P R O C E E D I N G S

of the

ENTOMOLOGICAL SOCIETY OF MANITOBA

DECEMBER 1945

Volume 1 Number 1

Proceedings of the

ENTOMOLOGICAL SOCIETY OF MANITOBA

Vol. 1 December, 1945 No. 1

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LIST OF MEMBERS

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Vice-President -- R. R. Lejeune, Forest Insects Laboratory

Secretary-Treasurer -- W. S. McLeod, University of Manitoba

Members

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Ruth Barker (Mrs. W. S.), Forest Insects Laboratory, Winnipeg

B. Berck, Grain Research Laboratory, Winnipeg

R. D. Bird, Dominion Entomological Laboratory, Brandon

W. A. Cumming, Manitoba Hardy Plant Nursery, Dropmore

R. H. Handford, Dominion Entomological Laboratory, Brandon

R. J. Heron, Forest Insects Laboratory, Winnipeg

E. C. Martin, Provincial Apiarist for Manitoba

A. V. Mitchener, University of Manitoba, Winnipeg

W. C. McGuffin, Forest Insects Laboratory, Winnipeg

J. McLintock, Virus Laboratory, Winnipeg

D. J. Petty, Dominion Seed Potato Certification Service, Winnipeg

L. G. Putnam, Dominion Entomological Laboratory, Brandon

C. A. S. Smith, Dominion Plant Inspection Service, Winnipeg

D. S. Smith, Dominion Entomological Laboratory, Brandon

J. B. Wallis, Royal Crest Apartments, Winnipeg

L. T. White, Forest Insects Laboratory, Winnipeg

W. M. Whiteway, Dominion Plant Inspection Service, Winnipeg

T. H. Williams, Deer Lodge Hospital, Winnipeg

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INTRODUCTION

The suspension of meetings of the International Great Plains Crop Pest Committee at the outbreak of the war deprived the entomologists of Manitoba of an important means of exchanging information among themselves and with entomologists from the adjacent provinces and states. This circumstance, coupled with the increased need for discussion on new developments, and aggravated by restricted travel, led the entomologists of Manitoba to seek every opportunity to meet together. Such an opportunity was afforded by the annual meeting of the Manitoba Agronomists, and this served for a time, but in 1943 and 1944 occasional special meetings were held. These meetings attracted practically all professional entomologists in the Province, and from their success it developed naturally that a proposal for a permanent organization should come forward. Accordingly, on March 23, 1945, the Entomological Society of Manitoba was formally constituted.

The Society immediately proved its usefulness. On May 4, the Society facilitated a meeting between its members and the State Entomologist and Extension Entomologist for Minnesota. Again, on June 30, a meeting with the distinguished British entomologist, Dr. V. B. Wigglesworth, was arranged under the auspices of the Society, and the Society acted as host at a luncheon in Dr. Wigglesworth's honour. One of the most pleasant and profitable meetings of the year was a two-day conference with entomologists from Minnesota and North Dakota at the Morden Experimental Station, August 20 and 21; the Society organized these meetings and prepared the program. The first general meeting of the Society was held November 2 and 3, and featured formal reviews of entomological and related subjects presented by members and outside authorities. A final business meeting was called on December 21. As a result of the deliberations and concerted action of its members, the Society may claim credit for the official adoption of common names for eight important insect pests in Manitoba.

In the first nine months of its existence the Entomological Society of Manitoba has served well the object set forth in the constitution--to foster the exchange of information on entomology. It has facilitated such an exchange not only among its members, but also between them and entomologists outside the Province. Indeed, visiting entomologists have expressed their pleasure at finding such a compact little group available for the discussion of a wide range of entomological problems. The Society now lists 22 members. It is fortunate that in this rather small membership almost every field of entomological interest is represented--teaching, apiculture, medical entomology, plant quarantine, and insect pests of field crops, forests, gardens and stored products. Such an organization cannot fail to be of value to its members, and through them, to the community which they serve.

The Society now offers its members this first number of the Proceedings, which contains a brief record of the pre-constitution meetings, the constitution, an account of the year's activities, and summaries of the papers presented at the first general meeting.

The Society was formed at a most opportune time and as a natural outcome of the need for closer contact between the entomologists of Manitoba--but its immediate success was the result of the efforts and enthusiasm of the individual members. Among these, a few may be mentioned who have rendered outstanding service to the organization. Dean A. V. Mitchener called the first meeting from which the Society ultimately grew, and his encouragement and experience assisted in all subsequent stages of its development; Mr. H. A. Richmond who prepared the first draft of the constitution and acted as vice-president until his resignation, and Mr. R. R. Lejeune who succeeded in the office of vice-president; and Mr. W. S. McLeod whose energy and ability in the office of Secretary, and later, Secretary-Treasurer, has made the most important single contribution to the success of the Society.

BEVERLEY N. SMALLMAN
President.

PRE-CONSTITUTION MEETINGS

Prior to the constitution of the Entomological Society of Manitoba, four informal meetings were held, primarily to discuss the matter of common names of insects of economic importance in Manitoba. An opportunity to seek official adoption of common names was afforded by the Committee on Common Names of Insects, The American Association of Economic Entomologists, which invited submissions for approval by ballot. The entomologists of Manitoba have to deal with a number of economic insects which lack approved common names, and such common names are highly desirable for extension work and teaching.

Meeting of November 5, 1943.

The meeting was called under the chairmanship of Dean A. V. Mitchener. After careful consideration, a list of 16 common names for insects of economic importance in Manitoba was prepared. This list was submitted by Dean Mitchener to the Secretary of the American Association of Economic Entomologists for the consideration of the Committee on Common Names of Insects. The list is included as Appendix I of these Proceedings.

Meeting of December 14, 1943.

The meeting was called by Dean A. V. Mitchener for the further discussion of common names for insects of economic importance in Manitoba. Dean Mitchener was elected chairman of the meeting and Mr. W. S. McLeod was elected Secretary. The meeting discussed a list of 23 insects with suggested common names. This list was accepted as the first supplement to the original "Tentative List" and is included as Appendix II of these Proceedings. The meeting approved a motion that a meeting be called at least once a year, and Mr. W. A. Cumming was elected chairman for a meeting to be called in 1944.

Meeting of December 13, 1944.

The meeting was called under the chairmanship of Mr. W. A. Cumming, with Mr. W. S. McLeod as Secretary. Dean Mitchener reported that the Committee on Common Names of Insects was now preparing to submit a list to the members of the American Association of Economic Entomologists for approval by ballot. The meeting approved a motion that the Secretary solicit support for the names submitted in the "Tentative List" from members of the A.A.E.E. in Canada and in those States adjacent to Manitoba. It was decided to prepare a list of common names for use in the province of Manitoba until such time as they are officially adopted

or discarded in favour of better names. A number of changes were made in the names listed in the "First Supplement" and the Secretary was instructed to forward this list to Dr. J. H. McDunnough in Ottawa and Mr. C. F. W. Muesebeck in Washington for comment.

It was at this meeting that the matter of a formal organization was first discussed. The meeting approved a motion that a meeting should be called in April of 1945 to consider this matter. Mr. H. A. Richmond was elected as chairman to preside at this meeting, and during the interim, to investigate the various types of organization that might be proposed. The meeting asked the present Secretary to continue in office until an executive was elected at the next meeting.

The full minutes of this meeting are included as Appendix III to these Proceedings.

The Charter Meeting

On March 23, 1945, a meeting was called to consider the formal organization of the group. In the absence of Mr. H. A. Richmond, Dr. R. D. Bird acted as chairman.

The Secretary reported that corrections to the "First Supplement" of the list of common names submitted to authorities in Ottawa and Washington had been received. These corrections had been assembled and made available to members of the group in the form of a mimeographed report, and this report is included as Appendix IV to these Proceedings.

After some discussion, the meeting approved unanimously a motion that the group should constitute a formal organization. A constitution drafted by Mr. Richmond was discussed at length and, after some revision, was unanimously adopted.

Officers elected were: Dr. B. N. Smallman, President; Mr. H. A. Richmond, Vice-President; Mr. W. S. McLeod, Secretary-Treasurer.

The Secretary-Treasurer was requested to prepare a press notice reporting the formation of the Entomological Society of Manitoba. Members agreed that the first general meeting of the Society should be called for late October or early November.

The complete minutes of this important meeting, with the exception of the constitution which is set forth below, is included as Appendix V to these Proceedings.

THE CONSTITUTION

Article 1. Title

This Society shall be known as The Entomological Society of Manitoba.

Article 2. Objects

The objects of the Society shall be:
(a) to foster the exchange of information on entomology,
(b) to further the dissemination of entomological knowledge.

Article 3. Membership and Dues

(a) Any person interested in entomology may become a member on application in writing to the Secretary of the Society.

(b) A member may withdraw from the Society upon giving notice in writing to the Secretary.

(c) Levies or dues of amounts necessary for the operation of the Society may be made from time to time, as circumstances dictate, at the discretion of the executive and subject to the approval of a majority of the members present at a regularly called meeting.

Article 4. Meetings

Meetings shall be called each year by the President at times and places suitable to the majority of the members.

Article 5. Nature of Meetings

The meetings shall be informal insofar as possible.

Article 6. Officers

The officers of the Society shall consist of a President, a Vice-President and a Secretary-Treasurer. These three officers shall constitute the executive with full power to act on behalf of the Society within the bounds of the constitution and to appoint committees as necessary.

Article 7. Elections

Elections shall be held once a year and officers so elected shall remain in office for a period of 12 months or until such time as another election has been held. The office of President shall not be held by the same member for more than two consecutive years.

Article 8. Alteration of the Constitution

The constitution and by-laws may be altered or amended at any official meeting of the Society by the approving vote of three-fourths of the members present and in good standing. Such alterations must be made by notice of motion which shall have been sent to the Secretary and a copy of such forwarded to all members at least two weeks before the general meeting.

Article 9. Minutes

The preparation and custody of the minutes shall be entrusted to the Secretary who shall also hold all books and records.

