

PROCEEDINGS OF THE

**ENTOMOLOGICAL
SOCIETY OF
MANITOBA**

VOLUME 40

1984

Proceedings of the
ENTOMOLOGICAL SOCIETY OF
MANITOBA

Volume 40
1984

Robert E. Roughley
Editor
Winnipeg, Manitoba

CONTENTS

	Page
MINUTES OF THE 40TH ANNUAL MEETING	1
EXECUTIVE REPORTS	2
BOARD REPORT	2
COMMITTEE REPORTS	2
ELECTION RESULTS	4
TRANSFER OF OFFICE	4
OTHER BUSINESS	4
ADJOURNMENT	4
APPENDICES	
A. AGENDA	5
B. PRESIDENT'S REPORT	6
C. AUDITOR	7
C-1 RECEIPTS AND DISBURSEMENTS	7
C-2 BALANCE SHEET	8
D. EDITOR: MANITOBA ENTOMOLOGIST	9
E. REGIONAL DIRECTOR'S REPORT	9
F. ENDOWMENT FUND	10
G. FINANCE COMMITTEE REPORT	10
H. PUBLICITY	13
I. PUBLIC EDUCATION	13
J. SOCIAL COMMITTEE	14
K. INSECT COMMON NAMES COMMITTEE	14
L. REPORT OF THE ARCHIVIST	15
M. MANITOBA ENVIRONMENTAL COUNCIL	15
N. AWARDS COMMITTEE	16
O. ESC SCHOLARSHIP COMMITTEE	16
ABSTRACTS OF PAPERS PRESENTED TO THE ANNUAL MEETING, 1984.	
Factors influencing Lygus Bug damage in Alfalfa seed grown in the Peace River region of Alberta. RICHARD A. BUTTS	18
European Corn Borer infestation - 1984. A.J. KOLACH	18

	Page
Damage assessment of the pea aphid, <u>Acyrtosiphon pisum</u> (Harris) on field peas in Manitoba. GOERGE A. MAITEKI and ROBERT J. LAMB	19
The economic impact of Colorado Potato Beetle and the Potato Flea Beetle on potato in Manitoba. D.G. SENANAYAKE and N.J. HOLLIDAY	19
Growth and yield of transplanted and direct-seeded broccoli (<u>Brassica olerace</u> var. <u>italica</u> Pl.) subjected to Flea Beetle (Coleoptera: chrysomelidae) feeding. J.J. SOROKA and M.K. PRITCHARD	20
The effects of temperature on calling behaviour of the Bertha armyworm, <u>Mamestra configurata</u> Walker (Noctuidae: Lepidoptera). M. A. HOWLANDER AND G. H. GERBER	20
Thermal strategies for development in a north-temperate Chrysomelid beetle. ROBERT J. LAMB and GEORGE H. GERBER	21
Parasitoids of <u>Acyrtosiphon pisum</u> (Harris) (Homoptera: aphididae) in Manitoba. F.O. MATHESON and H.G. WYLIE	21
Effects of cold stress during diapause on the survival and development of the cabbage root fly. W.J. TURNOCK	22
<u>Bacillus thuringiensis</u> : Evaluation as a black fly control agent. M.M. GALLOWAY and D.K. BURTON	22
The effect of biting flies on the behaviour and weight gain of dairy heifers at Seven Sisters Falls, Manitoba. W. RALLEY	23
Seasonal dynamics of <u>Oropsylla (Opisocrostis) Bruneri</u> (Baker) (Siphonaptera), a flea on Franklin's Ground Squirrel, <u>Spermophilus franklinii</u> (Sabine) (Scuridae). TODD R. REICHARDT and TERRY D. GALLOWAY	23
The impact of Methoxychlor on selected non-target invertebrates in a riffle of the Souris River, Manitoba. R.J. SEBASTIEN and R.A. BRUST	24

	Page
<u>PAPERS</u>	
Distribution of wheat midge damage on wheat in Manitoba in 1984. PHILIP S. BARKER	25
Hymenopterous parasitoids of aphids (Homoptera: aphididae) in Manitoba. B.A. BATULLA and A.G. ROBINSON	30
Distribution of Manitoba Stoneflies (Plecoptera). DAVID K. BURTON	39

MINUTES OF THE 40TH ANNUAL MEETING
ENTOMOLOGICAL SOCIETY OF MANITOBA

13:30 h., 9 November, 1984
Seminar Room
Freshwater Institute
501 University Crescent
Winnipeg, Manitoba R3T 2N2

The President, Dr. G. K. Bracken, presided. A quorum being present, the President called the meeting to order and asked Dr. G. H. Gerber to be Acting Secretary and take minutes of the meeting.

Present

Executive: Dr. G.K. Bracken, President Dr. R.A. Ellis, President-Elect;
Dr. R.A. Brust, Member-at-Large; Dr. T.D. Galloway, Regional Director to E.S.C.; Dr. G.R.B. Webster, Past-President.

Executive Staff: Mr. W.L. Askew, Treasurer, and Dr. R.E. Roughley, Editor of the Proceedings.

Members:

G.H. Gerber	W. Ralley	W.B. Preston
A.G. Robinson	Y. Deedat	S.R. Loschiavo
M. Henderson	R. Currie	E. Straszynski
J. Buth	S.C. Jay	P.A. MacKay
M. Friesen	W.J. Turnock	L.B. Smith
M. Galloway	N. Holliday	H.G. Wylie
F. Matheson	R. Cochrane	
G.L. Ayre	B. Galloway	

1. Agenda (Appendix. A)

Motion - M. Galloway/W. Ralley: Adoption of the agenda.

Carried

2. Minutes of the 39th Annual Meeting

Motion - R. Ellis/T. Galloway: Adoption of the minutes of the 39th Annual Meeting of the Entomological Society of Manitoba Incorporated, held on 4 November 1983, and published in the Proceedings of the Entomological Society of Manitoba (Vol. 39, 1983).

Carried

3. Business arising from minutes of 39th Annual Meeting.

None.

4. EXECUTIVE REPORTS

4(a). President (Appendix. B)

Motion - L.B. Smith/S.C. Jay: Acceptance of the President's report as circulated.

Carried

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

Motion - W. Askew/J. Buth: That the treasurer's/auditor's report be accepted.

Carried

Motion - W. Askew/R. Ellis: That H. Samboluk be reappointed as the auditor for the Entomological Society of Manitoba for the fiscal year ending in 1985.

Carried

4(c). Editor - The Proceedings of the E.S.M. (Appendix. D)

Motion - R. Roughley/N. Holliday: That the report of the editor of the Proceedings be accepted as circulated.

Carried

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

Motion - T. Galloway/N. Holliday: That the report of the Acting Regional Director, Dr. N. Holliday, be accepted as circulated.

Carried.

5. BOARD REPORT

5(a). Endowment Fund Board (Appendix F)

Motion - R. Brust/T. Galloway: That the report of the Endowment Fund board be accepted as circulated.

Carried

6. COMMITTEE REPORTS

Motion - W. Turnock/R. Ellis: That all committee reports be received.

Carried

6 (a). Finance Committee (App. G)

Motion - R. Brust/W. Ralley: That the ceiling for the Endowment Fund be \$25,000.00.

Carried

Motion: R Brust/G. Webster: That the Life Membership Dues be \$200.00.

Carried

Motion: R. Brust/G. Ayre: That an amount of \$1,000.00 be set aside annually for a student scholarship in Entomology beginning in 1985-1986.

Carried.

Amendment to the Motion: L. Smith/R. Ellis: That the words "1985-1986" be deleted from the motion.

Carried.

Motion: W. Turnock/M. Galloway: That a committee be set up to develop guidelines for the student scholarship in Entomology and report back to a Special General Meeting of the Society.

Carried.

Motion: R. Ellis/G. Ayre: That an amount of \$750.00 be set aside to cover the costs of a guest speaker for the 1985 Annual Meeting of the Society.

Carried.

Motion: R. Brust/J. Buth: That the 5-year projected budget be approved as circulated.

Carried.

6 (b). Publicity Committee (Appendix H): - No actions taken.

6 (c). Social Committee (Appendix I): - No report submitted.

6 (d). Public Education and Youth Encouragement Committee (Appendix J):
- No actions taken.

6 (e). Committee on Insect Common Names (Appendix K): -No actions taken.

6 (f). Archivist (Appendix L): -No actions taken.

6 (g). Manitoba Environment Council (Appendix M): -No actions taken.

6 (h). Awards Committee (E.S.C.)

Dr. G.H. Gerber reported that the committee was putting together the documentation for a candidate for the gold Medal Award of the Entomological Society of Canada.

No actions taken.

6 (i). Awards Committee (E.S.M.) (Appendix N): -No actions taken.

6 (j). E.S.C. Scholarship Committee (Appendix O): -No actions taken.

6 (k). Scientific Program Committee

No report submitted.

7. 1984-1985 Election Results

Dr. G.R.B. reported the results of the election of officers for 1984-1985:

President-Elect: M. Galloway
Member-at-Large: Y. Deedat

Motion: G. Webster/W. Ralley: That the ballots be destroyed.

Carried

8. Transfer of Office

The office of the president was transferred from Dr. G. Bracken to Dr. R. Ellis.

9. Other Business

Dr. G. Bracken was asked to return to chair the meeting.

Motion - R. Ellis/W. Ralley: that the E.S.M. extend an invitation to the Entomological Society of Saskatchewan to hold a joint Annual Meeting of the 2 Societies in Winnipeg on 24-25 October 1985.

Carried

10. Adjournment (14:50 h of 9 November 1984)

Motion: T. Galloway/S.C. Jay: That the meeting be adjourned.

Carried

APPENDIX A

40TH ANNUAL BUSINESS MEETING

November 9, 1984

AGENDA

1. Appointment of Secretary to record the proceedings of the annual business meeting.
2. Acceptance of agenda.
3. Minutes of last annual meeting.
4. Business arising from the minutes.
5. Reports - Executive

a) President	G.K. Bracken
b) Treasurer	W. Askew
(Auditors)	
Appointment of auditors	
c) Editor Proceedings	R.E. Roughley
d) Regional Director to ESC	T.D. Galloway
e) Endowment Fund BD.	R. Brust
6. Reports - Committee

a) Finance Committee	R. Brust
b) Publicity	R. Ellis
c) Social	J. Buth
d) Youth and Education	W. Ralley
e) E.S.C. Insect common names	G. Robinson
f) Archivist	G. Robinson
g) Manitoba Environmental Council	M. Friesen
h) Awards (ESC)	G. Gerber
i) Awards (ESM)	S. Loschiavo
j) ESC Scholarship Committee	M. Galloway
k) Scientific Program	R. Lamb
7. 1983-84 Election Results
8. Transfer of Office
9. Other Business
10. Adjournment

APPENDIX B

PRESIDENT'S REPORT

In this report I highlight some activities of the Society during the past year, comment on our present status, and commend and thank specific members for their work for our Society.

The Executive, in addition to routine duties, has established a Finance Committee to provide a more comprehensive approach to the financial management of the Society. This action was necessitated in large part by a change in the primary purpose of the Endowment Fund. The Executive also has appointed committee chairpersons to make appropriate arrangements for our joint meeting in 1986 with the national society. Social activities have been below average in number but our two luncheons and the New Members' Social had excellent guest speakers and were well attended. I must add that all activities of the Society were reported in an exemplary manner by Dr. R. Ellis in 4 issues of the ESM Newsletter during the year.

Our Society is in a very positive position in terms of financial status and number of members. In the past year we have had continued support from a very important sector, insects themselves, providing chronic and acute problems that keep entomology before the public eye. We will need these assets because many of us will face very soon the possibility of even greater financial restraint on the part of governments applied to resources that are thinly stretched even now.

One learns quickly as president the truth in the adage "the buck stops here". Nevertheless, the ready cooperation and help of the membership has made my tenure both easy and enjoyable. I thank all of you who have responded positively to my various requests and who have served on the many committees. Specifically I thank the following chairpersons for special efforts in their respective areas: Ms. J. Buth, Social Committee; Dr. R. Ellis, Publicity; Dr. R. Lamb, ESM Scientific Program; Ms. W. Ralley, Education and Youth Encouragement. I thank also Dr. R. Roughley, editor, Proceedings ESM for getting us through the transition to the new Proceedings format and to our secretary, Dr. N. White for reminding me constantly of what must be done. Finally, I thank all members of the Executive and Executive Staff for their direction and support throughout the year.

To all members of the Society my thanks for giving me the honor of being your president. I am confident that you will support our new president Dr. R. Ellis, and the Executive in their endeavours to lead our Society through an exciting and productive year.

G.K. Bracken
President 1983-84

APPENDIX CENTOMOLOGICAL SOCIETY OF MANITOBA INC.
AUDIT REPORT FOR THE YEAR ENDED
AUGUST 31, 1984

I have examined the records of the Entomological Society of Manitoba for the year ended August 31, 1984.

