

sip

newsletter

society for invertebrate pathology

Volume VII, Number 3
June 1975SIP VIIITH AND IXTH ANNUAL MEETINGSVIIITH ANNUAL SIP MEETING
CORVALLIS, OREGON; AUGUST 16-22, 1975

POSTER SESSION

Surprisingly, interest in the poster session format for presentation of research reports has been very limited. Only six authors requested that their presentations be scheduled in the poster session, or expressed no preference for the poster session or in the conventional session. Thus, reluctantly, the Program Committee decided to eliminate the poster session at the Corvallis meeting. However, the Committee believes that the poster session format has great merit (see SIP Newsletter, Vol. VII:2, March 1975) and that the Society should promote it again at future meetings. This year, all papers have been scheduled in conventional sessions (lecture presentations).

"STAND-BY" PRESENTATIONS

As it has happened in the past, some authors may be unable to attend the Annual Meeting and to present their papers. Thus, a few 20-minute slots may become available on very short notice. The Program Committee intends to assign these slots to SIP members who may wish to present reports on a "stand-by" basis. Members who could use a vacated time slot for a 15-minute presentation (followed by 5 minutes discussion) must notify Dr. Mauro Martignoni or Dr. Mike Mix on Monday morning, August 18. Since the exact number of vacated time slots (if any) will be known only as the meeting opens, please do not apply before August 18, 1975. Authors who are unable to attend the meeting and to present their papers as listed in the program are urged to notify Dr. Mix or Dr. Martignoni as soon as possible.

SERENDIPITY TIME

All members are reminded again that Wednesday afternoon has been reserved for informal meetings, specialized working groups, impromptu discussions, visits with colleagues on and off campus, etc. Wednesday afternoon will be a serendipitous occasion, it will be time for finding valuable things relating to each and everyone's areas of endeavour. Those members who wish to reserve rooms for group meetings may contact Dr. Chris Bayne.

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INTERNATIONAL COLLOQUIUM ON INVERTEBRATE PATHOLOGY

IXTH ANNUAL SIP MEETING

KINGSTON, ONTARIO, CANADA, AUGUST 29 - SEPTEMBER 3, 1976

CALL FOR PROGRAMMING SUGGESTIONS

The joint international and society meeting will be held at Queen's University, Kingston, Ontario, Canada, August 29-September 3, 1976. The meeting will follow the International Congress of Entomology being held in Washington, D.C. Kingston is situated midway between Montreal and Toronto at the eastern end of Lake Ontario and at the source of the St. Lawrence River. University residence accommodation will be available at Queen's University.

The programme committee solicits your suggestions for principal topics for symposia sessions, together with names of possible speakers. Current thinking is to run one or two symposia concurrently in morning sessions and to have short papers and poster sessions presented during the afternoons. Please send your ideas to either:

Dr. T. A. Angus
Insect Pathology Research
Institute, P.O. Box 490
Sault Ste. Marie, Ontario
CANADA P6A 5M7

or Dr. Peter Faulkner
Department of Microbiology
Queen's University
Kingston, Ontario
CANADA K7L 3N6



Dr. Manfred Cziesla (NSF, Tokyo), Mrs. Cziesla, Mrs. Karl Maramorosch, and Dr. D. Heyneman at a reception given by the Japanese hosts of the US-Japan Seminar on Invertebrate Tissue Culture. (See story on page 3.)

INSTRUCTION

INVERTEBRATE PATHOLOGY

Included in this issue of the Newsletter is a Directory of Courses of Instruction in Invertebrate Pathology. It is hoped that additional responses to the questionnaire circulated by Dr. Marshbarger in the last issue will be returned and that this Directory can be updated on an annual or biennial basis. Questionnaires will be distributed periodically

POST SUMMER SCHOOL COURSES IN CONJUNCTION WITH THE AIBS ANNUAL MEETING, 17-22 AUGUST

By special arrangement with AIBS, the following four courses will be given during the period 17 August through 23 August 1975, and may be taken by AIBS registrants for 1-2 credit hours from the Oregon State University or for audit:

Bot 507--Seminar. Flora and Plant Communities of Western Oregon, Prof. K. L. Chambers, Oregon State University

Ent. 516--Selected Topics in Entomology. Unique Features of the Pacific Northwest Insect Fauna, Prof. J. D. Lattin, Oregon State University

Mb. 562--Selected Topics in Microbiology. Infectious Diseases of Fishes of the Pacific Coast, Profs. J. L. Fryer and R. E. Olson, Oregon State University

Zo. 507--Seminar. Topics in Northwestern Ecology, Prof. R. M. Storm and Zoology faculty, Oregon State University

Enrollment will be at the following fees:
One hour credit or audit -- \$30.00
Two hour credit -- \$54.00

Registration and fees should be mailed to:
Dr. Richard Dodge
AIBS Education Division
1401 Wilson Boulevard
Arlington, Virginia 22209 USA

Additional details are available in the AIBS Education Review, 4:1, March 1975 or from Dr. Dodge.

INSECT TISSUE CULTURE

As part of its 1975 Continuing Education Program, the W. Alton Jones Cell Science Center will present a course entitled "Invertebrate Cell and Organ Culture" (July 28 - August 1, 1975). This program is designed to introduce participants to basic techniques and applications of invertebrate cell and organ culture. Major emphasis will be focused on laboratory sessions designed to provide experience in establishing cell and organ cultures from various invertebrates, including silkworm, mosquito, cockroach, and marine animals. Technical application of primary as well as established cell lines to study of invertebrate physiology, virology, genetics and developmental biology will be discussed. In addition, the laboratory exercises will include procedures for phase microscopy, immunofluorescence microscopy, autoradiography, electron microscopy, and karyotype analysis. For further information write:

Miss Marion Thomas
W. Alton Jones Cell Science Center
P.O. Box 631
Lake Placid, New York 12946 USA
Phone: 518/523-2427

INFORMATION SERVICE

The Centre National de la Recherche Scientifique Centre de Documentation, 26, Rue Boyer, 75971 Paris, which, for many years, has provided abstracts of journals on a series of biological and non-biological subjects, is beginning a new service, "The Selective Diffusion of Information" which consists of the computer selection of references relating to a specific subject called "profile." These are published ten times a year, and consist of a variable number of cards, each describing a document with every pertinent biographical element, the key words, and most of the time, an abstract. Reproductions of the original documents described on the card can be made by request.

Standard Profiles, some meeting your requirements already exist; e.g., Invertebrate Pathology is covered in Section 340, MICROBIOLOGY, VIROLOGY, IMMUNOLOGY:

- A. MICROBIOLOGY
 - 07 Arthropodes vecteurs en general
 - 09 Microorganismes pathogenes des Invertebres, Aore propre aux Invertebres
- B. VIROLOGIE
 - 02 Virus de l'homme et des animaux et pathologie correspondante and Section 360 BIOLOGIE ANIMALE, PHYSIOLOGIE ET PATHOLOGIE DES PROTOZOAIRES ET DES INVERTEBRES ECOLOGIE
 - 03 Pathologie des Invertebres
 - a) Generalities
 - b) Pathologie infectieuse
 - c) Parasitisme
 - d) Action des toxiques des rayonnements (see also Section 320 BIOCHIMIE, BIOPHYSIQUE AND Section 330 SCIENCES, PHARMACOLOGIQUES, TOXICOLOGIE)
 - d) Divers

Yearly subscription rates for standard profiles are approximately 200 francs.

Personalized Profiles exactly suitable to your needs will be set up with you on any subject. The first three editions of this personalized profile are sent at no charge so you can evaluate their value to your research work. At the end of the trial period, you will be offered a subscription which will become effective if you are satisfied with the results. Yearly subscription rates for Personalized Profiles are approximately 350 francs.

Jean R. Adams
Research Entomologist
Insect Pathology Laboratory
USDA, ARS
Beltsville, Maryland, 20705 USA

DON'T FORGET YOUR DUES

ANNOUNCEMENTS

Back issues of the SIP Newsletter are available by writing to the Newsletter Editor, Department of Entomology, 1735 Neil Avenue, Columbus, Ohio, 43210.

Copies of the Proceedings of the IV International Colloquium on Insect Pathology, 25-28 August 1970 may be obtained from Dr. A.M. Heimpel for \$10.00. Insect Pathology Research Laboratory, Plant Industry Station, USDA, Beltsville, Maryland, 20705, USA.

MEETINGS

U.S.-Japan Seminar on Invertebrate Tissue Culture Applications in Fundamental Research Tokyo, December 9-13, 1974

The application of invertebrate tissue culture systems to fundamental research studies was the topic discussed at a U.S.-Japan Seminar, sponsored jointly by the National Science Foundation and the Japan Society for the Promotion of Science, held in Tokyo December 9-13, 1974. A total of 10 Americans and 10 Japanese participants as well as 12 observers took part in the proceedings: The U.S. scientists and observers were: Marion A. Brooks (University of Minnesota), Sonja M. Buckley (Yale University), James W. Frstrom (University of California, Berkeley), Donald Heyneman (University of California, San Francisco), Edwin P. Marks (USDA, Fargo, North Dakota), A. H. McIntosh (Rutgers University), John D. Paschke (Purdue University), Imogene Schneider (Walter Reed Army Hospital), James L. Vaughn (USDA, Beltsville), R. Hirumi (Boyce Thompson Institute), and T. J. Kurtti (University of Minnesota). Karl Maramorosch (Rutgers University) and Soichi Fukuda (Biological Laboratory, Aichi Medical University) were the organizers for the program and conduct of the seminar.