SPECIAL MEETING WITH THE STATE ENTOMOLOGIST, MINNESOTA

A special meeting of the Entomological Society of Manitoba was held on Friday, May 4th, 1945, at 9 a.m. when members of the Society gathered in Dr. Smallman's office to exchange information with visiting entomologists from the State of Minnesota. Those present were: Dr. B. N. Smallman, chairman, Dr. T. L. Aamodt, State Entomologist of Minnesota, who was accompanied by Mr. H. L. Parten of the Extension Service in that State, Dean A. V. Mitchener, Dr. R. D. Bird, Dr. R. H. Handford, Messrs. W. R. Allen, R. R. Lejeune, C. A. S. Smith, J. B. Wallis, and W. S. McLeod, Secretary-Treasurer.

Discussion at this meeting was largely confined to an exchange of information between the American and Canadian entomologists on the status of various economic pests in their respective regions, the expectations regarding the increase or reduction in importance of such species, and some mention of the control measures which have proven effective or which were to be tested during the coming season.

The meeting proved both pleasant and profitable to all present and it was suggested that another meeting might be held during the month of August at the Morden Experimental Station, provided that arrangements could be made which would be suitable to a sufficiently large number of interested people.

W. S. McLeod,
Secretary-Treasurer.

SPECIAL MEETING WITH DR. V. B. WIGGLESWORTH

A special meeting of the Entomological Society of Manitoba was held on Saturday, June 30th, 1945, when members gathered in Dr. Smallman's office to exchange information with Prof. V. B. Wigglesworth. Dr. Wigglesworth, the noted British authority on insect physiology and lecturer at the London School of Hygiene and Tropical Medicine, was on a tour of the United States and Canada. His purpose was to meet scientific entomologists and to discuss with them the various problems which they were investigating and the methods which were being followed in the work.

Those present at the morning meeting were: Dr. B. N. Smallman, Chairman, Prof. V. B. Wigglesworth, Dean A. V. Mitchener, Dr. R. D. Bird, Messrs. W. R. Allen, W. Chefurka, D. S. Smith, H. A. Richmond, R. R. Lejeune, W. C. McGuffin, R. J. Heron, C. A. S. Smith, B. Berck, J. McLintock, J. B. Wallis and W. S. McLeod, Secretary-Treasurer.

Dr. Wigglesworth first outlined the purpose of his tour. The Chairman then called upon various members of the Society to describe the work being conducted in their laboratories or field plots. These were as follows: Dr. Bird, sweet clover weevil; Mr. Chefurka, food studies on grasshoppers; Dean Mitchener, the general program of the Department of Entomology; Mr. McLeod, the onion maggot; Mr. Richmond, forest entomology in Western Canada; Mr. Allen, currant fruit fly work; Mr. McLintock, work on the vectors of equine encephalitis; Dr. Smallman, stored products investigations. Following each member's outline, the Chairman asked Dr. Wigglesworth for comments. Dr. Wigglesworth's comments, based on current British and American work, were most interesting and provoked valuable discussion.

At 12.45 noon the meeting adjourned. A luncheon was held at 1 p.m. at the Marlborough Hotel where members of the Society were joined by various scientists and medical men from the City. Those in attendance included all who were present at the morning meeting as well as Dr. K. W. Neatby, Prof. R. A. Wardle, Dr. J. A. McLeod, Mr. R. K. Stewart-Hay, Mr. H. A. Watson, Dr. H. Williams, Dr. H. M. Speechly, Dr. H. Rice, Dr. D. Nicholson, Mr. G. Shirley Brooks, Mr. L. T. S. Norris-Elye and Dr. C. Alcock.

Following the luncheon, Dean Mitchener introduced our distinguished guest to the gathering. Dr. Wigglesworth then gave a short address in which he described in broad terms the types

of studies which are involved in the profession of economic entomology and the relationship which exists between these and the study of insect physiology. Professor Wardle expressed our thanks to the speaker for his interesting address.

This marked the end of the formal part of the program. Upon leaving the hotel, however, a number of members accompanied Dr. Wigglesworth on a visit to the Forest Insects Laboratory and the campus of the University of Manitoba. The following day Dr. Wigglesworth visited the Grain Research Laboratory and a large temporary grain storage plant in company with Dr. Smallman.

W. S. McLeod,
Secretary-Treasurer.

THE MORDEN CONFERENCE

On July 17, 1945, an executive meeting was called to make arrangements for a meeting with American entomologists to be held at Morden during August. A committee was formed, and as a result of its work the following agenda for the meetings was sent out to all members and invited guests.

A G E N D A

August 20.

1.30 p.m. - Address of Welcome
W. R. Leslie, Superintendent, Dominion Experimental Station, Morden.

Introductory Remarks
B. N. Smallman, President, Entomological Society of Manitoba.

2.00 p.m. - Field Crop Insects
T. L. Aamodt, State Entomologist, Minnesota.

3.00 p.m. - Recess

3.30 p.m. - Garden Insects
R. D. Bird, Dominion Entomological Laboratory, Brandon.

4.15 p.m. - Stored Product Insects
C. E. Mickel, University of Minnesota.

5.00 p.m. - Adjourn.

August 21.

9.00 a.m. - Forest Insects
R. R. Lejeune, Dominion Forest Insects Laboratory, Winnipeg.

9.45 a.m. - Plant Quarantine
J. A. Munro, State Entomologist, North Dakota.

10.30 a.m. - Recess

11.00 a.m. - Trip around the Station
W. R. Leslie, Superintendent.

2.00 p.m. - Insect Pests of Man & Animals
R. H. Painter, Dominion Entomological Laboratory, Lethbridge, Alberta.

3.00 p.m. - Adjourn.

THE MORDEN CONFERENCE

The Morden conference of entomologists, which had been suggested at our meeting of May 4th, was held on August 20th and 21st, 1945. The committee appointed by the executive to take charge of this conference consisted of Dr. B. N. Smallman, Chairman, Mr. C. A. S. Smith and Mr. W. C. McGuffin. The success of the entire program was due in no small measure to the excellent work done by these members in preparation for the event.

The conference was opened at 1.30 p.m. on Monday, August 20th, by an address of welcome from Mr. W. R. Leslie, Superintendent of the Dominion Experimental Station at Morden. Those present were: Dr. B. N. Smallman, Chairman, Dr. C. E. Mickel, Professor of Entomology at the University of Minnesota; Dr. J. A. Munro, State Entomologist of North Dakota; Mr. E. L. Thomas, Assistant to the State Entomologist of Minnesota; Mr. H. L. Parten, Extension Entomologist of Minnesota; Dr. R. D. Bird, Dr. R. H. Handford, Dean A. V. Mitchener, Messrs. W. R. Allen, W. Chefurka, R. R. Lejeune, W. C. McGuffin, J. McLintock; R. H. Painter from the Dominion Entomological Laboratory, Lethbridge, Alta.; D. S. Smith, C. A. S. Smith, H. Richardson and W. S. McLeod, Secretary-Treasurer.

Following a few introductory remarks, Dr. Smallman turned the meeting over to Dr. Bird who was chairman of the section on garden insects. Among the topics discussed were: the insect pest survey being initiated this year in connection with garden insects, the various experiments being conducted against potato insects, onion maggot, apple seed chalcid in crabapples, and the various methods which might be tried to control them.

With Dr. C. E. Mickel as Chairman, the meeting next devoted itself to a discussion of stored products insects. Dr. Smallman was asked to describe the Canadian work which had been done in an effort to protect the huge quantities of grain which had been stored during war years in temporary annexes. He mentioned also the use of such inert dusts as aluminum oxide and magnesium oxide as well as combinations and preparations of DDT in connection with the control of warehouse pests. Dr. Mickel described in some detail his laboratory experiments with stored products pests on various soybean products being produced in the United States. His findings were most interesting.

The third and final discussion period for the afternoon meeting was concerned with forest insects and was led by Mr. R. R. Lejeune. Mr. Lejeune's account of the large scale experiments with aeroplane spraying against budworm larvae in Northern Ontario was of interest to all present and led into a more

or less extensive discussion of the use of DDT. The Manitoba entomologists were surprised to learn from Dr. Mickel that a severe infestation of walking stick insects had appeared in certain sections of his territory. In conclusion, Mr. McGuffin described the Canadian Forest Insects Survey, a service which is one of the best of its kind in the world.

A number of those present expressed their appreciation of the fact that the program, as prepared by our Committee, allowed recesses between discussion periods. It was generally thought that these free periods had two chief advantages, namely, that they removed the pressure of the time element from the discussions, thus allowing an interesting topic to be pursued to its conclusion, and that they permitted members to hold private conversations with others holding similar interests, simultaneously giving us the opportunity of becoming better acquainted with our American visitors.

The meeting of Tuesday morning, August 21st, was opened by Mr. E. L. Thomas who, in the absence of Dr Aamodt, acted as chairman for the discussion of field crops insects. This was a topic of great importance to most of the entomologists present and many observations were reported. Among the most serious pests discussed were grasshoppers, corn borer, and sweet clover weevil. Dr. Munro mentioned his experimental work with DDT dust against this weevil. Dr. Bird, on the other hand, while doing some work with DDT, has given more attention to the life cycle of this insect and the possibilities of control by cultural methods. The role of insects in the pollination of alfalfa was also mentioned, together with the possibility of using honey bees to better advantage in this regard.

The discussion of plant quarantine, under the chairmanship of Dr. J. A. Munro, with contributions from Mr. C. A. S. Smith, brought forth a good deal of interesting information which could not have been discussed under other headings. It was felt that this method of control is of vital importance and should not be neglected in any way.

Insect pests of man and animals were discussed under the chairmanship of Mr. R. H. Painter. Mr. Painter, in his own inimitable style, discussed the value of the livestock industry in Western Canada and emphasized the crying need for more research men specializing in the field of insect pests of animals. He mentioned the great amount of work that is being done in the United States but showed how many of their recommendations were impractical for use in our northern climate unless modified to suit the conditions which exist here. Mr. McLintock contributed a description of the work which is being done in Manitoba in connection with the vectors of equine encephalitis.

This concluded the morning session. After dinner many of the members availed themselves of the opportunity of seeing the work which is being conducted at the Morden Experimental Station. Our thanks are due to Mr. Leslie for his hospitality which permitted us to hold a most interesting and valuable conference in such pleasant surroundings. It is hoped that a similar meeting may be held again in the not too distant future.