In my opinion the attached financial statements present fairly the financial position of the Society as at the year ended August 31, 1984 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, 1984RECEIPTS:

Membership	\$ 674.00
Subscriptions	354.28
Committees	132.00
E.S.C. Donation for Youth Committee	300.00
Annual Meeting	1,332.00
Premium on U.S. Funds	29.59
Advance return by Social Committee	50.00
	<hr/>
	\$2,871.87.

DISBURSEMENTS:

Printing	\$ 488.48
Stationery	522.58
Postage	647.35
Bank Charges & Safety Deposit	39.75
Committee Expenses	449.31
Meetings - Annual	1,719.05
Deposit on 1984 Banquet	500.00
Subscription Refunds	25.68
Advance to Social Committee	50.00
Company returns	5.00
	<hr/>
	4,447.20

Net Loss from Operations	(\$1,575.33)	
G.I.R. Investment Income	2,001.87	
Investment Interest	429.29	
		<hr/>
NET INCOME for year ending		
August 31, 1984		\$ 855.83
		<hr/>

ENTOMOLOGICAL SOCIETY OF MANITOBA INC.
BALANCE SHEET
FOR THE YEAR ENDING AUGUST 31, 11, 1984

ASSETS:

Current Account Bank Balance	\$ 450.05
Savings Account Bank Balance	1,711.77
Investments: XM3845	\$3,000.00
EN9903	2,000.00
RC5523	2,200.00
GE0069	2,000.00
CH6727	2,000.00
HK9093	3,024.33
XK5133	2,000.00
WN2560	5,000.00
	<hr/>
	21,224.33
Petty Cash: Treasurer	25.00
Secretary	50.00
Editor	25.00
	<hr/>
	\$23,486.15

LIABILITIES AND SURPLUS:

Liabilities	nil	
Surplus Account		
Balance as at 31/8/83	22,630.82	
Net Income for Period	855.83	
	<hr/>	
		\$23,486.15

APPENDIX DAnnual Report of the Editor of the
Proceedings of the Society

Three hundred copies of Volume 39 (1983) were ordered along with 200 reprints of the scientific paper included in this Proceedings. The initial cost for printing was \$1,001.90. With the expected return to the Society of the cost of production of the scientific paper then the cost to the Society per copy of this Proceedings is approximately \$1.52 or about half the cost/copy of last year. The low cost this year was due to volunteered resources and cannot be expected to continue. Due to the delay in printing, and other factors, the copies of Volume 38 were mailed out rather later than usual. It is hoped that recent and future changes in the duties of the Editor will rectify these delays.

APPENDIX E

E.S.C. REGIONAL DIRECTOR'S REPORT - 1984

The Annual Meetings of the Governing Board of the Entomological Society of Canada were held on 29-30 September and on 3 October 1984 in St. Andrews, New Brunswick.

The board approved our preliminary plans for the joint Annual Meetings of the ESM and ESC to be held at the Holiday Inn South, Winnipeg from 6 - 8 October 1986. The board referred to the ESC finance committee a request from ESM that ESC increase the amount of money it provides to regional societies organizing joint Annual Meetings.

Next year ESC is participating with other societies of the Biological Council of Canada in a Canadian Congress of Biology, 23-29 June 1985 at London, Ontario. The Annual Meeting of ESC will be in Ottawa, 23-25 September 1985. In 1988 the 18th International Congress of Entomology will be held in Vancouver from 3-9 July. In light of these summer meetings, and the possibility of others, ESC is considering amending its by-laws to allow its Annual Meeting to be held in the summer when necessary.

N. J. Holliday
Acting Regional Director, E.S.C.
5 November 1984

APPENDIX FEntomological Society of Manitoba
Annual Report of the ENDOWMENT FUND BOARD

Investments, in the form of Royal Trust
Guaranteed Investment Certificates are as follows:

<u>Cert. No.</u>	<u>\$Amt.</u>	<u>Interest Rate</u>	<u>Maturity</u>	<u>Annual Int.</u>
EN9903	2000	12.375	April 1989	247.50
XM3845	3000	10.875	December 1988	326.25
XK5133	2000	11.375	June 1988	227.50
HK9093	3024.33	12.375	December 1987	374.26
CH6727	2000	18.625	October 1986	372.50
GE0069	2000	11.875	July 1985	237.50
RC5523	2200	12.375	November 1984	272.25
<u>Total</u>	<u>16224.33</u>			<u>2057.76</u>

SHORT TERM GIC (5 months)

WN2560	5000	10.125	November 1984	210.94
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W. Askew
F. Matheson
R. Brust, Chairman

APPENDIX GE.S.M. Finance Committee Report Nov. 9/84

On 17 January, 1984, the Entomological Society of Manitoba Executive set up a Finance Committee consisting of R. Brust, Chairman, W. Askew, F. Matheson (all three members of the Endowment Fund Board), R. Roughley and a member at large.

The Finance Committee was instructed to review banking and accounting procedures used by the ESM Treasurer, review expense budgets submitted by ESM committees, recommend page charge fees for contributors to the Proceedings, and prepare a projected budget for the Society.

The Finance Committee (including J. Conroy, member at large) met on 15 March, 1984, and drew up 5 recommendations and a 5-year proposed budget. These have been printed in the November Newsletter, and are shown below. In addition to these, the committee found that the banking and accounting procedures used by W. Askew have served the Society well. They found no need to change anything at present.

Although there are a number of unknowns on the income side of the ledger, for example, the income generated by dues may be less than \$1400 for 1984-85 if the membership shrinks due to the tripling of dues. Income generated from papers published in the Proceedings is also an unknown factor. However, the Committee felt that if the Endowment Fund were allowed to grow to \$25,000, sufficient income should be generated to begin offering a \$1000 student scholarship by 1985-86. By 1987-88, additional monies would also be available to increase the size of the invited speaker fund for the Annual General Meeting of the Society.

Finance Committee Recommendations:

1. The ESM membership approve a ceiling of \$25,000 for the Endowment Fund.
2. ESM Life memberships be set at \$200.
3. An amount of \$1000 be set aside annually by the Society for the purpose of supporting a student scholarship in Entomology beginning 1985/86.
4. An amount of \$500 be set aside beginning 1987, as start-up money for future speakers for the Annual General Meeting of the ESM.
5. The Finance Committee reassess the projected budget annually, to maintain a healthy financial position.

W. Askew
J. Conroy
F. Matheson
R. Roughley
R. Brust, Chairman

Table 1. Five-year Projected Budget, Entomological Society of Manitoba.

Budget Item	Expenses						Income					
	83-84	84-85	85-86	86-87	87-88	88-89	83-84	84-85	85-86	86-87	87-88	88-89
Endowment Fund							2000	2300	2400	2500	2500	2500
Annual General Meeting	1700	1700	1700	1700 ²⁾	2200 ³⁾	2200	1300	1300	1300	1400	1500	1500
Proceedings, ESM	2500	2500	2600	2700	2800	2900	1500	1500	1600	1700	1800	1900
Newsletter	885	1000	1000	1000	1000	1000						
Youth Education Comm.	410	300	300	300	300	300	410	300	300	300	300	300
Stationery (6-yr. supply)	600											
Social Committee	145	150	150	150	150	150						
Scholarship			1000	1000	1000	1000						
Awards Comm.	100	100	100	100	100	100						
Dues							600	1400	1400	1500	1500	1500
Subscriptions							250	250	250	250	250	250
TOTAL	6340 ¹⁾	5750	6850	6950	7550	7650	6060	7050	7250	7550	7850	7950

1) Fiscal year ends 31 August.

2) Joint ESM - ESC meeting, Oct. 1986

3) Budgeted for Nov. 1987 AGM.

APPENDIX H

ANNUAL REPORT OF THE PUBLICITY COMMITTEE - 1984

Five issues of the ESM Newsletter were prepared for Volume 11 in 1984, appearing in January, March, May, July, and November.

The name was changed from the Entomological Society of Manitoba Newsletter to the ESM Newsletter. Accordingly, the ISSN number was changed from 0229-6721 to 0826-306X.

The then current 1984 ESM Membership List was distributed with the Volume 11, Issue 3 mailing, at the request of the Executive.

Thanks are due to those members who have assisted the Editor by providing short articles, comments, criticisms and suggestions over the past year. Special thanks to one anonymous member who has reviewed each issue for errors, clarity and taste.

R.A. Ellis
Editor, ESM Newsletter
9 November 1984

APPENDIX I

The Public Education and Youth Encouragement Committee was very busy this year. Between October 83 and May 84, the Youth Encouragement Committee spoke to 15 Beaver groups, 4 primary schools and 2 day care centers. These talks were given by graduate students and technical staff from the Department of Entomology, University of Manitoba.

This year members of the Young Entomologists were solicited by stocking the local libraries and museum with pamphlets encouraging entomology. This resulted in 24 enthusiastic Young Entomologists who met twice this past summer for collecting trips.

This committee was also involved in a shopping mall display in April to commemorate National Wildlife Week. This display ran a full week and many people from the society were involved.

Some of the monies donated to this committee were spent on collecting equipment and photocopying for the Young Entomologists and materials for public displays.

APPENDIX J

Social Committee Report - 1984

As usual, three types of social functions were arranged for the members during the year:

1. New Members Social

About 65 members and their friends/spouses attended this function held in the Faculty Club of the University of Manitoba on February 25th. Dr. S. Cam Jay gave an excellent slide presentation, entitled "Kiwi Land Revisited and Fun in the Hairy Berry Jungles of New Zealand".

2. Luncheons

Two luncheons were held. The guest speakers included Dr. L. Sekla (on arbovirus surveillance), and Ms. K. Leavesley (on hognose snakes). Average attendance was about 35 people.

3. Annual Banquet

A medieval feast at the Viscount Gort was held following the Annual Meeting. The 67 members and guests present thoroughly enjoyed this novel type of banquet.

J.L. Buth
Social Chairperson
November 10, 1984

APPENDIX K

REPORT OF THE COMMITTEE ON
INSECT COMMON NAMES

The Insect Common Names Committee has not met since the Annual Meeting on 1983, and there are no activities to report.

A.G. Robinson

APPENDIX LREPORT OF THE ARCHIVIST

The Archives materials of the Entomological Society are held in Room 213B of the Department of Entomology, University of Manitoba. Donations of Newsletters or other material are welcome. No activities were undertaken since the Annual Meeting of 1983.

A.G. Robinson

APPENDIX MREPORT ON THE MANITOBA ENVIRONMENTAL COUNCIL

This is my second year as representative of ESM on MEC. I did not stand for reelection as MEC secretary at the Annual General Meeting in May, 1983 but I did accept the position as Chairperson of the Membership Committee. I am also serving on the Environmental Chemicals/Water and Waste Committee.

Several important issues re. MEC were resolved this past year. After the evaluation of the organization and activities of MEC by the Social Planning Council of Winnipeg numerous discussions were held to consider alternate ways of structuring MEC. After considerable deliberation, the MEC membership approved the recommendations of the Board of Directors to have MEC remain basically as it is, i.e. working within the "framework" of the Provincial government as an advisory body. A number of recommendations by the Social Planning Council have been incorporated including a priority setting procedure. The issue of staff for MEC has been resolved and there are now two full-time positions associated with MEC - an Executive Co-ordinator, Keri Barringer, and a secretary, Shelagh Finch.

Nine briefs were approved at the May Annual General Meeting: one on transportation subsidies for schools, two on the Environment Assessment Review Procedure, one on selling of crown lands, one on water quality monitoring in Manitoba, one on recycling aluminum containers, one on pesticide use for control of W.E.E. and one on the use of pesticides in the environment. One brief on trapping and one brief on the cruise missile testing were sent back to committee.

As a member of the Environmental Chemicals/Water and Waste Committee, I presented two briefs. The first was a brief on the MEC's position on fogging for control of nuisance mosquitos presented to the Executive Policy Committee of the City of Winnipeg. This brief was responded to by Parks and Recreation Committee and a response to the response was presented by Dr. Muir, the former Chairperson of the EC/WW Committee, at a later Executive Policy Committee meeting. The second

brief was presented to the Clean Environment Commission hearings on the proposed treatment of the Souris River with Abate for the control of black fly larvae. Copies of the briefs and response of the Parks and Recreation Committee are in the ESM secretary's files.

Council membership is close to the 100 maximum but since there is always a steady turn-over, I encourage anyone interested in joining MEC to submit an application.

Margaret K. Friesen
ESM representative on MEC
9 November 1984

APPENDIX N

REPORT OF THE AWARDS COMMITTEE, 1984

Letters of information and requests for nominations for the 1984 undergraduate student Achievement Award were sent May 14 to the Department of Entomology and Department of Zoology, University of Manitoba; Department of Biology, University of Winnipeg; and Department of Zoology, University of Brandon.

