient deposits are made in the eggs for detection.

(Pr easiest experiment forms only a small part of the whole paper)

* Gössel 1958 - [96]
* Bid 1959 - [98]


P13 at 48 dilutions was injected by capillary needle into paralyzed Bradyon larvae. Harsobrac on eggs were then transferred to these hosts as well as to controls, both injected and non-injected. Radioactive food did not affect hatchability significantly although deleterious effects appeared at later developmental crises. Most noticeable was the failure of treated bactroaids to accomplish holometabolism. The degree of holometabolism was related to the level of treatment. At higher dosages a developmental delay appears for the survivors along with increased frequency of developmental abnormality of treated males. Females, the diploid type, were more radioresistant (metamorphosis and structural abnormalities). The life span of males achieving adulthood was not affected nor was there any apparent influence on F1 egg production although embryon survival appeared slightly decreased. The discussion points out similarities between internal irradiation and irradiation from extraneous sources. The quantum of different periods of sensitivity for developing structures as well as the variability of uptake from an injection site are discussed. (from auth.)

* Jenkins and Hamet 1956 - [86]
* Jenkins and Knight 1956 - [61]
* Kairatman et al. 1956 - [45]
* Kupet and Pelc 1952 - [45]
* Nagel 1958 - [10]


The usefulness is stressed of morphological, biological and ecological studies of the insects in question. Cases of multi- and super-parasitism, and genetic factors are considered, and the use of radiotopic labelling. Examples of biological control are given. 106 references altogether.


Labelling of the adults of Bracco phosphoric acid (H3PO4) with P32 radioactivity. On the other hand, the latter being a convenient and satisfactory test, such individuals show a correlation of the developmental period of the affected and the adults remain.

* Pedleyton and Gohmensa 1964


The uptake of P32 is possible in contamination by 1,6 mc per 1,000 sperms of first generation 20,000 sperm, point. The transmission of P32 indicates a distinction from other sperms.

* Stein and Schlinger 1960 - [16]

I-B In
Labelling of the adults of *Saxon gecchus* by allowing them to feed on 10% glucose solution containing phosphoric acid (H₃PO₄) with PM. Isotopes are not practicable as the adult parasites are unable to pick up enough radioactivity. On the other hand, labelling of the adults by rearing them on host excreta of *C. fumosa* showed the latter being fed on crop meal mixed with radioactive phosphoric acid, is quite a convenient and satisfactory method for the purpose of mass release of the parasite under natural conditions. Small individuals show a tolerable high degree of radioactivity and are therefore easy to detect. Moreover, the developmental period of the parasite by rearing it on radioactive host carpellars is not adversely affected and the adults remain alive for a considerable period. (auth. summary)

9 Pendleton and Grundmann 1954 - [330]

135 Quednau, W. RADIOACTIVE MARKIERUNG VON SCHUPPENWIESEN (Radioactive labelling of certain heymenoptera). Anm. Z. 6, 12/11 (1960) 567–68. (in German)

The uptake of PM is possible during the parasite's (heymenoptera) development in the radioactive host. The contamination by 1, 0 m/c per 3 l of nutrient solution was as follows: leaf sample 0.000 cpm, aphids of first generation 20,000 cpm, aphids of second generation 15,000 cpm, parasitised 0.000 (at the saturation point). The transmission of 150 cpm into the host eggs parasitised by labelled *Trichogramma* proved to be adequate for a distinction from hosts which could be naturally infected. (auth.)

9 Spilin 1958 - [14]

9 Stein and Schnijder 1950 - [409]

I-B Insect Physiology and Metabolism

18-1 CARBOHYDRATES


ATP and the enzyme system catalysing the incorporation of PM into ATP have been studied in respiratory particles prepared from the mosquito *Aedes aegypti*. Addition of ethylenediaminetetraacetic acid to the isolation medium and of ethylenediaminetetraacetic acid and albumin either to the washing liquid or to the assay medium have been found obligatory for the exchange reaction. The effect of nucleotides, respiratory inhibitors and inhibitors of oxidative phosphorylation on the exchange reaction and the ATP activity has been investigated. Quantitative differences exist between the responses of insect and mammalian respiratory particles to 1, 1, 1-trichloro-2, 2-dichloroethylene (DDT). 0.1 mM DDT inhibits the exchange reaction by more than 50% in insect sarcosomes whereas the inhibition in mammalian liver mitochondria is less than 10%. (auth. summary)


A short note reports results of a study on trehalose biosynthesis. The authors have shown that the locust fat body to be an important site. Generally labelled D-glucose-C¹4 was incubated with fat-body tissue from *Schistocerca* (5th instar) and the products examined by paper chromatography, thymol and leg muscle, fore, mid and hind gut tissues were also tested but found to be largely inactive in converting glucose into trehalose. The probable mode of biosynthesis is discussed.


The effect of the above compound and its analogues on the ATP-P₄ exchange reaction in mosquitoes *Aedes aegypti* (1–3) sarcosomes has been compared. All analogues of DDT tested inhibited the exchange reaction to nearly the same extent when the concentration in the particles reached the same level. No correlation was found between the toxicity for mosquito larvae of the compounds tested and their effect in vitro on
the exchange reaction. The analogue tested included 1,2-dichloro-2,2-bis(p-chlorophenyl)ethane, 1,1,1-trichloro-2,2-bis(p-chlorophenyl)ethane, 1,1,1-trichloro-2,2-bis(p-chlorophenyl)ethane, 1,1,1-trichloro-2,2-bis(p-chlorophenyl)ethane, 1,1,1-trichloro-2,2-bis(p-chlorophenyl)ethane, and 1,1,1-trichloro-2,2-bis(p-chlorophenyl)ethane.

136 Gray, R.A. COMPOSITION OF HONEYDEW EXCRETED BY PINEAPPLE MEALYBUGS. Science 115 (1952) 129-33.

The general view that plant-mimicking insects which excrete copious quantities of excess carbohydrates in their honeydew must take in large amounts of plant juices in order to get sufficient amounts of amino acids and proteins, was not found to be the case with pine apple mealybugs. Relatively large amounts of as many as 13 different amino acids have been found in the honeydew excreted by pine apple mealybugs (Pseudococcus Vulneris, Ck.) by the method of paper chromatography. The number of amino acids excreted was shown to increase with the period of feeding. Thirteen amino components of the honey dew have been identified from their Rf values. Three ninhydrin spots have not been identified. At least 8 amino acids were found in the honeydew which were not found in the food source. The carbohydrate components identified by different sprays and radiograms of radioactive honeydew were fructose, glucose, sucrose, glucose-1-phosphate, and possibly maltose. Maltic acid, citric acid, and raffin of citric acid were also found.


Fructose diphosphate, glucose-1-phosphate, glucose-6-phosphate, and fructose-6-phosphate passed from the intestine to the muscle in rates which decreased in the above order. 32P-labelled compounds were used.


 Newly emerged adults of Pseudotribulus maculatus are known to be low in glycogen. When ample food is available the glycogen content increases rapidly in the first few days. Unfed adults less than 24 h old were exposed to an atmosphere containing CO2. Experimental details are given, and the steps taken to identify the radioactive carbohydrate obtained as glycogen. The mechanism of labelling and the positions occupied by the C14 (presumably random) were not investigated.


The study was aimed at finding the conditions under which the uncoupling agents provoke increased metabolic rates and at determining the resultant changes in carbohydrate and phosphate metabolism. Periplaneta americana was used. Stimulation of glycogenolysis was observed, and two independent regulatory reactions appear to take place resulting from dinitrophenol. Attention is focused on phosphate metabolism. A special technique is cited for studying it in intact muscle preparations. The animals were injected with 32P-labelled finger solution and left for 4 or more days to enable equal labelling in all parts compounds. Subsequent steps consisted of freezing and pulverizing in liquid air, separation of individual P compounds by paper chromatography and analyzing the activity preferably from fractions from individual parts of the paper after autoradiography.

The changes in phosphate compounds after application of 2,4-dinitrophenol are very profound. Within 30 min of injecting 10-9 M dinitrophenol there is a pronounced decrease in high energy phosphate compounds, accompanied by an increase in inorganic phosphate. The change in ADP is small, the ATP:ADP ratio shifts in favor of ADP, with a simultaneous increase in c-glycerophosphate. Tentative explanations of the mechanism of dinitrophenol action on muscle are offered.

143 Trebene, J.E. GLUCOSE ABSORPTION IN THE COCKROACH. J. exp. Med. 94 (1951) 478-480.

The absorption of glucose from the gut of the cockroach, Periplaneta americana, was studied by feeding starved insects with C14-labelled glucose together with a dye, Amaranth. This dye is not absorbed from the lumen of the intestine, and the net percentage glucose absorption was calculated from the glucose/dye

144 Trebene, J.E. FACILITATED D GLUCOSE. SCHISTOCERCA GREGARIA. L.

Preliminary account of investigaiton of low concentrations. The uptake of activity of labelled glucose in the gut of the gut lumen. The results initially containment of radioactive glucose.

145 Trebene, J.E. THE ABSORPTION OF SCHISTOCERCA GREGARIA. L.

The absorption of glucose was measured by the increase in glucose together by the dye. Ama calculated from the glucose/dye absorbed from the mid-gut eeca,

146 Trebene, J.E. THE DIGESTION OF SCHISTOCERCA GREGARIA. L. J. exp. Med. 94

The uptake of C14-labelled glucose absorbed by the eeca depending on the amount of the glucose

147 Trebene, J.E. THE NUTRITION OF SCHISTOCERCA GREGARIA. L. THE EXCHANGE

A rapid influx from the hemolymph and variable net movements in the serum of sacclae also were found, These and represent a very important reservoir of nutrient system of this insect. (B.)
The absorption of glucose was studied by filling the gut with a saline solution containing labeled glucose together with a dye, Amaranth, which was used as a marker. The net percentage absorption was calculated from the glucose/dye ratio in various parts of the alimentary canal. Most of the glucose was absorbed from the mid-gut cecae, lesser amounts by the venticuliculus. The percentage absorption was similar at concentrations of 0.069 and 0.02 M, but was significantly less at 0.00 M. The absorbed glucose was rapidly converted to trehalose in the hemolymph. At the high concentration this mechanism became saturated and the excess glucose accumulated in the hemolymph. The absorption in vivo from a gut suspended in saline containing KCN and iodoacetate was similar to that in the intact insect. Glucose is apparently absorbed by diffusion across the gut wall and this process is facilitated by rapid conversion to trehalose in the hemolymph, which tends to maintain a steep concentration gradient across the gut wall. (CA 51: 20755c, 1958)

The uptake of C14-labeled glucose, mannose, and fructose was confined to the mid-gut, the proportion absorbed by the cecae depending on the type of sugar and its concentration in the gut lumen. The absorbed sugars were converted, in varying degrees, to trehalose which accumulated in the hemolymph. The extent of this conversion paralleled the rate of absorption of these sugars. It is suggested that the sugars are absorbed by diffusion across the gut wall, this process being facilitated by the rapid conversion to trehalose. At very low concentrations in the gut lumen much of the uptake of labeled glucose occurred as a result of exchange with the small amount of glucose in equilibrium with the trehalose in the hemolymph. (Auct.)

A partial hydrolysis of C14-labeled tripalmitin was demonstrated in the crop of this insect. No significant absorption could be demonstrated in the crop, whether the tripalmitin was suspended in an experimental fluid or dissolved in emulsified oleic acid. Absorption occurred in the mid-gut but was largely confined to the ceca and the anterior part of the venticuliculus. Total absorption of tripalmitin showed a linear relation with crop emptying. Apparently the rate at which the material left the crop, rather than the uptake in the mid-gut, was the limiting factor in absorption. (Auct.)


A rapid influx from the hemolymph of C14-labeled trehalose and glucose has been demonstrated in the intact abdominal nerve cord. Approximately half of the absorbed C14 was incorporated into glycemic acid and glutamin in the nervous tissue. Smaller amounts of glycerogen, trehalose, glycine, aspartic acid and occasional traces of alanine were also found. These results demonstrate a linkage of carbohydrate and amino acid metabolism and support circumstantial evidence for the presence of the triacylxylic acid cyclase enzymes in the central nervous system of this insect. (BA 86: 1913, 1960.)


Time-course studies on the utilization by intact cockroaches (Periplaneta americana) of glucose-C14 were carried out. Radioactive assay of the respiratory CO2 samples provided confirmatory evidence for the operation of glycolysis and a direct oxidative pathway for the primary breakdown of glucose in this species. It was found that intact male adult cockroaches, glucose is catabolized by way of the direct oxidative pathway to an extent of only 4-9%, and the bulk of glucose is catabolized via the Embden-Mayorof-Parnas glycolytic pathway. The latter, in conjunction with tricarboxylic acid cycle processes, is probably responsible for the respiratory activity and biosynthetic function in this insect. It is possible that the observed small amount of activity of the direct oxidative pathway is primarily for the purpose of protein production.

(CA 52: 26979c, 1958)


Uniformly labelled C14 glucose (radioactive carbon dioxide C14O2) and also various glycolyse inhibitors (NaF and CH3I) were employed in order to investigate the transformation of carbohydrates in the cavity fluid of the silkworm during metamorphosis. Oxidation of sugar in the cavity fluid could be shown to produce phosphoric esters and organic acids. The presence of radioactivity in malic, fumaric and succinic acids when labelled sugar is administered in the cavity fluid shows that conversion of pyruvic acid is essentially linked with its role in dicarboxylic acid synthesis by means of carbohydrate. Synthesis of tricarboxylic acids, and in particular citric acid, is insignificant. The latter is formed chiefly, not from carbohydrates, but as a result of carboxylation of organic acids, probably decomposition products of fats. This fact strongly suggests that in the cavity fluid aminocoeal oxidation of carbohydrates is the predominant process. Sucrose introduced in the cavity fluid may be subjected not only to oxidative transformations, but may be used in the synthesis of a complex, unidentified high-molecular weight phosphoric compound. On suppression of glycolysis this method of transformation predominates. Study of carbohydrate transformation during metamorphosis showed that hydroxylation substantially reduces the capacity of the cavity fluid to synthesise phosphoric esters and organic acids from the introduced sugar, whilst, in the course of histogenesis and differentiation, this capacity is restored.

The abstract is essentially that of the paper given at the "All-Union Conference on the Application of Radioactive and Stable Isotopes and Radiation in the National Economy and Science" (Session Biology, Medicine and Agriculture), Moscow, 2-5 April 1957. Engl. transl. p.320, Consultant Bureau, Inc.

(For a more detailed abstract of the paper see CA 52: 6673b, 1958).


An adequate exchange of nutritive materials between the hemolymph and the central nervous system across the peritrophic must take place. In order to study this function the exchange and metabolism of some C14 labelled sugars in the abdominal nerve cord (N. c.) of P. americana, C14-labelled glucose solution was injected into the hemolymph. Graphs illustrate the rate of conversion to trehalose as it accumulated in the hemolymph, compared with the entry of radiocative into the n.c. expressed as the ratio activity in n.c./activity in hemolymph. Approximately 7 molcules of trehalose may be estimated to pass into the n.c. for every molecule of glucose. Since the radioactive molecules are, however, 17 times more concentrated than those of glucose, individual glucose molecules were therefore passing into the n.c. at approximately 2.6 times the rate of the disaccharide molecules. The metabolism of the sugar within the CNS was followed by separating the extracts of radioactive n.c. on paper chromatograms. At least 7 peaks of radioactivity were found (trehalose, glucose, glycoze, aspartic acid, glutamic acid, glutamine and alanine). Their proportions are tabulated, and the significance of the findings discussed.


Results of experiments with C14-1 BOMBYX mori under went the cyclic formation of phosphates esters acid during the period of histolytic resection into the body cavity of g formation of organic substances of the labeled sugar, the specific within the body cavity of the 0·00% which resulted in the production dicarboxylic acids by way of dicarboxylic acid formation, the process (CA 52: 26979c, 1958)

* Waringham et al., 1965 - 4 (3)

* Waringham, F. P. W. COMP. REFERENCE TO INSECTICIDAL / Congress on Biochemistry, Vienna Possible differences in basal not the light of recent work. These i tissues and that trehalose is broken. Tissue data on the metabolism (v.f. in vertebrates, the liver of muscle) after different treatment insect flight muscle even under : and the failure to find significance on the femoral (C14O2) lornate in rapid incorporation of C14 into the tissues. Increased concentrations of free g a soluble and readily available g being trapped as glutamine.


The labelled pool technique has phosphos compounds in the adh represented some 20% of the trit as phospho bicarbonate of un ploe of doubt because the latter was The possible importance of o-glu compound recovered from the he
IN THE CENTRAL NERVOUS SYSTEM (11th International Congress on Endocrinology, (Niemieckie Towarzystwo Medyczne, Warszawa)).

High and the central nervous system (CNS) exchange and metabolism of some C^{14}-Glc were studied in rats as it is accumulated in the CNS, expressed as the ratio activity in brain samples may be estimated to pass into the brain is, however, 17 times more concentrated in the than in the liver. A 7 peak of radioactivity in brain, moss, and glutaminic acid, acetate, and alanine. Their effects are.

THE SKELETAL MUSCLE IN VITRO [J. teres latissimi, 1989 (English translation)].

IN THE AMERICAN CORROSI.

Blancoe, M.H. and J.R. (1987) A new confirmation for the existence of the exchange and metabolism of some C^{14}-Glc was studied in rats as it is accumulated in the CNS, expressed as the ratio activity in brain samples may be estimated to pass into the brain is, however, 17 times more concentrated in the than in the liver. A 7 peak of radioactivity in brain, moss, and glutaminic acid, acetate, and alanine. Their effects are.

THE SKELETAL MUSCLE IN VITRO [J. teres latissimi, 1989 (English translation)].


(Pdetailed abstr. see “Nature of carbohydrate conversion in the cavity fluid of mulberry silkworm (Bombyx mori) in the metamorphosis period”, p. 156 in Abstracts of papers given at the “All-Union Conference on the Application of radioactive and Stable Isotopes and Radioisotopic in the National Economy and Science. (Session: Biology, Medicine and Agriculture), Moscow 2-5 Apr. 1957.” (Erk. 1956-88) III. New York, Consultants Bureau, Inc. 1957 (English translation)


Results of experiments with C^{14} labelled sugars showed that the carbohydrates in the body cavity fluids of Bombyx mori undermwent a continuous change during the period of metamorphosis with an accompanying formation of phosphate ester and organic acids. The rate of such conversion of carbohydrates ceased during the period of histolysis and was again during the period of histogranulation and differentiation. The injection into the body cavity of glycerolic lipoic acid hampers the process of phosphate ester synthesis and the formation of organic substances from the carbohydrates. About 1 h after the injection into the body cavity of the labelled sugar, the specific activity became concentrated in water, fat, and methodic acid. Within the body cavity of Bombyx mori the anaerobic oxidation of carbohydrates and their conversion predominated which resulted in the production of pyruvic acid; such processes seem to be associated with the synthesis of dehydrogenase by way of dehydrogenase in the case of tricarboxylic acid synthesis, and particularly in citric acid formation, the process is considerably depressed.

(CA 59: 208568, 1968)

Winteringham et al. 1955 - (211)

Winteringham 1956 - (156)


Possible differences in basal metabolism between insects and vertebrates have been critically examined in the light of recent work. There is evidence that inbreast plays the part of mammalian glucose to insect tissues and that carboxylic is broken down glycolytically as far as pyruvate and then to acetate in vertebrate tissues. Data on the metabolism of uniformly labelled (C^{14}) glucose by the adult housefly, Musca domestica, in vitro are tabulated, showing the distribution of total soluble C^{14} recovered from these tissues (light microscopy) after different treatments. There is evidence that lactate and does not accumulate significantly in insect flight muscle even under anaerobic conditions. The reported accumulation of a-glyceroephosphate and the failure to find significant lactate formation under conditions of anaerobiosis are discussed. Experiments on the fate of [3-14C]pantothenic acid injected intradermatically into adult M. domestica showed that there was a rapid incorporation of C^{14} into the free amino acids. This and other results suggest that the significance of the high concentrations of free glutamate and free amino acids in insect tissues may lie in their providing a soluble and readily available substrate reserve for the Krebs tricarboxylic acid cycle, liberated ammonia being trapped as glutamine.

Winteringham, F.W., PRESENCE AND SIGNIFICANCE OF a-GLYCERO-PHOSPHATE IN INSECT TISSUE. Biochem. J. 71 (1959) 51 P.

The labelled pool technique has been used to determine the relative concentrations of the principal soluble phosphorus compounds in the adult housefly. One fraction, which was resistant to acid hydrolysis and which represented some 20% of the total acid-soluble phosphorus of the thoracic tissues, was tentatively identified as phosphatide and by paper chromatography with the identity compound but there was an element of doubt because the latter was not chromatographically pure. (Winteringham, Bridges and Hillier, 1959). The possible importance of a-glycero-phosphate in insect metabolism prompted a re-examination of the compound recovered from the housefly. The insoluble compound which had been labelled with C^{14} in vivo
was separated from all the known compounds except α-glycerophosphate on paper chromatograms. Added α-glycerophosphate co-chromatographed exactly with the insect compound in all the systems tried. The implications of these results are discussed briefly.

I-B-2 PROTEINS AND AMINO ACIDS


Available information on general biochemical reactions undergone by amino acids is divided into data on deamination, transamination, decarboxylation, and peptide and protein synthesis. Radioisotopes have been used to work on transaminases in connection with the silkworm, Bombyx mori (references cited). The author describes work on inorganic nitrogen metabolism where pyruvic oxime-C2-14C and pyruvate-2-C14 were either injected or fed, in order to study (1) C14 -activity in the blood following injection of either (2) C14-incorporation into gut and "body" proteins after injection; (3) respired C14O2 after injection; (4) C14-activity of fecal pellets excreted after feeding either substance; (5) identification by chromatography of the excreted and produced following such radioactive feeding. The results revealed that pyruvic oxime-C2-14C is removed from the blood at a faster rate than pyruvate-2-C14. Contrary to the first, the latter is incorporated into the "body" and gut proteins. It further appears to enter the tricarboxylic acid cycle and is rapidly metabolized to C14O2, whereas the labelled oxime is not metabolized in such a way but rapidly excreted in the pellets as oxime-C2-C14. It is suggested that the conversion of oximes into amino compounds is of little, if any, importance in the silkworm. Radioisotopes are cited to work on peptide and protein synthesis.


C14-labeled phenylalanine was used to demonstrate that carboxyl phenylalansine was not utilized for the synthesis of alanine. The technique used for labelling the compound indicated the silkworms injected when they had already stopped eating and their silk glands were swollen prior to spinning their cocoons. Fibroin was isolated from the cocoons, and the tyrosine, glycine and alanine isolated. Only the purified tyrosine was found to be radioactive (not due to contamination by the labelled phenylalanine). Results indicate that phenylalanine is converted to tyrosine by the silkworm by a fairly direct process, since radioactive activity was exclusively localized in the carboxyl group of the injected phenylalanine and the isolated tyrosine. About 10% of the injected phenylalanine radioactivity was found in the tyrosine of the silk fibroin. On the other hand, the carboxyl carbon of phenylalanine is not utilized for the synthesis of alanine or glycine of the silk of B. mori.


Pour determiner le sort de la glycine presente par la glande pour la synthese de la soie, les auteurs ont injecte de la glycine-1-14C dans l'hémoclyme de ven a soie au debut du filage ("monture"). Un quart de l'activite totale injectee a ete retrouvee dans la fibroine du coco. Cette activite se repartit, dans l'ordre des activites specifiques decroissantes, entre la glycine, la stagne et l'alanine. La tyrosine n'a incorporer aucune activite.


When fasting and ready to spin their cocoons, the silk worms were each injected with 112 μg (2.1 μc) of glycine-C14. One quarter of the total activity injected appeared in silk fibroin. The injected glycine was found diluted about 1000-fold, which was most probably not uniformly labelled. Direct conversion of glycine to serine keeping the label in the C-2 position occurs in the silkworm. Glycine is also converted to alanine, possibly through serine and pyruvic acid, but in any case introducing the C-1 of glycine exclusively into the carboxyl group of alanine. Tyrosine did not incorporate any radioactivity from glycine-C14; the phenylalanine-tyrosine pair would appear to be essential to the silkworm.


Just prior to spinning their cocoons, each of 20 silkworms was injected with 1.7 mg (2.5 µg) of C-14-labelled formic acid. The isolated glycine was decarboxylated in C-1 was isolated as barium carbonate and C-2 as formaldehyde. Their specific activities are indicated. The degradation procedure was carried out on synthetic glycine C-1 and C-2 and the C-1 together in B. mori. 1.5% of the injected radioactivity appeared in the fibroin glycine, while 2% was found in fibroin serine which had a specific activity 5 times greater than glycine. Various possible biochemical pathways are postulated.


By mixing C-14-lactate with formic acid and saponifying the mixture, the radioactive glycine was isolated. The radioactivity was found in the fibroin of the silkworm, while no radioactivity was detected in the serine of the silkworm. The results are discussed in terms of the possible pathways of glycine synthesis in silkworms.


Five-tenth µg of Na pyruvate-1 C-14 (1), Na pyruvate-2 C-14 (II), or Na pyruvate-3 C-14 (III) were given to 3 groups of about 50 silkworms, and in the stage of development when the fibroin synthesis begins in the silk gland, the radioactivity was detected in the fibroin of the silkworm. The radioactivity was found exclusively in the C-1 and C-2 of the serine and alanine of the silk fibroin.


Phenylalanine labelled with C-14 in the carboxy group was prepared from glycine-1 C-14 by a modification of the method of Bregmann et al. (CA **81**, 61). Ten silkworms in the stage in which the silk production begins were anesthetized with ethylchloride and injected with 1.2 mg (0.02 µg) of C-14. The radioactivity was detected in the fibroin of the silkworm. When the radioactive flour was fed to the silkworm, the radioactivity was found exclusively in the C-2 of the serine and alanine.


A fraction very reactive of the activity injected was collected and the presence of glycine-1 C-14 was detected in the fibroin, the serine, and alanine of the fibroin. After injection of glycine-1 C-14, the radioautography showed in the fibroin the glycine, serine, and alanine of the fibroin. After injection of glycine-2 C-14, the radioautography showed in the fibroin the glycine, serine, and alanine of the fibroin. These data are discussed in terms of the possible pathways of glycine synthesis in silkworms.
During DDT pretreatment, the free proline in the blood and central nervous cord is selectively depleted to about 1/4 the normal level. By using C-14 labelled proline it was found that as proline was depleted, there was a corresponding rise in C-14 labelled glutamine. If the temperature was raised so that the roach recovered, free proline and glutamine contents were restored to a normal level.

Glutathione concentration was measured in preparations of propep, prope and newly emerged susceptible and DDT-resistant houseflies in its content with C-14 labelled N-ethylmaleimide. Free glutathiones in both strains followed the same general pattern, no over-all difference being noted. During the initial period the glutathione concentration decreased during the first 2 days, showed a relative increase on the 3rd, and fell to a low level on the 4th day. The newly emerged adult had a higher level of glutathione than any other stage studied.

Mechinolene-3-25 (I) was injected into the hemolymph on the basis of 20000 cpm/g. After a definite time the protein was separated from the hemolymph, fat, muscle, intestinal lining, and other organs, and the amount of 25 measured. To the larvae was added to the intensity of protein metabolism was observed up to the middle of the 6th larval stage. The maximum incorporation of 25 occurred on the 11th-12th day; a decrease was noticed on the 19th-20th day. As to the individual tissues, the largest amount of 25 was incorporated into the hemolymph during the second half. At the end of the larval stage the intestinal wall possessed the least intensity of protein metabolism. A high metabolite rate from the very beginning of the 6th stage was noted in the walls of the silk-forming gland. In spinning of the cocoon, the incorporation of 25 was on a low level and the synthesis of protein in the cocoon of the silkworm almost stopped, when silk appeared. After the end of silk formation, an increase in protein metabolism was noted. A gradual increase in the 25 incorporation occurred during the 1st-3rd day of development of the pupal stage with a maximum at 48 h. The most intense protein metabolism during the pupal stage occurred in the abdominal, and then in the hemolymph. Protein metabolism, especially in the intestines, varied with sex. No 25 was incorporated into the protein of dead cocoon. Hence, the contribution of the proteins separated from the hemolymph was not the result of adsorption of 25 but was caused by the incorporation of 25 into the protein molecules.

The incorporation of C-14 labelled glycine into tissues proteins of injected silkworm larvae was studied, and depends on the state of development of the larvae. The rate is low during the 4th molt and increases progressively during the 5th larval instar. Just before spinning the rate of incorporation is again low. Incorporation in vitro into silk gland minces is an aerobic process depending upon the presence of vital ions. It is enhanced by the addition of intermediates of the tricarboxylic acid cycle, particularly by malate, citrate, succinate, fumarate and α-glycerophosphate. A pH 5 extract was prepared by precipitating at pH 5.1 an ultracentrifugate of beetle oil that precipitate at pH 7.8. It by Mg ions and other adenosine derivatives. The incorporation increased progressively by increasing the pH of the reaction mixture.
ultrafiltrate of the bead obtained from the posterior portion of the silk gland and subsequently dissolving the precipitate at pH 7.8. Incorporation of C^14-labelled glycine into this extract is rapid, and is eliminated by Mg ions and either adenine or guanidine ethylphosphate. In addition to C^14-labelled glycine, labelled phenylalanine and glutamate are incorporated into the protein extract but at a slower rate. In mixture, the 3 amino acids are incorporated additively. The [1-C^14] glycine-pH 5 extract complex is decomposed by heating at pH 7.8 by treatment with hot trichloroacetic acid, and by the action of chymotrypsin. A glycine-activating enzyme has been purified 50-fold by ammonium sulfate precipitation of the pH 5 extract. The purified preparation no longer incorporates C^14-labelled glycine, which indicates that separate enzymes are involved in activation and incorporation. (aut.)


A section is devoted to the amionoacidemia of Bombyx mori. The author discusses aminoacidemia and amino acids in components of tissues, and the free amino acids taken up by the silk gland from the hemolymph, where some of them have already been made of C^14-labelling (cf. Fukuda 1958, 1959, 1957). The fate of the amino acid taken up by the gland from the hemolymph has also been traced. Radioactive series is found in the silk after injection of glycine-1-C^14 (Fukuda 1960) and the activity of glycine-1-C^14 injected into the hemolymph has been found (Inouye-Gregoire 1958) in decreasing order of specific activities in the glycine, serine and alanine of the silk. Changes in the pattern of aminoacidemia during the development of Bombyx mori are discussed.


The biosynthesis of C^14-labelled phenylalanine in丝绸蚕的丝蛋白 was confirmed by means of paper chromatography and autodensitometry. C^14-labelled glycine was seen to be converted into serine. The degree to which 4 radioactively labelled amino acids (glycine-2-C^14, DL-valine-1-C^14, L-phenylalanine-2-C^14 and glutamic acid-1-C^14) were incorporated into silk protein was shown. The significance of the findings is discussed.


After the injection of phenylalanine-2-C^14 into silk worm (50-125 x NIch 122) on the 4th day at 5th instar in an amount of 0.6 µ/liment (100 µ/liment, the specific radioactivities of serine and phenyll alanine isolated from cocoon fibre were 0.840 and 4.257 cpm/100 mg, respectively. Among amino acids composing fibroin, tyrosine possessed exclusively high activity (524 cpm/100 mg). This was also proved by paper chromatography with a phenyl-


C^14-labelled phenylalanine was used in a study to determine whether phenylalanine is a precursor of tyrosine. 0.5 µ of radioactive phenylalanine per worm was injected into the body cavity of the silkworms, on the 4th day of the 5th instar. The techniques are described. Of examining the radioactive amino acids isolated from fibroin amino acid analysis was found to be located in tyrosine. Analysis of isolated tyrosine by paper chromatography and radioautography gave results which suggest that the tyrosine is labelled with C^14. The synthesis of tyrosine from phenylalanine in vivo was confirmed, as was its subsequent utilization for biosynthesis of the silkworm proteins.