W. S. McLeod,
Secretary-Treasurer.

THE FIRST GENERAL MEETING

On September 14th the executive met to discuss plans for the first general meeting. A two-day conference was planned, with the program divided into a business session, and a session of scientific business. The program for these meetings was prepared, and the dates set for November 2 and 3. The executive also prepared a list of general topics suitable for reviews at future meetings, and this list is included as Appendix VI of these Proceedings.

The Business Session

The transfer of Mr. H. A. Richmond to Victoria had left the office of Vice-President vacant, and the meeting elected Mr. R. R. Lejeune to this office by acclamation.

Dean Mitchener brought in a report on the results of the ballot prepared by the American Association of Economic Entomologists in connection with the list of Approved Common Names of Insects. Most of the sixteen names on our submitted list were included in the fifty-one names on the ballot. Common names for twenty-six insects were approved, and eight of these were for insects on our list. In other words, half of the insects on the Society's list received approved common names. Members felt that this very creditable accomplishment was largely the result of the Society's action in soliciting support for its submission from members of the A.A.E.E.

The meeting approved a motion that the Society should prepare for its members an annual report to be called, "Proceedings of the Entomological Society of Manitoba".

The Secretary-Treasurer submitted a financial report, and was authorized to purchase suitable letterhead for the Society. Article 3 of the constitution was amended to allow the executive to make small expenditures during periods between meetings; and a levy of one dollar per member was approved.

The full minutes of this meeting are included as Appendix VII of these Proceedings.

Scientific Business

Under this section, two reviews of important entomological subjects were presented in the morning, and two in the afternoon of November 3. This liberal spacing allowed authors ample time to present their reviews and permitted full discussion following each paper. Two speakers--J. McLintock and R. R. Lejeune--are professional entomologists; the other two speakers--Dr. C. H. Goulden of the Dominion Cereal Division, and Dr. T. H. Williams of Deer Lodge Hospital, represent allied fields capable of making valuable contributions to entomology. The device of inviting contributions from authorities in allied fields added much interest to the program and is a practice that might well be adopted for future meetings.

Many members expressed their satisfaction with the comprehensive reviews presented at this meeting. The literature on the insect cuticle for instance, is widely scattered and difficult to assess, and it is of real value to have it assembled and integrated. To make this gain permanent, summaries of the papers are included in these Proceedings and the authors have also listed the principal references. By this means, members of the Society may retain comprehensive reviews of important fields of entomology and the means of fully exploring these fields.

SPECIAL MEETING -- A NATIONAL SOCIETY

On December 21 a meeting of the Society was called to discuss primarily a proposal from the Entomological Society of Ontario regarding the formation of a National Society. This proposal was discussed at an executive meeting on November 20, and the proposal, in the form of a letter from Mr. W. A. Ross, Chairman of the National Committee, was sent to all members by the Secretary. Mr. Ross's letter asked for an expression of opinion regarding the formation of an Entomological Society of Canada composed of provincial or regional branches.

After full discussion of the proposal, members voted in favour of a National Society and the Secretary was requested to inform Mr. Ross that this Society would support such an organization. Members were in favour of maintaining the present Entomological Society of Manitoba within the national body rather than forming a prairie regional branch, and the Secretary was asked to inform the Saskatchewan and Alberta members of the National Committee to this effect. The meeting felt that the matter of financial support for the national organization should be considered by the national body rather than the branches and that a Dominion grant should be sought rather than Provincial grants.

The meeting then discussed the matter of a further submission to the A.A.E.E. Committee on Common Names of Insects, and it was decided to submit a list of nine names--four from the original list, three from the first supplement, and two that were proposed at this meeting. This new list is included as Appendix VIII of these Proceedings.

Dr. Smallman reported on the compilation of the Proceedings. At an executive meeting on November 20, it was decided to prepare about one hundred copies, each to be stapled between heavy paper covers. The executive suggested that a thousand covers should be printed with the title, "Proceedings of the Entomological Society of Manitoba", and that volume numbers and dates be added by hand to each yearly edition.

The minutes of the meeting appear as Appendix VIII to these Proceedings.

THE INSECT CUTICLE -- A REVIEW

J. McLintock, M.Sc.

I. Introduction

Ten or fifteen years ago the page or so devoted by Comstock to the insect cuticle would have covered about all the available information on the subject. Today the literature is quite voluminous and too much to cover even in the generous time allotted here. I propose therefore, to present the more recent observations that have been made and which, added to what was already known, have confirmed the belief that the insect cuticle is a highly asymmetrical, semipermeable membrane. I will then proceed to an outline of the three principal theories that have been advanced to explain the mechanism of cuticle penetration on the basis of a semipermeable membrane. These theories will undoubtedly influence the present conception of insecticidal effect and the methods of measuring that effect.

II. Structure and Composition

The insect cuticle has a laminated structure and is usually described as consisting of three primary layers, viz., an inner, elastic, moist, fibrous endocuticle of chitin and protein laid down after moulting is complete; this is preceded by a hard, inextensible exocuticle of variable thickness in which an amber or brown material--the "cuticulin" of Wigglesworth (1933) or the "sclerotin" of Pryor (1940a)--is incorporated with the chitin. Finally, there is a very thin outermost epicuticle, about 1 micron thick, consisting of sclerotin alone without chitin but impregnated with lipoids. An endocuticle and epicuticle are always present but the exocuticle is sometimes lacking, especially in the conjunctivae between the segments, etc. In addition there is present, on many insects, a thin layer of a waxy substance lying on the surface of the epicuticle. In some this layer is continuous while in others it is patchy. This is believed to be produced by the dermal glands and in many insects the patches of the secretion are found on the surface only around the openings of the pores.

Most authorities are agreed on this gross structure but there have been some differences of opinion regarding the fine structure of the cuticle, and recently other components have been discovered.

The epicuticle was considered to be a homogeneous structure until recently when Richards and Anderson (1942), using the electron microscope, claimed that the epicuticle of the cockroach is

laid down in two distinct layers. Dennel (1944) stated that in the larva of Sarcophaga there is a layer, about 4 microns thick, underlying the epicuticle and composed of pure protein. This he believes to be a secondary epicuticle. Evidently the epicuticle is also made up of layers and is not the simple homogeneous layer it was originally believed to be.

It has been known for some time that the exo-and endocuticle do not have a homogeneous structure. Both are traversed vertically in many insects by striae looking like canals and as far back as 1867 Leydig called these "pore canals". He believed that they represented protoplasmic filaments given off as processes from the epidermal cells. This explanation has been generally accepted and Wigglesworth showed that in some insects they actually are canals (open spaces) in which case the filaments have been withdrawn. More recently Dennel (1943) has claimed that in the 3rd instar larva of Sarcophaga the pore canals at first extend completely through the endocuticle which at this stage is 10 microns thick. Later, when it is 35 microns thick, they extend through only the inner third of the endocuticle but instead of being canaliform they are now rod-like bodies which give Campbell's (1929) test for chitin. This chitinization proceeds inwards from the distal ends of the canals. Hence it appears probable that the pore canals may be filled with fluid or protoplasmic substance and also chitinized at different stages of development in the same insect.

The number of pores varies from none to very large numbers, e.g. Richards and Anderson (l.c.) state that in the cockroach there are 1,200,000 per sq. mm. whereas mosquito larvae have none at all.

Apart from these pores the exocuticle evidently has no particular structures. The endocuticle is laid down in horizontal lamellae believed by some to be capable of sliding on each other. It may often be complex, sometimes having layers of beam-like structures extending vertically.

Thus the cuticle consists of a heterogeneous system of protein, lipoid, chitin and other components whose nature and relative distribution vary greatly in different insects. Hurst (1943), in one of a series of recent papers, claimed that the "surface" of the insect cuticle consists of heterogeneous protein and lipoid associations or patches. Just what was meant by "surface" is not clear but at any rate he stated that the protein and lipoid components were continuous throughout the bulk of the cuticle.

I need say little about the chemistry of chitin. You know that it is generally referred to as a "colourless, acetylated, nitrogenous, polysaccharide", $(C_8H_{13}O_5N)_x$. X-ray analyses have

shown that it is microcrystalline and made up of long chains of glucosamine residues which form elongated particles or micellae. In addition to its other physical and chemical properties it was discovered by von Weimarn that it forms a colloidal sol capable of strong hydration in solutions of salts.

The chemical composition of sclerotin is unknown but chemical tests have indicated the presence of fatty acids, lipoids, cholesterol, aromatic groups and polyphenols. According to Pryor (1940a) it consists mainly of "tanned protein".

Besides chitin and sclerotin the black pigment melanin is usually found in the exocuticle and epicuticle. The melanins are nitrogenous compounds closely related to the proteins, and Trim et al (1941) believe that the melanin which is practically always present "is responsible for binding the chitin and protein together into a very compact and resistant complex". Fraenkel and Rudall (1940) have shown that the endo- and exocuticle are impregnated with water, the content being higher in the white elastic endocuticle. These authors also believe hardening of the cuticle to be a purely physical process of contraction and dehydration resulting in a closer packing of the molecules. On the other hand Pryor (1940, 1940a) believes hardening to be due to the formation of the insoluble protein compound, sclerotin, in an oxidation reaction. It is possible that both processes may be involved but Pryor's conclusions should be accepted with caution because they are based in part on studies of the ootheca of the cockroach which is not a chitinous structure. However his findings are supported by those of Dennel (1944) on Sarcophaga. Dennel claims that darkening and hardening are due to the reactions of respiratory enzymes derived in part from the blood. He found that, from the cessation of feeding to the onset of pupation, the larval blood shows a progressive increase in tyrosine content followed by a decline at pupation. He believes the decrease in tyrosine to be due to its oxidation in situ by tyrosinase to convert it into polyphenols. Now the secondary epicuticle contains a plyphenol oxidase and darkening of the cuticle begins at the secondary epicuticle where enzyme and substrate meet; it spreads inward through the exocuticle which is thereby converted into the hard and dark exocuticle of the puparium. The endocuticle does not darken, evidently because it lacks the necessary phenol. (Air, of course, is necessary for hardening of the integument to take place.)

Trim (1941) has recently produced evidence that the cuticle proteins resemble the silk gelatin, sericin, quite closely. This seems reasonable enough when it is remembered that the silk glands are epidermal in origin.

The facts and plausible guesses so far gathered on the insect cuticle certainly do suggest that it would behave like a semipermeable membrane.