No qualified candidates for this award were nominated by any of the above-named Departments. Consequently, the members of that Committee agreed that the award not be granted in 1984.

Respectfully submitted.
SD.R. Loschiavo, Chairman
J.C. Conroy
M.M. Galloway
D.L. Smith

APPENDIX O

REPORT OF THE ESC SCHOLARSHIP COMMITTEE, 1984

Two scholarships of \$1,000 each were awarded this year. The recipients are Heather J. McAuslane, University of Guelph, and Louis Mills of l'Université de Laval. Seven applications were received, one of which was disqualified and one withdrawn.

At the annual meeting, the ESC Board of Governors approved a motion of the Scholarship Committee to increase the awards to two, at \$2,000 each in 1985. The scholarship fund has been increasing, and reached a capital of \$31,275 in 1982 (the last year pertinent figures are available), with income of interest of \$3,400 and donations of \$1,340.

The new ESM representative for this Committee is Dr. S.C. Jay. Under the chairmanship of R.F. Shepherd, this year the committee will be discussing eliminating some of the eligibility restrictions, improved or more criteria for selecting winners, and promotion of the scholarships and scholarship program.

M.M. Galloway
ESM representative
31 October 1984

ABSTRACTS OF PAPERS PRESENTED TO THE FORTIETH ANNUAL MEETING
OF THE ENTOMOLOGICAL SOCIETY OF MANITOBA
NOVEMBER 8 - 9, 1984

SEMINAR ROOM, FRESHWATER INSTITUTE, 501 UNIVERSITY CRESCENT
WINNIPEG

FACTORS INFLUENCING LYGUS BUG DAMAGE IN ALFALFA SEED GROWN
IN THE PEACE RIVER REGION OF ALBERTA

RICHARD A. BUTTS

Department of Entomology, University of Manitoba,
Winnipeg, Manitoba R3T 2N2

Damage estimates of 21 fields in 1980-1983 indicated that seed loss due to Lygus feeding ranged from 8 to 32% of the total yield. There was a positive correlation between Lygus numbers and rainfall. Drought conditions and excessive rainfall resulted in little damage per L.D.U. (Lygus damage unit), however, when rainfall was within the normal range damage approached 0.5 lbs of seed/acre/L.D.U.

Variation in the amount of damage occurring in different districts within the Peace River region was not significant ($P=0.335$). Significant variation was found between fields ($P=0.0001$) between plants ($P=0.002$) and within plants ($P=0.006$). A control program is discussed based on the factors influencing the amount of damage likely to occur.

EUROPEAN CORN BORER INFESTATION - 1984

A.J. KOLACH

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The European corn borer infestation in Manitoba in 1984 was very severe in the Central and Eastern Region. Corn fields in Altona, Morden, Carman and Beausejour areas were heavily infested. The corn borer numbers per stalk were highest of all in the Morden area. Infestations were also present in the Southwest, Northwest and Interlake Regions but not nearly as severe.

Various insecticide treatments were used by growers, including some that are not registered. Furadan F applied by air twice between July 18 and August 4, gave the best control of corn borer. The treatment time was based on peak moth activity taken from light traps. Based on a 3% loss of yield per borer (Iowa State University Publication 22, 1983) the

losses in untreated fields in Manitoba in the severely infested areas ranged from 16 - 62%.

DAMAGE ASSESSMENT OF THE PEA APHID, ACYRTHOSIPHON PISUM
(HARRIS) ON FIELD PEAS IN MANITOBA

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Pea plants (cv. Century) in field cages were infested at different growth stages with Pea aphids in 1981 and 1982 at 5 densities to mimic natural populations. In 1983, reproductive parts were caged in sleeve cages and infested with aphids at 7 different densities for 4 days. In 1981, resulting yields were affected by aphid density and plant growth stage at time of infestation. In 1982, aphid feeding during the vegetative stage alone did not affect yields, but feeding through flowering, pod filling and pod maturity stages resulted in significantly ($P \leq 0.05$) less yields than noninfested plants. Infested flower buds, young and enlarged flat pods yielded significantly ($P \leq 0.05$) less than noninfested ones. Yield reductions resulted from pod shedding, reduced pod size and number of seeds per pod, and reduced seed weight. It appears damage during flowering and pod filling stages is critical.

THE ECONOMIC IMPACT OF COLORADO POTATO BEETLE AND THE POTATO
FLEA BEETLE ON POTATO IN MANITOBA.

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In 1983 and 1984 whole plant bag sampling was used to estimate the population densities of insects on potato cv. Norland in unsprayed plots near Morden, Manitoba. In experimental plots of the same cultivar, densities of Colorado potato beetle were manipulated on individually caged plants so that, throughout the growing season, plants were exposed to either half field density, field density, twice field density, or no beetles. A significant relationship between yield and Colorado potato beetle density was obtained. Similar manipulations of potato flea beetle density resulted in no significant depression of yield, even at twice field density; in 1984 plants were exposed to four and eight times field density and significant reductions in yield were found. Estimates

of the cost and efficacy of such treatments enable the determination of the economic injury level of both species.

GROWTH AND YIELD OF TRANSPLANTED AND DIRECT-SEEDED BROCCOLI
(*Brassica oleracea* var. *italica* Pl.)
SUBJECTED TO FLEA BEETLE (COLEOPTERA:CHRYSOMELIDAE) FEEDING

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To assess the effects of cruciferous-feeding flea beetles on transplanted and direct-seeded broccoli, a two year field study was carried out consisting of numerous bi-weekly plantings of 4, 3, and 2 week old transplants of the broccoli cultivar 'Premium Crop', as well as direct-seeded alone and direct-seeded plus carbofuran (Furadan) granule treatments. Plants in the earliest planted plots in both years experienced the highest direct mortality due to flea beetle feeding; mortality at all seeding dates was highest shortly after planting of transplants and emergence of seedlings. The direct-seeded alone treatment suffered the highest foliage feeding and mortality as well as the longest days to maturity requirement of any of the five treatments. The combined two year yield of the seeded alone treatment was 36.5% of the seeded plus carbofuran treatment yield. Yield of seeded plus carbofuran broccoli heads which had been subjected to heavy feeding pressure early in the season compared favorably with the numbers of 4 week old transplants harvested from the same plots.

THE EFFECTS OF TEMPERATURE ON CALLING BEHAVIOUR OF THE BERTHA ARMYWORM,
MAMESTRA CONFIGURATA WALKER (NOCTUIDAE: LEPIDOPTERA)

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The effects of temperature on calling behaviour in the bertha armyworm were studied at seven constant temperatures (5° - 35°C) in the laboratory. In females reared at 10° to 35°C from emergence, calling was initiated during the fifth day at 10°C, third day at 15°C, and the second day at 20°, 25°, and 30°C. At 35°C, calling was delayed until the fourth day and the ovaries were damaged by the heat. In females reared at 20°C until the third scotophase and then transferred to 5°, 10°, 15°, 20°, 25°, 30°, or 35°C at the beginning of the third scotophase, calling was initiated during the third hour after lights were switched off at 5°C, the fifth hour at 10°C, the sixth hour at 15°C - 30°C, and the eighth hour at 35°C.

THERMAL STRATEGIES FOR DEVELOPMENT IN A NORTH-TEMPERATE
CHRYSOMELID BEETLE

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Entomoscelis americana Brown, a Crucifer-feeding Chrysomelid beetle, has a north-temperate distribution in North America. Larvae and pupae develop in May and June at average monthly temperatures usually less than 11 and 17°C, respectively. Their development, growth, and survival were studied at 10 constant temperatures, in field cages, and in natural populations in Manitoba. Adult weight and developmental rate increased with temperature, but survival was low at the extreme temperatures indicating that 10 and 32.5°C were near the threshold and upper limit. On the basis of these responses, the "ecological temperature optimum" was estimated to be near 27.5°C, more than 10°C above the average air temperatures they normally encounter. A three-parameter normal function accurately described the relationship between developmental rates and constant temperatures. It was used in a computer simulation model to estimate developmental times to within 1 to 5 days in field cages. The model overestimated developmental times by 5 to 16 days in natural populations. We hypothesize that the discrepancy was due to behavioral thermoregulation and that the insect raises its body temperature by an amount equivalent to adding 6°C to the maximum daily temperature. These responses to temperature would not maximize developmental rate.

PARASITIDS OF ACYRTHOSIPHON PISUM (HARRIS)
(HOMOPTERA: APHIDIDAE) IN MANITOBA

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Primary and secondary parasitoids of the pea aphid, Acyrtosiphon pisum (Harr.), in southern Manitoba, were determined from aphids and mummies collected on field peas, alfalfa and fababeans and held in the laboratory. Four primary parasitoids, all aphidiids, were recorded: Aphidius ervi Hal., Aphidius pisivorus Smith, Praon occidentale Baker and Praon pinguicolum Vier. Of seven hyperparasitoids, two alloxystids, Alloxysta victrix (Westw.) and Phaenoglyphis ambrosiae (Ashm.) develop inside the larva of the primary parasitoid inside the aphid. Five other hyperparasitoids develop externally on the larvae or pupae of the primary parasitoids inside the aphid mummy. These ectoparasitoids include four pteromalids, Asaphes vulgaris Walk., Coruna clavata Walk., Pachycrepoideus vindemiae (Rond.), and Pachyneuron siphonophorae (Ashm.) and, one ceraphronid, Dendrocerus carpenteri (Curt).

EFFECTS OF COLD STRESS DURING DIAPAUSE ON THE SURVIVAL AND
DEVELOPMENT OF THE CABBAGE ROOT FLY

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1. The effects of exposing puparia containing diapausing Delia radicum (L.) to temperatures of -10.2°C for 34 to 77 days and -14.8°C for 4 to 14 days reduced survival to adult emergence and increased adult malformation. Exposures of 80 days at -7.1°C had no effect.

2. The rate of post-diapause development among adults emerging within 230°D 5.6 (early-emerging) was reduced with increasing duration of the lower temperature exposures but late-emerging adults were not affected.

3. Overwintering D. radicum parasitized by Trybliographa rapae (Westw.) and Aleochara bilineata Gyll. responded similarly to unparasitized D. radicum although T. rapae was less resistant to cold injury when exposed to -14.8°C .

4. Soil temperatures in England and Wales are rarely low enough to cause cold injury, and, therefore, are unlikely to affect the survival of D. radicum or its parasitoids.

BACILLUS THURINGIENSIS: EVALUATION AS A BLACK FLY CONTROL AGENT

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Field trials of two commercially available formulations of Bacillus thuringiensis H14 (var. israelensis), which is toxic to target species only following ingestion, were carried out against black fly larvae in Saskatchewan. Results demonstrate both efficacy of Bt H14 against pest species and a negligible effect on non-target fauna, compared to that of currently-used larvicides. Distance downstream over which dosages were effective varied, ranging up to 11 km and are shorter than those distances attainable with other larvicides. Factors affecting efficacy included dosage, dosage regime, formulation and discharge. These and other factors affecting larval feeding rates are discussed in relation to value of Bt H14 for controlling black flies.

THE EFFECT OF BITING FLIES ON THE BEHAVIOUR AND WEIGHT GAIN
OF DAIRY HEIFERS AT SEVEN SISTERS FALLS, MANITOBA

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The impact of biting flies on the behaviour and weight gain performance of two groups of dairy heifers at Seven Sisters Falls, Manitoba was examined. Animals in one herd received a 2L. spray of 0.1% Cypermethrin (2gm a.i.) approximately every 2 weeks during June and July. Weight gains of the sprayed and non-sprayed groups did not differ throughout the summer of 1983 with average daily gains of 1.1kg and 1.03kg respectively.

Behaviour of the cattle was qualified as to annoyance, quantified and recorded twice weekly during the peak of horse fly activity. The greatest annoyance to the animals was during the peak of the horse fly season. Ten species of horse flies, twelve species of mosquitoes, and one species each of black fly and stable fly were observed feeding on the animals.

SEASONAL DYNAMICS OF OROPSYLLA (OPISOCROSTIS) BRUNERI
(BAKER) (SIPHONAPTERA), A FLEA ON FRANKLIN'S GROUND SQUIRREL,
SPERMOPHILUS FRANKLINII (SABINE) (SCURIDAE)

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A study of the population dynamics of the flea, Oropsylla (Opisocrostis) bruneri, on Franklin's ground squirrel, Spermophilus franklinii, was conducted on two sites near Birds Hill Park, Manitoba during the spring and summer months of 1982 and 1983. Of the 856 adult fleas collected from ground squirrels in 1982 all were O. bruneri. Similarly in 1983, of the 1500 adult fleas collected 99.73% were O. bruneri, 0.20% were Epitedia wenmanni (Rothschild) and 0.07% were Ctenophthalmus pseudagyrtes Baker. The period of adult activity coincided with the active periods of the host (April to September) and there was a close host-parasite relationship.