**Fukuda, T.** CONVERSION OF PHENYLALANINE TO ALANINE IN THE SILK WORM LARVA. Nature 180 (1958) 249.

A solution prepared from silkworms by homogenization and freezing of the silk glands, the alimentary canal, and fat tissues, was used as an enzyme preparation. To 1 ml of the enzyme solution was added 0.5 µl

---

**RESISTANT AND SUSCEPTIBLE HOUSE**

There emerged susceptible and DDT-resistant Free glucosone in both strains followed the papil period the glucosone con- seen on the 3rd, and fall to a low level difference than any other stage studied. Resistant and susceptible flies. At timed 4-ethylalcohol and isolated chromato- expensive cystine into glucosone an d resistance flies. (aut.)

**REGISTRATION OF THE PROTEIN METABOLISM**

of RADIOACTIVE METHYLMETH.

10,000 ppm/g. After a definite time course, intestinal folding, and other significant factors in the protein metabolism incorporation of C^14 occurred in the 4th individual tissue, the largest amount of the end of the larval stage. The intestinal radioactive label was seen from the very beginning. In the cocoon, the incorporation of the silkworm almost stopped, when metabolism was noted. A gradual development of the summation papill stage during the pupal stage occurred in the 4th individual tissue, which was seen with the radioactive activity of the proteins separated by the incorporation of 14 into the

**SILK WORM BOMBYX MORI L.**

(1960) 14-3.

The label in tyrosine-3-C^14 is inti- activity found in protein following in- of C^14 uptake is also negligible, but injection or feeding indicates that reverted to tyrosine-3-C^14. The uptake are of little importance in the proteins in the silkworm.

3 day silkworm larvae was studied, and among the 5th molt and increases pro- incorporation is again low, incorpora- upon the presence of viable silk, 5th cycle, particularly by mitotic, citrate, pounced by precipitating at pH 8.1 an

---

---
of 0.1 M 1-glutamic acid, 0.5 ml of 13 Na pyruvate, and 0.1 ml of H/15 phosphate buffer, pH 7.4, containing 0.1 ml of Na pyruvate-2-C\(^14\) \& 13\,\textsuperscript{C}Na pyruvate, \& the mixture was incubated for 60 min at 30°C. Analysis by paper chromatography resulted in 2 spots, one of which was alanine (R\,\textsubscript{f} 0.42) in which most of the radioactive activity was concentrated, and another spot for the remaining glutamic acid. This indicated the conversion of pyruvate to alanine, an important constituent of the silk protein. (CA 51: 10938g, 1857)


After the period administration of 17.5 g Na pyruvate-3-C\(^14\) (500 mg) per silkworm (Bombyx mori) Nicchi 12X5 ml 115 mg/5 ml per day for 3 days from the 4th day of the 5th instar, the C\(^14\)- incorporation into cocoon fibre (5 amount to 3443 counts/min/100 mg of specific activity. The C\(^14\)- distribution in alanine (III) molecule isolated from 1 is determined as follows: COOH-C\(^13\) S, \(\alpha\)-C 80, \(\beta\)-C 80 90, \(\gamma\)-C 80 90, 5-C 80 90, 4-C 80 90. With the enzyme solution prepared by homogenizing the tissues with H/15 phosphate buffer of pH 7.6, freezing-thawing, and centrifuging off the insoluble protein, successively, the production of C\(^14\)-II occurs by posterior division of silk gland, alimentary canal, muscle plus fat tissue preparations in the presence of 1-glutamic acid (III). The transaminase activity of silk gland to convert pyruvic acid to \(\alpha\)-ketoglutaric acid is markedly high when III, or less extent, IV is used as \(\alpha\)-ketoglutaric acid substrate. (CA 51: 18971b, 1857)


Silkworms of the European race of B. mori were given 0.5 mg of \(\alpha\)-alanine-C\(^14\) from the 1st to the 13th day of the 5th stage. Alanine is a major constituent of the fibroin of silk and presumably is transferred from the hemolymph to the silk gland while fibroin synthesis is in progress. Thread from the cocoon was removed, degummed by boiling in a 0.02M solution of Na\,\textsubscript{2}CO\(_3\), washed with EtOH, Et\(_2\)O, dried, and laid out in horizontal segments. Autoradiographs of the thread segments revealed that a relation existed between C\(^14\) in the hemolymph and the different segments of the silk thread spun by the silkworm. (From CA 51: 14408a, 1959)


B. mori was fed 1 mg of glycine-9-C\(^14\). Autoradiographs of degummed and dried slices of isolated human silk gland showed that high radioactivity appeared in a definite section of the fibroin reservoir in the posterior division of the silk gland were stored in order of their synthesis. (CA 51: 14408b, 1959)


To further test the hypothesis that macromolecules of fibroin move in an ordered fashion in the reservoir of the silk glands of B. mori, 1 mg of glycine-9-C\(^14\) was fed to silkworms of the European race on the 5th day of the 5th instar. Autoradiographs were taken of sliced silk glands and the results showed that the fibroin synthesized at different periods was deposited in the reservoir in order of synthesis and appeared in the fibroin of the silk thread in this order. (CA 51: 14408c, 1959)


Oral administration of uniformity C\(^14\)-labelled serine to Bombyx mori at the 6th instar resulted in glycine-C\(^14\)-rich cocoon (silk fibroin) in the posterior silk gland, alanine in the isolated cocoon was slightly labelled by C\(^14\). Glycine had appropriately equal C\(^14\) at C-1 and C-2. (CA 54: 2867b, 1959)


Following oral administration of glycine-1-C\(^14\) and -2-C\(^14\) to silkworm the serine residue of fibroin and sericin was labelled in the carboxyl (C-1) and carboxyl (C-2 and C-3), respectively. At the same time glycine in body fluid was highly labelled. The following reactions are suggested for in vivo synthesis of serine: glycine + glycine + NADH+H\(^+\) + CO\(_2\) \& + glycine + NADH+H\(^+\) \& serine. (CA 54: 2867a, 1959)

After oral administration of glucose-C\(^{14}\) to the silkworm, keto acids were separated as the dicarboxylic compounds by paper chromatography and analysed for radioactivity. \( \alpha \)-Ketoglutaric acid was most highly enriched with C\(^{14}\). Oxalacetic acid was labelled considerably, but glyoxalic acid was almost free of C\(^{14}\) incorporation. (CA 56: 4793e, 1960)


The distribution of C\(^{14}\) was studied in the silk produced by the silkworm fed 1 cm\(^2\) of radioactive mulberry leaf or some radioactive amino acids on the different days of the 5th instar. The 1st, 10th, 20th, 40th, and 70th-1200 mm of silk was measured from a cocoon in the order given in Table 3. The radioactivity was measured on the 1st through 3rd day and at the last part (700-1200 mm) of the silk. (CA 55: 294a, 1961)


The movement of fibrin in the silk gland of the 5th instar silkworm was studied by using glycine-C\(^{14}\) as the tracer. Fibrin was synthesized in the posterior division of the gland and moved toward the middle and anterior divisions. (CA 55: 1689d, 1961)


Partial hydrolases of silkworm fat body contain enzymes that are active in the hydrolysis of glycosylated 1-amino acids. The results indicate that the enzyme is active in the cleavage of the glycosylated 1-amino acids.

196 Mace, Y. J., Oho, H., Tanaka YOKO HARA, THE PRELABELLED CELL DYE
The transfer of radioactivity in the presence of various conditions in the cell. The results show that the radioactive distribution is dependent on the conditions of the experiment.

197 Osaka, M., STUDIES ON THE USE OF SILK
Silkworm was reared with a diet containing amino acids. The results indicate that the amino acid distribution is dependent on the conditions of the experiment.

198 Pessaux, I. V., Williams (1958) 453-460.
During the first 2/3 of adult egg development, amino acids were labeled with carbon-14. The results indicate that the amino acid distribution is dependent on the conditions of the experiment.

199 Rabenowicz, M., Vagnman, MOLINO, J., Biophys. Biochem. The distribution of amino acids in the silkworm is dependent on the conditions of the experiment.

200 Shigemaru, A., INCORPORATION SILKWORMS, J. Biochem.
The incorporation of amino acids in the silkworm is dependent on the conditions of the experiment.

The synthesis of amino acids in the silkworm is dependent on the conditions of the experiment.
196


Partial hydrolyses of silk fibroin (Bombyx mori) have been analyzed by the isotope derivative technique, for glycine, alanine, glycylalanine, staclyglycine, and glycyglycine. In order to obtain distribution data in several immiscible solvent systems, following purification, minute amounts of each derivative were also prepared from radioactive (14C) piperidine chloride. Complete hydrolyses have been analyzed for certain amino acids. The results showed that glycylalanine is in partial hydrolysates, while the amounts of staclyglycine are so large as to eliminate the possibility of a random amino acid arrangement in fibroin. All of the analytical data, obtained from complete and partial hydrolysates, can be accounted for by the sequence

197


The transfer of radioactivity from CM-labeled cell debris of silk glands to microsomal proteins was measured in the presence of various micellar fractions. Considerable radioactivity was transferred to the protein under appropriate conditions. When glycine-Cm was used as the source of radioactivity instead of labeled cell debris, the relative specific activity of the microsomal protein was less than 0.004%, compared to around 20% in the case of the cell debris. (CA 55 (1961) 2, 197)

198


Silk fibroin was reacted with *H*-labeled piperidine chloride (1-hydroxyphenyl-sulfonyl chloride) in 50% aqueous solution containing an excess of NaNO3. Hydrolysates and paper chromatography yielded 3 peaks which were identified as (Glycine), (Alanine), O-piperidylylglycine, O-piperidylylglycylalanine, and glycyl O-piperidylylglycine. These 3 peptides accounted for at least 58% of the total tryptic in the sample of fibroin taken. The yields of these peptides exceeded the statistically indicated yield based on a random distribution of amino acids in fibroin. The amino acid sequinences found are compatible with the proposed repeating sequence of fibroin.

199


During the first 2/3 of adult development the melting fluid is a diffuse aqueous proteinaceous gel resembling egg albumin; at this time it is without effect on the pupal cuticle. At approximately the 14th day the gel is converted into a sol and shows considerable increase in chitinase activity and the first demonstrable proteolitecative procit isive activity. The active melting fluid then begins to hydrolyze the protein and chitin in the overlying pupal endocuticle. Finally, the melting fluid is completely released into the underlying insect. The melting fluid shows numerous quantitative and qualitative differences from the blood. A dynamic state exists between the melting fluid and the underlying insect. Radioactive glycine, injected into the melting fluid, was promptly absorbed and incorporated into the proteins of the adult moth. (CA 55 (1961) 2, 197)

200


Glycine-Cm was administered to B. mori larvae and its incorporation in the silk glands followed autoradiographically. After 15 and 30 min the autoradiograph showed strong and diffuse activity in the cell cytoplasm. At 4 h it was mainly found over the cell apex and newly formed secreted material. At 12 and 24 h the activity was localized mainly in the material secreted into the lumen. (auth.)

201


202


It is not yet clear which organ is concerned in the synthesis of blood protein in the larval stage. The protein content of the fat body of an individual has been shown to remain almost constant after the middle period of the larval instars, whereas protein synthesizing activity of the tissue during the same period was rather high. In the first experiment described here, net synthesis and secretion of protein by the fat body was demonstrated. In the second experiment, the incorporation of amino acids labelled with CM into proteins


After the administration of CH$_2$N$_2$C$^{14}$O$_2$H (5 mg, 1.2 x 10$^{6}$ cpm) to each silk worm larva on the 3rd-4th day of the 6th instar, silk fibroin was isolated from the posterior gizzard by washing with 0.14 M and 1 M NaCl, distilled water, ROH, and ether, in that order, and the radioactivity of the fibroin was then determined. The labelled glycerine was shown to be incorporated non-uniformly but to be present predominantly in N-terminal amino acids of the fibroin molecule.


After the injection of glycine-1-C$^{14}$ (1.4 x 10$^{4}$ counts/min/worm) to Bombyx mori on the 3rd-4th day of the 5th instar, it is incorporated promptly into posterior silk gland (III), the CH$_3$C$^{14}$O$_2$H (III)-precipitated protein of which shows the maximum radioactivity at the 4th h. Radioactivity of III-precipitated protein of middle silk gland rises slowly in initial 4-6 h and then increases rapidly up to the 10th h, while that of the 7% alcohol-precipitated protein of blood is far lower up to 24 h. Of protein fractions of posterior III prepared by the Griffin's method (cf. CA 45: 2314a) fibroin (IV) is predominantly radioactive, but the Griffin IV fraction is innoe in comparison with IV prepared by precipitating other protein by III. Of intracellular fractions of Schneider et al. (cf. CA 45: 2110a) of posterior II large granules (V) strongly incorporate I and small granules (VII) also do to a lesser extent. VII and VI have 9.5 and 8.3 for total N/important amino acid 8 ratio, and 461 and 75 for succinc oxidase activity (as O$_2$/mg H). The I incorporation into IV (the III-method) of posterior II shows a lag phase of 30 min., which is not the case with Griffin's IV fraction, Column (Dowex 25) chromatography of the hydrolyzate of IV (the III-method) of posterior II gives the following pattern of radioactive amino acid distribution: I 65, II 35, alanine 1, and threonine 0.5-5%. The incorporation pathway of I is presented: free I in blood-synthesis to IV in posterior II = IV in middle silk gland by simple transport.

(Liebig 1950, 1959)


After injecting glycine-1-C$^{14}$ or alanine-1-C$^{14}$ in Bombyx mori (strain S1122 X Nippon 122) at the 3rd-4th day of the 5th instar, the incorporation of C$^{14}$ in N-terminal amino acids of silk fibroin of the posterior silk gland was 2-5 times that in non-terminal amino acids of silk fibroin. The radioactivity of the N-terminal amino acids decreased at a rate higher than that of non-terminal groups. Similar tendencies were observed with tissue protein, fraction IV (Cohen and Hotchkiss, CA 42: 8210a), of the silk gland, A stepwise synthesis of silk fibroin is suggested. (CA 38: 921039, 1959)


The ability of the pupal cavity fluid to incorporate C$^{14}$-labelled glucose varies with time of metamorphosis, being low at 25-30% pupal age and intense at 65% pupal age. Addition of insulin increases the incorporation at histology stage by some 47%, while at histogenesis stage the addition causes a 3-fold increase of incorporation. Adenosine diphosphate (ADP) greatly increases the rate of incorporation at the histology stage, and almost stops it at histogenesis stage. The results were similar with paper of Abraham et al. (1955). At histolysis stage NaF inhibits the incorporation and ethanol has no effect or a slight stimulating effect during histogenesis stage. (CA 51: 13243b, 1957)


in the silk fibroin of Bombyx mori glycine and alanine. The effect of the peptides was identified in partial hyd. isolated derivative technique expected from a random array of a non-random, ordered as an important structural element.

Sparks 1968 - [14]

208 Suzukia, I., Shimura, K. I. PARTICLES OF POSTERIOR S. The particulate fraction of silk glands of Bombyx mori centrifuged and the debris (7 adjusted to pH 6.1, centrifuging glycine-incorporation stimulio into protein of I catalysed by 3% treated I (III) in 0.4 M is markedly stimulated by ribonucleic acid or other factor or the exchange reaction bet.


The relative rate of incorporation for Bombyx mori whereas the at the highest rate. The age or III preparation of B. mori The bulk of the incorporated III of B. mori and A. heub. coincided.

For key to notation used, see

210 Suzukia, I., Taoka, S., Shi J. Biochem., Tokyo 42 (1959)

211 Telfar, W. H., Williams, G. of the CECREPA SILKworm

Injection of radioactive glycine the appearance of radioactivity of the blood, the overestimating state of diapause at a slow rate. The terminus accompanied by a four-fold increase in blood in which the end of the protein at a rate characteristic in this manner: indicates that posterior. The effect of injor C$^{14}$ into blood protein paral and Williams, Biol. Bul

(Abtract of paper presented 1959)
In the third experiment, the silk fibroin was estimated for the presence of glycine. The author proposes 1-3, 14C-leucine and 14C-alanine to the amino acid sequence in the protein, which may be studied through the identification and estimation of the peptides obtained on partial hydrolysis of the protein. The tripeptide glycylalanine was identified in partial hydrolysates by a technique using 14C-labelled phenyl chloroformysis. Analysis by the enzyme derivative technique indicated amounts of this peptide well in excess of the maximum value to be expected from the random arrangement of amino acid residues in silk. Evidence is thus provided for the view of a non-random, ordered amino acid arrangement in silk fibroin, with the sequence glycine- alanine-lysine as an important structural element.

Sirlin 1958 - 1[16]


The large particulate fraction (D) capable of incorporating glycine, was purified as follows: the posterior silk glands of Bombyx mori were homogenized in 0.4 M sucrose-0.0025 M KCl-0.005 M MgCl2 (pH 8.0), centrifuged and the debris (700 g) removed. The supernatant was then adjusted to pH 6.1. centrifuged, the precipitants removed, the supernatant acidified to pH 4.0 and the glycine-incorporation stimulating factor (II) brought down by precipitation. The glycine-14C incorporation into proteins I catalyzed by II cannot be stimulated by II or any other intracellular fractions. Desoxycortisol (50)-treated I (III) in 0.4 M sucrose at pH 8.0 is not active and required II for glycine incorporation which is markedly stimulated by the addition of 2 x 10-8 M guanine triphosphate. II cannot be replaced by ribonucleic acid or other intracellular fractions. It does not catalyze the formation of glycine hydroxamate or the exchange reaction between adenosine triphosphate and phosphoric acid or 14C-labelled pyrophosphate.


The relative rate of incorporation of glycine-, alanine-, and leucine-14C by I was determined as 5:2:1:1 for Bombyx mori whereas the fraction for Attacus ricini (Bombyx) is high in alanine, incorporated alanine at the highest rate. The amino acid incorporation took place by combining either rat liver microsomes (IV) or III purification of B. mori. A. ricini with rat liver I (K) enzyme or II preparation of B. mori. A. ricini. The bulk of the incorporated amino acids was determined as leucine, glycine, and alanine with the use of I (B. mori) and II (A. ricini), respectively, regardless of the sort of activating or stimulating factor supplemented.

(For key to notation used, see abstract for part I of the study)


Injection of radioactive glycine (C14-carboxyl-labelled) intravenously into the Galleria silkworm leads to the appearance of radioactivity in the proteins of blood and tissues. Nishiyama (1950) revealed that the radioactivity of the blood proteins occurred in carbonyl groups associated with peptide bonds. Paper is not water-soluble form of amino acids, and it is water-soluble form of protein. The effects of these factors on the rate of glycine incorporation of C14 into blood proteins. The capacity of the system to respond to injury in this manner indicates that their utility to grow and development is not due to an inability to synthesize proteins. The effects of injury, carbon monoxide and stage of metamorphosis on the rate of incorporation of C14 into blood proteins parallel the effects of these same factors on the rate of oxygen consumption (Schneiderman and Williams, J. Biol. Chem. 208 (1956) 395-400).

(Original abstract of paper presented before the 53rd Ann. Meeting of the American Society of Zoologists, 6-8 Sept. 1955)

Radioactive glycine, injected into the hemocoels of dispausing pupae and developing adults, is incorporated into the proteins of the blood. The rate of incorporation parallels previously described rates of O consumption under a variety of conditions. The incorporation of amino acids can be added to the list of metabolic processes which proceed at depressed rates during dispausing, but which accelerate temporarily in response to injury. (CA 64: 4802a, 1965)


Chromatographic analysis of the hemolymph revealed the presence of 12 amino acids of which glycine and serine occurred in the relatively high concentrations of 33.3 and 34.3 mmol/l, respectively. After injection of C-labeled glycine and serine into the gut lumen, uptake was shown to occur rapidly in the mid-gut region and especially from the lumen of the caeca. The concentrations of glycine and serine, and also of glutamine in the caecal fluid, were found to increase significantly above the concentrations in the hemolymph, an effect which was paralleled by a relatively rapid decrease in fluid volume. During this time rapid exchange of C-labeled glycine and serine between the hemolymph and the gut lumen was demonstrated. Absorption of these amino acids depended, in part at least, upon the diffusion gradient created by the relatively rapid movement of water into the hemolymph. (CA 65: 5657g, 1965)

* Wintingham and Ramsten 1966 - (762)

1-3-1 NUCLEIC ACIDS


Tissues of queen bee larvae were incubated with thymidine-C at various stages of larval and pupal development. The radioactivity/nl of incubation of the acid-insoluble fraction and per mg wet weight of tissue increased sharply with the age of the larva. The activity per unit larva, however, increased with age, but less steeply. The implications of these findings are discussed. Despite the massive breakdown of the fat body cells prior to transformation of the larva, the biochemical and histological data suggest that DNA synthesized during early larval stages, or at least its nucleotides, may be utilized intact during later periods of cellular differentiation in the queen bee. Larvae fed thymidine-C in royal jelly apparently digested it, since the greater activity was then found in the silk cocoons spun at maturity. The C was not in the protein of the cocoon since only a insignificant amount of activity appeared in the acid-insoluble fraction of the silk after alkali extraction. Injection of thymidine into the blood space of the pupa led to some utilization, activity being still present after emergence of the mature queen, mating and beginning of egg-laying. (auth. summary)


Tritiated thymidine (0.01-0.1 µCi) was injected into larvae of Rhyychosciara angelae. The sites of greatest incorporation of thymidine into the chromosome vary with the age of the larva, but are constant at the same stage of larval development, and much more evident in certain loci of the chromosomes than in others. The authors conclude that the intense incorporation of thymidine in " puff" loci of the polytene chromosomes show that DNA plays a very active part in the puffing. "Puffs" which are characteristic for the larval stages are interpreted as indicating special gene activity which is localized and confined to certain periods. The gene metabolism in S. angelae appears to be linked with DNA synthesis.


The metabolism of the chromosomes of the salivary glands of Rhyychosciara angelae were studied by means of the specific radioactive precursors of the nucleic acids (thymidine-C and adenine-C) and proteins. Doses of 0.01 to 0.1 µCi of thymidine-C, adenine-C, or phenylalanine-C were administered to the larvae by microinjection. The larvae were then sacrificed, usually after 24 h, and after appropriate treatment the chromosomes were autoradiographed. The "puffs" show a higher incorporation of the two precursors, indicative earlier results.

217 Goldstein, M.E. DNA SYNTHESIS. Genetics

A study has been initiated to determine whether: I. DNA synthesis occurs in the midgut to determine whether radiolabeled thymidine is incorporated into the midgut tissue. If so, then the midgut tissue is not the progenitor of the adult organism. (CA 65: 5670g, 1965)


A preliminary study was made to examine whether the radioactive labeling was found in the salivary gland containing puff (4-5) and sections, which were stained with aldehyde fuchsin and phloxin. The puff appears to be much more highly concentrated in the salivary gland than in the larval tissue.


The 4th and 6th larval stage of the midgut. Larvae were injected with radioactive labeled thymidine-C and the incorporation of this labeled thymidine-C into the DNA of the midgut was examined. The incorporation of the labeled thymidine-C was found to be highest in the posterior midgut, with a gradual decrease anteriorly. The incorporation was also found to be highest in the midgut, with a gradual decrease anteriorly. The incorporation was also found to be highest in the midgut, with a gradual decrease anteriorly. The incorporation was also found to be highest in the midgut, with a gradual decrease anteriorly. The incorporation was also found to be highest in the midgut, with a gradual decrease anteriorly. The incorporation was also found to be highest in the midgut, with a gradual decrease anteriorly.

220 Kaplan, W.D., Skakal, J.F. IN TESTIS OF DROSOPHILA.

 Autoradiographic studies were performed to determine the incorporation of thymidine-containing diet into testis. The testis were divided into testis and into testis and into testis. The testis were divided into testis and into testis. The testis were divided into testis and into testis.
and developing adults, is incorporated temporarily. Described rates of O
acid can be added to the list of
which accelerate temporarily

DNA SYNTHESIS AND X-RAY EFFECTS AT DIFFERENT MITOTIC STAGES IN GRASSHOPPER
NEUROBLASTS. Genetics 4 (1959) 548.

217

A study has been initiated to determine at what stage or stages of mitosis synthesis of deoxyribo nucleic acid (DNA) occurs in the grasshopper neuroblast, to determine the effects of irradiation on this synthesis, and to determine whether radiation-induced mitotic inhibition can be correlated with the absence of DNA synthesis. Grasshopper embryos were observed in living culture preparations, when a neuroblast entered a given stage of mitosis, C-14-labelled thymidine was added to the culture medium. When the cell reached end of the given mitotic stage, the embryo was fixed immediately and washed with water to remove unincorporated thymidine. It was subsequently denatured, stained with Feulgen reagent, and covered with stripping film. The cell originally observed in living condition was then examined for presence of grains in film above it. Since fractionation of embryos revealed that the C-14 was in the DNA fraction, it is assumed that uptake of thymidine indicates synthesis of DNA.) - Uptake of thymidine in neuroblasts begins in the middle telophase and continues into very early prophase. Maximum uptake occurs during late telophase and interphase, rate of uptake being approximately the same in both stages. Thus the stages of mitosis most sensitive to x-rays, namely middle and late prophase, are not involved in synthesis of DNA. Data accumulated thus far indicate that interference with uptake of thymidine occurs only in cells that have received a dose of x-rays much higher than that sufficient for blocking mitosis.


226


A preliminary study was made into the rate of incorporation of P-32 into the chromosomes and associated structures in the salivary gland of the Chionomus. Monastral hypotonicus. Larvae were grown on medium containing P-32 (as phosphatidic acid) for 2-24 h, and the incorporation studied in autoradiographs of squashes and sections, which were stained with methyl-green-pyronin and in some cases extracted with ribonuclease or hydrochloric acid. Incorporation of tissue was adequate after feeding the larvae on labelled medium for 4-8 h. The puff appears to concentrate the P-32 much more actively than the remainder of the chromosome, which show an incorporation little above the background. Staining reactions indicate that ribonuclease acts much more highly concentrated in the puffs than in the remainder of the chromosome.

Horikawa and Sugahara 1962 - 1964

230


During the 4th and 5th larval instar of the silkworm, Bombyx mori, nucleic acid P occupies one-third of total P of the midgut, but before cocoon-spinning, nucleic acid P and lipid P decrease gradually, while acid-soluble P increases rapidly. This is caused by the increase in nucleic P, suggesting the exclusion of P as a form of nucleic acid from the midgut cells from other parts of the body at this period. There is almost no change in protein P throughout larval stage. At the time of pupation, it was shown that the part absorbing P actively is the posterior midgut. The total P of the midgut reaches the maximum 2 h after feeding P, then decreases gradually. The same is true for the acid-soluble fraction, which, however, decreases more rapidly with time than the total P. Lipid P reaches the highest level 24 h after feeding. The changes relative to the turnover in the midgut were also observed in various P fractions of the blood. There are some differences to paperchromatograms and radioautograms between the midgut and the blood. (auth.)

240


 Autoradiographic studies were made of D. melanogaster larvae at various intervals after removal from a thymidine-containing diet up to 6 h. The preliminary data show that spermatoocytes redistribute their chromosomes very early and move posteriorly as additional cells are proliferated from the apical spermatogonia. The mutagenic effect of tritiated thymidine was studied genetically. Unquestionably the thymidine produces a mutagenic effect. (auth.)


The excised ovaries of 5-day-old female Drosophila melanogaster were immersed in a solution containing TC 189 and uridine-4P. The 1H was incorporated into ribonucleic acid within 4 hours and localized in the dense ribonucleic acid of the nuclei in most of the cells associated with the oocyte. (CA 58: 12874e, 1962)

223 Kogure and Nakajima 1958 - [1148]


Patterns of radioautographic incorporation are useful characteristics in describing cellular RNA fractions and have indicated a distinct "nucleolus" RNA in order to characterize the RNA fractions of the two nuclear components, nucleolus and chromatin, and to determine thereby the precise location of RNA typical of isolated nuclei, transcriptional, and cytoplasmic RNA of Drosophila salivary glands have been determined from autoradiographs. Two experiments are reported which cover 15 and 18 h periods including an initial 2 h feeding on 3H-U. Concentrations of RNA-4P (identified by ribonuclease digestion) were determined by grain counts. After 4 h only the nucleolar RNA is labelled. Activity is detectable in chromosomal and cytoplasmic RNA after the 8th h. The nucleolar fraction reaches its maximum activity shortly after transfer of the larvae to non-radioactive food, the other fractions several hours later. Maximum activities persist in the chromosomal and cytoplasmic fractions; nucleolar activity decreases after the 9th h. The observed differences in times at which incorporation begins and maximum activities are reached, and in maintenance of maximum activities indicate that chromosomal and nucleolar RNA are distinct fractions. The metabolic characteristics which have been ascribed to "nucleolar" RNA apply only to the nucleolar fraction. (auth.)


Data was obtained for Bombyx mori.

226 Noyan 1960 - [305]


The morphological change in "pull" was examined in ter-pull and non-pull regions wit of tritium-labelled RNA synthesis is not necessary of during pull formation, 3H-4P bound to label cytoplasm, ch as on administration of thymidine.

228 Shiokawa, A., Miura, Y. BIOSYNTHÈSES DE L’ADN CHEZ BOMBYX MORI L. C.

Les auteurs ont mis en évidence les glandes sécrétrices, ainsi que aussi glande larvaire, glande 4P-4H-4C (Larva/7) de larve réelle de l’autoradiographie

229 Takeyama, S., Ito, H., Miura IN THE SILK GLAND. Bioch. Med. The posterior silk glands of Drosophila melanogaster was actively in (6-uracil-labeled ribonucleic acid) was apparently, the simultaneous ribonucleic acid (100 m/ml) added to RNA not the RNA tagging it by the addition of RNA obtained from intact RNA. (CA 58: 351)

230 Taylor, I.H., McManus, R. PHOSPHORUS-32 INTO RIBO 469-78.

Laye of Drosophila potrebata forced to non-labeled food, ribonucleic acid (RNA) detect. Incorporation was high in all radioactive RNA could be set sectors of chromosomes lying of nucleolus increased so that the from activity-time relations have a common precursor. (C

231 Weygand, P., Waldehardt, H., MARKERTEN VERBINDUNGEN cabbages moth by means of C

In a preliminary experiment, to feed on C-32-labeled folic acid 2,4-5-aminolevulinic acid. The uptake of radioactive folic acid in Drosophila larvae (1-32P) (375 larvae), the nucleic acids in both, two ways it was possible to it to that of the larvae and lo

The morphological change involving a local increase in diameter of the chromosome, frequently called "puff", was examined in terms of its chemistry, particularly a comparison of the metabolic activities of puff and non-puff regions with respect to both DNA and RNA. Methods are described for the incorporation of trimethylammonium thymidine and cytidine into puff regions. Results with HP-thymidine indicated that DNA synthesis is not a necessary concomitant of puff formation and disproportionate synthesis does not occur during puff formation. HP-cytidine incorporation was interpreted to indicate the presence of RNA, and was found to label cytoplasmic, chromosomes and nucleoli of all cells; puff regions were more heavily labelled than on administration of thymidine.


Les auteurs on mis en évidence que la synthèse de l'acide ribonucléique précède celle des protéines dans les glandes sébacées, ainsi confirmant leurs conclusions basées sur l'expérience in vivo. Les auteurs ont utilisé des boîtes mâles de 6 à 8 heures après l'éclosion de la larve, ou glycine-1-14C (1 μg) la partie sécrétoire des glandes sebacées a été fixée à la solution de Carnoy. Les résultats de l'autoradiographie a été résumé dans un tableau.