The diverse program included topics concerned with entomology, endocrinology, genetics, plant pathology and virology. Adequate time was provided by the organizers to discuss each topic after its presentation, a definite asset for those in attendance. Informal discussions continued after the formal sessions were completed.

Unprecedented in seminars of this type in Japan was the presence of 3 American and 2 Japanese women scientists.

The organizers of the Seminar are to be congratulated, as both Japanese and U.S. scientists were unanimous in their post-conference evaluation of the Seminar as one of the best they ever attended.

American scientists visited the Mitsubishi-Kasel Institute of Life Sciences in Tokyo and also spent 2 days sightseeing in Kyoto and vicinity as part of their post-conference activities.

John D. Paschke



Dr. H. Chino, Dr. K. Atsawa, Dr. N. Agui and Dr. Marion Brooks (presenting a paper at the US-Japan Seminar).

AUSTRALIAN APPLIED ENTOMOLOGICAL RESEARCH CONF Mildura, Victoria, April, 1975

Professor Ray F. Smith and Dr. Dudley Pinnock, both of the University of California, Berkeley, and about 100 local delegates attended the Australian Applied Entomological Research Conference at Mildura, Victoria, in April 1975. The theme was "Integrated Control," and Professor Smith reassured the conference with his address entitled "Integrated Control is Alive and Well."

Dr. Richard Milner of the C.S.I.R.O., Armidale, N.S.W., reviewed the subject of "Insect Pathogens." The role of pathogens, particularly viruses in integrated control systems where somewhat lower levels of mortality are tolerable, attracted considerable discussion.

Dr. Milner referred to the problem of the shortage of trained insect pathologists in Australia. Dr. Pinnock will be helping to tackle this problem during his sabbatical leave in Australia by conducting a residential course on insect pathogens at Monash University, Victoria, later this year, and possibly at Queensland University early next year.

*R. E. Teakle
Regional Correspondent*

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SUSTAINING MEMBERS

We are pleased to add to the list of Sustaining Members:
*Nutrilite Products Inc.
5600 Beach Boulevard
Buena Park, California 90620 USA*

PEOPLE

BULLA NAMED TO AGRICULTURE SECRETARY'S YOUNG EXECUTIVES COMMITTEE

Lee A. Bulla, Jr., head of Biological Research at the U.S. Grain Marketing Research Center, Agricultural Research Service, Manhattan, Kansas, was appointed by Secretary of Agriculture Earl R. Butz to serve on the Secretary's Young Executives Committee. The Committee is designed to bring together individuals 35 years of age or under to work on emerging issues of department-wide concern which are generated by the Office of the Secretary, the agencies, and by the Committee itself. In this manner, it will serve to bring additional insights and perspectives to departmental problems and opportunities. The Committee is chaired by Under Secretary J. Phil Campbell and is studying several areas that include agricultural research, foreign research development, and rural development. Dr. Bulla is on the subcommittee analyzing research in the Department of Agriculture.

SCHNEIDERMAN ELECTED TO NATIONAL ACADEMY OF SCIENCES

Dr. Howard A. Schneiderman, Professor of Biology; Chairman, Department of Developmental and Cell Biology; Director, Center for Pathobiology; and Dean, School of Biological Sciences, was one of 84 scientists recently elected to the National Academy of Sciences.

DR. JORGE LEONG, formerly of Tulane University, has accepted the position of Leader, Shrimp Disease Project, Aquaculture Investigation, Galveston National Marine Fisheries Service Laboratory, Galveston, Texas, USA.

PROGRAM
VIIITH ANNUAL SIP MEETING
August 16 - 22, 1975

SATURDAY AFTERNOON, AUGUST 16

2:00 EXECUTIVE COUNCIL MEETING. ARTHUR M. HEIMPEL, presiding. Forestry Sciences Laboratory, Large Conference Room.

SUNDAY AFTERNOON, AUGUST 17

1:00 EXECUTIVE COUNCIL MEETING. ARTHUR M. HEIMPEL, presiding. Forestry Sciences Laboratory, Large Conference Room.

MONDAY MORNING, AUGUST 18

SESSION 1. PLENARY SESSION. ARTHUR M. HEIMPEL and THOMAS A. ANGUS, presiding.

9:00 Presidential Remarks. ARTHUR M. HEIMPEL, USDA, Agricultural Research Service, Beltsville, MD.

9:20 Invitational Lecture, HILDEMAN, W. H. University of Hawaii, Hilo, HI. Some new concepts of immunological phylogeny in invertebrates.

10:20 RECESS.

10:40 ANNUAL BUSINESS MEETING. ARTHUR M. HEIMPEL, presiding.

MONDAY AFTERNOON, AUGUST 18

SESSION 2. Symposium: History of Invertebrate Pathology. PHYLLIS T. JOHNSON, presiding.

2:00 JOHNSON, PHYLLIS T. National Marine Fisheries Service, Oxford, MD. Introductory remarks on the history of invertebrate pathology.

2:10 STEINHAUS, MABRY C. University of California, Irvine, CA. Insect pathology - Some beginnings.

2:30 SPARKS, ALBERT K. National Marine Fisheries Service, Washington, DC. Some observations on the history of invertebrate pathology.

3:00 RECESS.

3:15 HARSHBARGER, JOHN C. Smithsonian Institution, Washington, DC. A chronology of the study of tumors in invertebrates.

3:45 HUGHES, KENNETH M. USDA, Forestry Sciences Laboratory, Corvallis, OR. The Laboratory of Insect Pathology at the University of California - The first decade.

4:15 FEDERICI, BRIAN A. University of California, Riverside, CA. *Baculovirus* structure: Interpretations in perspective.

4:45 DISCUSSION.

TUESDAY MORNING, AUGUST 19

Concurrent Sessions 3, 4

SESSION 3. Protozoan Diseases of Invertebrates. Co-sponsored by the Society of Protozoologists. ANN CALI, presiding.

9:00 HARLAN, D. P. Bioenvironmental Insect Control Laboratory, Stoneville, MS. Some relationships between *Tabanus subaimilis* Bellardi (Diptera: Tabanidae) and a microsporidan pathogen.

9:20 KURTTI, T. J. and M. A. BROOKS, University of Minnesota, St. Paul, MN. Pathogenesis of a microsporidan parasite in cultures of insect cells.

9:40 SANDERS, R. D. and G. O. POINAR, JR. University of California, Berkeley, CA. The fine structure of *Pleistophora* sp. (Cnidospora: Microsporida) in the mosquito, *Aedes sierrensis* (Ludlow).

10:00 SMIRNOFF, W. A. Canadian Forestry Service, Sainte-Foy, QUE. Evaluation of the important role of protozoa on forest Tenthredinidae.

10:20 RECESS.

10:40 GAUGLER, R. R. and W. M. BROOKS. University of Wisconsin, Madison, WI. Sublethal effects of infection by *Nosema heliothidis* in the corn earworm, *Heliothis zea*.

11:00 HALDAR, D. P. and N. CHAKRABORTY, University of Kalyani, India. On the occurrence of cephaline gregarines (*Protozoa: Sporozoa*) in orthopteran insects and their pathogenic effects on the hosts.

11:20 BREED, C. M. Oregon State University, Corvallis, OR. Microsporidiosis in the sand shrimp, *Cragon* spp.

11:40 POUNDS, J. G. and G. M. BOUSH, University of Wisconsin, Madison, WI. Ultrastructural pathology of *Trogoderma glabrum* infected with *Mattesia trogodermae*.

SESSION 4. Viral Diseases of Insects. RICHARD A. DICAPUA and RONALD H. GOODWIN, presiding.

8:40 SMIRNOFF, W. A. Canadian Forestry Service, Sainte-Foy, QUE. A Baculovirus of the European skipper (*Thymelicus lineola* Ochs.) (Lepidoptera: Hesperidae).

9:00 ADAMS, J. R., R. H. GOODWIN, J. L. VAUGHN and I. PISCOPO. USDA, Agriculture Research Service, Beltsville, MD. X-ray microanalysis of insect viruses, insect tissue culture cells and insect larval tissues and *Bacillus thuringiensis*.

9:20 ADAMS, J. R., R. H. GOODWIN and T. A. WILCOX. USDA, Agriculture Research Service, Beltsville, MD. Electron microscopic investigations on invasion and replication of insect viruses *in vivo* and *in vitro*.