There were two peaks in the number of fleas on trapped squirrels- the first occurred from late May to early June and the second from mid August to the beginning of September. Mean intensity of flea infestation during their peaks was 20.00 and 24.50 and 19.17 and 26.75 in 1982 and 1983 respectively. Adult female flea age was estimated based on a system of stage of ovarian development. Flea life history was investigated further by examining a parasitic nematode as well as two phoretic mite species. There is evidence that Oropsylla bruneri has two generations each year.

THE IMPACT OF METHOXYCHLOR ON SELECTED NON-TARGET INVERTEBRATES
IN A RIFFLE OF THE SOURIS RIVER, MANITOBA

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A riffle of the Souris River, Manitoba, located at Bunclody was treated with Methoxychlor on July 15, 1982 at a rate of 0.3 mg/litre for 15 minutes. Drift nets, artificial substrates, and emergence traps were sampled from the 'treatment' riffle and a 'control' riffle site located approximately 500 meters upstream at various times before and up to one year following treatment.

The treatment produced an immediate catastrophic drift in all of the 16 species of invertebrates identified which exceeded the 'normal' behavioural drift densities by many orders of magnitude. The catastrophic drift peak lasted from 4 to 24 hours depending on the species involved. The different species of invertebrates showed varying abilities to recolonize following treatment. For example, Baetis sp. (Ephemeroptera) showed no significant difference in densities on artificial substrates between the control and treatment sites only 8 days following treatment. Similarly, drift densities at the treatment site were not significantly different from the control two weeks following Methoxychlor injection. In contrast to this Psychomyia flavida (Trichoptera) had significantly reduced numbers on artificial substrates in the treatment riffle 2 months following treatment and did not fully recover until the following summer.

Shannon-Weaver diversity indices indicated that it required a period of 1 month after treatment for the diversity of invertebrates on artificial substrates at the treatment site to equal the diversity observed on substrates at the control site. The diversity of the drift was not restored at the treatment site relative to the control site until the following summer.

These results suggest that drift is a much more sensitive measure of impact due to methoxychlor treatment than are bottom densities using artificial substrates.

DISTRIBUTION OF WHEAT MIDGE DAMAGE ON WHEAT IN MANITOBA
IN 1984.¹

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ABSTRACT

Wheat heads were collected from 229 fields distributed in 26 Agricultural Representative's districts in Manitoba during August 1984. Wheat midges and their damage were found in samples from all districts. Severely damaged kernels were shrivelled and bent whereas in lightly damaged seeds the pericarp was sometimes split. There was considerable variability in the amount of grain lost in samples from any one district. For example, 0.0 to 25.7% grain loss was found in samples from Swan River and 4.3 to 18.0% in samples from The Pas. Samples with more than 4% loss came from Altona, Gladstone, Lundar, McCreary, Roblin, Selkirk, Steinbach, Swan River, Teulon, and The Pas.

INTRODUCTION

Allen (1955a,b) stated that the orange wheat blossom midge, *Sitodiplosis mosellana* (Gehin) had been reported in 1954 from Selkirk, Manitoba, by Prof. A.V. Michener (Univ. Manitoba). During 1955, specimens were collected at Teulon, St. Francois Xavier, Morris, St. Pierre, and Transcona.

The wheat midge damaged experimental plots at the University of Manitoba, Winnipeg (Bird and Robinson, 1956), and was a widespread pest during 1956; it was also reported from north-western Minnesota and Pembina County, North Dakota. Loss estimates ranged between 10 and 30% (Anon., 1956).

In Manitoba, during 1957, damage was estimated at 6.4% near Winnipeg, 5.9% at Morris, 4.2% at Altona, 4.4% at Portage la Prairie. No midges were found at Brandon, Neepawa, or Swan River (Westdal, 1957a).

Westdal (1957b) compared the infestation levels of wheat midge found on 10 cultivars of wheat grown in Fort Garry, and found that the variety Frontana was the only one which was not damaged by the midge. Frontana is a late blooming cultivar and probably was at an inappropriate stage of development during the oviposition period of the midge.

¹Contribution No. 1158 from Research Station, Agriculture Canada, Winnipeg, Manitoba.

No further work was done in Canada on the wheat midge between 1958 and 1982. It was not until 1983 that a sudden increase of midge populations in the north-western Manitoba and north-eastern Saskatchewan wheat growing regions renewed interest in this pest.

Samples of wheat heads were collected from the northwestern portion of the Manitoba wheat growing region during 1983. The damage in these samples varied from 3.3 to 21% at Swan River, 1 to 26% at The Pas, 0 to 13% damage at Roblin and two samples from Dauphin had 3 and 14% damage (Anon., 1983).

In the 1983 season's samples from the Agriculture Canada experimental plots at Glenlea, awned wheats showed an average loss of 6.5% of kernels, wheats grown on irrigated land had 3.6% damage and wheat grown on non-irrigated land had 2.3% damage. Some samples from the 1982 season which had been retained, showed damage of 4.9% (Barker, 1983).

The objectives of this survey were to establish the distribution and estimate the damage of the orange wheat blossom midge during the 1984 growing season.

MATERIALS AND METHODS

Samples of heads of wheat were collected at random from about five widely separated fields in each Agricultural Representative's district, except for the Swan River district where 114 fields were sampled because the midge had been prevalent there in 1983. A total of 229 fields distributed in 26 districts were sampled. The samples were collected by Manitoba Agriculture Representatives during August after the seeds had filled. Each sample consisted of ten heads of wheat which were placed in paper or plastic bags and sent to Winnipeg for examination.

Each head of wheat was dissected with forceps under a low power dissection microscope. The numbers of midge affected seeds were counted for each head of wheat and recorded. Each sample of 10 heads required 18 to 22 minutes for examination. Badly damaged seeds are considered to represent loss of crop because most of them are lost during threshing.

RESULTS AND DISCUSSION

The wheat midge caused shrivelling of the wheat kernels. This shrivelling of severely damaged kernels was characterized by a large number of longitudinal wrinkles in the pericarp and absence of endosperm and germ (Fig. 1). These seeds were usually bent into a "J" shape. Seeds that are lightly damaged do not show a "J" shape, or wrinkles, or very much shrivelling, but they often have a split, or tear, in the pericarp, which may expose the endosperm and the embryo. They are of almost normal size, and hence are included with normal grain. These kernels have been detected during grain inspections at the Canadian Grain Commission and wheat shipments can be downgraded because of the presence of these damaged seeds.

The size and weight of badly affected seeds are reduced. For example, in this study 186 affected kernels occupied a volume of 2 ml and weighed 0.362 g, whereas 186 normal kernels occupied a volume of 7.5 ml and weighed 5.50 g.

Table 1 shows that damage due to the orange wheat blossom midge was found in all of the districts covered by Agricultural Representatives. Of the fields examined, 14% showed no midge damage. The proportions of fields which had more than 3, 4, or 5% damage due to the midge were 39, 29, and 23%, respectively.

There was considerable variation in the amount of damage produced in different fields of wheat within a district. Damage at Swan River ranged from 0.0 to 25.7% and at The Pas from 4.3 to 18% (Table 1).

The zone where midges were most prevalent during 1984 extended from Beausejour, and Selkirk in the southeast to Roblin, The Pas and Swan River in the north-western part of the wheat growing area of Manitoba. Samples from the Red River Valley (Altona and Steinbach) and from the Interlake (Teulon and Lundar) also showed more than 4% damage. Gladstone was included in this zone.

Comparison of the 1957 and 1984 data is difficult because mean damage from three fields was presented for each locality examined during 1957 and there is no record of the variability between one field and another within each district (Westdal, 1957a). The main difference between the two surveys is that no midges were found in the Brandon, Neepawa and Swan River districts during 1957.

This survey did not indicate whether the midge populations were static, rising or declining; only further surveys during subsequent years will show population trends. However, the populations at Glenlea have not changed significantly during the past three years. Damage levels have gone from 4.9% in 1982 to 3.6% in 1983 for irrigated fields (Barker, 1983) and on non-irrigated land there was a 2.3% loss in 1983 and a 2.7% loss in 1984.

Though this survey indicates approximate levels of damage to wheat in different parts of the Province of Manitoba, it allows only an estimate of the total economic impact of the pest on the provincial economy. No attempt was made to determine the level of damage at which control measures would become cost effective.

CONCLUSIONS

The orange wheat blossom midge was found in all of the wheat growing areas of Manitoba and could cause considerable losses if weather conditions become favorable to this insect. The highest levels of damage were found for Swan River, The Pas and Selkirk where high levels of damage occurred previously, and where high levels of damage may occur again in 1985.

An investigation of the reasons for variability in amounts of damage found in different fields may suggest agronomic practices which could reduce the amounts of damage caused by the wheat midge.

Though damage to wheat was found for the various districts, the economic impact of the damage on the provincial farm economy was not determined.

I wish to thank Mr. D. Smith, Mr. A. Kolach, and the Agricultural Representatives of the Manitoba Department of Agriculture for the large role which they played in this project. Thanks are also due to Dr. Barrie Campbell for a multitude of samples from Glenlea.

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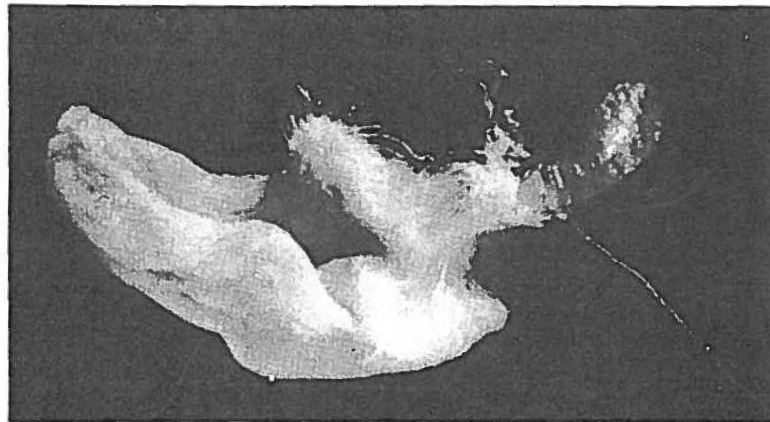


Fig. 1. Kernel of wheat badly damaged by the orange wheat blossom midge. Exuviae of a midge attached to the kernel. Magnification, approximately X13.

Table 1. The percent damage to wheat by the orange wheat midge, *Sitodiplosis mosellana*, in various localities of the province of Manitoba during the 1984 growing season.

Locality	Per cent damage in sample			
	Mean	± S.E.	Range	No. fields
Altona	1.64	1.109	0.0-6.0	5
Ashern	0.48	0.225	0.0-1.3	5
Beausejour	2.46	0.697	0.3-3.7	5
Boissevain	0.46	0.389	0.0-2.0	5
Brandon	0.43	0.237	0.0-1.1	4
Dauphin	1.35	0.427	0.3-2.3	4
Gladstone	1.54	0.951	0.0-4.7	5
Glenlea	2.70	---	-- --	1
Killarney	0.84	0.246	0.0-1.3	5
Lundar	1.32	0.878	0.0-4.7	5
MacDonald	0.82	0.385	0.0-2.0	5
McCreary	2.90	0.622	2.0-4.7	3
Minnedosa	0.98	0.622	0.0-3.4	5
Neepawa	0.26	0.193	0.0-1.0	5
Portage la Prairie	0.30	---	-- --	1
Roblin	3.35	0.828	1.7-6.0	4
Selkirk	6.36	1.390	3.5-11.5	5
Souris	1.88	0.453	0.7-3.0	5
St. Pierre	1.13	0.388	0.0-3.0	7
St. Rose	0.63	0.202	0.3-1.0	3
Steinbach	3.20	0.868	0.6-5.2	5
Stonewall	1.32	0.602	0.0-3.0	5
Swan River	4.90	0.479	0.0-25.7	114
Teulon	2.40	0.756	0.3-6.7	8
The Pas	8.66	3.143	0.0-18.0	5
Virden	0.64	0.290	0.0-1.3	5

HYMENOPTEROUS PARASITIDS OF APHIDS
(HOMOPTERA:APHIDIDAE) IN MANITOBA

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ABSTRACT

At least 24 species of aphid parasitoids from 2 families of Hymenoptera were collected from aphid colonies in Manitoba during 1980-1981. Their aphid hosts, plants, localities, dates, and habitats are listed. Fifteen species of secondary parasitoids from 5 families attacked parasitoids of aphids.

INTRODUCTION

In Manitoba, information on aphid parasitoid fauna has been limited to records in Bradley (1961) on aphids of the genus Cinara, Malyk (1971) on grain aphids, Bakker (1974) on the grain aphid Rhopalosiphum padi (L.), and in Melvin (1966) on Rhopalosiphum niger (Richards) attacking wild rice.