III. Function

The cuticle performs several vital functions in the life of an insect. The most obvious of these are, as a support for the internal organs and muscles etc., and as a protection for those organs. Not so obvious is the role that the cuticle plays in preserving the water balance between the animal and its environment.

Insects have a large surface area in proportion to their bulk, i.e., they have a large evaporating surface. The water-regulating ability of the cuticle depends on its permeability and in connection with the action of insecticides it is the permeability of the cuticle that is of most interest to the economic entomologist. During recent years this aspect of the insect cuticle has received more attention than any other.

The permeability of the insect cuticle is affected by its own physical and chemical structure and by the secretions of the ectodermal glands poured out on it. The heavy secretions of some insects must be important in reducing the permeability to water, and apart from these heavy and obvious secretions there are also the thin, waxy films secreted over the body surface Ramsay (1935) found that at ordinary temperatures the evaporation rate from the surface of the cockroach was very low but at 30°C and over, a sudden and considerable increase in rate occurred. The cuticle itself is permeable but Ramsay found a thin oily secretion on the surface and when a fine spray of water was applied the water droplets became covered with the secretion and remained for hours. But over 30°C they evaporated immediately. Ramsay suggested a change in phase in the film at 30°C which breaks its continuity.

In most insects the cuticle is impermeable to water due to the presence of lipoid substances in the epicuticle. According to Klinger (1936) cuticle thickness evidently plays a part within members of the same species but there seems to be little relation between members of different species, e.g., thin-skinned clothes moth larvae feeding on dry foods are much more resistant to desiccation than some thick-skinned species. However, impermeability to water is not universal, for many aquatic and semi- aquatic insects have permeable cuticles. Then again certain areas of the body surface, e.g., the conjuctivae, hair sockets, lining of the epidermal glands, etc., are more permeable than others. Possibly the lipoid constituents are absent from these permeable areas. Recently Wigglesworth (1944, 1944a)

has shown that scratching of the cuticle surface (i.e., breaking the continuity of the epicuticle) can increase the permeability to a fatal level.

In the 1930's a series of papers was published by O'Kane, Hoskins, Hockenyos, et al on the effect of arsenicals as dusts, in which they showed that these dusts acted as contact poisons, being able to penetrate the cuticle by absorbing water from it while in contact with the integument. It was also shown at this time by Alexandrov (1934, 1935) and Morozov (1935) that the cuticle is a semi-permeable membrane allowing weak acids and bases and feebly dissociating compounds to pass through more readily than the ions of strong electrolytes. Alexandrov showed that if the integument is boiled in strong alkalies this selectivity is lost, which suggests that it is due to the presence of the lipoids.

More recently, Hurst has shown that feebly dissociating compounds of high dielectric constant (e.g., heavy naphtha, fatty acids, alcohols, phenols, ammonia, HCN, etc.) penetrate the cuticle much more readily in the presence of relatively apolar substances of low dielectric constant (e.g., paraffins, cycloparaffins, etc.) while induced penetration is negligible for strongly dissociating compounds such as neutral salts and mineral acids. He also showed that the epicuticle was the seat of selection because endo-and exocuticle were equally permeable to polar and apolar substances. Wigglesworth (1942) and Robinson (1942) found that with solutions of pyrethrum in oil, the rate of penetration of the pyrethrum depends on the rate of penetration of the oil, i.e., it was slower in viscous oils. This penetration was ascribed to dissolution of the cuticle lipoids by the oil. Both Wigglesworth and Hurst tested several other oil mixtures and obtained similar results but with variations in the violence of the reaction due to the differing partition coefficients. This of course is important because it would determine the rate at which a toxicant would leave an oil base and enter the tissues of an insect.

Hurst, more than any other, has stressed the highly asymmetrical nature of the insect cuticle. For asymmetrical membranes it is known that permeability in one direction may be different to permeability in the oppoiste direction. Also, experiments have shown that combinations of asymmetrical membranes may be more permeable to a particular substance than the single components of the membrane system. For example, water evaporates through the cuticle of Calliphora larvae more than 100 times as rapidly in the direction lipoid layer → chitin layer than in the opposite direction. This indicates that in insects in which water may pass freely inwards the rate of evaporation may be much smaller. On the other hand the rate of

evaporation through two such cuticles is intermediate when the lipoid layers are in contact (Hurst, 1941).

Another property common to all semipermeable membranes is their ability to "imbibe" certain liquids. When imbibition occurs the membrane "swells", and the more rapidly it swells the more liquid can pass from one side of the membrane to the other, i.e., imbibition and swelling are accompanied by increased permeability (Freundlich, 1922).

IV. Membrane Penetration

The question can now be asked, "How does an insecticide or drug or any substance penetrate the insect cuticle?".

The pore canals, if they exist as Leydig and Wigglesworth have claimed, would offer a ready means of entry. But pore canals definitely do not function in the majority of insects for the permeability to undissociated molecules and impermeability to ions rules out the possibility of a "sieve" effect. The bulk of the evidence shows that penetration is possible due to the permeability of the endo- and exocuticles and to the semipermeable nature of the epicuticle.

The question then resolves itself to, "What is the mechanism of penetration of the semipermeable epicuticle?". This question is part of the larger problem of membrane penetration that has been engaging the attention of toxicologists for quite a number of years.

(a) The Overton-Meyer Theory.

The first substantial attempt to answer the above question was the "Lipoid" theory put forward by Overton and Meyer near the beginning of this century (Freundlich, 1922). Their theory was applied primarily to plasma membranes but was later extended to include a much wider range of membranes including the insect cuticle. It held that the plasma membrane consists essentially of lipoids and that the toxic action of a drug depends upon the partition coefficient of the drug between oil or lipoid, and water i.e. on the differential solubility of the drug. However, this theory was too specific; most of the work done since has indicated that the cell surface, and the insect cuticle, are more complex than is represented by the lipoid theory. Furthermore, it has been shown that certain lipoid-soluble substances readily penetrate the cells while certain fat-soluble substances do not (Freundlich, l.c.).

(b) Traube's Theory

The second, and probably the most important single contribution yet made to the problem of membrane penetration and toxi-

city in general, was that of Traube, advanced in 1904.

This theory stated that toxicity was due to the adsorption of "surface active" molecules at the plasma membrane - solution interface. It has been shown that such adsorbed substances will pass through a membrane provided no intermicellar liquid is present, and that even if they do not actually pass through the membrane, their adsorption is sufficient to inhibit biological activity, if they are capillary-active, i.e., have low surface tensions.

This explained the difference in toxicity between members of a homologous series. Surface activity, which is due to the undissociated molecules and not to the ions, increases greatly and regularly as we ascend the series (Traube's Rule) and also accounted for the lipoid solubility of Overton and Meyer, surface activity being an indication of solubility. Thus, in aqueous solutions, each addition of a $-CH_2-$ group increases the hydrophobic portion of the molecule and increases the lyophilic portion, i.e., the polarity for water decreases while the polarity for fats and oils increases.

However, this theory was by no means complete; it was found to hold only within certain limits. It also offered no explanation for the difference in toxicity between corresponding members of different homologous series. From the entomological point of view it deals only with "pure" toxicants which are seldom used in insecticidal work and offers no explanation for the well known phenomenon of "carrier" action nor for "induced" penetration of the so-called "inert" substances.

(c) Hurst's Theory

In an attempt to fill in some of these gaps Hurst has recently put forward a theory which is not new insofar as the chemical basis is concerned but does introduce several new concepts concerning the physiology of the insect cuticle.

Chemically, Hurst has extended the theories of Overton and Meyer and of Traube in the light of more recent developments in colloid chemistry. His theory is of particular interest to economic entomologists in that he has attempted to relate the known facts and theories to phenomena that are peculiar to insecticidal action.

Hurst's primary precept states that when a contact insecticide is applied to the external surface of an insect a pharmacological system is established consisting of: (1) an insecticidal phase, (2) a "biophase" and (3) a "carrier" phase.

The insecticidal phase consists of one or more components variable at will and under the control of the experimenter.

The biophase is highly complex and consists of the protoplasm and its surrounding membranes. These membranes vary with the individual insect in the quantitative and qualitative relations of their various components. In all cases however they do conform to one "fundamental pattern". This pattern is a "visco-elastic lipo-protein mosaic" consisting of hydrophobic lipoid and hydrophilic protein micellae which form a framework held together by a free and mobile lipoid bonding phase.

The preceding paragrph is composed mainly of Hurst's words and he is merely saying what Trim (1941), von Weimarn, Wigglesworth (1939), Fraenkel and Rudall and others have said before him, viz., that the insect cuticle is a thin sheet of colloidal gel (i.e., it consists of a mass of micellae which associate to form thread-like structures). These micellae or threads are separated by submicronic films of liquid (e.g., like bound water) which form the dispersion medium for the dispersed micellae. The threads traverse the gel in the form of a network and cause the cohesion and great elasticity which distinguishes gels from true sols. The only difference between the insect cuticle and a true gel is that the latter is homogeneous in composition whereas the cuticle is heterogeneous, i.e., both protein and lipoid micellae are interwoven in the cuticle.

The mobile lipoid bonding phase can be removed or dispersed by solvent action but it normally has what Hurst calls a "high functional viscosity", i.e., the micellae are held together by a van der Waal's attraction (the attraction between molecules that produces liquefaction and solidification under pressure).

The hydrophilic and hydrophobic nature of the cuticle will depend on whether there is a greater proportion of protein or lipoid present. Hurst considers that the insect cuticle is a living membrane when he claims that insects are able to secrete lipoid substances into the epicuticle even after the cuticle has hardened. In so doing they are able to regulate the asymmetry and hence the permeability of the cuticle. Proof of this has yet to be put forward.

A "carrier" is any substance which induces penetration by another substance or increases the permeability of the membrane to that substance. It may be a fat solvent or a protein solvent depending on whether the membrane is hydrofuge or hydrophil respectively. For the majority of insects carriers are fat solvents.

However, the action of a carrier is not entirely due to solvent action. The changes in permeability which are induced by fat solvents are readily reversible. Thus the integument of the blowfly larva is relatively impermeable to alcohol but in an alcohol:kerosene mixture it becomes readily permeable to the alcohol; then when transferred to pure alcohol again, the original permeability is restored. Only prolonged immersion in the kerosene will produce a permanent change in permeability.

