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PROCEEDINGS OF THE

**ENTOMOLOGICAL
SOCIETY OF
MANITOBA**

VOLUME 42

1986

Proceedings of the
Entomological Society of
Manitoba
Volume 42
1986

Robert E. Roughley
Editor
Winnipeg, Manitoba

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MINUTES OF THE 42ND ANNUAL MEETING

ENTOMOLOGICAL SOCIETY OF MANITOBA

13:00 h, 14 November, 1986
 Norlander Inn
 Winnipeg, Manitoba

The President, Dr. M.M. Galloway, presided. A quorum being present, the President called the meeting to order and asked the Secretary of the Society, Dr. N.D.G. White, to take minutes of the meeting.

Attendance:Executive:

Dr. M.M. Galloway, President; Dr. R. Ellis, Past-President;
 Dr. P.A. MacKay, President-Elect;
 Dr. J.C. Conroy, Regional Director to E.S.C.
 (Regrets: D. Dixon, Member-at-large).

Executive Staff:

Dr. R.E. Roughley, Editor of the Proceedings;
 Dr. N.D.G. White, Secretary;
 (Regrets: Dr. W.L. Askew, Treasurer).

Members:

G. Gerber	R. Gadawski	W. Preston
D. Giberson	R. Brust	S.C. Jay
A. Wiens	M. Trottier	T. Galloway
G. Wylie	R.J. Lamb	N. Holliday
A.G. Robinson	G. Ayre	D. Smith
W. Turnock	G. Bracken	

1. AGENDA (Appendix A).

Motion - T. Galloway/B.Lamb: Adoption of the Agenda.

CARRIED

2. MINUTES OF THE 42ND ANNUAL MEETING

Motion - G. Gerber/J. Conroy: Adoption of the minutes of the 41st Annual Meeting of the Entomological Society of Manitoba Incorporated, held on 25 October, 1985, and published in the Proceedings of the Entomological Society of Manitoba (Vol. 41, 1985).

CARRIED

3. BUSINESS ARISING FROM THE MINUTES OF THE 41ST ANNUAL MEETING

Amendment to the Endowment Fund Agreement

Motion - J. Conroy/R. Brust: That all reference to the publication "Manitoba Entomologist" be deleted in the Trust Fund Agreement.

Carried

4. EXECUTIVE REPORTS

4(a). President (Appendix B)

Oral Report given by M. Galloway, written report received for information.

CARRIED

4(b). Treasurer/Auditor (Appendix C)

Motion - P. MacKay/R. Brust: Acceptance of the Treasurer/Auditor report.

CARRIED

The appointment of an auditor for the current fiscal year is left to the next Executive Committee.

4(c). Editor - Proceedings of the Entomological Society of Manitoba (Appendix D)

R. Roughley indicated that costs of the Proceedings have increased because labour expenses are now included. Discussion arose on publication of abstracts from the ESC/ESM joint annual meeting in October in the Proceedings. It was mentioned that this would be expensive but N. Holliday indicated that some scientific content was needed in the Proceedings.

Motion - J. Conroy/G. Gerber/G. Bracken: That the Abstracts of all papers presented at the Joint Annual Meeting (Oct. 6-8, 1986) be published in the Proceedings of the Society for 1986.

CARRIED

4(d). Regional Director to E.S.C. (Appendix E)

The report was discussed by J. Conroy and was received for information. N. Holliday then presented a oral report on the "Profile of Entomologists" project. Biographical and professional data on ento-

mologists in Manitoba and individual pictures will be obtained. Dr. Holliday has been appointed by the Executive of the ESM to be Chairman of an ad hoc committee to collect data and determine costs and potential funding for the project.

4(e). Endowment Fund Board (Appendix F)

Motion - R. Brust/J. Conroy: Accept the written report as submitted.

CARRIED

5. COMMITTEE REPORTS

Motion - N. Holliday/T. Galloway: That all Committee Reports be received.

CARRIED

6(a). Finance Committee (Appendix G)

R. Brust discussed financial projections. A question arose on how the endowment fund could grow when the interest is returned to general revenues. The finance committee plans to deposit funds from general revenues into the endowment fund in the future. It was noted that there were no expenses for the 1986-87 Annual General Meeting because of the Joint Meeting with ESC.

Recommendations of the Finance Committee were presented by R. Brust.

1. Student Membership Fees

Motion - from the Finance Committee: That Student membership dues in the Entomological Society of Manitoba be increased from \$2.50 to \$5.00.

CARRIED

2. Publication in the Proceedings

The committee recommended that \$400.00 be budgeted for publication-related costs of a scientific paper to be published in the Proceedings of the ESM. The membership discussed the issue.

Action: Editor, Proceedings ESM, and Finance Committee:

Prepare guidelines on criteria for awarding funds, the purpose of the grants, etc. Specify if the main aim is to assist amateur ento-

mologists to publish material of local interest. In the next year's (1987-88) Proceedings budget include a tentative \$400.00 for amateur publication.

The guidelines and the issue will be dealt with at the next annual meeting.

6(b). Publicity/Newsletter (Appendix H)

6(c). Social (Appendix I)

6(d). Education and Youth Encouragement (Appendix J)

The report was presented by T. Galloway for W. Ralley. There was no mall display this year because of construction at Polo Park.

6(e). Common Names (Appendix K)

6(f). Archivist (Appendix L)

6(g). Manitoba Environmental Council

M. Trottier presented an oral report. He indicated that the Council is a voluntary organization with representatives from many organizations such as the ESM. The Manitoba government is planning to destroy the Council by replacing it with a governmental committee. This would possibly lead to problems of conflict of interest for civil servants and would serve to muzzle the organization since all information would pass through departmental ministers.

Motion - M. Trottier/J. Conroy and W. Turnock:

The executive of the ESM will write to the Minister of the Environment for Manitoba and protest the current attempt to destroy the Manitoba Environment Council, an action we deem to be unacceptable.

CARRIED

6(h). Honorary Members to ESC (Appendix M)

R. Brust gave an oral report outlining the procedure for nominating candidates to the Entomological Society of Canada.

6(i). Student Awards Committee (Appendix N)

A. Wiens presented his report and indicated that the Committee name should be changed to Student Awards rather than Student Achievement since two awards are now being given.

6(j). ESC Scholarship

J. Conroy listed the names of the national recipients of the scholarships.

6(k). ESM Scholarship (Appendix O)

Ingolf Askevold was awarded the first ESM scholarship of \$1000.00 and a certificate.

6(l). Scientific program Report (Appendix P)

N. Holliday thanked everyone involved in the 1986 Joint Annual Meeting (ESM/ESC) for contributing to a very successful meeting.

6(m). ESM Membership (Appendix Q)

T. Galloway indicated that Alma Criddle has offered 20 books to the ESC to be presented in the future (1/year) with the Criddle Award for amateur entomologists.

It was suggested that there may be a page charge waiver in place for publication in the Proceedings by amateurs since this was the policy for the Manitoba Entomologist.

Action: Editor, Proceedings, and Finance Committee: Determine if ESM policy currently allows amateurs to publish in the Proceedings without charge.

6(n). Membership ESC - no report

6(o). ESM Student paper - no report

6(p). ESC Awards - Gold medal nominees - no report

7. EXECUTIVE ELECTION RESULTS

A.G. Robinson, W. Ralley, and R. Gadawski received and counted the ballots; 150 were mailed by the Secretary and 88 were returned.

President-Elect - N. Holliday

Member-at-Large - A. Wiens

Motion - A.G. Robinson/T. Galloway: That the ballots be destroyed.

CARRIED

8. TRANSFER OF OFFICE

M. Galloway welcomed P. MacKay who took the Chair for the remainder of the meeting and began her term as President.

9. OTHER BUSINESS

Motion - J. Conroy/D. Giberson: That the current Rules and Regulations of the ESM be continued for 1987.

CARRIED

Re-appointment of the Joint Annual Meeting Committee to complete their work was done by the Executive.

10. ADJOURNEMENT - J. Conroy (14:15 h. Dec. 1.86).

APPENDIX A

ENTOMOLOGICAL SOCIETY OF MANITOBA

42nd Annual Business Meeting
October 25, 1985

AGENDA

1. Appointment of Secretary to record proceedings of the annual business meeting.
2. Acceptance of Agenda.
3. Minutes of last annual meeting.
4. Business arising from the minutes.
 - a) Endowment Fund Agreement Amendment.
5. Reports - Executive, Trustees.

a) President	M.M. Galloway
b) Treasurer (Auditor)	W. Askew
c) Editor of the Proceedings	R.E. Roughley
d) Regional Director to ESC	J.C. Conroy
e) Endowment Fund Board	R.A. Brust

6. Reports - Committees

a) Finance Committee	R.A. Brust
b) Publicity, Newsletter	R. Gadawski
c) Social	M. Trottier
d) Education & Youth Encouragement	W. Ralley
e) E.S.C. Insect Common Names	A.G. Robinson
f) Archivist	A.G. Robinson
g) Manitoba Environmental Council	M. Trottier
h) Honorary Members (ESC)	R. Brust
i) Student Achievement Award (ESM)	A. Wiens
j) ESC Scholarship Committee	J.C. Conroy
k) ESM Scholarship Committee	S.C. Jay
l) Scientific Program and Joint Annual Meeting ESM-ESC, 1986	N. Holliday and G. Gerber
m) Membership Committee (ESM) and Criddle Award	T.D. Galloway
n) Membership Committee (ESC)	R.E. Roughley
o) Nomination Committee ESM Student Paper	T. Pankiw

7. 1986-1987 Election Results - Scrutineer Committee, A.G. Robinson

8. Transfer of office

9. Other business:

- a) Continuation of current rules and regulations.
- b) Reappointment of JAM Committee.

10. Adjournment.

APPENDIX BPresident's Report

The major activity for the Society this year was hosting the Joint Annual Meetings with the Entomological Society of Canada. We can be proud of a successful and rewarding meeting. As a Society, we have a debt of gratitude to the organizing committee: Neil Holliday, John Conroy, George Gerber, and the chairpersons of their ten committees. Their success this year will be a guide for the planning of future national meetings.

A second feature of the year's activities was implementation of three new Society awards. The Entomological Society of Manitoba Scholarship, of \$1000, was awarded for the first time this year. The Entomological

Society of Manitoba Student Paper Award was set up; guidelines and criteria for evaluating winners were prepared. Thirdly, the Society accepted the offer of a privately funded award, the SWAT Student Award, to support the study of Entomology in Manitoba. The Society now enjoys four awards to support students pursuing formal studies or personal interest in Entomology.

On a less grandiose scale, but no less significant, is the progress made in the Society's routine activities. In the encouragement of entomological interests of non-professional entomologists, for example, a survey of amateur entomologists in Manitoba was carried out, new display equipment was acquired, and Society pins were produced. In addition, the status of the Society as a non-profit organization without the requirement to pay income tax on revenues was reconfirmed.

The executive carried out on-going business of the Society during the year. This included approval of committee budgets; preparation of guidelines and checklists for new committees: the ESM - AGM Local Arrangements Committee, and Scientific program Committee, the Social Committee, and the ESM Scholarship Committee; approval of guidelines for two new Society awards, and the nominees for this year's awards and scholarship. Our activities were greatly facilitated by the committee guidelines prepared last year, and the conscientious and competent efforts of committee chairpersons, officers of the Society, and executive members. I mark with regret the resignation of Wally Askew as treasurer of the Society. He worked diligently and reliably in this office on behalf of the membership. I am particularly grateful to the service provided by Wally Askew, Reiny Brust and his Finance Committee, Rany Gadawski, Terry Galloway, Cam Jay, Tanya Pankiw, Wendy Ralley, Noel White, and Al Wiens. It has been a pleasure to work with them.

M.M. Galloway,
President, 1985/86

APPENDIX C

ENTOMOLOGICAL SOCIETY OF MANITOBA INC.
AUDIT REPORT FOR THE YEAR ENDED
AUGUST 31, 1986

I have examined the records of the Entomological Society of Manitoba for the year ended August 31, 1986.

In my opinion the attached financial statements present fairly the financial position of the Society as at the year ended August 31, 1986 and the results of its operations for the year then ended in accordance with generally accepted accounting principles.

Helen Samboluk

ENTOMOLOGICAL SOCIETY OF MANITOBA INC.
STATEMENT OF RECEIPTS AND DISBURSEMENTS
FOR THE YEAR ENDING AUGUST 31, 1986

RECEIPTS:

Membership	\$1,384.50	
Subscriptions	384.44	
Page Charges	425.00	
Committees	111.00	
Annual Meeting	1,814.50	
Premium on US Funds	<u>75.12</u>	
		<u>\$4,194.56</u>

DISBURSEMENTS:

Printing	\$1,262.80	
Stationery	99.41	
Postage	659.44	
Bank Charges & Safety Deposit	62.50	
Committee Expenses	2,414.77	
Annual Meeting	2,399.61	
Typing	250.00	
Miscellaneous	<u>43.01</u>	
		<u>\$7,191.54</u>

Net Loss from Operations	\$(2,996.98)	
G.I.C. Investment Income	2,638.51	
Investment Interest	<u>214.46</u>	
NET LOSS for year ending August 31, 1986		<u>\$(144.01)</u>

ENTOMOLOGICAL SOCIETY OF MANITOBA INC.
BALANCE SHEET
FOR THE YEAR ENDING AUGUST 31, 1985

ASSETS:

Current Account Balance		\$539.36
Savings Account Balance		3,479.20
Investments:		
CH6727	\$2,000.00	
HK9093	3,024.33	
XK5133	2,000.00	
XM3845	3,000.00	
EN9903	2,000.00	
JJ4133	7,200.00	
LQ1596	<u>2,000.00</u>	
		21,224.33
Petty Cash: Treasurer		25.00
Secretary		50.00
Editor		<u>25.00</u>
		\$25,342.89

LIABILITIES AND SURPLUS:

Liabilities	nil	
Surplus Account		
Balance as at 31/8/85	23,486.90	
Net Loss for period	<u>(144.01)</u>	
		<u>\$25,342.89</u>

APPENDIX DANNUAL REPORT OF THE EDITOR OF THE PROCEEDINGS
OF THE SOCIETY

Two hundred and fifty copies of Volume 41 (1985) were ordered. The cost of producing these was \$960.28 or \$3.84 per copy. This represents an increase of \$1.55/copy over the cost/copy of Volume 40, an increase of \$2.32/copy from Volume 39, but an increase of only \$0.78/copy over Volume 38.

R.E. Roughley
Editor, Proceedings E.S.M.

APPENDIX EENTOMOLOGICAL SOCIETY OF MANITOBA
ANNUAL REPORT OF THE REGIONAL DIRECTOR

1. PROFILES OF ENTOMOLOGISTS: The overall cost of this item (to 1986) is \$8,000.00. The E.S.M. share is approximately \$2,072.00, that of E.S.S. is about \$1,600.00. The E.S.M. figure is a minimum figure.
2. The next Joint Annual Meeting will be with the ENTOMOLOGICAL SOCIETY OF BRITISH COLUMBIA in late September, 1987. The XVIII INTERNATIONAL CONGRESS OF ENTOMOLOGY will be held in VANCOUVER, BRITISH COLUMBIA, from July 3rd to 9th, 1988. Accomodations at U.B.C. and prices are claimed to be reasonable.
3. The STUDENT ENCOURAGEMENT GRANTS are now known as the PUBLIC ENCOURAGEMENT GRANTS. It should be noted that these grants are not intended to support activities of professional entomologists nor graduate students. A brief accounting of how the grants were used should be made to the Chairman of the Public Encouragement Committee of the E.S.C.
4. Membership dues for the E.S.C. must now be paid by January 1 (\$45). THE FEES AFTER THAT WILL BE \$50. For students the fees prior to January 1 will be \$20 and \$25 after that. The rights and priviliges of members will be suspended if no dues are paid by January 1. The extra \$5 (added to the fees after January 1) is a reinstatement fee.
5. Membership in Canada has dropped by about 20% during the past year. All members of Regional Societies are actively encouraged to join the National Society.
6. The SCHOLARSHIP COMMITTEE awarded scholarships to SUSAN FRASER, WATERLOO, and the SANDRA GRAHAM, Department of Zoology, University of Manitoba (supervisor E. Huebner). The overall Scholarship Fund went up by about \$5,000 during 1985.