A comprehensive study of aphidophagous invertebrates in Manitoba during 1980-1981 was reported by Batulla (1983) and Batulla and Robinson (1984). The following information on parasitoids of aphids, their aphid hosts, the host plants of the aphids, localities, dates, and habitats are from that study. Also included is a list of secondary parasitoids. The parasitoids are listed by family, and then alphabetically by species name. In some cases the parasitoid, host, or host plant are identified to genus only, either because the genus is undergoing taxonomic revision, or for some other reason a positive determination could not be made.

METHODS

Colonies of aphids were collected in the field and brought into the laboratory where they were sorted. Parasitoids and mummified aphids were retained in gelatin capsules.

Samples were taken from 34 different localities. These habitats included deciduous forest, mixed forest, coniferous forest, open and semi-open prairie, taiga and tundra, and are shown in detail on a map in Batulla (1983).

Abbreviations have been used for the following localities: Agassiz Provincial Forest APF, Belair Provincial Forest BPF, Birds Hill Provincial Park BHPP, Clear Lake (Riding Mountain National Park) CL, Grand Beach Provincial Park GBPP, Hecla Island Provincial Park HIPP, Northwest Angle Provincial Forest NAPF, Pine Grove Halt PGH, Sandilands Provincial Forest SPF, Spruce Woods Provincial Park SWPP, Urban Winnipeg WPG, Whitemouth Lake WL, Whiteshell Provincial Park WPP.

Parasitoids of Aphids

HYMENOPTERA:BRACONIDAE

Acanthocaudus tissoti Smith: Uroleucon russellae (Hille Ris Lambers) on Anaphalis margaritacea (L.) C.B. Clarke, Lilypond WPP, 21 July 1981, roadside habitat; Uroleucon sp. on Solidago sp., WPG, 11 August 1981, prairie habitat.

Adialytus salicaphis (Fitch): Chaitophorus populicola Thomas on Populus tremuloides Michx., PGH, 24 June 1981, deciduous forest; BHPP, 21 August 1981, aspen parkland; SPF, 4 September 1981, mixed forest; Chaitophorus populicola on Populus balsamifera L., Telford WPP, 21 July 1981, mixed forest; SWPP, 28 July 1981, deciduous forest; BHPP, 21 August 1981, aspen parkland; SPF, 4 September 1981, mixed forest; APF, 11 September 1980, deciduous forest; Aphis citricola van der Goot on Cornus alba L., SWPP, 28 July 1981, deciduous forest; Uroleucon ambrosiae (Thomas) on Solidago sp., St. Ambrose, 26 August 1981, beach community.

Adialytus sp.: Chaitophorus populicola on Populus balsamifera, SWPP, 12 August 1980, deciduous forest; CL, 16 August 1980, deciduous forest; CL, 16 August 1980, roadside; Chaitophorus populicola on Populus tremuloides, Moose Lake NAPF, 19 August 1980, mixed forest; Chaitophorus viminalis Monell on Salix sp., SWPP, 12 August 1980, deciduous forest; Chaitophorus nigrae Oestlund on Salix sp., SWPP, 12 August 1980, deciduous forest; Acyrtosiphon caraganae (Cholodkovsky) on Caragana arborescens Lam., CL, 16 August 1980, roadside; Aphis oenotherae Oestlund on Epilobium angustifolium L., CL, 16 August 1980, roadside.

Aphidius matricariae Hal.: Nasonovia (Kakimia) aquilegiae (Essig) on Aquilegia canadensis L., CL, 16 August 1980, roadside; Capitophorus elaeagni (del Guercio) on Cirsium arvense (L.) Scop. Glenlea, 18 August 1980, roadside.

Aphidius nigripes Ashmead: Nasonovia (Kakimia) borealis Heie on Heuchera richardsonii R.Br., WPG, 20 June 1981, urban habitat; Macrosiphum pseudorosae Patch on Rosa sp., PGH, 24 June 1981, deciduous forest; Lilypond WPP, 21 July 1981, lakeshore; host unknown on Corylus sp., BHPP, 6 July 1981, deciduous forest; Pterocomma smithiae (Monell) on Populus balsamifera, BHPP, 6 July 1981, aspen parkland; Nasonovia (Kakimia) houghtonensis similis Heie on Ribes oxycanthoides L., Churchill, 5 August 1981, tundra; Sitobion avenae (Fabricius) on Calamagrostis canadensis (Michx.) Beauv., Churchill, 5 August 1981, roadside; Churchill, 6 August 1981, roadside; Pleotrichophorus pseudopatonkus Corpuz-Raros and Cook and/or Macrosiphoniella tapuskae (Hottes and Frison) on Achillea millefolium L., Churchill, 6 August 1981, ocean shore (above tideline); Acyrtosiphon churchillensis Robinson on Hedysarum boreale mackenzii (Richardson) C.L. Hitchc., Churchill, 8 August 1981, ocean shore (above tideline); Illinoia sp. on Epilobium angustifolium, Churchill, 8 August 1981, tundra; Uroleucon sp. on Solidago sp., WPG, 11 August 1981, prairie; Aphis viburniphila Patch on Viburnum rafinesquianum Schultes, SPF, 4 August 1981, mixed forest.

Aphidius obscuripes Ashmead: Sitobion avenae on Triticum aestivum L., Glenlea, 7 August 1981, cultivated field.

Aphidius rosea Haliday: Uroleucon ambrosiae on Solidago sp., Morden 16 July 1981, deciduous forest.

Aphidius ribis Haliday: Nasonovia (Kakimia) borealis on Heuchera richardsonii, WPG, 20 June 1981, urban habitat; Uroleucon erigeronensis (Thomas) on Erigeron sp., Hanson Creek WPP, 11 August 1981, river bank.

Aphidius sp.: Uroleucon sp. on Solidago sp., BHPP, 18 June 1980, deciduous forest; Capitophorus hippophaes (Walker) on Shepherdia canadensis (L.) Nutt, Arnes Park, 4 July 1980, mixed forest; host unknown on Salix sp. CL, 16 August 1980, roadside; Acyrtosiphon caraganae on Caragana arborescens, CL, 16 August 1980, urban; Chaetosiphon fragaefolii (Cockerell) on Rosa sp., Zhoda, 19 August 1980, mixed forest; Cavariella pastinacae (L.) on Heracleum lanatum Michx, CL, 12 July 1981, roadside; Uroleucon ambrosiae on Solidago sp. Morden, 16 July 1981, lakeshore; Aphis viburniphila on Viburnum rafinesquianum, Morden, 16 July 1981, deciduous forest; Acyrtosiphon caraganae on Caragana arborescens, Hanson Creek WPP, 21 July 1981, edge of mixed forest; Acyrtosiphon churchillensis on Hedysarum boreale var. mackenzii, Churchill, 8 August 1981, ocean shore above high tideline.

Ephedrus incompletus Provancher: Chaitophorus populicola on Populus balsamifera, SWPP, 12 August 1980, mixed forest; Chaitophorus populicola on Populus tremuloides, CL, 12 July 1981, roadside habitat; Telford 12 July 1981, roadside habitat; Telford WPP, 21 July 1981, SPF, 4 August 1981; Chaitophorus viminalis on Salix sp., SWPP, 12 August 1980, marshland; Uroleucon nigrotuberculatum (Olive) on Solidago sp., BHPP, 6 July 1981, aspen parkland; Chaitophorus nigrae on Salix sp., Morden, 16 July 1981, lakeshore; Aphis viburniphila on Viburnum trilobum Marsh, SWPP, 28 July 1981, mixed forest; Chaitophorus nudus Richards on Populus tremuloides, BHPP, 21 August 1981, aspen parkland.

Lysiphlebus testaceipes (Cresson): Aphis viburniphila on Viburnum sp., WPG, 26 May 1980, urban; Myzus cerasi (Fabricius) on Prunus virginiana L., BHPP, 11 June 1980, deciduous forest; Rhopalosiphum cerasifoliae (Fitch) on Prunus virginiana, BHPP, 23 June 1980, deciduous forest; APF, 27 June 1980, deciduous forest; BHPP, 6 July 1981, deciduous forest; Chaitophorus populicola or Aphis maculatae Oestlund on Populus balsamifera, Arnes Park, 4 July 1980, mixed forest; Aphis maculatae on Populus tremuloides, WPG, 7 August 1980, urban; Asiphonaphis pruni Wilson and Davis on Prunus virginiana, SPF, 21 July 1980, mixed forest; SPF, 24 June 1981, mixed forest; SWPP, 28 July 1981, deciduous forest; BHPP, 21 August 1981, deciduous forest; Aphthargelia symphoricarpi (Thomas) on Symphoricarpos albus (L.) Blake, Morden, 30 July 1980, open deciduous forest; Aphis heraclella Davis on Heracleum lanatum, Morden, 30 July 1980, riverbank; host unknown on Prunus virginiana, SWPP, 6 August 1980, deciduous forest; Capitophorus elaeagni on Cirsium arvense, Glenlea, 18 August 1980, roadside; host unknown on Cornus alba, WPG, 7 August 1980, urban; Aphis neogillettei Palmer on Cornus alba, Beaver Creek, 9 July

1981, edge of deciduous forest; Hanson Creek (WPP), 21 July 1981, mixed forest; Souris, 6 September 1981, deciduous forest; Alf Hole Goose Sanctuary WPP, 11 September 1981, deciduous forest; Rhopalosiphum padi (L.) on Prunus virginiana, SWPP, 14 July 1981, deciduous forest; Aphis farinosa Gmelin on Salix sp., Hanson Creek WPP, 21 July 1981, riverbank; Aphis varians Patch on Epilobium angustifolium, Hanson Creek WPP, 21 July 1981, riverbank; SPF, 4 September 1981, mixed forest; Aphis barberae Robinson on Arctium lappa L., GBPP, 5 September 1981, roadside.

Lysiphlebus sp.: Aphthargelia symphoricarpi on Symphoricarpos albus, SPF, 21 July 1980, mixed open forest; Aphis maculatae on Populus tremuloides, WPG, 1 August 1980, urban.

Pauesia sp.: Cinara laricifex (Fitch) on Larix laricina (DuRoi) K. Koch, Churchill, 5 August 1981, taiga; Macrosiphum subarcticum Robinson or Macrosiphum euphorbiae (Thomas) on Epilobium angustifolium, Churchill, 7 August 1981, tundra.

Praon artemisaphis Smith: Aphis neogillettei on Cornus alba, WPG, 22 May 1980, urban; Chaitophorus nudus on Populus tremuloides, SWPP, 12 August 1980, deciduous forest; Aphis helianthi Monell on Cornus alba, WPG, 22 May 1981, urban habitat.

Praon sp.: Macrosiphum euphorbiae on Rosa sp., WPG, 2 June 1980, urban; Rhopalosiphum cerasifoliae on Prunus virginiana, Hanson Creek WPP, 26 June 1980, mixed forest; Chaitophorus nudus on Populus tremuloides, SWPP, 12 August 1980, mixed forest; Aphis oenotherae on Epilobium angustifolium, CL, 16 August 1980, roadside; Aphis helianthi or A. neogillettei on Cornus alba, WPG, 22 August 1980, urban; Hyperomyzus pallidus Hille Ris Lambers on Ribes sp., WPG, 26 May 1981, urban; Periphyllus negundinis (Thomas) on Acer negundo L. var. interius (Britt) Sarg., WPG, 5 June 1981, urban; Asiphonaphis pruni on Prunus virginiana, SPF, 24 June, 1981, mixed forest; Uroleucon ambrosiae on Compositae, Brokenhead, 25 June 1981, riverbank; on Solidago sp., Morden, 16 July, 1981; Cavariella konoi Takahashi on Cicuta maculata L., CL, 12 July 1981, roadside; Chaitophorus populicola on Populus tremuloides, CL, 12 July 1981, mixed forest; Uroleucon sp. on Solidago sp. WPG, 11 August 1981, prairie.

Praon sp.?: Rhopalosiphum insertum (Walker) on Cotoneaster acutifolia Turcz., WPG, 21 May 1980, urban; Sitobion manitobensis (Robinson) on Cornus alba, WPG, 21 May 1980, urban; Periphyllus negundinis on Acer negundo, Morden, 30 July 1980, deciduous forest; Chaitophorus nudus on Populus tremuloides, WL, 19 August 1980, deciduous forest; Rhopalosiphum padi on Prunus nigra Ait., WPG, 27 May 1981, urban.