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PROGRAM
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- 9:40 HESS, R. T. and L. A. FALCON. University of California, Berkeley, CA. Comparative electron microscope observations of two nuclear polyhedrosis viruses in *Spodoptera exigua*.
- 10:00 TANADA, Y., S. HARA, E. M. OMI and R. T. HESS. University of California, Berkeley, CA, and Osaka University, Toyonaka, Japan. An enzyme synergistic for insect viruses.
- 10:20 RECESS.
- 10:40 DICAPUA, R. A., P. W. NORTON and W. J. MCCARTHY. University of Connecticut Storrs, CT, and Pennsylvania State University, University Park, PA. Comparison of tissue culture and host derived *Porthetria (Lymantria) dispar* nuclear polyhedrosis virus proteins.
- 11:00 NORTON, P. W. and R. A. DICAPUA. University of Connecticut, Storrs, CT. Group specific antigenicity of nuclear polyhedrosis virus proteins.
- 11:20 ZERILLO, R. T. and J. D. PODGWAITE. USDA, Northeastern Forest Experiment Station, Hamden, CT. Free amino acids in the hemolymph of healthy and NPV-infected larvae of *Lymantria dispar* L.
- 11:40 CIBULSKY, R. J. and J. D. HARPER. Auburn University Agricultural Experiment Station, Auburn, AL. Biochemical comparisons of the polyhedral proteins of six nuclear polyhedrosis viruses.
- TUESDAY AFTERNOON, AUGUST 19
Concurrent Sessions 5, 6, 7
- SESSION 5. Symposium: *Nosema*: Some Aspects of Study. Organized by WAYNE M. BROOKS under the auspices of the Division on Microsporidia of the SIP. ARTHUR M. HEIMPEL, presiding.
- 1:30 Introduction. HEIMPEL, A. M. and W. M. BROOKS, USDA, ARS, Beltsville, MD, and North Carolina State University, Raleigh, NC.
- 1:35 SPRAGUE, V. Chesapeake Biological Laboratory, Solomons, MD. *Nosema*, a heterogeneous genus of Microsporidia.
- 2:10 ANTHONY, D. W. and E. I. HAZARD. USDA, ARS, Insects Affecting Man Research Laboratory, Gainesville, FL. Comparative ultrastructure of some *Nosema* species.
- 2:35 UNDEEN, A. W. University of Illinois, Urbana IL. Spore-hatching processes of some *Nosema* species.
- 3:00 RECESS.
- 3:25 BROOKS, W. M. and J. D. CRANFORD. North Carolina State University, Raleigh, NC. Host-parasite relationships of *Nosema heliothidis*.
- 3:50 MADDOX, J. V. and R. K. SPRENKEL, Illinois Natural History Survey and Illinois Ag. Expt. Station, Urbana, IL. Some enigmatic Microsporidia of the genus *Nosema*.
- 4:15 HENRY, J. E. USDA, ARS Grasshopper Laboratory, Bozeman MT. Microbial control of grasshoppers with *Nosema locustae*.
- 4:40 DISCUSSION.
- SESSION 6. Bacterial Diseases of Insects. THOMAS A. ANGUS, presiding.
- 1:40 Invited Paper. DULMAGE, HOWARD T. USDA, Agricultural Research Service, Brownsville, TX. The *Bacillus thuringiensis*- δ -endotoxin - A review of recent developments and of prospects of producing improved formulations of this microbial insecticide.
- 2:40 MAKSYMUK, B. USDA, Forestry Sciences Laboratory, Corvallis, OR. Nutrition-inhibition hypothesis of pathogenicity: antibacterial substances in trees affecting *Bacillus thuringiensis*.
- 3:00 RECESS.
- 3:20 LEWIS, L. C., R. E. LYNCH and C. C. BEEGLE. USDA, Agricultural Research Service, Ankeny, IA, and Iowa State University, Ames, IA. Determination of *Bacillus thuringiensis* international unit ratios between *Trichoplusia ni* and *Ostrinia nubilalis*.
- 3:40 DAVIDSON, E. W., H. MORTON and S. SINGER. Arizona State University, Tempe, AZ, USDA, Bee Laboratory, Tucson, AZ, and Western Illinois University Macomb, IL. The effect of *Bacillus sphaericus* on the honey bee.
- 4:00 EBERSOLD, R.-R. and P. LÜTHY. Swiss Federal Institute of Technology, Zurich, Switzerland. Morphological studies on the development of spores of *Bacillus popilliae* grown in tissue culture.
- 4:20 FAUST, R. M. and R. S. TRAVERS. USDA, Agricultural Research Service, Beltsville, MD. Should *Bacillus popilliae* and *Bacillus lentimorbus* Dutky be placed in the genus *Clostridium*? Recent evidence.
- SESSION 7. Physio-pathology and Histopathology. GILBERT B. PAULEY, presiding.
- 1:20 KUNO, G. and C. G. MOORE. University of Puerto Rico, Mayaguez, PR. Larval growth retardant in axenic cultures of *Aedes aegypti*.
- 1:40 OTIENO, W. A. and G. O. POINAR, JR. University of California, Berkeley, CA. Parasitic development of the nematode, *Reesimermis nielsenii*, in larvae of *Culex pipiens*.
- 2:00 POINAR, G. O. JR. and O. TRIGGIANI. University of California, Berkeley, CA. Life history of *Prosodentus aphodii* (Nematoda), a facultative parasite of *Aphodius fimetarius* (Coleoptera).
- 2:20 SHIELDS, K. and J. D. PODGWAITE. USDA, Northeastern Forest Experiment Station, Hamden, CT. Histopathological effects of the development of *Elypharipa scutellata* (R.-D.) in the gypsy moth, *Lymantria dispar* (L.)
- 2:40 YEVICH, P. P. EPA, Narragansett, RI. Comparative histopathology of cadmium poisoning in invertebrates.
- 3:00 RECESS.
- 3:20 BRENNER, L. J., D. G. OSBORNE and B. L. SCHUMAKER. Cleveland State University and Cleveland Clinic Foundation, Cleveland, OH. Electron microscopic comparison of endocytic vacuoles induced in *Tetrahymena pyriformis* by nonimmune fluids and by albumin.

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PROGRAM
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3:40 TESTER, P. A. and J. BAROSS. Oregon State University, Corvallis, OR.
Incidences and etiology of exoskeleton erosion in the spider crab,
Chionoecetes tanneri Rathbun (Brachyura: Majidae).

4:00 CHENEY, D. P. University of Hawaii, Hilo, HA. Tumors on corals:
an evaluation of atypical growths from the scleractinian coral, *Acropora*
formosa.

TUESDAY EVENING, AUGUST 19

6:00 SALMON BARBECUE. Avery Park

WEDNESDAY MORNING, AUGUST 20

Concurrent Sessions 8, 9, 10

SESSION 8. Division on Microsporidia, Annual Business Meeting.

9:00 JOHN E. HENRY, presiding.

SESSION 9. Diseases of Molluscs and Crustaceans. ALBERT K. SPARKS, presiding.

9:00 JOHNSON, P. T. National Marine Fisheries Service, Oxford, MD. A
possible viral disease of the blue crab, *Callinectes sapidus*.

9:20 FARLEY, C. A. National Marine Fisheries Service, Oxford, MD. Electron
microscopy of virus infections in oysters (*Crassostrea virginica*).

9:40 OTTO, S. V., J. C. HARSHBARGER and S. C. CHANG. NMFS, Oxford, MD, and
Registry of Tumors in Lower Animals, Washington DC. *Chlamydia* infections
in clams. I. Incidence, distribution and histopathology.

10:00 HARSHBARGER, J. C., S. C. CHANG and S. V. OTTO. Registry of Tumors
in Lower Animals, Washington DC, and NMFS, Oxford, MD. *Chlamydia* infections
in clams. II. Ultrastructure of the *Chlamydia* and an infecting virus.

10:20 RECESS.

10:40 MACKIN, J. G. Texas A & M University, College Station, TX. The
nature of "neoplasms" in oysters.

11:00 ARMSTRONG, D. A. and D. V. BUCHANAN. University of California, Davis, CA,
and Oregon Game Commission, Corvallis, OR. A fungal disease in laboratory
reared larvae of the Dungeness crab, *Cancer magister*, and possible chemical
treatment.

11:20 UNESTAM, T. and I. NYHLEN. University of Uppsala, Sweden. The
outermost tenth of a micron of the crayfish cuticle. Its importance to
fungal attack.

11:40 POINAR, G. O. JR. and G. M. THOMAS. University of California,
Berkeley, CA. The incidence of *Anacardis* spp. (Nematoda, Spiruridea)
infecting marine invertebrates.

SESSION 10. Fungal Diseases of Arthropods. MARSHALL LAIRD, presiding.

9:00 HUMBER, R. A. University of Washington, Seattle, WA. The *in vitro*
culture and development of an obligately parasitic fungus of flies.

9:20 BELL, J. V. USDA, Agricultural Research Service, Stoneville, MS.
The effect of outside temperatures on survival of three fungus entomopathogens.

9:40 ROBERTS, D. W., D. N. BOWN and F. J. MURPHEY. Boyce Thompson
Institute for Plant Research, Yonkers, NY; World Health Organization,
Kaduna, Nigeria; and University of Delaware, Newark, DE. Population
reduction of mosquitoes in artificial pools by *Metarrhizium anisopliae*.

10:00 ZEBOLD, S. L., J. A. SHEMANCHUK and H. C. WHISLER. University of
Washington, Seattle, WA, and Research Station, Lethbridge, Alberta, Canada.
Host-specificity in *Coelomomyces psorophorae*.

10:20 RECESS.

10:40 ROBERTS, D. W., M. SHAPIRO and J. M. CASTILLO. Boyce Thompson
Institute for Plant Research, Yonkers, NY. Growth of *Coelomomyces in vitro*.

11:00 Informal Workshop on Arthropod Mycoses. DONALD W. ROBERTS, moderator.