It follows then that the primary association of fat solvents with the cuticle framework is physical. Hurst describes this association as "functional participation" of fat solvent in the cuticle framework. He means that there is a van der Waal's attraction between fat solvent molecules and the lipoid centres which opposes the van der Waal's attraction between the micellae, tending to pull them apart, thus spreading or swelling the cuticle framework and increasing the free volume of the bonding lipoid phase. This is accompanied by a reduction in the "functional viscosity" of the lipoid phase. This explains the decrease in carrier activity with increase in viscosity of the carrier such as Wigglesworth found in his oil and pyrethrum mixtures.

The elasticity of the lattice framework opposes the dispersive action of the solvent and the irreversible increase in permeability which may occur after prolonged treatment of the cuticle with a fat solvent is due to the rupture of the van der Waal's bonds which normally influence the stability and elasticity of the lipophilic chains.

Thus there are two main avenues of penetration through the epicuticle:

1) Induced penetration due to Overton and Meyer's differential solubility, through either the protein phase or the lipoid phase, depending on the polarity of the toxicant.

2) Carrier action, due to molecular interaction between the toxicant molecules and the protein or lipoid molecules at the interfaces and lipoid centres.

On the other hand, penetration is prevented by either:

1) Non-polarity, i.e., absence of solubility.

2) The Traube effect, i.e., adsorption of toxicant molecules at the protein/lipoid interfaces resulting in blocking.

Hurst extends his theory to show that a drug may either induce its own penetration or exert a carrier action similar to that of a fat solvent provided that the dispersive van der Waal's interaction with the lipoid components is sufficiently strong.

Traube's theory was applied primarily to cell membranes, in which case the interface involved was that between the plasma membrane and toxicant, and toxicity was due mainly to adsorption at the interface. According to the theory there should be a proportionate increase in toxicity for each $-CH_2-$ group added in a homologous series. But the theory was attacked because this did not always happen. For example, Hurst found that in the straight chain aliphatic alcohols the rate of penetration increases as we pass from C_1 to C_5 where it reaches a maximum and then begins to decrease. On the other hand in the series of fatty acids the rate of penetration decreases as we pass from C_1 to C_5 where it reaches a minimum then increases to C_7.

Carrier activity and capillary activity are properties of the hydrocarbon chain. In a homologous series carrier activity increases as the series is ascended but reaches a maximum when capillary activity begins to predominate. Capillary activity becomes pronounced in the fatty acid series at C_6-C_7 and in the alcohol series at C_4-C_5, the differences being due to differences in the activity of the polar groups. Thus in the lower alcohols polarity for the water-soluble proteins is slight and the remainder of the molecule is too small to exert any carrier activity (i.e., there is no van der Waal's attraction between the alcohol molecules and the lipoid centres); hence penetration is very slight. As the $-CH_2-$ chain lengthens, carrier activity increases and reaches a maximum at amyl alcohol when the capillary effect begins to be felt. From C_6 upwards the capillary activity increases, the molecules become adsorbed at the protein/lipoid interfaces and eventually block the penetration.

In the fatty acid series the high polar attraction for the water-soluble proteins and the absence of capillary activity permits penetration of the lower members of the series through the protein phase. But as chain length increases and capillary activity increases, the fatty acid molecules tend to become anchored by adsorption, and penetration decreases due to a balance between polar and non-polar interaction. This balance reaches a maximum at C_5 where drug penetration is at a minimum. From C_5 to C_7 penetration of the fatty acids increases due to the predominance of the lipoid-soluble portion of the acid molecules and penetration is now via the lipoid phase. Above C_7 the fatty acids are solids.

There are several obvious objections to Hurst's theory. His assumption that the insect cuticle is a living membrane is contrary to the present conception which regards it as a non-cellular mechanical structure. Also, his statement that insects can secrete lipoid substances into the epicuticle after it has hardened will probably promote criticism in the absence of supporting experimental evidence. On the other hand this assumption

is not as far-fetched as it appears at first glance when one considers that it has been known and accepted for some time that water can evaporate through the cuticle. The water of course must come from the epidermis as long as the latter is still in contact with the cuticle. If it is true that the insect can secrete lipoid into the epicuticle, then it offers a very satisfactory explanation for the toxic and desiccating action of the so-called "inert" dusts. Many finely divided inert dusts would readily adsorb labile lipoid or lip-protein substances from the surface layers of the epicuticle. If these substances were removed faster than they could be replaced by transmission through the bulk cuticle, then removal of the mobile lipoid "bonding" phase would result in a reduction of the cohesion of the lattice elements. Under such conditions the insect would be unable to control the rate of transmission of water through the cuticle and death would result from desiccation. The theory would also influence our conceptions regarding the temperature responses of insects, e.g., the rapid loss of water by insects at high temperatures could be accounted for by assuming low melting points for the lipoids which would decrease the "functional viscosity" of the lipoid phase and hence increase the permeability of the cuticle.

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THE APPLICATION OF STATISTICS IN ENTOMOLOGICAL RESEARCH

C. H. Goulden, Ph.D.

The Statistical Viewpoint on Problems of Sampling and Experimental Design

The Statistician pictures a hypothetical infinite population for which there are certain fixed values known as parameters. The purpose of sampling is to calculate from the samples values known as statistics that are unbiased estimates of the population parameters.

It is important for the investigator to have a clear picture of the population sampled. Not having this clear picture is equivalent to not knowing exactly what information the experiment is supposed to provide. Clarity with respect to the population simplifies problems of sampling and design.

In the interpretation of the results of experiments there are two kinds of errors. These can be illustrated by the example of making a comparison of two kinds of poison bait. If the experimenter decides that the baits are different when they are actually not different, he makes an error of the first kind. This kind of error is the one that is usually emphasized in tests of significance. An error of the second kind would be made if the experimenter decides that the baits are not different when they actually are different. This is the kind of error which is frequently overlooked. It becomes more frequent as we increase the level of significance. It is the kind of error that is made most frequently by those who believe that tests of significance are unnecessary because important results are obvious and therefore, do not require the making of tests.

Transformations

Entomological data is frequently in the form of counts or percentages. These data sometimes occur in a form which invalidates tests of significance made in the ordinary way; e.g. t or F tests. The outstanding characteristic of certain sets of data taken as counts or percentages is skewness of the frequency distribution and a relation between the mean and the variance.

In order to overcome the difficulties encountered in the use of counts or percentages, certain transformations have been suggested. These transformations remove the skewness and the relation between the mean and the variance.

It is sometimes difficult to decide which transformation to use, and in order to make this somewhat easier, the following key has been worked out.

	Appropriate Transformation
I WHOLE NUMBER COUNTS	
1. Small numbers 0 - 20	
Mean $<$ 10	* $\sqrt{\frac{1}{2} + x}$
Mean $>$ 10	$\sqrt{x}$
2. Wide range e.g. 10 - 10,000	$\log_{10}(1 + x)$
3. " " e.g. 0 - 10,000	* $\log_{10} x$
II PERCENTAGES	
1. Numerators $<$ 100	
Percentages 0 - 25, or 75 - 100	$\sqrt{x}$ or inverse sign
" 25 - 75	* * None or " "
2. Numerators $>$ 100	None

* to avoid zero values

* * inverse sign may be used in order to make data comparable with other sets of data where inverse sign must be used.

The inverse sign is the angle ($0 - 90^0$) for which the sine is $\sqrt{x}$.

Tables are available for all transformations. The inverse sign table is given in Snedecor's "Statistical Methods", and Fisher and Yates' "Statistical Tables for Biologists".

With respect to whole number counts it will of course be understood that counts not falling in the above three classes will not ordinarily require transformation.

Dosage Mortality Curve

Assuming a population of insects normally distributed for the log of the Individual Lethal Dose, (I.L.D.), the actual distribution of the kill will be a typical sigmoid curve. Bliss has suggested a transformation of the percentage kill to values known as probits, such that if the population of insects is normally distributed for the I.L.D., the relation between log dose and percent kill will be a straight line. In a normal curve, the area to the left of a deviation of -2 x 6 is 2.3%, and to the left of -1 x 6 is 15.9%. Thus a percentage kill of 2.3 could be transformed to -2, and a kill of 15.9 to -1. To avoid negative values, Bliss adds 5 to each of the values expressed above as deviations from the mean in terms of the standard deviation; thus for 2.3% the corresponding probit would be +3.

The goodness of fit of the results of a dosage experiment to the theoretical straight line is carried out by methods that correspond very closely to those of linear regression. However, due to the unequal weights that must be given to each frequency, and the fact that these weights should theoretically be determined from the population, it has been customary to fit a provisional line by eye and to use this to estimate the weights for final fitting. Mr. J. O. Irwin, in "Statistical Method Applied to Biological Assays" which appeared in Supplement to the Journal of the Royal Statistical Society, Vol. IV, No.1, 1937, has outlined a method of fitting by the Method of Maximum Likelihood. This is an objective method, and gives excellent results, but is more time consuming than using the provisional regression line.

Poor fits to the straight line are likely to result when the samples are large, but this does not mean that the data are worthless or inconclusive. It points out the lack of normality in the distribution of the I.L.D., and may lead to the discovery of the reasons for this, such as heterogeneity of the insect population or of the toxic material, irregularities in technique, etc. Small samples may give good fits where the material is actually not normally distributed. This is due simply to the small samples not giving a sufficient degree of precision.

MEDICAL ENTOMOLOGY

T. H. Williams, M.D.

Modern medical entomology as we know it, is a science of fairly recent origin, the development of which is of necessity founded on fundamental scientific discoveries. Leewenhoek's invention of the microscope in the 17th Centry was an essential prerequisite for the satisfactory development and advancement of this science. Perhaps the first and certainly one of the outstanding men in the field of medical entomology was Theobald Smith, who in 1893 reported that Texas fever of cattle is a disease transmitted by ticks, and was the first to show that insects are vectors of disease. His brilliant work was the spark and inspiration for such notable scientists as David Bruce, Patrick Manson, Ross, Grassi and Reed. Bruce discovered the relation between the tsetse fly and sleeping sickness in Africa. Manson originated the theory that malaria was carried by mosquitoes, a theory which was subsequently proved by Ross and Grassi. Reed, who solved the riddle of yellow fever, saved the world thousands of lives and millions of dollars. It is remarkable that these men who, as a group, may be considered the founders of our present day knowledge of medical entomology, were all more or less contemporaneous workers.