Trioxys sp.: Hayhurstia atriplicis (L.) on Chenopodium album L., WPG, 30 May 1980, roadside; Aphis helianthi on Cornus alba, GBPP, 18 June 1980, deciduous forest; Aphis varians on Epilobium angustifolium, Hanson Creek WPP, 26 June 1980, riverbank; Aphis spiraeophila Patch on Spiraea alba DuRoi, Lilypond WPP, 26 June 1980, lakeshore; Sipha kurdjumi Mordvilko on Graminae, WPG, 7 July 1980, urban; Aphis neogillettei

on Cornus alba, WPG, 21 July 1980, urban; Aphis helianthi or A. neogillettei on Cornus alba, HIPP, 3 August 1980, deciduous forest; host unknown on Cornus alba, WPG, 7 August 1980, urban; Aphis helianthi on Cicuta maculata, SWPP, 12 August 1980, open deciduous forest; Chaitophorus nudus on Populus tremuloides, WL, 19 August 1980, deciduous forest.

Trioxys (Binodoxys) sp.: Uroleucon ambrosiae on Solidago sp., PGH, 24 June 1981, deciduous forest; Macrosiphum pseudorosae on Solidago sp., Beaver Creek, 9 July 1981, open riverbank; Aphis neogillettei on Cornus alba, Beaver Creek, 9 July 1981, deciduous forest; CL, 12 July 1981, roadside; Rathwell, 14 July 1981, mixed forest; WPG, 19 July 1981, urban; Uroleucon rudbeckiae (Fitch) on Rudbeckia hirta L., SWPP, 14 July 1981, mixed forest; Aphis spiraephila on Spiraea alba, Rathwell, 14 July 1981, mixed forest; Aphis citricola on Cicuta maculata, SWPP, 14 July 1981, deciduous forest.

HYMENOPTERA: ENCYRTIDAE: APHELININAE

Aphelinus mali (Haldeman): Rhopalosiphum cerasifoliae on Prunus virginiana, BHPP, 6 July 1981, deciduous forest; Nearctaphis crataegifoliae (Fitch) on Crataegus rotundifolia Moench, BHPP, 6 July 1981, deciduous forest; Morden, 16 July 1981, deciduous forest; Asiphonaphis pruni on Prunus virginiana, BHPP, 21 August 1981, aspen parkland; Rhopalosiphum maidis (Fitch) on Zea mays, Glenlea, 2 September 1981, cultivated field.

Aphelinus semiflavus Howard: Eriosoma lanigerum (Hausmann) on Ulmus americana L., La Barriere, 11 June 1981, deciduous forest-riverbank; Nasonovia (Kakimia) borealis on Heuchera richardsonii, WPG, 20 June 1981, urban; Symydobius americanus Baker on Betula occidentalis Hook, Beaver Creek, 9 July 1981, lakeshore; Meliarhizophagus fraxinifolii (Riley) on Fraxinus pennsylvanicus Marsh, SWPP, 14 July 1981, deciduous forest; Chaitophorus populicola on Prunus virginiana, GBPP, 19 July 1981, deciduous forest.

Aphelinus sp.: Rhopalosiphum cerasifoliae on Prunus virginiana, SPF, 10 June 1980, mixed forest; BHPP, 23 June 1980, and 11 June 1980, deciduous forest; Aphthargelia symphoricarpi on Symphoricarpos albus, SPF, 21 July 1980, open mixed forest; Aphis neogillettei on Cornus alba, WPG, 21 July 1980, urban; Moose Lake NAPF, 19 August 1980, deciduous forest; HIPP, 3 August 1980, deciduous forest; Hanson Creek WPP, 21 July 1981, mixed forest; Asiphonaphis pruni on Prunus virginiana, SWPP, 6 August 1980, mixed forest; SPF, 24 June 1981 and 4 September 1981, mixed forest; Aphis penootherae on Epilobium angustifolium, CL, 16 August 1980, roadside; Hyperomyzus lactucae (L.) on Sonchus arvensis L., La Barriere, 6 August 1980, flooded river bank; Aphis spiraephila on Spiraea alba, SPF, 24 June 1981, mixed forest; Pterocomma smithiae on Populus balsamifera, BHPP, 6 July 1981, aspen parkland; Chaitophorus populicola on Populus tremuloides, SPF, 4 September 1981, mixed forest.

Aphidencyrus aphidivorus (Mayr): Aphthargelia symphoricarpi on Symphoricarpos albus, SPF, 4 September, 1981, mixed forest; Aphis neogillettei on Cornus alba, WPG, 11 August 1981, urban; Hamamelistes spinosus

on Betula glandulifera (Regel) Butler, Rathwell, 12 August 1980, edge of mixed forest.

Aphytis sp.: Chaitophorus nigrae on Salix sp., SWPP, 12 August 1980, deciduous forest; Chaitophorus populicola on Populus tremuloides, SWPP, 12 August 1980, mixed forest.

Secondary Parasitoids

The following is a list of secondary parasitoids of aphid parasitoids collected in Manitoba during 1980-1981. In most cases the primary parasitoid was not known; thus, most often, only the aphid and host plant species, location, date and habitat are listed.

HYMENOPTERA:ALLOXYSTIDAE

Alloxysta lachnini (Ashmead): Rhopalosiphum cerasifoliae on Prunus virginiana, SPF, 10 June 1980, open mixed forest; BHPP, 23 June 1980, deciduous forest; Aphthargelia symphoricarpi on Symphoricarpos albus, SPF, 21 July 1981, open mixed forest; primary parasitoid Praon sp.? attacking Periphyllus negundinis on Acer negundo, Morden, 30 July 1980, deciduous forest; Asiphonaphis pruni on Prunus virginiana, SWPP, 6 August 1980, deciduous forest; Hamamelistes spinosus on Betula glandulifera, Rathwell, 12 August 1980, mixed forest; Capitophorus elaeagni on Cirsium arvense, Glenlea, 18 August 1980, roadside; Aphis neogillettei on Cornus alba, Moose Lake NAPF, 19 August 1980, deciduous forest; Chaitophorus populicola on Populus tremuloides, Moose Lake NAPF, 19 August 1980, deciduous forest; Uroleucon solirostratum (Richards) on Solidago sp., Zhoda, 19 August 1980, deciduous forest.

Alloxysta halli Andrews: Uroleucon ambrosiae on Solidago sp., St. Ambroise, 26 August 1981, marshland.

Alloxysta megourae complex: Aphis viburniphila on Viburnum rafinesquianum, BHPP, 6 July 1981, deciduous forest; Aphis neogillettei on Cornus alba, Beaver Creek, 9 July 1981, lakeshore; WPG, 11 August 1981, urban; Uroleucon sp. on Solidago sp., GBPP, 25 July 1981, roadside.

Alloxysta victrix (Westwood): Macrosiphum pseudorosae on Rosa sp., PGH, 24 June 1981, deciduous forest; Lilypond WPP, 21 July 1981, lakeshore; primary parasitoid Praon sp. attacking Chaitophorus populicola on Populus tremuloides, CL, 12 July 1981, mixed forest; primary parasitoid Aphidius nigripes? attacking Pleotrichophorus pseudopatonkus and/or Macrosiphoniella tapuskae on Achillea millefolium, Churchill, 8 August 1981, oceanshore above tide line; Pterocomma smithiae on Salix sp., SPF, 4 September 1981, marshy lakeshore.

Lytoxysta brevipalpis Kieffer: Asiphonaphis pruni on Prunus virginiana, SPF, 24 June 1981, open-mixed forest; Aphthargelia symphoricarpi on Symphoricarpos albus, SPF, 4 September 1981, open mixed forest.

Phaenoglyphis ambrosiae (Ashmead): Praon sp.? attacking Uroleucon ambrosiae on Compositae, Brokenhead, 25 June 1981, riverbank.

Phaenoglyphis americana Baker: Cavariella pastinacae (L.) on Heraclium lanatum, CL, 12 July 1981, roadside; Chaitophorus populicola on Populus tremuloides, PGH, 24 June 1981, deciduous forest; Praon sp.? attacking Uroleucon ambrosiae on Compositae, Brokenhead, 25 June 1981, riverbank; Uroleucon ambrosiae on Solidago sp., Morden, 16 July 1981, lakeshore; Macrosiphum pseudorosae on Rosa sp., BHPP, 6 July 1981, deciduous forest; Chaitophorus nigrae on Salix sp., Morden, 16 July 1981, lakeshore; Aphis helianthi on Cornus alba, WPG, 22 May 1981, urban.

HYMENOPTERA: PTEROMALIDAE

Asaphes vulgaris Walker: Asiphonaphis pruni on Prunus virginiana, SWPP, 6 August 1980, deciduous forest; Sitobion avenae on Triticum aestivum, Glenlea, 7 August 1980 cultivated field; Rhopalosiphum cerasifoliae on Prunus virginiana, WL, 19 August 1980, deciduous forest; Uroleucon solirostratum on Solidago sp., Zhoda, 18 August 1980, deciduous forest; Praon sp.? attacking Rhopalosiphum padi on Prunus nigra, WPG, 27 May 1981, urban; Praon sp.? attacking Periphyllus negundinis on Acer negundo, WPG, 5 June 1981, urban; Adialytus sp.? attacking Chaitophorus populicola on Populus balsamifera, SWPP, 28 July 1981, deciduous forest; Chaitophorus populicola on Populus tremuloides, PGH, 24 June 1981, deciduous forest; Praon sp. attacking Cavariella konoii on Cicuta maculata, CL, 12 July 1981, roadside; Adialytus sp.? attacking Uroleucon ambrosiae on Solidago, St. Ambroise, 26 August 1981, marsh; Meliarhizophagus fraxinifolii on Fraxinus pennsylvanica, SWPP, 14 July 1981, deciduous forest; Trioxys (Binodoxys) sp.? attacking Uroleucon rudbeckiae on Rudbeckia sp., SWPP, 14 July 1981, deciduous forest.

Pachyneuron sp.: Asiphonaphis pruni on Prunus virginiana, SWPP, 6 August 1980, deciduous forest; Myzus cerasi on Prunus virginiana, BHPP, 11 June 1980, deciduous forest; Rhopalosiphum cerasifoliae on Prunus virginiana, BHPP, 23 June 1980, deciduous forest; WL, 19 August 1980, deciduous forest; Hyperomyzus lactucae on Sonchus arvensis, La Barriere, 6 August 1980, open riverbank; Hamamelistes spinosus on Betula glandulifera, Rathwell, 12 August 1980, mixed forest; Chaitophorus viminalis on Salix sp., SWPP, 12 August 1980, moist deciduous forest; Cinara pergandei (Wilson) on Pinus banksiana Lamb, SPF, 24 June 1981, mixed forest; Lysiphlebus sp.? attacking Rhopalosiphum padi on Prunus virginiana, SWPP, 14 July 1981, deciduous forest; Chaitophorus populicola on Populus tremuloides, Treesbank, 28 July 1981, deciduous forest.

Euneura lachni (Ashmead): Myzus cerasi on Prunus pensylvanicus, BHPP, 6 July 1981, deciduous forest; Pterocomma smithiae on Populus balsamifera, BHPP, 6 July 1981, aspen parkland.

Eupteromalus sp.: Hyperomyzus lactucae on Sonchus arvensis, St. Ambroise, 26 August 1981, marshland.

HYMENOPTERA: EULOPHIDAE

Diglyphus begini (Ashmead) Hyadaphis tataricae on Lonicera tatarica, WPG, 24 July 1981, urban.

Diglyphus pulcripes (Crawford): Hyadaphis tataricae on Lonicera tatarica, WPG, 24 July 1981, urban; WPG, 11 August 1981, urban; Aphis neogillettei on Cornus alba, WPG, 20 August 1981.

HYMENOPTERA:MEGASPILIDAE

Dendrocerus carpenteri (Kieff): Asiphonaphis pruni on Prunus virginiana, SWPP, 6 August 1980, deciduous forest; Aphis viburniphila on Viburnum sp., WPG, 21 May 1980, urban; Sitobion manitobensis on Cornus alba, WPG, 21 May 1980, urban; Lysiphlebus testaceipes attacking Myzus cerasi on Prunus virginiana, BHPP, 11 June 1980, deciduous forest; Praon sp. attacking Rhopalosiphum padi on Prunus nigra, WPG, 27 May 1981, urban; Rhopalosiphum padi on Prunus virginiana, SWPP, 14 July 1981, deciduous forest; Chaitophorus populicola on Populus tremuloides, PGH, 24 June 1981, deciduous forest; Praon sp.? attacking Uroleucon ambrosiae on Compositae, Brokenhead, 25 June 1981, riverbank; Aphis neogillettei on Cornus alba, Beaver Creek, 9 July 1981, lakeshore-edge of mixed forest; Rathwell, 14 July 1981, mixed forest; Macrosiphum pseudorosae on Solidago sp., Beaver Creek, 9 July 1981, roadside; on Rosa sp. Lilypond WPP, 21 July 1981, lakeshore; Cavariella konoii on Cicuta maculata, CL, 12 July 1981, roadside; Nasonovia (Kakimia) houghtonensis similis on Ribes oxycanthoides, Churchill, 5 August 1981, tundra; Sitobion avenae on Calamagrostis canadensis, Churchill, 6 August 1981, disturbed area; Hyperomyzus lactucae on Sonchus arvensis, GBPP, 1 September, 1981, roadside; Hyperomyzus pallidus on Sonchus arvensis, GBPP, 1 September 1981, roadside; Lysiphlebus sp.? attacking Aphis barberae on Arctium lappa, GBPP, 5 September 1981, roadside.