The posterior silk glands of the 5th instar larva of stigmamea were inoculated with RNA and protein precursor Glycine-C14 was actively incorporated into the protein fraction and citric acid-C14 into the RNA fraction. The greater part of the radioactive incorporation into protein represented fibrin synthesis. Citric acid was incorporated into RNA too. Impairment of protein synthesis by treatment with RNA metabolism (1-methylriboflavin) was not accompanied by impairment of the incorporation of glycine into protein. Apparently, the simultaneous renewal of RNA was not necessary for the synthesis of fibrin. Ribonucleic acid (200 μg/μl) almost completely inhibited fibrin synthesis. Neither the metabolic removal of RNA nor the RNA remained after enzyme treatment was able to restore this synthesis, not was it restored by the addition of RNA obtained from the same tissue. Thus, fibrinogenesis was dependent on the existence of intact RNA.


Larvae of Drosophila repleta were given food containing 32P-labelled phosphate for 1 to 2 h and then transferred to non-labelled food. The larvae were fixed 24 h and the incorporation of 32P into ribonuclease (RNA) determined in the cytoplasm, chromosomes, and nucleoli of the salivary glands. Incorporation was high in all cells during the first half of the third instar but then decreased to such an extent that no radioactive RNA could be detected in the third third of the instar. Labelled RNA was detected after 1 h in several part of the cytoplasmic regions near the nuclei and in the nucleolus itself. Within 3 h activity in the nuclei increased so that RNA appears in cytoplasm about this time and in 6-8 h as high as in the nuclei. From activity-time relation study, the cytoplasmic RNA could originate from nuclear RNA or both could have a common precursor.


In a preliminary experiment, larvae of Goniopterus ryukyuensis and Pliota brachyptera were reared on a diet containing 32P-labelled folate-2 (C-2), glyoxylate (C-3), hypoxanthine (C-6), 8,4,5-trimethyl-4-oxopyrimidine (C-2, C-5), hydrochloric, glyoxylate (C-2, C-3) and sodium formate (C-3). The uptake of radioactive activity from the various compounds was tested, and considerable variation found. Glyoxylate (C-2, C-3) (1 μg/larva) and sodium formate (100 μg/larva) were injected into the larvae. By separating the leucopterin in both cases, and from analysis of the degradation products (degradation taking place in two ways) it was possible to show that pyruvic synthesis in the bacteria follows an analogous pattern to that of the phytin and leucopterin.
I - E - 4 STEROIDS


The metabolism of C13-labelled cholesterol and cholestrol acetate was studied in the adult cockroach and housefly, and larvae of confused flour beetle. Sterols from the homoeally were isolated and at least three compounds separated chromatographically. An attempt was made to characterize these sterols.


Cholesterol (3) synthesis in Dermestes vulpinus larvae was studied with the aid of tracer technique. Acetate-1-C14 was used for the synthesis of both fatty acids and unsaponifiable matter during larval growth. However, synthesis of 1 from acetate did not occur. Dermestes larvae were unable to use acetates in lieu of I for growth and development. Since acetate-C14 is incorporated into cholesterol, but was not incorporated into either 1 or lanosterol, the sterol requirement of Dermestes may be attributed to an interruption of 1 biosynthesis at the squaene stage. (CA 56: 16975c, 1960)


Certain aspects of insect sterol metabolism were investigated with Psocidiana americana. The normal distribution of free and esterified sterols among the organs was determined and compared with the distribution of cholesterol-4-C14 18 hr after injection. The rate of esterification with the Schonheimer-Sperri reagent from the sterols in the various organs differed greatly. Injection of acetate-1-C14 into cockroaches and mice resulted in almost the same percentage recovery of labelled digeridoles. Cockroach cholestrol ester was investigated in relation to distribution among the organs and substrate specificity. (CA 53: 93114, 1959)


Larvae of the beetle Dermestes vulpinus reared on diets containing 1-C14 acetate or randomly labelled C14-fuctose failed to form radioactive squaene or sterols. The unsaponifiable matter isolated from these insects contained two radioactive fractions. One of them is shown to be a saturated aliphatic hydrocarbon, or mixture of hydrocarbons, with an average molecular weight of 346 and an unsaturated carbon chain. The second fraction has been characterized as a primary aliphatic alcohol with an average molecular weight of 98±4. The cholesterol necessary for the growth of Dermestes larvae cannot be replaced or spared by mevinolinic squaene, laconol, or A4-6-dimethylcholesterol. It is suggested that the pathways of cholestrol biosynthesis are multiply blocked in this organism. 5-Dehydrocholesterol can substitute for cholestrol in supporting the growth of Dermestes larvae. (Sum. summary)


The utilization of dietary ergosterol by nymphs of the German cockroach, Blatella germanica, was investigated. The insects were given ergosterol which had been uniformly labelled with C14. The formation of a new radioactive sterol was observed. This conversion product could not be demonstrated with ergosterol labelled at C-28 only, which showed that it no longer contains the C-28 methyl substituent of ergosterol. By isotopic techniques the hydroxylation product of ergosterol was shown to be 22-dehydrocholesterol. A small amount of crystalline sterol was isolated from a large number of ergosterol-fed nymphs and shown to be identical with authentic 22-dehydrocholesterol. The significance of this conversion is discussed. (from Sum. summary)


The incorporation of glycine-C14, leucine-C14, NaOAc-2-C14, and glucose-C14 into Schistocerca fat body was studied under in vivo conditions and the distribution of radioactivity in the various fat body fractions and the labelling of compounds in the fractions are described. There was high incorporation into fat and proteins and very low incorporation into glycogen. Incubation with glycine-C14 led to the appearance of

radioactivity in the glycine an acetate led to radioactivity in intermediates of tricarbonyl i-conversion to choline. Sucrose in the fat body, contrary to previous results, was not incorporated into fat body, and was suggested that fat body acts all available for further metabolism.

Kaplan, J.N., Motorn, E.S. IN THE ADULT HOUSE FLY. When houseflies were fed a diet utilized in egg production. As of several metabolites.

Kaplan, J.N., Schindl, W.F LESTERS BY THE ADULT HC

The metabolism and catabolism. Only low levels of excretion (1 as acidic material, while from recovered 3 weeks after treatment in the housefly. The administered active sterols were not found to be cause isotope dilution method hydrocholesterol - a lesser product.

Kowalec, E., Lestinov, Z.H. OF ACETATE-2'4 MC BY BL/WI.

Larvae of Calliphora erythrocephale techniques are given. The chair diglucoside-pentahydroxy sterols, expired by the larva were taken from CM-labelled acetate, but from acetate, but rather by de seen to be utilized at least a matter, other than sterols. Big than sterols; they were involved in the still significant radioactive acceptor was also used for the &

Luschnaths, S.J., Kaplan, J, THE AMERICAN COCKROACH.

The incorporation of radiocarbon American cockroaches was data was fractionated by chromatography were analyzed by gas chromatography.

(Published more fully in Ann.)

Robbins, W.E., Kaplan, J., NYMPH ALTERED GERMAN COCKROACH.

Only low levels of C14 compos. Most of the administered radioactivity and eggs were characterized by

Robbins, W.E., Darby, R.C., BY NYMPH TERNED GERMAN COCKROACH.

86
radioactivity in the glycine and isoleucine of the protein and of the amino acid pool. Insects with labelled acetate led to radioactivity in glutamic acid, proline, aspartic acid, and alanine, showing that the intermediates of the tricarboxylic acid cycle provided the C atoms of the amino acids. Glucose was largely converted to valine, leucine, and valine, but no other materials were shown to be present in the fat body, contrary to previous reports. The succinic acid oxidation system was highly labile on homogenizing the tissue. Fat body, unlike flight muscle, used glycine and leucine as respiratory substrates. It is suggested that fat body acts like the vertebrate liver by transaminating amino acids and making them available for further metabolism by other tissues. 

(AC 56: 1620I f., 1960)


When houseflies were fed a diet containing Hp-D-sitosterol the result was found to be efficiently absorbed and utilized in egg production. Analysis of the Hp compounds from the adult and eggs indicated the presence of several metabolites.


The metabolism and excretion of ingested 4-CM-cholesterol was studied in the housefly (Musca domestica). Only low levels of cholic acid (0.5% - 5.5%) were found 5 days after treatment and about 10% of this behavior in acidic material. When female flies were treated and the eggs collected, 7% of the radioactivity was recovered 3 weeks after treatment. The high recovery and low excretion rate indicates a strict sterol economy in the housefly. The administered cholesterol was efficiently utilized in egg production. Some of the radioactive sterols were found to be extracted in both egg and adult. Analyses by column chromatography and reverse isotope dilution demonstrated the presence of 8 major components - unhydroxylated cholesterol and 7-dehydrocholesterol - and a lesser fraction consisting of unidentified polar steroids. (auth.)


Larvae of Calliphora erythrocephala were fed some sodium acetate-2-14C in their diet. Details of the technique are given. The distribution of radioactivity in the total lipid contents, unsaponifiable matter, triglyceride-preferrable insoluble, diglyceride-non-preferrable fatty acids, lipoprotein-free residue and total C14 expelled by the larvae was determined. Results show that Calliphora larvae are unable to synthesize sterols from CM-labelled acetate, but indicate also that the cholesterol side-chain is not formed by de-synthesis from acetate, but rather by de-synthesis of the 8-sitosterol side-chain at position C3. Aceate would appear to be utilized at least as efficiently for biosynthesis of fatty acids as for biosynthesis of unsaponifiable material, rather than sterols. Significant amounts of CM were incorporated into unsaponifiable lipids other than sterols; they were investigated by reversed-phase paper chromatography and radioautography. From the still significant radioactivity remaining in the larvae after removal of lipid it is assumed that acetate was also used for the synthesis of non-lipid constituents of the body.


The incorporation of radioactivity into the saponifiable and unsaponifiable fractions of male and female American cockroaches was determined following injection of CM-acetate. The unsaponifiable material was fractionated by chromatography and digitonin precipitation and the methyl ester of the fatty acids were analyzed by gas chromatography.

(Revised in full in Ann. ent. Soc. Amer., 54, 1 (1961) 99-103, not included in this bibliography)


Only low levels of CM compounds were excreted following injection of CM-cholesterol to female flies. Most of the administered material was utilized in egg production. The CM compounds present in the adults and eggs were characterized by column chromatography and reverse isotope dilution.

When houseflies were fed a diet containing IP-8-stereoside the test was found to be efficiently absorbed and utilized in egg production. Analysis of the IP-8 compounds from the adults and eggs indicated the presence of several metabolites. Nymphal German cockroaches were reared on a synthetic diet containing IP-8-stereoside. The isolated IP-8 compounds were fractionated by chromatography and further analysed to determine the nature of the metabolites.


Hoskitts (Musca domestica L.) were injected with an aqueous solution of 1-C14-acetate and held for 18 h. On analysis, the ratio of fatty acid synthesised from C14-acetate was found to be 3.7 to 8 times greater in females than in male flies. The males and females incorporated about the same percentage of radioactivity into the unsaturated fatty acid (1.3 to 2.8%) Further fractionation by column chromatography demonstrated that 50 to 80% of this radioactivity behaved as hydrocortisone (4) and less than 2% as sterile. When the neutral fraction was analysed by gasliquid chromatography, no radioactivity was detected in the precipitate representing choledsterol and hydrocholesterol.


The metabolism and excretion of injected 4-C14-cholesterol was studied in the housefly (Musca domestica). Only low levels of excretion (250-550 ppm) were found 6 h after treatment, and about 10% of this was recovered as acetic acid. When female flies were treated and the eggs collected, 75% of the radioactivity was recovered 3 days after treatment. The high recovery and low excretion rate indicated a high storage capacity in the ovary. Analysis by gas-liquid chromatography demonstrated the presence of 4 major compounds - unchanged cholesterol and 7-dehydrocholesterol, and a fraction consisting of unidentified polar sterols. (auth.)

(An earlier report appeared as an abstract in Bull. ent. Soc. Amer. 5, 8 (1969) 137, abstract 283.)

13-5 ELEMENTS


Houseflies (Musca domestica L.) and German cockroaches (Blattella germanica L.) were fed IP to study its effect on their fertility. In houseflies the biological halflife of the ingested IP was about 0.8-8 d, whereas in female cockroaches the radioactivity did not fall to 50% in the 1-day observation period. In male cockroaches this point was reached about the 6th day. Houseflies fed 3H-labelled food continuously for 6 days did not oviposit, but 2 days after they had been returned to a normal diet a few eggs of low viability were deposited. Flies reared on the 3H for shorter periods showed inhibited oviposition and fertility. Their ovaries were immature, but they recovered partially after a normal diet was given. Larvae reared on 3H medium (15.3 ppm) developed into normal adults. Some German cockroaches fed 3H developed oothecae, but they were fissicid and contained no eggs.


Some experiments on the synthesis of protein-bound sulfur from inorganic sulfur were carried out on the German cockroach, Blattella germanica L.). 35S was added to the drinking water under controlled conditions (sterile, to eliminate possible bacterial contamination). Results indicate that cystine and methionine may have separate as well as combined synthetic pathways in Blattella.


Wasp's accumulate Mn during larval life, but much of it is lost at pupation, and accumulate it again at adults. Accumulation takes place rapidly in the cells of the mid-gut epithelium. Male wasps never build Mn stores in their bodies; queen wasps only after leaving the nest, but worker store Mn almost immediately after emerging from the pupa. Manganese isotopes Mn57, Mn58 and Mn60 were used. No evidence of a nutritional basis for egg sex development was furnished by these studies. The distribution of Mn throughout each intestinal cell (radiometric techniques) is not rapid, and transfer to the hemolymph may be discontinuous.

The cells of the wasp mid-gut between the Mn in excess of, with lack of control over also (See earlier report ARCB-605).

Bowne, V.T. THE UPTAKE DECOXIPHILA DEPILATA, J.C.

The bacterium metabolism of D. uptake from the interior host material is rapidly transferred where it is stored in a somatic or encapsulated patches of cells (morules). Lactobacillus is not when formed in the body by 39 h in the space between the foodstuff between this shows up it is seen to be of great interest that the location of Bu uptake particular food, and not a lot (See earlier report NL-1015).

Bruce-Crowett, L.J., Hayward OF MOSQUITOES. Nature 27

Larvae of Aedes aegypti were of the radiotracers ranging from delay in production of the larvae the 4480-mg/mil bath at 25° dead pupae. Apparently, a cor of emerging adults, females were radioactive. (CA 50: 10269).


Houseflies were either fed or (Extracts, hydrolyzate, and for metabolism. Cysteine-methionine of flies injected with cystine-d seemed to arise from cysteine-vi found in detectable quantities I synthesis, in the latter case rel- Gatet-Spear was not incorporated, one of which may transaminate system. (auth.)

Crowley, D.A., Jr., Pryor, M. MAZAMA MOXIPERA, H Adults of Mazama mexicana, venture the utilization and elimination plants where grasshoppers w: half-life was used to predict the tissue, but some was also found found in the moth skeleton. (auth.)
The cells of the waxy mid-gut offer a water-holding protein sheath of high stability, larval and worker honeys store Mn in excess of any known metabolite used, probably due to insufficient Mn extraction coupled with lack of control over absorption. (item auth.)

(See earlier report AECI-225, Technical Information Service, AEC, 49p)

249


The barium metabolites of D. reperta larvae, studied by use of radioactive Ba45, is described as involving uptake from the anterior part of the mid-gut, and to a less extent from the bases of the caecae. The absorbed material is rapidly transferred to the haemolymph of the ascending portion of the anterior malphigian tubules, where it is stored in a somewhat soluble form, until after pupation. Smaller amounts of the element appear in scated patches of cells of the posterior mid-gut, and some is excreted from the anterior malphigian tubules. Lanthanum-146 is not found to be absorbed by D. reperta larvae, nor does it appear to be excreted when formed in the body by decay of Ba45. The observation is made that material may be held for 20 to 20 h in the space between the peritrophic membrane and the anterior mid-gut epithelium. Partition of foodstuff between this slow-moving stream and the rapidly moving content of the peritrophic membrane is seen to be of great importance in determining efficiency of absorption by the larvae. It is concluded that the location of Ba uptake indicates a functional localization of treatment of dissolved as opposed to particulate food, and not a localization of uptake of a particular ion or ions. (auth.)

(See earlier report BNL-1018, Brookhaven National Lab., Upton, N.Y. 29p.)

250


Larvae of Aedes aegypti were immersed in mixtures of Na32P04, 3H2O, and radioactively labelled phosphorus was measured in the radioactivity ranged from 10 to 4400 muf/ml. The higher the concentration, the greater was the delay in pupation of the larvae, although at the end of two weeks, all larvae had been 3H2Oated with labelled phosphorus. At 2240 muf/ml, the larvae remained normal for more than 5 weeks, but produced dead pups. Apparently, a concentration of radioactive phosphorus greater than 100 muf/ml decreased the number of emerged adults. Females were (average) 1.8 times heavier than the males, but were 2.8 times more radioactive. (CA 50 10285a, 1952)

251


Houseflies were either fed or injected with 35S-labelled cysteine, cystine, methionine, taurine or sulfate. Extracts, hydrolysis, and was then analyzed by chromatography and autoradiography for radioactive metabolites. Cysteine sulfoxide acid, a key intermediate in sulfite formation, appeared on chromatograms of flies injected with cysteine-35S. There appeared to be two pathways for the synthesis of taurine. Taurine seemed to arise from cystine via hypotaurine. When methionine was the precursor, hypotaurine was not found in detectable quantities, but there was an increase in cysteic acid, a recognized intermediate in taurine synthesis. In the latter case relatively more taurine-35S was formed than when cysteine-35S was administered. Sulfate-35S was not incorporated into soluble organic compounds, one of which may be benzoic acid. The results indicate that benzoate possess an active transaminization system. (auth.)

252


Adults of R. microptera the eastern lubber grasshopper, were fed cesium-137 in bean plants to investigate uptake and elimination of this isotope. A biological half-life of 2 to 4 days was obtained. In experiments where grasshoppers were allowed to feed repeatedly on cesium-containing food, the biological half-life was used to predict the equilibrium value. Most of the ingested Cs was concentrated on muscular tissue, but some was also found in the digestive tract and reproductive organs. Only trace amounts were found in the excrement. (auth.)

A study on Colex molestit which, in the larval or pupal stage, had been placed in solutions containing NaCl2HPO4 with an activity of 0.15 µCi/ml showed the radiation to be detrimental to the uterine, sex organs, and reproduction rate of the mosquitoes. The general average activity of adult females appears to be 2.3 times higher than that of males. Pupal activity was found to be proportional to the initial start of the larvae. Larval satiation occurred on the 4th and 5th day (32,000 cpm).


P² was used in chemical and isocopic studies to trace the changes in the metabolism of phosphorus compounds in the tissues of the larvae and pupae of the oak silk worm. Intensity of the phosphorus metabolism at the beginning of the 5th larval stage of the caterpillars decreased, increased towards the middle and dropped again towards the end of that stage. The intensity of phosphorus metabolism reached its minimum on the 8th day of development of the non-diapause pupae. The intensity of phosphorus metabolism in the diapausating pupae reached its maximum on the 9th day.


Pats do not affect the start of diapause in the oaktree silkworm. During the diapause only the metabolism of low molecular weight P compounds is observed. Intensity of glycogen metabolism in the tissues of summer and hibernating larvae differ from the 1st days of larval existence. (CA 59: 6881, 1985)


(See abstract for Demyanchuk and Rusnova 1986).

In the summer larvae the P metabolism decreases up to the 9th day of life when it increases again. In winter larvae only the low molecular weight P compounds participate in metabolism and the intensity of P metabolism in all tissues except muscle tissues increases toward the 8th day of life and decreases toward the end of larval development.


It was shown with labelled phosphorus that the protein metabolism in the diapausating pupa of oak silkworm was on a high level in all tissues and especially in the muscles. The addition of vitamin B12 had no noticeable effect on the metabolic rate of the proteins; there was a slight augmentation in the rate of fat metabolism. (CA 62: 28861, 1988)


Third-stage larvae of Wuchereria bancrofti and Setaria digitata were obtained with a radioactivity that would enable them to be traced in the definitive host. This was 175 β-counts/min in the case of the S. digitata larvae. The larvae had been produced in the respective vectors, Colex uhligi, fasciatus Wird. and Armigeres robustus Wird., which had been kept for one to several days during the second to third larval stages in baths of Na2HPO4 (orthophosphate) of activity 1 µCi/ml. C. f. f. fasciatus females were allowed to feed on human volunteers infected with W. bancrofti, and A. robustus on cows infected with S. digitata. In spite of the large dose of radiation to which the filarial larvae were exposed in the mosquitoes their development was not noticeably affected. The distribution of ³²P in mosquitoes, pupae and infective filarial larvae were studied by means of autoradiographs. The highest amounts were found in the thoracic region of the male and in the visceral region of the female mosquito. (From Helmin. Abstr. 28, 2: 850, for 1987)

Doreenly, L. METHODS OF P² IN BLOWFLIES LAB. A simple method of radioisotopes: are obtained in individuals a non-critical food. The radionuclide counting rates of resulting in live weight. The loss of P² in pupal stage to 2 weeks of the original P² was found as little as 10% in the adult blowflies have a lower activity Service, AEO.


The distribution of P² in adults of Piptocephalus intermedius containing 2.5 µCi/kg was removed by washing, dissection, and 1995 of the P² was in phagel organic form. The glycolysis data are known to be inaccurate.

Futter, R.A., Siegert, P.W. (ACRIDEAE) TAGGED WITH Nymphs of Carausius morosus sprayed with an aqueous solution for 1 hour to be readily detected through excrescence was very g of radioactivity through most untreated ones.


Mulberry leaves were labelled with radioisotopes. A series of experiments of radioactive activity were fed, they were fed on leaves sprayed with The ingested radioactivity c was also tested and variation carried out in the spring and summer.

Gamet, T., Nishiyama, H. ISOTOPE UPON THE PHYSICAL AND CHEMICAL INJURIOUS EFFECTS ON WORMS (Research Report of the Fukuoka summary in English)

Ca²⁺⁺ was administered orally in the hungry state Ca²⁺⁺ was more o the nervous system, sexual o
CHANGES OBSERVED IN CULEX
the Egyptian Delegation to the UN

placed in solution containing
extremely high mortality. Sex
activity of adult females appears to
continue to the initial spike of the
diapausing stage.

THE ORGANISM OF THE OAK
(Translation)
A metabolism of phosphorus compounds
in the organisms of the diapausing
eggs is necessary for their continued liveliness.
The Experimental and Applied Biology 38, 2, 1956,

3. THE ORGANISM OF THE OAK BEETLE
V. L. Landi (Kafadan), Cap. Vol.

when it increases again. In winter
the intensity of P metabolism
decreases towards the end of

DIAPAUSING OAK SILKWORM
(Translation), Cap. 1, Biol.

a diapausing pupae of the oak silk-
the addition of vitamin B1 had no
augmentation in the rate of fat

FURTHER STUDIES ON RADIO-

Techniques. 41, Parasitol.

lized with a radioactivity that
in the case of the rat.

Ophraephila sp. were
fed to females allowed to feed on
blood of the mosquito. The development
of the diapausing stage was
the same as in the case of the


A simple method of radioactive labelling of Lucilia sericata larvae is described. More uniform count levels are obtained in individuals which have fed entirely on radioactive food than in those which first feed on
nonradioactive food. The radioactive count rates of the larvae are correlated with larval live weight and the counting rate of resulting imagines correlated both with corresponding larval counting rates and with imaginal live weight. The loss of \(^{3}P\) in the larvae due to causes other than decay of the isotope is traced from the prepupal stage to 3 weeks after emergence. The first and major loss occurs at emergence, when about 90% of the original \(^{3}P\) is shed as empty puparium and malpighian. Adults lose about 1.5% per day. The distribution of \(^{3}P\) in the adult body of L. sericata labelled in the larval stage has been determined. The abdomens have a lower activity than the rest of the body. (Abstract, 147, in YID-2078, Technical Information Service, AEC.)


The distribution of \(^{31}P\) in different parts of the body of Dendroctonus pseudotsugae Hopkins and its incorporation into phosphorilated intermediates was studied. Adult biax Beetle were allowed to feed on 2.5% glucose solution containing 2.5 mCi/mmol \(^{31}P\)-labelled phosphoric acid for 2 days. Only 2% of the total radioactivity was removed by washing. Dissection showed that about 10.5, 14 and 83% of the remainder were in the head, thorax, and abdomen, and 6.8 and 9.3% in the legs and wings respectively. In the alcohol extract, about 80% of the \(^{31}P\) was in phosphorylated intermediates, and in the water extract more than half was in the inorganic form. The gynostegium cycle is considered to be present in the beetle. Most of the phosphate esters that are known to be intermediates of glycolysis were found.


Nymphs of Carinaria pelbioda (Scudd.), allowed to feed in the first instar for 24 h on wheat seedlings sprayed with an aqueous solution containing \(^{31}P\) in the form of phosphate ion, retained sufficient radioactivity for it to be readily detected with a portable Geiger counter throughout their development. Loss of radioactivity through excretion was very slow at first, but decreased steadily and almost ceased 12 d after treatment. Loss of radioactivity through moultting was negligible. The survival of treated grasshoppers was as high as that of untreated ones.


Mulberry leaves were labelled with \(^{31}P\) by spraying with \(^{31}P\)HCl, and silkworms were allowed to feed on
them. A series of experiments were carried out in which groups of 100 worms were tested. Varying levels of radioactivity were fed, the feeding of radioactive material starting at different larval stages. Controls were fed on leaves sprayed only with unlabelled phosphoric acid. The results were weighed more in the head, thorax, and abdomen, and 6.8 and 9.3% in the legs and wings respectively. In the alcohol extract, about 80% of the \(^{31}P\) was in phosphorylated intermediates, and in the water extract more than half was in the inorganic form. The gynostegium cycle is considered to be present in the beetle. Most of the phosphate esters that are known to be intermediates of glycolysis were found.

263 Gamo, T., Nibiyama, H. SOME OBSERVATIONS OF BIOLOGICAL INFLUENCES OF RADIOACTIVE ISOTOPES UPON THE PHYSIOLOGICAL FUNCTIONS OF THE SILKWORM. (1) ON THE ABSORPTION OF Ca41 ADMINISTERED THROUGH THE MOUTH INTO SEVERAL TISSUES OF THE SILKWORM AND ITS INHIBITORY EFFECTS UPON THE RESPIRATORY FUNCTION. Shimizu Daigaku Sen Yabuse Kenkyu Hokoku (Research Reports of the Faculty of Textile and Sericulture, Shimizu University) 8 (1988) 37-41. (In Japanese summary in English)

Ca41 was administrated orally either (1) in the course of feeding mulberry leaves, (2) in the surface or (3) in the hungry state. The maximum quantity of absorbed Ca41 was found in the blood in (2). In the hungry state Ca41 was more quickly absorbed into blood than in the other two cases. Uptake of Ca41 by the nervous system, sexual organs, fatty tissue, muscle, and the silk gland were measured 06, 20, and
60 min after administration of CaCl₂. The nervous system generally took up the largest amount of Ca⁴⁺, and the sexual organs, muscles, and fat tissue followed successively in this order. The injection of Ca⁴⁺ was assayed by measuring the O₂ consumption per unit weight of the silkworm larvae, pupa and adult.


CaCl₂ solution was administered orally to silkworms at various growing stages, and variations in the blood picture were studied. Platelet count was most extensively influenced by this administration and decreased to an average of 19% of the original value. The decrease in the platelet count was 68%, globule cells 67%, and mesocytes 57%. The effects of radioactivity were greater in male than in female silkworms.


Attempts were made to show some sexual differences in the destructive influences of radiation upon the number of hemocytes of the silkworm, just moultsed silkworm larvae of the first stage were administered 1 or 0.5% solution of CaCl₂ or 0.3% solution of Na₂SO₄ through the mouth. It was concluded from the result that the largest damage of Ca⁴⁺ and S⁴⁺ was inhibited on the platelets, especially in the male silkworm. (NRA 15: 221-85, 1961)


The practical importance of such data for pollution problems is stressed. The elimination of radioactive substance (solute, Se⁴⁺, Ru⁴⁺, Cr⁶⁺, Co⁶⁰) from aquatic insects (Coleoptera ptychid pteryx and Helice incipiens zett) was, like accumulation, found to proceed in different ways, and to depend on the chemical element and the species. Monosodiumeliminated in most slowly, cadmium-flies Ca⁴⁺. The accelerating effect on deposition of the addition of EDTA (the sodium salt of ethylenediaminetetra-acetic acid) was studied and confirmed except for S⁴⁺. Two tables list concentration and deposition in larvae, in clear water and EDTA.


The deposition of radioactive isotopes from mosquitoes (Culex pipiens ptychid pteryx), flies (Helice incipiens zett), and molluscs (Aplysia hypogonias l.) was studied in order to determine the washing time in live organisms after they were transfused with contaminated medium to clean water, and also to find the effect of water-soluble complex ethylene diamine tetra-acetic acid (EDTA) on incorporated radioisotopes. The tests were made in laboratory-filled aquariums contaminated with S⁴⁺, Ru⁴⁺, Cr⁶⁺, and Co⁶⁰. The results show that EDTA and the adsorption process except for S⁴⁺. The uptake and deposition of S⁴⁺ is lowest in mosquitoes; Cr⁶⁺ is the slowest in flies; and Co⁶⁰ is the slowest in molluscs. An intensive absorption of S⁴⁺ and Co⁶⁰ was observed during the first 2-4 days, after which it was stabilized; deposition of Ca⁴⁺ was much slower. In spite of a high percentage of deposition, the organisms carry a considerable amount of the radioactive substance into the clean water. (NRA 14: 2280, 1960)


О възможност на водното въздействие на вдомо вещества на водните организми под различни условия. (Георги, А. Б., Георгиева-Рьовската, Н. И., Георгиев-Рьовски, Б. Н.)


Възможност на водното въздействие на вдомо вещества на водните организми под различни условия. (Георгиев, А. Б., Георгиева-Рьовската, Н. И., Георгиев-Рьовски, Б. Н.)


Radioisotopic investigations on "labeled" midges show that the chief site of intestinal absorption was the hindgut. (NRA 15: 221-85, 1961)
The elimination of radioactive phosphate from the larval intestine of the silkworm, in order to determine the remaining phosphorus content, was found to be similar to that in the adult. This similarity suggests that the utilization of radioactive phosphate in the larva is similar to that in the adult.

The radioactive phosphorus was administered to the adults of the silkworm, in order to study the fate of this material in the larval intestine. The results showed that the radioactive phosphorus was absorbed and utilized by the larva, indicating that the radioactive phosphorus was transported from the intestine to the other parts of the body.

In conclusion, the radioactive phosphorus administered to the adults was absorbed and utilized by the larva, indicating that the radioactive phosphorus was transported from the intestine to the other parts of the body.

**References:**


8. Investigations on P-32 labelled phosphates introduced into the intestine of the cockroach show that the rate of absorption is the rate of absorption. Other factors affecting movement of phosphates from the intestine have been examined. KCN, for example, has no inhibitory effect; low temperatures decrease rate of absorption.

A study is reported on the incorporation of P32-labelled orthophosphate in the pyrophosphates of the ejaculatory duct of the adult male. Data is presented which proves the enzyme found by Hoppe and Hiltunen in bovine sperm to be present in the genital passage of Celerio euphorbe.

275


The genital pouch and the spermatic duct of the male moth are rich in pyrophosphate which originates from nucleotide phosphates. When P32 is injected into the abdomen of males immediately on hatching or 3 days prior to or later after metamorphosis it is found in the same location. After mating, the polyphosphate is not reabsorbed in the egg.