It is now known that arthropods are the cause of many human and animal diseases. One type of human affliction might be termed mechanical injury by insects. Some good examples of this type are the sting of a wasp, a bee or a centipede, and the bite of the black widow spider. Tick bites in particular may sometimes have serious or fatal results which vary with different people. Some individuals react as long as a tick is attached, but the symptoms disappear as soon as the tick is removed. One theory maintains that individual variations in nervous reaction are responsible, such manifestations often being evident in young people. It may be indicative that tick bites usually occur on the head and neck, near the sympathetic nerves. Chiggers and other mites causing such conditions as dermatitis and scabies are another major source of trouble.

Then we have miasis caused by flies responsible for a large group of parasitic diseases of man and animals. We may have external miasis when maggots attack open wounds. Since the maggots prefer to consume putrefying tissues they have at times been reared under sterile conditions, and used to clean deep wounds. Internal miasis is sometimes brought about by the ingestion of ova of the cheese skipper. This results in dysentry accompanied by the discharge of mucous and blood. Humans may occasionally act

accidental hosts to Gastrophilus. When this happens, the victim usually develops enhanced symptoms. In the same vein cattle are the normal hosts of the warble fly, but in rare instances humans are also attacked. There is one case on record where a grub travelled through a man's body from the knee to a molar tooth. In another type of attack the parasite deposits its eggs on the abdomen of a mosquito. When the mosquito feeds, the heat of the ingested blood hatches the egg, and the young parasite enters the host animal, usually producing a boil. Cocclelomya, a screw worm in living flesh is caused by a calliphorid. The maggot is held in place by spines arranged spirally around its body, thus giving it its name.

Finally we come to the third and major class of diseases, those carried by insect vectors. By far the most important is malaria, which has been responsible for more deaths than any other known human ailment. The mosquito, the carrier of malaria, is known as an active vector. There has recently developed considerable controversy over the possibility of malaria becoming indigenous in Manitoba. It is my belief that this will not happen, for two reasons. First, there is an insufficient reservoir of infection to make up for mosquito mortality. Secondly the malarial plasmodium must spend several days in the mosquito before it is infective. In Manitoba the evening temperatures are usually so low that mosquito digestion and metabolism are increased to such an extent that the blood meal and plasmodia are digested before it would be possible to complete the developmental cycle to the production of infective spores.

A second group known as passive vectors is well illustrated in the case of the Cyclops water flea, which is a carrier of the medina worm. The infected water flea may be ingested in drinking water by humans, and thus infect the new host. The worm matures in nine months, and may reach up to a yard in length. A remarkable thing is that the worm locates itself in a part of the body where the skin is most certain to contact water. This area may vary with individuals, the back being preferred in water carriers, the toes for workers in rice plantations, and the hands in the case of housewives.

The war against insect vectors is a never ending struggle carried on with all the weapons at the disposal of the medical entomologist. The mode of attack varies with different insects and environments, but as a general rule an effort is made to attack them at their weakest point. The most direct approach to the problem is to go after their breeding places. This requires a knowledge of their habits, the use of such knowledge having in many cases resulted in the adoption of effective means of control. For example, some mosquitoes which like shade may be controlled by cutting the foliage back from the water's edge where they

deposit their eggs while, on the other hand, the reverse procedure is effective for some species which prefer sunlight. The Tennessee River Valley project in the United States manipulates water levels in such a way as to control mosquitoes. It was found that the mosquito eggs require a certain optimum depth of water for successful hatching. By lowering and raising the water levels it is possible to kill the eggs by alternately drowning and desiccating them. One of the most common controls of course, is the use of chemicals such as arsenicals for surface feeders, and fuel oil and DDT for sub-surface species of mosquito larvae. Biological control through the use of tropical fish in rain reservoirs for example is often very effective. The Gambusia fish has proved to be the most suitable species for this purpose. Finally contact with mosquitoes may be prevented by killing them with poisons such as DDT or pyrethrum or by the use of repellents and screens.

A knowledge of the biology and physiology of insects is fundamental in any attempt to solve these problems, and, as previously noted, such information has in some instances led to development of unusual but effective remedies. Such things as feeding habits and preferences, (nocturnal or diurnal feeders, etc.) overwintering habits, range of flight, and color perception are all factors which have been shown to have a bearing on problems investigated. The importance of insect vectors indicates a real need for extensive research in the field of surveys of existing species, and their breeding places as well as experimental studies with laboratory animals.

LARGE SCALE DDT EXPERIMENTS

R. R. Lejeune, M.Sc.

Editor's Note -- Permission to include Mr. Lejeune's excellent review of large scale DDT experiments, in this Proceedings, has been withheld. Those interested in the subject may find most of the material presented by Mr. Lejeune in the following references.

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Appendix I.

TENTATIVE LIST

OF SUGGESTED SCIENTIFIC AND COMMON NAMES

OF INSECTS OF ECONOMIC IMPORTANCE IN MANITOBA

This list was submitted by Dean A. V. Mitchener to the Secretary of the American Association of Economic Entomologists for consideration of the Committee on Common Names of Insects.

1. Acarus siro L. (Tyroglyphus farinae DeG.) - common grain mite.
2. Adelphocoris lineolatus (Goeze) - alfalfa plant bug.
3. Anoplonyx laricis (Marl.) - Marlatt's larch sawfly.
4. Chrysomela tremulae F. - aspen leaf beetle.
5. Coccinella transversoguttata Fald. - transverse ladybeetle.
6. Corythuca arcuata (Say) - oak lace bug.
7. Disonycha triangularis (Say) - triangular flea beetle
8. Homeosoma electellum (Hlst.) - sunflower moth.
9. Hylemya floralis Fallen - turnip maggot.
10. Ips pini (Say) - pine engraver
11. Laemophloeus ferrugineus Steph. - rust-red grain beetle.
12. Lopidea dakota Knight - caragana plant bug
13. Pikonema alaskensis (Roh.) - yellow-headed spruce sawfly
14. Pikonema dimmockii (Cress.) - yellow-headed spruce sawfly to green-headed spruce sawfly.
15. Sitona cylindricollis (Fahr.) sweet clover weevil
16. Symmerista albifrons A. & S. - red-humped oak caterpillar

November 18, 1943.

Appendix II.

FIRST SUPPLEMENT

to the Tentative List of Suggested Scientific and Common Names of Insects of Economic Importance in Manitoba

1. Aphis cerasifoliae Fitch -- choke cherry aphid
2. Aphis helanthi Mon'l -- sunflower aphid
3. Bedellia sommulentella Zell. -- convolvulus leafminer
4. Epicauta ferruginea Say -- ferruginous blister beetle
5. Epicauta trichrus Pall. -- red-headed blister beetle
6. Erythroneura comes (Say) -- grape leafhopper
7. Euptoieta claudia Cramer -- variegated fritillary
8. Exentera improbana Wlshm. -- aspen leaf roller
9. Galerucella decora Say -- willow leaf beetle
10. Hoplocampa monticola Roh. -- Saskatoon sawfly or June berry sawfly
11. Hoplocampa lacteipennis Roh. -- Choke cherry sawfly
12. Hyalopterous pruni Fab. -- a correction: according to Hottes & Frison this name has priority over Hyalopterous arundinis (F.) which is approved as mealy plum aphid.
13. Lina tremulae (F.) -- aspen poplar leaf beetle
14. Macrobasis subglabra Fall -- shiny black blister beetle
15. Malacosoma fragilis Stretch -- cherry tent caterpillar
16. Melanoplus packardii Scudd. -- Packard's grasshopper
17. Metargiope trifasciata -- banded garden spider
18. Miranda aurantia -- garden spider
19. Myzus pseudosolani Theo. -- false potato aphid
20. Parectopa albicostella Braun. -- sweet clover leafminer
21. Sciara coprophila Lintner -- house plant fungus gnat
22. Simulium venustum Say -- white-stockinged blackfly
23. Systoechus vulgaris Loew. -- grasshopper bee-fly

Dec. 14/43.

Appendix III

Meeting of Manitoba Entomologists

A meeting of Manitoba Entomologists was held at The University of Manitoba on December 13th, 1944, at 2 p.m. Those present were: Mr. W. A. Cumming, Chairman, Dean A. V. Mitchener, Dr. R. D. Bird, Dr. R. H. Handford, Dr. B. N. Smallman, Messrs. W. R. Allen, H. A. Richmond, R. R. Lejeune, W. C. McGuffin, C. A. S. Smith, and W. S. McLeod, Secretary.

(1) The minutes of the meeting of Dec. 14th, 1943, were read and mimeographed copies were distributed to those present. It was moved by Mr. Allen and seconded by Mr. Lejeune that these minutes be adopted. Carried

(2) At the meeting of Nov. 5th, 1943 a list of 16 common names of insects was prepared. Dean Mitchener forwarded this list to Dr. E. N. Cory, Secretary of the American Association of Economic Entomologists, for the consideration of the Committee on Common Names of Insects. It was this list which was later mimeographed and mailed to the Manitoba entomologists under the title of "Tentative List of Suggested Scientific and Common Names of Insects of Economic Importance in Manitoba".

Dean Mitchener reported to the meeting that he had had correspondence with Dr. Ray Hutson, Chairman of the Committee on Common Names of Insects, to whom the correspondence had been forwarded. Dr. Hutson stated that the names had been placed before the Committees, that the ballots had been prepared and that they would be placed in the hands of members of the A.A.E.E. in the near future.