WEDNESDAY AFTERNOON, AUGUST 20

1:30 INFORMAL MEETINGS.

THURSDAY MORNING, AUGUST 21

Concurrent Sessions 11, 12

SESSION 11. Symposium: Invertebrate Immunology. Arranged by the American Society
of Zoologists, Division of Invertebrate Zoology and co-sponsored by the Society
for Invertebrate Pathology. Organized by JOSEPH L. SIMON, University of South
Florida. EDWIN L. COOPER, presiding.

8:30 Introduction. COOPER, E. L., University of California, School of Medicine,
Los Angeles, CA.

8:35 CHUNG, T. C. Institute for Pathobiology, Lehigh University,
Bethlehem, PA. Biochemical and ultrastructural evidence for the double role
of phagocytosis in molluscs: defense and nutrition.

9:05 FENG, S. Y., J. S. FENG and T. YAMASU. Marine Research Laboratory,
University of Connecticut, Noank, CT. Roles of *Mytilus aeneus* and
Crassostrea gigas blood cells in defense and nutrition.

9:30 COWDEN, R. R. and S. K. CURTIS. East Tennessee State University,
College of Medicine, Johnson City, TN. Some cytological observations on the
behavior of octopus white body cells.

10:00 RECESS.

10:30 POINAR, G. O. JR. University of California, Berkeley, CA. Immune
responses of annelids and crabs to nematode parasites.

11:00 SCHAPIRO, H. C. San Diego State University, San Diego, CA.
Hemocytes and phagocytosis in the American lobster, *Homarus americanus*.

11:30 STEWART, J. E., J. W. CORNICK, B. ARIE, B. M. ZWICKER and W. D.
PATERSON. Fisheries & Marine Service, Environment Canada, Halifax, Nova
Scotia, Canada. Caffeemia and defense mechanisms in the lobster,
Homarus americanus.

SESSION 12. Epizootiology and Microbial Control. JAMES D. HARPER, presiding.

8:20 GOLDBERG, L. J., I. FORD, A. M. TANABE and H. M. S. WATKINS. Naval
Biological Laboratory, Oakland, CA. Effectiveness of *Bacillus sphaericus* as
a potential mosquito larval control agent: The role of variations in natural
microbial flora in the larval environment.

8:40 PODCWAITE, J. D. and R. C. REARDON. Northeastern Forest Experiment
Station, Hamden, CT. Virus - parasitoid relationships in *Lymantria dispar* L.
populations.

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PROGRAM
Continued from page 6

- 9:00 MCGAUGHEY, W. H. and R. A. KINSINGER. USDA, Agricultural Research Service, Manhattan, KS. Studies with *Bacillus thuringiensis* for preventing moth infestations in stored grain.
- 9:20 HARPER, J. D. and L. ABRAHAMSON. Auburn University, Auburn, AL, and USDA, Forest Service, Atlanta, GA. Factors affecting control of forest tent caterpillars with commercial *Bacillus thuringiensis* preparations.
- 9:40 RECESS.
- 10:00 SORENSEN, A. and L. A. FALCON. University of California, Berkeley, CA. Artificial manipulation of insect pathogens in the field: A prognosis.
- 10:40 Informal Workshop on Microbial Control. C. G. THOMPSON, moderator.

THURSDAY AFTERNOON, AUGUST 21

Concurrent Sessions 13, 14

SESSION 13. Symposium: Invertebrate Immunology. Arranged by the American Society of Zoologists, Division of Invertebrate Zoology and co-sponsored by the Society for Invertebrate Pathology. Organized by JOSEPH L. SIMON, University of South Florida. EDWIN L. COOPER, presiding.

- 1:30 CHADWICK, J. S. Queens University, Kingston, Ontario, Canada. Induction and effector mechanisms of insect immunity.
- 1:50 VINSON, S. B. Texas A & M University, College Station, TX. Differences between insect host responses against parasitoids with emphasis on the parasitoid *Cardiochiles nigriceps*.
- 2:20 NAPPI, A. J. State University of New York, Oswego, NY. Comparative ultrastructural studies of hemocyte transformations during cellular immune reactions and tumorigenesis in *Drosophila*.
- 2:40 RECESS.
- 3:10 ANDERSON, R. S. Donald S. Walker Laboratory, Sloan-Kettering Institute for Cancer Research, Rye, NY. Biochemistry and physiology of invertebrate macrophages *in vitro*.
- 3:30 BAYNE, C. J. Oregon State University, Corvallis, OR. Aspects of internal defense in tunicates.
- 4:00 PAULEY, C. B. Washington Cooperative Fisheries Unit, University of Washington, Seattle, WA. A comparison of immune mechanisms of molluscs and crustaceans with those of fishes.
- 4:30 Summary and Conclusions. E. L. COOPER.

SESSION 14. Working Group on the Safety of Microbial Control Agents. MARSHALL LAIRD, presiding.

- 1:30 Invited Paper. RICKARD, SAMUEL F. The Upjohn Company, Kalamazoo, MI. Microbial pest control agents - Can fungi make it?
- 2:00 Invited Paper. ENGLER, RETO. Environmental Protection Agency, Washington, DC. The safety of microbial pest control agents: Beyond the baculoviruses.
- 2:30 DISCUSSION.

FRIDAY MORNING, AUGUST 22

SESSION 15. Contributed Papers in Invertebrate Immunology. THOMAS C. CHENG, presiding.

- 9:00 FARRENS, B., M. BROWNE and T. SPENCER. University of San Diego, San Diego, CA. Induced protozoan immunity in *Tenebrio molitor* with special reference to *Tetrahymena pyriformis*.
- 9:20 SMITH, A. C. Hawaii BioMarine, Honolulu, HA. Search among marine invertebrates for eosinophils useful in medical research.
- 9:40 CHENG, T. C. Institute for Pathobiology, Lehigh University, Bethlehem, PA. Energy requirements of phagocytosis in molluscs.
- 10:00 LIE, K. J. and D. HEYNEMAN. G. W. Hooper Foundation, University of California, San Francisco, CA. Acquired specific resistance to trematode infections in *Biomphalaria glabrata*.
- 10:20 RECESS.
- 10:40 RICHARDS, C. S. Laboratory of Parasitic Diseases, National Institutes of Health, Bethesda, MD. Factors affecting hemopoietic activity in *Biomphalaria glabrata*.
- 11:00 PATERSON, W. D. and J. E. STEWART. Halifax Laboratory, Fisheries & Marine Service, Environment Canada, Halifax, Nova Scotia, Canada. Vaccine induced enhancement of the phagocytic capacity of the lobster (*Homarus americanus*).
- 11:20 NAPPI, A. J. State University of New York, Oswego, NY. Suppression of melanotic tumor formation in *Drosophila* by the wasp parasite *Pseudaecolia bocheri*.
- 11:40 HOOVER, K., F. HOSAIN and F. B. BANG. Johns Hopkins University, Baltimore, MD. Measurement of phagocytic function in shore crabs (*Carcinus maenas*) with virus infection.

* * * *

ABSTRACTS

CZECHOSLOVAK ACADEMY OF SCIENCES
Insect Pathology Group
Liblice, Czechoslovakia, December 1974

BACTERIAL CHITINASE AND ITS TOXICITY FOR INSECTS
O. Lysenko, Insect Pathology, Institute of Entomology, Czechoslovak Academy of Sciences, Prague, Czechoslovakia

The microorganism *Serratia marcescens* forms chitinase (I.C. 3.2.1.14), which is toxic when parenterally administered to larvae of *Calleria mellonella*.

Chitinase was formed in different quantities by the various strains of *S. marcescens* examined. The greatest quantity was formed by *S. marcescens* CCEB 415 in a production medium containing chitin after 25 hrs. incubation on a shaking machine. Chitinase production was dependent logarithmically in the range of 0.1 to 3.0 mg. chitin per 1 ml. medium.

Using different separation methods (precipitation, DEAE cellulose, Sephadex G 75) the enzyme was semi-purified and its biochemical characteristics determined. The pH optimum was 8.5 to 9.0. The molecular weight is 36 000 (Sephadex G 75). The primary difficulty of purification was separating chitinase from protease. The latter has an m.w. of 45 000 and is also toxic.

By parenteral administration of the semi-purified chitinase preparation to 7th instar *Calleria mellonella* larvae, an LD₅₀ of 1.3 to 3.0 units per larvae (1 unit = the amount of the enzyme hydrolyzing 1 µg. chitin per min., pH 7.2, 37°) was determined.

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ABSTRACTS
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TOXICITY OF EIGHT BACTERIAL PREPARATIONS OF *B. THURINGIENSIS* FOR REGIONAL PLANT PESTS

J. Vankova, *Institute of Entomology, Czechoslovak Academy of Science, Prague, Czechoslovakia*

Eight available preparations containing *B. thuringiensis* (Bathurin--CSSR; Bitoskibacillin, Dendrobacillin, Eksotoksin, Entobakterin, Insektin, and Toxobakterin--USSR; and Dipel--USA) were tested for comparative toxicity on major regional pests (*Mamestra brassicae*, *Lymantria dispar*, *Euproctis chrysorrhoea*, and *Galleria mellonella*). Bathurin, Entobakterin, and Dipel gave the most balanced activity. Other preparations were more toxic for one pest, but less for another. The Bathurin preparation was most toxic after 15 yrs. storage. Results were calculated after application of the preparations in 1% spray and evaluation after 7 and 14 days.