276


The intermediary metabolism of inorganic sulfur into organic compounds in cockroaches was investigated by either feeding or injecting Na235SO4 into Blatella germanica (L.) and Periplaneta americana (L.). The possible role of the gut microorganisms and the intracellular symbionts of B. germanica on the metabolic pathways was studied by determining the 35S-labelled compounds detected in normal insects and specifically reared insects containing the symbionts and in cockroaches bred without symbionts. In both normal and sterile insects the 35S was found primarily in glutathione, cystine, methionine, and methionine sulfoxide, and only in limited quantities in taurine, sulfite, and several unidentified compounds. In symbiont-free B. germanica the 35S was detected only in sulfite and two unidentified compounds. (authors)

(See earlier report in Bull. ent. Soc. Amer. 5, 3 (1959) 141, abstr. 271 under "sulfate utilization and the role of intracellular symbions in cockroaches (Orthoptera Blattidae")

277


The fat-feeding technique of Winteringham (1950) was applied to the study of P32-labelled compounds in Periplaneta americana nerve extracts. Seven days after injection of 400 µg of carrier-free P32PO4, the abdomen of each cockroach was opened and part of the ventral nerve cord dissected free from all other tissues. Only actively conducting cords, as indicated by electrical stimulation, were used. The cord was placed on a filter paper saturated with liquid nitrogen and a single sample rapidly transferred to a glass homogenizer immersed in liquid nitrogen. Six to ten samples were extracted three times with 5% aqueous ethanol and the combined extracts analyzed and resolved into five fractions (1-5) by ascending paper chromatography at 5°C in the acetic acid/formic acid/water solvent of Barrow, Grylls & Harrison (1962). Some components have been tentatively identified by co-chromatography. The amounts of P32 in fractions II, III and IV measured by radioscintigraphy (Winteringham, Harrison & Bridges, 1955), have been expressed as percentages of the total P32 in the three fractions. When EDTA was used 100 µg was applied normally in 5 µl of aconite 24 or 48 hr before dissection. Animals showing early (Tennison) and later (Proctor's) signs of EDTA poisoning were used. Results and identifications are discussed.

278


Adult male and immature B. germanica (L.) can utilize inorganic sulfate for the production of both cystine and methionine. The sulfate ion was provided in the form of trace amounts of H33SO4, which was offered ad libitum at 0.018 mg/ml. The procedures followed for chromatography and radioassay are described. The two amino acids appear to be synthesized by independent routes. The degree of utilization depends on the developmental stage of the test animals; growing nymphs utilize sulfate at a more rapid rate than do adult males. The rate of utilization also depends on whether or not the insects are reared aerobically. The in-

279


S35S-labelled cysteine fed to hydrolases and extracts peaks of radioactivity after retained in the body and after it was formed, it is

280

Hout, L., Verly, W.G. (COLLECTER: TIMBER). Les résultats démontrent une erreur de ± 5% qui est la faible variation de ce fac

281

Hopper, J., Myers, W.C. MADAREA (abstr). Bo

282


Eggs of Canton Special male A. assamae radiographic P32 were heavy in fat body; concentration of P32 occurred in P32 in early pupal stage. In the adults, the gonads.

283

Iynegt, R., Pasigeh, M. DOMESTICUS. C.R. AC

Pluseurs génétiquement de D. gaupte partie du phosphore des cinq premiers jours de la vie des ouvrières pondent que rapide des phosphates, C. intra-abdominales d'une à emis plus de 15 des organes de la vie de D. gaupte et l’alimentation des tubes de Malpighi est son excrétion. Par la salive génite.

284


King, R.C. STUDIES WI IN ADULT D. MELANOGA 1965, 11p.

The turnover of phosphorus studied utilizing 33P. The adult D. simulans males a by two phase systems. The

285

This work is followed up t
The conversion of inorganic sulfur into methionine and cystine can be carried on to a moderate degree under asptic conditions and at a high rate under anaerobic conditions.


S8-labelled cystine fed to adult male or female houseflies was converted into sulfide and sulfate. The hydrolyases and enzymes as well as excreta from the flies were examined by paper chromatography. The peaks of radioactivity after hydrolysis and extraction occur in cystine and peptone. Taurine was partly retained in the body and partly excreted, while virtually all of the sulfate was excreted within 24 to 48 h after it was formed. Flies are unable to synthesize methionine from cystine.


Les résultats démontrent qu’il est possible de mesurer le 35T total d’une larve vivante de T. molitor avec une erreur de 5% qui dépand essentiellement de l’erreur sur le facteur de correction appliqué. La très faible variation de ce facteur de correction en fonction du poids de la larve a été interprétée.


Eggs of Canton Special stock of Drosophila were hatched and larvae reared on medium containing 35S. Alternate radiographed and rival samples were made of larvae, pupae, and adults. Deposits of 35S were heavy in fat bodies, nervous structures, and in organs of digestion and excretion. Very high concentrations of 35S occurred in imaginal disks. Discharged materials and nuclei from fat bodies had high 35S in early pupal stages, the activity becoming concentrated at sites of organ differentiation in later pupae. In the adults, the gonad, the nervous system, and the digestive tract contained much 35S. (auth.)


Plurichemiques de Drosophiles sont élevées sur un milieu contenant du N35F, à P radioactif. La plus grande partie du phosphate radioactif ingéré par la Drosophile pendant la vie larvare est diminuée lors des cinq premiers jours de vie de l’imago. La perte en radioactivité se fait ensuite beaucoup plus lente. Les auteurs ont pensé que les tubes de Malpighi pouvaient être l’organe responsable de cette diminution rapide des phosphates. On effectue chez des Gyrilles adultes des injections intra-thoracique ou intra-abdominale d’une solution de phosphate de Na 35P1 (1 à 3 μ) qui change de la radioactivité de poids équivalents de certains organes (les tubes de Malpighi, les ovaires, les testicules, le tube digestif, le 3e stade et l’œuf porteur), montrant que le 35P se concentre dans les ovaires. Phénomène qui doit être lié à la vitellogenèse.

Khodakov 1950 - (337)


The turnover of phosphorus by adult males and females of Drosophila melanogaster and D. simulans was studied utilizing 32P. The half time of phosphorus turnover by adult male and female D. melanogaster and adult D. simulans males and females are 31, 32 and 33, respectively. All 4 classes of flies lose phosphorus by two phase systems. The turnover of phosphorus by female D. melanogaster is faster than that of males because their fast phase has a shorter half time than that of males. Male D. simulans lose phosphorus more slowly than females because of the longer half time of the slow phase of the males. (auth.)

This work is followed up in J. exp. Zool. 135 (1954) 322.


The distribution, concentration, and turnover of phosphorus in the tissues of Drosophila were studied utilizing tracer techniques. Data are presented in tabular form on the distribution of $^{32}P$ in various tissues of totally labelled adult flies of both sexes. (NRA 7: 5011, 1959)


Male flies of D. melanogaster (L) and D. simulans turn over phosphorus more slowly than females. Both sexes of L turn over about half of their phosphorus by a fast phase and half by a slow phase. These studies of L indicate that the majority of P is in the thoracic region, with large amounts in the hemolymph and head; 96% of the P in the female reproductive system occurs in the ovaries. Large amounts of P occur in the various parts of the male reproductive system with 60% of this P in the testes. During development, over 90% of the total P resides in the metamorphosed insect; 1% remains in the pupa of D. melanogaster. Freshly hatched adults of each sex is quite low in P, but it rises with feeding. Calculated values are given for P turnover in a 24-h period by various regions of the adult body of each sex of L. (CA 68: 7212b, 1954)


(See article In Amer. Nat. 88 (1954) 155-8)


The paper describes striking differences in the uptake of $^{32}P$ by adults of two related species of Drosophila (melanogaster and simulans) feeding on different yeast species (Saccharomyces cerevisiae, Candida albicans, Debaromyces Hansenii, Hansenula polymorpha, and Schizosaccharomyces pombe). It was found that phosphorus uptake by both species is increased on medium containing live yeast. The rate is increased more in females than in males. Phosphorus uptake is sometimes strikingly different for flies of different species feeding on the same yeast.


$^{32}P$ was employed as a tracer in a study of the phosphorus metabolism of yeast by adult Drosophila. Data are presented on the incorporation of $^{32}P$ into tissues and eggs, P excretion, the relationship between endogenous and exogenous P and differences in P turnover demonstrated in male and female Drosophila. Females of L weighing 1.5 mg each, when fed $^{32}P$-labelled Saccharomyces cerevisiae ingested about 6 x $10^{-5}$ mg P per day per fly. An equal amount was lost during the day.

(See also BNL-1978, Brookhaven National Lab., Upton, N.Y. 1954, 229p.)

290 King, R.C., Robinson, A.C. DISTRIBUTION OF CALCIUM IN ADULT DROSOPHILA MELANOGASTER. Science 125 (1957) 546.

Autoradiographic studies of Ca$^{45}$ localization in adult and larval stages of D. melanogaster indicate rapid transfer and storage in the excretory organs of the insect. It is concluded that the insect requires only trace amounts of Ca and that the concentration in the excretory tube is no higher than that in the cytoplasm and body fluids. (CA 61: 10792c, 1957)

292 Kogure, M., Nakajima, M., Hiraizumi, K., Terjil, T. STUDIES ON $^{3}H$ IN THE SILK WORM. Zool. Mag., Tokyo 56 (1951) 24. (In Japanese)

The uptake of $^{3}H$ by silkworm larvae was studied, and the role of the digestive tract in phosphorus metabolism discussed.


The fate of radioactive formate in roach, Periplaneta americana, the house fly, Musca domestica, and the silkworm, Bombyx mori, was studied. Radiocarbon formate, 2-[14C] formate, formic acid, and formamide were administered to a number of insects and the incorporation of the various forms into various fractions was measured. (CA 60: 10484, 1963)


The distribution and toxicity of AC 585-913 (formamide, nitrogen mustard) to a number of insects and other organisms was studied. The compound was found to be highly toxic to insects and other organisms, and the results indicate that the compound is a potential insecticide. (CA 62: 10484, 1959)


The uptake and distribution of lucanidus cepyus, L, was for the effects of the level of autophagy. Thus, in radiographs were further in other samples with the autophagic tubules and the hemolymph.

296 Lüdtke, M. ÜBER DIE 8[PHOSPHORUS proton]3H-LABELED DIANTHUS X RHOEOD (In German)

Different methods were used to study radioactive hist. AVH: 8[PHOSPHORUS proton]3H-LABELED DIANTHUS X RHOEOD (In German)

The uptake of 8[PHOSPHORUS proton]3H by silkworm larvae was studied, and the role of the digestive tract in phosphorus metabolism discussed.

5h later silkworms were injected with $^{32}$P$_{2}O_{5}$ diluted with Na$_{2}$HPO$_{4}$ to 10 H$_{2}$O solution. The distribution with time and the concentration of $^{32}$P is discussed for various tissues (alimentary canal, silk gland, sexual gland, Malpighian tubules) and for blood. Following injection and also after the administration of $^{32}$P-labeled mulberry leaves. Results of the uptake and transformation of $^{32}$P in mulberry tree's (seeds) are also summarized.


The fate of radioiodide was investigated in several insects: Aeschna sp., dragon fly; the Anopheles cockroach, Periplaneta americana L.; the German cockroach, Blatta germanica L.; a cricket, Tibicen sp.; the squash bug, Anasa tristis (DeGeer); the larger beetle, Pachycreton vespilloides (Cress.; the locust, Locusta migratoria M.; the grasshopper, Schistocerca gregaria (Faur.); the termite, Termes sp.; the cockroach, Periplaneta americana L.; the house fly, Musca domestica L.; the locust, Locusta, 3 (of 9) monooxydo-


The distribution and metabolism of certain radioiodine compounds and radioiodine within Periplaneta americana L. were investigated. In vivo metabolism studies supported the findings reported in part I, and further demonstrated that iodine and thiourea do not inhibit the ability of iodide to iodinate absorption. The biological half-life of iodine in cockroaches was established at about 27 h. An examination of the in vivo metabolism of $^{131}$I-labeled monodeiodinated iodide, and of the excretion process. Distribution studies with radioiodide revealed that the cuticle was able to absorb iodine from the blood, and the animal retained absorbed iodine more efficiently than the other internal tissues. Thiourea and thiocyanate did not decrease the ability of cuticle to absorb iodine from the blood; they did, however, promote the concentrating ability of most other tissues. The fumigant, methyl iodide, was concentrated by the cuticle and head, apparently undergoing rapid excretion. Compared with radioiodide, radioiodine was concentrated from the blood by the cuticle, mouth, nerve cord and Malpighian tubules. Distribution studies with labelled monodeiodinated diiodotyrosine and thyroxine indicated rapid excretion via the Malpighian tubules and the hindgut. (from auth. summary)

Ludicke, M. ÜBER DIE AUFNAHME VON RADIOAKTIVEN, SEKUNDÄREM NACHTRÄMISCHPhOSPHAT BEI LUCANID PERNICULIS (Enthe uptake of radioactive secondary iodine phosphate by Lucanus cervus L.) Z. physiol. Physiol. 26 (1939) 86-94. (in German)

The uptake and distribution of orally administered Na$_{2}$H$^{32}$PO$_{4}$ solution in the wing, legs and antennae of Lucanus cervus L. was investigated. Relative concentrations of radioactivity in the different organs, and the effects of the level of the initially administered dose and of time are discussed. Use is also made of autoradiography. Thus, in addition to studying the distribution of radioactivity in the above organs, autoradiographs were further made of membrane fragments, muscle fibers, ovotestis, fat bodies, the intestine with the Malpighian tubules, the thoracic ganglia and the brain. The results are discussed.


Different methods were used for labelling various insects by means of $^{32}$P-labelled Na$_{2}$H$^{32}$PO$_{4}$ (direct feeding, via a radioactive bait, via an artificial membrane, etc.). The oocytes, colostrum, lepidopterans and hemipterans examined showed a distribution of radioactivity which corresponded to the system of veins in the wings. In the coleopterans examined (Lucanus, Melolontha and various carabids) the cuticles were much more radioactive than the hindgut. The relative hemolymph distribution within the wing is discussed.
Among the orthoptera (Phyllolemna, Blatta and Gryllotalpa) the difference between the wing pain is not so pronounced. In heteroptera (Hemiptera and Tenebrionidae) radioactivity originates almost entirely from the coxal portion. Lepidoptera studies (e.g., Locusta (vanessa) by L.) showed an apparently similar distribution in both wing pairs. Results of other workers are discussed.

L dicta, M. **ÜBER DIE VERTEILUNG DES IN RAUPENSTADION AUFGEFORDERNEN 47P-O-DINITRAT-HYDROGENPHOSPHATS BEI DER SCHLÜPFENDEN IMAGO VON VANESSA ROY.** (On the distribution in the emerging imago of Vanessa in the P-labelled Na$_2$HPO$_4$ solution taken up at the larval stage). **Z. vergl. Physiol.** 35 (1934) 358-360. (In German)

Distribution was tested by means of autoradiographs and a G-M counter. Both wings of palms showed practically equal radioactivity, essentially concentrated in the veins of the wings. Radioactivity increases immediately after injection, followed by a drop. Dissected organs such as the intestine, the Malpighian tubules, muscles, fat bodies, the central nervous system, and chitin and the hemocyanine were also tested for their activity. The intestine (in contrast to the Malpighian tubules) and muscles showed high values. The time for radioactive food to pass through the intestines of the larva is 12 to 3 minutes. Experimental results on pupae of Delphiella euphobius L., are also recorded, and some work on orthoptera and coccinellidae, the orthoptera being intermediate to coleoptera and lepidoptera with regard to the localisation and relative distribution of radiation from the wings. Details are given.

The following were studied: orthoptera; Phyllolemna germanica L., Blatta orientalis L., Gryllotalpa gryllotalpa L., coccinellidae; Carabas bidentatus L., Carabas auratus L., Carabus ulrichi L., Melolontha vulgaris L., lepidoptera; Delphiella euphobius L., Vanessa in L.

Poulson, D. F., Bowen, V. T. **THE COPPER METABOLISM OF DROSOPHILA.** Science 114 (1951) 466.

The uptake, distribution, and excretion of copper by larvae of four species of Drosophila, D. melanogaster, D. repleta, and D. virilis, were followed by determining activities of whole and dissected larvae as intervals after the feeding of Cu$^{64}$ in various media, as a series of copper concentrations.

(Abstract of paper presented at the autumn meeting of the National Academy of Sciences, 9-7 Nov. 1951, New York, N.Y., USA)


A review article. For this bibliography, the sections dealing with autoradiographic localization of minerals are of interest. Autoradiographic studies of inositol metabolism in larvae of various species of Drosophila (virilis, repleta, melanogaster, funchuta) by means of Fe$^{59}$ showed some tissues to contain considerably higher concentrations in the medulla than others. Results obtained with Cu$^{64}$ in the uptake, distribution and excretion of copper (D. repleta) are reviewed, and correlations between copper and fluorescence discussed. Autoradiograms gave no indication of nuclear localization in D. repleta. Work with radiocesium is also mentioned. New methods and techniques and their possibilities are discussed.


The radioactive Cu$^{64}$ was produced by neutron irradiation. The uptake of copper by larvae of species of Drosophila (repleta, melanogaster, melanogaster) traced by Cu$^{64}$ is proportional to the copper concentration in the medium over the range 0.1-10$ \mu $g Cu/g. Above this level uptake falls off. Rates of excretion as well as distribution in the tissues have also been determined. From these data factors relating copper content of larvae to copper concentration in the medium have been calculated. Both counting and autoradiographic methods demonstrate that a large fraction of the tissue copper of Drosophila is in a form not demonstrable with presently available histochemical techniques. Further work is left to the hypothesis, previously advanced, of a profound difference in copper metabolism between two of the major subgroups (Drosophila and Tephritidae) of this genus. It is shown that Cu$^{64}$ ingested as part of the yeast cell is absorbed without any opportunity of mixing with stable konic copper simultaneously ingested. Thus there appear to be at least two pathways of copper uptake, one for konic, the other for bound forms. (from auth. summary)


The numbers of Tetraonids positively correlated with the content of Cu in the soil of their habitat. Radioactivity of the Cu was taken up during the quiescent, uptake continued adult males maintained the same intensity rate to its uptake, the rate doubled for half the females lived for an average of 20 days. It was relatively in radioactive, showing that Cu was injected into the leaf.

Sasaki, K. **SOME OBSERVATIONS ON PHYSIOLOGICAL FUNCTION A/CONIF. 8/7/1967.** 12 (1)

The absorption of orally administered inorganic copper (Bombay) system generally took up in that order. The stomach (in man) or orally in man, and the stomach is the site of absorption in the latter. The diminution of about 363

Semeneva, L. M. **STUDY OF THE METHOD OF TAGGING MT2.** J. Physiol., 1952. **290**

Solutions of Na$_2$HPO$_4$ and 0.05, 0.05, 0.1% K$_4$ of isotope permeating the root was depressed by the higher one-sided for the salts rose.

Sparrman, Sancy, K., Nord, N. **RICE MOTH, CORNICE.** 364

The levels at which dietary (1.9% ZnCl$_2$ in dextrose) was the only vitamin except th. 0.4% ZnCl$_2$. Vitamin B$_6$ w growth in this condition. Reduction of growth from Zn to diet reversed the inhibition influence the uptake of Zn$^{65}$

Sapsik, J. I. **INJECTION OF DIHEDRAL.** 1963 836-42.

Preliminary experiments were proteins, especially in arbor arthropodin, and mono- an 24 h. than fixed in Carney's analysis demonstrated that the greatest intensity of P- and

The number of *Tetranychus urticae* (Harvey developing on tomato leaves have been shown to be positively correlated with the phosphorus content of the latter up to about 0.9% dry weight of foliage. Since this P-content is common in food plants of the mite, bean plants were grown in a solution containing $^{32}$P and the radioactivity of the leaves and eggs determined at intervals during 10 d. Almost half the acclimated $^{32}$P was taken up during the first 8 h of feeding. Full capacity (2007 cpm) was reached in about 26 h subsequently uptake continued slowly as the mites increased in size. The $P$-content of the egg to that in the adult mite maintained an approximately constant ratio. Utilization of $P$ in egg production proceeded at a similar rate to its uptake, but utilization in the body of the mite was much slower, since about 30 h were required for half the $^{32}$P to be used. $P$ was 3 times as concentrated in the egg as in the mite body. The females lived for over 10 d, laying about 10.5 eggs/day during this time. Egg production therefore consumes relatively large quantities of $P$. On transferring radioactive mites to leaf dishes, they became radioactive, showing that a $P$-containing secretion, thought to originate in the tracheal salivary gland was injected into the leaf.


The observation of orally administered radioactive Ca$^{40}$ (as Ca$^{40}$Cl solution) into certain tissues and organs of silkworm larvae (Bombyx mori) was studied on normal 7th instar larvae, results are tabulated. The nervous system was not taken up the largest amount of Ca$^{40}$, and the sexual organs, muscle and fatty tissues followed in that order. The injurious effects of Ca$^{40}$ on respiration was checked. The distribution of $^{40}$P after administered intramuscularly or orally was also investigated; further, the turnover of phosphorus compounds during metabolism, and the role of the alimentary canal in phosphorus metabolism, The excretion of considerable amounts of phosphorus in the later days of 6th instar is due to degradation in the silk glands and alimentary canal, and the distillation of absorption by the larva itself.


Solutions of Na$_2$HPO$_4$ and K$_2$HPO$_4$ were made in concentrations employed for fertilization in hydroponics: 0,068, 0,025, 0,005, 0,005, 0,001. The $^{31}$P penetrated the larval cuticle in greater amounts than did $^{40}$P. The quantity of isotope permeating the cuticle was related to the concentration in the medium, but the rate of absorption was depressed by the higher concentrations. The permeability of cuticle of these larvae was one-sided for the salts tested. (CA 52: 12205d, 1958)


The levels at which dietary Zn becomes toxic to rice-moth larvae have been determined. At lethal levels (1.6% ZnCl$_2$ in diet) supplementation of the diet with vitamin B$_2$ or liver extract checked mortality. None of the B vitamins except biotin and B$_6$ was effective in reversing the inhibition of growth induced by 0.4% ZnCl$_2$. Vitamin B$_2$ was more effective in prolonging the survival of the larvae than in preventing growth in this condition, liver extract, as well as its alkaline-stable fraction, partially reversed the inhibition of growth from Zn toxicity. Deoxycorticosterone acid and triamcinolone acetonide at 0.3-1.0% levels in the diet reversed the inhibition of growth from Zn toxicity completely. Dietary deoxycorticosterone acid did not influence the uptake of Zn$^{65}$ from the diet. (CA 51: 3891d, 1959)


Preliminary experiments were performed in order to explain the metabolism of linoic in its relation to protein, especially to arthropodin, present in cuticle of arthropods. Linoic react with cyanide present in arthropodin, and mono- and di-sodioformate are formed. Living larvae were exposed in water to $^{14}$C for 24 h, then fixed in Carnoy's Liquid, embedded in paraffin, and cut in sections 10 µ thick. Three-isotope analysis demonstrated that $^{14}$C accumulated in the outermost layer of epicuticle (which is free of chitin). Greatest intensity of $\beta$- and $\gamma$-radiation was in the region of anal papillae. (CA 48: 7211d, 1958)

Early and late 4th instar larvae of C. pipiens placed in tap water containing P32 for 24 h and then removed to plain tap water followed in 24 h by removal of the Malpighian tubes show great accumulation of P32 in the tubes near the time of pupation, and the amount remains constant during the rest of metamorphosis.

The majority of the P32 is in material soluble in 10% HCl and also in the granules (probably polyphosphate) of 1-3 μm diameter which appear in the Malpighian tubes near pupation and which show a strong affinity for basic dyes and are soluble in 10% HCl, H2SO4 or 5% HNO3. Accumulation of P32 in the granules also occurs if the gut does not show radiolactivity, this shows it must be taken up from the blood. In the change from early 4th instar larva to early pupa the amount of P32 extracted by ECCH 0-4 falls (36.4 to 24.7%), while the amount extracted by 5% HCl then (22.4 to 68.9%), and that extracted by 10% HCl falls (38.8 to 31.3%). It has been shown (unpublished) that the phosphatase arises from bacilliform organs (especially the gut) during metamorphosis and this is taken up from the blood by the Malpighian tubules which are thus active in the regulation of the phosphorus balance. (CA 56: 6628, 1960)


The influence of DDT (D, Lindane (I), methyl-Parathion (II), and Ramanon (IV) on the distribution of radioactive phosphorus in the different tissues of the cockroach, Periplaneta americana, and the incorporation of radioactive phosphate into phosphorylated intermediates in the nerve cord and the muscar muscle of the insect were studied. Radioactive phosphate injected into the abdomen of the insect translocated quickly to the head, legs, wings, nerve cord, and muscar muscle. The location of the distribution of radioactive phosphorus in the different tissues of the intact body was similar to that of other insects which consumed orally radioactive phosphorus: 6-8 h after the injection, the order of the accumulation of radioactive phosphate in the tissue was gut > nerve cord > legs > head > wings. The radioactive phosphorus intermediates were found in the nerve cord and the muscar muscle were traced by paper chromatography. Orthophosphate, ATP, ADP, glucose-1-phosphate, glucose-6-phosphate, fructose-6-phosphate, hexose phosphate, 3-phosphoglyceraldehyde, and 2 unidentified compounds were found in the nerve cord, while the same 5 compounds and 6 unidentified compounds were found in the muscar. In both tissues, most radioactive phosphate esters which are known to be intermediates of glycogen synthesis were also found to be present in both tissues, but in relatively small amounts. The ratio of orthophosphate-P to ATP + ADP = PP was higher in the muscle than in the nerve cord. The incorporation of radioactive phosphate into phosphorylated intermediates in the nerve cord and muscle was inhibited by treatment with insecticides in the following order: IV > II > I. Also, the incorporation of radioactive phosphate into lipids and total parts in the trichloroacetic acid-insoluble fraction was inhibited by II, I, II, and III had a little effect on the incorporation of radioactive phosphate into the fraction. (CA 51: 9701, 1957)


The exchange of Na-labeled sodium between the external medium and the haemolymph and whole body was investigated in the larva of A. aegypti. The time for half exchange was 26 h. Most of the exchange of labeled sodium was found to occur through the anal papillae, although smaller amounts entered the haemolymph through the gut and general body surfaces. Transfer constants were used to describe the transport rate and uptake of labeled Na in the whole system. The rate of uptake of Na was independent of the external concentration used in these experiments. K-fions do not compete with Na for uptake, which suggests separate mechanisms for the accumulation of these two ions. The effect of temperature on the rate of uptake of labeled Na was also investigated.


1-metabolism in 2nd instar larvae and pupae was studied by means of a Galger counter, histolatochromatographs, and filter paper chromatographs. The K was concentrated by the skeletal parts of the larva, the median larval structures, i.e., buccopharyngeal arms and spiracles, concomitantly absorbed the greater portions of it than the unstripped larval skin. The treated puparia likewise showed an K concentration higher than that in the unstripped larval skin. The pupa cases, in contrast to fresh larval skins, incorporated K non-metabolically when placed in an I solution. Data obtained from Galger counts suggested that I was accumulated by the larval ring gland. A region celloxed, black pigment forms. The region is histologically a somewhat narrowed esoude from a (2CH3)2 hydrocaron c by scanning the chromotoga tissue; it is suggested that it is (auth.)

310 Winteringham, F. W., Low MUSCA DOMESTICA. (coln)

The distribution of phosphorus in the biochemistry of the invertebrates is the subject of the compounds contained in the subsequent paper. The ratio of the non-labeled prepare demonstrated a high proportion of phosphorus in the experimental distribution. (CA 52: 4705, 1957)

311 Winteringham, F. W., Low WITH LABELLED SYSTEMS, MUSCA DOMESTICA L. I

As discussed by an insectologist, the significance of the time was studied by the labeled, extracting, resolving the compounds by means of a chromatographic. This paper contains the distribution of the labeled distribution is found described in this paper. (CA 53: 2495, 1959)

312 Winteringham, F. W., Low THE ADULT HOUSEFLY, MUSCA DOMESTICA L. J. 75 (1960) 38-45

In order to facilitate interpenetration the soluble phosphorus compounds were studied. The isozymes were identified, labelled with 32P and the presence of 32P-glycogen was normal activity was as follows: an accumulation of ATP in increasing phosphatase and A TP c was found in head ATP which was accumulated in gut, injected water and thoracic P compounds could c


The importance of P related metabolic studies on insect metabolism between the blood and the tissues in parasites and adult stages of insects is increased above that in insects to be produced more or less c had been injected into papo acids in insect development.
THE MAUPHIGNIAN TUBES DURING

...ing 93 for 24 h and then removed
...ow a great accumulation of 93 in
...uring the rest of metamorphosis. It
...alized in granules (probably poly-
...r and start a strong accumulation
...h 93 to the granules taken up from the
......the 93-Et,E-Ca salts (3.4
......tions from histologically organs
......n blood by the Malayphigian tubules which
......96)

II.I. USE OF INSECTICIDES. VII. PHOSPHORUS COMPOUNDS. Harry Kaye. (Smith. List. Insect
......due (IV) on the distribution of radio-
......cations, and the incorporation of
......and the former muscle of the insect
......tly to the head, and the incorporation of radioactive phosphate in the
......active radioactive phosphate in the tissues was
......ild in the intermediate contained in the nerve
.........nt phosphatase. ATP, ADF. glucose-1-
.........nd 5-phosphomalic. and 2 unidentified
.........ntions which are known to be inter-
.........le relative small amounts. The ratio
.........n the nerve cord. The incorporation of the
.........e muscle was inhibited also. The incorporations of radioactive
.........able fraction was inhibited by III
.........phate into the above fraction.

II. sled aedes AEGYPTI L. J. exp.
.........ed the histoautograph and whose body
.........ed 2-20 h. Most of the exchange
.........ough smaller amounts entered the
.........ed to use the result as independent of the external con-
.........or uptake, which suggests separate
.........asure on the rate of uptake of

III. IODINE METABOLISM STUDIED
.........eller counter. histochromatographs,
.........e larvae; the named larval
.........ent quantities of 1
.........oncentration higher than that in
.........nned i anti-metabolically and that I was accumulated by the

Larval ring gland. A region of extremely high 1 concentration located posteroventrally in the larva is described. Black pigment formation occurred in this same area when larvae were placed in methyl alcohol.

The region is histologically distinguished by very large hypodermal cells, an epicuticle free of scales, and a somewhat narrowed endocuticle. One-dimensional thin paper chromatograms run in phenol were made from a 1H-OH-hydrolysat of larvae which had fed on 1P2. Four peaks of radioactivity were determined by running the chromatogram with a Geller counter. One peak of radioactivity was identified as free iodine. It is suggested that the other peaks may indicate monoiodotyrosine, diiodotyrosine, and triiodide. (Auth.)


The distribution of phosphorylated intermediates in normal and poisoned flies was investigated in order to study the biochemistry of insecticidal action mechanisms in vitro. Adult flies were fed some PM. The effects of feeding and killing the flies is described, and the determination of unidentified compounds contained in the muscle extracts are resolved by ascending unidimensional paper chromatography. Subsequent quantitative determinations of very small samples of labelled compounds are described. Autoradiographs demonstrated a high concentration of labelled material in the gut wall.


At disturbance by an insecticide of the distribution of phosphorylated intermediates in an insect is likely to be of significance in the insecticide's mode of action, the distribution in normal and poisoned flies (Musca domestica L.) was studied by a technique that involves feeding the insects on PM so that the intermediates become labelled, extraining the labelled compounds under conditions likely to preclude their decomposition without retaining them by means of unidimensional paper chromatography, and scanning the chromatograms radioautographically. This paper contains a description and discussion of the technique and results obtained in an investigation of the intermediates in the thoracic tissue of normal flies. The effects of insecticides on the distribution found is described elsewhere.


In order to facilitate interpretation of data on the effects of insecticides on the relative concentrations of the soluble phosphorus compounds in adult M. domestica, the effects of physical activity, starvation, etc. were studied alone. The techniques are described in some detail. Usually, soluble phosphorus compounds were uniformly labelled with 32P in vivo, to obtain the same specific activity of the P for each compound. The presence of a glycophosphatase was confirmed enzymatically. The transition from cytochrome-induced rest to normal activity was associated with a fall in thoracic a-glycophosphatase. Anoxia due to drowning caused an accumulation of thoracic a-glycophosphatase and a slower breakdown of ATP, with the formation of inorganic phosphate and possibly adenosine monophosphate. Starvation to the point of prostration caused a fall in head-ATP which could be reversed by injection of normal glucose. Extended cytochrome a anemia, injected water or acetone were apparently without effect on P distribution. Changes in head and thoracic P compounds could occur independently in the same insect.


The importance of P metabolism in insect development is stressed, and work in the field reviewed, in metabolic studies on Ceconotia silkworm, 32P was injected to study the exchange of inorganic phosphate between the blood and the tissue, the specific activities of orthophosphate in Ceconotia plasma for both pupal in diapause and adults were determined and plotted. The shape of the curve and variations in the rate of exchange are discussed. As an early stage of adult development the rate of exchange has apparently increased above that in diapause, similar to the increase in myophase rate. Blood phosphates are considered to be produced more or less continuously, supported by experiments where radioactive inorganic phosphate had been injected into pupae and developing adults. The results are tabulated. In some studies of nucleic acids in insect development, tracer doses of 32P-labelled orthophosphate were injected into pupal Ceconotia.
wing, 3H incorporation into nucleotides of wing tissue RNA was determined, in diapause and on 2nd day of adult development. The activities of adenylc, uridylc, cytidylc and guanylic acids are shown graphically and discussed. Experiments on incorporation during 2 time intervals after injection showed that the rate of RNA synthesis increases sharply early in adult development and declines again. The significance of the results is discussed.

I-B-6 VIRUS DISEASES


In the spring of 1953 about a hundred bombyx mori L. Larvae were injected with polyvalent virus suspended in 3H-labelled alanine and glycine (about 10 mc per larva). Unexpectedly, the 3H-activity inhibited the virus multiplication and about 40% of the silkworms overcame the virus infection and developed into adults. These produced eggs which still had enough radiation to be counted readily. The offspring from these eggs as well as the next following generations (to about 20,000 individuals) were reared. Possible genetic effects of the irradiation are being studied in co-operation with Dr. G. Stilen. About 500 mc radioactive polyvalent bodies were purified from the 60 silkworms which died from polyvalent disease. This material was radioactive to the extent of about 1,000 cpm per mg. The virus particles were liberated from the polyvalent bodies and separated from the polyvalent process, and they gave about 3,000 cpm per mg. Several injection experiments with this radioactive virus and polyvalent protein are under way with silkworms and gypsy moth. (auth.)


Larvae of the silkworm, bombyx mori, were either inoculated with the virus or fed KNO3 and then given an injection of 32P. Co-inoculating the isotope contamination it was found to be highest in virus obtained from larvae which had been treated with 32P in the later stage of the development of the disease. Only a small amount of the administered dose, however, was incorporated into the polyvalent crystals.


Polyvalent bodies were labelled with 32P and intact as well as inactivated 32P-polyvalent solutions were injected into larvae or pupae. About 0.1% of 32P is transferred from parent to offspring virus; the isotope in the individual polyvalent crystals is distributed in equal parts to almost the same degree. The incorporation of inorganic 32P into polyvalent also was about 0.1%. Virus P is transferred very freely from papa to egg. (CA 53: 82385b, 1959)

I-B-7 MISCELLANEOUS

317 Berwig, W. UNTERSUCHUNGEN ÜBER CUTICULARE STOPFANGABE BEI AMEISENWEBECHEN, DURCHSETZUNG MIT RADIOSTOFFEN (A radiostere study on cuticular excretion in female ants). Naturwissenschaften 44, 21 (1956) 610-1. (In German)

No accurate data is, so far, available on the distribution by worker ants of cuticular substances given off by sexually potent animals. Work was done on formica polyctena formica. 32P-labelled orthophosphate being injected into a glass capillary into the thorax. Autoradiography showed that radioactivity was distributed over the entire organism within 45 minutes. Precautions were taken to ensure that only cuticularly emitted radioactivity would be considered in subsequent measurements. Cuticular excretion in sexually potent ants was confirmed, and followed an exponential law. Worker ants were rendered radioactive by latching, and being licked in turn. The distribution of 32P was examined. Hypostomal gland cells and the gland complex of the metathoracic glands would appear to be responsible for substances excreted by the cuticle.


The ratio of females to males is correlated with the amount of sperm furnished in a single mating. This supply depends upon the condition of the male and the time spent in copula. Males labelled with 3H-thymidine were used to investigate the site of fertilization.

The speed of mixing in the blood of an injected solution containing D₂O was determined in the adults of the yellow mealworm, Tenebrio molitor L., the squash bug, Anasa tristis (de Geer), and the blackleg cabbage bug, Murgantia histrionica (Hahn). Details of the techniques are given. The times required for uniform mixing of injected radiophosphorus are tabulated for the different species and appendages.


Tribus that are vectors of tomato spotted wilt cannot acquire the virus except by feeding on diseased plants as nymphs, although both nymphs and adults transmit it. The reason for this inability was investigated in tests with Tribus tabaci, in the laboratory. Both nymphs and adults were fed on radioactive sucrose solution and on radioactive leaves, and no effective difference was noticed in the amount of food ingested at the different stages, nor could any physiological differences be detected. Some differences may nevertheless exist in the permeability of the midgut of the two stages, and it is further possible that the virus may be unable to multiply in the tissues of the adult.


Les pigments de l'hypoderme et des yeux du Grillon Gryllus bimaculatus de Géer comportent au moins trois fractions: aminés, xanthophyllines et un pigment jaune, auxquelles il faut peut-être ajouter une quatrième fraction dont l'identité avec une phosphinute est douteuse. L'origine de ces pigments a été étudiée à l'aide de crytophrane radioactif marqué au 32P. (auth.)


Les observations réalisées avec des substances marquées au 32P montrent que les pigments noir et jaune de la cuticule d'un insecte (le Gryllus bimaculatus de Géer, Orthoptère) - dont la formation est clairement distincte du processus de dardement de cette cuticule - résultent tous deux du métabolisme de la tyrosine après la mue.


An improved method for the rearing of houseflies free of microorganisms is described. Eggs are subjected to ethyl alcohol digestion for 2 h, rinsed in water, placed in 1% ethanol hypochlorite for 2.5 minutes, and rinsed again in sterile water. They are then suspended in 4% formaledge and cultured in drop cultures. The droplets are then mixed with sterile water, and then reared on a sterile medium prepared from Gased dog food and yeast. A procedure for maintaining sterility while adult flies are feeding on a synthetic medium supplemented with isotopically labeled compounds is described. (auth. - M.S.H.)


Autoradiographs of 24 - 98 h old male and female larvae of D. melanogaster which had been fed standard food containing added radioactive ICHNO (C) (of Auerbach, Nature, 220, 6, Suppl. 247, 1960) for varying lengths of time showed that I enter the male and female gonads with equal penetration in all regions. The differential sensitivity shown by genetic techniques appears to be a result of differential response to the presence of I rather than of differential penetration. A positive autoradiograph indicates the presence of CH₂ atoms but cannot determine the compounds in which they are present. (CA 50: 13366t, 1960)

Kovalev and Talin 1899 - [412]

The most important thoughts presented in the various papers are summarized. A number of these studies included work on radiotropes (Fukuhara, Honeines, Falenda et al., Wyatt, Wittingham and Gelada)


C14-carboxyl-lisin, injected into the 6th instar Pseudonia cirtalae (Southern Armyworm) larvae, can be recovered quantitatively from the larval body, is bound by the hemolymph protein, and is neither metabolized nor excreted. A method employing C14-carboxyl-lisin for the determination of tissue extracellular water, and hence the intracellular water content of insect tissues, is described. The method larvae also to measure the total extracellular fluid volume of insects. Values are presented for the extracellular fluid volume content of the soil-buried, gut and combined internal tissues of the mature Pseudonia cirtalae larva, together with measurements of the total extracellular fluid volume. (sum. summary)


Brief review.

Lu, C.-T. EFFECTS OF ATOMIC ENERGY ON SILKWORM AND MULBERRY TREE. J. agric. Assoc. China (Taipei) 10 (1956) 99-105. (Summary in English)


A l'aidé de colorants vitrifici et de H35S, il est possible de determinare le volume des liquides organiques composant l'hemolymph, Ce volume est beaucoup plus élevé que celui que l'on trouve par l'ajout de dicoté. Il semblait que les insectes n'apportaient pas de sang vitrifici, mais un liquide organique assimilé à l'hemolymph, correspondant au sang liquide interstitiel des Vertébrés. (56: 334-357, 1959)


C14-labelled formic acid (H) injected into the female roach was incorporated into the urea C atoms of the uric acid recovered from the fat body. A rapid increase in the rate of C14O2 production during the 12-18 h period following injection indicates that it rapidly becomes unavailable for oxidation. No significant amount of H was found in the excreta. Since the activity in the fat body uric acid accounted for only 3-5% of the injected activity, the major portion of the H must be incorporated into uric acid not located in the fat body or into other metabolic pathways. It is postulated that a transformation system similar to that found in other organisms accounts for the metabolism of H in the roach. (CA 58: 5008, 1962)


Studies with C14-formate show that the adult roach metabolism inject formic acid to uric acid. In vivo studies with fat body tissue show that incorporation of formate into uric acid occurs primarily at the 5-position and the addition of glycine accelerates this process. Fat body can also incorporate C14-formate into urea acid, the majority of activity appearing at carbons 5 and 6 (ureido carbons). (auth.)

Takashahi, J., VITAMIN B6 IN SILKWORM, III. Nippon Nogou Kobunshi Kaishi 51 (1956) 606-5.

Larvae of Bombyx mori were fed with Maiz kernels leaves, which were previously soaked in C14O2 solution. Vitamin B6 was assayed with the Hughes gracie method on several organs of larvae, and the radioactivity of it fraction measured. A fraction containing C14O2 was found in the intestinal canal, and the amount of the fraction increased by a diminishing Autoclavitura and/or non-labeled Co at the 1 precursor. It was suggested that 1 was synthesized by Autoclavitura in the digestive tract of the worm. (CA 51: 11280, 19

Achtemeier, L. 1956 - [1]

Comar, L. 1955 - [1]

Jenkins and Hassett 1950 - [1]

Ogg, W.H. PHOSPHORUS-BIOCHEMICAL (BOUCHARD) (DIPTA) Two methods for tagging H, P and H and cons of spraying P2O5; some radioacitive eggs were laid and not all flies into a pool. Some flies contained some radioactive material, since their satisfactory. It consisted of Fe, P, N, S.

Pedersen, F.J.L., Spinks, J.W. FLOURESCENT (DIPTA) A method for tagging large no. of work in Saskatchewan durum wheat treated with a Co3+ of a compound containing P2O5 in their development. The test laboratory in small containers galvanized iron tubes placed is motion by means of a paddy field tests, tagged larvae and were returned to the river. In the stream, but only once was more tagged adults was abn...
I-C Insect Labelling

Survey Articles

* Anksaniut 1589 - [1]
* Comar 1958 - [769]
* Jenkins and Hargest 1966 - [908]

Files

Donnelly 1958 - [259]


Two methods for tagging H. brassicae (Boch.) with P-32 were developed for studying the dispersal of adults, and consisted of spraying P-32-labelled phosphoric acid or of feeding labelled sucrose solution. Although some radioactive eggs were laid, following the first treatment, it was generally found to reduce the life span and not all flies in a group necessarily received sufficient spray. The second method produced a significant count within a few days which was maintained for a considerable period beyond that of feeding radioactive material. Since there was no apparent effect on survival or oviposition, this method was considered satisfactory. It consisted of feeding P-32 in dilute 1-100 in 100 or 5-7% sucrose solution.


A method for tagging large numbers of Simulium spp. for flight-range investigations, devised in the course of work in Saskatchewan during 1950-51, is described. Radioactive larvae, pupae and adults that were readily detected by a Geiger counter were obtained by keeping the larvae for 24 h in a very dilute solution of a compound containing P-32 (0.5 μC/ml) and then returning them to non-radioactive water to complete their development. The treatment did not visibly harm the larvae or adults. Larvae were treated in the laboratory in small containers of water that was circulated and aerated with air jets, and in the field in galvanized iron tubs placed in the stream and filled to a depth of 6 in with river water, which was kept in motion by means of a paddle wheel on a shaft driven by a larger paddle wheel dipping into the river. In field tests, tagged larvae and pupae were found as far as 850 yd downstream from the point at which they were released into the stream. Tagged adults were taken in cages placed over radioactive larvae and pupae in the stream, but only one was caught in the open, and this only 100 yd from the stream. Failure to find more tagged adults was believed to be due mainly to inadequate collecting methods. (From auth. summary)


In 1949 studies on the treatment of houseflies, Musca domestica L., with P-32 were undertaken at Corvallis, Oregon, to determine its possibilities as a means of tagging flies for flight studies, and also to learn the effect on egg production and subsequent generation of flies. A few tests were also conducted with the blow fly, Phaenicia sericata (Meig.). The flies were either fed sugar solutions of radioactive phosphoric acid or reared in a medium containing this radioactive material. In the preliminary tests flies were made radioactive by both feeding and rearing, the treatment had some effect on fertility, and when large doses were fed some radioactivity was carried over into the next generation. Subsequent tests with known amounts of P-32 supported the results. It was also indicated that feeding adult flies a solution containing P-32 was the more economical and efficient method of tagging with P-32. (Auth. summary)


A method is described for labelling adult houseflies, Musca domestica (L.), Callitroga macellaria (P.) and tsetse flies, Glossina morsitans (Wied.) (Diptera: glossinae). The most prevalent flies in trap catches in southeastern Georgia, P-32 was either incorporated in ground fish or in milk fed to larvae and to adults respectively. Low activity was shown by adult flies from larvae raised in P-32-containing media. Females took up more P-32 than did males on all the feeding treatments. Females took up and retained appreciably more P-32 when the feeding period was longer than one day, but males did not. C. macellaria attained the highest level of radioactivity and G. morsitans the lowest. Adults from 1-6 d old showed only minor differences in initial
uptake of $^{32}$P with a 1-d feeding period. The initial uptake of $^{32}$P was approximately proportional to the concentration of $^{32}$P in the various milk solutions within the range tested. Decline in radioactivity was influenced by different diets of the adult flies after $^{32}$P feeding and may be correlated with the phosphorus content of these diets. Practical tests have shown that tagged flies can be detected in dead samples from trap catches or in living material at base stations. The former method is more efficient.


Adults of Pannia caeciliaria, were allowed to feed for 24 to 48 h on cotton pads saturated with milk or honey water containing concentrations of 0.5, 1.0, 3.0, 2.0, 0.5, and 5.0 millimoles $^{32}$P/liter. Measurement of radioactivity at daily intervals after feeding showed that $^{32}$P could be satisfactorily tagged for a period of 10-12 d with either honey water or milk containing 2.0 or 2.5 $^{32}$P/liter. Feeding for 48 h was not considered necessary. Dosages of less than 2.0 mc $^{32}$P/liter provided insufficient activity. A technique for tagging $^{32}$P using a standard CSMA media with twice the normal volume of water, was devised. The method provided unilimited production of adults, the cycle from egg to adult requiring 14 d. Tightly rolled corrugated cardboard placed over the rearing medium provided a highly satisfactory pupation site.

Kling & Wilson 1854 - (391)

MacLeod & Donnelly 1957 - (277)


An account is given of experiments carried out in Ontario in 1958, in a field of early turnips that was heavily infested with Hylomyia spp., early in the season. On 4th July, a dilute solution containing $^{32}$P was poured on the soil at the base of the plants, so that two lots of 24 plants received each 0.8 and 0.5 mc $^{32}$P, respectively, and a third lot was left untreated. Half of the plants in each series were covered with a cheesecloth cage from 13th July to 14th August, and adults of Hylomyia taken in the cages were tested for radioactivity with a Q-M counter. Of 10 taken on the plot treated with 0.8 mc $^{32}$P, 7 (all males) were radioactive, whereas none of 8 taken on that treated with 0.5 mc and none of 3 taken on the untreated plots were radioactive. Net sweeps were made twice in July and six times in August around 4 positions in the field, one including treated plots and the most distant being about 300 yards away. The Anthomyids taken was killed and examined, but none was radioactive. Examination of one turnip and the surrounding soil from the heavily treated lot on 19th July revealed 4 puparia and 2 larvae of Hylomyia, all of which were strongly radioactive. Marking in this way with $^{32}$P may facilitate the study of the dispersal, local distribution and habits of Hylomyia spp., and their parasites. (RAF-A 45: 397, 1953)


Experiments are described in which Callitroga americana were produced, labelled with phosphorous 32, by feeding in artificial medium containing $^{32}$P, and in natural hosts by administering $^{32}$P-labelled phosphoric acid to the host. Several dosages and variations of technique are described. The regional distribution of $^{32}$P in larvae and adults was determined and the counting rates of eggs and larvae from flies reared on radioactive medium are given. Callitroga americana is easily labelled with $^{32}$P. Only minimal manipulation is required. For field studies a concentration of 0.5 mc $^{32}$P/g of artificial medium appears to give adequate labelling for positive identification of flies and their egg masses. (auth. summary)

Rohan 1942 - (285)

Roth, A. R., Hoffman, R. A. *A NEW METHOD OF TAGGING INSECTS WITH $^{32}$P.* J. Econ. Ent. 45, 6 (1952) 1981.

The authors describe a method for rendering insects radioactive by dipping them in a solution of phosphoric acid prepared from $^{32}$P, with or without a wetting agent, and give the results of experiments in which it was applied to flies. It was also used successfully with wasps, several species of Coleoptera, grasshoppers and other insects (Russian and English) have become available since going to press and are given on p. 104.

Dissantkia et al. 1860 - (385)

Dissantki, R. S., Dissantki OF WUCHELBA RADASCH.

Attempts to obtain radioactive pigments from larvae or adults of Hylomyia americana were made. Radioactive pigments varied in radioactivity. Marking with $^{32}$P in 10-1000 mc $^{32}$P/g of larvae gave no observable ill-effects on the larvae, which were then used.
lethargy, but caused about 80% mortality of aphids in 24 h. All took up the $^{32}P$, but the radioactivity per insect depended on its size and the amount of cuticle wetted. (RAS-A 47: 214, 1953)

345

Vorobjev, M. V. APARAT FOR NAUPNITENCE RADIOAKTIVNYKH IZOMORPHIIZ NA NA DIRNIKH NPOMUNY NEFRA-VUKON. NEF. VESE. ANTH.-LITR. NEV. VOG. KAM. I RODAPREMALEN. 1 (1856) 26:

Between two differing or non-normally distributed isomers or substances in their metabolic pathways radioisotopes were used in these experiments. This apparatus, especially the motor-driven rotator for the rotation of the radioactive substances. An apparatus for radioactive substances - $^{32}P$ (Na$_2$HPO$_4$, and $^{35}S$) in the apparatus is placed in the position of non-radioactive substances. The motor is driven by the radioactive source, however, only in the absence of the radioactive source, the apparatus will not work.

346


The difficulties of feeding blood-sucking insects may be overcome by feeding radioactive substances inapplicable sometimes. An apparatus is described designed for feeding them by sprinkling with radioactive substances. Radioactive solutions of $^{32}P$(e.g., Na$_2$HPO$_4$) are made to circulate and to cover the insects inside without getting outside the apparatus. The apparatus is made of a metal or other material, the insects will be exposed for a certain period and the feeding apparatus can be used for any insects, as long as they are able to be kept in the apparatus.

347


The larvae and adults are placed in a solution of choline nitrate $110000$, and are identified as adults by means of a radioactive emission. The thorax is found in the Malpighian tubules and, to trace the particles, the mosquitoes must be dissected or encased. Mosquitoes could still be identified after 2 months of adult life. (BA 14m, 1958)

348


A method is described in which mosquitoes, made radioactive by being bated in a solution of 110000 choline nitrate, were identified by the trachea left on plates covered with a special substance. The cultivation of the mosquitoes, Aedephora (Kinetisia) spp., and the preparation, development, and fixation of the plates is described. The results obtained indicate a maximum flight range of at least 800 m.

349


Attempts to obtain radioactive infective larvae of Wuchesia banksii were made by feeding adults of Culex piperans feeding on a medium containing orthophosphate and sodium. In a few cases, by feeding adults on sugar solution containing orthophosphate to give 7.5$\mu$g of orthophosphate to give 8$t_{1/4}$ and sodium chloride to $5\mu$g/ml. The intake of $^{32}P$ from sugar solution was low, and that of $^{35}S$ negligible. Feeding $^{35}S$ in the feeding medium was unsuccessful, as mortality of larvae was high, even in having a solution of $0.05\mu$g/ml, and the few adults emerging had low $B$-activities but could not feed. The results, which were not in agreement with some obtained with Aedes aegypti (L.) suggest that the observed $B$-effects were chemical. Feeding larvae in water containing $^{32}P$ at $0.025, 0.1$, and $1\mu$g/ml produced adults of high radioactivity, which increased with increasing concentration of $^{32}P$, but adults.
emerging from the strongest concentration showed signs of retarded growth and the females did not feed.


Since larvae of uniform age are suited for tagging with NaHP3O4 solution, laboratory studies were undertaken to determine (a) the rate of egg production of adult females, and (b) the possibility of delaying egg hatch so that eggs from several days could be combined. Experimental details are given. One million tagged females for dispersion studies can be obtained by (a) the collection of 120,000 pupae in a 5-day period and the raising of the eggs produced in the first 4 days by the resistant adult, or (b) by the collection of 16000 eggs within a 4-day period and the raising of the resistant larvae at (c) by a combination of methods (a) and (b). Based on laboratory studies, production rates are as follows: 36 egg rafts/160 females in a 4-day period, a mean of 156 eggs/raft, 30% egg hatch, 87% perepation and 4.6% adult emergence, with total egg duration. Exposure of 6- to 9-day-old larvae to concentrations of 10000 larvae/ft2 of water surface for periods of 24 or longer in 0.03 to 0.1% NaHP3O4 solutions will yield adults with activity levels detectable for a period of at least 2 weeks.

* Hassett and Jenenn 1961 - [276]


1. The injury of radioactive phosphorus (in form of NaP3O4 or K3P3O4) can be easily detected in laboratory and field conditions. 2. The method is very useful in determining the time of development of radioactivity in various stages of the mosquitoes, and of the effects of radioactivity on the insects and other organisms that feed on them. 3. The use of radioactive phosphorus can be of great value in the study of the effects of radioactivity on the development of the mosquitoes, and of the effects of radioactivity on the insects and other organisms that feed on them. 4. The method is very useful in determining the time of development of radioactivity in various stages of the mosquitoes, and of the effects of radioactivity on the insects and other organisms that feed on them.


Any quantity of flies (Musca domestica, Calliphora) or mosquitoes (Culex, Aedes) treated with radioactive phosphorus (NaP3O4 or K3P3O4) can be easily labelled by feeding the image on a piece of paper. The activity can be measured by adding P32 (specific activity 10 mc/ml) for 1-3 d. Mosquito larvae are not more than 2-3 d before perepation (10 - 20 mosquitos per 100 ml) are placed in a beaker containing medium. The radioactivity of the medium is 0.076 mc/ml. Labelling of flies with NaP3O4 proved unsuitable since it was quickly lost from the insect body, with subsequent very rapid loss of radioactivity.

* Jenkins and Hassett 1961 - [110]
* Kuper and Fele 1952 - [106]
* Proctor 1957 - [113]
* Proctor 1960 - [118]


Tagged adults were obtained from 4th instar mosquito larvae (mostly Aedes sp.) by keeping 0.2 l of a 0.01 mc/ml solution of P32 for 24 h in 0.1 l of a 0.01 mc/ml solution of P32, or a density of 1 larva/ml of radioactive solution. After exposure the larvae could be returned to their normal, non-radioactive habitat for further development. Adults were found to retain readily detectable amounts of radioactivity. Field experiments were carried out with the above and, in addition, with A. aegypti (Meli) and A. algarum (Melg.) from

spring flood pools. The shrimp and reduced mortality could larvae assimilating lethal.

* Zinschin, V. A., Himatsingka, TAGGING INSECTS AND F I addamsoin foveolatus biofic

Methods of labelling Musco adding K3P3O4 or NaP3O4 described. The nicotine soil and remaining easily detect in the body and of the insects and other organisms that feed on them. 4. The method is very useful in determining the time of development of radioactivity in various stages of the mosquitoes, and of the effects of radioactivity on the insects and other organisms that feed on them.

* Banks 1951 - [29]

350 Ammon, A. P., Pullar, R. OF SOIL-INHIBITING D35E The wireworm, Cryptoa: cavity of the larvae. The field is apropos of the discovery of the effects of radioactivity on the larvae of the insects and other organisms that feed on them.

Sihon, M. A., Roum, C. C. J. Econ. Ent. 47 (1954) 922

A preliminary note. In one it became necessary to tag the larvae 6 months after egg was dropped. The number of eggs was reduced to 18 by placing the larvae in a room and washing. It was found that

* Banks 1955 - [59]
spring flood pools. The short exposure method reduced the possibility of over-exposure to surface irradiation, and reduced mortality caused by prolonged artificial rearing conditions. There is also less chance of the larvae assimilating lethal doses of Pb. The simplicity of the equipment and method is released.

XADIS, B.I.; LUKYANENKO, T.H.; SAVICH, A.X.; TROHIN, A.O. "BIOLOGY METHODS AND METHODS TO PROVIDEハウスキミカ AND РС РАДИОАКТИВНЫМИ РЕЗУЛЬТАТАМИ." Труды научной конференции по достижениям и опытам Советского биоцикла в овсяном хозяйстве, Москва (1955) 276-34.

Oписывается методки иночения Musca domestica, Calliphora vomitoria радиоактивными фосфорами (P-32) путем добавления коксовых K$_{3}$$^{32}$P или Na$_{3}$$^{32}$P04 на стадию джентил в куколках или для взрослых особей K$_{3}$$^{32}$P04 к Р-32 раствору глюкозы или вуществе. Удельная активность раствора глюкозы составляла 1 мкк/(мл). В течение 24 часов после вылупления радиоактивность и сохраняла эту радиоактивность как в воде, так и сухими формами. Кроме того, введение в водный раствор R-32 вводится в воде (средняя удельная активность 0,075 мкк/(мл) или 0,085 мкк/(мл)) не менее 4 стадии развития, во взрослых случаях не позже чем через 1-2 дня после образования. В этих условиях животных хороших разработки, оккукулярирован и происходит перезарядка особей с высокой радиоактивностью высокого уровня их жизни.

Zherdin, V.L., Novokhov, N.B., Svetlovskaya, A.Kh., Troshin, A.B. "PROBLEMS AND METHODS OF TRACKING INSECTS AND FISH WITH RADIOISOTOPES." p. 276-34 in Trudy научной конференции по достижениям и опробованию советского биоцикла в овсяном хозяйстве, Москва (1955). Methods of labelling Musca domestica and Calliphora vomitoria by Pb in the larval and pupal stage, by adding K$_{3}$$^{32}$P04 or Na$_{3}$$^{32}$P04 to mit or, for adults, K$_{3}$$^{32}$PO4 to a 2% glucose or galactose solution are described. The glucose solution had a specific activity of 1 mcr/m/l. Within 24 h all flies were radioactive and remained so for many months throughout their lives. A P-32 tagging technique for mosquitoes (Adles and Couture) is also described. It is a matter of safety and convenience which represents a rather substantial modification of the technique of Hedges and Hargett, 1934. Mosquito larvae were obtained from reservoirs and pools, put into wooden boxes filled with river water (10 ml/larva). At the 3rd or 4th stage, in any case not later than 2-3 d before pupation, P32 was introduced into the water (average specific activity 0.075 mcr/m/l or 0.085 mcr/m/l). Under such conditions larvae develop well, form pupae, and later adults whose radioactivity remains high throughout their lives.

MISCELLANEOUS


The wireworm, Chersina argentea destructor, was labelled by inserting a Co$^{60}$ wire into the body cavity of the larva rather than by feeding. The wireworm was used as a study of the insect's movements. The method is applicable to the study of responses to different conditions and investigations on other species.


A preliminary note. In order to study the overwintering habits of the boil weevil, Enaphalos granide Bus., it became necessary to tag several thousand adults with a material the activity of which could still be detected 5 months after application. The solutions used were 1) stock solution: 6 mg of Co$^{60}$ chloride in 0.2 ml of distilled water; 2) working solution: 2 ml of stock solution, and 18 ml of distilled water, giving a specific activity of 0.9 x 2 x 10$^{8}$ mcr/ml. A working agent ("Tagging No.7") greatly increased the amount of radioactive solution retained and reduced the amount removed by washing. It was found possible to obtain slow labelling of cotton plants by a Co$^{60}$ solution.

* Banks 1955 - [65]
* Banks 1956 - [69]

The methods described are suitable for obtaining radioactive host plants of insect populations in the field. All three techniques mentioned suffer from two disadvantages, namely, the translocation of Rb from the point of application is small and the distribution of tracer within the tree is localized. Similar results were obtained with Ca and strontium-85 injected into yellow birch. Future methods will be carried towards methods of root application. Three techniques were studied with a view to investigating the movement of the radioactive vector of viburnum-diseased trees. Since the artificial release of labelled insects in the field is unsatisfactory in this case, it is aimed to achieve labelling of insects at their feeding sites under field conditions.


Colloidal radioactive gold, Au, was added to food. Bees from a particular hive and from neighbouring hives were tested for radioactivity after certain time intervals. Radioactivity was found in nearly all bees of the hive within a few hours, and some bees were occasionally found entering to neighbouring hives. It could also be shown that the flight range was relatively small, and that the bees from each hive had their own narrowly circumscribed field of action.


Techniques were devised for applying enough y-strain (ca. 20 min/strain) to forest insects. In this case primarily to Engelmann spruce beetles (Dendroctonus Engelmanni Houtk.) to permit their being rapidly located when under the bark of trees or under debris on the forest floor. Na22, 32P, and Na23Sr were used successfully, whereas Ag111, Au, and Ra26Cl were toxic in the amounts required. The insects were apparently unaffected by the treatment.

Donnelly 1963 - [189]


In the course of investigations in Ontario on the dispersal of adults of Hylemya brassicae (Boh.), two methods of tagging the flies with Pb2+ were developed. In 1951, spraying about 70 cages adults with 0.5 mc Pb2+ (la phosphoric acid) diluted to 60 ml with distilled water resulted in counts per minute of 1500 - 1600 after 24 h, 260 - 160 after 48 h, 80 after 96 h, when only one fly survived. In 1952, similar treatment of 50 flies with 0.15 mc Pb2+ in 100 ml resulted in averages of 345 cpm after one day and 78 after 2, when all but two flies were dead. The radioactivity was not removed by washing, and radioactive eggs were laid by some females, indicating that the solution had been absorbed, but as the length of life was reduced and all the flies in a group might not receive sufficient spray, the method was considered unsatisfactory. About 100 flies that were allowed to feed on a solution of 2 mc Pb2+ in 400 ml 5% sucrose solution daily for 3 d, the average cpm rose from 360 on the second day to 900 on the 12th and fell thereafter to 150 on the 40th, when only one fly survived. Females developed significantly more radioactivity than males, and some laid radioactive eggs; larvae from the latter showed no radioactivity. As a significant amount of a considerable period after feeding with radioactive material ceased, and as there was no apparent effect on survival or oviposition, this method is considered unsatisfactory. (RAD A, 465, 1957)

Fleming et al., 1962 - [33]

Food and Agriculture Org. "Report of the first meeting of the FAO/67/11, 1965-6." Very general survey of the meeting is made of plants. No details are given. - R.