7. The Joint Annual Meeting, 1986, showed a surplus of about \$6,600. We recommend that the \$4,000 advance received from the E.S.C. be returned minus the approximately \$880 for the E.S.C. sponsored receptions. The remainder of about \$2,600 goes to the E.S.M. No restriction should be placed on the \$3,200 returned to the E.S.C. as they have a minor budget problem of about \$900,000 for the XVIII International Congress. This will be discussed more fully when the Joint Annual Meeting Committee makes its report.

John C. Conroy
Regional Director,
Entomological Society of Manitoba.

APPENDIX F

ESM ENDOWMENT FUND REPORT

The Endowment Fund has remained at the same level as last year. However, we expect the fund to grow to the ceiling of \$25,000 in 2 or 3 years. We feel the interest generated should be sufficient to publish the Proceedings and fund a student scholarship each year. We remind the Society, that the main purpose of the Endowment Fund is to publish the scientific papers, including those of regional significance. To encourage this objective, we suggest that the Finance Committee set aside some funds to fund the final stages of a research project and cover the pages charges in the Proceedings.

Revenue Canada status of the ESM Endowment Fund was investigated by R. Gadawski this year. In 1968 the Society was granted permission to accumulate up to \$5,000 as a "Registered Charity" for a period of 5 years, ending in 1973. This provision enabled the Society to establish the "Endowment Fund", and to use the income generated from the fund to finance the "Manitoba Entomologist". An amendment has been added to the Endowment Fund "Trust Agreement" set up by the Society, to substitute the "Proceedings of the Entomological Society of Manitoba" for the "Manitoba Entomologist".

Since 1973, the Society has not had specific permission from Revenue Canada to accumulate property. Therefore it must in any taxation year, expand amounts to at least 80% of the aggregate of amounts for which it issued donation receipts in the preceding taxation year. Since life memberships are the main source of donations, this has been an easy requirement to meet. The treasurer has filed statements with Revenue Canada each year, and any donation receipts are submitted at that time. The Endowment Fund Committee feels the Society has complied with the regulations for a registered charity.

October 16, 1986
Wally Askew
Randy Gadawski
Reinhart Brust, Chairman.

Entomological Society of Manitoba
Annual Report of the Endowment Fund Board

Guaranteed Investment Certificates with Royal Trust				
<u>Cert. No.</u>	<u>\$ Amt.</u>	<u>Interest Rate</u>	<u>Maturity</u>	<u>Annual Int.</u>
001310705	2000	10.500	Oct. 1991	210.00
LQ1596	2000	10.875	Aug. 1990	\$217.50
JJ4133	7200	12.125	Nov. 1989	873.00
EN9903	2000	12.375	Apr. 1989	247.50
XM3845	3000	10.875	Dec. 1988	326.25
XK5133	2000	11.375	June 1988	227.50
HK9093	3024.33	12.375	Dec. 1987	374.26
Total	21,224.33	\bar{x} 11.666		2,476.00

W. Askew
R. Gadawski
R. Brust, Chairperson
October 21, 1986.

APPENDIX G

The Finance Committee reviewed the income and expenses of the Society, and have projected a budget for 1987-1988. We feel the introduction of the Student Scholarship this year is a very positive step towards encouraging good science and student participation in the Entomological Society of Manitoba. The committee recommended that the Society in folding display boards. These were purchased and will be stored by the Youth Education Committee, and are planned for use at malls and society events. The Finance Committee also wishes to commend the Youth Education Committee on the attractive ESM pin which adorns the lapels of many non-ESM members as well. The production cost for the pin appears in the Youth Education budget, but will be repaid as the pins are sold.

The Finance Committee views the Newsletter as a very important contribution to the Society. Without this, our membership would undoubtedly

decrease. The Proceedings of the ESM are well prepared, and report the various committee activities, but the Finance Committee is concerned about the absence of scientific contributions. We feel that Society members have research results that should be published in the Proceedings, and that monies should be budgeted to encourage publication of these papers. We also suggest that the Proceedings Editor and Finance Committee be authorized to fund some final costs of a selected research project (Library searches, graphics, vehicle mileage) to speed up publication in the Proceedings. For 1987-88, we have added \$400 to the ESM Proceedings budget line for this purpose.

The Newsletter Editor feels the cost of the Newsletter can be reduced slightly and the Finance Committee felt that the Social Committee should finance a greater share of their costs through increased charges for events. If the inducement to publish scientific papers is successful, we would recommend that more society funds be assigned to this very important activity. We remind the Society that the main purpose of the Endowment Fund is to publish a scientific journal. We must strive to return our society and its members to this objective.

The student ESM membership fee has been \$2.50 for at least 15 years, and the Finance Committee recommends it be raised to \$5.00 to cover the member cost for the Proceedings and the Newsletter.

Recommendation: 1) ESM student membership fee be raised to \$5.00 beginning November, 1987.

2) That \$400 be budgeted for publication related costs of a scientific paper to be published in the Proceedings of the Entomological Society of Manitoba.

Nov. 13, 1986

APPENDIX G

Entomological Society of Manitoba

BUDGET ITEMS	1984-85 ¹ Actual	1985-86 Actual	1986-87 Actual & Projected	1987-88 Projected
Endowment Fund	21,224.33	21,224.33	21,224.33	23,000.00
INCOME				
Endowment Fund and Bank Interest	2,471.28	2,852.97	2,700.00	2,800.00
Dues, ESM	1,483.36	1,483.36	1,300.00	1,300.00
Subscriptions, Proceedings	367.33	384.44	300.00	300.00
Annual General Meeting	1,912.50	1,814.50	2,400.00 ³	1,800.00
Youth Education Committee	200.00		400.00	200.00
Social Committee	131.00	111.00	100.00	100.00
Student Award (SWAT)			100.00	100.00
Miscellaneous	71.43	75.12	100.00	100.00
Proceedings, ESM - Page charges	538.41	425.00		
Totals	7,175.31	7,043.53	7,600.00	6,700.00
EXPENSES				
ESM Scholarship			1,000.00	1,000.00
Proceedings, ESM	1,001.90	936.63	960.28	1,400.00 ⁴
Annual General Meeting	1,280.19	1,649.61		1,400
Invited Seminar Speaker(s) (AGM)	747.44	749.90		750.00
Newsletter & Photocopying	633.32	576.27	500.00	500.00
Postage	524.92	659.44	650.00	650.00
Youth Education Committee		1,934.56 ²	500.00	300.00
Awards Committee	0.00	115.29	300.00	300.00
Stationery Supplies	44.84	99.41	150.00	150.00
Social Committee	358.25	364.92	350.00	250.00
Miscellaneous	583.70	105.51	150.00	100.00
Total	5,174.56	7,191.54	4,560.28	6,800.00

¹ Fiscal year ends 31 August.

² Includes \$477 cash advance for ESM Pins.

³ Includes \$500 cash advance.

⁴ Includes \$400 publication costs for scientific paper(s).

Wally Askew,
Colin Demianuk,
Randy Gadawski,
Robert Roughley,
R.A. Brust, Chairperson.
November 13, 1986.

APPENDIX G, continued.Amendment Two to the Trust Agreement, set up by the Society on 27 October, 1969, known as the Endowment Fund.

In the Executive Meeting of 7 April 1982 held at the Grant Motor Inn, Winnipeg, the results of the mail ballot on proposed changes to the Society's by-laws concerning termination of the Manitoba Entomologist were reported by the Secretary, Dr. Noel White. Fifty-seven of 59 ballots favoured the proposal to stop publication of the Manitoba Entomologist. The by-laws were changed to reflect this change.

In the Executive meeting of 20 September, 1982, the Secretary was instructed by the Executive to delete reference to the Manitoba Entomologist from the Rules and Regulations of the Society.

A report by the Editorial Board concerning proposed changes to the Proceedings of the Entomological Society of Manitoba, relating to cessation of publication of the Manitoba Entomologist was presented to the Annual General Meeting of the Society held on 5 November, 1982 (Vol. 38, p. 15-16, Proc. Entomol. Soc. Manitoba, 1982). The suggested format of the Proceedings included 1) Guest Speaker's address, 2) Referred publications, 3) Special Articles, 4) Abstracts of Papers Presented, 5) Minutes and Committee Reports, 6) Membership List. A motion on acceptance of the report was tabled and left with the Executive.

The Editorial Board report presented to the Annual General Meeting of the Society of 4 November, 1983 outlined recommendations concerning inclusion of scientific papers in the Proceedings and outlined possible formats for the future editions of the Proceedings. It was recommended that the proposals presented in 1982 be accepted (see above) and that the criteria for accepting scientific papers and the editorial policies applied to them be the same as previously established for the Manitoba Entomologist (Vol. 39, p.13-15, Proc. Entomol. Soc. Manitoba). A motion to accept the report of the Editorial Board was carried by members of the Society.

As a result of the above action, reference to the "Manitoba Entomologist" in the Trust Agreement should read "Proceedings of the Society".

R. Ellis, President
N. White, Secretary
R.A. Brust, Endowment Fund Chairman
W. Askew, Treasurer
F. Matheson, Endowment Fund Member
June 24, 1985.

APPENDIX H

ANNUAL REPORT OF THE PUBLICITY COMMITTEE

Traditionally, the Publicity Committee has been limited to the Committee Chairperson, often equated with being the ESM Newsletter Editor. However, to provide for an expanded Newsletter format, the Publicity Committee has expanded to include Marjorie Smith as Associate Editor. This doubling of effort and sharing of responsibilities has proven to be very successful and will be encouraged in the future.

It is expected that four issues of the ESM Newsletter will be prepared for Volume 13 in 1986. A spring and summer issue have already been compiled and mailed to members. I welcome this opportunity to thank all members of the Society who have submitted information for publication in the Newsletter.

I share the concern of the Finance Committee regarding the absence of scientific publications in the latest issue of the Proceedings of the ESM. As such, I have recommended to their Chairperson, R. Brust, that some of the funds normally allocated to the Publicity Committee be made available to research projects of regional interest. The Publicity Committee is agreed that this will in no way compromise the quality of the Newsletter.

R.M. Gadawski
Chairperson
17 October 1986.

APPENDIX I

SOCIAL CONVENOR'S REPORT

A luncheon on the 3rd of March 1986 at the Norlander attracted 29 people. Dr. R.C. Plowright gave a slide presentation on the "Sociobiology of Bumblebees".

The New Members Evening on the 22nd of March 1986 was attended by 40 people. The speaker Dr. R.E. Harder presented a travelogue of his trip to China.

It should be noted that the current cost to send activity notices to the membership, including printing and postage, is approximately \$28. The proposed budget for the 1986 Social Committee underestimated these costs and future Social Convenors should revise budget estimates to include the publicity costs.

Marc Trottier
November, 1986.

APPENDIX J

YOUTH ENCOURAGEMENT

The primary focus of Youth Encouragement for 1986 has been the presentation of talks to approximately 20 various school grades, cubs, beavers, and nature groups. The assistance of Terry Galloway in presenting some of these talks is gratefully acknowledged. All of the presentations involve a slide show of the Ross Collection, which has become rather worse for wear and thus, a copy of these slides has been made.

Most of the money this year has been used to purchase a badly needed display board for future mall displays and annual meetings. A pin of our Society logo was manufactured this year. The initial cost was covered by the Society, but any profits from the sales will be donated to this committee. Approximately half of the pins have been sold, and they will now be advertised in the Can. Ent. Bulletin.

Please find enclosed the 1986 budget for Youth Encouragement and Public Education.

	Expenditures	Credits
ESC Grant		\$200.00
ESM display board	\$1,456.83	
Duplication of slides	83.95	
ESM Pins	453.00	350.00
Total	\$1,993.78	\$550.00

Wendy Ralley
Chairperson

APPENDIX K

ENTOMOLOGICAL SOCIETY OF MANITOBA
REPORT OF THE
COMMON NAMES COMMITTEE

There have been no applications from ESM members during the past year for new common names or changes in old common names and there are therefore no activities to report.

A.G. Robinson, Chairperson.

APPENDIX L

REPORT OF THE ARCHIVIST

The Archives materials of the Entomological Society of Manitoba are held in Room 213B of the Department of Entomology, University of Manitoba. The retiring treasurer of the ESM, W.L. Askew, has recently added two boxes of old records to this collection. Donations of any old records are welcome.

A.G. Robinson, Chairperson

APPENDIX M

ESC HONORARY MEMBERS REPORT

No new names were forwarded this year. The chairman urges that ESM members who wish to nominate someone as an ESC Honorary Member please forward the name to the ESM Executive or to the chairperson appointed by the ESM.

October 16, 1986
R. Brust, Chairman.

APPENDIX NREPORT OF THE 1986 STUDENT ACHIEVEMENT
AWARD COMMITTEE.

Miss Lynn Manaignre was selected the recipient of the 1986 Student Achievement Award. Her selection was announced at the Joint Annual Meeting of the Entomological Societies of Canada and Manitoba held in October. The award of \$100.00 in books of her choice will be made at the New Members Social in March, 1987.

Guidelines for a new award were drawn up by this year's Committee, and approved by the Executive. The new Student Award has the purpose of fostering interest in entomology, particularly natural methods of insect control, and the proper use of insecticides. It consists of a presentation of \$100.00 and a certificate from SWAT Professional Exterminators Inc. to an undergraduate student selected by the Committee. The first recipient of this award is Miss Lisa Reichert, a fourth year entomology student at the University of Manitoba. The presentation was made at the Annual Meeting, November 14, 1986.

A. Wiens

SWAT STUDENT AWARD

Purpose of Award:

The purpose of the award is to foster and encourage interest in Entomology, particularly in natural methods of insect control, and the proper use of insecticides. The award shall consist of a cheque for \$100.00 and a certificate, suitably inscribed, to be presented from SWAT Professional Exterminators Inc. to an undergraduate student pursuing Entomology at one of the universities in Manitoba. One award will be presented annually.

Eligibility:

Eligible candidates are those students enrolled in an undergraduate program, and who have completed at least their first year of undergraduate studies by September 1. Students in their final year are also eligible prior to September 1 of the year of their graduation. A student may be presented the award only once.

Selection Criteria:

It is expected that candidates will have shown exceptional interest in entomology, and demonstrate:

- 1) Superior scholastic ability, as evidenced by their collections, or excellence in class assignments,
- 2) High research potential, as shown by their attitude, originality, and industriousness in laboratory courses, or summer work, and
- 3) Excellent communication skills, both written and spoken.

Candidates for this award shall be solicited from professors, through notice to their Department Head. Professors should submit a letter of recommendation detailing the student's achievements. The student should also submit a current transcript, and a short (less than one page) description of their future plans in the field of entomology.

Procedures for Selection:

On or about January 1 of each year the Chairperson of the Student Achievement Award Committee of the Entomological Society of Manitoba will send an award notification letter bearing the President's signature to the Heads of the Departments of Entomology, Zoology, and Biology of the three major Manitoba universities. The letter, to be posted in their departments shall notify the students and professors of the SWAT Student Award for the current year. Notification at this time will provide students with about four months notice prior to the summer break.

Professors and students shall send their materials for assessment to the Awards Committee Chairperson prior to October 1. Selection of the best qualified undergraduate student will be made by the E.S.M. Student Award Committee, and recommendation will then be forwarded to the SWAT Professional Exterminators Inc.'s representative for production of the monetary award and certificate. Presentation of the award will take place at the Entomological Society of Manitoba's Annual Business Meet-

ing. Following a short introduction of the student by the Meeting Chairperson, or the head of the Awards Committee, the award will be given to the student by the Company's representative.

APPENDIX O

E.S.M. SCHOLARSHIP COMMITTEE REPORT

The E.S.M. Scholarship Committee (1985-1986) consisted of Drs. T.D. Galloway, N.D.G. White, and S.C. Jay (Chairperson).

Letters were sent out to Chairpersons of Departments of Zoology (Universities of Manitoba and Brandon), Biology (University of Winnipeg), and Entomology (University of Manitoba) asking them to circulate and post guidelines and other information to prospective candidates about the scholarship. The Secretary (E.S.M.) made applications and referee's forms available through his office. para; Four excellent candidates made application for the scholarship. The committee recommended that the scholarship be presented to Ingolf Askevold, Ph.D. candidate in the Department of Entomology (University of Manitoba).