For larvae of the housefly the most efficient preparations were those with a high exotoxin content (Eksotoksin, Toxobakterin, Bitoksibacillin). Bathurin, which does not produce the thermostable exotoxin, had an 80% mortality.

Soviet workers report that strains of *B. thuringiensis* have optimum activity in areas to which they are climatically adapted (the toxicity of the endotoxin is increased under local temperatures). This optimum adaptation must be considered in programs of application of bacterial strains for pest control.

THE DEGRADATION OF THE CUTICLE PROTEINS OF *GALLERIA MELLONELLA* LARVAE BY TOXIC PROTEOLYTIC ENZYMES OF THE FUNGUS *BEAUVERIA BASSIANA*

A. Samsinakova, *Institute of Entomology, Czechoslovak Academy of Science, Prague, Czechoslovakia*

Cultivation media of the entomophilous fungus *Beauveria bassiana* contain two proteolytic enzymes with pH optima of 5 and 8 which are associated with the toxic activity of the fungus. The activity of both enzymes was tested qualitatively on purified cuticles of *Galleria mellonella* by staining the cuticle components, and quantitatively, by using the Kjeldahl test and determination of amino-nitrogen after exposure of the cuticle to separate concentrated enzymes.

Both proteolytic enzymes attack and degrade the proteinic components of the cuticle of *Galleria mellonella*. The speed of decomposition by both isolates differs during the first days, but their final effect after 8 days is identical.

ARTIFICIAL INFECTIONS OF THE SCALE *COCCUS HESPERIDUM* WITH THE FUNGI *VERTICILLIUM LECANI* AND *ASPERGILLUS CANDIDUS*

A. Samsinakova and S. Kalalova, *Institute of Entomology, Czechoslovak Academy of Science, Prague, Czechoslovakia*

The strain of *Verticillium lecanii* used in the experiments was isolated from infected *Lecanium corni*. Hyphae resulting from four days of submerge fermentation were used for inoculation of a solid granulated carbohydrate medium. After 3 - 4 weeks at 27°C, the well-sporulated mass was ground in a ball grinding mill. The remains of the nutrient medium did not exceed 10% of the final dust.

The conidial dust produced was applied as a concentrate or in 10% dilution in talcum. Greenhouse citrus trees, heavily infested with adult and larval *Coccus hesperidum*, were dusted with both concentrations of *Verticillium lecanii* which caused 85 to 100% mortality of the scales within 3 - 4 weeks.

Aspergillus candidus cultivated under the same conditions applied with the same technique in parallel dustings caused mortality in the same high range.

INCREASE OF PATHOGENICITY OF *CONIDILOBOLUS CORONATUS* FOR THE TERMITES *COPTOTERMES FORMOSANUS* AND *RETICULITERMES LUCIFUGUS*

R. Krejzova, *Institute of Entomology, Czechoslovak Academy of Science, Prague, Czechoslovakia*

An attempt was made to enhance the virulence of a fungus through the method of precultivation on an insect host. A strain of *Conidiobolus coronatus* (Constantin) Srinivasen et Thirumalachar was precultivated on two species of termites, *Coptotermes formosanus* (Shiraki) and *Reticulitermes lucifugus* (Rossi), or on larvae of *Galleria mellonella* L. The pathogenicity of the original strain as well as that of the reisolated cultures was then tested on the two species of termites which were infected by timed exposure of the experimental specimens to conidia discharged by cultures of the fungus on coagulated egg yolk.

The original strain killed 30 - 95% of *C. formosanus* and 10 - 75% of *R. lucifugus*. Of the 15 reisolated cultures tested on *C. formosanus*, only 7 showed higher pathogenicity than the original strain. Six of the latter were precultivated on *C. formosanus*, one on the larvae of *G. mellonella*. Of 10 other reisolates tested on *R. lucifugus*, only 4 were more pathogenic than the original strain. Three of these were isolated from *C. formosanus*, 1 from *G. mellonella*. Reisolates precultivated on *R. lucifugus* did not show enhanced pathogenicity in any of the two termite species investigated.

These results show that the rate of pathogenicity and virulence of the fungal strain may depend on its precultivation in some living organisms. The enhancement of pathogenicity for *C. formosanus* and *R. lucifugus* by precultivation has been achieved in about one half of the reisolates. Nevertheless, there occurred also reisolates whose pathogenicity could not be increased by precultivation on insects.

A LOCAL AND SEASONAL VARIATION IN *COELOMYCIDIUM SIMULII* INFECTIONS OF BLACK FLY LARVAE

J. Weiser, *Institute of Entomology, Czechoslovak Academy of Science, Prague, Czechoslovakia*

The seasonal distribution of 8 pathogens was studied for 4 subsequent seasons in one locality with a year-round persistent population of *Odagmia ornata* and *Dusimulium latipes*.

Coelomycidium simulii (Chytridiales) infections are present year-round, with thalli and sporangia containing motile zoospores. Peak infestation was 5.6% of the present larval population, with a normal infestation of only 0.5 - 1%. Incidence fluctuates slightly from year to year, with 4-year peaks in April, the end of June and the greatest peak in October. Incidence of the infection is low in December through March.

Thick-walled cysts, resting sporangia, of *C. simulii* are not the obligatory stage in the cycle of development of the fungus. They appear at the end of the October peak, but other black fly larvae with spherical thick-walled cysts were present in March.

Yearly differences in the infection rate are negligible. Infected larvae died before pupation and there was no infection of adults emerging from pupae collected on plants in the locality studied.

TWO INTERESTING STRUCTURES IN THE MEROZOITES OF THE NEOGREGARINE *FARINOCYSTIS TRIBOLII*, WEISER

Z. Žizka, *Institute of Entomology, Czechoslovak Academy of Science, Prague, Czechoslovakia*

Studies of the ultrastructure of developmental stages of the Neogregarine *Farinocystis tribolii*, Weiser 1953, in infected lobes of the fat body of the flour beetle *Tribolium castaneum* were conducted. The material was fixed with glutaraldehyde and osmic acid after Millonig and Sabatini and embedded in Vestopal W. Contrasting of the sections was accomplished with uranyl acetate and lead citrate after Reynolds.

An undescribed spiral structure in the perinuclear space and transversal membranal septum of free merozoites was observed. The osmiophilic spiral structure is 400 nm long and 30 nm broad, and appears with contrast after lead impregnation. It is between both sheets of the nuclear membrane which forms a well-expanded perinuclear space. In some cases what were believed to be developmental stages of the structure were observed, which appear as narrow contrasting lines in the perinuclear space on the apical pole of the nucleus, close to the Golgi apparatus.

The transversal membranal septum is formed across the body of the merozoite in the second third of its length, behind the nucleus. The membrane has two layers, splits at the ends, does not proceed to the surface, and ends free in the cytoplasm.

Both structures are present only in this stage of merozoites and do not reappear in any further stage of the development of the neogregarine. The function, origin, and further development of the structures in the body of this parasite are not known. Analogous structures do not appear in the ultrastructure of other protozoa or metazoa.

CHANGES OF ENZYME MARCKERS DURING MICROSPORIDAN INFECTION

M. Kucera and J. Weiser, *Institute of Entomology, Czechoslovak Academy of Science, Prague, Czechoslovakia*

Increase in enzyme activity as alanine aminotransferase, phosphatase and protease was observed in the gut and fat body of *Barathra brassicae* (Lepidoptera) infected by *Nosema plodiae*.

Lactate dehydrogenase (LDH) and glutamate dehydrogenase (GLDH) activity in larvae infected by *Nosema heterosporum* were studied. The specific activity of LDH and GLDH in normal larvae reached its maximum two days after the last molt. In infected larvae LDH and GLDH show different activity compared not only to controls but also to each other. The LDH activity of the gut rises above that of normal larvae by 166%, the GLDH activity decreases to 45%, but both the dehydrogenases follow the general course of normal animals; i.e., they also show maximum two days after the last molt. A further difference in the course of GLDH activity in the infected fat body is that during the last instar no maximum occurs.

In infected animals activity differences as well as qualitative changes of the enzyme complex are apparent. Thus the ratio of LDH isoenzymes and the thermal inactivation of alanine aminotransferase were changed during the disease. Further study showed that the Michaelis constant of acid phosphatase purified by chromatography and by electrofocusing appeared to change. In control animals the $K_m = 9.2 \times 10^{-4}$, in diseased animals the K_m decreases almost to half. The K_m of other enzymes is under investigation.