It was moved by Dr. Bird and seconded by Dean Mitchener that the Secretary be instructed to write to members of the A.A.E.E. in Canada and those regions of the United States which lie immediately south of Manitoba, soliciting their support for the names submitted by Dean Mitchener. Carried

(3) It was moved by Dean Mitchener and seconded by Dr. Handford that we proceed to prepare a list of common names for our own use in the Province of Manitoba. Carried

Mimeographed copies of the "First Supplement to the Tentative List of Suggested Scientific and Common Names of Insects of Economic Importance in Manitoba" were distributed to those present to serve as a basis for this project. The following changes were suggested:

No.	Name	Changed to
2.	Mon'l	Mon'l.
4.	ferrugineus blister beetle	rusty blister beetle
10.	Saskatoon sawfly	saskatoon sawfly
11.	Choke cherry sawfly	choke cherry sawfly
12.	This name was removed from the list when Dr. Bird read correspondence which stated that Hyalopterous arundinis (F.) should have precedence over H. pruni Fab.	
13.	Lina tremulae (F.) was removed from the list until Mr. Richmond is able to establish its status.	
15.	Malacosoma fragilis Stretch removed from the list.	
16.	Packard's grasshopper	Packard grasshopper
17.	banded garden spider	banded spider
17 & 18	Dr. Bird was asked to make an effort to secure the names of authors of these two species.	
20.	Parectopa albicostella Braun. removed from the list.	
21.	house plant fungus gnat	common fungus gnat
23.	grasshopper bee-fly	grasshopper beefly

It was further suggested that the Secretary send a copy of the revised list to Dr. J. H. McDunnough in Ottawa and Mr. C. F. W. Muesebeck in Washington for correction of the scientific names therein and that their corrections be included in a mimeographed list of common names to be mailed to Manitoba entomologists in the early spring.

(4) It was moved by Mr. Allen and seconded by Dr. Handford that, in future, any proposed names of insects be submitted to the Secretary before August 15th, that such names be forwarded by the Secretary to authorities in Ottawa and Washington, and that, upon receiving corrections from these authorities, the Secretary should prepare a list of proposed names and mail copies to the Manitoba entomologists for their consideration before the date of the next meeting. Carried

(5) It was moved by Mr. Allen and seconded by Dr. Handford that a meeting be held in April of 1945 to discuss the formal organization of a Society having a definite program of business and social activities. Carried

(6) Mr. Richmond was unanimously elected as chairman for the purpose of calling a meeting in April and of presiding at that meeting.

(7) It was moved by Dean Mitchener and seconded by Dr. Handford that the chairman for the April meeting should name a committee to investigate the various types of organization which might be proposed. Carried

In this connection it was suggested that we might consider a purely local organization for the benefit of Manitoba entomologists, a wider type of organization which would include entomologists over the three prairie provinces, or an affiliation with the Entomological Society of Ontario as a Western local.

(8) It was moved by Dean Mitchener and seconded by Mr. Richmond that the present Secretary continue in office until the election of an executive could be held in April. Carried

(9) Moved we adjourn at 4:30 p.m.

W. A. Cumming,
Chairman.

W. S. McLeod,
Secretary.

Appendix IV

The following list embodies the corrections to our FIRST SUPPLEMENT as presented to me by Mr. Hucsebeck of Washington and Mr. Brown of Ottawa after consultation with the members of their respective staffs. Since the various specialists failed to agree in all cases, the symbol (M) is used to indicate the name on our Manitoba list, (W) is the correction received from Washington, and (O) is the correction from Ottawa.

1. choke cherry aphid --Aphis cerasifoliae Fitch (M) (W) (O)

2. sunflower aphid --Aphis helanthi Mon'l. (M) (W)
--Aphis helianthi Monell (O)

3. convolvulus leafminer --Bedellia sommulentella Zell. (M)
--Bedellia somnulentella (Zell.) (W) (O)

4. rusty blister beetle --Epicauta ferruginea Say (M)
--Epicauta ferruginea (Say) (W) (O)

5. red-headed blister beetle --Epicauta trichrus Pall. (M)

--Epicauta trichrus (Pall.) (W)
"The great variability of Epicauta trichrus (Pall.) makes the name 'red-headed blister beetle' somewhat misleading."

--Epicauta trichrus (Pall.) (O)

6. grape leafhopper --Erythroneura comes (Say) (M) (W) (O)

--"The 'Official List' refers this common name to numerous species of the genus." (O)

7. variegated fritillary --Euptoieta claudia Cramer (M)
--Euptoieta claudia (Cramer) (W) (O)

8. aspen leaf roller --Exentera improbana Wlshm. (M)
--Pseudexentera improbana (Wlshm.) (W)
--Pseudexentera oregonana (Wlshm.) (O)

9. willow leaf beetle --Galerucella decora Say (M)

--Galerucella decora (Say) (W)
"There are several other species which breed only on willow in different parts of North American that would seem equally eligible for the designation 'willow-leaf beetle'." Ten such species are listed in the accompanying letter.

-- Galerucella decora (Say) (O)
"This common name has been used in literature for other Chrysomelids."

10. saskatoon sawfly or June berry sawfly
-- Hoplocampa monticola Roh. (M)
-- Hoplocampa montanicola Roh. (W) (O)

Dr. Peck appended a note in this connection. (O)

11. choke cherry sawfly -- Hoplocampa lacteipennis Roh. (M) (W) (O)

Dr. Peck appended a note in this connection. (O)

12. shiny black blister beetle
-- Macrobasis subglabra Fall (M)

-- Epicauta (Macrobasis) subglabra (Fall)(W)
"Macrobasis is now regarded as inseparable from Epicauta generically, although it might be treated as a subgenus."
"The common name you have given to this blister beetle seems to Mr. Barber to lack the distinction that we like common names to indicate. In addition to subglabra (Fall) there are several North American species of blister beetles which are both black and shiny and to which the name 'shiny black blister beetle' would seem to apply equally well."

-- Macrobasis subglabra Fall (O)

13. Packard grasshopper -- Melanoplus packardii Scudd. (M) (W) (O)

14. banded spider
-- Metargiope trifasciata (M)
-- Metargiope trifasciata (Forskål) (W)
-- Argiope trifasciata (Forskål) (O)

15. garden spider
-- Miranda aurantia (M)
-- Miranda aurantia (Lucas) (W)
orange garden spider -- Argiope aurantia Lucas (O)

16. false potato aphid
-- Myzus pseudosolani Theo. (M) (O)
-- Myzus convolvuli Kalt. (W)

17. common fungus gnat
-- Sciara coprophila Lintner (M) (O)
-- Lucoria coprophila (Lintner) (W)

18. white-stockinged blackfly -- Simulium venustum Say (M) (W) (O)

19. grasshopper beefly -- Systoechus vulgaris Loew. (M) (W) (O)

Appendix V

Meeting of Manitoba Entomologists

A meeting of Manitoba Entomologists was held at the Dominion Forest Insects Laboratory at The University of Manitoba at 9.30 a.m. on March 23rd, 1945. Those present were: Dean A. V. Mitchener, Drs. R. D. Bird, R. H. Handford, B. N. Smallman, Messrs. W. R. Allen, R. R. Lejeune, W. C. McGuffin and W. S. McLeod, Secretary.

(1) In the absence of Mr. H. A. Richmond, it was moved by Dean Mitchener and seconded by Dr. Smallman that Dr. Bird act as chairman for the meeting. Carried

(2) The minutes of the meeting of December 13th, 1944, were read and mimeographed copies were distributed to those present.

It was moved by Mr. Lejeune and seconded by Dr. Smallman that the minutes be adopted. Carried

(3) The Secretary reported that a circular letter, accompanied by a copy of the list of suggested scientific and common names submitted by Dean Mitchener to the Committee on Common Names of Insects of the American Association of Economic Entomologists, had been sent to 83 entomologists across Canada and in those States occupying the same ecological region as the Province of Manitoba. Ten individuals or groups replied to this letter and showed interest in our proposals.

It was also reported that the ballot of the Committee on Common Names of Insects had been prepared and forwarded to members of the A.A.E.E. early in this month.

Discussion on this matter was held in abeyance.

(4) It was also reported by the Secretary that copies of our "First Supplement to the Tentative List of Suggested Scientific and Common Names of Insects of Economic Importance in Manitoba", as amended in the meeting of December 13th, 1944, had been forwarded to Mr. C. F. W. Muesebeck in Washington and Dr. J. H. McDunnough in Ottawa for correction. Replies had been received and the substance of these had been assembled in a mimeographed report which had been forwarded to the members of our group.

Discussion on this matter was also held in abeyance.

(5) The next item of business arising out of the minutes of the last meeting was a discussion on the need for a formal organization of this group which had been meeting informally

now for a period of eighteen months. Regret was expressed concerning the unavoidable absence of Mr. Richmond who had made a study of the advantages and disadvantages of various types of organization and affiliation with larger bodies.

It was moved by Dean Mitchener and seconded by Mr. Lejeune that we organize on a formal basis as a group of entomologists. Carried unanimously

(6) It was moved by Mr. Allen and seconded by Dr. Handford that the following constitution be adopted. Carried unanimously

(The constitution is included in the text of these Proceedings, page 6.)

(7) Moved we adjourn until 1.30 p.m.

(8) The meeting reconvened at 1.30 p.m. Mr. H. A. Richmond was able to attend the afternoon session but Dr. Bird continued to act as Chairman. Dr. Smallman had been called back to the City at noon.

(9) The Chairman now called for an election of officers for the Society.

Those nominated for the office of President were: Mr. Richmond (nominated by Dr. Handford), Dr. Bird (nominated by Mr. Richmond) and Dr. Smallman (nominated by Mr. Allen). Voting was by ballot and Dr. Smallman was elected.

Those nominated for the office of Vice-President were: Dr. Bird (nominated by Dean Mitchener), Mr. Richmond (nominated by Mr. Allen) and Dr. Handford (nominated by Mr. Lejeune). The ballot resulted in a tie between Mr. Richmond and Dr. Handford. Mr. Richmond was therefore elected by the deciding vote of the Chairman.

Mr. McLeod was nominated for the office of Secretary-Treasurer by Mr. Lejeune and was elected by acclamation.

(10) It was moved by Mr. Allen and seconded by Dr. Handford that the Secretary-Treasurer prepare a short notice on the organization of this Society and the election of its officers for submission to the Press. Carried

(11) It was moved by Mr. Allen and seconded by Mr. Lejeune that the Secretary-Treasurer look into the matter of design and cost of letter-head sheets and envelopes and report back to the Society at its next meeting. Carried

(12) The Secretary now read the correspondence which had been received from various entomologists in reply to the circular letter sent out on December 22nd, 1944. This item had been mentioned earlier in the meeting but had been held in abeyance. A number of welcome suggestions were contained in these letters and it was emphasized, in the discussion which followed, that in future this Society should justify the proposal of any common name of an economic species when submitting such proposals to the A.A.E.E. Committee on Common Names.