Fredericksen, C., L. "Laboratory tagging with radionuclides." Wireworms of the genus Haplotrupes (L.) activity about 0.07 mc/L to a maximum of 2 different strains were studied. The substrate was found to be glass. Dieldrin had the least effects on wireworms after 4 d, some treatment was done. Some fumigants are toxic to wireworm larvae.

Fuller, R., A., S. "Intriguing oil treatment of beehives (B. mori) and curving (M. formicola) for observations on their energy of y-radiation: minimum corrections for isotopes with long half-lives are described, incl. were carried out by means to within 1.5 in depth of soil. The e semi-mature (h) followed, both larval and t was toxic to wireworm larvae: 1965 - [77]

Gillies 1968 - [77]

Godwin et al., 1957 - [9]

Glaswald, K., Kelle, W. "Mit calotropis plantae." Exp. Exper. Ent. 40 (4) (1961) 274-87. larvae of Calotropis plantae do not feed 4 d. Some are trying to feed effects of C. floribunda in techniques for these larvae can grow through material proof material. If the per releasing mechanisms for testing for repellency as
Food and Agriculture Organization of the United Nations, Rome, European Commission on Agriculture. 


Very general survey of European research programs engaged as far as to be envisaged for the future. Mention is made of Finnish studies with Ca in the wheat dust, Diacronia baenca and Lygaeus equestris. No details are given. - Some introductory reading is listed for the whole field.

Fletcher, C.P., Lilly, J.H. MEASURING WIREWORM REACTIONS TO SOIL INSECTICIDES BY TAGGING WITH RADIOACTIVE COBALT. J. econ. ent. 48, 4 (1955) 438-42.

Wireworms of the genus Melanophotius were tagged with Co60 by having a small piece of cobalt wire (initial activity about 0.07 uCi) cemented to the dorsal surface of the caudal segment after which the wireworm reactions to 4 different soil insecticides (Aldin, Dieldrin, heptachlor or Lindane - almost pure y BHC) were studied. The subsequent vertical and horizontal position was determined by a Ge-M counter. Movement was found to be greater in untreated soil, with greater reduction in soil treated with Aladin or BHC. Dieldrin had the least effect. However, all wireworms that entered treated soil and stayed in it were dead or moribund after 4 days, so that all the insects were toxic to them, and all from the boxes containing some treated soil were dead within 2 weeks, even though they had not actually entered the treated areas; some remaining effect is thus implied. The wireworms in untreated soil survived normally.


The author describes experiments carried out in Canada, in which wireworms (Cuterebra borealis) and cutworms (Euxoa ocellata [Gn.] and Agrotis orthogona) were marked with Co60 for observations on their behavior in the soil. This material was chosen because the comparatively high energy of its γ-rays makes detection possible through several inches of soil, and its long half-life minimizes corrections for decay of the larvae studied are slow-moving and unlikely to be lost, so that an isotope with a long half-life could be used without much danger. The technique and its effects on the worms are described, including the distribution of radioactivity within them. The number of experiments were carried out by means of a probe which allowed the position of radioactive larvae to be determined to within 1 in on a depth of 3 in. Curves are given to show absorption of γ-rays from Co60 by soil of different densities. The effect of temperature on wireworms was tested. Wireworms were also offered alternative soil-moisture conditions. In another experiment, the paths of several wireworms seeking food were followed; both sites and routes varied greatly. Insertion of Ca60 on wire into the body cavity proved more toxic for wireworm larvae, but gave only a small percentage of mortality in cutworms.

Gillies 1958 - [771]

Godwin et al. 1957 - [98]

Goswaid, K., Kritz, W. ZUR LABORATORYPRÜFUNG VON TEXTILIEN AUF TERMINENFESTIGKEIT MIT CALOTERMES FLAVICOLLIS FABR. (Laboratory testing of textile fabrics for termite resistance by means of Calotermes flavicollis Fabr.). Ent. exp. et appl. 2 (1955) 263-78.

Experiments were made over a period of two years on the resistance of various materials, especially textiles, to termites. The dry wood termites, Calotermes flavicollis Fabr. was used as a test insect, as this insect is resistant to environmental conditions and readily attacks hard materials. Quantitative radio-biological investigations (the insects were rendered radioactive by feeding them CN-labelled filter paper) showed that fifth-instar larvae and "Pseudogaster", which both feed actively, are good test animals. After molting, larvae do not feed for 4 d. It is advisable therefore to use large batches (30 larvae in each) to ensure that some are feeding at any time. Experiments should last 21 d at least. The method used in testing the effects of CN-flavicolis on termites, and the way the insect is acclimatized, are described. A useful new technique for these tests consists of pulling the textile into the metal frame of a projector-side. Termite can grow through materials otherwise resistant when they are covered by a thin perforated film of termite-proof material, if the perforations are of the same diameter as the termites' heads they serve as innate releasing mechanisms for "food-train grasping". This method should only be used in special cases, e.g., testing for repellency, surface hardness, etc. (auth, summary)
* Green et al., 1957 - [123]

* Holling 1958 - [1560]

* Hyland and Hammar 1966 - [190]

360 Jacob, J., Sirin, I.I., LABELLING OF INSECT SPERMATOZOA BY ADENINE-8-4C. _Experientia_ 14, II (1958) 462-3.

A labelling technique for mature spermatozoa of _Phaenis mirtellae_ (Coleoptera) and of _Drosophila melanogaster_ is described. About 0.2 mg of a solution of adenine-8-4C (19 μc/mg, 8.8 μc/μM) was injected into each larva of _P. mirtellae_ using a micropipette. _Drosophila_ larvae fed on dead yeast medium containing adenine-8-4C (2 μc/mg of medium). Autoradiographs of sections, squashes or smears of adult testes were made.

* Karman et al., 1968 - [401]


Experiments are described in which hoppers and adults of _Schistocerca gregaria_ were fed on materials containing 45Ca. This method would make it possible to mark hoppers, for which external markings are of no use because they shed their skins frequently. However, it would be costly and difficult. Unless some automatic recording device can be found, it means that the radioactive isotopes have no advantages over colour paints for labelling adult locusts. (BA 59: 27326, 1959)


Locusts (Locusta migratoria L. and _Locusta pardalis_ Walk.) were labelled with 32P in the nymph and adult stages. 32P was rapidly absorbed in the organic or inorganic form. Autoradiography showed differences in localisation of radioactivity, depending on whether the 32P had been injected before or after reaching the adult stage. The author concludes, however, that without the use of some automatic recording device, radioactive labelling of locusts has little advantage over colour paints since these can be recorded by untrained workers.

* Koff 1966 - [97]

* Koff and Elbadawi 1959 - [41]


About 1,000 ticks (Amblyomma americanum) were made radioactive by immersion in a solution containing 35S as sodium dihydrogen phosphate and having a specific activity of 10 μc/ml. The ticks (in lots of up to 500) were confined in a Bicheno funnel by a disk of 26-gauge brass wire, with a 1/4-inch hole in the centre through which they were inserted. The solution was poured into the funnel, allowed to stand for one minute and then drawn off. This procedure was carried out three times with the same solution. The ticks were then transferred to clean petri dishes. They were measured for uptake and retention of 35S with a vertical and window 3-M tube attached to an autoscaler. They were held in place individually under the window and at 3 inch from it in a rubber retaining ring with a less-paper cover on a stainless steel plate. The mean counts per minute for lots of about 25 individuals treated 14 days before in solution containing no wetting agent were 218 for males and 387 for females. Addition of a wetting agent to the solution did not increase uptake or retention of 35S but substantially reduced survival of female ticks. The use of wetting agents is therefore not recommended. (BA 56: 110, 1957)

364 Korshikov, NIKOLAI, NAVIA E NAVIA, Moscow 56 (1929) 61-4.


Experiments have may be conducted, or by radioactivity with 35S. Natural sources have therefore replicated on the either or either computer (10, 179) were radioactive in population with increases are discussed, radiocarbon investigation, and removed advantage, however, of: transmission and has a convex...

* Listering 1960 - [401]

366 Lomer, M., MARKUSH SA DESCENDANCE PAP. L'homme et le micro-technique qu'une fraction du milieu génétiques. Il n'a pas de descendance d'Aphe leguminus.

367 Quass, E.F., Harwell, Y. MEDICAL BIOLOGY, radioactive curium (Cu III and IV). It has a short half-life, easily detect (females of Malacosoma tel. [bodies sp.] were marked 10 μc/ml, maleus (A water containing less than 10% of the germanium (L.) by the to...detectable amount of the diaminephenylazide is only very slightly below equipment. A disadvantage carried out in an area in elapse of decay of the...


369 Rings, R.W., COMPARE DISPERSAL OF PLUM CUR. Laboratory and field lines material for tagging adult c, 35S, Cu, Zn, Cd, and 14C on peach foliage, 35S tissue, has a relatively low tagging agent but could render studies because of their...


A good account is given (immersion and direct fed...
Levita, M. D. COMPARISON OF TWO METHODS OF MASS-MARKING FORAGING HONEY BEES. J. econ. Ent. 52 (1960) 996-

Experimental bees may be identified by using the genetically marked strain of Apis mellifera L. called cordovan, or by radiactive tagging. Black Caucaicuan bees were tagged by feeding them sugar syrup marked with Pb. Natural bees was no abundant at that time that the bees were slow to take up syrup, and it was therefore sprinkled on the frames inside each colony. Bees collected in the field were assayed for radioactivity either by Geiger counter or autoradiograms. Of 680 bees collected, 40% (6.5%) were cordovan and 25% (10.7%) were radioactive. In spite of this difference both types of bees seemed to show similar generations in population with increasing distance from the apiary. The relative merits of the two types of marking are discussed. Radioactive tagging requires special equipment and facilities not readily accessible to all investigators, and removes treated colonies from normal production for the remaining season; it has the advantage, however, of immediate application to available colonies. Pb was chosen because it is relatively harmless and has a convenient half-life.

Leverett 1960 - [498]


L'auteur décrit une technique de marquage radioactif du Pucron de l'Arachide par voie nutritionnelle suite à une fraction du radioprotéine ingérée par les femelles pathologiques qui transmette jusqu'à la seconde génération, Il n'a pas observé de modifications significatives des caractéristiques de développement et de reproduction d'Arachis lugumonosis.


Radioactive cerium (Ce), which emits α- and γ-radiation has a considerably longer half-life (243 d) than Pb and Kr. It has a short-lived daughter, promyrotonium (Pr) of 17.5 min-half-life, with very energetic α-emission, easily detected and measured. Cerium appears to form stable combinations with thiosulfates. Flies (females of Drosophila melanogaster (R.) Xenopus coccus (R.) and Hystrichosura sp.) and ticks (Ixodes sp.) were marked by immersion for less than 5 min in aqueous solutions of Ce at 50-60°C containing 10 μg/ml, mosquitos (Aedes aegypti (L.)) by rearing them from late 5th larval stage and pupae kept in water containing less than 10 μg/ml and uninfested individuals of Culex p. molestus (R.) and Haemotoma riomanae (L.) by the topical application of 1 μl solution containing about 1 μg/ml to their backs. No detectable amount of the isotope could be removed by washing the arthropods with a 5% solution of ethylene-diamine-tetra-acetic acid. The amount of the isotope mixture retained by the various species after 7 d were very only slightly below those observed after 7 d. The method of tagging is simple, rapid and needs no special equipment. A disadvantage of the use of cerium is that further studies with other γ- or α-emitters cannot be carried out in an area in which it has been used until the tagged insects have died or until enough time has elapsed for decay of the Ce to background levels.


Rings, R. W. COMPARATIVE EFFECTIVENESS OF FIVE RADIOISOTOPES AS TRACERS IN STUDYING THE DIURNAL MOVEMENTS OF PLUM CURCULIO (CONTRACHELUS NENUPHAR). Ohio J. O. Ent. 54 (1961) 386-

Laboratory and field investigations were conducted with 5 radioisotopes to determine the most effective material for tagging adult plum curculios for dispersal studies. The radionuclides tested were Sr, Ba, Co, Ce, and Pt. They were fed KI, PtCl₂, CoCl₂, ZnCl₂, SrCl₂, or PtCl₄ as solutions or on peach foliage. Sr was proved the most useful since it could be given to insects in solution or via plant tissues, has a relatively long half-life, and a comparatively strong radiation. Co was very persistent tagging agent but could only be given in solution. Sr and Ba were unsatisfactory for those particular field studies because of their short half-lives. Zn had too low a specific activity to allow reliable results.

Rings, R. W., Layne, G. W., Jr. RADIOISOTOPES AS TRACERS IN PLUM CURCULIO BEHAVIOUR STUDIES. J. Econ. Ent. 56, 3 (1963) 474-7.

A good account is given of the difficulties of tagging adults of Conotrachelus nenuphar. Topical application (transverse or direct individual application) and feeding (directly or via previously labelled plant foliage)

* Medina, Ohio, USA
were used. 4% and 5% were quickly absorbed by the peach foliage, optimum concentrations being 100 µg/ml and 2 µg/ml respectively. 5% was unsatisfactory and replaced by 4%. P is suitable for dispersal studies but not for determining hibernation sites. Zea was found to be either too toxic to foliage or else not to activate the beetles sufficiently. Attempts to produce P-labelled foliage proved unsuccessful, partly because of uneven distribution. Ca was absorbed unequally by the weevils. Whereas they did not retain sufficient activity for exact site determination, overwintering in the orchards could be identified after 8.5 months.


P was used in an attempt to determine flight range of the Southern pine beetle, Dendroctonus frontalis Zimmerman. Some preliminary results are given. For determination of the movement of white grubs through the soil, pieces of activated charcoal were injected into the body cavity of each grub. Details of the technique are given. The grubs were replaced in the soil but different conditions of ground cover to determine whether the type of ground cover affected larval movement. Ant predation proved annoying. Treated larvae were able to transform to adult stage and still retain their activity.

Sipple 1555 - (12)

Sullivan 1553 - (101)


Phylognosta lembiphila (neopodema) is a small leaf-mining moth. Mass emergence of imagos occurs in July, after which the moths disappear and cannot be traced by usual methods. The following spring they reappear and breed. Newly emerged imagos were fed a mixture of sugar, water and P-labelled phosphoric acid in the laboratory. They survived well, even when fed with a solution containing 100 µg of P/ml. Moths fed with this concentration could be detected by a Geiger counter 0.5 m away. Two hundred tagged moths were liberated in the field and then detected 8 days later. They were in the ground, some distance below the surface. Subsequent searches showed only little change of location by the moths up until the first frost arrived in September. Unfortunately, the short half-life of P prohibited detection of the imagos at the following spring. (BA 53: 74682, 1955)


Nymphs were reared on coconut infusoria placed in distilled water containing 4% or 5% at the rate of 2 cc per pint. The 4% was in the form of carrier-free orthophosphate in dilute HCl (pH 3-5), with original activity 3.87 µc/ml. The 5% was in the form of a sulphate containing a little NaCl (pH 1-2) with the carrier-sulphate not exceeding 100 µg/ml and an activity 5 µc/ml. The infusoria became radioactive within 24 h and sections (stored or photographed) showed that, whereas the P was distributed chiefly in the meristematic tissue, on some of which P, was tested, the distribution of the S was more uniform. Nymphs reared on these infusoria became strong radioactiv. Adults reared from such nymphs gave 500 cpm above the 100 cpm background. For release-captive studies, the longer-lived 5% is more suitable than 4%. Several hundred radioactive adults were released in a relatively isolated plantation, with palms spaced roughly 10 x 10 yd apart. The method used for raising infusoria proved too clumsy for use as a basis for determining the size of a population. (Summary of radioactive marking technique)


Studies were made to determine how to introduce P-labelled phosphoric acid into both larvae and adult mosquitoes in amounts that would be detectable with radioactive measuring devices. Adult females (Meg.), and A. exponent (Meg.) mosquitoes gave 54 to 801 cpm above background after they had been allowed to feed on the blood of rats that had received 0.373 mCi of P2E in aqueous solution intraperitoneally 24 h earlier. In three dissected specimens an average of 27% of the radioactivity was found in the abdomen and 4% in the legs. Second- and third-instar larvae of Culicex floridana (Coq.) reared in water having an unknown concentration of P2E had radioactivity ranging from 164 to 427 cpm. Fifteen percent of this radioactivity was present in the legs and 4% in the abdomen. Adult females fed on water having an unknown con-


Radiation effects from I do not appear to have any are discussed.

Suomalainen, E., Tappel MEDIA CONTAINING CA I. The metabolic action of in media containing CA-I media contain 1, 0.1, generation reared on the technique of Nenam (C 0.1, e medium (total 5 medium) 8 Tol 4


X-chromosomes of P-I-tre. Treated larvae were rear 837 treated chromosomes 4 P-I-content of the food, 6 the same frequency of rac. S in larvae in a mastering, a calculated was recorded. For equi- (auth.)


5% fed as larvae on medium a cutaneous rate in daily (a deletion-X). The P-I con- and excretion as well as was related to the the speci

1 - 5 Dev
mum concentrations being 180 μg/ml P32. P32 is stable for disposal.
other extremely toxic to foliage or
sulfate foliage proved unsuccessful
result, whereas they did not
the orchards could be confirmed

2. 9th. agric. Wis. 52 (1968) 120.

beetle, Derodononous frontalis
movement of white grubs through
of such grub. Details of the
conditions of ground cover to
at production proved annoying.
activity.

ELLA HERN, WITH RADIOACTIVE

as emergence of imagos occurs in
4-6. The following spring they
water and P32-labelled phosphoric
containing 100 μc of P32 per ml,
5 is away. Two hundred tagged
in the ground, some distance below
the mud up until the first few
several of the imagos the

THIS WAY! BROWN (CORNELIDAE),
THE INSECT. Bull. ent. Res. 41, 5
containing P32 or SI at the rate of
late HCl (pH 2-5), with original
little Nacil (pH 1-2) with the
afluorescense became radioactive
and distributed chiefly in the meten-
more uniform. Nymphs reared
such nymphs gave 600 cpm above
it more suitable than P32. Several
, with palms spaced roughly
as use as a basis for determining

OF MOSQUITO LARVAE AND

held into both larvae and adult
1 devices, Aedes exstis (Meig.)
and after they had been allowed
influences intraspecifically 54 h
was found in the abdomen and
used in water having an unknown
a percent of this radioactive was
in water having an unknown con-
centration of P32 gave readings of 577 to 1103 cpm 1 to 15 d after. The legs had approximately 9% and
the abdomen 4% of the total radioactivity. Aedes
testiculae and A. vexans adults reared from the second-
stage larvae in water containing 0.05% μc of P32/ml gave average readings of 41,147 cpm for females and
86,072 cpm for males. In later tests dosages of 0.01, 0.001, and 0.0001 μc per ml gave 14,323, 6,412, and
352 cpm respectively, for the females. It is suggested that a concentration of approximately 0.0001 μc of
radioactive phosphoric acid per ml may be a practical dosage for the larvae in flight studies of adults.

Adults may be readily tagged by feeding them sugar solutions containing small amounts of P32. (sum.)

I - D Developmental and Genetic Effects Incurred
Through Labelling


Radiation effects from internally applied tritium (by injecting 1H-labelled thymidine) or external x-irradiation do not appear to have any appreciable effect on pup formation. Techniques and implications of the results are discussed.

C4


The mutagenic action of C4 was investigated by rearing D. melanogaster individuals from eggs to adults on media containing C4-labelled sugar. Prepared photochemically by Carius bulbs. The culture media contained L, 0, 1, or 0.1 μc radioactivity per culture bottle. The male offspring of the first and second generations tested on these media were tested for the presence of the X-chromosomal lethals by the Miller's-technique of Drosophila. (CA 45: 17465c.) The number of mutations observed in flies reared on the 0.1-μc-medium (total radiation approximately 75 μc) was not significantly different from 0. For the 1-μc-medium (900 μc) a significant frequency of mutation (2.2-2.8%) was observed. (CA 50: 17211a, 1956)

P32


X-chromosomes of P32-treated wild-type D. melanogaster were treated for recessive lethal mutations. Treated larvae were reared in food medium containing initially 0.5A, 0.5B, 0.5C and 0.5D μc P32/g. The 0.5A treated chromosomes 42 had recessive lethals. The frequency of mutation was roughly proportional to P32 content of the food. An initial concentration of 18, 8 μc P32 In larval food is expected to produce about the same frequency of recessive lethal mutations as is obtained with 1,000 x-rays applied to mature sperm. A fly reared in a medium having an initial concentration of 32.5 μc per ml received, plus to mating, a calculated total radiation dose of 0.98 gram rontgen. At this dosage 3.9% recessive lethals were recorded. For equivalent amount of ionization P32 is been apparently 5.3 times as effective as x-rays.


All fed as larvae on medium containing P32 were mated daily to fresh batches of attached-X yellow Y flies. The mutation rate in daily sperm samples was measured as the incidence of non-yellow daughters (hyperploid for a deleted-X). The P32 content varied greatly during the life of the fly, according to the rates of absorption and excretion as well as radioactive decay. The variation in mutation rate between daily sperm samples was related to the P32 content of the fly, papa, or larva and to the presence or absence of active food medium, when the sperm sampled was in its hypersensitive stage, 7-8 d before maturity.

96

P32 was administered to the larvae of D. melanogaster in order to determine the number of mutations which could be induced by the radiophosphorus. The highest specific activity introduced into the larvae was 1 mc per bottle: this resulted in the death of all the insects before pupation. A 0.1 mc amount resulted in the death of an appreciable number of the insects. While the introduction of 0.01 mc of P32 resulted in no appreciable number of deaths, flies emerging from 0.1 mc bottles were further studied: their activity was measured and, though it was variable, the mean figure was 0.0122 mc/fly 2-3 d after emergence. The overall lethality of the irradiation was observed (7,0%) to be the rate which would be expected for an x-ray dose of 2,500 r. The lethal mutation-rate of P32 was derived for the D. virilis and for a dose of 2,500 r of x-rays, and was found to be similar, but the author cautions against attaching too much significance to this similarity. The high mutation rate of P32 was shown to correspond to the expectation from 12,000 r of x-rays. It was concluded that additional work is necessary to confirm whether P32 is really four times as efficient as x-rays in the production of visible mutations. (NSA 4: 1969, 1949)

320 Ehrlich, J. THE ACTION OF RADIOPHOSPHORUS IN DROSOPHILA. Science 113 (1951) 205-6.

In the present investigation, P32 was used to study the action of X-rays on D. melanogaster and D. virilis. Pairs of mature flies were placed in small vials containing a culture medium, consisting of a standard Drosophila culture medium and added radioactive H3PO4, the original volume (about 306 ml) of medium, a count of 0,0000 g/ml, was distributed among 30 vials in 6 ml amount. Twelve days after exposure, the distribution of radioactivity in the various tissues of the insects was determined: few of the D. virilis, generation batches in the radioactive solution survived, and some of the adults were tested, but in the case of D. melanogaster, the batch was normal and all present, adults and larvae, were examined. All batches individuals D. virilis strain morphologically abnormal, the abnormalities persisting mostly to the eyes, legs, abdomen, wings, and genitalia. Other data indicate that radioactive P32 not only produces mutations in D. virilis but also chromosomal rearrangements. The tolerance to such irradiation is considered to be high. (NSA 4: 2567, 1950)

321 Davidov, et al. 1968 - [251]

322 Dinsdale et al. 1967 - [345]

323 Gorsich et al. 1966 - [260]


Feeding of P32 labelled honey to male wasps (starved) and subsequent mating under the experimental conditions described gave rise to a sex ratio of nearly 1:1 instead of the typical 65-70% predominance of males. In females similar feeding can cause permanent cessation of egg production. Even when successful, radiophosphorus feeding experiments show considerably less effect when males rather than females are used. In order to corroborate evidence of dominant lethality, the cocoons containing unclosed pupas were opened and the contents identified where possible. Nearly twice as many unemerged females were obtained from treated males as from controls. Possible reasons for the relative ineffectiveness of P32 fed to males are suggested in terms of recent studies.

331 Gorsich 1966 - [1137]


Unfed females ofAssigned females to each of the following 4 groups: 1) a group of 3 wasps were provided with 1 mc of P32 labelled beef heart homogenate at 30°C, 2) a group of 3 wasps were provided with 0.01 mc of P32 labelled beef heart homogenate at 30°C, 3) a group of 3 wasps were provided with 0.1 mc of P32 labelled beef heart homogenate at 30°C, 4) a group of 3 wasps were provided with 1 mc of P32 labelled beef heart homogenate at 30°C. The P32 labelled beef heart homogenate at 30°C was added to the mixture of P32 labelled beef heart homogenate at 30°C and the wasps were observed for 1 day to test viability. At doses of 0.01 mc of P32 the wasps were dead within 1 day, while at doses of 0.1 mc of P32 the wasps were dead within 2 days. At doses of 1 mc of P32 wasps were dead within 3 days. A method is described for calculating the number of eggs per female, which is based on the number of eggs observed in each wasp, and the number of females in the wasp population.


A method is described for calculating the number of eggs per female, which is based on the number of eggs observed in each wasp, and the number of females in the wasp population.
of embryos from eggs produced within the first 2/3 of life were correlated with the level of radioactivity ingested. With doses above 200 μg/g, the viability of embryos from eggs produced during the 2/3 of life was correlated with the level of ingested radioactivity. None of the animals showed a decrease in longevity as a result of radioexposure. (CA 46: 7084a, 1955)


Precision weighing is used to determine the amount of radioisotope required to cause temporary and permanent sterility. The entire wasp, Habrobracon juglandis, is weighed before and after feeding an honey ad libitum with radioisotopes. As shown by lowered egg production and hatchability, the descending order of effectiveness of the ingested radioisotopes is the same as the ascending order of physical half-life: 3H, 53M, 57Co, Ca58. Permanent sterility was obtained only after feedings of 53M and 57Co. Experimental results support the concept that effectiveness of a given isotope is correlated with the number of particles received by an organism within a critical period of time after ingestion, and with the energy of these particles. (auth., D.S.G.)

Gosch et al., 1958 - [203]


A total of 260 Aedes aegypti mosquitoes were allowed to engage on chickens which were infected with Plasmodium gallinacium; but there was no development. The mosquitoes were provided daily with 5% glucose solution containing radioactive sodium chloride (with a low radioactivity of about 30 μc of 32P). The remaining mosquitoes were served with water and were provided with an radioactive glucose solution. Nine days following the blood feeding, 10 mosquitoes from each group were dissected for determination of the presence of oocysts in their stomata; all 10 of the irradiated specimens contained oocysts, as did 8 of the controls. Five days later, mosquitoes from the same mosquitoes were dissected and no sporozoites were found in the salivary glands of the irradiated specimens, but 11 out of 15 control specimens showed these forms. The lowest activity for any salivary gland in the specimens administered the P32 solution was 30 μc, while the average was 2400 μc; calculations suggest a very high equivalent monogon dosage was delivered to the salivary gland tissue, despite the apparent absence of any deleterious effects. The author concludes that the radiation delivered by the ingested P32 was sufficient to arrest the development of the parasites during the exoerythrocytic stage. (NIA 4: 424, 1960)

Hawkes and Jenkins 1961 - [270]

Hoffman et al., 1961 - [386]


Males show a higher percentage of sex-linked lethals than females. Developmental stages are very sensitive to radiation and fail to develop and survive this treatment which would result in very few mutant induction in adults. P32 is distributed among the head, thorax, gut, gonad and abdominal shell in the ratio of 29:50:16:10:10 regardless of the total activity of the fly for males labelled as adults. Radioautographs (photographs, exposed organ of inseminated females) showed radioactive sperm. As high as 20% sex-linked lethal mutation rates have been induced in adult males of an inbred Canton-S stock by the 65 technique. Out of a total of some 1951 X's treated so far, 59 sex-linked recessive lethals and 31 viable mutations have been recovered. By changing the irradiation activity - feeding time relations or by increasing the number of P32 atoms in the medium while keeping the number of P32 atoms constant it is possible to expose different groups of flies to an equal flux of high energy α-particles from the medium but to an entirely different internal radiation dose from the radioactive decay of P32 atoms incorporated into tissue.


A method is described for calculating the geometrical factor necessary for determining the radiation dose absorbed by the head of the male. A very simple model of a male fly is proposed, consisting of 3 spheres of water, corresponding to weight to the head, thorax, and abdomen. A homogeneous distribution of P32
atom is assumed. It is calculated that about 12.4% of the total energy dispersed by particles originating from internally decaying $^{222}$Rn is absorbed by the time of male D. melanogaster. Radiation contributed to the gonad by $^{222}$Rn-labelled tissue of the head and thorax is negligibly small when compared to that contributed by abomasal tissue.

See also BNL-1250, Brookhaven National Lab., Upton, N.Y., 15p.

King, R.C. THE MUTAGENIC EFFECTIVENESS OF RADIOACTIVE PHOSPHORUS IN DROSOPHILA MELANOGASTER (absatr.), Genetics 37 (1952) 526.

The mutagenic effectiveness of radiophosphorus in D. melanogaster has been studied using the Muller-6 method for recovering sex-linked recessive lethal mutations. Methods are described for varying the radiation dose from the radioactive medium and the dose from $^{32}$P with tissue from each sex. The radiation dose from the medium is determined by actual measurements, while the radiation dose to the male gonad from $^{32}$P in tissue is calculated. It is shown that radiation from internally located $^{32}$P atoms are mutagenetically effective, however, in the case of male Drosophila fed upon $^{32}$P as adults there is no indication that internal $^{32}$P is more efficient mutagenically than external $^{32}$P. Among the genetic changes recovered following $^{32}$P treatment are sex-linked recessive lethal and viable mutations, inversions and dominant lethals. $^{32}$P treatment also increases somatic crossing over and produces potential chromosome breaks leading to the production of unilateral meiosis. The importance of this work in the study of genetic effects accessible to the actual determination of $^{32}$P to $^{32}$P is discussed.


Exposure of developmental stages of D. melanogaster to media of activities above 5 $\mu$g results in the killing of embryos, larvae, and pupae, in the retardation of development, and in the production of sterile adults. Females are more resistant to $^{32}$P treatment than males. The external radiation from the medium is shown to be relatively unimportant in killing insects. (auth.)


Females hatched males were given $^{32}$P-labelled food. Methods are described for varying the radiation dose from the radioactive medium and from $^{32}$P in tissue with respect to each other. The former is determined by actual measurements, the latter by calculation from the dose to the $^{32}$P medium. Radiations from internally located $^{32}$P atoms are shown to be mutagenetically effective. Calculations lead to an erroneously high value describing gonal absorption of energy liberated by decaying $^{86}$Kr in tissue. Only 2% of such energy is absorbed in the gonad. 1.5 x 10$^{-8}$ disintegrations/ed/night will produce 1% sex-linked lethal mutation frequency. Some sex-linked recessive lethal and sex-linked viable mutations, inversions and dominant lethals were among the genetic changes recovered following treatment with $^{32}$P. It all increased somatic crossing over. Potential chromosomal breaks leading to unilateral meiosis were also produced. The significance of this work in the study of genetic effects in the transmutation of $^{32}$P to $^{32}$P is examined.

See also BNL-1297, Brookhaven National Lab., Upton, N.Y. 1953.


The effect of various concentrations of $^{32}$P in the medium upon the development of Drosophila was studied. Flies reared from a medium containing 50 $\mu$g of $^{32}$P degraded high embryo mortality, larval and pupal mortality, and there was a retardation in development depending on the concentrations involved. Pupae adults appeared in culture containing 5 $\mu$g or less. Concentrations too low to allow complete development may produce sterility. Failsafe, probably as a result of their X-chromosomal diploidy are more resistant to treatment than males. Under the experimental conditions applied here radiation from the medium is relatively unimportant in producing lethality. Of the energy liberated by $\alpha$-particles from decaying $^{32}$P in tissue sufficient is absorbed by the fly to account for the lethal effects observed.

Dimorphophila homogeneously labelled with $^{32}$P have been produced by scoring flies for their entire life cycle on homogeneously labelled yeast growing on a solid $^{32}$P-labelled synthetic medium. Dimorphophila adults contain 3 mg $/g$ wet weight and maintain their phosphorus content at this level, even when forced to feed on media abnormally rich in phosphorus. Death to adults occurs when the overall phosphorus content of all tissues rises above 0.6%. A study of the variation of $P$ content during development showed the egg to contain the highest $P$ concentration of any stage. The relation between total $P$ and wet weight for 1st and 2nd instar larvae was found to be hyperbolic, for 3rd instar larvae quadratically. The daily radiation dose to homogeneously labelled Dimorphophila developing on labelled medium was calculated. Under the experimental conditions ($1.24 M/1 \times 10^7 P^{32}$ at $T_0$) no detectable difference was noted between labelled and control Dimorphophila with respect to egg hatchability, eclosion, time required for development from egg to adult, and sex ratio of the progeny adults. Fecundity and fertility of $P^{32}$-labelled females was lowered, and evidence is presented relating this to transmutation of internal $P^{32}$ to $^{32}P$ rather than to ionization. (auth.)


Kogure and Nakajima 1935 - [1147]


The findings of Ofstad and Montigny that incorporation of $P^{32}$ in sperm followed the same curve as the mutation rate for sex-linked recessive lethals in daily broods suggested the possibility that some of the mutations might be due to the disintegration of $P^{32}$ incorporated in the genetic material. To attempt to elucidate this question the day-to-day mutation curve for 11-11 translocations was determined. After an acute dose of radiation to newly eclosed males, the daily sensitivity pattern for translocations and recessive lethals has been determined. If, after ingestion of $P^{32}$, an appreciable number of mutations is due to disintegration in the genetic material, and if these disintegrations are able to produce broods leading to translocations as well as to sex-linked lethals, translocations should be found among the progeny of days 9 and later as these could be induced by disintegration in postmeiotic sperm. No such translocations have been found.


In previous communications concerning the incorporation and mutagenicity of radiothorium during Drosophila spermatogenesis, the authors have emphasized the difficulty of calculating the fraction absorbed in the testes of the total dose delivered by the phosphorus contained in the fly. In the present paper this fraction has been estimated genetically. The genetic experiments have been made on mature sperm only, feeding 3-day-old males which have not previously been marked, storing them for an additional 24 h, and then mating them for a few hours only so as to limit the variation in exposure time of the sperm utilized for mating. The recessive sex-linked lethal mutation rate in these sperm is then compared with mutation rates obtained with acute doses of X-rays. Taking into consideration the biological decay of $P^{32}$ in the fly during the first 24 h after ingestion, the result is found to be equivalent to between 1 and 2 r per hour per 1000 cpn in the fly as measured by our technique. Calculations based on the total amount of radiosensitivity contained in the fly give a total dose of some 50 rad/1000 cpn. Thus only a very small amount of the energy, approximately 0.4%, is absorbed in the testes. This agrees with King's (1953) results obtained by a different technique.


Biological decay curves of $^{32}P$ and $^{32}P$ in Drosophila males are shown, and recessive sex-linked lethal mutations after 1000 r x-rays, and mutation curves after $^{32}P$ feeding, together with theoretical curves. Efficiency factors are given. A mutation curve is also shown for $^{32}P$ citrate injection, with theoretical curves. It is not possible, from the curves, to obtain insight into whether all the mutations observed after $^{32}P$ ingestion could be explained on the basis of disintegration of $P^{32}$ within the fly, whether some mutations were caused by the transmutation of the $P^{32}$ incorporated into the sperm. The significance of the results is discussed.

99

The retention of $^{32}$P by Drosophila females after a single meal of carbonated sugar solution may be adequately described as a sum of three exponential processes, all of which are influenced by diet and/or mating. Differences in retention between groups on diets of low or normal phosphorus content are in the expected direction. $^{32}$P incorporated into the DNA of mature sperm is recovered 7 or 8 h after a single meal, under conditions of excessive mating, which coincides with maximum genetic effect. The number of $^{32}$P atoms per sperm is calculated. Radioactive yeast is retained completely after injection in the form of citrate. The fraction of dose absorbed in the test is calculated to be 5-8%. On the basis of this absorbed fraction of dose, the pattern of sensitivity to acute irradiation, the retention curve for $^{32}$P, and the shift in $^{32}$P distribution and the mutation to be expected from $^{32}$P radiation are calculated. Discrepancies between the observed genetic effect and calculations are found on days with high incorporation of $^{32}$P into sperm DNA, and transmutation of $^{32}$S to $^{35}$S is taken to be responsible for the unexplained genetic effect. The efficiency of the transmission in producing recessive lethals is found to be 1 in 100. (Inasmuch, this note)


The incorporation of $^{32}$P was followed during spermatogenesis at the same time as the genetic effect of the radioactive decay was measured. Experimental procedure is described. Results are tabulated, and mutations and incorporation given in a graph. The close correlation found between incorporation and mutation might tempt one to suggest the following alternatives: (1) mutations are caused by transmission of $^{32}$P atoms incorporated into the genetic material, and the correlation reflects a case causal relationship, and (2) mutations are caused by radiation emitted from the $^{32}$P contained in the whole fly, and the whole correlation reflects a coincidence in time of incorporation activity and mutagenities.


Newly eclosed Drosophila males were fed a sugared solution of $^{32}$P. The procedures for testing male productivity and for assaying $^{32}$P incorporation during spermatogenesis are described. Two graphs show corrected $^{32}$P incorporation and mutation curves. The amount of $^{32}$P incorporated during spermatogenesis was found to vary with time. A close correlation between the mutation curve and time was noted. The significance of the results is discussed.


A quantitative and qualitative study is described in which adults were injected with $^{32}$P (3.75 - 60 μc/cm² concentration) and the resulting meiotic anomalies observed. Chromatid breaks, dicentric bridges, stickings, etc. occurred as after X-ray treatment. Considerable quantitative fluctuations were observed under similar experimental conditions. The frequency of bridges and fragments increased with concentration and with duration of treatment. The variation with concentration of the bridge:fragment ratio is discussed.

Sullivan and Gooch 1953 - (1250)

Gooch et al. 1956 - (585)

Gamsd and Nishiyama 1956 - (588)

Jenkins, D.W. PARASITOCISK ISOTOPES. Exp. Parasit. 3

Gamsd et al. 1958 - (364)

Gamsd et al. 1960 - (585)

Gooch et al. 1956 - (585)


Cytological studies with pre-natal spontaneous chromosome loss in chromosome stability. The above at which the cells pass the cleavage have shown that Cb apparently firmly bound in the incorporation of isotope in 21 chromosomes: are due
MUTAGENICITY DURING SPERMATOGENESIS

The same time as the genetic effect of the treatment, results are tabulated, and mutations are recorded. Incorporation and mutation might take place by transmission of Pr5-Pr6 strains, a causal relationship, and (3) mutations Pr6, and the whole correlation reflects the effect of Pr5.

The procedure for testing male generations is described. Two graphs showing corrected standards during spermatogenesis were found and the same time was noted. The significance of the evaluation of spermatogenesis was discussed, and a fragment ratio is discussed.

* Gargi et al., 1959 - [264]
* Gargi et al., 1960 - [265]
* Gargi et al., 1966 - [353]


Cytological studies with Tradescantia have indicated that metal deficiencies result in higher frequencies of spontaneous chromosome breakage and that calcium, magnesium, and strontium are likely metals involved in chromosome stability. The frequency of chromosome breakage in maize is dependent on the temperature at which the cells passed through mitosis. Isotope studies with Lilium longiflorum and Habronanora communis have shown that Ca^{40} and Sr^{90} are incorporated into the chromatin material of nuclei and is apparently firmly bound in the chromosomes. The possibility of mitostalas consequences resulting from the incorporation of isotopes in the hereditary material and the possible role for diverse metal ions in the chromosome structure are discussed. 28 references. (auth.)

* Gargi 1968 - [1397]


The time distribution of Sr^{90} was studied in virgin females (wild stock 53) of H. communis, following feeding with Sr^{90}-labelled citrate in honey (277 μc/g of citrate) and maintained at 30°C. Egg laid within the first days of feeding only showed some high radioactivity. The radioactivity was mainly concentrated in the abdomen, half the Sr absorbed is eliminated within a day. Irreversible sterility was produced in Habronanora females.

* Gargi et al., 1966 - [353]
* Gargi et al., 1967 - [350]


The feeding of radoncontaminated, Sr^{90}, to houseflies, Musca domestica L., for 18 h caused varying degree of mortality. Continuous feeding inhibited oviposition entirely, while feeding for shorter periods, although allowing oviposition, caused a marked decrease in egg viability. Fly eggs apparently show growth and radiate Sr^{90}. The average biological half-life for the element was 16.4 h. A similar experiment performed with the German cockroach, Blaneula germanica L., gave inconclusive results concerning sterility. The biological half-life for this species was 5.3 d for males and 6.06 d for females. (BA 81: 10244, 1963)

* Steffenssen and LaChance 1960 - [356]


1- F. Insects as Disease Vectors in
1- F. 1. Man

Survey Articles
Radiotracer techniques applied to ecology and dispersal studies are reviewed. In experiments on the radiotracer marking of Plasmodium gallinaeum, however, it was observed that injection of 221P30 by Aedes aegypti (L.) during the period of extrinsic incubation caused the development of the parasite to be arrested in the oocyst stage. The results are cited of unpublished experiments by the author and his associates in which bacteria labelled with 32P were used to study the persistence and multiplication of Streptococci coli in Musca domestica L. when ingested with food. The difficulty was to ensure that the tracer was chemically bound. Thus in one experiment in which the time and amount of regurgitation and excretion of the bacteria by the flies was checked quantitatively by plating bacteria and determining radioactivity, correlation between radioactivity and bacterial counts was good during the first few days of the test. Subsequent accumulation of radioactivity in the flies implied that the bacteria were probably not tagged molecularily. Radiotracer for inosine nucleotides have proved very valuable for studying the size of entry or physiological action, and have also facilitated distribution studies on a treated surface. They have shown promise in assessments of the discrimination of sprays applied from aircraft.

Jenkins 1956 - [73]

Beveridge 1956 - [109]


Culex fatigans larvae reared in both containing varying concentrations of 32P as the orthophosphate developed into adult females, the females having an activity 4 times greater than that of the males. Only adult females reared in a medium containing 0.1 μg 32P/cm² took a blood meal, and were fed on mice having a high count of Plasmodia larvae of Wucheria bancrofti. The activity of the microfilarial larvae isolated from the dissected mosquitoes was consistent at about 25 B. c. mm/min. The successful tagging of Plasmodia larvae will aid in studying their further development in the definitive host. (CA. 1:32608, 1957)

Diasamol et al. 1957 - [245]

Diasamol et al. 1957 - [238]

Kernwell et al. 1958 - [241]

Jackson and Mather 1958 - [58]

Knapp et al. 1958 - [350]


Plasmodium gallinaeum was selected for tests because of the ready availability of gametocyte, the occurrence of cytoplasmas at the site of inoculation, and the ease of rearing and maintaining the insect host, Aedes aegypti. An account is given of the methods used to produce radioactive cells of P. gallinaeum. Both 32P and 38Sr were used, feeding the radiotrope to mosquitoes that had already become infected with malaria finally proved most appropriate as technique. Autoradiographs demonstrated early pre-cytotrophic forms of the malaria parasite.

1 - 2 ANIMAL.

Diasamol et al. 1957 - [256]

Hahn et al. 1956 - [364]


In the course of this review article data is presented on the direct observations of fly transfer between host species. Flies and other arthropods were labelled with 32P. Flies were bathed for less than 8 min in aqueous solutions of 32P-Po 32P containing 10 μCi/ml. Tagging was accomplished by a stable combination of 32P with exoskeleton. Work is described Malariae telencinem. Flies Radioactive flies were also: Tests with domestic rats also under certain conditions. Flies in all trials, tagged flies > the 56 days. 3.6 to 5.1 x 10^9 will also transfer to rats.

Björngärd, K., Linwell, D., PHOSPHORUS. Acta agric. Preliminary experiments made radioactive when 10 0.35 mC 32P. The radioactive of techniques are given, Ap radioactivity from plants. The extensive experiments which were carried out of aphids (C. peroncia 32P as sodium orthophosphate same centrum could be extended the distance covered, the points of view, including the (An abridged report was reprinted in the proceedings.

Cornwell 1956 - [104]

Cornwell 1959 - [105]

Day and McKinnon 1951 - [241]

Day and Inskytewicz 1953 - [350]

Day and Inskytewicz 1954 - [72]

Kleib and Kniebeil 1950 - [350]

Linsenrath, R. BEITRAG ZUR VIRUSIKAL KOCH (TETANIA) mechanism of action of Tet.

In order to settle the question were labelled with 32P. This activity from 10 2 (mC mC P. A further 5 d were required in its saliva, Intermediate P active contamination of the meat and autoradiography d. This result is of great impor transmission by insects as
exoskeleton. Work is described on 2 rodents, Microtus califomicus and Raton norvegicus, and tagged fleas, Malaxis tetraphylla. Fleas were found to transfer between individual Microtus. The data are tabulated.

Radioactive fleas were also recovered from voles; radioactive fleas confirmed some ingestion of fleas. Ten with domestic rats showed that the fleas would transfer readily from the field voles to domestic rats under certain conditions. Fleas were combed from rats and also obtained from rat mess. Data are tabulated. In all trials, tagged fleas showed an initial average count of 0.5 to 8.8 x 10^6 counts/flea/min and, after 30 days, 3.6 to 5.1 x 10^6 counts/flea/min. Undoubtedly, other important wild-rat flea vectors of plague will also transfer to rats.

I-9-3 PLANT


Preliminary experiments (laboratory) showed that aphids (Myzus persicae Sulf., and Aphis fabae Scoop.) became radioactive when living on broad bean plants watered with labelled sodium orthophosphate (0.65 - 0.75 mCi 32P). The radioactivity of the aphids could easily be demonstrated autoradiographically. Details of techniques are given. Aphids received their radioactivity for at least 2-3 weeks after removal to non-radioactive plants. The radioactivity was "inherited" by the offspring for at least 2 generations. The main experiments which were carried out on sugar beets in the field, were arranged in such a way that the distribution of aphids (M. persicae and A. fabae) from a radioactive centre (plants watered with 0.4 - 1.5 mCi 32P as sodium orthophosphate) to the surrounding plants in the plot and the spread of yellow virus from the same centre could be studied. The conclusions drawn on the movements of the aphids, their average speed, the distances covered, the effectiveness of the aphids as virus vectors, etc., are discussed from different points of view including the limitations of the method in its present form.

(An abridged report was read by D.L. at the Potato Virus Conf. In Wageningen, 19-20 Aug. 1954, and is published in the proceedings of the conference.)

* Cornell 1950 - [104]
* Cornell 1958 - [105]
* Day and McKeehan 1951 - [53]
* Day and Traycovitch 1955 - [23]
* Day and Traycovitch 1956 - [992]
* Klopf and Kunkel 1950 - [23]

I.4. WITH PLASMODIU. Parasitology

Availability of gametocytes, the raising and maintaining the insect in radioactive conditions of P. gallinaeform, and already become infected with demonstrated early pre-erythrocytic...

ROCNE ON THE ECOLOGY OF SYLVATIC

Infections of fleas transfer between host and host for less than 1 min in aqueous by a stable combination of Ce with...

A study was made to determine the best method of labelling insects (Musca domestica and Blattella germanica) using radioactive food. Flies and roaches were used in the study which compared P32, Ca46, Fe55, Zn65, Sr89, Y90, Cd112, Bi214, and Ba in various food preparations. It was found that a 24-h exposure was required for 100% tagging, the best results being obtained with P32. In a mixture of 3 parts milk and 1 part 10% sugar water, a direct relation was found between P32 concentration in food and the radioactivity of the flies, and the females were twice as radioactive as males, being twice as heavy. The effects of elimination, isotope decay, and energy of the emitted ray were considered. Radioisotopes with a beta emission above 0.8 MeV and a half life not less than 3 weeks are suitable. The food for studies lasting 20 to 26 days should contain 1 to 2 µc. (NNAL 1A: 3546, 1960)

*) Post-script to reference 357, cited on p. 86.

408 Dahm, P.A. RADIOACTIVITY (9) 136-7, 138, 101; (19) 13
Review Article. The principle discussed. A survey of the w individual research being g

* Dahm 1950 - [665]
* Dahm 1957 - [666]

410 Haller, H. L. RADIOACTIVE ACTIVE ISOTOPES IN AGRICULTURAL LAB. Council of Participating Review article. Applications systemic insecticides are ma been applied for tagging ins

* Histone 1954 - [9]
* Jenkins 1954 - [603]

411 Kirschke, E. ZUR VERWEN
application of radioisotopes Short review article.


Except for the very end of the foreign publications, except a3-labelled Hamilton, then shown to possess greater per relative to "water"-sprays. when applied as a fatty sulfon stability of fatty solutions of 48 h. The importance of be useful applications of a31:9

* Lindquist 1957 - [9]
* McCracken 1968 (Bibliog

413 Metcalif, R.L. RADIOACTIVITY p. 237-28 (in "Radioisotopes"
II INSECTICIDES

II-A Survey Articles

409 Dahl, P.A. Radioactive Tracers in Insecticide Research. SECT. N.Y. 22 (1953)
(9) 156-7, 159, 161; (10) 146-9, 161, 163, 165; (11) 141, 143, 145, 147, 165; (12) 167-8, 178.
Review Article. The principles of applying radioisotopes generally and in this field, in particular, are discussed. A survey of the way in which radioisotopes have already been applied is given, references to individual research being given.

7 Dahl 1953 - [806]

8 Dahl 1957 - [806]

Review Article. Applications of radioisotopes to chlorinated hydrocarbons, organic phosphorus, and systemic insecticides are reviewed, followed by a discussion on penetrating radiation. Radioisotopes have been applied for tagging insects used in flight, migration and dispersal studies.

9 Hinton 1954 - [6]

10 Jentsch 1954 - [465]

411 Kissberg, E. Zur Verwendung Radioaktiver Isotope in der Schädlingsbekämpfung (On the application of radioisotopes to pest control). Pestl. Schädlingsbekämpfung 8, II (1959) 190-96. (in German)
Short review article.

Except for the very end where some research in Leningrad is described, the paper is a review article of foreign publications. Experiments (1958) are described on the decomposition products and isomers of 32P-labelled Parathion, identified by a paper-chromatographic technique. Fatty solutions of Parathion were shown to posses greater penetrating powers than water emulsions. This was also true of cold aerosols relative to "water"-sprays. Autoradiographically, the insecticide could be proved to have greater spread when applied as a fatty solution. A radiometric separation method (1957) was employed for testing the stability of fatty solutions of Parathion. No hydrolysis was found after they had been subjected to 1-4°C for 48 h. The importance of being able to measure the penetrating ability of aerosols is stressed. Further useful applications of radioisotopes to related problems are discussed.

12 Lindquist 1957 - [9]

13 McCormick 1958 (Bibliography) - [597]

413 Metzli, R.L. Radioisotopes in the Study of the Mechanisms of Action of Insecticides. p. 231-52 in "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the

A review article, illustrated by specific examples. Auxiliary techniques valuable with insecticides are discussed: paper chromatography, column chromatography, partition coefficients, and radioautography. Further sections are devoted to recent work on the chemistry of insecticides, plant systemic insecticides (absorption, translocation, and metabolism), insect resistance to insecticides and the study of the mechanisms of action of insecticides by the labelled metabolic pool technique of Winteringham. An appendix gives a source list for descriptions of synthesis of most of the labelled insecticides reported up to 1958.


Review article. The respective efficacy and application of selective insecticides are discussed, also the usefulness of radioisotopes in investigations on translocation, decomposition, etc.


A general article, dealing with radioisotope tracers in plant nutrition and insecticides research.


Review article. Investigations into insecticide biochemistry are surveyed, concerned with such problems as insecticide absorption, distribution, their decomposition or metabolic products and residues, etc. The applications of radioisotope (e.g., a radioactive Br-analogue of DDT was used, C14-labelled fumigants, 14C labelled methyl fumigates) and their scope in such studies, also in combination with other techniques (paper chromatography, autoradiography, etc.) is discussed.


The impact of the combined application of radioactive tracers and micro-fractionation techniques such as chromatography in bringing new fields of biochemical research within the range of quantitative analysis are discussed. Successful application involves first the introduction of suitable radioisotopes into the system to be studied followed by adequate techniques of fractionation and identification. Methods of using labelled reagents, radioactivation, and the labelled technique used for the first conditions are described. Methods for characterizing and identifying labelled compounds separated on paper chromatograms in amounts below the limits of chemical detection are also discussed. (from auth.)

419 Андреева, О. И., Костенко, Г. К. ИЗУЧЕНИЕ РЕАКЦИИ ЙОДОВОГО ОБЛАЧЕНИЯ УГЛЕРОДА МЕЖДУ ЛИАЗОВЫМ НАБИВКИ И КАРБОНАТАМИ И ИСПОЛЬЗОВАНИЕ НИХ ДЛЯ ПОЛУЧЕНИЯ ЛИАЗОВОГО НАБИВКИ, МЕЧЕННОГО ЙОДОМ С К*. Труды Конференции по Использованию радиоизотопов в хим. науках и пром., Киев, 6-17 сентября 1950 г., том 3, стр. 151-22. Киев, Видавничо-Наукова Громада по хим. темам, 1952.

Работы по исследованию реакций иодоводных облаков, которые базировались на следующих основных операціях: 1) Процедура реакции иодоводного облака KI 131 + Na2S2O3 при 600° в течение 2-х часов. 2) Разделение смеси I- с Na2S2O3 путем экстракции ИОД ионов нейтралом на диазоникоксом экстракторе. При облучении экстракционных веществ KI и Na2S2O3 получена целостной набивки о химическом выходе на 90% и содержании основного вещества 99-100%. При применении Na2S2O3 с высокой удельной активностью (50-70 микр/мг) удельная активность KI получаются лишь 30 микр/мг. Указанная добавка, образующаяся полиле С14, регенерируется после экстракции нейтралом без заметных потерь.

420 Belouso, B., Hebb, R. D. F. Amer. chem. Soc. 22

The method of preparation of a gaseous low-molecular-weight product (triphenylphosphine) micro- or macro-scale; or may be obtained directly.

421 Bond, E. J. THE METAK

Soc. Am. Ge. 3 (1956) 1

The uptake of hydrogen by a carbonated stone. (Kuphalo state of C14-labelled hydrocarbon.)

422 Bridges 1955 - 1965

Bridges 1956 - 1965

423 Coey, J. D. W., Wain, R. J. SYNTHESIS OF OXYGEN AND E.

A synthesis of ethylene oxides are given of apparatus and (in 97% isotopic yield). C2O 95-99% (Na2CO3: reductive based on BaCO3).

424 Farnham, W. W., Murty, METHYLISU(3-CHLORO)BROMIDE LABELED WITH

MeCH3-Cl3CHBrCl has damage caused by 1. Cl3C, of 5-8 c c of a mixture of 3. allowed to react in a space containing C14N2, amount of SO2, giving with an activity corresponding 20-30% C14N2 to CH3Cl.

425 Geotherm, M., T., Tilsenb FUMIGATED WITH C14-E

Dried prunes fumigated with relatively acoustically allylic hydroxymethyle cellulose in

The authors obtained cyanide-labelled potassium by the following method: (1) The isotope exchange reaction K34CN + BaC14CO3 is produced at 90°C in 2 h. (2) The mixture KCN + BaCO3 is separated by extracting the KCN with liquid ammonia in a circulating extractor. By exchanging the carbohydrate potassium KCN and BaCO3, potassium cyanide is obtained with a carbon-14 content of about 95-96%. By using BaCO3 with a high specific activity (60-70 mc/g), a KCN specific activity of about 80 mc/g may be obtained. The barium carbonate decomposed from isotope C14 regenerates after the ammonia extraction without appreciable loss.


The method of preparation described offers several worthwhile advantages: (a) In one conversion reaction, a gaseous low-molecular-weight starting material (C14CO2, mol. wt. 26) leads to a solid high-molecular-weight product (triphosphatetacetic acid-1-C14, mol. wt. 280, melting point 85°C); (b) it is equally adaptable to a micro- or macro-scale; and, (c) other useful carbon compounds such as formate, methylamine, etc., may be obtained directly (to the course of explanation).


The uptake of hydrogen cyanide by this species increased linearly during feeding even after absorption of a lethal dose. Respiratory inhibition did not appear to be the direct cause of death by this poison. The fate of C14-labelled hydrogen cyanide within the insect was studied.

Bridges 1885 [765]

Bridges 1886 [766]


A synthesis of allyl alcohol-1, 2-C14 is described. The compound is of interest as a fumigant. Details are given of apparatus and methods for the preparation from CH2=CH2, of C14H2 through barium cyanide (in 97% isotopic yield), CH2-C14H; (quantitative yield) and CIOCH3-CH2-CH2OH (97% recovery of isotope); KNO3 gives 95-96% (C14H2)2O; reduction with LiAlH4, gives 93% a, a, d-labelled EOH (over-all isotope recovery of 76% based on K14O3).


Men(C14H2)2-C14H2 (C14) has been modelled in the Me group with C14 for a study of the mechanism of the cell damage caused by I. C14H2-OH (0.8-10 nmol/L) is converted in a specially designed apparatus by means of 5 cc of a mixture of 2, 2 cc concentrated H2SO4 and 2, 63 g 44% HBr into 84-94% C14H4 Br (D). It is allowed to react in a special apparatus with H2 (C14H2-C14H2) (112) to form ethylene, and the mixture, containing C14H2-N(C14H2-C14H2) and I1, treated in C14H2 saturated with HCl with the calculated amount of SOCl2, giving 55% (based on the CH2OH used) C14H2-NH2-C14H2-C14H2HCl, melting point 100-110°C, with an activity corresponding to 22 mc/mg (H2NC14H2, m. 12-14°C). When the ratio of h and i is 1:1, 20-35% (C14H2)2-H2(C14H2-C14H2Br, m. 217-18°C) is obtained. (CA 44:461b, 1960).


Dried plants fumigated with ethylene cyanide-C14 react with the fumigant to give non-volatile and relatively nontoxic alkylation products. Over 50% of the total radioactivity is combined as insoluble hydroxethyl cellulose in the plants skin, 96% as hydroxethylated sugars in the pulp, and 9% as glycols.
(mostly diethylene glycol). The remainder has been tentatively identified as hydroxyethylated amino acids and proteins. (auth.)


The combustion of oxygen in an intimate mixture of barium sulfate and red phosphorus was found to give a good yield of pure SO$_2$. Experimental and analytical procedures are described. The method is rather tedious.

McCartney, J.A. PREPARATION OF C-14-CYANIDE FROM C-14-CARBONATE. J. Amer. Chem. Soc. 73 (1951) 482.

The author describes a relatively simple and inexpensive procedure for obtaining a 90% yield of HCN with a specific activity essentially unchanged from that of the K$_2$CO$_3$ used as starting material.

* McCollum et al. 1951 - [744]

* Perlowitz-Steinmetz 1952 - [406]


Experimental details are presented for the preparation of HCN from Bac$_6$CO$_6$. By reduction with $K$ metal in the presence of H$_2$. The procedure was essentially that of Czernik and Klinakis (J. Biol. Chem. 157, 547 (1943)), as modified by Looff (Tetrahedron, 1 (9) 54 (1947)) except that dilute $H_2SO_4$ was used to generate the HCN. No difficulties were encountered, and yields of 80 to 90% were obtained. (1964 5; 4469, 1991).


When C$_4$S$_2$ containing $S$ was administered intraperitoneally, subcutaneously, intraperirenally, or by inhalation to guinea pigs and mice, the distribution was general throughout the body tissues, with more retained in the liver than other tissues. The unmetabolized C$_4$S$_2$ was excreted rapidly, but the tissues retained a large proportion and gave it up slowly. Approximately $20\%$ of the retained C$_4$S$_2$ was excreted in the urine, largely as inorganic nitrates. (CA 44:4133a, 1950).

Tombeck, A.J., Mahler, R.J. THE SYNTHESIS OF ETHYLENE OXIDE-1,2-C$^{14}$. J. Amer. chem. Soc. 73 (1951) 4966-6.

Ethylene oxide-1,2-C$^{14}$ was isolated in 30% yield from the reaction of ethylene-1,2-C$^{14}$ with phenol in trimethylpoxet solvent in the presence of iodine catalyst. A procedure was developed for the determination of ethylene oxide in tetrachloroethylene solution. (auth.)

* Winteringham and Hellyer 1954 - [728]

* Winteringham 1955 - [707]

* Winteringham 1955 - [764]

* Winteringham 1957 - [761]

* Winteringham et al. 1958 - [730]

II - C Halogenated Hydrocarbons

Survey Articles

The author reviews the protective mechanisms concerned with DDT-resistance in *M. domestica*, which may be characterized as morphologic, physiologic and behavioristic. They are discussed in some detail. Numerous studies from which data are drawn have used radioisotopes. Among the factors reported, some are directly concerned with protecting the insect from the lethal action of DDT; others supplement a protective mechanism already present. Still others, i.e., certain structural differences, etc., are incidentally associated with resistant strains but offer no protection to the fly ("resistance-modifiers"). The complex nature of DDT-resistance makes it difficult to characterize this phenomenon in terms of a single common factor. It is likely that each strain possesses a combination of attributes for resistance which are different from that found in other strains.


An excellent review article, discussing detoxication mechanisms, which may bring about (a) conversion of insecticide to non-toxic metabolites which are either excreted or retained within the tissues; (b) excretion in the unchanged form; or (c) storage in non-sensitive tissues of toxic metabolites or of the unchanged chemical. Work with radioisotopes is cited freely. Reference is also made to unpublished work by Ferry (1967) on the metabolism of $^{14}C$-labelled Lindane in houseflies. Topical application (4% insecticide fly) led to rapid toxicant metabolism. After 54 h 80% of the radioactivity was in the excreta. Partition of the $^{14}C$-labelled compounds in excreta between water and cyclohexane showed 44% to be water-soluble. The amount of $^{14}C$ in the fly also indicated a non-toxic, dechlorinated product. Investigations with the $^{14}C$-label of BHC indicated that both resistant and susceptible flies metabolized and excreted the product at an approximately equal rate. However, smaller amounts of water-soluble metabolites were indicated.


A reference book. The various compounds are listed with their formulas, procedures for their preparation, notes, references and other preparations. To quote just the example of DDT, the $^{14}C$ analogue is discussed on pages 1157, 1158, the $^{15}N$ analogue on p. 1279, DDT labelled at $^{13}C$ on p. 888, and at $^{14}C$ on p. 892.


A review article. It includes a discussion of biochemical, physiological effects, the metabolic fate and possible mode of toxic action of Mel,L $^{13}C_2H_3C\cdot$, $^{13}C_2H_3$-Cl, dichlorobenzene, DDT and its analogues, hexachlorocyclohexane isomers, Aldrin, Dieldrin, and Chlordane. Amongst the 833 references are numerous references to work utilizing radioisotopes although these are not mentioned specifically in the text.

Aldrin and Dieldrin


Tagged Dieldrin was used in a metabolism study in susceptible and resistant houseflies. Paper chromatographic separation of the benzene-extracted dode demonstrated only one radioactive spot with identical Rf value of reference Dieldrin in three solvent systems. A constant specific activity was shown for three successive crystallizations.


The insecticides 1,2,3,4,10,10-hexachloro-1,4,4a,5,6,7a-dimethyl-naphthalene (Aldrin) and 1,2,3,4,10,10-hexachloro-1,4,4a,5,6,7,8,8a-octachloro-1,4-endooxn-6,8-dimethanododecahexane (Dieldrin) were prepared labelled with carbon-14. They were synthesized by labelling hexachlorocyclohexanes and subsequent reaction with 8,9-endo-bromine. Starting with
Bac*CO* a 20% yield of Aldrin (melting point 102. 5°C) and a 22% yield of Dieldrin (melting point 181°C) were obtained. The specific activities were 8.8 and 3.5 * 10^16 cpm per gram for Aldrin and Dieldrin, respectively.

**Wintemberg, F. P. W., Huntson, A.**

**ABSORPTION AND METABOLISM OF 14C-LABELLED ALDRIN BY SUSCEPTIBLE AND RESISTANT MOSQUITO LARVAE** (Unpublished observations) WHO Information Circular on Insecticide Resistance No. 21, (1959) item 55.

The absorption and metabolism of 14C-labelled Aldrin by susceptible and Dieldrin-resistant larvac of *Aedes aegypti* have been compared. Both strains absorbed about one quarter of the Aldrin initially added to the water (2 ppm) after 4 h at 25°C but this was largely recovered by rinsing the animals in acetone and relatively little had penetrated the internal tissues of either strain. There were similar but small conversions of Aldrin to Dieldrin in the tissues of both strains. The data suggest that resistance of the larvae is not due to lack of cuticular penetration or detoxification in the tissues as a whole.

**Wintemberg, F. P. W., Huntson, A.**

**MECHANISM OF RESISTANCE OF ADULT HOUSEFLIES TO THE INSECTICIDE DIELDRIN.** Nature 184 (1960) 608-10.

The sodium analogue of Dieldrin (14C-labelled) was shown to be partly metabolised by resistant and susceptible houseflies. The results were determined as 14C-radioactivity, corrected for decay, self-absorption, etc., and expressed as a percentage of the dose applied. Unchanged insecticide and metabolites were determined by radio-paper chromatographic techniques. The rate of accumulation of 14C-metabolites in the abdomen of adult *M. domestica* is illustrated. A table gives details of the fate of the 14C analogue of Dieldrin in three hours after topical application to Dieldrin-resistant and susceptible adult houseflies, at a dose of 2 mg per insect. A bromine analogue of Dieldrin (14C-labelled) was shown to be excrated unchanged in equal proportion by both resistant and susceptible houseflies. Small amounts of water-soluble metabolites were also produced.

**BHC and isomers**

**Ronquist, A.**


Bromone hexachloride was mixed with thurin and its distribution studied by analysis of its radioactivity. This gives depth of penetration as well and is useful in explaining discrepancies shown by biological tests.

**Bradbury, F. R.**


Experiments on the absorption and metabolism of BHC isomers in houseflies (*Musca domestica* L.) are described for a strain normally susceptible and a strain resistant to BHC. The flies were exposed to vapours of the isomers at 20°C [14C], the isomers being labelled with C14 or C18. Radioactive material was recovered from the treated flies by extraction with carbon tetrachloride and with petroleum ether. The ultimate production of 11 water-soluble compounds from both the al and BHC was reduced from chromatographic data, and is discussed. The part played by metabolism in making an insect resistant to poisoning is discussed in terms of the effect of the product of concentration and time, and it is concluded that detoxification by metabolism is essential for the complete recovery of an insect following absorption of insecticide. Figures are given showing the extent to which al and BHC were metabolised to water-soluble materials in susceptible insects of several species, including mosquitoes and cockroaches. It is evident from them that the susceptible strain of the housefly is in a class by itself in its ability to eliminate BHC as water-soluble products. It is thought that the existence in normal houseflies of a metabolic way of dealing with BHC predisposes the species to the acquisition of resistance. (Rev. 58, 46; 52, 1958)

**Bradbury, F. R., World, P., Newman, J. F.**

**ACCOUNT OF GAMMA-BENZENE HEXACHLORIDE PICKED UP BY RESISTANT HOUSEFLIES REARED ON A MEDIUM CONTAINING BENZENE HEXACHLORIDE.** Nature 172 (1958) 1002.

The gamma-benzene hexachloride was labelled with C14. Normal flies (Hawthorne stock of *Musca domestica*) were used, with another strain originating in Uruguay, having a very high resistance. Results of the particular technique use resistance to precipitation of the resistant benzene hexachloride insecticide to kill normal flies.

**Bradbury, F. R., Staden, H.**

**HOUSEFLIES. I. J. Sci. Food.**

The site of γ-benzene hexachloride absorption has been studied. After exposure to the insecticide, the flies were examined for the normal flies, to present in the benzene hexachloride is converted into water-soluble material of this product is gamma-chloride absorbed during its 6 b

**Bradbury, F. R., Staden, H.**

**Nature** 172 (1958) 1002-4.

The absorption and metabolism of which one was 26% labelled with C14 were made to incorporate 50-100% of mixed pieces of unreacted film; estimated as fractions soluble resistant strain (musca) but not in the benzene hexachloride survival of the 6 strain. The strain and convert into a smaller human-soluble products. The 6 strain was knocked down and further experiment was carried out at 24 h at 25°C in a clean tank with the longer exposure. The metabolism of the benzene hexachloride to BHC to recoverable product more than 95%.

**Bradbury, F. R., Staden, H.**


Studies were made of the site of injection of water-soluble material metabolism of the benzene hexachloride in the benzene hexachloride is converted into water-soluble material of this product is gamma-chloride absorbed during its 6 b

**Bradbury, F. R., Staden, H.**

**HOUSEFLIES II.** J. Sci. Food.

A detailed study of the site of injection labelled γ-BHC has established resistance. Under various or small amounts (5%) or less than 5% of precipitated in the metabolism is the only way to detect the benzene hexachloride resistant is shown by the determination of benzene hexachloride in 3
The fate of γ-benzene hexachloride in both normal and benzene hexachloride-resistant houseflies (Musca domestica) has been studied by radiochemical methods by means of C14-labelled γ-benzene hexachloride. After exposure to the insecticide the resistant flies showed less radioactivity in carbon tetrachloride extracts than did the normal flies, but paper chromatography of these extracts showed the radioactive compound present to be γ benzene hexachloride. A proportion of the absorbed benzene hexachloride in both kinds of flies is converted into water-soluble products which are not extracted by carbon tetrachloride, and the amount of this product is greater for resistant flies, being approximately 50% of the total benzene hexachloride absorbed during 6 hours exposure of the insects to the insecticide. (auth.)

The lecithin-hill strain of flies resistant to benzene hexachloride was exposed to 2-5 g benzene hexachloride labelled with C_{14}. The experimental procedures adopted are described. Alkaline hydrolysis of the metabolite products was found to give dichloro-lithophenols. The results are tabulated, which show that about 65% of the water-soluble products from the C_{14}-litho and 61% from the C_{14}-litho are produced. It is inferred that the metabolism of benzene hexachloride by the flies to produce water-soluble compounds involves the formation of a C-1 bond. A scheme which would satisfactorily account for the production of dichloro-lithophenols from benzene hexachloride is put forward.


Tests with seedlings grown for 14 days in solution of C_{14} HCl labelled with C_{14} showed that the plants did not convert the insecticide into water-soluble products, so that the loss of insecticide must be attributed to evaporation from the plant of either the unchanged insecticide or a volatile decomposition product. The results indicate that virtually all the C_{14} HCl applied in a seed dressing may be absorbed and that the main effects of such treatment are systemic.

Bridges, R. G. FATE OF LABELLED INSECTICIDE RESIDUES IN FOOD PRODUCTS. VI. DETECTION OF C_{14}-BENZENE HEXACHLORIDE BY WHEAT AND CHEESE. VII. THE RATE OF C_{14}-BENZENE HEXACHLORIDE RESIDUES IN FLOUR DURING BAKING. J. Sci. Food Agric. 9, 7 (1958) 621-9, 420-4.

As C_{14} HCl is being increasingly used for the control of insects and mites that infest stored foods and is persistent enough to leave a residue, especially in flours, the fate of the residue in various products was investigated. The results are given in these two parts of a series. HCl labelled with C_{14} was used to study the fate of the insecticide from whole wheat and its distribution between the flour and broken fractions after milling. Loss from exposed wheat was rapid, but when it was stored in closed containers no loss was detected. After milling the wheat, 40-45% of the initial dose was still present in the "fine" flour fraction, while the residue in the bran was increased between 2- and 4-fold. Most of the insecticide from Cheddar and Buttermilk cheese was lost, about 6% of the weight applied remaining after 44 weeks. Penetration of the insecticide into both types of cheese was slow, although appreciably more rapid in the Buttermilk cheese. Repeated applications caused a buildup of the insecticide in the outer few millimeters of the cheese, but little effect on the amount penetrating more deeply. The toxicological significance of such residues is discussed. C_{14}-labelled C_{14} was used to study the effect of heating at baking temperatures on the insecticide when present in wheat starch, gluten and milled wheat. The amounts of C_{14}-activity returned by the starch and gluten after heating for 1 h at 180°C (360°F) depend on the initial moisture content of the material. With milled wheat at moisture contents between 6 and 11%, little difference in the amount of C_{14}-activity retained was observed, but when mixed into a dough with water prior to baking, a greater proportion of the initial C_{14}-activity was retained. The residue remaining after baking was "locked up" in dissolved starch granules and could not be extracted with acetone until the heated material was treated with water. The residue in the heated starch consisted mainly of unchanged C_{14} HCl, but that in the flour was shown to be mostly a mixture of tri- and monochlorobenzene. The toxicological significance of these breakdown products in bread is discussed. (RAF-A 47: 232, 1959)


A Dielmin-resistant (R-strain) and susceptible strain of Musca domestica were used. A simultaneous high resistance to γ-HC was encountered. Studies of the resistance mechanism were made using C_{14}-labelled α, γ and δ-isomers of HCl. Details of the methods and their application are given. Results suggest that monochloro-deracemization is not the first step in any major pathway for the metabolism of γ-HCl by houseflies. Detection of γ-PCD together with other chlorinated benzene may mean that an alternate pathway by dehydrochlorination is possible, though of secondary importance.

Craig, et al. 1960 - [778]
Craig 1956 - [779]
Craig 1969 - [780]

Elias, H., Lieber, P. J., Kohl DE3 1, 2, 3, 4, 5, 6-HEXACHLORO 1, 2, 3, 4, 5, 6-HEXACHLOROCYCLOHEXANE.

With the use of C_{14}-labelled γ to follow quantitatively the loss 1, 2, 3, 4, 5, 6-HEXACHLOROCYCLOHEXANE.

Hill, R. Jones, A., Pelt, D. CHLORIDE BY A CARBOXY-14 F.

A method of preparing C_{14}-labelled used as a laboratory check on c.

Hornstein, I. [ANALYSIS OF]

The results for the C_{14} isotopic of Methods of Analysis, 7th ed., modified procedure reported on results by the Craig and Tryon excellent agreement with those.
Blight, H., Lieser, K., Krobher, H. W. 
RADIOCHEMISCH UNTERSUCHUNG DER ISOMERSYNTHETISCH DES 1,2,3,4.6,6-HEXACHLORECYCLOHEXANES (Radiochemical investigation of the isomerization of 1,2,3,4,5,6-hexachlorocyclohexane). 
Chem. Rev. 25, 9 (1939) 2128-37 (in German)

With the use of C14-labeled γ- and α-HCH (i.e., 1,2,3,4,5,6-hexachlorocyclohexane) it was possible to follow quantitatively the isomerization of γ-HCH and α-HCH in the homogeneous system HCH/HCCl3/1,2,3,4,5,6-hexachlorocyclohexane as a function of time in the temperature range from 0°C - 10°C. Calculations based on experimental data showed that isomerization may be considered as equilibrium reactions of the type γ-HCH = α-HCCl2 + α-HCH. In the region 10°C - 15°C the equilibrium is very markedly displaced toward α-HCH. Velocity constants and activation energies of intermediate stages were determined, assuming second order bimolecular reactions. (Tr. auth. /MS)

Hill, R., Jones, A., Pate, D. 
THE DETERMINATION OF GAMMA ISOMER IN CRUDE BENZENE HEXACHLORIDE BY A CARBON-14 ISOTOPE DILUTION METHOD. 

A method of preparing C14-labeled γ-BHC 1,2,3,4,5,6-hexachlorocyclohexane, is described. It was used as a laboratory check on other analytical procedures.

Horstetin, I. 
[ANALYSIS OF] BENVENE HEXACHLORIDE. 

The results for the analysis of benzene hexachloride obtained by the present AOAC method (AOAC Methods of Analysis, 7th ed., 1950, 3, 153 (CA 45, 29246e)) were similar to those obtained by the modified procedure reported previously. Therefore no change in the present procedure is recommended. The results by the Craig and Tryon radiotractaicate dilution method (Craig et al., CA 46, 29274b) showed excellent agreement with those found by the infrared method. (CA 50, 98605g, 1956)

Horstetin, I. 
DETERMINATION OF BENVENE HEXACHLORIDE. 

As a result of a collaborative study, the present official partition chromatographic method for the determination of γ-benzene hexachloride (γ) was revised (details given). The following average values were obtained on a 0.1 % dist. (5.6% by infrared analysis): present method 5.70, revised 5.28; on a 0.5 % dist. (11.1 % by infrared) and 13.9 % by radiotractaicate analysis: present 13.07, revised 12.26. (CA 50, 98610c, 1956)

Horstetin, I. 
DETERMINATION OF BENVENE HEXACHLORIDE. 

The Craig et al. radiotractaicate dilution method for the determination of the γ-isomer content of technical BHC (γ) was applied by 6 collaborators to 2 samples of technical grade containing 12 and 35% of γ, 5% of benzene hexachloride, and γ-1,2,3,4,5,6-hexachlorocyclohexane prepared by known amounts of purified γ-1,2,3,4,5,6-hexachlorocyclohexane. Statistical analysis of all samples except the concentrate revealed an overall variation of 4.3% at the 95% confidence level. The accuracy and precision of the method is considered excellent. It was difficult to obtain representative samples of the concentrate. (CA 51, 138440c, 1957)

Pauli, D. 
DETERMINATION OF GAMMA ISOMER IN CRUDE BENZENE HEXACHLORIDE BY A CARBON-14 DILUTION METHOD (abstr.). 
Analyst. Chem. 29 (1957) 886.

A C14 isotope dilution method for determining the Lindane content in crude BHC is described.

Petras, G., Kruse, S. 
CHLORINE EXCHANGE BETWEEN ALUMINUM CHLORIDE AND γ-1,2,3,4,5,6-HEXACHLOROCYCLOHEXANE. 

Chlorinated hydrocarbon isocoupled labeled with C14 express the most effective tool in studies of the fate and toxicology of this class of compounds in natural strain of animals as well as in a laboratory. The use of exchange reactions appears to offer a simple way of preparing C14-labeled compounds as their complex synthesis. Chlorine exchanges readily between aluminum chloride and γ-1,2,3,4,5,6-hexachlorocyclohexane (γ-HCC) at temperatures above 100° with some decomposition and isomerization, primarily to α-HCC and δ-HCC. Mechanisms for both exchange and isomerization are proposed.
Chlorobenzene


The excretion and metabolism of C4-labelled chlorobenzene was studied in the locust Schistocerca gregaria. About half the dose was excreted unchanged. The probable presence, in excreta, of g-, m-, and p-chlorophenyl-l-cysteine and smaller amounts of m- and p-chlorophenylmethanesulfonic acid was shown by isotope-dilution techniques. These compounds were excreted as acid-soluble products. A weak acylase is present in crop fluid and excreta which slowly hydrolyses 1-p-chlorophenylmercuric acetate to p-chlorophenyl-l-cysteine. p-Chlorophenyl-l-cysteine is enzymatically degraded to unidentified products by crop fluid and excreta.


Phenol, g-, m-, and p-chlorophenol, and 4-chlorocatechol have been detected in the excreta of locusts dosed with chlorobenzene. The absence of phenol, m-, and p-chlorophenol in locust excreta was carried out by a chromatographic-isotope-dilution method, and the results were compared with similar estimations on the urine of rats, cats, ferrets, and rabbits dosed with chlorobenzene. The significance of the ratio of p-chlorophenol: m-chlorophenol: g-chlorophenol excreted by different species is discussed. (CA 54: 16725a, 1960)


The studies were carried out on Schistocerca gregaria. Half of an injected dose of chlorobenzene-C4 (the labelled) is eliminated unchanged in 48 h. The remaining C4 is found in the excreta at g- and p-chlorophenol, 4-chlorocatechol, p-chlorophenyl-l-cysteine.

DDT

Babten, F. H. THE SOLUBILITY OF DDT IN WATER DETERMINED RADIOMETRICALLY. J. Amer. chem. Soc. 27 (1935) 4666.

In a brief note the author described how the water solubility of C4-labelled DDT was determined at 3 temperatures by radiochemical methods. It was found that in very thin layers and microgram quantities DDT is appreciably volatile at room temperature.


A knowledge of the solubility of DDT in water is required to study the effect of dissolved and undissolved toxicant on biocides with mosquito larvae. The DDT was analyzed radiochemically, dissolved particles (4 x 104) were removed by an average ultracentrifugal force of 84,150 g. The solubility of DDT in water was found to be 1.2 parts per 105 at least 30°C. Date on spite of undissolved DDT particles and on recovery of DDT after ultracentrifugation at 1 g are presented.
The toxicity of DDT in aqueous-essence suspensions to mosquito larvae is affected by the volume of suspension and the type of the test containers. To learn whether the differences are due to settling, settling rates for different concentrations of DDT suspensions were determined. Settling does take place at the 1 ppm level but not at 0.01 ppm. A concentration approximating that normally used in mosquito larvicide tests. In further studies of much suspensions, a high proportion of the DDT was found deposited on the inner walls of glass, aluminum, or paper containers when the liquid phase was withdrawn within minutes after preparation of the suspensions. The concentration of the DDT in suspension was thereby reduced. Another surprising finding was that more than a 92% of the DDT from 0.01 ppm suspensions was lost by volatilization with the liquid phase during 24 hours. This volatility plus the deposition on the walls of the container appears to account for the loss of DDT from larvicide test suspensions. A physicochemical explanation for these findings is presented. C4-labelled DDT was used. (auth.)


A method is described very briefly to meet the need for uniquely labelled DDT; it represents a microscale adaptation of Fry's technique (J. Amer. chem. Soc. 72 (1950) 3238). The overall yield for this procedure was found to be 10%. The isolated product DDT gave a melting point 104-105°C (lit. 103-104°C), with a specific activity of 4 x 10^6 cpm/mm.


2-C4-labelled DDT was synthesized with a specific activity of 1.5 mc/mM, and injected into cockroaches. Among 29 cockroaches, each injected with 3 ml of ethanol containing 50 mc of radioactive DDT, 22 survived after 48 hr in a respiratory chamber at 3-35°C. Various fractions were tested for radioactivity. The findings led the authors to speculate that the water-soluble radioactive principle in this case is probably a conjugated compound composed of a DDT derivative and another, possibly chlophane, fragment. This formation of a conjugate might be related to the detoxification mechanism of DDT to roaches.


The authors undertook the synthesis of DDT labelled with C4 in the benzene ring. Both benzene-1-C4 and aniline-1-C4 are readily available; the preparation of tagged chlophane was by direct chlorination of benzene with iodine, as well as by the Sandmeyer reaction with sulfone. Experimental conditions and results are described. A sample of 1,1,1-trichloro-2,2-14C-heptyl-4'-C4)-ethane from chloro- benzene-1-C4 under the conditions described in the paper had a specific activity of approximately 34 mc/mM.


The amounts of C4-labelled DDT absorbed by mosquito larvae and ppare were determined with a commercial type windowsless gas-flow counter attached to a scale. Fourth-instar larvae of Aedes vexans and A. aegypti absorbed 0.00510 to 0.00571 g of DDT in 74 hr when subjected to aerosol films and from 0.00610 to 0.00614 g when treated with aqueous suspensions of radioactive DDT. The mortality rates ranged from 21-97%. Dead larvae absorbed about two-thirds as much DDT as did living larvae. Larvae tested in aqueous suspensions of DDT absorbed nearly twice as much DDT at 70°C as at 10°C and the mortality was lower at 90°C. Further details are given of the absorption of ppare of these species, and of the reaction to treatment of the resistant Aedes aegypti larvae which absorbed six times as much DDT as non-resistant larvae treated with 0.02 ppm. Biopsy of the extracts of these larvae with second-instar larvae of Aedes and rickettsios fumigated that both resistant and non-resistant larvae had degraded a large amount of the DDT to non-toxic substances, (from such, summary) (The salient features of this article were also briefly reported in Agnew, Chemist, 20, 3 (1960) 70) under "Radio DDT studies".

Four methylene dioxyphenyl compounds, 1, 1 bis (p-chlorophenyl) chloromethane (OCH); 1, 1 bis (p-chlorophenyl) ethyl (DCE); and 1, 1 bis (p-chlorophenyl) ethoxymethyl (DE) were tested for synergistic action when applied topically to adult houseflies of two strains. The (p-chlorophenyl) compounds were all effective in increasing the initial action of DDT. The other chemicals showed no synergism. The fly males did not affect the results. Increasing the proportion of synergist from 1:1 to 1:10 increased the effect. Studies using C14-labelled DDT revealed no increase in DDT penetration due to the synergist. When either DDT or synergist was applied in advance of the other, or when applications were made in different locations on the body, the synergistic effect was the same, but mixtures applied directly to the brain tissue were little more effective than DDT alone. When the synergist was applied to the proboscis, and the DDT to the thorax after the cervical region had been lightly ligated, the effect of the ligature in reducing mortality was still evident, but was not so marked as with DDT alone applied to the thorax.


Stomatos granarius (L.) mortality in wheat treated with DDT was greater when small numbers of weeds were present. C14-labelled DDT was used to determine pickup. Several possible causes of the differences in mortality were investigated.


Knockout tests with non-resistant females showed that the total exposure time needed to affect knockdown also increased as the interval between exposures was lengthened. In a series of tests with radioactive DDT (containing C14), resistant flies exposed intermittently for a total of 7 hr in 8 mg per ft2 had a mortality of 5% whereas resistant flies exposed continuously for the same time had a mortality of 65%, although the radioactivity of the two lots (and therefore the amounts of DDT absorbed by them) did not differ significantly.


The author emphasizes the importance of using the absorption studies with DDT. A 5-day delay in the analysis of flies feeding within 24 hr after treatment increased the amount of DDT absorbed as much as 45%, and a one-day delay 63%. About the same increase was obtained for flies that survived the DDT treatment for five days, indicating that absorption of DDT proceeded at about the same rate in dead as in living flies. Treated flies reared after a lapse of more than a year showed a large increase in the amount of DDT penetrating the integument.


The metabolism of DDT in 30 spp. of insects fall into 3 types: (a) absorbed DDT remained unchanged and could be recovered by solvents; (b) much of the DDT was converted to dichloro- (p-chlorophenyl) ethane (DDE); and (c) the products of metabolism of DDT did not match the Schaeffer-Haller (1937) test (C. Schaeffer et al., CA 49, 2006) and hence were not DDT or its (p-chlorophenyl)acetic acid (DDA). The discovery of DDT from survivors of LD50 doses in 30 spp. was as follows: Toxanthry myrci, DDT 89, DCE 13, and neo-5H 96%; Nymphimella antepilota, DDT 99, DDE 4, and neo-5H 29%; Mallophaga hirsuta, DDT 15, DDE 9, and neo-5H 19%; Musca domestica, DDT 6, DDE 66, and neo-5H 34%; Fulgoridae indentata, DDT 15, DDE 9, and neo-5H 29%; Oriolothrips citriformis, DDT 5, DDE 5, and neo-5H 7%. The large miller midge (Chironomus fasciatus), the resistant housefly (Musca domestica), and the cockroach (Periplaneta americana) illustrated the 3 types of metabolism. Results of studies of these 3 spp. of insects with DDT tagged with C14 were given. There was a definite sequence in the metabolism of the 3 insect spp. The paper chromatogram strips were scanned by a gas-flow scanner of novel design. The C14 on the strips could be measured if the counts were 100/min. or more. The apparatus was described. (CA 36: 25546c, 1950)

Radioactive p,p'-DDT was incorporated into 18 representative soils at a normal rate of application. After storage periods of 1 and 6 months the soils were extracted with acetone and the amount of radioactivity recovered from each soil was measured. Identification of the degradation products of DDT was made on soil extracts by means of paper partition chromatography. The following conclusions were reached: (1) Decomposition of p,p'-DDT is generally greater in soils with a pH higher than 7.5; (2) the principal degradation product of p,p'-DDT found in 18 of the 21 soils was p,p'-DDE; (3) the chloropicrin derivative, p,p'-DDA, is not persistent in any of the soils studied in this work. (Lith. summary)

(some text is not legible)

4 Josen et al., 1987 - [728]


(brief note) DDT has been labelled in various ways, particularly by means of C-14. The author briefly discusses a technique for 2,2-bis-(p-chlorophenyl)-1,1,1-trichloroethane, the 14C analogue of DDT.

A detailed description is given in Document 3488, American Documentation Institute, 1715 N Street, N.W., Washington 6, D.C.


Experimental techniques are described, and the results tabulated and discussed. When DDT is topically applied to adult houseflies, the locus of application influences the rate of penetration, distribution, and accumulation at the site of action. The DDT is distributed by way of the haemolymph, but not accumulated in it. Other tissues and organs, particularly the imagines, absorb the DDT or its metabolites from the haemolymph. The site at which DDT crosses the haemolymph and is dispersed to the various parts of the body is directly related to the area of contact. Distribution from the point of application continues at a reduced rate in dead flies. The site of action appears to be some organ or part in or produced within the head of the adult fly. Muscular lethal doses calculated from the topical application of DDT and estimates of the difference in susceptibility between fly strains are both influenced by the locus of application. The more it is to the site of action (in the case of the housefly the inside of the head), the lower the observed median lethal dose and the less the observed differential in strain susceptibility. The greater susceptibility of individuals treated near or on the site of toxic action offers a method of increasing the sensitivity of bioassay methods.

(From RAE-B 45; 192, 1955)

475 Leclerc, E. L., Morrison, F. O. DOSE OF DDT NEEDED TO KILL A HOUSE FLY. J. econ. Ent. 46, 6 (1953) 1109-10.

DDT was applied to the thorax-epinotal joint of the metarthoracic leg or to the labelia of larvae of the housefly, Musca domestica L., by Fisher's method at 2 µg per fly. Accumulations of the treated leg after 20 minutes were found to be less than 0.1% of the applied dose. Therefore, the percentages of the total radioactivity in these treated appendages were 91 in legs and 90 or 92 in labelia after 20 minutes, and 88 in legs after 3 hours. Thus, absorption and distribution of 14C-DE of the applied dose produced the lethal effect, and the site of application did not influence the rate of absorption but did influence effectiveness.

(From RAE-B 45; 192, 1954)


The increased use of chlorinated hydrocarbon insecticides in soil has raised the question of whether or not these insecticides might translocate into the aerial parts of plants from the soil in spite of their extremely low solubility in water. This was tested by roasting to very high concentrations of insecticide and using a soil of minimum solubility and complexity. Plants were grown in insecticide-free sand within a glass container surrounded by insecticide-treated sand. Lindane, Aldrin, Dieldrin, and heptachlor as well as C14-labelled p,p'-DDT was used. Because a relatively small amount of DDT was available only one aluminum foil-covered pet-constituting DDT-treated quartz sand (30 gpm) was planted with peas. Per plants grown in sand treated with C14-labelled DDT did not show any translocation of this insecticide. On the basis of extraction of plant material and radioassay, only 0.01 ppm of C14 derived from DDT was found.

117
The absorption, metabolism, and excretion of C¹⁴-labelled DDT in adult females of the Madeira cockroach (Lecanophasa maderae (F.)) and fifth-instar larvae of the European corn borer (Pyrausta nubilalis (Hb.)) were studied. The cockroach absorbed DDT rather slowly (about 90% in 20 days) and excreted 50% of the total applied radioactivity over a period of 90 days. Separation of the radioactive compounds excreted in feces by DDT-treated cockroaches was accomplished by paper chromatography. The presence of DDT, DDE (2,2-bis (p-chlorophenyl)-1,1-dichloroethane) and some unidentified metabolites was demonstrated. DDT was the predominant radioactive compound excreted in the first 24 hours after treatment, after which a metabolite with an Rf value of about 0.86 was the major radioactive compound excreted. Metabolic pathways for the DDT in the cockroach are proposed. Fifth-instar larvae of P. nubilalis, have some tolerance of DDT and convert significant amounts of absorbed DDT to DDE. No evidence of DDT metabolism other than DDE was found. Both chromatographic and radioactive analyses were used in the study of P. nubilalis. (from author, summary)

The distribution of C¹⁴-labelled DDT in various internal organs and external parts of resistant houseflies, Musca domestica L., was studied. Flies topically treated with 0 to 11.25 mg of DDT each showed from 30-94% of the total absorbed in the internal organs and the remainder distributed throughout the cuticle. Flies exposed to a residual deposit of the DDT showed a similar distribution of the toxicant, but only 4 to 24% of the dose was excreted. The prevention of ingestion of the DDT by removal of the proboscis did not appreciably alter the percentage recovery in the different parts. In another series of tests it was found that 13% of the total DDT absorbed was present in the body fluids. The intestinal tract, thoracic ganglia, reproductive system, and thoracic muscles of all flies examined showed some radioactivity. (from author, summary)

Penetration of an insecticide through the cuticle of resistant Musca domestica was studied by applying 15 mg of C¹⁴-labelled DDT. After 24 hr, both the dead and surviving flies were washed in acetone to remove external DDT, and then macerated and the DDT or metabolites extracted with acetone. The quantities of DDT recovered in the wash and extract were determined by radioactivity measurements and calculating the equivalent weights and percentages. From these results the survival rates of the treated insects was calculated and the percentages of dead and surviving DDT were recovered, respectively, from surviving and dead flies. Approx. 1/10 less DDT or metabolites were recovered from the flies exposed to a residue. Emissions of the fly extracts with mosquito showed that 80% of the total DDT absorbed by topically treated surviving flies was non-toxic and therefore metabolized. The 20% that was toxic was probably DDT, since neither of the metabolite products, 2,2-bis (p-chlorophenyl) acetic acid or 2,2-bis (p-chlorophenyl)-1,1-dichloroethane, killed mosquito larvae.

Synthesis of carbon¹⁴-labelled DOT. (from author, summary)

The method described a method for synthesizing carbon¹⁴-labelled DDT, 2,2-bis (p-chlorophenyl)-1,1-dichloroethylene. The reaction was carried out in a mixture of NaOH and H₂O₂ at 85°C. The labelled product was isolated and purified by paper chromatography. The product was then used to study the metabolism of DDT in insects. (from author, summary)

A rapid method for the measurement of rates of sorption of DDT by mud surfaces was described. The method involved the use of a radioactive tracer and the determination of the amount of DDT sorbed to the mud surfaces. The results were then used to study the fate of DDT in the environment. (from author, summary)