NEOPLECTANA JANICKII IN AN OUTBREAK OF THE SAWFLY *CEPHALEIA ABIETIS* IN CZECHOSLOVAKIA

J. Weiser, *Institute of Entomology, Czechoslovak Academy of Science, Prague, Czechoslovakia*

Two major long-lasting outbreaks of the European false spruce webworm, *Cephalcia abietis*, were investigated for disease. One locality, a large area in the Jeseniky mountains, was without any infection of hibernating

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nymphs. In another, less extended area in South Bohemia with as many as 1000 eonymphs and pronymphs of the sawfly under 1 m² an infection with entomopathogenic nematodes *Neocaplectana janickii* was discovered. The nematode was first described by Weiser and Koehler in 1955 from another sawfly, *Acantholyda nemoralis* under similar conditions. An apparent infection with the nematode was present in less than 5% of hibernating pronymphs and eonymphs and was present in 10 - 15% of the nymphs during the hot period of the year. The limiting conditions in the spread of the infection were the low temperature in the deep layers of soil and the isolation of the larvae in clay without organic material. There was a high coincidence of 50 - 70% of nematodes and parasitization with the parasitic fly *Thereva* sp.. The oviposition site of the fly was the site of entry for the nematodes. In populations of the upper layers of soil during the summer, infection was rather frequent in samples of sawflies sent to the laboratory which were 100% infected during three days.

Infected nymphs are lead-gray to brownish compared with green or orange healthy nymphs. The interior of infected nymphs is filled with greenish dense jelly containing thousands of invasive larvae, with some adult males and females. The whole mass contains only one bacterium which grows well on artificial media. Maintenance of cultures of the nematode on *Galleria mellonella* larvae is difficult. There is a competition between *N. janickii* and free-living Tylenchids which invade dead insects with *Neocaplectana* and replace the specific nematode.

A LOCAL AND SEASONAL VARIATION IN MERMITHID INFECTIONS OF BLACK FLIES
J. Weiser, *Institute of Entomology, Czechoslovak Academy of Sciences, Prague, Czechoslovakia*

In one locality with a year-round persistent population of *Odagmia ornata* and *Eusimulium latipes*, the seasonal distribution of 8 pathogens was studied for 4 subsequent seasons. A seasonal distribution was recorded for mermithids. The first visible infections appeared during July, which was the peak of the season. In August and September, the infection decreased and only a few infected larvae appeared in October. There was no mermithid infection during the rest of the year.

The infection rate in all cases was quite low, between 0.1 and 6.9% of the larval population, with a peak in the last larval instar of 10 - 50% of the last larvae.

The seasonal variation in number was not connected with any variation of water current or with meteorological factors. This seasonal distribution differs from the year-round occurrence of mermithids in other areas; e.g., Canada, U.S.. There was no coincidence of this infection with other infections in the black fly populations observed.

MICROSPORIDIA AFFECTING LARVAL AND ADULT TICKS, *IXODES RICINUS*
J. Weiser and J. Rehack, *Institute of Entomology, Czechoslovak Academy of Sciences, Prague, and Institute of Virology, Slovak Academy of Sciences, Bratislava, Czechoslovakia*

Microsporidia occur in ticks which are obligatory blood suckers during their whole life. After *Nosema ixodis* from a nymph of *Ixodes ricinus* (Weiser, Csl. parasitologie, 4:355, 1957) another microsporidian, *Nosema slovacica* was described. This infection was present in one hungry adult female of *I. ricinus* from several hundred mites collected in different natural foci of infections. The infected tick, when dissected, burst with hemolymph and tissues. These were filled with oval spores 4 x .16 µm and therefore not reduced by starvation. Stained after Robinow, two distinct nuclei appeared inside the spores, corroborating the generic diagnosis.

The gut of the tick was not infected and the means of transmission was not established. The tick must have been infected in its nymphal state. This relatively rare case documents the participation of typical invertebrate disease in natural control of ticks. It also shows that possibility of transmission of disease germs among exclusive blood suckers, by cannibalistic attacks, by introduction of spore material with sweat on the surface of the skin of the host, or finally by over-the-egg transmission.

PREPARATION OF INFECTIVE SPORES OF *NOSEMA GASTROIDEAE* FOR INFECTIONS OF
LEPTINOTARSA DECEMLINEATA
Z. Hostounsky, *Institute of Entomology, Czechoslovak Academy of Sciences, Prague, Czechoslovakia*

Experimental infections of the Colorado potato beetle with *Nosema gastroideae* have shown that this microsporidian has a relatively high pathogenicity and early mortality in the new host. The short time between infection and death does not allow the microsporidian to produce enough spores for efficient spread in the biotope or for production of the spores needed for further infections. The average output from one larva is 30 to 40 mill. spores.

The original host of *N. gastroideae*, the minute chrysomelid beetle, *Gastroidea polygona*, develops a chronic infection, lasting from larva to adult. The last larvae or pupae contain 20 mill. spores. The infection develops later in the ovary of adult females and infects the eggs. At this stage the yield is 60 - 80 mill. spores per animals, with extreme cases of up to 320 mill. spores.

In the first egg batches of infected adult *G. polygona*, only 5 - 10% of the eggs are infected. In subsequent late summer egg batches, 100% of the eggs are infected. When all the eggs hatch from the first egg batches in spring, only an average of 5% hatch from the late summer batches.

MEETINGS
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CONFERENCE ON PATHOBIOLOGY OF INVERTEBRATE VECTORS OF DISEASE,
The New York Academy of Sciences, March 17-19, 1975

The Conference on Pathobiology of Invertebrate Vectors of Disease was organized by the New York Academy of Sciences under the chairmanship of Dr. L. A. Bulla and Dr. T. C. Cheng. The program published earlier in the SIP Newsletter (January 1975) indicated the breadth of the Conference which covered vertebrate pathogens in arthropod vectors, the effects of plant disease agents on insect vectors, the pathobiology of non-insect invertebrates, and mollusc-parasite interactions. Emphasis upon the effects of pathogens of vertebrates in insect vectors provided an opportunity for invertebrate pathologists to enter into discussion with medical entomologists and parasitologists on the interpretation of transovarian transmission of pathogens within vectors and the consequences of this transmission. One of the important themes concerned the significance of transovarian transmission of pathogens and the maintenance of infectious agents in vectors. It is evident from the results of the discussions that individuals with a primary interest in invertebrate microbiology can draw upon a large amount of documentation by parasitologists who have investigated the question of maintenance of vertebrate pathogens in populations of vectors when reservoir hosts of the pathogens are not in evidence as part of the epizootiology of diseases in man. The sessions on the second and third days of the program emphasized the host-microorganism systems that are generally better understood by invertebrate microbiologists and pathologists. Sessions concerning snail vectors of human disease, and insect vectors of plant disease, involved a greater number of contributions in formal presentations and in discussions by pathologists, in contrast with sessions on the first day when medical entomologists and parasitologists were the principal discussants. Formal contributions concerning the responses of invertebrate vectors to pathogens of humans, and in response to challenges by materials injected into the vectors, provided an opportunity for all participants in the Conference to identify questions concerning the pathology of vectors discussed during the first sessions.

The Conference provided the most recent evidence that there is a large area for cooperative investigations to be entered into by medical entomologists and parasitologists concerned with diseases of man, and invertebrate pathologists with primary interest in how invertebrates are affected by microorganisms. It is fortunate that the Conference was sponsored by the New York Academy of Sciences, which will assure that the formal presentations and the results of discussions will be published in a forthcoming issue of the Annals of the New York Academy of Sciences.

Several scheduled participants did not attend and the time periods allotted for their presentations were available to other invertebrate pathologists attending the meeting. For example, Dr. Chris Bayne, among others, provided a formal contribution as part of the last session of the program.

John Briggs

FIRST WORKSHOP ON THE PATHOLOGY AND TOXICOLOGY OF PENAEID SHRIMP,
Galveston Texas, April 8-10, 1975

The First Workshop on the Pathology and Toxicology of Penaeid Shrimp was held in Galveston, Texas, April 8-10, 1975. The workshop was sponsored by the National Marine Fisheries Service, Gulf Coast Fisheries Center and the Environmental Protection Agency, Gulf Breeze Environmental Research Laboratory, and was organized by Del Nimmo, Donald Lightner, and Richard Neal. The Workshop concerned propagation of shrimp, with particular emphasis on the toxicity of heavy metals and microorganisms, the anatomy and physiology of shrimp, and the histopathology of shrimp subjected to heavy metals, chemicals, and infectious diseases.

Two important aspects of this Workshop were the multidisciplinary contributions by individuals actively engaged in research on the physiology and mass propagation of shrimp *in vitro* and the formal contributions throughout the entire Workshop by young scientists and graduate students engaged in research on shrimp diseases. In addition, participants included Dr. Jean-Robert Bonami from the Laboratory of Comparative Pathology, Montpellier, France, and Jean Francois LeBitoux who is actively engaged in research on shrimp culture for the French government in Tahiti.

In addition to detection and control of diseases of shrimp, a principal concern for many of the participants was the production of shrimp in large vessels of ocean water enclosed in environmentally controlled buildings. The Workshop drew to the attention of invertebrate pathologists the common concerns which are shared by individuals attempting to propagate large numbers of invertebrate animals. Scientists experienced in the production of populations of insects face the same challenges as individuals investigating the mass propagation of shrimp under controlled conditions. It will be to our advantage to identify the difficulties of invertebrate husbandry generally and draw upon those resources in invertebrate pathology relevant to the maintenance and care of populations of invertebrates. The marine water environment presents an additional dimension to the health of invertebrates when compared to mass propagation of insects. The Society should facilitate the challenges in mass propagation of invertebrates by encouraging cooperative efforts among all invertebrate pathologists and other scientists with these interests.