(13) The correspondence with Washington and Ottawa concerning our "First Supplement", which also had been held in abeyance from the morning session, was read. It was agreed that the information provided by these experts is invaluable and that we should always submit any proposals to them for correction and advice.

(14) It was suggested that an effort should be made to call our next meeting for late October or early November. It was felt that the past policy of calling meetings at such a time as the Annual Conference of Manitoba Agronomists or some other business should bring the Brandon members to Winnipeg resulted not only in forcing us to crowd a full agenda into a limited period of time but also caused these men to be absent from their laboratories for too long a period of consecutive days.

(15) Moved we adjourn at 2.30 p.m.

R. D. Bird,
Chairman.

W. S. McLeod,
Secretary-Treasurer.

Appendix VI

List of Subjects suitable for Reviews, with suggested Speakers

---

1) The Practice, Results and Limitations of Large Scale DDT Experiments. -- R. R. Lejeune

2) Recent Advances in Agricultural Entomology in Their Broader Aspects. -- Dr. R. D. Bird

3) The Testing of Insecticides in the Laboratory, in the Field, with a Discussion of the Statistics Involved. -- W. S. McLeod

4) The Water Economy of Insects. -- Dr. B. N. Smallman

5) The Insect Cuticle. -- J. McLintock

6) Insect Nutrition, Growth, Number of Instars, Etc. -- Dr. R. H. Handford

7) Transmission of Diseases of Plants by Insects. -- C. A. S. Smith or J. F. Jones, or a combined paper by both speakers.

8) Statistics as Applied to Entomological Research. -- Dr. C. H. Goulden

9) Entomological Experiments Conducted by the Armed Forces at Suffield, Alberta. -- A. W. A. Brown

10) Collecting Lepidoptera North of the 53rd Parallel. -- G. S. Brooks

11) Growth of Insects. -- R. A. Wardle

12) Medical Entomology. -- Dr. T. H. Williams

Appendix VII

A meeting of the Entomological Society of Manitoba was held at the Dominion Government Forest Insects Laboratory at the University of Manitoba on Friday, November 2nd, 1945, at 1.30 p.m. Those present were: Dr. B. N. Smallman, Chairman, Dean A. V. Mitchener, Dr. R. H. Handford, Messrs. R. J. Heron, R. R. Lejeune, E. C. Martin, J. McLintock, L. G. Putnam, C. A. S. Smith and W. S. McLeod, Secretary-Treasurer.

(1) The minutes of the organization meeting of March 23rd, 1945, were read. It was moved by Dr. Handford and seconded by Mr. McLintock that these minutes be adopted. Carried

(2) The Secretary-Treasurer reported that price quotations on letterheads and envelopes for the Society had been secured. It was moved by Mr. Smith and seconded by Mr. Lejeune that an assessment be made to cover the cost of one thousand sheets of letterheads and envelopes at a price of approximately ten dollars. Carried

(3) The Secretary-Treasurer reported that minutes had been prepared for the four special meetings held in the interval between the two regular meetings. It was moved by Mr. McLintock and seconded by Mr. Martin that these minutes be accepted without reading and that they be entered in the record. Carried

(4) The Vice-President, Mr. H. A. Richmond, had been placed in charge of the Dominion Government Forest Insects Laboratory at Victoria, B. C., during the past season and had transferred to that city to take up his new duties on August 1st, 1945. Mr. R. R. Lejeune, who succeeded Mr. Richmond in charge of the Winnipeg laboratory, was nominated by Dr. Handford to fill the office of Vice-President for the remainder of Mr. Richmond's term. It was moved by Mr. Smith and seconded by Mr. McLintock that nominations cease. The motion was carried and Mr. Lejeune was declared elected by acclamation.

(5) The Executive felt that the fifty cents levied upon the membership in connection with the banquet for Professor V. B. Wigglesworth on June 30th had been rather irregular though justified under the circumstances. It was therefore moved by Mr. McLintock and seconded by Mr. Heron that the action of the Executive in making this levy be approved by the meeting. Carried

(6) The Secretary-Treasurer reported that a total of seven dollars had been collected on June 30th. Of this amount, four dollars had been expended in connection with the banquet on that date, leaving three dollars cash on hand.

(7) On September 4th, 1945, it was moved by Mr. W. C. McGuffin in a letter addressed to the Secretary-Treasurer that the following be inserted in the Constitution:

Article 3.

(d) "Small items of expense, not exceeding five dollars, which may be incurred during periods between meetings, may be met by the Secretary-Treasurer with the approval of other members of the Executive. Such expenditures must be ratified at the next regular business meeting by a majority of the members present."

Notice of motion was duly sent by the Secretary-Treasurer to all members, as prescribed in the Constitution. The motion was seconded by Mr. Lejeune. Carried

(8) It was moved by Mr. McLintock and seconded by Mr. Smith that the above mentioned amendment to the constitution be regarded as a temporary arrangement for a period of one year. Carried

It was the intention of the mover that this motion should cause the previous motion to be brought forward for discussion at the end of the allotted time.

(9) It was moved by Mr. Smith and seconded by Mr. McLintock that a levy of one dollar per member be collected by the Secretary-Treasurer for the purpose of purchasing official stationery and covering other incidental expenses. Carried

(10) Dean Mitchener brought in a report on the results of the ballot prepared by the American Association of Economic Entomologists in connection with the list of Approved Common Names of Insects. Most though not all of the sixteen insects on our "Tentative List" were included in the fifty-one names on the ballot. Twenty-six names out of this total were approved by the required number of affirmative votes and of these, eight were names which had been submitted as a result of the discussion held by this group.

It was felt by the members of the Society that this work constitutes an important part of our program and that it should be given a reasonable proportion of our time. It was therefore decided to hold a short meeting in December in order to hold further discussions on common names of insects. Names which had been considered previously were assigned to certain individuals with the request that they investigate the insects and be prepared either to justify the common name which had been chosen or to propose a more suitable one.

It was therefore moved by Dean Mitchener and seconded by Mr. Heron that a meeting be held at the call of the Chair, to agree with the dates of the Annual Convention of Manitoba Agronomists. Carried

(11) It was moved by Mr. Martin and seconded by Mr. McLintock that an annual report be prepared in mimeographed form by the Executive, the said report to cover the period from January 1st to December 31st of that year and to include the minutes of all business meetings as well as summaries of the talks given at various meetings.

It was suggested during the discussion of this motion that the report should be called "Proceedings of the Entomological Society of Manitoba" and that it should contain the statement, "The contents of this volume are for private distribution and are not for publication." Carried

(12) Moved we adjourn at 4.30 p.m.

B. N. Smallman,
Chairman.

W. S. McLeod,
Secretary-Treasurer

Appendix VIII

A meeting of the Entomological Society of Manitoba was held in the Plant Inspection Office, 722 Dominion Public Bldg., on the morning of December 21, 1945. Those attending were Dr. B. N. Smallman, Chairman, Dean A. V. Mitchener, Drs. R. D. Bird and R. H. Handford, Mrs. W. S. Barker, and Messrs. B. Berck, R. J. Heron, R. R. Lejeune, E. C. Martin, W. C. McGuffin, J. McLintock, D. J. Petty, H. Richardson, C. A. S. Smith, L. T. White, W. M. Whiteway and W. S. McLeod, Secretary-Treasurer.

1) The minutes of the meeting held on November 2 were read. It was moved by Mr. Martin and seconded by Dr. Handford that the minutes be adopted. Carried

2) Business arising from the minutes of the last meeting concerned item 11 on the publication of the "Proceedings of the Entomological Society of Manitoba". Dr. Smallman reported that the work was progressing and that it was hoped to have it published in January, 1946.

3) The Secretary-Treasurer reported a balance of $4.31 on hand in the treasury and a total of 19 full members. It was moved by Dean Mitchener and seconded by Dr. Bird that our fiscal year correspond with the calendar year. Carried

4) Mr. McLeod now read correspondence with Mr. W. A. Ross regarding the feasibility of forming a Dominion Entomological Organization. Considerable discussion followed. Arguments in favour of such an organization were that it would provide (a) a medium for the presentation of papers on applied and pure entomology, (b) an opportunity for western members to attend a national conference and present western problems, (c) a stronger representation to governments for needed projects, and (d) it would assist in establishing the science of entomology as a profession. A negative factor suggested was the possible submergence of the western branches in the larger organization. It was moved by Dr. Bird and seconded by Dean Mitchener that we inform Mr. W. A. Ross of the favourable attitude of this group towards the formation of an Entomological Society of Canada. Carried

5) The membership of the Society went on record in favour of maintaining our own provincial organization within the national body. The Secretary was requested to write a letter expressing this opinion to Saskatchewan and Alberta members of the National Committee which had been appointed to look into the matter of a national organization.

6) It was decided that the problem of financial support for the national organization is a question for that body to consider.

The Manitoba group favours a Dominion grant rather than Provincial grants. If, after the organization is completed and a national policy has been laid down, funds are not forthcoming from the Dominion Government, we would consider requesting a Provincial grant.

7) It was moved by Dr. Bird and seconded by Mr. C. A. S. Smith that Dean Mitchener submit the nine names listed below to the A.A.E.E. Committee on Common Names of Insects and that the Secretary send out a circular letter to Entomologists in Canada and States adjacent to Manitoba who are privileged to vote in this matter. Carried

This new list includes 4 names from the original list submitted, 3 from the first supplement and 2 proposed at the meeting. They are as follows:

1. Coccinella transversoguttata Fald. - transverse lady beetle
2. Corythuca arcuata (Say) - oak lacebug
3. Disonycha triangularis (Say) - triangular flea beetle
4. Simulium venustum Say - white-stockinged blackfly
5. Lopidea dakota Knight - caragana plant bug
6. Melanoplus packardii Scudd - Packard grasshopper
7. Systoechus vulgaris Loew. - grasshopper beefly
8. Menopon gallinae L. - chicken louse
9. Heliothis anonis Schiff - flax bollworm

Moved we adjourn at 11.40 a.m.

B. N. Smallman,
Chairman.

W. S. McLeod,
Secretary-Treasurer