Dendrocerus sp.: Cinara laricifex on Larix laricina, Churchill, 6 August 1981, taiga.

HYMENOPTERA:CERAPHRONIDAE

Aphanogmus sp.: Chaitophorus populifolii on Populus tremuloides, SPF, 24 June 1981, mixed forest.

DISCUSSION

Four hundred and seven samples were collected during 1980 and 1981. From these samples, 108 aphid species from 42 genera were collected on 71 host plant species. Of the 108 species, at least 60 were parasitized by one or more species of parasitoids. There were at least 24 different parasitoid species collected.

The 1981 collections contained a greater diversity of both aphid and parasitoid species than did the 1980 collections. The lower diversity in 1980 can be attributed (at least in part) to the unusually hot, dry weather at the beginning of that season. During this dry period, the most common aphid species collected were those in ant-attended colonies

on shrubs, and tree saplings (e.g. Prunus spp., Cornus alba, Crataegus spp., Populus spp.). Because of the lower aphid species diversity in early 1980, some parasitoids may have chosen suboptimal hosts. Consequently, some 1980 host records may not represent 'typical' records for some species. In addition, there existed some bias in sampling in both years since areas in a 120 km radius of Winnipeg were sampled more often than areas a greater distance away.

The most common species of parasitoid collected was Lysiphlebus tesci. At least one new species of parasitoid was collected from the genus Praon; it was obtained from Uroleucon spp. colonies. More parasitoids of aphids were collected in woodland areas, particularly deciduous and open-mixed forest habitats. Praon spp. were the exception, being most common in cultivated areas.

Of the 800 specimens of parasitoids of aphids collected, 43% were parasitized by secondary parasitoids. Most secondary parasitoids were collected in 1981 than in 1980.

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DISTRIBUTION OF MANITOBA STONEFLIES (PLECOPTERA)

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An annotated list of the stoneflies (Plecoptera) of Manitoba was compiled from an examination of literature, museum collections and the author's personal collection. This list includes 46 species of which 7 are new provincial records and two questionable for Manitoba. A comparison is made between the stonefly fauna of Manitoba and that of Minnesota, Saskatchewan, Quebec and British Columbia. Manitoba's stonefly fauna is composed of both eastern and western elements in relatively equal numbers when compared to other provinces and states.

Résumé

Une liste annotée de perles (Pléoptères) du Manitoba fut compilée d'après un examen de littérature, de collections de musées ainsi que de la collection personnelle de l'auteur. Cette liste contient 46 espèces dont 7 sont de nouveaux records et deux sont contestables au Manitoba. Une comparaison est faite entre la faune de perles du Manitoba et celle du Minnesota, la Saskatchewan, le Québec et la Colombie Britannique. La faune de perles du Manitoba est composée d'éléments de nombres égaux de l'est et de l'ouest lorsque comparée à d'autres provinces et états.

Introduction

The first reports of stoneflies in Manitoba are those of Claassen (1924) and Needham and Claassen (1925) who examined specimens from Aweme, Manitoba. Neave (1933, 1934) studied the insect fauna of Lake Winnipeg and its tributaries and reported 9 species of Plecoptera. Recent records for Manitoba have resulted from studies by Stark and Gaufin (1976, 3 species), Flannagan (1978, 3 species), Flannagan and Flannagan (1982, 38 species), Flannagan and Cobb (1983, 10 species) and Friesen *et al.* (1984, 8 species). In the present study 7 species (indicated by *) are recorded for the first time from Manitoba.

Despite these works the stonefly fauna of Manitoba remains relatively unknown in the southeastern and northern parts of the province (see Fig. 1). This suggests that many more new provincial records remain to be discovered.

Materials and Methods

A literature search was conducted on stoneflies of North America. This provided the necessary keys for identification and many distribution records for Manitoba. The museum collection at the University of

Manitoba, Department of Entomology and personal collecting by the author were used to confirm previous records and to provide new records of stonefly species in Manitoba.

Distribution records are based on adult material except where otherwise indicated. Collection records by the author are abbreviated as D.K.B. Places where stoneflies have been collected in Manitoba are shown in fig. 1.

Nymphs were reared by using a modified air-powered laboratory stream (MacKay 1981).

The systematic classification followed is that of Illies (1966) and Zwick (1973) with modifications based on the critique of Steyskal (in Baumann 1976).

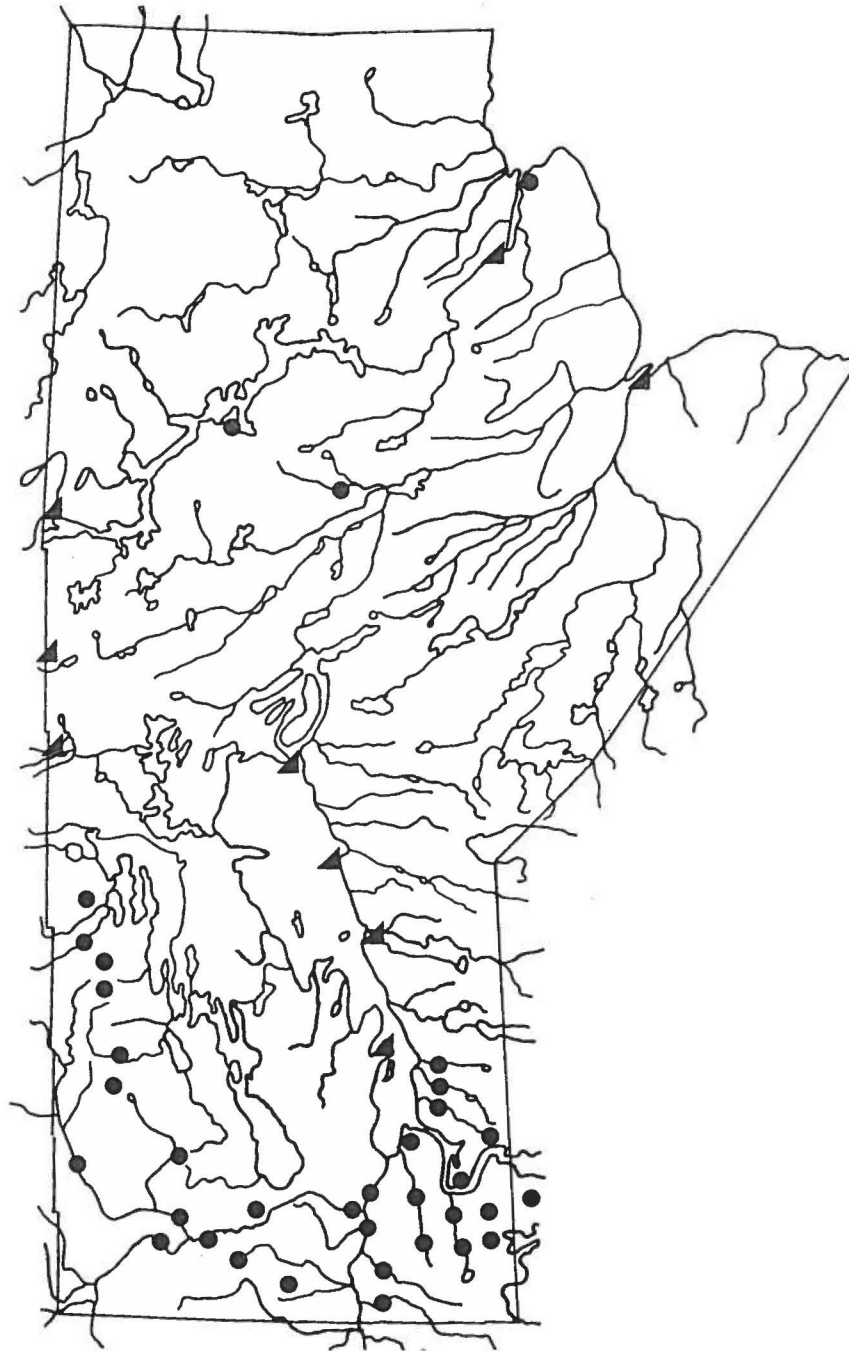


Fig. 1. Map of localities for records of stoneflies in the Province of Manitoba. Circles indicate localities where the author, and others, have collected; triangles indicate localities collected by other workers and not revisited during this study.

Results

Known Records of Stoneflies in Manitoba

ORDER PLECOPTERA
Suborder Arctoperlaria
Group Euholognatha

Superfamily Nemouroidea
Family Nemouridae
Subfamily Amphinemurinae

Genus AmphinemuraA. linda (Ricker)

Churchill (Ricker 1952); Cowan Creek (Friesen et al. 1984).
Brokenhead River, Sandilands Provincial Forest, 18.IX.82, 26.X.82
(D.K.B.).

Genus MalenkaM. californica (Claassen)

South Duck River and Cowan Creek (Friesen et al. 1984).
Stoney Creek, Minnedosa, 12.X.80 (D.J. Bailey).

Subfamily Nemourinae

Genus NemouraN. arctica Esben-Petersen

Churchill (Ricker 1944 as Nemoura trispinosa in partim Ricker 1952).
Traylor Bay Creek, Southern Indian Lake, 15.VII.80 (C.A. O'Neill);
Goose Creek, Churchill, 3.VI.82 (R.A. Brust).

*N. rickeri Jewett

Churchill (Ricker 1944 as Nemoura trispinosa in partim; Ricker 1952
as Nemoura arctica in partim).
Goose Creek, Churchill, 7.VI.76, 19.VI.76 (T.D. Galloway), 8-11.VI.82
(R.A. Brust).

Genus ShipsaS. rotunda (Claassen)

Churchill (Ricker 1944, 1952).
Burntwood River, Thompson, 8.VI.83 (D.K.B. and R.A. Brust); Broken-
head River, Sandilands Provincial Forest, 24.V.84 (D.K.B.).

Genus ZapadaZ. cinctipes (Banks)

Aweme (Ricker 1946); Clearwater Creek, Cowan Creek, North Pine River
and South Duck River (Flannagan and Cobb 1983; Friesen et al. 1984).
Aweme, 22.VI.82, 17.III.83 (D.K.B. and T.D. Galloway).

Family Taeniopterygidae
Subfamily Brachypterinae

Genus Oemopteryx*O. fosketti (Ricker)

Saskatchewan River at Baptizing Creek, 16.IV.46 (W.M. Sprules) (Ricker pers. comm.).

Genus Strophopteryx*S. fasciata (Burmeister)

Whitemouth River, Hadashville, 20.III.82, 27.III.82 (D.K.B. and D.J. Giberson) (Nymphs).

Subfamily Taeniopteryginae

Genus TaeniopteryxT. nivalis (Fitch)

Rat River and Roseau River (Flannagan 1978); Black River, Manigotagen River, North Pine River and O'Hanley River (Flannagan and Cobb 1983). Whitemouth River, Hadashville, 12.IV.82, 27.III.83 (D.K.B.); Birch River, McMunn, 27.III.83 (D.K.B.); Brokenhead River, Sandilands Provincial Forest, 27.III.83 (D.K.B.).

T. parvula Banks

Aweme (Ricker and Ross 1968); Rat River and Roseau River (Flannagan 1978); Black River and O'Hanley River (Flannagan and Cobb 1983). Whitemouth River, Hadashville, 12.VI.82, 27.III.83 (D.K.B.).

Family Capniidae

Genus AllocaepniaA. granulata (Claassen)

Rat river and Roseau River (Flannagan 1978); O'Hanley River (Flannagan and Cobb 1983). Whitemouth River, Hadashville, 12.IV.82, 14.III.83, 27.III.83 (D.K.B.); Birch River, McMunn, 27.III.83 (D.K.B.).

Genus CapniaC. coloradensis Claassen

Clearwater Creek, Cowan Creek and South Duck River (Flannagan and Cobb 1983).

C. confusa ClaassenCowan Creek, North Pine River and South Duck River (Flannagan and Cobb 1983) (Friesen et al. 1984). Stoney Creek, Minnedosa, 14.IV.80 (D.J. Bailey).C. gracilaria Claassen

Aweme (Claassen 1924); Clearwater Creek, Cowan Creek and South Duck River (Flannagan and Cobb 1983).

C. manitoba Claassen

Aweme (Claassen 1924).

Aweme, 22.IV.82, 14.III.83 (D.K.B. and T.D. Galloway).

C. nearctica Banks

Churchill (Ricker 1964).

C. vernalis Newport

Hayes River, York Factory (Ricker 1938); Churchill (Ricker 1964).

Genus ParacapniaP. angulata Hanson

Garland River and South Duck River (Flannagan and Cobb 1983).

Genus UtacapniaU. trava (Nebeker and Gaufin)

Clearwater Creek, Cowan Creek, North Pine River and South Duck River (Flannagan and Cobb 1983).

Family Leuctridae
Subfamily MegaleuctrinaeGenus MegaleuctraM. stigmata (Banks)Winnipeg, British America (Banks 1900 as Nemoura stigmata).

Note: This species is found in spring-fed streams in the Pacific Northwest (Baumann 1973). Its occurrence in Manitoba is questionable.

Group Systellognatha
Superfamily Pteronarcyzoidea

Family Pteronarcyidae

Genus PteronarcysP. dorsata (Say)Winnipeg (Needham and Claassen 1925); Pigeon River and Winnipeg (Neave 1934); Churchill (Ricker 1938 as P. frigida); Churchill (Frisson 1942 as P. shelfordi); Aweme, Red River, Swan River and Treesbank (Ricker 1946).

Assiniboine River, Rosendale, 5.VI.25 (F.B. Fetterman); Flin Flon, 10.VII.61 (W. Tostawarik); Winnipeg River, Pinawa, 19.V.78 (P. Copps); North Birch River, Porcupine Hills Provincial Forest, 13.VI.82 (D.K.B.); Burntwood River, Thompson, 15.VI.83 (D.K.B. and R.A. Brust).

P. pictetii Hagen

Roseau River (Flannagan and Flannagan 1982).

Dauphin, 16.VI.52 (collector unknown); Winkler, 20.V.65 (A. Bergen); Roseau River, 2.VI.82 (T.D. Galloway and D.J. Giberson).

P. proteus Newman

North Red River (Hagen 1861).

Note: This record is considered unreliable (Ricker 1946) as this species has not been found to occur west of New York state (Hitchcock 1974). These specimens are probably Pteronarcys dorsata which has Pteronarcys proteus Pictet (nec Newman) as a junior synonym.

Superfamily Perloidea

Family Perlodidae

Subfamily Isoperlinae

Genus IsoperlaI. bilineata (Say)

Lake Winnipeg tributaries (Neave 1934); Aweme and Winnipeg (Ricker 1946).

Assiniboine River, Winnipeg, 16.VI.78 (J. Broatch); Winnipeg River, Powerview, 30.VI.79 (P. Kok); Red River, Glenlea, 4.VI.83 (W. Galloway); Red River, Winnipeg, 7.VI.83 (D. Pollock); Red River, Oak Hammock, 10.IV.83 (D.K.B.).

I. decolorata (Walker)

Churchill (Ricker 1944).

*I. dicala Frison

Westhawk-Caddy Lake, Whiteshell Provincial Park, 28.VI.83, 5.V.83 (D.K.B. and K. Nixon).

*I. frisoni Illies

Bird River, 26.V.81 (D.K.B. and V.I. Burachynsky) (Nymph).

I. longiseta Banks

Winnipeg (Neave 1934); Aweme and Glenboro (Ricker 1946).

Assiniboine River, Winnipeg, 19.VI.83 (J. Broatch); Red River, Glenlea, 25.V.80, 26.V.80 (D.K.B.); Grand Beach, Lake Winnipeg, 2.VIII.80 (B.D. Prystupa); Red River, Winnipeg, 11.V.83 (D.K.B., S. Miele and D. Pollock).

I. marlynia Needham and Claassen

Churchill and Aweme (Frison 1942); Aweme and Douglas (Ricker 1946). Aweme, 18.V.22 (J.B. Wallis).

*I. signata (Banks)

Lac du Bonnet, Winnipeg River, 17.VI.51 (D.H. Groves); Whitemouth River, Hadashville, 18.IX.82 (D.K.B.) (Nymph).

I. transmarina (Newman)

Lake Winnipeg tributaries (Neave 1933, 1934 as I. fumosa); Churchill (Frison 1942); Aweme and Swan River (Ricker 1946); South Duck River and Cowan Creek (Friesen et al. 1984).

Burntwood River, Thompson, 13.VI.83 (D.K.B., R.A. Brust and G.M. Kraljevic); Woody River, 19.VI.84 (D.J. Giberson); Mistik Creek, Flin Flon, 20.VI.84 (D.J. Giberson); Grass River, Wekusko Falls, 20.VI.84 (D. Pollock).

Subfamily Perlodinae

Genus Diura

D. bicaudata (Linnaeus)
Churchill (Ricker 1964).

Genus Isogenoides

I. colubrinus (Hagen)
The Pas (Ricker 1964).

I. frontalis (Newman)
Churchill (Frison 1942; Ricker 1964); South Duck River and Cowan Creek (Friesen et al. 1984).
N. Birch River, Porcupine Hills Provincial Forest, 7.VI.82 (D.K.B. and M.M. Quaglia).

*I. krumholzi (Ricker)
Aweme (Ricker 1946 as I. elongatus).
Assiniboine River, Stockton, 9.V.80 (V.I. Burachynsky).

Genus Skwala

S. parallela (Frison)
North Pine River and South Duck River (Flannagan and Cobb 1983).

Family Perlidae
Subfamily Acroneuriinae

Genus Acroneuria

A. abnormis (Newman)
Aweme (Ricker 1946).
Rennie River, Whiteshell Provincial Park, 28.VII.68 (P. Copps); Winnipeg River, Pinawa, 17.VII.77 (A.W. Brown); Southern Indian Lake, 14.VII.79, (P. Crawford); Roseau River, 15.X.78 (T.D. Galloway) (Nymph).

A. carolinensis (Banks)
Churchill and Lake Winnipeg (Stark and Gaufin 1976). Souris R., Buncloody, 2.VI.81 (S. Nawrocki).

A. lycorias (Newman)
Pigeon River, Lake Winnipeg and Winnipeg (Neave 1934 as A. perbranchiata in partim and A. pennsylvanica in partim) Swan River and Aweme (Ricker 1946).
Whitemouth River, Hadashville, 11.VI.82 (D.K.B.).

Genus Attaneuria

A. ruralis (Hagen)
Aweme (Needham and Claassen 1925).

Genus Perlesta

P. placida (Hagen)
Forked River and Glen Souris (Ricker 1946).
Morden, 19.VII.25 (J.J. Neilson); Morden, 5.VIII.65 (collector unknown); Roseau River, 21.VII.83 (K. Nixon); Rat River, 27.VII.83 (D.K.B., D.J. Giberson and M.M. Quaglia).

Subfamily Perlinae

Genus Claassenia

C. sabulosa (Banks)
Churchill River and Nelson River (Ricker 1964).
North Pine River, Duck Mountains Provincial Forest, 11.VIII.81 (D.K.B. and M.M. Quaglia) (Nymphs).

Genus Paragnetina

P. media (Walker)
Pigeon River, Manigotagen River and Wanipigow River (Neave 1934 as Perla media); various localities in Manitoba (Ricker 1964).
Roseau River, 15.X.78 (D.K.B.) (Nymphs); Whitemouth River, Hadashville, 20.IX.80 (D.K.B.) (Nymphs); Black River, Maskwa River and O'-Hanley River, 26.V.81 (D.K.B.) (Nymphs).

Genus Phasganophora

P. capitata (Pictet)
Winnipeg River (Flannagan and Flannagan 1982).

Family Chloroperlidae
Subfamily Chloroperlinae

Genus Hastaperla

H. brevis (Banks)
Aweme (Needham and Claassen as Chloroperla cydippe); Pigeon River (Neave 1934 as C. cydippe); Churchill and Pigeon River (Frison 1942); Swan River and Treesbank (Ricker 1946); Nelson River (Ricker 1964); Seal River (Flannagan and Flannagan 1982); South Duck River and Cowan Creek (Friesen et al. 1984).
Eastern Creek, Churchill, 10.VII.52 (J.G. Chillcott).

Genus Suwallia

S. pallidula (Banks)
Cowan Creek (Friesen et al. 1984).

Discussion

The present list contains 46 stonefly species from Manitoba. Seven species, Isogenoides krumholzi (Ricker), Isoperla dicala Frison, I. fri-

soni Illies, I. signata (Banks), Nemoura rickeri Jewett, Oemopteryx fosketti (Ricker), Strophopteryx fasciata (Burmeister) were not previously recorded from Manitoba. Two species, Pteronarcys proteus Newman and Megaleuctra stigmata Banks are questionable records from Manitoba (Ricker 1946).

During the last full-glacial period, known as the Wisconsin, Manitoba was completely covered with ice which eliminated the previous flora and fauna. Therefore, the present stonefly fauna in Manitoba is composed of species which have immigrated from unglaciated refugia. Ricker (1964), Ross (1965), Scudder (1979), Lehmkuhl (1980) and Flannagan and Flannagan (1982) have shown that based on current distributional patterns and post-glacial dispersal routes, stoneflies have emigrated into Manitoba from unglaciated refugia in the southwest, northwest, southeast and south of North America. The post-glacial dispersal routes from the southwest and southeast have been shown to be the most important contributor to the known Manitoba stonefly fauna (Lehmkuhl 1980; Flannagan and Flannagan 1982).

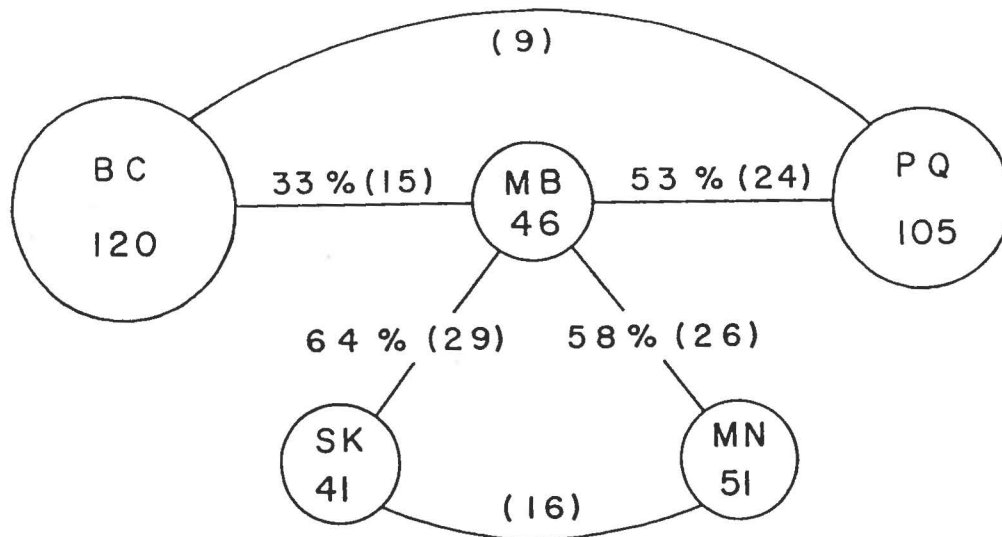


Fig. 2. Diversity of Plecoptera in Manitoba (MB), British Columbia (BC), Saskatchewan (SK), Quebec (PQ) and Minnesota (MN). Circle size is proportional and the known number of stonefly species in each fauna is given by the numeral; connecting lines have percentage of Manitoba fauna and number, in parentheses, of shared species.

A comparison was made between the stonefly fauna of Manitoba (46 species) and the fauna of British Columbia (120 species, Ricker and Scudder 1975), Saskatchewan (41 species, Dodsall and Lehmkuhl 1979), Minnesota (51 species, Harden and Mickel 1952) and Quebec (105 species, Ricker et al. 1968; Harper 1971; Harper and Harper 1983). The results of this comparison are diagrammed in fig. 2.

Manitoba shares 64% (29 species) of its stonefly fauna with Saskatchewan and 58% (26 species) of its fauna with Minnesota. In contrast Minnesota and Saskatchewan only have 16 stonefly species in common.

Manitoba shares 33% (15 species) of its stonefly fauna with British Columbia and 53% (24 species) of its fauna with Quebec. Quebec and British Columbia only have 9 stonefly species in common. Similarly, 44% (20 species) of Manitoba's stonefly fauna is western in origin and 56% (25 species) is eastern in origin (Ricker 1964; Lehmkuhl 1980; Flannagan and Flannagan 1982). The confluence in Manitoba of four major biomes (Dice 1943) and three major drainage patterns (Weir 1960) is reflected in that Manitoba's stonefly fauna is composed of western and eastern elements in relatively similar numbers when compared to surrounding provinces and states.

It is expected that future collections will add to the list of Manitoba stonefly species. For example, both Arcynopteryx compacta (McLachlan) and Leuctra ferruginea Claassen have been collected in eastern and western Canada and should occur in Manitoba (Dodsall and Lehmkuhl 1979).

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