The formal Workshop on shrimp pathology provided an excellent example of the benefits to be gained from specialized regional meetings. The Workshop in Galveston covered many areas of interest; e.g., nutrition, physiology, and pathology with regard to an invertebrate of immediate concern.

The major problems identified in the Workshop can be brought to the attention of the invertebrate pathology community internationally, and planning for the solution of these problems using the resources of all invertebrate pathologists can be done through national and international colloquia.

Dr. A. K. Sparks, Deputy Director for Resource Research in the National Marine Fisheries, addressed the Workshop and indicated that the publication of the formal presentations and the discussions can be expected to be completed in the near future.

John Briggs

VIIIth ANNUAL MEETING

Continued from page 1

REMINDER

Airline reservations to the VIIIth Annual Meeting should be made to Eugene, Oregon rather than to Portland since it is closer to the Oregon State University campus.

CORRECTION

The address given in the Newsletter VII:2, March 1975, for registration and housing information for members outside the U.S. was incorrect. The correct address is:

Ann F. Kulback
AIBS, 1401 Wilson Boulevard
Arlington, Virginia 22209 USA

Enclosed in this Newsletter are registration and housing forms for foreign members. U.S. members who have not received these forms by mail from AIBS will find them in BioScience, March 1975, 25, 889-192. Registration materials must be returned to AIBS by July 18 to avoid late registration charges.

NEW DIVISION

Because of the increasing interest (as evidenced by the large number of papers at this year's annual meeting) in pathological phenomena and cellular responses of non-insect invertebrates, it seems appropriate to consider forming a Division of the Society that is concerned with shellfish-molluscs and crustaceans cellular defense mechanisms and cellular proliferation. Therefore, Dr. Mix is calling a meeting on Wednesday afternoon, August 20, 1975, for those interested in forming such a Division. For those who are interested but will be unable to attend the meeting in Corvallis, please feel free to write or call Dr. Mix who will relay suggestions and comments to those attending the meeting.

PROGRAM CO-CHAIRMEN:

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Pathology of Invertebrates
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LOCAL ARRANGEMENTS:

Dr. Christopher J. Bayne
Department of Zoology
Oregon State University
Corvallis, Oregon 97331 USA

MICROSPORIDA WORKSHOP

Contributions to a Microsporida Workshop to be held at the VIIIth Annual Meeting are invited. Such contributions may include photographic materials, light microscope slides, electron micrographs, posters, charts, or projector slides. The Workshop will cover a broad distribution of microsporida, but will emphasize the lesser-known microsporidan genera.

Students engaged in microsporidan research are encouraged to participate. The Workshop will provide an opportunity for discussion and resolution of questions encountered in current research.

To make arrangements for participation in the Workshop and for space and equipment contact:

Dr. Ann Cali
Department of Zoology and Physiology
Rutgers University
Boyden Hall, 195 University Avenue
Newark, New Jersey USA

If you cannot attend the Workshop, but would like to have your material presented, please forward it to Dr. Cali.

* * * * *

WORKSHOP ON MOLLUSCAN PATHOLOGY
September 3-5, 1975, Middle Atlantic Coastal
Fisheries Center, Oxford, Maryland, USA

In view of the recent and exciting developments in molluscan pathology, especially neoplasia, the Committee on Animal Models and Genetic Stocks, National Research Council, National Academy of Sciences has decided to sponsor a Workshop on Molluscan Pathology as it relates to abnormal growth.

Dr. Dante Scarpelli, University of Kansas Medical Center, is the program organizer and chairman of the steering committee, which is composed of Drs. John C. Harshbarger, Smithsonian Institution; Clyde J. Dawe, National Cancer Institute; C. Austin Farley, National Marine Fisheries Service; and George Nagaki, Armed Forces Institute of Pathology. The workshop will be held on September 3, 4, and 5, 1975, and is to be hosted by National Oceanic and Atmospheric Administration, Middle Atlantic Coastal Fisheries Center, Oxford Laboratory, using nearby conference facilities generously arranged for by the Wye Institute in Wye Mills, Maryland.

A variety of lesions in mollusks are to be reviewed and discussed, followed by a similar treatment of neoplasms and related disorders in both mollusks and other animals. It is hoped that the comparative approach to be used in the workshop will further the understanding of neoplastic lesions in mollusks and also help clarify problems concerning their classification and nomenclature.

Several investigators have been invited to present examples of specific diseases in research areas where they are the most knowledgeable. In a further effort to assist other participants in the workshop, these individuals have been asked to send the Smithsonian Institution slides of each lesion, or sufficient wet material so they can be prepared before the workshop. Limited availability of microscopes, bench space, and histologic preparations has necessarily restricted the number of workshop participants. However, those who would like to be invited to the workshop as observers are welcome to contact:

Dr. Aaron Rosenfield
Oxford Laboratory
Oxford, Maryland 21654 USA

SIP NEWSLETTER

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Published in January, March, June, September, and November by the Society for Invertebrate Pathology. Deadline for submissions to the Newsletter is the 15th of the preceding month.

DIRECTORY OF COURSES OF INSTRUCTION
IN INVERTEBRATE PATHOLOGY*

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24.	<u>Washington</u>	6
25.	<u>Wisconsin</u>	6

*This Directory has been compiled from the replies received to the questionnaire prepared by Dr. Harshbarger. Dr. Harshbarger would appreciate receiving questionnaires for those courses not included here so that they may be listed in future summaries.

DOMINICAN REPUBLIC

1. Introduction to Pathobiology of Fish and Shellfish

Scope: Introduction to disease problems in fish and shellfish of coastal and estuarine waters, including those relating to water pollution.

Level: Undergraduate

Prerequisites: Students who are presently in training in biology at the university level, as well as qualified non-matriculated students are eligible.

Instructor: Sophie Jakowska

Institution: Centro de Investigaciones de Biología Marina (CIBIMA)
Universidad Autónoma de Santo Domingo

Address: Santo Domingo, Dominican Republic

Comments: This is the first time the course will be offered. It is given under a Performance Contract of the Organization of American States as part of the Multinational Program in Marine Sciences in the Dominican Republic. The programs are prepared in consultation with Drs. Sindermann and Rosenfield of the National Marine Fisheries Service.

ENGLAND

2. Agricultural Zoology

Scope: The biology, economic importance and management of the animal life for which agricultural ecosystems are a habitat. This includes the biology and epidemiology of the diseases of insect pests.

Level: B.Sc. honors program

Prerequisites: Two, or preferably three, advanced level passes in science subjects, one of which must be chemistry, of the British General Certificate of Education, or an equivalent qualification.

Instructors: Dr. A. Ibbotson, Dr. W. J. S. Kershaw, Dr. M. L. Luff, and Dr. B. J. Selman

Institution: Department of Agricultural Zoology
University of Newcastle upon Tyne

Address: Newcastle upon Tyne, NE1 7RU, England

Comments: Invertebrate pathology forms an integral part of the course in Agricultural Zoology and is taught against a background of general agriculture. Agricultural microbiology may be studied as a subsidiary course in addition to the invertebrate pathology in Agricultural Zoology.

ISRAEL

3. Diseases of Invertebrate Pests of Crops

Scope: Diseases of insect and nematode pests caused by fungi, viruses, bacteria, and nematodes. Lectures and laboratory sessions.

Level: Graduate

Prerequisites: Introductory Plant Pathology, Introductory Entomology

Instructors: Dr. I. Harpaz, Dr. R. Kenneth, Dr. E. Cohn

Institution: Faculty of Agriculture, Hebrew University of Jerusalem

Address: P.O. Box 12, Rehovot, Israel

Comments: Given for the first time, Spring 1975.

UNITED STATES

CALIFORNIA

4. Insect Pathology (Entomology 140)

Scope: 5 units (4 lectures and 1 laboratory per week). General principles of insect pathology and insect microbiology; infectious diseases of insects; epizootiology, microbial control.

Level: Upper division undergraduate and graduate

Prerequisites: General Entomology, Entomology 100 and at least one course in a microbiological science.

Instructors: Y. Tanada and G. O. Poinar

Institution: University of California, Berkeley

Address: Department of Entomological Sciences, Berkeley, California, 94720, USA

5. Advanced Insect Pathology (Entomology 240)

Scope: 3 units (2 lectures and 1 laboratory per week, offered odd-numbered years). Advanced and recent considerations of infectious and non-infectious diseases of insects.

Level: Restricted to four students, mainly insect pathology majors

Prerequisites: Entomology 140

Instructor: Y. Tanada

Institution: University of California, Berkeley

Address: Department of Entomological Sciences, Berkeley, California, 94720, USA

6. Control Methods in Pest Management--Biological and Microbial Agents

Scope: Biological control in pest management; techniques for use of parasites, predators, and pathogens against pests; advantages and limitations.

Level: Third-year undergraduate

Prerequisites: Basic courses in pest management, entomology and microbiology

Instructors: Drs. Caltagirone, Falcon, Schroth

Institution: University of California, Berkeley

Address: Department of Entomological Sciences, Berkeley, California, 94720, USA

7. Insect Pathology

Scope: Pathogenic microbes, fungi and nematodes of insects and an evaluation of their control potential (offered every two years).

Level: Upper-division undergraduate

Prerequisites: General Zoology, General Entomology, Introductory Microbiology recommended

Instructor: F. E. Schreiber

Institution: California State University, Fresno

Address: Department of Biology, Fresno, California, 93740, USA

8. Insect Pathology (Entomology 231) and Seminar in Insect Pathology (Entomology 257)

9.