APPENDIX P

REPORT OF THE E.S.C./E.S.M. JOINT ANNUAL MEETING COMMITTEE

The Annual Meeting was held at the Holiday Inn South, Winnipeg, from 6 - 8 October 1986. The Heritage Lecture, entitled "The Research Branch - 100 years of progress" was given by Dr. E.J. LeRoux, who was also the Gold Medal. The plenary lecture "New Generation insecticides" was given by Dr. J.E. Hollebhone. There were two symposia, "Insect-Plant relationships" and "Current topics in insect physiology"; a student paper competition, sponsored by E.S.C., in which there were 35 entries; submitted papers sessions in which 54 papers were offered; and a poster session and commercial exhibition area. Social events included a reception at the Winnipeg Art Gallery, a banquet and musical entertainment at the Holiday Inn South, and a spouses program.

The total registration at the meetings was approximately 250. Donations were received from N.S.E.R.C., Agriculture Canada, Manitoba Department of Agriculture, the City of Winnipeg, and over 20 companies. Advances were received from the Entomological Society of Canada and the Entomological Society of Manitoba. The Joint Annual Meeting committee has recommended to the Executive of E.S.M. that, once all bills have been paid, remaining money from the meeting account be disbursed as follows: the advance from E.S.C. be returned (less bills for E.S.C. sponsored social events), the advance from E.S.M. be returned, and the remainder (probably about \$2000) be transferred to the general revenues of E.S.M.

The Joint Annual Meeting Committee wishes to thank all those who assisted in the organization and running of the meetings.

J.C. Conroy
G.H. Gerber
N.J. Holliday (Chairperson)

APPENDIX Q

MEMBERSHIP COMMITTEE - ANNUAL REPORT 1986

The primary activity of the Membership Committee in 1985-86 has been to initiate compilation of a list of amateur entomologists in Manitoba. The current list stands at 25 amateurs, 6 of which belong to the E.S.M. It is recommended that each of these entomologists be contacted, not with the intent of persuading them to become active members (though this might be a logical result), but to encourage them to publish worthwhile observations in the proceedings. I further recommend that page charges be paid by the Society, when manuscripts of suitable merit are submitted, perhaps to a maximum number of pages.

The Membership Committee nominated Mr. Paul Klassen as the recipient for the Norman Criddle Award, presented at the J.A.M. on 6 October at the Winnipeg Art Gallery, by Miss Alma Criddle.

T.D. Galloway (Chairman)
W.B. Preston
R.E. Roughley

OBITUARIES

Robert John Heron 1919-1987

Jack Heron died on February 25, 1987, at his home in Brentwood Bay, British Columbia.

He was born on November 22, 1919, in Winnipeg, Manitoba, where he attended public and high schools. He obtained the degree B.Sc. (Honours) in 1945 at the University of Manitoba, the M.Sc. degree in 1949 at the University of Minnesota, where he specialized in Entomology, and the Ph.D. degree in 1962 at the University of Manitoba. He taught school for a year before deciding to go into the biological sciences ultimately focusing on Entomology in which he spent his career. He was employed as Forest Entomologist and Research Scientist with the Canadian Forestry Service in Winnipeg from 1945 to 1970, and later, 1970 to 1971 as Research Scientist with the Canadian Forestry Service, Sault Ste. Marie, Ontario.

Jack made valuable contributions and published several scientific papers on the ecology and physiology of the larch sawfly and spruce bud-

worm. Out of his doctoral thesis came some significant basic papers on the feeding behavior of the spruce budworm which were published in reputable scientific journals. Jack was meticulous, exacting, thorough, and totally dedicated to his work. Even after retirement he maintained an active interest in butterflies, birds, and marine biology. One of his most enjoyable projects was done from 1974 to 1976, after his retirement from the Forestry service, as a Research Associate with the Department of Entomology, University of Manitoba, when he spent three summers conducting field studies for Parks Canada on the Butterflies and skippers of Riding Mountain National Park, in Manitoba.

For many years Jack had a summer home on the Lake of the Woods, near Longbow Lake, Ontario and he made welcome many visitors, including both of the undersigned. He was an ardent naturalist, particularly in Zoology, and for many years participated in the meetings of the Natural History Society of Manitoba. For about five years after retirement he spent winter months at Bradenton, Florida, where he was active in the local branch of the Audubon Society and Camera Club. He was a member of the Entomological Society of Canada, and had served as Editor Librarian of the Entomological Society of Manitoba.

He enjoyed reading, listening to good music, and canoeing. Although quiet and unassuming, Jack was socially active and enjoyed the company of family and friends. He had a healthy sense of humor and was fond of telling and listening to anecdotes.

The word Mensch literally means a man or human but in Yiddish it has a broader connotation in that it describes a person of superior qualities - reliable, responsible, dependable, compassionate, understanding, and kind. Jack was a Mensch. He will be greatly missed by his family and friends. He is survived by his sister Florence Donald, four nephews and their wives and children, and many friends who will keep his memory very much alive.

S.R. Loschiavo
A.G. Robinson

Lawrie Booth Smith 1930-1987.

Dr. Lawrie Booth Smith died on January 29, 1987, peacefully at the Misericordia Hospital, Winnipeg, following a few weeks of illness.

Lawrie was born in Oakville, Ontario, on June 6, 1930, and completed his secondary education at Oakville High School. In 1948 he entered McMaster University from which he graduated in 1952 with a B.Sc. (Honours) in Botany and Zoology. He continued as a post-graduate student at the University of Toronto (Ontario Agriculture College, Guelph) earning an M.S.A. degree in 1955. In June of that year he joined the Stored Products Insects Unit, Canada Department of Agriculture Ottawa and went to Nottingham University, England, where he obtained Doctor of Philosophy degree in 1960. His thesis was on the population dynamics of rusty grain beetle, Cryptolestes ferrugineus (Stephens).

During his absence, the center for stored products entomology was transferred to Winnipeg, under the Crop Protection Section of the Research Station Agriculture Canada located on the campus of the University of Manitoba. Upon his return from England in 1960, Lawrie joined the Winnipeg Research Station where he embarked on long-term research on the biology and population dynamics of stored products insects. His research included some important pioneer work on cold tolerance of several economic species, and it provided the basis for recommendations on temperatures and exposure times that will kill rusty grain beetles in stored grain. He found that certain insects of recent introduction into Canada can successfully overwinter in some parts of the country. His research included a distribution study of insects in farm granaries in western Canada and the taxonomy of various species of insects associated with stored products. Whatever project he undertook, Lawrie conducted it with diligence, dedication, and thoroughness.

Lawrie was also an Honourary Professor at the University of Manitoba and Adjunct Professor at Simon Fraser University where he taught a short course in stored product entomology which was part of a Master's program in pest management and attended by students from many parts of the world.

Lawrie was a member of the British Ecological Society, Entomological Society of America, Entomological Society of Canada, Entomological Society of Manitoba and Manitoba Naturalists Society which he joined in 1961. He served as president of the Entomological Society of Manitoba in 1961-62 and as president of the Manitoba Naturalists Society for two years 1965 to 1967. Lawrie was one of the group that initiated the creation of the Ralph Bird award granted by the Manitoba Naturalists Society. His interest in birds resulted in several popular articles published between 1962 and 1969. He was keenly interested in ecology and the environment but maintained a balanced, reasonable and objective attitude to the subject of environmental protection. Lawrie was a member of the Professional Institute of the Public Service of Canada and of Sigma Xi.

Lawrie retired as a professional research scientist on November 28, 1986, with a view to pursuing a new career in counselling for which he had started to prepare himself academically at the University of Manitoba. Possessed with a deep understanding of, and compassion for fellow human beings, Lawrie already had the basic prerequisites for a second career.

He was an active member of St. Aidan's Anglican church to which he contributed much time in the service of people. Lawrie was a devoted family person and will be greatly missed by his wife Marion, his daughter Jennifer, two sons Kevin and Christopher, and many other members of the family, and friends. Lawrie's memory will continue to live in the minds and hearts of those who knew and loved him.

S.R. Loschiavo

ABSTRACTS OF PRESENTATIONS TO THE 1986 JOINT ANNUAL MEETING
OF THE ENTOMOLOGICAL SOCIETIES OF CANADA AND MANITOBA

STUDENT COMPETITION - SESSION I

Monday Afternoon, October 6

INFLUENCE OF PLANT ANTIBIOSIS THROUGH FOUR TROPHIC LEVELS. David B. Orr, and David J. Boethel, Department of Entomology, Louisiana State University, Baton Rouge, Louisiana, USA, 70803. The effects of an insect herbivore-resistant soybean genotype on relationships between four levels of a trophic system were examined in the laboratory using both greenhouse and field-grown plants. Pre-imaginal development of the predatory pentatomid, Podisus maculiventris (Say), was affected by soybean antibiosis in a manner similar to that of its lepidopteran prey, Pseudoplusia includens (Walker). Pre-imaginal development time was increased, and cumulative weight gain tended to be reduced on both greenhouse and field-grown resistant foliage; although mortality was increased on greenhouse-grown resistant foliage, it appeared unchanged on field-grown foliage. Reproductive capacity of P. maculiventris reared on P. includens larvae that were fed resistant soybean generally was unaffected, although peak progeny production was delayed and extended slightly. Pre-imaginal development and adult emergence of the egg parasitoid Telenomus podisi Ashmead from eggs of P. maculiventris reared on P. includens larvae that were fed resistant soybean were unaffected. However, the overall reproductive capabilities of this parasitoid were reduced. Our results demonstrate that plant antibiosis can influence the biology of organisms over four trophic levels, thus documenting a relationship heretofore undescribed.

ACTIVITY AND DIVERSITY OF ADULT CARABIDAE IN A CARROT FIELD IN SOUTHWESTERN QUEBEC. Danica Baines, Department of Entomology, Macdonald College, Ste. Anne de Bellevue, H9X 1C0. Carabidae were monitored using pitfall traps in a carrot field in Southwestern Quebec. Thirty seven species were captured; species diversity was greater in the field border while carabid density was higher in the carrot field. Five species were most abundant in the carrot field: Bembidion quadrimaculatum oppositum Say, Clivina fosser L., Pterostichus melanarius Ill., Pterostichus lucublandus Say, and Anisodactylus santaecrucis F. In the field borders, Amara sp., Harpalus sp., and Stenolophus comma F., predominated.

Carabid activity was influenced by temperature and moisture as shown by seasonal pitfall catches. The peak in trap catches for the dominant species was correlated with the presence of the stages of

carrot weevil (Listronotus oregonensis LeConte). This indicated that these carabid species may have an impact on the population dynamics of the carrot weevil.

TESTS WITH ENTOMOGENOUS NEMATODES FOR CONTROLLING THE NORTHERN CORN ROOTWORM, DIABROTICA LONGICORNIS BARBERI. Graham S. Thurston, Dept. of Entomology, Macdonald College of McGill University, Ste. Anne de Bellevue, P.Q. H9X 1C0.

The entomogenous nematodes Steinernema feltiae All and Mexican strains, Neoaplectana bibionis Sn strain, and Heterorhabditis heliothidis were tested for effectiveness against northern corn rootworm, Diabrotica longicornis barberi (NCR). In laboratory bioassays with first instar larvae of NCR, N. bibionis and S. feltiae Mexican strain had the lowest LD 50's. These two nematodes were then tested in a field experiment. Treatments compared were two rates of application of each nematode in furrow at seeding time; a granular insecticide (fonofos) also applied at seeding time; and an untreated control. Larval NCR densities and corn root damage were determined approximately six weeks after treatment. Grain yield and plant height were measured at maturity.

PARASITIDS OF ACYRTHOSIPHON PISUM (HARRIS) (HOMOPTERA: APHIDIDAE) IN MANITOBA. F. O. Matheson and H. G. Wylie, Agriculture Canada Research Station, Winnipeg, Manitoba, Canada, R3T 2M9.

A survey of the parasitoids of the pea aphid was conducted in field peas and alfalfa in the Red River Valley area of Manitoba in 1983, 1984 and 1985. Praon peguodorum Viereck and Aphidius ervi Haliday comprised 91-100% of the primary parasitoids collected each year. Praon occidentale Baker, Aphidius pisivorus Smith and Aphidius smithi Sharma and Subba Rao comprised the remainder of the primary parasitoid complex. A complex of twelve hyperparasitoids including five pteromalids, Asaphes lucens (Provancher), Coruna clavata Walker, Pachycrepoideus vindemiae (Rondani), Pachyneuron siphonophorae (Ashmead), Pachyneuron sp.; three alloxystids, Alloxysta victrix (Westwood), Alloxysta megourae Complex, Phaenoglyphis ambrosiae (Ashmead); three megaspilids, Dendrocerus carpenteri (Curtis), Dendrocerus sp. A., Dendrocerus sp. and one encyrtid, Aphidencyrtus aphidovor (Mayr) were present in small numbers. A. lucens comprised 70% of the total number of hyperparasitoids collected.

EARTHWORM MUCUS STIMULATES OVIPOSITION IN A PREDATORY FLY. Dael E. Morris, Department of Biology, Laval University, Ste-Foy, Quebec. (Present address: Department of Biology, Queen's University, Kingston, Ontario.)

Coerosia tigrina (Fab.) (Diptera: Anthomyiidae) adults are predators of other insects, such as the onion maggot fly, Delia antiqua (Meig.), while larvae are soil dwelling and feed on earthworms. Eggs hatch about one week after they are deposited at the soil surface, then larvae locate an earthworm host. A primary mechanism in host finding, however, is believed to be oviposition site preference by the C. tigrina female.

A significant proportion of females displayed the ovipositor, which is normally concealed, when isolated in a dish with earthworm mucus during peak oviposition period, as compared to control flies given water, and 75% of the females responding to mucus oviposited within the 10 min. test period. This indicates that an earthworm mucus-borne component acts as a kairomone stimulating oviposition in *C. tigrina*. In a separate experiment, females did not respond to the kairomone when prevented from contacting earthworms. Further, the effects of the time of day of encounter with mucus on the diurnal oviposition rhythm was tested for 5 days. Females oviposited more eggs between 1600 and 1800 hours during peak oviposition, when exposed to mucus at this time, and there were significantly more incidences of egg-laying during the photophase, when compared to a group of females exposed to mucus between 0600 and 0800 hours, or to a control group where mucus was entirely absent. Peak egg-laying did not shift from the afternoon although mucus was present 0600-0800 hours in the one group, while peak egg-laying was postponed until just before the onset of scotophase at 2030 hours in the control group. The significance of these results is discussed relative to the surfacing activity of earthworms.

DISPERSAL OF *DIPLOLEPIS SPINOSA* (HYMENOPTERA: CYNIPIDAE) AND ITS PARASITOID COMMUNITY WITHIN A PATCH OF DOMESTIC ROSES. Mary Jane Kelleher, Department of Biology, Laurentian University, Sudbury, Ontario, P3E 2C6.

Diplolepis spinosa induces a large stem gall on wild roses in southern Canada. Large numbers of *D. spinosa* and its gall have recently moved onto *Rosa rugosa*, a common domestic shrub rose in Ontario. An assemblage of five species of parasitoids associated with the wild galls has moved along with the gall inducer onto these roses. Galls of *D. spinosa* are particularly common on *R. rugosa* in Sudbury, Ontario, where a parking lot with six large rose beds, each containing several hundred galls, were available for study. All galls were removed from four of the six rose beds to examine dispersal of the entire component community.

LATITUDINAL VARIATION IN THE PHOTOPERIODIC RESPONSES OF PEA APHID POPULATIONS (HOMOPTERA: APHIDIDAE). Marjorie A. H. Smith and Patricia A. MacKay, Department of Entomology, University of Manitoba, Winnipeg, Manitoba, R3T 2N2.

The purpose of this study was to determine whether or not there was a latitudinal gradient in the photoperiodic responses of pea aphid populations. The approach was to measure photoperiodic responses of all clones at a standard photoperiod of 14L:10D at 20°C, and compare populations by making use of information on the relationship between photoperiod and the morphs of progeny produced. The tests involved 90 clones from 4 latitudes, ranging from 44°45'N to 53°12'N. The results showed that all 4 populations differed significantly in their responses. In general, the test photoperiod was perceived as being relatively long by the more southerly clones, and relatively short by the more northerly

clones. The findings are discussed in relation to the high migratory tendency of the pea aphid.

IMPACT OF LEPIDOPTEROUS LARVAE ON CAULIFLOWER IN SOUTHERN ONTARIO. Jeff Stewart, Department of Environmental Biology, University of Guelph, Guelph, Ontario, Canada, N1G 2W1.

Feeding by imported cabbage worm (ICW), cabbage looper (CL), and diamondback moth (DBM) larvae did not affect head weight or diameter of cauliflower, 'Snowball Y', sprayed biweekly with permethrin (968.2 g, 17.5 cm), managed with a threshold from transplant to harvest (986.5 g, 17.1 cm), or managed with a threshold from curd formation to harvest (936.1 g, 17.0 cm). Values for the untreated control were significantly lower (805.5 g, 16.1 cm). The proportion of unmarketable heads was lowest for plants sprayed at biweekly intervals (4.0%) and greatest for the control (89.6%). Permethrin was applied at 70 g a.i./ha. A threshold of 0.5 cabbage looper equivalents (CLE) per plant was employed either from transplant to harvest or from curd formation to harvest. One CLE = 1 CL = 1.5 ICW = 20 DBM. Cauliflower plots managed with the threshold yielded heads of a size similar to those protected with biweekly applications of permethrin but head quality was reduced. A threshold of less than 0.5 CLE per plant after curd formation is required to produce cauliflower of an acceptable size and quality.

DAMAGE ASSESSMENT OF THE SUNFLOWER BEETLE, ZYGOGRAMMA EXCLAMATIONIS (F.) IN MANITOBA. Yakub D. Deedat and Patricia A. MacKay, Department of

Entomology, University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2N2. In 1984 and 1985 intensive studies were conducted to determine the effects of defoliation by sunflower beetles on sunflower. Results from both years indicated that densities of up to 4 adults per plant and densities of up to 20 larvae per plant did not significantly reduce plant height, head diameter or yield.

EFFECT OF INFESTATION BY THE GREATER GRAIN BORER, PROSTEPHANUS TRUNCATUS (HORN) AND THE LESSER GRAIN BORER, RHYZOPERTHA DOMINICA (FABRICIUS) (COLEOPTERA: BOSTRICHIDAE) ON STORED CORN. C. J. Demianyk and R. N.

Sinha, Agriculture Canada Research Station, 195 Dafoe Road, Winnipeg, Manitoba, Canada, R3T 2M9.

The quantitative and qualitative losses in stored corn infested by Prostephanus truncatus (Horn) and stored for 20 weeks at 30°C and 70% RH were compared to those caused by Rhyzopertha dominica (Fabricius). Treatments included insect-infested whole corn, uninfested whole corn plus ground corn (dockage), and uninfested whole corn. The quality assessment criteria included adult insect number, dust weight production, seed moisture content, changes in seed fat acidity value, germination, and microfloral infection of seeds. Both insect species multiplied quickly, with P. truncatus peaking at 880 adults/120 g corn by week 14, then declining slightly because of an exhausted food supply. R. dominica adult numbers increased to 550/120 g corn by week 14 and 1300/120 g corn by week 20. P. truncatus produced significantly more

dust ($P < 0.005$) than *R. dominica*, with over 30 g dust produced by week 11 declining to 24 g by week 20; *R. dominica* produced over 14 g dust by week 20. Both species caused significant increases ($P < 0.005$) in seed moisture content (over 16% compared to 13% in controls); fat acidity values (300 and 410% increases for *P. truncatus* and *R. dominica*, respectively); and bacterial infection of seeds. Both species caused a significant decrease ($P < 0.005$) in seed germination compared to controls, with *R. dominica* reducing germination to 0 by week 11. *P. truncatus* did not totally eliminate germination because some kernels at the top of the grain mass remained undamaged throughout the experiment. There was no difference ($P > 0.05$) in *Penicillium* spp. infection levels among treatments, and only *P. truncatus* caused a decrease ($P < 0.005$) in infection by *Aspergillus glaucus* group after week 11.

YIELD REDUCTION OF CAGED RUSSETT-BURBANK POTATO PLANTS DUE TO INFESTATION BY COLORADO POTATO BEETLE. Derek J. Lactin, Department of Entomology, University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2N2. The Colorado potato beetle (CPB), *Leptinotarsa decemlineata* (Say) (Coleoptera: Chrysomelidae) is the major economic pest of potato (*Solanum tuberosum* L.) in S. Manitoba. In this area, growers apply insecticides according to a schedule, and pay little attention to CPB populations. The present study aims to establish the economic injury level (EIL) of CPB on potato cv. Russett-Burbank in this area. This information may benefit growers by reducing unnecessary chemical applications. I present one full year's data (1985), and some preliminary data from 1986.

Field densities (FD) of each CPB instar were monitored weekly in a potato field in Portage la Prairie, MB. Multiples of FD were maintained over the growing season on caged plants on the University of Manitoba campus. The market values of the tubers produced by the caged plants were regressed against the multiples of FD to which they had been subjected. The EIL was interpolated from this regression. This value was much higher than the densities observed in the field at the time when the farmer applied insecticide. The EIL estimate had a large standard error, due to difficulties in precisely maintaining CPB populations in cages, and to phenotypic variation among plants. Attempts to compensate for these difficulties and to generalize the results, were undertaken during the 1986 season. Results of these are presented and discussed.

INCIDENCE AND IMPACT OF POLYGRAPHUS RUFIPENNIS (KIRBY) (COLEOPTERA: SCOLYTIDAE) ON BLACK SPRUCE IN NEWFOUNDLAND, CANADA. Wade W. Bowers, Department of Biological Sciences, Simon Fraser University, Burnaby, British Columbia, Canada, V5A 1S6.

Examination of budworm damaged black spruce disclosed that *Polygraphus rufipennis* is an aggressive secondary bark beetle. Severely damaged trees baited with male-infested bolts were highly susceptible to beetle attack. On baited trees with less than 70% cumulative crown damage most attacks were unsuccessful. Crown recovery was evident among

unsuccessfully attacked trees and among trees protected with 2% lindane.

SUBMITTED PAPER

DISPERSAL BEHAVIOUR OF THE COLORADO POTATO BEETLE ON POTATOES. H. M. Morris and N. J. Holliday, Department of Entomology, University of Manitoba, Winnipeg, Manitoba, R3T 2N2.

Mark-release experiments of adult beetles in experimental plots showed that beetles did not move consistently in one direction. Wind influence on the direction movement of beetles was sometimes significant. The number moving was not influenced by density of beetles on the plants on which they were released.

Dispersal experiments in a large cage also showed that different densities on plants did not influence the proportion of adults which moved. The adult beetles moved either upwind or downwind to locate potato plants. The number of larvae moving, differed between defoliated and non-defoliated plants. High numbers of larvae even of the first instar were seen to move away from defoliated plants. Few larvae moved when leaves remained on the plant.

STUDENT COMPETITION - SESSION II

Monday Afternoon, October 6

FEEDING RESPONSES OF STABLE FLIES (STOMOXYS CALCITRANS (L.)) TO BLOOD FRACTIONS AND ADENINE NUCLEOTIDES.

Ann Ascoli and Jim Sutcliffe, Queen's University, Kingston, Ontario, Canada, K7L 3N6.

Stable flies, Stomoxys calcitrans (L.), were membrane-fed on blood fractions or chemically defined diets and amounts ingested were assessed volumetrically. Flies fed on whole blood, washed red blood cells, platelet-rich-, platelet-poor-, filtered and boiled plasma. Most failed to feed on the buffy layer, dialysed plasma, plasma filtrate and precipitated plasma proteins. Phagostimulatory activity of dialysed plasma was restored through the addition of a physiological concentration of NaCl and was further enhanced by the addition of adenine nucleotides and sodium bicarbonate buffer. Some feeding occurred on solutions of saline plus bicarbonate buffer. Dose-response relationships of some adenine nucleotides were also determined.

FINE STRUCTURE OF OCELLI OF THE LARVAL BLACK FLY, SIMULIUM VITTATUM (DIPTERA: SIMULIIDAE).

Joyce M. Nyhof.

The fine structure of light and dark-adapted ocelli of last instar larval Simulium vittatum Zetterstedt was described using scanning and transmission electron microscopy. Larvae have six ocelli arranged in groups of three on each side of the head. The larger two ocelli of each group are externally visible as two darkly pigmented eyespots. The third, smaller ocellus lacks pigmentation and, therefore, is not externally visible. Each ocellus has its long axis oriented dorso-ventrally, has thirteen reticular cells, and lacks an expanded cuticular lens. Conspicuous rhabdoms occur in the three ocelli. The rhabdoms of the pigmented ocelli are centrally located and enveloped by pigment granules. The microvilli of the rhabdoms are oriented primarily in one plane, an indication of a possible sensitivity to polarized light. The rhabdom of the unpigmented ocellus is eccentrically located and its microvilli are not uniplanar. Each ocellus has numerous cell organelles, including mitochondria, ribosomes, endoplasmic reticulum and Golgi bodies. Especially conspicuous are membranous figures, which are associated with the nuclei and vary in size and complexity from simple stacks to lamellar whorls. These latter organelles are probably involved in the turnover processes of the rhabdomeric membranes.

THE DISTRIBUTION OF ADULT FEMALE BLACKFLIES (SIMULIIDAE) IN RELATION TO TERRESTRIAL HABITAT IN NEWFOUNDLAND.Frances Martin, Department of Biology, Memorial University, St. John's, Newfoundland, Canada, A1B 3X9. Adult female blackfly activity is influenced by several environmental factors. This study focused on the spatial distribution of certain large mammal feeders (Prosimulium mixtum and Simulium

venustum/verecundum complex) in relation to vegetational characteristics. Blackflies were collected using sweep nets and cylindrical sticky traps. Trapping experiments were conducted on the Avalon Peninsula, Newfoundland to determine differences in blackfly abundances in a hay pasture, open bog, sheltered bog, forest regrowth and mature fir forest. There were significantly fewer blackflies (collections composed largely of Simulium venustum/verecundum complex) collected on sticky traps operated in the pasture and forest compared to the other habitats. A similar distribution was observed in morning, afternoon and evening sweep net collections. These patterns in relation to environmental factors such as wind, reflected light intensity, saturation deficit, air temperature and trap visibility will be discussed.

EMBRYONIC AND LARVAL DIAPAUSE IN Aedes TOGOI (THEOBALD) (DIPTERA: CULICIDAE). Brian Galka, Department of Entomology, University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2N2.

The mosquito, Aedes togoi (Theobald), is a vector of numerous pathogens throughout the Pacific Rim region of the Far East. This species has been introduced to Canada and is currently established in localities near Vancouver and Victoria, B.C. My study focuses on how it overwinters in its North American habitat.

Results to date indicate that A. togoi undergoes larval or embryonic diapause, depending upon the ambient temperature and photoperiod. Larvae experience a fourth instar diapause at temperatures below 17°C where the photophase is less than 10½ hours per day. At temperatures above 17°C, larval development proceeds independently of photoperiod. Embryonic diapause is dependent upon the conditions experienced by the preceding pupal and adult stages, and its expression is dependent upon both temperature and photoperiod. At 22°C, I obtained 100% diapausing eggs when pupae and adults were kept at a photoperiod of 10L:14D. When these stages are maintained under long day conditions (18L:6D), at 22°C, nearly all the eggs hatch. These results demonstrate a high degree of similarity with those of the Nagasaki strain (32°N Lat).

THE EFFECT OF BITING FLIES ON THE BEHAVIOUR OF DAIRY HEIFERS. Wendy A. Ralley, Department of Entomology, University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2N2.

The daily and seasonal activity patterns of pastured cattle are influenced by blood-sucking flies. Behavioural responses of 40 and 34 dairy heifers, to biting flies, in 1983 and 1984, respectively, were observed at the Seven Sisters Grassland Project, Manitoba. Animals were divided equally into a control herd, and one which received a whole-body-spray of cypermethrin (1gm a.i.). Severe feeding by mosquitoes and horse flies caused an increase in the frequency of head tosses, foot stomps, tail switches and ear flicks, however, there were no significant treatment differences ($P=.05$) of these individual responses. Horse flies had the greatest effect on individual and group

behaviour causing the formation of grazing lines and bunching as a response to increased numbers. There were significant group differences between the beginning and end of the fly season, and significant treatment differences only at the end of the fly season.

SEASONAL DYNAMICS OF OROPSYLLA BRUNERI (SIPHONAPTERA: CERATOPHYLLIDAE), A FLEA PARASITE OF FRANKLIN'S GROUND SQUIRREL, SERMOPHILUS FRANKLINII AT BIRDS HILL, MANITOBA. Todd R. Reichardt, Department of Entomology, University of Manitoba, Winnipeg, Manitoba, R3T 2N2; Hoechst Canada, Inc., Agriculture Division, #109, 2915-21st St. N.E., Calgary, Alberta, T2E 7T1.

All fleas collected from Franklin's ground squirrels in 1982, and 99.73% of those collected in 1983 from study plots near Birds Hill, Manitoba, were Oropsylla bruneri. In both years, when 856 and 1,500 fleas were collected respectively, there were two distinct peaks in intensity of infestation. The first peak occurred from late May to early June while the second was from mid August into September. Mean intensity of infestation during these peaks was 20.0 and 24.5 in 1982; 19.2 and 26.8 in 1983. Reproductive activity in female fleas was determined based on stage of ovarian development.

A REVIEW OF THE ORDER MECOPTERA IN CANADA. Antonio M. Aranguren, Department of Entomology, Macdonald College of McGill University, Ste. Anne de Bellevue, Quebec, Canada, H9X 1C0.

The ultimate purpose of the present study is to produce a handbook of the Mecoptera of Canada. The specimens preserved in most of the major Canadian insect collections have been studied. Four families are represented, each by a single genus: Panorpidae (Panorpa; 12 spp.), Bittacidae (Bittacus; 3 spp.), Meropeidae (Merope; 1 sp.) and Boreidae (Boreus; 7+ spp.). Panorpa, Bittacus and Merope are eastern only and do not extend far into the boreal zone. Boreus is divided into eastern and western groups with several of the western species ranging northward through British Columbia into the Yukon. All Canadian species seem to belong to more northerly populations of species that extend southward, especially through the Appalachian region. The species have been reviewed and new characters of taxonomic interest have been noted.

PATTERNS AND EVOLUTION OF ENDOPHALLIC STRUCTURE IN DONACIINE LEAF BEETLES (COLEOPTERA: CHRYSOMELIDAE). Ingolf S. Askevold, Department of Entomology, University of Manitoba, Winnipeg, Manitoba, R3T 2N2. The endophallus is the apical complex of the internal sac of male genitalia. In Donaciinae, it primitively consists of a basal supporting block, median ejaculatory guide, and paired lateral and dorsal sclerites. In some species groups, parts of invaginated telescoping folds of the sac form distinct sclerites, or are evaginated to form novel structures. Shapes and arrangements of these sclerites are of great importance to identification of species of Donaciinae, and are usually species specific. The endophallus is of value at species-group, generic, and tribal levels as well. It is useful for phylogenetic

analysis because it exhibits far less homoplasy than do some external characters such as sculpture and appendage colour.

Donaciinae show three basic patterns of endophallic sclerite arrangement: 1) the generalized primitive, most similar to the condition found in the proposed out-group Sagrinae; 2) compression of the two lateral sclerites to enclose the median ejaculatory guide, which may be reduced or absent; and 3) paired dorsal sclerites fused and enlarged, in close association with the fused lateral sclerites. These three states form a transformation series of sclerite configuration, each step represented by: 1) Plateumarini (2 genera); 2) Donaciini (5 genera); and 3) Macropleini (2 genera). Placement of Poecilocera in this series is difficult, but is hypothesized on the basis of other characters to be near Plateumaris.

A COMPARISON OF THE NEARCTIC CENTROPTILUM INFREQUENS McDUNNOUGH (EPHEMEROPTERA: BAETIDAE) WITH THE PALEARCTIC CENTROPTILUM PENNULATUM EATON, A POSSIBLE SYNONYMY. Robert G. Lowen, Department of Entomology, University of Manitoba, Winnipeg, and the Freshwater Institute, 501 University Crescent, Winnipeg, R3T 2N6.

Centroptilum infrequens McDunnough was rediscovered in Manitoba for the first time since 1924. Descriptions of the nymph and male imago are presented for the first time. This species appears very similar to the European species C. pennulatum Eaton. Adults of these species were compared on the basis of the original descriptions, subsequent descriptions of shape and colour, genitalia, and wing shape. Nymphs are similar in the shape of their gills, legs, mouth parts, and colouration. Confirmation of synonymy awaits specimens from Europe. If confirmed, this represents the first Holarctic member of this genus.

PRE-PUPAL AGGREGATION IN NEOPHYLAX (TRICHOPTERA: LIMNIPHILIDAE) AND ITS EFFECTS ON EMERGENCE SYNCHRONY AND MORTALITY. Ian D. Martin and David R. Barton, University of Waterloo, Department of Biology, Waterloo, Ontario, N2L 301.

Larvae of Neophylax fuscus form dense but isolated pre-pupal aggregations in the Maitland River of southern Ontario in May, remaining sealed in their cases until September when metamorphosis and adult emergence occur. We encased cobbles with varying densities of pupal cases in Nitex bags just prior to the onset of emergence in late September, 1984 and collected adults from the bags at frequent intervals to assess emergence synchrony and success. At the end of the experiment, pupal mortality was also assessed for each substrate. Pre-pupal densities from 1,500-12,000 individuals m^{-2} showed no consistent relationship to mortality from predation (by mites and chironomids) or silt and marl overgrowth. Emergence was most synchronous at high densities of pupal cases (5,500-9,500 m^{-2}) and consistently lower at densities below 5,300 m^{-2} . Low air temperatures (frequent frost, occasional snow) during this emergence period may affect flight activity, so emergence synchrony may enhance mating success. The relationship of synchrony to the density of pre-pupal aggregations

suggests that some developmental cues may originate with conspecifics.

INVERTEBRATE DISTRIBUTION IN THE SUBSTRATE OF A CANADIAN SHIELD STREAM.

D. J. Giberson, Freshwater Institute, Winnipeg, Manitoba, R3T 2N6; R. J. Hall, Ministry of the Environment, Box 39, Dorset, Ontario, POA 1E0, and R. J. Mackay, University of Toronto, Toronto, Ontario, M5S 1A1.

Streams located in the Canadian Shield are generally softwater streams characterized by shallow substrate deposits overlying bedrock and highly compacted materials. In the Muskoka region of Central Ontario, many of the streams are also subject to regular pulses of Hydrogen ion stress associated with acid precipitation. Although invertebrates have been recorded to depths up to a metre in the well drained gravel substrates of streams running over sedimentary rock, little is known about vertical distribution with Canadian Shield streams; largely due to the shallowness of the substrate and the nature of the deposits. During 1985 and 86, core samples were taken in an erosional and depositional zone in the outlet to Harp Lake (central Ontario), a shield stream with a substrate depth ranging from 0-30 cm. pH and alkalinity were consistently higher in the substrate than in the surface waters, even as little as 10 cm below the surface, and this trend was especially pronounced during periods of acid stress. At all times of the year, insects, small crustaceans, mites, oligochaetes, and nematodes were found at all substrate depths sampled in both zones, though composition and distribution varied with season and with discharge. The insect fauna consisted mainly of early stages of insects common in the surface fauna (Ephemeroptera, Plecoptera, a few Trichoptera, aquatic Diptera, and Coleoptera), and these were often found in higher densities than on the surface. Non-insects, mainly ostracods, oligochaetes, and small molluscs, were rarely recovered from surface samples, but were very abundant at depths between 5 and 25 cm.

DISPLACEMENT AND RECOLONIZATION OF AQUATIC INSECTS FOLLOWING METHOXYCHLOR TREATMENT OF THE NORTH SASKATCHEWAN RIVER. Lloyd M. Dossall and D. M. Lehmkuhl, Department of Biology, University of Saskatchewan, Saskatoon, Saskatchewan, Canada, S7N 0W0.

Brick artificial substrates were used to monitor removal and recolonization of selected aquatic insect species representing Plecoptera, Ephemeroptera, Trichoptera and Simuliidae following methoxychlor treatment (0.3 ppm for 15 minutes) of the North Saskatchewan River in May, 1984 and 1985. At the upstream untreated site, no significant change in numbers occurred between most pre- and post-treatment populations. However, at three downstream sites subjected to treatment, response varied depending on species and distance from the injection point. For example, the closely related stonefly species Isoperla bilineata and I. longiseta showed different treatment responses at a site 36 km downstream from methoxychlor injection. In both years, I. bilineata declined significantly after treatment although I. longiseta increased in number after treatment. Similarly, numbers of Hydropsyche occidentalis, H. placoda and H.

confusa declined at this site following treatment although populations of H. alternans showed no significant change.

STUDENT COMPETITION - SESSION III

Monday Afternoon, October 6

OOGENESIS IN APANTELES FUMIFERANAE (HYMENOPTERA: BRACONIDAE), A PARASITOID OF THE EASTERN SPRUCE BUDWORM, CHORISTONEURA FUMIFERANA.

Susan I. R. Fraser and J. F. Sutcliffe, University of Waterloo, Waterloo, Ontario, Canada, N2L 3G1.

Oogenesis in Apanteles fumiferanae (Hymenoptera: Braconidae) will be described from a structural and ultrastructural perspective. General ovarian anatomy and rates of follicle maturation will also be examined.

With the maturation of the follicles, changes occur in the oocyte, trophocytes and follicular epithelial cells within the polytrophic ovarioles of this parasitoid. An elaborate microvillar contact area forms where the oocyte borders with the follicular epithelium. The cytoplasm of follicular epithelial cells is liberally supplied with rough endoplasmic reticulum and free ribosomes. A large number of nuclear pores are found on the nuclei of these cells. Trophocytes, containing an abundance of free ribosomes and mitochondria are connected to each other by simple openings in their cell walls. The ring canals in the nutritive pore of the follicle may allow intercellular transport between the oocyte and its trophocytes. Only lipid yolk is present in the mature follicle. Follicle maturation culminates with the deposition of a simple hydroptic chorion.

HIGH-RESOLUTION, TWO DIMENSIONAL GEL ELECTROPHORESIS ANALYSIS OF RHODNIUS PROLIXUS EMBRYOGENESIS.

Gregory M. Kelly and Erwin Huebner, Department of Zoology, University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2N2.

Degree of embryonic perturbation of the hemipteran R. prolixus by the juvenile hormone analogue Fenoxycarb (Ro 13.5223) is dependent on time of topical application. Treatment early in development eventually leads to anomalies later on, suggesting that the chemical interferes with the pre-programming of normal events. Although JH analogues are known to affect embryonic development in other insects, little is known of their effects on cellular-molecular mechanisms. To study the potential effects of Fenoxycarb at the molecular level, we are utilizing polyacrylamide gel electrophoretic (PAGE) techniques to examine the pattern of protein synthesis in normal and perturbed embryos. SDS-PAGE reveals two distinct populations of proteins. The most prevalent, which are seen in day 1 embryos are present throughout development. These proteins probably represent maternally synthesized products which are taken up by the egg during oogenesis. The second population are embryonically derived proteins which appear at different stages of embryogenesis. Since SDS-PAGE has limitations with regards to resolution, the more sensitive 2d approach was taken. Results of experiments reported here detail the two-dimensional protein maps of

normal and JH analogue perturbed embryos. Research funded by NSERC postgraduate scholarship to GMK and NSERC operating grants EH.

ATTRACTION OF GLISCHROCHILUS QUADRISIGNATUS (COLEOPTERA: NITIDULIDAE) ADULTS TO FOOD PLANT VOLATILES. Robert S. Bouchier and R. K. Stewart, Department of Entomology, Macdonald College, Ste-Anne de Bellevue, P.Q. Eighteen volatile components of food baits, selected from foods known to be attractive to G. quadrisignatus, were compared in a laboratory olfactometer and in field experiments. Two new chemical baits, 2,3 butanedione and iso-butyl acetate were found to be attractive to G. quadrisignatus. Propyl proprionate was confirmed as the best single chemical attractant for picnic beetles. N-butyl acetate, a previously reported chemical bait was found to be only slightly attractive. The response to iso-butyl acetate is the first demonstration of the ability of G. quadrisignatus to discriminate between isomers.

THE PHARMACOKINETICS OF 6-METHOXYBENZOXAZOLINONE (MBOA) ON THE LARVAE OF THE EUROPEAN CORN BORER, OSTRINIA NUBILALIS. F. Campos, J. T. Arnason, B. J. R. Philogenè, J. Atkinson, P. Morand, N. Werstiuk, Department of Biology, University of Ottawa, Ottawa, Ontario, K1N 6N5. DIMBOA, 2,4-dihydroxy-7-methoxybenzoxazin-3-one, and its degradation product MBOA, 6-methoxybenzoxazolinone, are naturally occurring compounds in the corn that reduce growth and development of the larvae of the European corn borer (ECB), Ostrinia nubilalis, and are the major factors responsible for resistance to this insect. H^3 -MBOA, synthesized by the method of Kubo and Kamikawa (1983) and labelled using a high temperature dilute acid procedure, was used to determine the pharmacokinetics of this compound on the larvae of the ECB.

In topical application studies using the 5th instar, elimination of the compound in the frass is rapid, reaching 60% by 6 hours, and levelling off at 82% by 24 hours. Accumulation in the tissues was very small. In feeding trials using 1.5 mg MBOA/g diet, accumulation in the insect increased from 4th to 5th instar (0.313 mg MBOA/g insect to 0.426 mg MBOA/g insect), but declined to less than half as the insect entered into pupae and adult stage. Analysis of extracts by TLC from insects and frass showed that MBOA is not metabolized, and is excreted as is.

PHOTOTOXICITY, PHARMACOKINETICS AND METABOLISM OF ALPHA-TERTHIENYL IN SENSITIVE AND RESISTANT HERBIVOROUS INSECTS. Seshadri Iyengar, Department of Biology, University of Ottawa, Ottawa, Ontario, K1N 6N5. Thiophenes are among the major secondary substances of the plant family Asteraceae. The role of a phototoxic representative of these compounds, h-terthienyl, in the chemical defence of composites against 3 species of herbivorous insect, was investigated.

The compound was administered either topically on the dorsal surface of the insect or incorporated in an artificial diet and fed to insects. Alpha-terthienyl was highly phototoxic to the tobacco hornworm, Manduca sexta (topical LD_{50} for last instar larvae was 10 μ g/g). It was less phototoxic to the European corn borer, Ostrinia

nubilalis, or the tobacco budworm, Heliothis virescens (LD₅₀ 698 and 474 $\mu\text{g/g}$ respectively).

In the feeding studies at 10 and 31 $\mu\text{g/g}$ of h-terthienyl in the diet, larval survivorship (% of the control) was 100 for O. nubilalis and H. virescens and 70 and 0 for M. sexta. Necrotic lesions leading to ecdysis failure and pupal deformities were some of the gross effects of phototoxicity observed in M. sexta. In order to investigate the reasons for sensitivity or resistance, the pharmacokinetics of ³H- α -terthienyl (prepared by a new exchange process) and the role of mixed function oxidases in the metabolism of this compound has been studied.

FUNCTIONAL SYNAPTOSOME, SYNAPTOSOME MEMBRANE VESICLES PREPARATION FROM THE BRAIN OF BERTHA ARMYWORM MAMESTRA CONFIGURATA WLK. ADULT. Ma Luo and Robert P. Bodnaryk, Department of Entomology, University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2N2; Agriculture Canada, Winnipeg Research Station, 195 Dafoe Road, Winnipeg, Manitoba, R3T 2M9. Synaptosomes and synaptosome membrane vesicles have been prepared from the brain of bertha armyworm Mamestra configurata adults. Electron microscopic analysis and marking enzyme assay indicate that the preparations are relatively pure and devoid of mitochondria and microsome contamination. It is shown that the synaptosomal fraction possesses an active voltage-dependent Ca⁺⁺ uptake mechanism and the synaptosome membrane vesicles have an ATP-dependent Ca⁺⁺ uptake activity with very high free Ca⁺⁺ affinity of less than 1 nmol.

THE ROLE OF MALE PHEROMONE IN THE TRUE ARMYWORM, PSEUDALETIA UNIPUNCTA (LEPIDOPTERA: NOCTUIDAE). Sheila Fitzpatrick, Département de biologie, Université Laval, Québec, P.Q., Canada, G1K 7P4. The anterior abdominal hairpencils of true armyworm males contain a blend of benzaldehyde and acetic acid. Laboratory experiments have shown that this is released just prior to copulation and acts as a female aphrodisiac. Individual females, presented with either an intact (control) male or a male from which hairpencils had been removed, were more likely to refuse the hairpencil-less male by avoiding or prematurely terminating copulation. If males were placed with females before the onset of the 8 hour scotophase, copulatory success was similar in the two treatments, despite female refusals. However, if males were placed with females after the onset of calling in the latter half of the scotophase, refusals of hairpencil-less males became more frequent and vigorous, resulting in a significant decrease in their copulatory success. The pheromone seems to affect only the female's acceptance of a male and not the events which follow this decision: copulation duration, size of spermatophore transferred, as well as daily and total fecundity of mated females were independent of whether or not males possessed hairpencils. Calling virgin females showed no changes in calling behaviour or subsequent oviposition after exposure to the male pheromone.

A HIGH-CYSTEINE PROTEIN IN THE HEMOLYMPH OF TENEBRIO MOLITOR LARVAE AFTER DESICCATION. E. M. Kroeker and V. K. Walker, Department of Biology, Queen's University, Kingston, Ontario, Canada, K7L 3N6. Numerous reports of proteins believed to be involved in overwintering strategies of insects exist in the literature. Several workers have suggested that these proteins are also involved in water regulation. In two species of beetles, Dendroides canadensis and Tenebrio molitor, and one lepidopteran, Choristoneura fumifera, the proteins studied contained substantial amounts of cysteine. In order to identify these proteins, Tenebrio larval fat bodies were cultured in vitro in the presence of ³⁵S-cysteine and labelled, secreted proteins were analysed by PAGE and fluorography. Hemolymph proteins were also labelled in vivo by injecting larvae with ³⁵S-cysteine and analysed in a similar fashion. These experiments revealed a high-cysteine protein, 29 kd in size, which was synthesized at a substantially increased rate by the fat body of larvae deprived of water. Proteins in homogenates of Malpighian tubules and rectal complex were analysed following in vivo labelling. No appreciable amount of the 29 kd protein or any other high-cysteine protein was observed in these tissues. We are purifying this protein to determine whether it alters the freezing-point of a solution. We are also investigating a possible relationship between the concentration of the 29 kd protein in the hemolymph and larval ability to absorb atmospheric water. (Supported by Agriculture Canada.)

SUBMITTED PAPER

FUNCTIONAL AND SENSILLAR MORPHOLOGY OF THE LABRUM AND HYPOPHARYNX IN THE STABLE FLY, STOMOXYS CALCITRANS (DIPTERA: MUSCIDAE). Jim Sutcliffe and M. Julien, Department of Biology, Queen's University, Kingston, Ontario. The hypopharynx and labrum of the stable fly, Stomoxys calcitrans, combine forming the piercing sucking unit called the syntrophium. Light, scanning electron, and transmission electron microscopy provided insights into the sensillar and functional morphology of this unit. It forms both the blood transport tube and the salivary duct (latter completely housed within hypopharynx). Chemosensory and mechanosensory sensilla occur near the labral tip while mechanosensory sensilla are distributed along the labral portion of the food tube. Possible roles for these sensilla during biting and feeding are discussed as are some of the dynamics of the syntrophium.

SUBMITTED PAPERS - SESSION I

Tuesday Afternoon, October 7

THE EFFECTS OF A COLONIES QUEEN STATE ON THE ORIENTATION OF DRONE HONEYBEES (APIS MELLIFERA L.) TO THEIR HIVES. Robert W. Currie and S. C. Jay, Department of Entomology, University of Manitoba, Winnipeg, Manitoba, Canada, R3N 1C5.

Drones that return from flights often make orientation errors and drift into neighbouring hives. The purpose of this study was to determine if the behaviour of drones orienting to their hives is affected by a colonies queen state. Hives were arranged in pairs and spaced one metre apart with the hive entrances facing south. Four cohorts of individually marked drones ranging from 5 to 20 days old were established in each colony. Queens were removed from the east position in each of the six pairs of hives and the queen state of these colonies was altered to either mated laying queens, mated caged queens, queenless virgin queens (<7 days old), virgin queens (>7 days old), or to the queen's sex pheromone (trans-9-oxodec-2-enoic acid).

Drones were attracted to colonies with virgin queens. More drones drifted to colonies that contained virgin queens or trans-9-oxodec-2-enoic acid than to either queenless or queenright colonies. The attractiveness of virgin queens to drones increased with the age of the drone and with the age of the queen. Higher proportions of drones were attracted to virgin queens greater than 7 days old than to colonies with younger virgin queens. The proportion of drones that were attracted to a colony was correlated with quantitative and qualitative differences in the pheromones that are produced by different types of queens.

Colonies with virgin queens did not retain their own drones. However, 48% of the drones that drifted away from colonies with virgin queens were attracted back to those colonies on subsequent flights (on the same day). When both hives in a pair had the same queen state then the proportion of drones that drifted between colonies that were queenright, queenless, or had virgin queens was not significantly different. It is proposed that drones that are in colonies with virgin queens may become habituated to the virgin queen's pheromones and this may play a role in preventing inbreeding in feral populations of honeybees.

INFLUENCE OF POLLEN ON THE CALLING BEHAVIOUR OF VIRGIN SUNFLOWER MOTH FEMALES. Jeremy N. McNeil and Johanne Delisle, Département de biologie, Université Laval, Québec, P.Q., G1K 7P4.

The possibility that pollen may influence the calling behaviour of virgin sunflower moth, Homoeosoma electellum, females was examined as sunflowers are only acceptable oviposition sites for a brief period following blooming. Females held with both pollen and an 8% sucrose solution initiated calling at a significantly younger age following

emergence ($\bar{X}=3.3$ days) then controls ($\bar{X}=7.1$ days) provided only sucrose. Furthermore calling was much more intense for those females having access to pollen. Whether the pollen acts as a kairomone and/or as a nutrient source that accelerates sexual maturation is unknown at this time (this translates to: we are presently carrying out the experiments and hope to have the answers by the October meeting). The marked influence of pollen on calling behaviour will be discussed within the context of resource availability and the northern migration of the sunflower moth into the prairie provinces.

PREDICTING BERTHA ARMYWORM LARVAL ABUNDANCE FROM PHEROMONE TRAP CAPTURES IN MANITOBA. W. J. Turnock, Agriculture Canada Research Station, 195 Dafoe Road, Winnipeg, Manitoba, R3T 2M9.

There is a direct relationship between the number of male moths captured in sex attractant traps in canola fields and the number of larvae in the damaging later instars in the trap field and in adjacent fields. Variability is too high to allow predictions to be made for individual fields but predictions of the proportion of fields in an area that will have larval populations above the economic threshold can be made. Such predictions provide sufficient advance warning to avoid problems of shortages of insecticides or spray planes and enable extension personnel to alert growers to the necessity of carefully examining their fields. Factors affecting the accuracy of a bertha armyworm monitoring system are examined, areas in Manitoba that are most susceptible to outbreaks are identified and a monitoring system for the province is described.

MONITORING CUTWORM POPULATION LEVELS WITH SEX-ATTRACTANT MOTH TRAPS. J. Robert Byers and Dean L. Struble, Agriculture Canada Research Station, Lethbridge, Alberta, Canada, T1J 4B1.

A pilot monitoring project using sex-attractant moth traps to determine the abundance of 8 species of noctuid moths at 81 locations in a 13,000 km² (5,000 mi²) area of southern Alberta has shown that reliable estimation of population levels can be obtained and that the potential for subsequent larval infestations can be predicted. Approximate economic thresholds have been established for the most important pest species. The monitoring program enabled prediction of the outbreaks of bertha armyworm and pale western cutworm that occurred during the course of the study. Ancillary experiments were done to assess trapping-out effect and to test the suitability of various commercially available traps. The study has provided a sound basis in theory, technology and practical experience for a monitoring system that makes feasible, in terms of both reliability and resource requirements, the long-term monitoring of cutworms on the prairies of western Canada.

COMPARISON OF MINOR PHEROMONE COMPONENTS IN TRAPPING ADULT CHORISTONEURA FUMIFERANA, OCCIDENTALIS AND BIENNIS. R. Shepherd, T. Gray, B. Moody,

H. Gates, Canadian Forestry Service, Victoria and Edmonton.

Three types of traps and five chemical lure combinations were exposed in a randomized block design in moderate populations of each of the three

Choristoneura species. Differences in behaviour resulted in different trapping patterns between species.

HOST COMPOUNDS AS A LURE FOR THE NORTH AMERICAN ELM BARK BEETLE,

HYLURGOPINUS RUFIPES. Geoffrey Munro,¹ Irene L. Pines,¹ Robert M. Silverstein² and Gerald N. Lanier,² Manitoba Natural Resources, Winnipeg (1) and State University of New York College of Environmental Science and Forestry (2).

The North American elm bark beetle, Hylurgopinus rufipes aggregates in response to odorants released by moribund elms. An extract of volatiles collected from air entrained over diseased elm logs attracted H. rufipes adults dispersing from overwintering sites during the spring. During 1985 and 1986 various combinations of elm odorants were field assayed. This paper will present results of those tests and assess the potential for using a bouquet of synthetic chemicals to monitor and control the native elm bark beetle.

SUBMITTED PAPERS - SESSION II

Tuesday Afternoon, October 7

INTERSPECIFIC CROSSES AND FERTILE HYBRIDS AMONG THE CONIFEROPHAGOUS CHORISTONEURA. George T. Harvey, Great Lakes Forestry Centre, Sault Ste. Marie, Ontario.

The latest checklist of coniferophagous Choristoneura lists 8 species and 7 subspecies. Information on single-pair matings among most members of this complex group has been assembled. Fertile matings have been obtained in all crosses where adequate numbers have been attempted, both among the spruce-fir feeding and among the pine feeding forms, as well as between members of the two groups. Fertile matings among F¹ hybrids and various backcrosses can also be obtained. Some differences in the proportion of successful matings are reported. The significance of these results for reproductive isolation among these closely-related species is discussed.

LABORATORY METHOD TO REAR GRAPHOLITHA MOLESTA ON A FORMULATED DIET.

Victoria Y. Yokoyama and Gina T. Miller, U.S. Dept. of Agriculture, Agriculture Research Service, Horticultural Crops Research Laboratory, 2021 S. Peach Avenue, Fresno, California, 93727 U.S.A.

The oriental fruit moth, Grapholitha molesta (Busck), was successfully reared on a new formulated diet with greater than 90% survival to the adult stage. Rearing procedures and a new ovipositional cage are described. Head capsule widths, developmental times for each larval instar, and peak egg laying periods for adult females are reported. An inverse relationship between the number of larvae in the diet and the weight and number surviving to the pupal stage was found.

COMPARISONS OF LARVAL DEVELOPMENT OF ALSOPHIA POMETARIA ON DIFFERENT SPECIES OF DECIDUOUS TREES. B. Timlick and N. J. Holliday, Department

of Entomology, University of Manitoba, Winnipeg, Manitoba, R3T 2N2. Fall cankerworm, Alsophia pometaria, were reared on foliage of Betula glandulosa, Salix lutea, Quercus macrocarpa and Ulmus americana to examine larval performance on these hosts, both when eggs hatched at normal times and when egg hatch was delayed. Performance of larvae raised on excised leaves in the laboratory was compared with that of larvae reared in cages on trees to ascertain whether laboratory results were artifactual, and to determine if the effects of hosts changing over time results in a diminished larval performance.

Preliminary work indicated that larvae performed best on B. glandulosa and it is hypothesized that this species might have an induced defence system against herbivores and, that, because of low herbivore populations in the field, host defence was at a low level. This hypothesis was tested by exposing the trees to different densities of fall cankerworm larvae in field cages. The performance of larvae fed

foliage of these trees was assessed both in the laboratory and in the field.

Indices of larval performance used were survival, duration of feeding, weight at the cessation of feeding before pupation, and color morph.

CYCLIC POPULATION FLUCTUATIONS OF INSECT FOREST DEFOLIATORS: WHAT DOES A COMPREHENSIVE HYPOTHESIS HAVE TO EXPLAIN. Judith Myers, Institute of Animal Resource Ecology and Dept. Plant Science, University of British Columbia, Vancouver, B.C., V6T 1W5.

The eight to ten year fluctuations in population densities of insect forest defoliators are fascinating natural phenomena. The following have been proposed to explain the cycles: variation in food quality, trends in weather patterns, density-related responses of predators, parasites, diseases, or insect quality. However, a comprehensive hypothesis must explain synchronous declines of populations with different histories of outbreak, peak densities, micro-climates, predator and parasite loads and, for some insects, different host plants. For western tent caterpillar and tussock moth, population declines are associated with viral disease and the initial phase of the decline occurs between the late larval or pupal stage and oviposition of eggs for the next generation. In the second year of decline, early larval survival deteriorates. This pattern is expected if disease in the first year is only expressed late in development and is more prevalent at early stages in the next generation. The characteristics of cyclic insect populations can be explained by variation in the susceptibility to disease or virulence of virus caused by strong selection in the decline phase and relaxed selection during the increase phase. Such a mechanism may explain the population cycles of most forest insects and because it does not require a density dependent component, can account for synchronous declines of populations with different densities, predator and parasite loads, and levels of dosage to host trees.

SOLUBLE PROTEIN NITROGEN AND PECAN APHID POPULATIONS. Alan R. P. Journet, Department of Biology, Southeast Missouri State University, Cape Girardeau, MO, 63701; and Marvin K. Harris, Department of Entomology, Texas A & M University, College Station, TX, 77843. Various forms of nitrogen have been implicated in the population dynamics of herbivorous insects. For phloem-sucking insects such as aphids, the soluble protein extract offers better correlations than total nitrogen in the plant tissue. This paper reports on the results of a test of the hypothesis that field populations of the blackmargined aphid (*Monellia caryella*) can be predicted by the soluble protein nitrogen content of the foliage of pecan (*Carya illinoensis*). The study revealed that aphid numbers are a predictive consequence of soluble protein nitrogen early in the season, while later in the season, the potential for aphid increase shows a lag relationship with soluble protein nitrogen.

POSTER SESSION

Tuesday Afternoon, October 7

SIZE SELECTION OF CANADA THISTLE FLOWER BUDS BY OVIPOSITING LARINUS PLANUS (F.) (COLEOPTERA, CURCULIONIDAE).

A. S. McClay, Alberta Environmental Centre, Vegreville, Alberta, Canada, T0B 4L0.

The European weevil Larinus planus (F.) occurs as an accidental introduction in the north-eastern U.S.A. on Canada thistle (Cirsium arvense (L.) Scop.). It is recorded from Europe mainly from C. arvense, but also from several other species of Cirsium, Carduus and Galactites. Its biology was studied under growth chamber conditions as part of an assessment of its suitability for redistribution in North America as a biocontrol agent for Canada thistle. Eggs were laid in the flower buds of C. arvense. Females oviposited selectively in buds 6-7 mm in diameter. Measurements of the growth rates of buds suggested that oviposition in buds in this size range may optimize the chances of eggs being laid in buds which will be actively growing when larvae hatch. This preference for small buds is in agreement with the hosts reported from Europe, which are mainly small-flowered thistle species, and suggests that native Canadian Cirsium species, which generally have much larger heads than C. arvense, are unlikely to be preferred hosts for L. planus.

SIZE CATEGORIES: HOW MANY ARE THERE? AN OBJECTIVE APPROACH TO THE PROBLEM OF INSECT INSTAR DETERMINATION.P. Taylor,¹ A. Mazumder, I. Martin, & F. Chow.² University of Waterloo, Department of Biology & Department of Systems Design Engineering,² Waterloo, Ontario, N2L 3G1; Order of authorship is random.¹

A problem encountered commonly when researching insect life histories or calculating secondary production is that of the number of stadia in the species of interest. Traditionally, graphical methods or running mean analyses have been used, but these may suffer from a high degree of investigator subjectivity. We have developed a numerical approach to this problem, using a univariate or multivariate clustering of an initial sample of individuals, followed by a Maximum A Posteriori (MAP) classification of subsequent samples which assigns individuals to the putative stadia with a known probability of error. This method allows a more objective assessment of instar number, as well as the setting of an acceptable probability of error for the particular study. We illustrate the method with real and simulated data.

TRAP TREE TECHNIQUE CONTROLS BARK BEETLE VECTORS AND DUTCH ELM DISEASE.

Gerald N. Lanier, State University of N.Y. College of Environmental Science and Forestry, Syracuse, New York.

Elm trees injected with the herbicide cacodylic acid are highly attractive to native (Hylurgopinus rufipes) and European (Scolytus

multistriatus) elm bark beetles. Attracted beetles bore into the bark and oviposit, but broods fail to mature owing to herbicide-induced drying of the bark. Diseased and unwanted healthy elms killed in this manner act as traps for elm bark beetles. If 50% of the crown is alive when treated, broods will be reduced by more than 90%. If 10% of the tree crown is alive the beetle brood productivity will be reduced by more than 50%. Field operations utilizing this technique in urban and in greenspaces resulted in reductions of Dutch elm disease rates of 50% or more in each successive year of the program. In the National Capital Parks of Washington, DC where the cacodylic acid-trap tree technique is the only DED control applied in natural areas, DED infection rates dropped 6-fold (to less than 4 trees per 1,000) over 5 years. Arsenic residues in wood at the injection site ranged from 3-32 ppm (dry wt.) while residues in wood 1 m or more from the point of application were usually less than 1 ppm. In ten years of use no deleterious effects of this technique have been detected. Cost of treatment is 1% or less of the cost of removal of the tree.

ENTOMOLOGY AND PUBLIC EDUCATION. Insect Control Branch, Parks and Recreation Department, City of Winnipeg, 2799 Roblin Blvd., Winnipeg, Manitoba, R3R 0B8.

The success of the various insect pest management programs undertaken by Winnipeg's Insect Control Branch is dependent upon the support and co-operation of the general public. Major emphasis is placed on public education through press releases, interviews, exhibits, displays, demonstrations, and talks to community groups to ensure that the objectives of the Insect Control Branch are clearly understood.

COMBINED EFFECTS OF INSECT STRESSES ON CORN GROWTH AND DEVELOPMENT. T. J. Gibb and R. A. Higgins, Department of Entomology, Kansas State University, Manhattan, Kansas, 66506, U.S.A.

Unreliability in recommending management tactics developed for individual pests in crops experiencing multiple stresses has prompted studies assessing interaction among stresses. In this study, 3 common and yet physiologically distinct stresses including two defoliation and a root pruning stress were imposed during the vegetative growing stages of irrigated field corn in Kansas. Measurements on growth and development, taken throughout the growing season, were used to assess the effects of the treatments and their interactions. Results indicate a significant interaction among certain stresses based on the stress history of the corn plant and serve to demonstrate the importance of understanding crop stress history in insect pest management decisions.

SUBMITTED PAPERS - SESSION III

Wednesday Afternoon, October 8

CONTROL OF TRIBOLIUM CASTANEUM AND CRYPTOLESTES FERRUGINEUS WITH THE INSECT GROWTH REGULATOR FENOXYCARB ON WHEAT OR STRUCTURAL SURFACES. N. D. G. White, Agriculture Canada Research Station, 195 Dafoe Road, Winnipeg, Manitoba, Canada, R3T 2M9.

Five adult males and five adult females of Tribolium castaneum or Cryptolestes ferrugineus were placed in stored wheat with 0, 5, 25, 100% of the kernels treated with 8 ppm fenoxycarb and held at 30°C, 70% RH for up to 32 weeks when the grain was cleaned and 20 adults reintroduced into the grain. Fenoxycarb applied to 5% of wheat kernels reduced but did not completely prevent development of T. castaneum and C. ferrugineus. Treatment of 25% of the kernels, however, controlled these insects indicating that a treatment somewhere between 5 and 25% of the seeds at 8 ppm would be adequate; residual effectiveness was not decreased after 32 weeks of storage at 30°C. Last instar larvae of both insects were exposed for 24h to plywood, galvanized steel or concrete surfaces sprayed with 0.25 or 0.50 g/m² fenoxycarb. Residues of 0.25 g/m² were usually as effective as 0.50 g/m² for both species except on concrete. Residues on steel were the most effective, preventing adult development up to 32 weeks after treatment; sprayed wood did not completely prevent adult emergence whereas sprayed concrete was least effective over time indicating a breakdown of the fenoxycarb. Larval production by adult T. castaneum and C. ferrugineus in 2-cm deep layers of wheat at 25°C, 65% RH for 5 weeks above wood, steel, or concrete sprayed with 0.25 or 0.50 g/m² fenoxycarb was negligible for both species at both concentration on steel. T. castaneum larval numbers above wood and concrete were reduced at both concentrations while C. ferrugineus numbers were not greatly affected. Treatment of empty galvanized steel granaries at 0.25 g/m² is adequate for long-term control of these insects.

DISTRIBUTION OF STORED GRAIN INSECTS IN UNSWEPT FARM GRANARIES IN THE PRAIRIE PROVINCES. Lawrie B. Smith, Research Station, Agriculture Canada, 195 Dafoe Road, Winnipeg, Manitoba, R3M 3L3.

Collections of insects were made in unswept granaries in each of the three Prairie Provinces in separate years: Manitoba, 1981; Saskatchewan, 1982; Alberta, 1984. The number of species found in farm granaries was approximately the same in each province, 26 in Manitoba, 33 in Saskatchewan and 29 in Alberta. The most important stored grain pests, Cryptolestes ferrugineus (Stephens) and Tribolium castaneum (Herbst), occurred primarily in the southern regions of each province. The percentage of farms infested with each species decreased from Manitoba westward to Alberta. The highest percentage of farms infested with Tribolium audax Halstead, 78%, was in Saskatchewan. This species was

found on more farms in each province than C. ferrugineus which was an entirely unexpected result. The distribution pattern for Ptinus villiger Reitter was similar to that for Tribolium audax except that the highest percentage of infested farms was 37% in Saskatchewan. Oryzaephilus surinamensis (L.) was rarely found in any of the provinces, even though it is still reported in pest outbreaks. The highest number of farms on which it was found was 3 in Saskatchewan. The two most common fungus beetles in Prairie stored grain, Lathridius minutus (L.) and Cryptophagus varus Woodroffe and Coombs, differed from the distribution of the other species in that they were found on the highest percentage of farms in Saskatchewan, followed by Alberta and Manitoba.

The only characteristic of a granary that had a significant effect on insect occurrence was the construction material. C. ferrugineus had a higher frequency of occurrence in steel granaries, while Tribolium audax, Tenebrio molitor L. and a scavenger species, Trogoderma sinistrum Fall, had a higher incidence of occurrence in wood granaries.

SPACING AND FEEDING OF SIMULIUM VITTATUM LARVE (DIPTERA: SIMULIIDAE): EFFECTS OF CURRENT FOOD CONCENTRATION. Jan J. H. Ciborowski and Douglas A. Craig, University of Windsor, Windsor, ON, N9B 3P4 and University of Alberta, Edmonton, AB, T6G 2E3, Canada.

We investigated larval spatial pattern and feeding responses to controlled levels of current and seston. Positioning on 10 x 10 cm tiles in a laboratory stream was photographically monitored. Trials incorporated current velocity of 15, 24, or 43 cm/sec. in either filtered (0.5 mg/l) or filtered + yeast supplement (3.5 mg/l) water. Larval movement decreased with increasing velocity, but was independent of food level. Significant aggregation (nearest neighbour analysis, p 0.05) occurred only at 15 cm/sec. Degree of aggregation was independent of food level. Proportion of larvae subsequently ingesting suspended dye particles decreased with increasing velocity, but interactions with food concentration occurred. Feeding was only weakly related to location relative to conspecifics.

CHEMO-ORIENTATION IN THE TUBER FLEA BEETLE, EPITRIX TUBERIS. Don Thomson, Department of Biological Sciences, Simon Fraser University, Burnaby, British Columbia, V5A 1S6.

The focus of this research was to determine whether pheromones are employed in the reproductive strategy of E. tuberis.

An arena style olfactometer was used to quantify the movements of E. tuberis with respect to insect volatiles. Data on certain parameters of movement, such as distance travelled, number and angle of turns, rate of movement and the amount of time spent in treatment and control areas, was collected and analyzed. This technique enhanced the discrimination of bioassays by testing concurrently for taxis, klinokinesis and orthokinesis.

The potential for incorporating pheromone baited lures into a pest management program will be discussed.

ACID-TOLERANT SCAB OF POTATOES, COLLEMBOLA, AND PESTICIDES. R. H. Storch and F. E. Manzer, Departments of Entomology and Botany & Plant Pathology, University of Maine, Orono, Maine, 04469. Certain insecticides, as well as, some fungicides reduce the incidence of acid-tolerant scab of potato. Soil samples (7.5 cm dia. x 15 cm) were taken from plots treated with various pesticides every two weeks from planting until the application of vine desiccant. Soil arthropods were extracted using a modified Tullgren apparatus and stored in von Torne's medium. Collembola specimens were cleared in liquid of Marc André and mounted between coverslips in Hoyer's medium. Most specimens were identified to the genus level.

Specimens in the genus Isotoma were most abundant. Other specimens in the family Isotomidae collected were in the genera Folsomia, Isotomiella, and Isotomodes. A few specimens in the families Entomobryidae, Hypogastruridae, Onychiuridae, and Sminthuridae were also collected. Some seasonal life history comments will be made.

MEASURING YIELD LOSSES IN SUNFLOWERS CAUSED BY SUNFLOWER MIDGE, CONTARINIA SCHULZII GAGNE. G. K. Bracken, Agriculture Canada, 195 Dafoe Road, Winnipeg, Manitoba, Canada, R3T 2M9. Sunflower midge, a recent pest of sunflowers in the Red River Valley, destroys developing ovules which distorts the shape of the head as it matures. A method of assessing economic loss caused by midge is being developed for use in Provincial surveys and for underwriters of crop losses. A damage rating system for heads has been studied for both simulated and natural head damage. Regression analyses of various head properties indicate that head area is the best predictor of yield. Damage rating systems account for more variation in regressions than actual measurements of damaged areas, particularly in naturally damaged heads. A yield loss model based on damage ratings is compared to a model based on receptacle weight, a property significantly correlated with yield but independent of head damage.

PEA APHID ACYRTHOSIPHON PISUM (HOMOPTERA: APHIDIDAE) DENSITIES ON SEVERAL FIELD PEA CULTIVARS IN MANITOBA. J. J. Soroka and P. A. MacKay, Department of Entomology, University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2N2.

Different cultivars of field peas grown in southern Manitoba have been observed to support different densities of pea aphids. To determine whether these density variations are consistent and to examine the reaction of field pea cultivars to feeding by the pea aphid, 5 pea cultivars in 1984 and 6 in 1985 were grown in field plots at Glenlea, Manitoba. Aphid numbers on the terminal 20 cm of plant tips were monitored on unsprayed and malathion sprayed plots throughout each season, and cultivar yields and other plant parameters in each spray regime were measured. Significant differences in aphid numbers were found among the various cultivars. Century had the lowest mean number of aphids per plant tip in 1984; the leafless cultivar Tipu was the only selection to have fewer aphids than Century in 1985. Triumph plants

supported the highest aphid densities in 1984, and those of Trapper in 1985. Weight of 1,000 seeds was the only yield variable found to be significantly affected by aphid feeding.

THE EFFECTS OF AZADIRACTIN ON LARVAE OF THE EUROPEAN CORN BORER, *OSTRINIA NUBILALIS*. Jon G. Houseman, F. C. Campbell, N. Donskov, J. T. Arnason and B. J. R. Philogène, Department of Biology, University of Ottawa, Ottawa, Ontario, Canada, K1N 6N5.

Azadiractin, a terpenoid from the neem tree, acts as an insect antifeedant, disrupts growth and produces moult inhibiting effects. In the European Corn Borer, *Ostrinia nubilalis* Hubner, a diet containing 10 ppm azadiractin severely reduces growth and the toxicity was due to a lower efficiency of conversion in the azadiractin treated groups rather than changes in digestibility. During this study quantitative and qualitative changes in haemolymph, parietal fat body and the sheet-like fat body suspended in the haemocoel are followed using SDS-denaturing polyacrylamide gel electrophoresis and protein determinations. Preliminary results show changes in haemolymph protein concentration and composition. Observed decreases in both fat body protein contents can be attributed to disrupted growth.

DEVELOPMENT AND ADULT WEIGHT OF PEA APHIDS: LACK OF GEOGRAPHICAL VARIATION IN TEMPERATURE RESPONSES. R. J. Lamb, P. A. MacKay, and G. H. Gerber, Agriculture Canada and Department of Entomology, University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2M9.

The temperature responses of developmental rate and adult weight are described for five populations of pea aphid, *Acyrtosiphon pisum* (Harris), sampled between 39° and 53° latitude in central North America, and for three populations sampled between 27° and 37° latitude in eastern Australia. Results for 15 to 18 clones tested separately are presented for each population. The developmental response is described by the three parameter equation of a truncated normal curve and the adult weight by a linear equation with negative slope. Variation among clones is demonstrated, but the populations show no latitudinal trends in the parameters describing the responses. The results are discussed in relation to the hypothesis that life history parameters of the pea aphid show latitudinal or altitudinal gradients reflecting adaptation to local climatic conditions.

DISTRIBUTION OF ¹⁴C-LABELLED SYSTEMIC INSECTICIDES IN ROYAL JELLY, QUEEN LARVAE AND NURSE HONEYBEES (*APIS MELLIFERA* L.). A. R. Davis and R. W. Shuel, Department of Environmental Biology, University of Guelph, Guelph, Ontario, Canada, N1G 2W1.

Sixty 8 day-old worker adults were collected from frames of uncapped brood in a queenright colony and placed in Liebefeld cages held at 34°C and furnished with pollen/honey patties and a vial of water. Twenty hours later, a vial of 50% (w/v) sucrose syrup contaminated with either [¹⁴C-ring]-carbofuran or [¹⁴C-O-methyl]-dimethoate at sublethal concentrations was supplied to each cage. Twelve hours later, two young

larvae were grafted into queen cups and hung in each cage. Seventy-two hours afterward, the remaining, growing larva was separated from its food; after weighing, both components were oxidized and counted by liquid scintillation. Experiments were replicated three times for both insecticides. ^{14}C -activity was detected in both royal jelly and larvae in all cases.

To investigate the nature of larval food contamination, individual 8-day-old nurse bees were fed with sublethal concentrations (approx. 1/25 of LD_{50}) of the ^{14}C -labelled systemic insecticides in 2 M glucose solution and dissected at regular intervals later. Radioactivity was largely confined to parts of the digestive system, with little or no activity detected in the various "brood food" glands of the head. The results suggest that the latter are not contaminated by systemic movement of insecticides within the adult, and that contamination of larval food probably occurs via regurgitation of the honey sac contents.

AVOIDANCE OF PERMETHRIN BY DROSOPHILA MELANOGASTER MEIGEN (DIPTERA: DROSOPHILIDAE) AND ITS IMPLICATIONS. S. F. H. Threlkeld, Department of Biology, McMaster University, Hamilton, Ontario, Canada, L8S 4K1. A neglected area in the study of insecticide resistance is that of behavioural resistance, or insecticide avoidance. Previously we presented data showing that adult Drosophila avoid the synthetic pyrethroid insecticide permethrin, before acquiring a lethal dose. We now provide data showing that Drosophila avoid laying eggs in medium supplemented with low levels of permethrin. The presence of genetic variation for avoidance levels, on which selection for behavioural resistance is dependent, is examined through the study of several populations of different origins. Data are also provided on the effects of adding an attractant to the permethrin. In the interests of beneficial insects and economics in general, insecticides that act mainly as repellants may be better replaced with repellants, such as some of the non-insecticide carriers used in commercial preparations of permethrin.

SUBMITTED PAPERS - SESSION IV

Wednesday Afternoon, October 8

THE EFFECT OF BIRD PREDATION ON SPRUCE BUDWORM POPULATIONS: DATA FROM SINGLE-TREE EXCLOSURE CAGES. Jacques Régnière and D. F. Perry, Canadian Forestry Service, Laurentian Forestry Centre, P.O. Box 3800, Ste-Foy, Quebec, G1V 4C7.

To measure the effect of bird predation on populations of the spruce budworm (SBW), *Choristoneura fumiferana* (Clem.), eight single-tree exclosure cages were built around four 14 to 17 m-high white spruce, *Picea glauca* (Moench.) Voss., and balsam fir trees, *Abies balsamea* L., in a natural stand near Quebec City, Quebec, in 1986. The cages were made of 25 mm and 19 mm-diameter galvanized steel pipe, assembled with K-Clamp aluminum couplings, in a 6.7 m-diameter hexagon. The cages were covered with black, single-strand polypropylene netting (15 mm-mesh) to exclude birds, between the peak of the third larval instar and adult emergence of SBW. Three times weekly during the exclosure period, SBW larvae and pupae found on mid-crown branch samples from inside and outside of the cages were counted, and subsamples were put in individual rearing, to determine the frequency of parasites and pathogens. A technique was designed to sample branches non-destructively inside the cages during the 6th larval and pupal stages to conserve foliage on the caged trees. Cage design, construction, and results from the first season are presented.

A TRANSITION MATRIX MODEL OF THE POPULATION DYNAMICS OF A TWO-PREY TWO-PREDATOR SYSTEM. R. Harmsen and M. Woolhouse, Department of Biology, Queen's University, Kingston, Ontario, K7L 3N6.

A transition matrix model was designed to describe and predict the population dynamics of two taxa of phytophagous mites and their two predominant mite predators in apple orchards in Ontario. The model considers transitions among 16 states of the acarid complex (defined as the possible combinations of high/low abundances of the four taxa in a leaf sample) for individual trees over two summer seasons. The transition probabilities are related to temperature and to the abundances of the four taxa. The model provides a fair description of changes in mite abundances during the two seasons and proves capable of predicting considerable accuracy, particularly for the two prey taxa. More general predictions regarding the effects of differing abundances of the other taxa on one of the prey taxa are discussed.

DECLINE OF WINTER MOTH POPULATIONS: IS THE INTRODUCTION OF PARASITOIDS JUST A "RED-HERRING"? Jens Roland, Institute of Animal Resource Ecology, University of British Columbia, Vancouver, B.C., Canada, V6T 1W5.

The introduction of parasitoids for the control of winter moth in Nova Scotia and British Columbia was followed by the decline of moth numbers. In the absence of controls, it is not possible to determine whether populations would have declined without parasitoid introduction. Re-analysis of data for Nova Scotia and study of populations in British Columbia suggest that decline was due to mortality of pupae in the soil, not to parasitism by introduced parasites. Pupal mortality was much higher than parasitism in all years, and more strongly density-dependent both within and among years. The major factor appears to be pathogens.

SEASONAL OCCURRENCE OF PHORETIC MITES AND PARASITES OF OROPSYLLA BRUNERI (SIPHONAPTERA: CERATOPHYLLIDAE) AT BIRDS HILL, MANITOBA. Terry D.

Galloway and Todd R. Reichardt, Department of Entomology, University of Manitoba, Winnipeg, Manitoba, R3T 2N2.

As part of a study on the host/parasite relationship between Franklin's ground squirrel, Spermophilus franklinii, and its primary flea parasite, Oropsylla bruneri, at Birds Hill, Manitoba, records were kept on associates and parasites of O. bruneri. The most frequently encountered associates were the phoretic stages of a Trichouropoda sp. and a Psyllanoetus sp. The former are attached by a stalk to all parts of the flea's body, including abdominal sclerites, thorax, head and less frequently, the legs. The Psyllanoetus sp. was always found beneath the abdominal sclerites. Oropsylla bruneri was also infested by an allantonematid nematode, which severely affected the development of the ovaries in parasitized females. A gregarine parasite was present in the gut of the fleas throughout the season of host activity. Oropsylla bruneri was also implicated as an intermediate host for Hymenolepis citelli, the cestode parasite of S. franklinii. Cysticercoids of H. citelli were found in the body cavity of the fleas.

DISTRIBUTION AND RELATIONSHIPS AMONG FLEA PARASITES (SIPHONAPTERA: CERATOPHYLLIDAE, CERATOPHYLLUS SPP.) OF THE CLIFF SWALLOW (HIRUNDO PYRRHONOTA) IN NORTH AMERICA. Terry D. Galloway, Department of

Entomology, University of Manitoba, Winnipeg, Manitoba, R3T 2N2. Five species of fleas are currently recognized in association with the Cliff Swallow in North America: Ceratophyllus arcuegens Holland, C. calderwoodi Holland, C. celsus Jordan, C. petrochelidoni Wagner and C. scopulorum Holland. Reproduction in all five species is restricted to the breeding season of the host, which builds mud nests on vertical surfaces which are sheltered from wind and rain. Historically, these fleas were found in limited areas where suitable nest substrate was available for the host. However, in recent times, by construction of railway and highway bridges and buildings along waterways, man has allowed the Cliff Swallow to expand its range and to increase in abundance across the continent, into previously unavailable areas. The ranges of the flea associates have expanded coincidentally with that of the host and are now broadly sympatric in many areas.

INTERACTION BETWEEN APANTELES FUMIFERANAE AND NOSEMA FUMIFERANAE PARASITIZING THE EASTERN SPRUCE BUDWORM. V. G. Nealis and S. M. Smith, Great Lakes Forestry Center, Sault Ste. Marie, Ontario, Canada, P6A 3H7. The relationship between a braconid parasitoid, Apanteles fumiferanae, and a microsporidial pathogen, Nosema fumiferanae, two larval parasites frequently coincident in the eastern spruce budworm, Choristoneura fumiferana, was examined in the laboratory. When reared in budworm with high levels of Nosema (i.e. greater than 20×10^6 spores/mg), over 85% of the larval Apanteles expelled Nosema spores in their meconium. The rate of larval development for female Apanteles from these infected hosts was reduced slightly although survival, time for pupal development, pupal weight, and adult longevity for all parasitoids were not affected. Adult Apanteles were not infected by Nosema; spores were only found externally on 6% of the adult parasitoids. It is unlikely, therefore, that Apanteles is an important vector of Nosema in budworm populations or that the intensity of infection by Nosema in the eastern spruce budworm will have a significant effect on Apanteles populations in the field. This apparent lack of biological interaction between Nosema and Apanteles will be discussed in relation to the population dynamics of their host.

ORIGIN EACH SPRING OF A YEAST TRANSMITTED TO MUSTARD CROPS BY THE FALSE CHINCH BUG. Larry Burgess, Agriculture Canada Research Station, Saskatoon, Saskatchewan, Canada, S7N 0X2. The false chinch bug, Nysius ericae (Schilling), has been identified as the major vector of Nematospora sinecauda, a yeast that infects some prairie province mustard crops. Until recently there was no indication of the manner in which this yeast overwinters to begin the insect-plant infection cycle again each spring. New results of a field study in Saskatchewan suggest the possibility that the yeast overwinters in dry, ripe, ungerminated seeds of flaxweed, Descurainia sophia, and that false chinch bugs acquire the yeast by feeding on infected seeds.

USE OF BACILLUS THURINGIENSIS IN AGRICULTURE, FORESTRY AND PUBLIC AND ANIMAL HEALTH IN CANADA. O. N. Morris, Agriculture Canada Research Station, 195 Dafoe Road, Winnipeg, Manitoba, R3T 2M9. Research in Canada and abroad during the past 20 years has resulted in the registration of 23 formulations of the bacterium, Bacillus thuringiensis Berliner (B. t.), for use against insect pests of agriculture, forestry and public and animal health in this country. B. t. is recommended in all provinces of Canada for the control of a variety of crop pests and biting flies. About 8,000 ha of cole crops, tobacco and orchards in Canada are treated annually with B. t. In forestry, B. t. will be used on 74% of the approximately 2 million ha planned for treatment in 1986. The use of B. t. var. israelensis against aquatic stages of mosquitoes and blackflies is increasing yearly especially in Alberta, Manitoba, Ontario and Quebec. Insect pests in Canada which require priority research on the use of B. t. in their control include jackpine budworm, gypsy moth, hemlock looper, climbing

cutworms, armyworms, leaf rollers and blackflies. The research should include studies on deposit assessment on foliage, sunlight screens, selection of more toxic strains, environmental tolerance of the pathogen and development of appropriate recombinant DNA technology.

THE SUSCEPTIBILITY OF THE BERTHA ARMYWORM, MAMESTRA CONFIGURATA TO STRAINS OF BACILLUS THURINGIENSIS VARIETY AIZAWAI. Marc R. Trottier and Oswald N. Morris, Agriculture Canada Research Station, 195 Dafoe Road, Winnipeg, Manitoba, Canada, R3T 2M9.

Sixty-one strains of Bacillus thuringiensis Berliner (B. t.) belonging to varieties thuringiensis, alesti, kurstaki, dendrolimus, kenyae, galleriae, canadensis, entomocidus, aizawai, and tolworthi were bioassayed against early third instar larvae of the bertha armyworm, Mamestra configurata Walker (Lepidoptera, Noctuidae). Larvae were allowed to feed ad libitum for 7 days on an artificial diet into which quantities of primary powders of B. t. isolates were incorporated. The reference standard strain HD-1-S-1980 (B. t. var. kurstaki) was bioassayed simultaneously with all bioassays of other strains. Eleven strains, belonging mostly to the variety aizawai, were significantly more toxic at a concentration of 500 tg/ml of diet than the reference standard strain. The three best strains were two to four fold more potent than the reference standard strain.

A further 45 strains of the variety aizawai are currently being evaluated for their toxicity to M. configurata.

SUBMITTED PAPERS - SESSION V

Wednesday Afternoon, October 8

THE SYSTEMATICS OF MEMBERS OF THE GENUS DYTISCUS L. (COLEOPTERA: DYTISCIDAE). Robert E. Roughley, Department of Entomology, University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2N2.

The genus Dytiscus Linnaeus 1758 is Holarctic in distribution and consists of 26 species. Character states of the metacoxal processes and the median lobe of males provide important taxonomic characters useful in identification and also form important transformation series for use in a cladistic analysis of relationships of the species. These and other characteristics of adults and larvae were used to construct a phylogenetic hypothesis and biogeographic analysis which revealed that the plesiotypic (primitive) species-groups are North American and that in more apotypic (derived) species-groups there has been repeated vicariance between the Nearctic and Holarctic faunas.

TRICHOPTERA AND SUBSTRATE INSTABILITY IN THE OCHRE RIVER, MANITOBA. D. G. Cobb and J. F. Flannagan, Department of Fisheries and Oceans, 501 University Crescent, Winnipeg, Manitoba, R3T 2N6.

An aquatic invertebrate survey was conducted on the Ochre River in West-Central Manitoba to investigate possible causes of poor spawning success of Dauphin Lake walleye (Stizostedion vitreum), a valuable sport and commercial fish species in Canada.

Two-1m² emergence were sampled three times per week from May to September in 1983 and 1984 at 5 stations. These stations were situated along the river from near the mouth upstream some 20 km to just inside Riding Mountain National Park.

A total of 17 genera and 35 species of Trichoptera were collected. This is similar to species diversity reported in other streams of the area. Densities of Trichoptera were, however, lower than expected. There was an absence of a spring emergence, with the first emergence not occurring until early June. Although the river as a whole had a relatively good diversity of Trichoptera, the two stations at the upper reach of the study area and above any obvious anthropogenic influences had densities and diversities less than 50% of each of the other three stations. A combination of substrate instability at these two stations and the timing and occurrence of spates has a direct effect on the Trichoptera of the Ochre River, and probably on the success of walleye spawning.

THE IMPACT OF METHOXYCHLOR ON SELECTED NON-TARGET ORGANISMS IN A RIFFLE OF THE SOURIS RIVER, MANITOBA. R. J. Sebastien and R. A. Brust, Department of Entomology, University of Manitoba, Winnipeg, Manitoba, Canada, R3T 2N2.

A riffle of the Souris River, Manitoba, located at Bunclody, was treated with methoxychlor on 15 July 1982 at a rate of 0.3 mg/litre for 15 minutes. The treatment caused an immediate catastrophic drift in all of the 16 species of invertebrates examined. "Normal" behavioural drift densities were exceeded by many orders of magnitude. The catastrophic drift peak lasted from 4 to 24 h depending on the species involved, and was followed by a large decrease in the drifting population.

Individual taxa demonstrated varying abilities to recolonize artificial substrates following treatment. Species that had a high propensity to drift under natural conditions recolonized most rapidly e.g. Baetis spp. Taxa that required the longest period of time to recolonize were generally univoltine species that had a very low propensity to drift and a limited ability to disperse as adults e.g. Psychomyia flavida.

Species richness in the drift was significantly reduced ($p < .05$) at the treatment site for at least 33 days following treatment. Species richness on substrates was significantly lower ($p < .05$) at the treatment site for only 4 days after injection.

Drift was restored only after recovery of the benthic standing crop as measured on artificial substrates. Invertebrate drift is a more sensitive measure of the impact of methoxychlor treatments on aquatic invertebrate communities than are benthic densities.

EFFECTS OF FENITROTHION ON PITCHER-PLANT INHABITANTS. D. C. Eidt, Canadian Forestry Service - Maritimes, Fredericton, N.B., E3B 5P7 and W. L. Fairchild, Department of Biology, University of New Brunswick, Fredericton, N.B., E3B 6E1.

By injecting fenitrothion into the fluid in leaves of pitcher plants, Sarracenia purpurea, it was determined that the mosquito Wyeomyia smithii and the midge Metriocnemus knabi are under some risk from fenitrothion sprays in the range of 210 g/ha. The other principal insect inhabitant, the sarcophagid Blaesoxipha fletcheri, and copepods were not sufficiently abundant to evaluate. Mites and rotifers were not affected by concentrations of fenitrothion in the fluid up to 9.6 tg/L that affected the mosquito and the midge.

PARITY RATES, SPERM AND SUGAR PRESENCE, AND FOLLICLE DEVELOPMENT OF TABANUS QUINQUEVITTATUS (DIPTERA: TABANIDAE) IN SOUTHWESTERN QUEBEC.

Daniel J. Leprince, Dép. de Pathologie et de Microbiologie, Faculté de Médecine Vétérinaire, Université de Montréal, Saint-Hyacinthe, Quebec, Canada, J2S 7C6, and David J. Lewis, Department of Entomology, Faculty of Agriculture, Macdonald College of McGill University, Saint-Anne-de-Bellevue, Québec, Canada, H9X 1C0.

Specimens of Tabanus quinquevittatus, collected during 1980-81 in south-western Quebec, were dissected for parity, sperm presence, fat body reserve and stage of terminal follicle development. Diverticulae were tested for the presence of fructose or sucrose by the anthrone test. Parity was similar in both years, nulliparous individuals being twice as abundant as parous flies. The prevalence of nulliparous

specimens with terminal follicles in stage II suggests that the population studied in southwestern Quebec is anautogenous. Sperm was found in 90% and sugar in 88% of specimens dissected; percentages of sperm and sugar presence were significantly higher in parous than in nulliparous specimens. Lower fat body reserve and earlier stages of terminal follicle development were found in parous as compared to nulliparous specimens.

CHIRONOMIDAE (DIPTERA) EMERGING FROM A MIRE IN NORTHWESTERN ONTARIO. A. P. Wiens, D. M. Rosenberg, B. Bilyj and D. J. Giberson, Fisheries and Oceans, Freshwater Institute, Winnipeg, Manitoba, Canada, R3T 2N6.

The experimental acidification of a mire in the Experimental Lakes Area of northwestern Ontario provided an opportunity to study the Chironomidae emerging from this habitat during 1984 and 1985. Of 64 species collected during the period May-September of both years, 16 are undescribed, and 7 more are new North American records. Numerical standing stocks (850-1,900 individuals/m²) were similar to those from nearby lakes, but biomass standing stocks (35-60 mg/m²) were only 1/2 to 1/10 those of nearby lakes. Possible reasons for the relatively small size of Chironomidae from the mire are discussed. Most emergence was completed by the end of July to the start of August, sooner than for neighboring lakes. This may be an adaptation to avoid the driest part of the season in the mire, although moisture content of the Sphagnum does not appear to regulate directly the distribution and abundance of most species of Chironomidae. Experimental acidification has not yet affected chironomid emergence from the mire.

THE MOLECULAR BASIS OF INSECTICIDE RESISTANCE IN THE MOSQUITO CULEX TARSALIS. S. Whyard, R. Ziegler, M. J. Gouzoules, A. E. R. Downe, G. R. Wyatt, and V. K. Walker, Department of Biology, Queen's University, Kingston, Ontario, K7L 3N6.

Since malathion was introduced as an insecticide, numerous species of insects have developed resistance against this agent. In a number of instances, this resistance is believed to be linked to increased activity of a malathion-degrading carboxylesterase. This enzyme cleaves at one or both of the carboxylesters and forms the less toxic, easily excreted carbonic acids of malathion.

Two populations of Culex tarsalis are maintained in the laboratory. The control population is sensitive to low concentrations of malathion (LC 50 0.01 ppm), whereas the resistant strain is highly resistant (LC 50 4.5 ppm). When ¹⁴C-labelled malathion was used as a substrate, there was 50-100 times the carboxylesterase activity in resistant mosquitoes as compared to susceptible ones.

Preliminary work on the isolation and characterization of the malathion-degrading carboxylesterase has suggested that the enzyme in resistant insects is the same as that of the sensitive strain. This lends support to the hypothesis that resistance in these mosquitoes is conferred by increased enzyme levels in the resistant strain.

Progress in the characterization of this carboxylesterase and its relation to the malathion resistance will be discussed.

HOST PREFERENCES OF CULISETA INORNATA AND ANOPHELES EARLEI (DIPTERA: CULICIDAE) FROM SOUTHWESTERN MANITOBA. W. J. Galloway and R. A. Anderson, Department of Zoology, Brandon University, Brandon, Manitoba, R7A 6A9.

Knowledge of the host preferences of mosquitoes is essential for distinguishing important pest species and for understanding their role in disease transmission. The capillary tube precipitin test was used to determine the host preferences and feeding patterns of Culiseta inornata and Anopheles earlei from southwestern Manitoba. Blood-fed mosquitoes were collected from culverts and old buildings during the summer in 1985 and 1986. Ruminant and horse blood were identified in most of the blood-meals from C. inornata. Human, swine and avian blood, in total, accounted for less than 5% of the C. inornata blood-meals. Culiseta inornata preferentially fed on large mammals compared to birds. However selection between cattle and horses reflected relative abundance of these two hosts rather than a specific preference for either one. Anopheles earlei also fed on large ungulates such as cattle and horses, but a large proportion of the blood-meals were identified as being from beavers. Anopheles earlei may be an important vector of tularemia to beavers.

EFFECTS OF HONEYDEW ON BEHAVIOR OF APHIDIUS NIGRIPES SEARCHING POTATO FOLIAGE FOR APHID HOSTS. Conrad Cloutier, Departement de Biologie, Université Laval, Quebec, P.Q.

We have previously demonstrated that contact with residues of aphid honeydew has a stimulatory effect on host searching in A. nigripes females. Direct observations were made of parasitoids searching potato foliage both in the presence and absence of aphid honeydew, in order to determine if behavioral effects of aphid honeydew might increase parasitism under natural conditions. The visit time of females searching young plants increased from 9.2 to 16.2 minutes when honeydew residues were present. Parasitoid females visiting plants with honeydew residues searched 50% of the leaves present, compared to only 32% of clean plants. In addition, parasitoids spent more time per leaf visited when honeydew was present, resulting in 77% of the undersurface of leaves being searched in the presence of aphid honeydew, compared to only 38% on clean plants. The results demonstrate that honeydew residues can significantly increase the searching effort of A. nigripes on the foliage of plants, in the absence of host aphids.

ACOUSTICAL RESONANCE OF MOSQUITO ANTENNAE. Peter Belton, Centre for Pest Management, Department of Biological Sciences, Simon Fraser University, Burnaby, B.C., V5A 1S6.

First described by Meyer in 1874, the tuning of the antennae of mosquitoes to particular sounds has never been completely explained. Experiments to investigate the resonance of the antennae of males and,

for the first time, females of several species will be described. The flagellum of the male antenna of these species bears 12 rings of very long setae but otherwise the anatomy and acoustic physiology of the antennae are similar.

Differences between males and females in the mechanical responses of the flagellum and the electrical responses of Johnston's organ in the pedicel (2nd. segment) will be illustrated. Recordings were made simultaneously of the mechanical and electrical resonance of each antenna in response to frequency sweeps of sine waves of different intensity and the role of the long setae of the males is analysed.