Scope: Principles of general insect pathology and microbiology; detailed study of non-infectious and infectious diseases of insects, diagnosis, epizootiology, physiopathology, and the use of microbial agents in the control of insect pests.

Level: Graduate (Entomology 231 is open to qualified undergraduates)

Prerequisites: Entomology 100 and at least one course in microbiology or permission of instructor

Instructors: B. A. Federici and I. M. Hall

Institution: University of California, Riverside

Address: Department of Entomology, Riverside, California, 92502, USA

Comments: Special Problems (Directed Studies) are also available for both undergraduate and graduate students.

CONNECTICUT

10. Pathobiology of Invertebrates

Scope: A study of the invertebrate host response elicited by natural and experimental infections.
Level: Graduate
Prerequisites: Permission of instructor
Instructor: S. Y. Feng
Institution: Biological Sciences Group, University of Connecticut
Address: Storrs, Connecticut, 06268, USA

IOWA

11. Insect Pathology (Entomology 673)

Scope: Principles of insect pathology and microbiology; infectious and non-infectious diseases of insects; diagnosis, prevention, and use of entomogenous pathogens in insect population management.
Level: Graduate
Prerequisites: General Entomology and a course in microbial science
Instructor: Clayton Beegle
Institution: Iowa State University
Address: Department of Entomology
Ames, Iowa, 50010, USA

KENTUCKY

12. Insect Pathology (Entomology 626)

Scope: Principles of insect pathology related to the etiology, pathogenesis, gross pathology, histopathology, and epizootiology of insect diseases, with emphasis on infectious diseases caused by occluded viruses, bacteria, fungi, and protozoans.
Level: Graduate
Prerequisites: Permission of instructor
Instructor: Gerald L. Nordin
Institution: University of Kentucky, Department of Entomology
Address: Lexington, Kentucky, 40506, USA

MARYLAND

13. Invertebrate Pathology (Entomology 462)

Scope: Two 1-hour lectures and one 3-hour laboratory per week.
A survey of invertebrate pathogens.
Level: Advanced undergraduate and graduate
Prerequisites: One semester of microbiology and one semester of insect physiology or permission of instructor
Instructor: Charles F. Reichelderfer
Institution: University of Maryland
Address: Department of Entomology, College Park, Maryland, 20742, USA
Comments: This course is designed to familiarize the student with the best known invertebrate pathogens and with laboratory techniques which are useful to the invertebrate pathologist. Volumes I and II of Insect Diseases, edited by George E. Cantwell, are supplemented with readings from current issues of the Journal of Invertebrate Pathology.

MINNESOTA

14. Insect Microbiology or Symbiology and Invertebrate Pathology

Scope: The range of mutualistic associations, insects/symbiotes; the groups of pathogens of insects; and some laboratory work with microtechnique, virus feeding, bacterial LD₅₀ etc.

Level: Advanced graduate students majoring in entomology, zoology, plant pathology, microbiology, or similar areas

Prerequisites: First year graduate course work in entomology and preferably some graduate work in microbiology

Instructor: Marion A. Brooks-Wallace

Institution: University of Minnesota

Address: Department of Entomology, Fisheries, and Wildlife
University of Minnesota, St. Paul, Minnesota, 55108, USA

Comments: I now teach a lower-level graduate course which covers embryology and development. I would like to change both this and the above course in order to add a third course as follows:

1. Embryology and Symbiology
2. Growth and Post-embryonic Development and Artificial Rearing
3. Pathology, including microbial as well as nutritional

MISSISSIPPI

15. Insect Pathology (Entomology 8453)

Scope: A three-credit course with two lectures and two hours in the laboratory, offered in the fall. A study of abnormal conditions among insects as caused by non-infectious and infectious diseases. A survey of the physical, mechanical, chemical physiological, and genetic non-infectious diseases. The relationship between microorganisms and insects is studied and diseases caused by bacteria, fungi, protozoa, nematodes, and viruses are examined in detail.

Level: Graduate

Prerequisites: General Microbiology

Instructor: Peter P. Sikorowski

Institution: Mississippi State University

Address: Department of Entomology, P.O. Drawer EM
Mississippi State, Mississippi, 39762, USA

16. Parasites of Marine Animals

Scope: A study of the parasites of marine animals with emphasis on morphology, taxonomy, life history, and host-parasite relationships.

Level: Graduate or undergraduate

Prerequisites: General parasitology or permission of instructor.

Instructor: Dr. Robin M. Overstreet

Institution: Gulf Coast Research Laboratory

Address: P.O. Box AG, Ocean Springs, Mississippi, 39564, USA

Comments: Six-week course taught every other summer during even years (six semester hours).

NEW YORK

17. Insect Pathology (Entomology 453)

Scope: A survey of diseases caused by viruses, bacteria (including Rickettsiae and spirochetes), fungi and protozoans, with emphasis on pathogenesis, pathologies, and epidemiology; the role of microbial disease in natural and applied control.

Level: Upper division undergraduate and graduate

Prerequisites: Entomology, microbiology and permission of instructor

Instructor: John P. Kramer

Institution: Cornell University

Address: Ithaca, New York, 14850, USA

18. Problems in Invertebrate Pathology

Scope: Selected topics for discussion, literature (current) study, and a laboratory research problem

Level: Senior-level undergraduate and graduate

Prerequisites: Permission of instructor

Instructor: A. J. Nappi

Institution: State University of New York

Address: Oswego, New York, 13125, USA

NORTH CAROLINA

19. Insect Pathology (Entomology 520)

Scope: Three credit hours. A treatment of the non-infectious and infectious diseases of insects, the etiological agents and infectious processes involved, immunological responses, and applications.

Level: Graduate

Prerequisites: Introductory entomology and microbiology

Instructor: Wayne M. Brooks

Institution: North Carolina State University

Address: Department of Entomology, Raleigh, North Carolina, 27607, USA

Comments: In addition to regularly scheduled labs, students are required to participate in a special problem of a research nature, the results of which are presented orally as well as in manuscript style. (Offered during spring semester of odd numbered years.)

OHIO

20. Insect Pathology (Entomology 741)

21. Special Topics in Invertebrate Pathology (Entomology 796.10)

Scope: Entomology 741 is a general introduction to insect pathology. Both courses cover the treatment of infectious and non-infectious diseases of invertebrates, with particular emphasis on insects.

Level: Advanced undergraduate and graduate

Prerequisites: Introductory Microbiology for 741; and Entomology 741 or permission of instructor for 796.10

Instructors: W. F. Hink (Ent. 741)
W. F. Hink, G. R. Stairs, and J. D. Briggs (Ent. 796.10)

Institution: The Ohio State University

Address: Department of Entomology, Columbus, Ohio, 43210, USA

PENNSYLVANIA

22. Insect Pathology (Entomology 536)

Scope: Theoretical and practical aspects concerning the diseases of beneficial and harmful insects.
Level: Graduate
Prerequisites: Introductory microbiology
Instructor: Dr. William G. Yendol
Institution: The Pennsylvania State University
Address: Entomology Department, University Park, Pennsylvania, 16801, USA
Comments: Graduate research program in insect pathology is also offered for interested individuals. Research: principally in bacterial, fungal and virus pathogens.

PUERTO RICO

23. Insect Pathology

Scope: Non-infectious diseases, as well as infectious diseases of insects.
Level: Graduate
Prerequisites: General Microbiology, General Entomology
Instructor: Goro Kuno
Institution: University of Puerto Rico at Mayaguez
Address: Entomological Research Laboratory, Mayaguez, Puerto Rico, 00706, USA
Comments: Tropical insects as experimental animals are emphasized in lab sessions.

WASHINGTON

24. Invertebrate Pathology

Scope: Infectious diseases and non-infectious disease processes in invertebrates of all phyla.
Level: Upper division undergraduate and graduate
Prerequisites: Invertebrate zoology and introductory microbiology
Instructors: Dr. Gilbert Pauley and Dr. Marsha Landolt
Institution: University of Washington
Address: College of Fisheries, Seattle, Washington, 98195, USA

WISCONSIN

25. Insect Pathology (Entomology 710)

Scope: Insect-microbial associations, particularly pathogenic (ranging from chance contamination to obligate pathogenicity). The course is based on laboratory studies. Proof of pathogenicity (Koch's Postulates) and quantitation of normal v. disease states from the standpoint of the entire association as well as on the cellular and subcellular level are stressed.
Level: Graduate
Prerequisites: Microbiology or permission of instructor
Instructors: G. Mallory Boush and H. C. Coppel
Institution: University of Wisconsin
Address: Department of Entomology, 237 Russell Laboratory
Madison, Wisconsin, 53706, USA

Q U E S T I O N N A I R E

To assist us in answering inquiries from prospective students of Invertebrate Pathology would you please send the following course information to John C. Harshbarger, Secretary, SIP, National Museum of Natural History, Room W216-A, Smithsonian Institution, Washington, D.C., 20560. The information will be included in a future SIP NEWSLETTER.

Name of course(s):

Scope of course(s):

Level of course(s):

Prerequisites:

Name of instructor(s):

Name of institution:

Address of institution:

Additional comments: