# MINUTES OF THE ANNUAL MEETING

# CANADIAN ASSOCIATION OF PROFESSIONAL APICULTURISTS

Saskatoon, Saskatchewan

November 18-19, 1985

**MEMBERS PRESENT:**

- K. Clark
- L. Crozier
- A. Davis
- D. Dixon
- B. Fingler
- D. Gray
- J. Gruszka
- S. C. Jay
- D. MacDonald
- D. McCutcheon
- D. McKenna
- D. McRory
- A. Méthot
- D. Murrell
- D. Nelson
- G. Otis
- T. Szabo
- M. Winston

**GUESTS:**

- J. Awram, CHC
- E. Mussen, AAPA
- B. McElheran, Agric. Canada
- B. Sterritt, Agric. Canada

The C.A.P.A. met at the Ramada Renaissance Hotel, Saskatoon, Saskatchewan, November 18-19, 1985. Eighteen members were present. Guests included Dr. J. Awram, President of CHC, Dr. Eric Mussen, representing AAPA, Dr. Bill McElheran and Dr. Bill Sterritt, Agriculture Canada, Ottawa.

John Gruszka extended a welcome to all participants. Introductions were made around the table.

Congratulations were extended to Don Nelson on completion of his Ph.D. and Mark Winston on receiving the C. Gordon Hewitt award from the Canadian Entomological Association.

The president then reviewed the agenda.

**Motion:** D. Dixon, D. Nelson. That the agenda be adopted. Motion carried.

In review of the length of the minutes and the fact that they had been circulated, these were reviewed by the president.

**Motion:** D. Dixon, D. Nelson. That the minutes be accepted as circulated. Motion Carried.

## Business Arising from the Minutes

**Varroa Film** - It was pointed out that the use of the film had been requested by a beekeepers' association in New Jersey. The film was presently at the University of Guelph. Gard Otis agreed to send the film to New Jersey. It was restated that the film is to be insured for $1,000.00 when it is sent out.

Don Gray asked if the film had been shown to CHC. It was felt that the film had been circulated through all provincial associations. Concerning the condition of the film, it was noted that it had recently been cleaned and repaired.

Discussion followed on whether the film should be copied. It was decided that by the time the film needs replacement, that it would probably have served its purpose.

**I.B.R.A. Sponsorship-Motion:**C. Jay, M. Winston. That we continue our I.B.R.A. sponsorship. Motion carried.

**Ottawa Research Position** - The status of the Agriculture Canada research positions was discussed.

It was mentioned that the pesticide pollinator position may be moved to St. Jean, Quebec.

Don Gray stated that no commitment toward filling them at this time had been made. It may be some time before they would be filled.

**Motion:** M. Winston, G. Otis. That the C.A.P.A. recommend to the C.H.C. to reiterate our concerns to Agriculture Canada that these positions be filled and that one of these positions be in the pesticide-pollinator area. Motion carried.

## President's Report

President Gruszka reported on the past year's activities including the tri-country meeting in Tampa and the CHC meeting in Mont Ste. Marie, Quebec. (See Proceedings.)

**Motion:** D. Nelson, B. Fingler. That we accept the president's report. Motion carried.

## Financial Report

The secretary-treasurer presented the financial statement for 1985 plus a report on the contingency fund and a proposed budget. There was some discussion concerning the use of the contingency fund and whether or not both representatives to the tri-country meetings should be funded.

**Motion:** D. Dixon, D. McCutcheon. That the financial report be received and that any further motions and concerns be tabled. Motion carried.

**Motion:** M. Winston, D. Dixon. That the membership fee be set at

# C.A.P.A. FINANCIAL STATEMENT 1985

| | | | |
|---|---|---|---|
| Balance Forward November 1, 1984 | | | $ 575.76 |
| Receipts: | Membership Fees | $ 835.00 | |
| | Registration Fees | 575.00 | |
| | Membership in Arrears | 25.00 | |
| | Registration in Arrears | 15.00 | |
| | Rental of Varroa Film | 85.00 | |
| | U.S. Exchange | 29.80 | |
| | | $1,564.80 | 1,564.80 |
| | | | 2,140.56 |
| Expenditures: | 1984 Meeting | $ 296.10 | |
| | Tampa Meeting | 500.00 | |
| | IBRA | 216.50 | |
| | Certificates | 37.00 | |
| | Postage | 114.73 | |
| | Receipt Book | 4.68 | |
| | Bank Charges | 3.00 | |
| | Contingency Fund | 190.00 | |
| | | $1,362.01 | 1,362.01 |
| Balance November 1, 1985 | | | 778.55 |

Respectfully submitted:

Lorne Crozier

Lorne Crozier
Secretary-Treasurer

# C.A.P.A. CONTINGENCY FUND 1985

| | | |
|---|---|---|
| Balance November 1, 1984 | | $ 766.37 |
| Contributions from C.A.P.A. Memberships | | 190.00 |
| | Interest November 9, 1984 | .15 |
| | Interest April 30, 1985 | 26.41 |
| | Interest October 31, 1985 | 23.58 |
| Balance November 1, 1985 | | $1,006.51 |

Respectfully submitted:

Lorne Crozier

Lorne Crozier
Secretary-Treasurer

$30.00 per year and that the registration fee be set at $30.00. The associate and student membership fee remain at $10.00. Motion carried.

It was suggested that the secretary-treasurer adjust the proposed budget to reflect the fee changes and present this later in the meeting.

**A.A.P.A. Report**

Mark Winston reported on the A.A.P.A. meeting in San Antonio.

The meeting was poorly attended. Most discussion concerned the mite survey and related topics.

An invitation for A.A.P.A. and C.A.P.A. to meet together had been extended. While a joint meeting is desirable, it is unlikely that it will come about.

**Election of New Executive**

John Gruszka indicated that he had served for six years and expressed his desire to step down.

Nominations were asked for:

**Nomination:** D. Murrell, D. Gray. That Don Dixon be president.

As no further nominations were forthcoming, Don Dixon was declared president.

Don thanked the group for their confidence in his nomination. He also thanked Gruszka for his work as president.

**Nomination:** J. Gruszka, M. Winston. That Doug McCutcheon be nominated for vice-president.

As there were no further nominations, Doug McCutcheon was acclaimed vice-president.

**Nomination:** D. Dixon, T. Szabo. That Lorne Crozier be nominated for secretary-treasurer.

In a moment of weakness, Crozier consented to let his name stand. As there were no further nominations, Lorne Crozier was acclaimed as secretary-treasurer.

**Motion:** D. Nelson, D. Gray. That C.A.P.A. express thanks to the past executive and for the support of their employers. Motion carried.

Somewhat to his dismay, Don Dixon took over the chairmanship of the meeting. He began with a tirade of his past night experience of being woken by his roommate to interpret a dream. Further to this, he had been assaulted the previous night by having a teddy bear thrown at him. Dr. Jay denied the allegations.

**Provincial Reports**

The provincial apiculturist reports were presented as follows: British Columbia, Doug McCutcheon; Alberta, Don MacDonald; Saskatchewan, John Gruszka; Manitoba, Barry Fingler; Ontario, Doug McRory; Québec, Dr. Armand Méthot; Nova Scotia, Lorne Crozier.

Discussion on chalkbrood and a Sac brood-like disease arose from the Alberta report. As a result, Don Nelson was directed to co-ordinate a broad base survey and on a more limited basis, an economic impact study.

Provincial apiculturists will be co-operating.

The need for research on control measures was emphasized.

**Research Reports**

Research reports were given by Mark Winston for Simon Fraser University. Don Nelson reported on research carried out by Dr. Liu as well as his own research. Tibor Szabo reported on his research at Beaverlodge.

Denis McKenna reported on the bee breeding program at Fairview College.

John Gruszka read a letter from Dr. Peter Sporns. Dr. Sporns requested samples of honey from hives that have had phenol or other bee repellents applied to them.

Cam Jay reported on his work at the University of Manitoba.

Gard Otis gave a summary of research at Guelph.

Dorothy Murrell reported on a pollen supplement study she had been doing.

Dr. Armand Méthot gave a brief summary of research in Québec.

Eric Mussen reported on a study of Apis cerana in China in which it was observed that the worker bees actively remove Varroa jacobsoni from the hives. European bees are not capable of doing this.

**A.A.P.A. Report**

Dr. Eric Mussen, University of California gave a report on the A.A.P.A. meetings. Two meetings were held. One in San Antonio and one in Tampa. A.A.P.A. had been approached by the publishers of Apidology and asked to handle its subscriptions in North America. They are still looking into the possibility of doing this.

The next meeting of the A.A.P.A. will be held in conjunction with the American Beekeeping Federation meeting in Phoenix on January 21, 1986.

## Committee Reports

**Report of the Chemicals Committee, D. Murrell -** The status of ETO remains unchanged and no new uses will be registered.

The Ontario Beekeepers' Association would like methyl bromide registered for wax moth control. Great Lakes Chemical is redoing their data package for a submission to have this registered. Some residue data may be needed.

Dr. Liu has assessed two acaracides, Menthol and Methyl salicylate. Neither of these show much promise of being used for mite control.

Folbex and Frows mixture are no longer used in England or Germany.

Bee Repellents - None are registered for use in Canada. Phenol, Benzaldehyde and Butyric anhydride. The latter two are registered in the U.S.A.

Discussion of this report followed. Don Gray pointed out that registration of ETO may be approached by asking for its use by trained operators only.

With reference to bee repellents, the following motion was made.

**Motion:** M. Winston, D. Nelson. That the chemicals committee find how registration can be acheived and obtain data on Benzaldehyde and Butyric anhydride from the U.S.A. IF it then seems appropriate, pursue the registration of these chemicals and co-operate with Dr. Peter Sporns to gather data for phenol. Motion carried.

It was suggested that this be presented to the CHC.

**Motion:** D. Murrell, A. Davis. That if construed by C.A.P.A. and CHC that use of ETO by trained operators only is a reasonable approach that this committee prepare a brief on ETO for submission for registration to the proper authorities. Motion carried.

Dorothy Murrell requested that if any developments take place regarding chemicals that the chemicals committee be notified.

Don MacDonald expressed concern over the supply of calcium cyanide. It was suggested that the committee look into this as the supply from South Africa could be in jeopardy because of possible embargoes.

It was also suggested that the committee look into the registration status of Bacillus thurigiensis.

**Motion:** M. Winston, G. Otis. That Dorothy Murrell remain as chairperson of the Chemicals Committee. Motion carried.

Doug McRory and Armand Méthot agreed to be added to the chemicals committee.

**Report of the Research Committee** - Dorothy Murrell asked for direction as to whether this committee should be left intact.

Don Dixon requested that the committee meet and review the research priorities listed last year and report back to the meeting.

It was pointed out that it was time to review research priorities on a national basis.

**Motion:** J. Gruszka, D. Gray. That the executive be charged with setting up a research workshop for the 1986 meeting. Motion carried.

**Stock Development** - John Gruszka reviewed the aims and objectives of the committee.

The committee was not active during the past year. It was felt by Gruszka that the committee had met its objectives and that perhaps the committee should be disbanded.

**Motion:** D. McCutcheon, J. Gruszka. That the honey bee stock development committee be disbanded. Motion carried.

**Honey Bee Importation Committee** - Doug McCutcheon presented this report.

The role of the committee was outlined.

It was felt that the committee should be concerned with offshore imports only and that the U.S. import situation should be dealt with by the C.A.P.A. as a whole.

Mark Winston expressed concern that the C.A.P.A. does not always have the technical background for all of the subjects that we are asked to give recommendations for. He suggested that the executive should ask members to prepare such background material before the annual meeting.

**Australian Importation** - Doug McCutcheon presented some information he had received from Australia regarding their quarantine facilities.

Discussion followed on the information needed from Australia to allow importation from that country.

Dr. Sterritt pointed out that C.A.P.A.'s role should be to outline the criteria required to allow importation.

Don Dixon asked the import committee to meet and report back to the meeting.

It was also suggested that someone from the Canadian beekeeping industry should make an onsight inspection of the Australian industry.

**Motion:** M. Winston, D. Nelson. That the chairman of the importation committee pursue a trip to Australia to carry out an onsight inspection of the disease situation. Motion carried.

**New Zealand Importations** - McCutcheon read a letter from New Zealand indicating the history of bee importations. The letter indicated that reports that queens had been imported from Israel were erroneous and in actuality, queens had been exported to Israel.

**Motion:** D. McCutcheon, M. Winston. That we continue with importation of honey bees from New Zealand as in the past, subject to their meeting the requirements similar to those required for importation from other countries. Motion carried.

**Importation from Chile** - A report was received from Chile indicating that they had acted on recommendations provided by the Canadian delegation that had visited their country in 1984.

An inspection service was in place and according to their information no bee diseases had been found.

After considerable discussion, the consensus was that we should acknowledge the information from Chile and will look forward to receiving future reports from them.

**Honey Bee Disease Publication** - Don Dixon reported on the status of this publication.

All submissions except for viruses have been received. First draft should be submitted to editorial committee by the new year.

He reported that publication could be a problem. It was not likely that Agriculture Canada could publish it. Funding for C.A.P.A. to publish it could be a problem. It was estimated that it will cost about 50¢ per copy. This could be used to make money for C.A.P.A.

**Motion:** J. Gruszka, D. McCutcheon. That C.A.P.A. proceed with the publishing and distribution of the disease publication. Motion carried.

Barrie Fingler presented the slides that would be used in the colour plates in the publication. The slides were obtained from Dr. M. V. Smith and from Doug McCutcheon.

Dixon asked if anyone had slides which were improvements or additions.

**Motion:** D. McCutcheon, J. Gruszka. That we extend a vote of thanks to the committee responsible for the publication.

**Importation Committee** - The Importation Committee reported back to the meeting. It was felt that Australia had a good record as far as brood diseases and inspection of apiaries were concerned.

A record of importations as far back as 1960 would be required as well as evidence of surveys for mites including dates, extent to techniques and results.

**Motion:** D. McCutcheon, B. Fingler. That we base our decision to import honey bees from Australia on their providing us with records of importations from 1960 plus evidence that they are free from the mites Acarapis woodi, Varroa jacobsoni and Tropilaelaps clareae by providing us with information on surveys they have conducted, when they began, extent of the surveys, techniques used and results of the surveys. Motion carried.

**Motion:** P. McCutcheon, G. Ottis. That future imports from other offshore countries be considered on condition that the country provide copies of their import and disease legislation, regulatory procedures, names of chief apicultural officer, record of brood diseases, extent of examinations, incidence of diseases and length of time that surveys were carried out. Proof of absence of the mites Acarapis woodi, Varroa jacobsoni and Tropilaelaps clareae.

In addition, a history of importations, numbers of importation, quarantine procedures, proof of surveys for the above mentioned mites extent of surveys, techniques used and results.

Also, an onsight inspection of the apicultural industry and of their research capabilities would be required. Motion carried.

Tibor Szabo indicated that perhaps there should be consideration for importation from one part of a country. Dr. Sterritt pointed out that it was very difficult to control movement within a country and that Agriculture Canada would negotiate on a country basis only.

Doug McCutcheon indicated that these criteria would be used in considering the application for importation from Fiji.

It was felt that in view of the fact that a trip will be requested to Australia that an official appointment for chairman should be made.

**Motion:** M. Winston, T. Szabo. That Doug McCutcheon be the chairman of the C.A.P.A. importation committee. Motion carried.

The president thanked the Importation Committee for the work they had done.

The president then asked for other members for the committee. McCutcheon suggested Cam Jay, Mark Winston, Lorne Crozier, and Tibor Szabo.

**Core Committee** - Cam Jay asked about the status of the Core Committee set up in Winnipeg 1984. Jerry Awran indicated that it was an ad hoc committee which ceased to exist at the 1984 CHC meeting. It was replaced by the tri-country committee.

**Acarine Disease Discussion** - Mark Winston and Gard Otis reported on the Robison paper dealing with sampling levels for detecting Acarapis woodi.

The paper pointed out that for medium to high infestation levels, it did not make any difference at what level they were sampled. At low levels, the most crucial factor was the number of colonies in the sample. The number of bees sampled was also important.

This discussion was used to review the certification procedure devised at the Mont Ste. Marie meeting of the CHC.

**Motion:** M. Winston, D. Gray. That Parts 1 and 2 be adapted as they stand and that in Part 3, 100% of apiaries from which bees coming to Canada under certification originate be sampled, (b) an apiary be defined as 50 hives or less; (c) that this section be modified to 50% of hives in an apiary be sampled from and (d) that each sample consist of a minimum of 500 bees collected and a minimum of 100 bees examined. Motion carried.

The recommended certification procedure is, therefore, as follows:

1) Only states that have conducted a state-wide survey for Acarapis woodi of at least 10% of apiaries (at the level of the U.S. National Survey) and that this survey be conducted between August 1, 1985 and the 1986 shipping season.

2) If a survey reveals a mite infestation in the state then bees will only be accepted from that state if the state has an acceptable action plan of containment and control. Bees can only be shipped from outside the control area.

3) Further to the state-wide survey, each shipper who produces package bees and/or queens for shipment to Canada must be sampled according to the following procedure.

a) 100% of apiaries from which bees coming to Canada under certification originate shall be sampled,

b) an apiary shall be defined as 50 colonies or less,

c) that 50% of colonies in an apiary shall be sampled from,

d) that each sample consist of a minimum of 500 bees,

e) that a minimum of 100 bees are examined from each sample.

**Motion:** D. Murrell, B. Fingler. That Gard Otis will compile the results of the tracheal mite surveys carried out in Canada and have this report published. Motion Carried.

Gard requested that the information be forwarded to him.

**Motion:** D. McRory, A. Méthot. That C.A.P.A. support the initiative taken by the eastern provinces to prevent the importation from the U.S.A. of package bees and queens into Ontario, Quebec, New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland.

| | |
|---|---|
| In Favour | 7 |
| Against | 4 |
| Abstained | 7 |

Motion carried.

**Saskatchewan Project** - Don Dixon introduced Dr. Don Peer.

Dr. Peer gave a report on the project being carried out by the Saskatchewan Beekeepers' Association at LaRonge. This is a one-year project which under present circumstances will be ended on or before September 1986.

Dr. Peer requested that if others were willing to help with analysis of bees for Acarapis woodi that this help would be welcomed.

John Gruszka showed slides of the project.

Dr. Peer then answered questions concerning the project.

**University of Guelph Project** - Gard Otis explained the project he was carrying out on infected bees in New York State.

This study differs from the La Ronge study in that a high level of infection exists in the colonies.

The study will be looking at infection rates of dead versus living bees as well as a study of the possibility of using gas chromatography for detecting the presence of mites.

**Tri-Country Meeting** - The North American Commission on Parasitic Mites and Africanized Bees.

Gard Otis reviewed the history of this commission. Their next meeting will be held in conjunction with the American Beekeepers' Federation meeting in Phoenix, Arizona, January 20, 1986.

He expressed concern about the amount of support being received from the other Canadian members.

Dr. Sterrit pointed out that the structure and organization of the meetings was somewhat questionable.

John Gruszka outlined the objectives of the commission. He explained some of the difficulties with the situation and questioned whether continued participation was warranted.

**Motion:** G. Otis, D. McCutcheon. That C.A.P.A. support the continued involvement of Canada in the tri-country meeting. Motion carried.

**Motion:** D. Gray, D. Nelson. That C.A.P.A. look into the possibility of finding funds for a future symposium for the tri-country meeting in Canada. Motion carried.

Gard Otis asked for feedback from the membership concerning this topic.

## Proposed 1986 Budget

Amendments to the budget tabled earlier were read by the secretary-treasurer.

**Motion:** D. McCutcheon, D. Nelson. That the A.I.A., A.A.P.A. meetings allocation be raised to one thousand dollars ($1000.00) to accommodate the expenses of two members of C.A.P.A to the tri-country symposium in Phoenix. Motion Carried.

## Action Plans

It was felt that C.A.P.A. had carried discussion of these plans as far as present circumstances allow.

D. McCutcheon suggested that as far as the Acarine action plan is concerned, that each province should decide whether they can or should adopt this plan for their own usage.

It was recommended that a discussion of what each provinces' response to use of these plans be included in next year's C.A.P.A. agenda.

Dr. Sterritt pointed out that Agriculture Canada is developing an action plan for Varroatosis. This plan will be circulated later in the year.

# PROPOSED BUDGET FOR C.A.P.A. 1986

| | | | |
|---|---|---|---|
| Balance November 1, 1985 | | | $ 778.55 |
| Projected Revenues: | | | |
| | Membership Fees | $ 970.00 | |
| | Registration Fees | $ 600.00 | |
| | Varroa Film Rental | $ 50.00 | |
| | | $1,620.00 | $1,620.00 |
| | | | $2,398.55 |
| Projected Expenditures: | | | |
| | 1985 Meeting | $ 250.00 | |
| | AIA or AAPA | $ 700.00 | |
| | IBRA | $ 220.00 | |
| | Postage | $ 125.00 | |
| | Printing | $ 100.00 | |
| | Miscellaneous | $ 25.00 | |
| | Certificates | $ 40.00 | |
| | | $1,460.00 | $1,460.00 |
| Expected Balance | | | $ 938.55 |

It was suggested that the Varroa plan be discussed at next year's meeting.

**Research Committee**

The Research Committee reported back to the meeting. This report was read by Dorothy Murrell (See Proceedings). She indicated that she would like to be replaced as chairperson.

**Motion:** D. Murrell, B. Fingler. That this report be accepted. Motion carried.

**Motion:** D. Murrell, D. Gray. That Don Nelson become chairman of the C.A.P.A. Research Committee.

The Committee will be composed of Don Nelson, Dorothy Murrell, Doug McCutcheon, Mark Winston, Gard Otis and the chairman of the CHC Research Committee.

**Other Business**

**Acarine Survey Co-ordination** - The suggested proceedings from the 1984 meeting was discussed.

The following changes were suggested:

- .That samples representing 10% of colonies in the province
- .That 50% of colonies in the apiary be sampled
- .It was noted that if beekeepers take samples then precise instructions should be sent with the sample bottles.
- .A Varroa survey can be carried out at the same time. The bees should be shaken for 30 minutes in alcohol.
- .The timing of the survey was questioned. It was suggested that packages should be sampled as early as possible.

**Motion:** D. Nelson, J. Gruszka. That the above suggested changes be accepted. Motion carried.

**Pollen Importation** - Don MacDonald brought this concern before the meeting. After considerable discussion, it was suggested that we recommend to beekeepers that they not use pollen from unknown sources.

**Western Apicultural Society** - Doug McCutcheon mentioned that the WAS would be meeting in Victoria on August 20-22.

He asked if provincial apiculturists could advertise this in their newsletters.

Dr. Sterritt pointed out that Don Gray would be retiring in the next year.

**Motion:** J. Gruszka, D. Dixon. Expressed our feeling of gratitude and appreciation to Don Gray for his participation and contributions throughout his association with C.A.P.A. Motion carried.

Discussion on the need for letterhead and membership certificates followed.

**Motion:** T. Szabo, D. Murrell. That we purchase more letterhead and that yearly stickers be used instead of yearly certificates. Motion carried.

**Motion:** D. Nelson, J. Gruszka. That the meeting be adjourned. Motion carried.

Don Dixon thanked the participation of our guests Dr. Bill MacElheran, Dr. Bill Sterritt and Dr. Eric Mussen.

# 1985 PROCEEDINGS

of

The Annual Federal-Provincial Work Planning Meeting

of the

CANADIAN ASSOCIATION OF PROFESSIONAL APICULTURISTS

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# Canadian Association of Professional Apiculturists



PRESIDENT'S REPORT

November 18, 1985

I would like to take this opportunity to thank the executive and the committee chairpersons for their assistance during the past year and for the work that they have performed on behalf of CAPA.

Thanks are also due to those people who participated in the national acarine survey early in 1985. I am pleased with the way that CAPA responded to the needs of the industry and that an adequate survey was performed. This survey, which revealed that the acarine mite was not yet present in Canada, was a significant issue in negotiating sampling and certification requirements for the import of package bees to Canada. I believe that we will need to continue this survey on an ongoing basis until the circumstances change.

In January of 1985, I had the opportunity to represent CAPA at meetings of the North American Committee on Bee Pests and Africanized Bees which was held in conjunction with the American Beekeepers Federation meetings in Tampa, Florida. I was accompanied by Dr. Gard Otis. At that meeting, the chairmanship of the organization was passed to the President of the American Beekeepers Federation and plans were made to hold a second International Symposium at the Federation meeting in January 1986. Since that meeting in Tampa, Dr. Otis has gathered information requested by the organization regarding the listing of researchers in Canada and research priorities for the committee to consider.

CAPA was also involved in discussions with U.S. officials regarding sampling procedure and certification of packages and queens coming into Canada during 1985. This meeting was a culmination of discussions which began in Guadalajara and continued in Victoria. An agreement was finally realized regarding the level of sampling and the certification process. Although the certification requirements were not as stringent as we had hoped for in our initial discussions, samples that were taken in the package bee areas in the United States and from packages that were imported into Canada seemed to indicate that the certification process was sufficient at that time and that the mite has not yet been imported into Canada.

The sampling and certification did cause problems in Georgia which found the honey bee tracheal mite in colonies in the States just before the shipping season. This caused some delays, however, the sampling requirements were met and the packages eventually were certified for shipment.

During July of 1985, I represented CAPA at a special interim meeting of the Canadian Honey Council which was called to deal with a sampling and certification process for the 1986 shipping season and to discuss action plans for the honey bee tracheal mite and *Varroa jacobsoni*. Hopefully, the industry will continue to seek our advice on dealing with these pests.

The Canadian Honey Council has not yet endorsed any action plans for either acarine or varroa. It appears that each provincial apiarist will need to work with the industry in their respective provinces until such time as a national plan may be adopted.

It has been an honour and a pleasure to serve as your President for the past six years, at a time when the responsibilities of the office have increased dramatically. I believe that CAPA is well prepared to serve the industry in the near future and I look forward to working with the new executive.

Respectfully submitted,

John Gruszka

# COMMITTEE REPORTS

Report of the CAPA/CHC Chemicals Committee

Report of the CAPA Research Committee

Report of the Importation Committee

# Report of the CAPA/CHC Chemicals Committee
November, 1985

The CAPA/CHC Chemicals Committee is a standing committee whose purposes are:

1. To research the use of chemical substances used in the beekeeping industry, and

2. To make recommendations on the use and proper registration of the various chemicals to ensure the safety of beekeepers and the production of a pure food product.

This committee is currently comprised of D. Murrell (Chair), D. MacDonald, D. Dixon, J. Gruszka, D. McRory, and A. Methot.

Several chemicals or groups of chemicals which are commonly used in the beekeeping industry are not registered for their purposes, and the following is a summary of the current position of each of these chemicals and a recommendation from CAPA to this committee for further action.

## A. FUMIGANTS

### 1. Ethylene oxide

Ethylene oxide (ETO) is not available for use in comb fumigation. Quebec wishes to continue using ETO and more recently some beekeepers in Alberta have expressed a need for ETO for chalkbrood control, although it is not clear whether or not ETO is effective in controlling this disease.

The Chemicals Committee has been directed by CAPA to pursue the registration of ETO by submitting a brief on the use of ETO in the beekeeping industry to the appropriate federal agencies.

### 2. Methyl bromide

The Pesticide Division of Agriculture Canada is awaiting a data package on this chemical from the Great Lakes Chemicals Corporation, which is expected to be completed in 1986. Once received, Agriculture Canada will make their decision on continuing use of methyl bromide.

The Ontario Beekeepers Association is interested in pursuing a minor use registration on this chemical pending Agriculture Canada's decision on its status in Canada.

### 3. Calcium cyanide

Calcium cyanide is currently registered for use by the beekeeping industry. The Chemicals Committee has been asked to determine the sources of this chemical.

### 4. Acaricides

It may eventually become necessary to have some chemical agents available for help in controlling parasitic mites of honey bees in Canada.

Both menthol and methyl salicylate (oil of wintergreen) were applied to honey bee colonies at the Beaverlodge Research Station in 1985 with adverse effects on bees, comb and beekeeper (refer to Beaverlodge Research Report, CAPA Proceedings, 1985). Also, apparently Folbex and Frow's mixture, both used in Britain for tracheal mite control, are no longer being produced there due to the presence of carcinogens in these formulations. Folbex VA is apparently still in use.

## B. BEE REPELLENTS

The use of bee repellents in the honey bee industry was outlined in the 1982 Proceedings of CAPA and CHC. No further action has been taken either by CHC or CAPA. The Chemicals Committee has been asked to determine the exact procedures for registration of butyric anhydride ("Bee Go") and benzaldehyde for use as bee repellents, and if deemed appropriate to pursue registration of these chemicals. CAPA also recommends that further participation in Dr. Sporn's work with phenol be encouraged.

## C. BIOLOGICAL CONTROL PRODUCTS

Certan, a formulation of Bacillus thuringiensis, has been registered for some time in the United States for wax moth control. It has not as yet been registered in Canada, and the Chemicals Committee has been directed by CAPA to look into its use in the U.S. and to explore the possibility for its registration in Canada.

Respectfully submitted,

Dorothy Murrell

Dorothy Murrell
Chairperson
CAPA Chemicals Committee

# Report of the CAPA Research Committee
November, 1985

The CAPA Research Committee was formed in 1984 to advise Agriculture Canada Research Branch of apiculture research needs and priorities. Members of this committee are D. Murrell (Chairperson), G. Otis, D. Nelson, D. McCutcheon and M. Winston.

The committee met during the evening of November 18, 1985, to outline and priorize apiculture research needs in Canada. These needs are as follows:

I. The research committee strongly re-iterates the need for the appointment of apiculture research scientists to the two vacant apiculture research positions within Research Branch of Agriculture Canada.

II. RESEARCH PRIORITIES

1. Acarine disease

- that research into the effects of acarine disease on wintering and honey production in Canada or the northern U.S. be continued

- that research be conducted on techniques for control of acarine disease, including chemical and management techniques and breeding for resistance.

2. Chalkbrood disease

- that research be initiated into methods for prevention and control of chalkbrood disease under Canadian conditions.

3. Varroa disease

- that a literature review be conducted to assess what is now known about the economic effects of varroa on honey bee colonies, ie. effects on honey production and on broodrearing, as well as to evaluate current control measures

- that research be conducted on the economic effects of varroatosis under climatic and beekeeping conditions as similar to those of Canada as possible.

4. Sacbrood-like disorder

- that the causative organism be identified

- that the impact of this disease be assessed and monitored to determine its severity.

5. Pesticides

   - that research be initiated and continued in the following four categories:

     - sublethal effects of pesticides on pollinators
     - integrating pesticides, pollination, bee management and honey production under Canadian conditions
     - native and introduced pollinator alternatives
     - selection for tolerance or resistance to pesticides

6. Queen overwintering

Respectfully submitted,

Dorothy Murrell
Chairperson

# REPORT OF IMPORTATION COMMITTEE
# TO CANADIAN HONEY COUNCIL
# SASKATOON 1985

Committee: D. McCutcheon, Chairman, Dr. S. C. Jay, T. Taylor, Dr. Don Gray and Dr. Mark Winston

This committee's role is 1) in securing information on beekeeping in countries where alternative sources of queens and bees might be obtained. 2) in recommending the advisability of allowing imports from such countries. 3) In reviewing conditions in countries from which we presently allow imports.

## New Zealand

Imports from New Zealand have been allowed under the permit systems for a number of years. In 1985 it is estimated 8,000 queens and 4,000 packages were imported.

The industry in Canada has expressed a number of concerns about New Zealand importations.

1) A report in the Scottish Beekeeper intimated New Zealand had recently imported queens from Israel. We are assured by New Zealand authorities they had not imported bees from any country since 1956. They have in fact exported queens to Israel for a number of years.

2) Halfmoon disorder - Dr. Shimanuki from U.S.D.A., Beltsville, Maryland, carried out a disease survey in New Zealand recently at the request of that country. He has isolated a bacterium Bacillus coagulans which is believed to be the causative organism. A literature search turned up three other references, two from the U.S.A. which report the discovery of the organism in the U.S.A.

Dr. Shimanuki assures us thus disorder is of no importance. The New Zealand officials report it is of no commercial concern. The incidence is 0.05% of hives. Field symtoms are much like those of E.F.B.

3) Mellitiphis alvearius - mites were found associated with New Zealand package bees imported to Nova Scotia. These mites are found in New Zealand, and where present are in low numbers, usually moving quickly on the top bars of frames. The New Zealanders feel the mite is quite unimportant. Usually insufficient mites are available for study. There is no information to indicate they are harmful to bees or have an economic impact.

It is recommended Canada continue to allow imports of honeybees from New Zealand.

(2)

## Australia

We have established that Australia has imported breeding stock from Austria, Russia, and Italy from time to time since 1977. These queens and attendant bees were placed in a special quarantine facility completely isolated from the outside. Since 1977, 60 queens have been imported. Each consignment has been examined for diseases and mites, the attendants destroyed and replaced with Australian bees. The imported queens were retained in quarantine and after successful grafting from them were killed and examined for diseases and mites. None have been found.

The committee considers 1) The import quarantine system very adequate 2) The regulatory situation to be of high calibre 3) The disease incidence as it relates to brood diseases to be very low.

Before recommending imports from Australia the committee recommends Australian officials be asked

1) to supply Agriculture Canada with a complete record of imports to Australia from 1960 to present.

2) To supply evidence that the country is free from the mites Acarapis woodi, Varroa jacobsoni and Tropilaelaps clareae. Such evidence to include the following.

A record of surveys for these mites which would include i) dates when survey began ii) extent of surveys iii) techniques of analysis of survey samples iv) results.

3) Importation will be recommended if such surveys have taken place and if surveys indicate positively no mites were detected.

4) The committee strongly recommends an on site visit to Australia by a representative from Canada to seek first hand knowledge of the Australian situation.

## Future Policy on Imports

The committee has developed a policy relating to securing appropriate information from countries which in future wish to initiate honeybee sales to Canada. Such a policy will aid in the consideration of the application and in making a decision as to the appropriateness of such importation.

The applicant country must provide Canadian officials with:

A. General:
1) A copy (or copies) of their bee disease control legislation.
2) An overview of the organization and extent of their regulatory services.
3) A description of their diagnostic capabilities.
4) The name and address of the chief Apiculture officer.

B. Brood Diseases:
1) Information on the extent of their examination of hives for brood diseases over past years.

(3)

2) The incidence of such diseases.

C. Importations:

1) History of honeybee importations including number and sources.

2) Whether quarantine facilities are available and used for importation.

3) Whether import permits are required and what such permits must specify.

D. Other:

1) Information on status of beekeeping in the country - hive and beekeeper numbers, production, distribution, operation type, (migrating, pollination, etc.)

2. Research capabilities.

E. In addition: On site inspection visits by an official Canadian representative is highly desireable and is recommended.

D. M. McCutcheon
Chairman
Importation Committee
Canadian Honey Council
November, 1985

## PROVINCIAL REPORTS

PROVINCE: British Columbia

# APICULTURIST REPORT TO C.A.P.A , 1985

By: D. M. McCutcheon

Address: 32916 - Marshall Road
ABBOTSFORD, B. C. V2S 1K2

Name, Title and Address of Supervisor or Department Head: Walter Wiebe
Director, Field & Special Crops Branch
B. C. Ministry of Agriculture & Food, Parliament Buildings, Victoria,
B. C. V8W 2Z7

Provincial Beekeeping Statistics: early estimates

| | |
|---|---|
| No. of Beekeepers | 5,450 |
| No. Producing Colonies | 53,500 |
| Average Yield/Colony | 94 lbs. |
| Total Crop | 5,035,000 |

| | |
|---|---|
| Number of Colonies Wintered 1984-85 | 42,000 |
| 1985-86 | 45,500 |

Bee Diseases:

| | | |
|---|---|---|
| No. of Inspectors | 13 | 7,140 hive bodies |
| No. of Colonies | 4,300 hives | of combs |
| Incidence of AFB | 6.6% | 8% of combs |
| EFB | .7% | |
| Chalkbrood | 6.23% | |
| Sacbrood | 2.2% | |
| Other | 140 samples examined for Acarine. | |

COMMENTS: (If more space required, attach additional sheets.)

PROVINCE: ALBERTA

## APICULTURIST REPORT TO C.A.P.A., 1985

BY: Donald N. MacDonald, Supervisor of Apiculture

ADDRESS: Box 415, FALHER, Alberta TOH 1MO (403) 837-2252

NAME, TITLE and ADDRESS OF SUPERVISOR or DEPARTMENT HEAD:

Mike Dolinski, Section Head - Entomology, Plant Pathology & Apiculture
Alberta Agriculture, Crop Protection Branch
7000 - 113 St.
EDMONTON, Alberta
T6H 5T6 (403) 427-5339

PROVINCIAL BEEKEEPING STATISTICS:

| | |
|---|---|
| No. of Beekeepers | 1700 |
| No. of Producing Colonies | 175,000 |
| Average Yield/Colony | 105 lbs/hive (48 kg/hive) |
| TOTAL CROP | 18.5 million lbs (8.39 million/kg) |

| | | |
|---|---|---|
| NUMBER OF COLONIES WINTERED | 1984-85 | 80,000 |
| | 1985-86 | 90,000 |

BEE DISEASES

| | |
|---|---|
| No. of Inspectors | 1 full-time and 5 seasonal |
| No. of Colonies Inspected | 16,000 |
| Incidence of AFB | 6.6% of inspected colonies |
| EFB | 0.3% |
| Chalkbrood | Generally widespread in areas inspected & increasing |
| Sacbrood | Some heavy infestations |
| OTHER | |

COMMENTS (If more space required, attach additional sheets)

## CROP CONDITIONS

Most regions of Alberta experienced a decrease in honey production over 1984. Very low crops were seen in areas south of Red Deer and in the Peace region while the Edmonton and St.Paul area crops were almost normal. Prices for bulk honey to the producer have risen to about 58¢ per lb.

## PESTICIDES

Extremely heavy applications of pesticides for grasshopper control were made in southern Alberta resulting in high hive losses. Alberta Agriculture subsidized the cost of insecticides up to 50% which probably resulted in more applications than normal. Due to cost and availability most farmers used Furadan, the most lethal for honey bees. Cutworm infestations resulted in considerable application of Lorsban.

## WINTERING

Wintering losses were heavier than normal in 1985. Winter preparation came to an abrupt end in early October 1984 and the winter was harsher than normal. Furthermore many queens had ceased laying by late August resulting in aging wintering populations.

A survey conducted in fall 1985 indicated a 13% increase in the number of hives being wintered over 1984. This increase is probably due to the favourable economics of wintering and the fear of mites and Africanized bees. There is a considerable interest in indoor wintering in the Peace district, traditionally a package bee area.

## EXTENSION ACTIVITIES

Ten evening short courses on disease control were given throughout Alberta during March 1985. A 2 day commercial beekeepers short course was held in conjunction with Fairview College in February and 6 wintering seminars were held in August. Demonstrations in constructing plastic winter wraps were made and a wrap was raffled at each meeting.

## PESTICIDE TESTING

Insecticide degradation tests using caged bees were carried out using Decis, Lorsban, Furadan and Larvin. All but Decis were tested at 2 field concentrations while Decis was tested at one. Results indicate that Decis is a good pesticide from the beekeepers' point of view while Furadan is disastrous.

## SACBROOD ANALYSIS

In previous years a sacbrood like disease has been reported in Alberta and elsewhere but diagnosis has been difficult due to unusual symptoms. In 1985, this disease was quite heavy in some apiaries. Alberta Agriculture has identified sacbrood virus from samples submitted through electron microscopy.

## CHALKBROOD INCIDENCE

Chalkbrood was observed to cause major problems in some apiaries in 1985. The ABA and some commercial beekeepers have asked Agriculture Canada that research be conducted so that a cure may be found.

## NEW PUBLICATIONS

Protecting Bee Hives From Bear Damage in Alberta — Agdex 616-2

Build Your Own Pollen Trap — Agdex 616-22

Both are available from the Print Media Branch, Alberta Agriculture, 7000 - 113 St. Edmonton, Alberta T6H 5T6.

PROVINCE: SASKATCHEWAN

APICULTURIST REPORT TO C.A.P.A., 1985

By: John Gruszka, Provincial Apiculturist

Address: Box 3003

Prince Albert, Sask. S6V 6G1

Name, Title and Address of Supervisor or Department Head: John Buchan, Director

Soils & Crops Branch, Saskatchewan Agriculture

3085 Albert Street, Regina, Sask. S4S 0B1

Provincial Beekeeping Statistics:

| | |
|---|---|
| No. of Beekeepers | 1600 |
| No. Producing Colonies | 105,000 |
| Average Yield/Colony | 155 lb. (70 kg) |
| Total Crop | 16,275,000 lb. (7,397,727 kg) |

Number of Colonies Wintered 1984-85? 65,000

1985-86? 72,500

Bee Diseases:

| | |
|---|---|
| No. of Inspectors | 5 |
| No. of Colonies Inspected | 4,200 |
| Incidence of AFB | Approximately 2% |
| EFB | |
| Chalkbrood | |
| Sacbrood | |
| Other | 226 Acarine samples (all negative) |

COMMENTS: (If more space required, attach additional sheets.)

# Saskatchewan Report to CAPA, 1985

## 1. Drought Assistance

During the summer of 1984 beekeepers in southern Saskatchewan were stricken with severe drought conditions. As a consequence the honey crop was severely reduced and many of the commercial beekeepers did not extract any honey at all. The Saskatchewan Beekeepers Association made representation to Saskatchewan Agriculture for drought assistance. A program was initiated in which commercial beekeepers, 100 colonies or more, who operated in the designated drought area were offered assistance up to $26.68 per colony. Beekeepers who received assistance had to operate at least 80% of their colonies in the following year. The total amount of drought assistance was in excess of $260,000.

## 2. Crop Insurance

Saskatchewan Agriculture informed the Beekeepers Association that drought assistance would only be offered because there was no crop insurance program in place and that such assistance would not be available in the future. The Saskatchewan Beekeepers Association made representation to the Saskatchewan Crop Insurance Corporation and a crop insurance scheme was in place for the 1985 honey crop. A total of 18 beekeepers took out crop insurance during 1985. This represents almost every commercial beekeeper in southern Saskatchewan, however, only one or two beekeepers in the northern part of the province took out crop insurance during 1985.

## 3. Insecticide Damage

The grasshopper infestation in southern Saskatchewan during the summer of 1985 was recognized as possibly the worst in recorded history. It has been estimated that as much as $100 million was spent for chemicals and application to control grasshopper populations in southern Saskatchewan. As a result of the massive amount of insecticide that was applied, many beekeepers in southern Saskatchewan sustained severe insecticide damage to honey bee colonies.

The grasshopper forecast for 1986 indicates that the grasshopper levels might be as bad as the 1985 levels or possibly even worse. At present, there is no compensation program to pay for insecticide damage in Saskatchewan and plans are being made to increase the public's awareness of the dangers of insecticides to honey bee colonies by more extensive use of the media during 1986.

PROVINCE: Manitoba

APICULTURIST REPORT TO C.A.P.A., 1985

By: Don Dixon, Provincial Apiarist

Address: 911 Norquay Building, 401 York Avenue
Winnipeg, Manitoba R3C 0P8

Name, Title and Address of Supervisor or Department Head: M. Deveson, Director, Technical Services and Training Branch, 810 Norquay Building, 401 York Avenue, Winnipeg, Manitoba R3C 0P8

Provincial Beekeeping Statistics:

| | |
|---|---|
| No. of Beekeepers | 1,350 |
| No. Producing Colonies | 120,000 |
| Average Yield/Colony | 66 kg. (145 lbs.) |
| Total Crop | 1.9 million kg. (17.4 million lbs.) |

| | |
|---|---|
| Number of Colonies Wintered 1984-85? | 57,527 (48%) |
| 1985-86? | 60,093 (50%) |

Bee Diseases:

| | | |
|---|---|---|
| No. of Inspectors | | 10 |
| No. of Colonies Inspected | | 17,398 |
| Incidence of AFB | | 172 (.99%) |
| | EFB | 7 (.04%) |
| | Chalkbrood | |
| | Sacbrood | |
| | Other | |

COMMENTS: (If more space required, attach additional sheets.)

## Crop Synopsis

Following the relatively harsh winter of 1984/85 beekeepers reported generally good wintering success. Spring conditions were fair to good for the build up of package bees and wintered colonies.

Early summer conditions were good to excellent for both nectar production and foraging, however, widespread cool and wet conditions during August caused the honey flow to stop at the end of July. Also, because of cool conditions and the prevalence of Canola (rapeseed), beekeepers reported much higher than usual granulation in the comb. The honey crop was variable throughout Manitoba, however, on average beekeepers reported a slightly less than average crop.

## Colony Number Determination

Beekeepers reported that producing colonies were derived from the following sources:

| | |
|---|---|
| Imported packages (75% from California) | 63,000 |
| Wintered Colonies | 55,000 |
| Nuclear colonies produced from wintered stock | 2,000 |
| TOTAL | 120,000 |

The colonies derived from packages and nuclear colonies have been corrected to account for an estimated 5% spring loss.

## Bee Mite Surveys

Additional staff were hired to conduct two honey bee tracheal mite surveys during 1985; a survey of wintered colonies comprising 273, 100 bee samples, and a survey of imported package bees comprising 805, 100 bee samples. No evidence of acarine infection was found in either of the surveys. In addition, Manitoba Agriculture is conducting a relatively small Acarine survey of colonies to be wintered that were located close to the North Dakota border during the summer. These colonies are considered to be a higher risk because of the large number of Acarine infested colonies which were managed in North Dakota during the summer.

## Insecticide Damage

As a result of widespread spraying for grasshopper control, several beekeepers reported significant losses of honey bees.

PROVINCE: ONTARIO

APICULTURIST REPORT TO C.A.P.A., 1985

By: Douglas G. McRory

Address: Ontario Ministry of Agriculture and Food
17 Wilson Drive, Unit #12, Milton, Ont. L9T 3J7

Name, Title and Address of Supervisor or Department Head: J. Wheeler, Director
Fruit and Vegetable Inspection Branch, O.M.A.F.
Legislative Buildings, 801 Bay Street, Toronto M7A 1A7

Provincial Beekeeping Statistics:

| | |
|---|---|
| No. of Beekeepers | 4,500 |
| No. Producing Colonies | 113,000 |
| Average Yield/Colony | 84 lbs. (38 kgs) |
| Total Crop | 9,492,000 lbs. (4,294,000 kgs) |

| | |
|---|---|
| Number of Colonies Wintered 1984-85? | 110,000 |
| 1985-86? | 113,000 |

Bee Diseases:

| | |
|---|---|
| No. of Inspectors | 50 |
| No. of Colonies Inspected | 33,056 |
| Incidence of AFB | 726 |
| EFB | no record |
| Chalkbrood | no record |
| Sacbrood | no record |
| Other | no record |

COMMENTS: (If more space required, attach additional sheets.)

## Honey Crop Situation

Ontario had a good crop, similar to the past two years. Where there was canola, production was above normal and offset some lower production in areas that dried out. The fall flow did not materialize in the southern part of the province due to wet weather, but an exceptional late flow occured across the north.

## Honeybee Tracheal Mite

Concern over the honeybee tracheal mite remains high. A survey is being conducted this fall with 800 samples as our objective. We are also training about eight people to be able to do samples in case of an infestation of mites.

## Alternative Sources of Honeybees

A good deal of effort was put into developing two viable alternatives to U.S. bees.

1) Ontario nucs were marketed for the first time in significant numbers
2) New Zealand packages and queens were imported in significant numbers

PROVINCE: ______________

## APICULTURIST REPORT TO C.A.P.A., 1985

By: ARMAND METHOT, D.M.V.

Address: 77 Principale, Granby, Québec
J2G 9B3 Tel: (514) 375-3443

Name, Title and Address of Supervisor or Department Head:

Dr. Yvan Rouleau, M.V. - Director

Direction de la Santé Animale, 200-A, chemin Ste-Foy, le étage, Québec
G1R 4X6

Provincial Beekeeping Statistics:

| | |
|---|---|
| No. of Beekeepers | 3,410 |
| No. Producing Colonies | 122,846 |
| Average Yield/Colony | 49 kg (108 lv) |
| Total Crop | 6.02 millions kg (13.2 millions lvs) |

Number of Colonies Wintered 1984-85? 121,000.

1985-86? idem

Bee Diseases:

| | |
|---|---|
| No. of Inspectors | 33 |
| No. of Colonies Inspected | 18,908 |
| Incidence of AFB | 1.6 |
| EFB | 0.15 |
| Chalkbrood | 0.026 |
| Sacbrood | 0.015 |
| Other | |

COMMENTS: (If more space required, attach additional sheets.)

# Quebec report to the
# Canadian Association of Professional Apiculturists
# November 1985, Saskatoon

## APIARY INSPECTION

During spring and summer of 1985, 18,912 colonies were inspected, most of them from beekeepers with 1 to 10 colonies. We found that a few of these apiaries were sources of contamination for commercial apiaries in the neighbourhood. In spite of high incidence of robbing during the spring, a slight decrease of foulbrood was noted.

## CONFERENCES AND SHORT COURSES

Aiming to self sufficiency in bees and queens for our beekeepers, many very succesful queen rearing and nuclei production clinics were held.

For the second year, information meetings on the management and disease problems were held in the 12 administrative areas of the Province.

## PUBLICATIONS

A brochure on queen rearing for the beekeeper's own needs is published and one on commercial queen rearing is submitted for approval by the Beekeeping Committee of C.P.V.Q. (Conseil des Productions Végétales du Québec).

A beekeeping course (in french) is almost completed and will soon be submitted to M.E.Q. (Ministère de l'Education du Québec).

Also a leaflet on bee diseases written by Vétérinarians is almost ready for free distribution to beekeepers.

ACARINE DISEASE AND IMPORTATION

3,000 packages of bees were imported from New Zealand. After the mite "Mellitiphis Alvearius" was found in Nova Scotia, a survey was conducted on New Zealand bees and no mite was detected.

1,393 packages of bees have been imported from U.S.A. and we obtained the list of the 69 buyers. During September and October, samples of bees were taken from 52 of the resulting colonies owned by 34 buyers (4% of the U.S. packages imported). Laboratory work is completed and no tracheal mite has been found.

Our policy is the same as last year: to protect our beekeepers from tracheal mite ready for infestation and Varroa in the near future, we suggest the closure of the U.S. border for importation of packages of bees and queens, according to the C.H.C. agreement to close the border for East Provinces.

PROVINCE: New Brunswick

APICULTURIST REPORT TO C.A.P.A., 1985

By: Bruce Palmer

Address: P.O. Box 6000

Fredericton, N.B.

Name, Title and Address of Supervisor or Department Head:

E. T. Pratt, Director, Plant Industry Branch

N. B. Dept. of Agriculture and Rural Development

Provincial Beekeeping Statistics:

| | |
|---|---|
| No. of Beekeepers | 420 |
| No. Producing Colonies | 4,300 |
| Average Yield/Colony | 85 lb. |
| Total Crop | 364,500 lb. |

Number of Colonies Wintered 1984-85? 4,200

1985-86? 4,300

Bee Diseases:

| | |
|---|---|
| No. of Inspectors | 8 (part-time) |
| No. of Colonies Inspected | 3,068 |
| Incidence of AFB | 30 |
| EFB | 9 |
| Chalkbrood | 54 |
| Sacbrood | 6 |
| Other | |

COMMENTS: (If more space required, attach additional sheets.)

PROVINCE: Nova Scotia

## APICULTURIST REPORT TO C.A.P.A., 1985

By: Lorne Crozier

Address: N.S. Department of Agriculture & Marketing
P. O. Box 550, Truro, Nova Scotia B2N 5E3 (902-895-1571)

Name, Title and Address of Supervisor or Department Head: Mr. David Sangster, Director, Horticulture and Biology Services, N.S.D.A.M., P. O. Box 550, Truro, Nova Scotia B2N 5E3

Provincial Beekeeping Statistics:

| | |
|---|---|
| No. of Beekeepers | 800 |
| No. Producing Colonies | 8,000 |
| Average Yield/Colony | 65 lbs. (29.5 kg) |
| Total Crop | 520,000 lbs. (235.9 tonne) |

Number of Colonies Wintered 1984-85? 4,500
1985-86? 6,800

Bee Diseases:

| | |
|---|---|
| No. of Inspectors | 1 |
| No. of Colonies Inspected | 543 |
| Incidence of AFB | 9 colonies |
| EFB | 15 colonies |
| Chalkbrood | 94 colonies |
| Sacbrood | 49 colonies |
| Other | |

COMMENTS: (If more space required, attach additional sheets.)

## BEEKEEPING SEASON

Cold, damp weather in April, May and June resulted in poor colony build-up. Colonies, therefore, used the July clover flow for build-up rather than storing much surplus. The fall flow was rather late but made up for the earlier season. Some beekeepers reported a good flow occurred between September 20 and October 1. It is, therefore, expected that colonies will go into winter in good shape. October was quite mild, so there was no problem in feeding bees.

## BEE DISEASES

One inspector was hired on a part-time basis. Five hundred, forty-three (543) colonies were inspected. AFB was found in nine. This figure is down substantially and reflects the inspection service which has been carried out in the past few years.

Chalkbrood continues to be the most common brood disease. Infection ranges from a few cells to very heavy. I feel that there is a need for control measures to be developed to check this disease.

Seventeen samples were checked for the presence of tracheal mites. One hundred (100) bees per sample were checked. All samples were negative.

A further survey has been carried out this fall. To date, 30 samples have been collected and are presently being analyzed.

## EXOTIC MITES

The importation of package bees from New Zealand brought with it a mite new to North America.

These mites were first noticed in a queen cage from a package of bees purchased by a beekeeper at Hopewell, Pictou County, Nova Scotia. A sample sent to the Biosystematics Research Institute (BRI) in Ottawa was identified as *Mellitiphis alvearius*. Following identification, I consulted with Dr. E. Lindquist, Ottawa, Dr. H. Shimanuki, U.S.D.A., Bellsville, Maryland, and with apicultural authorities in New Zealand. I was told that very little was known about the mite and that it was not considered to be a pest of honey bees. It was, therefore, felt that an eradication program was not warranted.

I carried out a survey to determine how many colonies started from New Zealand packages were infested with the mite.

A total of 106 hives were sampled using a paper tray and tobacco smoke. Preliminary indications are that the mite was present in a large proportion of the packages received.

I am presently awaiting confirmation of additional samples sent to the BRI in Ottawa.

It is fortunate that this is not a serious pest. It does illustrate how easily diseases and pests can be transported around the world. In view of this and the fact that New Zealand has another disease known as half-moon disease,it brings doubt to my mind in the wisdom of importing bees from New Zealand until further information is known about this disease.

## BEE IMPORTATIONS

Package bees and queens were brought in from Georgia and for the first time from New Zealand.

The overall number of packages was down by about 50% compared with the previous year. Only 800 packages were brought in from Georgia and 500 from New Zealand. Extra queens were also brought in from Weaver Apiaries, Texas and Strachan Apiaries, California. Just over 2,000 queens were imported.

PROVINCE: PRINCE EDWARD ISLAND

# APICULTURIST REPORT TO C.A.P.A., 1985

By: E. ELAINE CLARK

Address: BOX 1600

CHARLOTTETOWN, P.E.I. C1A 7N3

Name, Title and Address of Supervisor or Department Head:

RAY CARMICHAEL, SUPERVISOR, CROPS SECTION

P.E.I. DEPT. OF AGRICULTURE, BOX 1600, CHARLOTTETOWN

P.E.I., C1A 7N3

Provincial Beekeeping Statistics:

*Estimates

| | |
|---|---|
| No. of Beekeepers | 145 |
| No. Producing Colonies | 900 |
| Average Yield/Colony | 95 lbs |
| Total Crop | 85,500 lbs |

Number of Colonies Wintered 1984-85? 500

1985-86? 550

Bee Diseases:

| | | |
|---|---|---|
| No. of Inspectors | | 1 full-time May-Sept (3 part-time) |
| No. of Colonies Inspected | | Approx. 850 represented |
| Incidence of | AFB | Approx. 20 colonies |
| | EFB | 15 colonies |
| | Chalkbrood | 7 colonies |
| | Sacbrood | Some but not significant |
| | Other | Skunk damage very prevalent |

COMMENTS: (If more space required, attach additional sheets.)

1985 Report to CAPA

Prepared by Elaine Clark, PEI Dept. of Agriculture

1) New Zealand Bees

In order to reduce the risk of importing parasitic mites, the PEI Beekeepers Cooperative Association (PEIBCA) arranged through F. W. Jones to bring in a shipment of packages and queens from New Zealand. These arrived in April in good condition. Beekeepers report that the colonies built up well, were productive and were much more gentle to handle than Italians. The N.Z. bees are being overwintered both indoors and outdoors in 85/86 so we should get a good evaluation of their talents in this area.

2) Overwintering

More bees were overwintered in 84/85 and in general did well although a 84 survey does indicate that many beekeepers still lack the knowledge or inclinations to properly prepare colonies for overwintering.

In a project report released in 85, it is concluded that bees can be successfully overwintered on PEI if certain basic rules are adhered to namely disease free colonies, sufficient stores (at least 60 pounds), treatment with Fumidil - B, top ventilation, protection from skunks which are a serious problem and young vigorous queens. The degree of extra winter wrapping is not critical if the hives are in a sheltered location.

A method of climate controlled indoor wintering developed and refined in Alberta by H. Pirker has been tested for 2 years on PEI. The results for the 84/85 winter were better than 83/84. Fifty-six colonies were installed in December with 86 colonies resulting in the spring of 85. Overall the colonies were very strong. Sixty-one were used for blueberry pollination. However, despite improvements the Chalkbrood problem persisted. The development of several hives was set back due to this disease. The building will be privately leased again in 85/86.

3) Acarine Mite Survey

Federal funds were available to test all known PEI colonies for Tracheal mite in the summer of 85. Jane Ramsey was hired to carryout this testing. The results were negative. Additional benefits of this project include the development of computerized mailing list of beekeepers, and a successful Maritime disease workshop in November with guest speaker Doug Colter.

4) Queen Project

A project was funded to support the efforts of a local breeder Larry Cosgrave to test various strains under PEI conditions. The final report is not yet prepared but results look promising. Queen rearing could be especially important if we maintain our mite free status.

5) Bee Disease Committee

A joint committee of government and PEIBCA members are working on developing an overall disease strategy and program for PEI. To date the committee has coordinated the 85 regular disease inspection and the mite project. We had new regulations to the Apiary Inspection Act put in place May, 1985 which give us the authority to quarantine any bees coming into the province and to destroy any which are found to be infested with Tracheal or Varroa mites.

In 86 we intend to overhaul the entire act and make various changes/ additions.

In 85 a Fumidil - B subsidy was made available to PEIBCA members to encourage nosema control.

6) Other PEIBCA activities:

- Brought in a bulk order of plastic and glass containers

- Carried out a crocus bulb fund raising sale

- Suggested prices for honey
  $1.45 500g wholesale to store; $1.60 direct to customer
  $1.25 lb. bulk without container

- Still investigating the issue of honey grades and how best to implement a system of provincial grades for retail sales

- Produced an attractive honey recipe pamphlet

# RESEARCH REPORTS

## Research at Simon Fraser University

M. L. Winston

## Research at Beaverlodge, Research Station, Alberta

D. L. Nelson

T. P. Liu

T. Szabo

## Research at University of Manitoba

S. C. Jay

## Research at University of Guelph

G. Otis

# CAN PACKAGE BEES AND NUCLEI BE PRODUCED COMMERCIALLY IN BRITISH COLUMBIA, CANADA?

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The purpose of this article is to summarize our research investigating the feasibility of package bee and nucleus production in British Columbia, Canada. We began these studies for two reasons: 1) the likely possibility that quarantines of package bee importations to Canada would be imposed due to the presence of mite pests and Africanized bees in the package-producing areas of the southern United States, and 2) such a bee production industry would be a new and lucrative source of income for local beekeepers. Canadian beekeepers are highly dependent on package shipments from the U.S.; in 1984 over 350,000 packages were imported into Canada, with a total value of $10 million, representing about half of Canada's bee colonies. Disruptions of these shipments have already occurred due to quarantines imposed on importations from regions in the United States where the tracheal mite Acarapis woodi has been reported, and provinces in Eastern Canada will not accept importations of packages from anywhere in the U.S. There is good reason to expect increased disruptions of package importations as Acarapis woodi expands its range and when Africanized bees and the mite Varroa jacobsoni arrive in the southern United States (Winston 1983).

We have now completed our third year of research into the feasibility and management techniques for package and nucleus production in British Columbia. The southwestern region of B.C. is the only area of Canada in which bee production might be feasible, since our climate is mild enough to produce bees for sale in April and early May, when northern beekeepers require them. I will report here a series of experiments which show that production of 2-4 packages from colonies in April has minimal impact on colony performance and can more than double profit per colony over that of management systems for honey production alone. This industry has the potential to supply at least half of Canada's current package needs and, when the trends towards increased overwintering and queen rearing are considered, to make Canadian beekeeping largely self-sufficient.

## Methods

A successful package or nucleus production system must satisfy two criteria; it must be biologically possible and economically sound. The current management cycle for bees in Canada involves package importation throughout April, and bee production in B.C. must provide bees at that time while leaving colonies in reasonable condition for honey production, overwintering, and bee production the following season. We examined two types of production systems, the traditional method of package production and an alternate method, nucleus production. To evaluate these systems, we examined the effects of removing packages or nuclei on the original colonies by measuring brood rearing, colony population and weight, pollen storage, honey production, and profit following various combinations of package and nucleus production.

More detailed methods and results can be found in Winston et al. (1985), Winston and Mitchell (in preparation), and Punnett and Winston (in preparation). Briefly, colonies were overwintered in two supers of standard Langstroth equipment at apiaries in the Fraser Valley region of southwestern British Columbia. These colonies were requeened at the beginning of the studies with Italian (*Apis mellifera ligustica* L.) queens reared from British Columbia Ministry of Agriculture and Foods stock. All colonies were fed eight to sixteen liters of sugar syrup with antibiotics in the fall, an additional 8-13.5 liters in the spring, and 2-4 liters additional syrup in May or June when necessary to prevent starvation during a dearth period. Colonies were also fed 600-1550 grams of pollen supplement in the spring to stimulate brood rearing. To produce packages, the required numbers of workers were shaken from colonies at various dates in April or early May; all packages contained 0.9 kg (2 lb) of workers. Nuclei contained four frames of workers, brood, honey, and pollen. Following package shaking, the areas of sealed brood, honey, and pollen, colony weights, and number of frames covered by workers were measured throughout the season. The amount of extracted honey was also measured by weighing supers before and after extraction. For the economic analyses, we calculated honey profit as $1.12 per kg in 1984 and $1.21 per kg in 1985, the average figures for bulk sales in those years. Profits per package ranged from $7.25-$8.47 depending on the amount of feeding colonies were given. These figures were based on an average sale price of $29.70 and a production cost of $21.23-22.45. The profit per nucleus was calculated as $14.90, based on a sale price of $45.00 for a single nucleus. The production costs are the most conservative figures available, since they include not only immediate expenses such as the purchase of queens and empty packages but also labor and depreciation. These figures are all in Canadian dollars ($1.00 Canadian = $0.73 U.S.), and are based on British Columbia Ministry of Agriculture and Food economic analyses.

In 1984 and again in 1985, we managed approximately 120 colonies each year for package and nucleus production. The schedules for bee production are summarized in Table 1; each treatment generally involved 7-10 colonies distributed at 2 different apiary sites. Five different sites were used in 1984 and three in 1985. Thus, these experiments include the variability between sites and years typical of a commercial beekeeping situation.

Results

The first criteria for successful bee production is that colonies from which packages and nuclei have been removed must perform reasonably well during the rest of the season and into the next spring. The results for colony performance exceeded our most optimistic expectations; in all cases, control colonies and colonies from which bees were removed in the spring showed no differences in sealed brood, honey, or pollen areas, colony weights, and frames covered with workers by the end of the season. Further, measurements taken in May and June only occasionally showed any significant differences, and even then it was often the control colonies which were weaker than bee production treatments (see Winston et al. 1985 and our mansucripts in preparation for detailed data). This is a remarkable result, since it indicates that colonies from which one half to two thirds of the worker population are removed in the spring can recover so as to be indistinguishable from colonies which suffer no worker loss. The mechanism for this rebound effect deserves further study, but changes in age-specific division of labor following package shaking are one mechanism that is important (Winston and Fergusson 1985). In that study, workers marked and introduced into colonies after two or three packages were shaken in April began foraging at earlier ages and had shorter life spans than in control colonies, suggesting that shifts in the timing of tasks can compensate for worker loss. Thus, colonies appear to have a reserve force that can respond to population loss caused by package and nucleus production by workers accelerating their task performance and living shorter but more productive lives.

The economic data from these studies are equally encouraging. In most cases, bee production colonies produced as much honey as controls, except for the 3-nucleus treatment in 1984 and some of the 1984 package-production treatments (Table 1). Even more impressive are the profit data; in almost every situation we examined, bee production significantly increased profits, sometimes more than doubling profit per colony. Control colonies used only for honey production produced profits of $22-36 per colony. The per-colony profit in treatments from which packages or nuclei were removed averaged $38 for two packages, $50 for three packages, $55 for four packages, and $56 for three nuclei (Table 1). Thus, even in situations where honey yield was lower, colonies from which packages were shaken or nuclei removed consistently earned higher incomes than colonies used solely for honey production.

These results have also proven that packages can be shaken in British Columbia throughout April, which is when they are needed by commercial beekeepers. In our 1985 study, two packages could be removed the first week of April without any deleterious impact on colony performance (Table 1). Colonies from which three packages were removed that early did not survive, indicating the upper limit of package production in early April. Further, our results point to the benefits of additional pollen supplement feeding in package production. The only package-producing colonies which produced less honey than control colonies were in 1984, and these colonies had received only 600 grams of pollen supplement, as opposed to 1550 grams in the other 1984 experiments. The higher level of feeding cost only $0.40 more than the lower one, indicating how a small investment in supplement can significantly increase the bee and honey production capacity of colonies.

We have also investigated the incorporation of bee production into management systems involving pollination (Scott and Winston 1985). In this study only one package or nucleus was produced per colony, since colonies had to be maintained at pollination strength, defined by the B. C. Ministry of Agriculture and Foods as 8 frames of bees and 5-6 frames of brood. Colonies from which bees were removed in the spring and which were used for pollination had significantly more sealed brood than the other treatments, and, as in the other studies, the highest profit per colony was realized from bee production treatments. Thus, the most intensive colony management for pollination, honey production, and bee production did not detract from overall colony vigor and yielded the best income.

## Discussion

The results from these studies are unambiguous; package and nucleus production in British Columbia is both biologically feasible and economically sound. Bee production has no deleterious effects on colonies, and can more than double profit per colony. These results have important implications for bee management in North America. Even without possible restrictions on package shipments to the northern United States and Canada, package production in British Columbia and possibly the northwestern United States has the potential to provide a new and lucrative source of income for beekeepers. However, the restrictions on package shipment already in place due to *A. woodi* and those likely to occur when Africanized bees and *V. jacobsoni* arrive in the southern United States will result in northern package production having a significant role in the beekeeping community during the coming years. In 1983, there were 18,130 commercial honey bee colonies in the potential package-production areas of British Columbia, which include the Okanagan Valley (Scott and Winston 1985), the Fraser Valley, and Vancouver Island. If four packages per colony were produced annually from each of these hives, British Columbia could provide 72,520 spring packages each year, and increased colony density and a higher level of commercial beekeeping could easily double that figure. We expect a sufficient number of queens to be available for these packages from a combination of queen overwintering, local spring queen rearing, and importations of queens from islands such as Hawaii and New Zealand, where mites and Africanized bees are not present.

Can Canada become self-sufficient, and supply all of our own packages, nuclei, and queens? I believe that we can approach that goal if the current trends in Canadian beekeeping continue (Winston 1983). There has been a tremendous increase in colony overwintering during the last ten years, so that more than half of Canada's 650,000 colonies are now overwintered. This trend has been due to both concerns about the availability of imported bees in the future and to economic analyses showing higher profits per colony from overwintered colonies than from packages (MacDonald and Monner 1982; McCutcheon 1984). Should this trend continue, it is not unreasonable to expect that 450-500,000 colonies may be overwintered in the future, and that 150-200,00 colonies will be initiated each spring from British Columbia packages. There is also a rapidly growing queen production industry in British Columbia and Alberta which will likely supply some of our spring queens for packages and, with the growing trend towards summer requeening, most of the replacement queens for normal colony requeening (Taylor and Clifford 1983). Thus, package production in British Columbia, when coupled with increased overwintering and queen production, could result in a high degree of Canadian self-sufficiency within the next few years, and even package exports to the northern United States. A number of beekeepers in British Columbia are beginning commercial package production, and this new industry will grow and provide an important source of bees in the future.

Acknowledgements

I am grateful to the students and technicians who have worked on this project, including Stephen Mitchell, Elizabeth Punnett, Cynthia Scott, and Linda Fergusson, and to Doug McCutcheon of the British Columbia Ministry of Agriculture and Foods for providing queens, colonies, economic analyses, and advice. Financial support was provided by grants from the British Columbia Science Council, Simon Fraser University, and the Natural Sciences and Engineering Research Council of Canada. This paper is dedicated to John Corner in recognition of his outstanding service to beekeeping in British Columbia and throughout the world.

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**Table 1:** Results of package and nucleus production experiments

| | TREATMENT: No. of packages or nuclei removed | | | | EXTRACTED HONEY Kg | PROFIT, $ | | |
|---|---|---|---|---|---|---|---|---|
| | 1-10 Apr | 11-20 Apr | 21-30 Apr | 1-10 May | | Packages/Nuclei | Honey | Tota |
| 1) 1985 Packages | | | | | | | | |
| Control | 0 | 0 | 0 | 0 | 17.9 | 0 | 21.66 | 21.6 |
| 2 Packages | 0 | 1 | 1 | 0 | 15.7 | 16.94 | 19.00 | 35.9 |
| 3 Packages | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 Packages | 2 | 1 | 0 | 0 | 23.4 | 25.41 | 28.31 | 53.7 |
| 3 Packages | 1 | 2 | 0 | 0 | 15.7 | 25.41 | 19.00 | 44.4 |
| 3 Packages | 0 | 2 | 1 | 0 | 25.2 | 25.41 | 30.49 | 55.9 |
| 3 Packages | 0 | 1 | 2 | 0 | 21.0 | 25.41 | 23.52 | 48.9 |
| 2) 1984 Packages | | | | | | | | |
| Control | 0 | 0 | 0 | 0 | 31.8 | 0 | 35.62 | 35.6 |
| 2 Packages | 0 | 1 | 1 | 0 | 15.6 | 16.94 | 17.47 | 34.4 |
| 3 Packages | 0 | 1 | 2 | 0 | 18.2 | 25.41 | 20.38 | 45.7 |
| 4 Packages | 0 | 1 | 2 | 1 | 19.2 | 33.88 | 21.50 | 55.3 |
| 3) 1984 Packages/Nuclei | | | | | | | | |
| Control | 0 | 0 | 0 | 0 | 25.8 | 0 | 28.90 | 28.9 |
| 2 Packages | 0 | 2 | 0 | 0 | 28.1 | 14.50 | 31.47 | 44.7 |
| 3 Packages | 0 | 2 | 0 | 1 | 24.1 | 21.75 | 26.99 | 48.7 |
| 2 Pack/1 Nuc | 0 | 2 | 0 | 1 | 28.2 | 29.40 | 31.58 | 60.9 |
| 3 Nuclei | 0 | 2 | 0 | 1 | 10.4 | 44.70 | 11.65 | 56.3 |

# RESEARCH REPORT
# BEE MANAGEMENT
November 1985

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Continuous pollen trapping Package bee colonies used in continuous pollen trapping studies produced an average of 12.7 kg and 7.2 kg of pollen in 1983 and 1984, respectively. There was little effect on brood production and a good honey crop was produced in each year. In 1983 the colonies with pollen traps produced 30% less honey than controls (significant at $P < 0.05$) and in 1984 18% less honey than controls (not significant). However, if one looks at the amount of pollen produced in addition to honey and the relative gross income, the pollen collecting colonies had the highest income (Table 1). Thus, in many regions the collecting of pollen should increase the gross income per colony.

Table 1. COMPARISON OF GROSS INCOME FROM COLONIES WITH AND WITHOUT POLLEN TRAPS

| Year | Treatment | Ave. Honey Production (kg) | Honey Income @ $1.10/kg | Ave. Pollen Production (kg) | Pollen Income @ $7.70/kg | Gross Income |
|---|---|---|---|---|---|---|
| | Control Colonies | 115 | $126.50 | - | - | $126.50 |
| 1983 | Trap Colonies | 79 | $86.90 | 12.7 | 97.79 | $184.69 |
| | Control Colonies | 129.5 | $142.45 | - | - | $142.45 |
| 1984 | Trap Colonies | 106 | $116.60 | 7.2 | 55.44 | $172.04 |

The effect of apiary relocation on the drift and loss of honey bees Relocation of colonies of honey bees showed a significantly higher rate of lost bees from transported colonies (move out and back to original position) than from unmoved colonies. Relocated colonies lost a significantly higher rate of bees than either unmoved or transported colonies. There was significantly more drift in relocated colonies than in the unmoved or transported colonies.

The use of coloured boards over the entrances of colonies significantly reduced the rate of loss for bees 21-34 days old compared to placing tree branches in front of colony entrances or to colonies without orientation cues. However, no difference in the rate of bee loss was evident for relatively young bees (7 to 20 days) for the same set of treatments. Coloured boards also significantly reduced drifting of older bees compared to colonies without orientation cues, but tree branches significantly increased drifting compared to the use of coloured boards.

There was no significant difference in the rate of bee loss between unmoved controls and the U (horseshoe) shaped layout; also the U shape layout significantly reduced bee losses and drifting of relatively old bees

(21-45 days) compared to the straight line, offset entrance layout.

In all trials, including unmoved treatments, bee losses occurred over the duration of the tests, (which varied from 7 to 16 days) however, the rate of bee loss decreased significantly after the first day.

Queen storage Queens stored for 17 days in (A) 4-frame nuclei, gained 60 mg, whereas, queens stored in (B) queen banks and (C) in an incubator, lost 6 and 30 mg, respectively. The queens in (A) were then transferred to a queen bank for another 17 days and lost 60 mg, and queens in B and C were transferred to nuclei and gained 30 and 59 mg, respectively. The use of nuclei, which allows each queen to lay to her potential, is a superior method of queen storage. Nuclei stored queens, therefore, should be used for the replacement of lost or failing queens as they provide the least interruption to colony development.

Nectar Studies Different Brassica species were compared for nectar volume and concentration under greenhouse conditions and there were some significant differences between species. For example, B. campestris, B. nigra and B. hirta were similar with regard to mean nectar production. Similarly, B. napus and B. juncea did not show significant difference in mean nectar volume. In general, the tetraploid species produced a significantly higher volume of nectar compared to diploid species.

The parents and two interspecific hybrids between B. napus (Westar and DI820) and B. campestris (Tobin) were compared for nectar volume and concentration. The B. napus varieties had significantly higher nectar volume as compared to the B. campestris variety, Tobin. However, the hybrids between the species displayed nectar characteristics similar to B. campestris.

The $F_3$ progenies from five intervarietal crosses (Cresar x Westar, Karat x Westar, Midas x Westar, Topaz x Westar and Rabo x Westar) of B. napus were evaluated for nectar volume and concentration under field conditions in 1985. The progenies from different crosses showed significant differences with regard to nectar production. The progeny from Rabo x Westar was highest in nectar production while the Topaz x Westar progeny yielded the lowest nectar. The progenies from other crosses were intermediate with regard to nectar production.

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# RESEARCH REPORT
# HONEY BEE DISEASES
November 1985

by T.P. Liu
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1. Identify the pathogen which causes the sacbrood-like disease in the honey bee Samples collected from Fairveiw area. All samples had identical symptoms i.e. larvae, pupae even pre-pupae were brownish in color, full of fluid and had extensive tissue histolysis. Preliminary electron microscope observations confirmed there were virus-like particles present in the body fluid and in the histolyzed tissue. More extensive work needs to be done in order to establish that virus-like particles are the true pathogen of the sacbrood-like disease. Ultracentrifuge and transmission electron microscope are essential for this type of work, but currently the Research Station does not have this equipment.

2. Study of the bee mites Varroa jacobsoni and Acarapis woodi (a) Scanning electron microscope observations confirm the Varroa mite possess a set of well developed chemoreceptors. These observations suggest that the Varroa mite locates its host and habitats by chemical communication. The Varroa mite is noted to prefer drone brood and that they are able to detect the specific volatile chemicals or odors in the drone brood. The present study suggests that pheromones and volatile compounds might be extracted and used in a mite trap. Pheromone traps have been used as one of the effective tools for integrated pest management. (b) In cooperation with Prof. R.A. Morse of U.S.A. and Prof. W.A. Ritter of F.D.R. a survey of microorganisms associated with the Varroa mite, by use of light and scanning electron microscopes, is being conducted. The purpose of this study is to find pathogens specific to Varroa or the ability of the Varroa mite to carry or to transmit honey bee pathogens. If specific pathogens are found they could be used as biological agents to control the Varroa mites. Spore balls of Ascosphaera sp were observed in the intestine; long rod shaped Bacillus sp. spores were observed in the intestine, Malpighian tubules and hemocoel; short rod shaped bacteria were observed in the intestine; and Rickettsia-like bacteria were observed in the hemocoel. On the surface of the of Aspergillus sp both germinated and intact condia were very common. (c) In cooperation with Prof. Ritter, F.D.R. and Prof. B. Mobus, U.K. a series of ultrastructure observations, were made on the effects of the tracheal mite, A woodi, on honey bee organs. Preliminary observations showed: 1) an extensive histolysis (degeneration) had occurred in the honey bee worker food glands heavily infected with A woodi; 2) dramatic fine structural changes took place in the corpora allata of the heavily infected honey bees.

3. Testing the effects of Acaracides (Menthol and Methyl salicylate) on the honey bee Nine hives of honey bee were used to test the above chemicals according to the techniques used in Europe and Mexico. The results showed that these two chemicals, especially menthol, caused

heavy mortality of worker bees and induced 3 of the 6 treated colonies to swarm. Also food gland degeneration was observed in all bees examined. Menthol, a very volatile compound, is very dangerous to use. These preliminary results indicate that these chemicals may cause severe side effects on bees and would be dangerous for beekeepers to use. Therefore, they cannot be recommended as potential control agents for use in Canada.

4. Testing the effect of antiprotozoal drugs on *Nosema apis* and *Malpighamioba mellificae* Antiprotozoal drugs are massively produced for the treatment of protozoal diseases such as malaria. These drugs are registered for use by humans throughout the world and are very inexpensive. *Nosema* and *Malpighamoeba* are protozoal diseases of the honey bee. Fumigillin is the only drug presently used for control of *Nosema*. Fumigillin is very expensive, very toxic to humans and its effectiveness is not conclusive. It is desirable to find a more effective, non toxic and inexpensive drug for controlling protozoal diseases in the honey bee. Sulfisoxagole at 0.5 mg/ml was effective in reducing the *Nosema* spore count. Metronidazole, formycin B and chloroquine at 0.05 mg/ml, 0.01 mg/ml and 0.05 mg/ml, respectively, were effective in reducing the level of *Malpighamoeba*. 5-chloro-7-iodo-8-hydroxyquoline, emetine and thimerosal at 1.0 mg/ml, 0.01 (Malpighamoeba) and 0.05 (Nosema) mg/ml, and 0.05 mg/ml, respectively, were effective against both *Nosema* and *Malpighamoeba*. Emetine at 0.05 mg/ml caused bee mortality of 8.4% and inhibited protein (royal jelly) synthesis, but destroyed the developmental stages of *Nosema* in the midgut. Thimerosal reduced spore levels, cause no bee mortality and allowed restoration of food gland activity. The effectiveness of these drugs were also confirmed by the use of the electron microscope and immuno-chemical observations.

5. Parasite-host relationship Electron microscope observations revealed that the corpora allata of the honey bee infected with *Nosema apis*, was distinctly different from those of healthy bees. This structural change indicates that juvenile hormone secretion was affected by the infection. Juvenile hormone controls royal jelly synthesis in the food glands.

6. Relationship between *Nosema apis* and other microorganisms Electron microscope observations on the midguts of honey bees infected with *Nosema apis* revealed that intracellular microorganisms were closely associated with the *Nosema apis*. This finding suggests that *N. apis* may have symbiotic relationships with one or more of these microorganisms.

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# BEE BREEDING RESEARCH RESULTS IN 1985

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## 1. HONEY BEE BREEDING

A closed population breeding program which started in 1979 with 20 families continued in 1985. Due to a very severe winter the selection of breeding stock was based on the wintering ability of bees. The sixth generation of the Alberta bee produced an average of 107.9 kg (238 lbs.) and 103.3 kg (228 lbs.) honey in two yards. These are remarkable results considering the drought conditions in the region.

The seventh generation of two strains of honey bee queens, Alta Peace and Alta Prairie were released to Fairview College, 471 queens, a limited number of 16 queens to Olds College and 244 queens remained in Beaverlodge. In 1985 an estimated 24,000 queens were reared from the Alberta bee by queen breeders in North America and 15,000 in South America.

On request of the Chilean government I travelled to that country (February-March, 1985) and advised on honey bee breeding. During the 1985 season two Chilean apiculturists studied and worked with the Bee Breeding Program at Beaverlodge.

## 2. THE THERMOLOGY OF WINTERING HONEYBEE COLONIES IN 4-COLONY PACKS AS AFFECTED BY VARIOUS HIVE ENTRANCES

Journal of Apicultural Research 24(1): 27-37 (1985), (Tibor I. Szabo)

**Summary**

Daily winter hive temperatures were recorded in multiple-packs of honeybee colonies (*Apis mellifera*) equipped with different types of hive entrance. Sixteen hives, each of two Langstroth boxes, were divided into 4 groups; these were then packed with insulation and tar-paper for wintering. In each group, two hives faced N and two S and the same treatment was used within each group. Treatments were: (1) bottom and top entrances (1 x 5 cm each; (2) fully open bottom entrance; (3) bottom and upper-side entrances (1 x 5 cm each); (4) bottom entrance (1 x 5 cm) and a 2.5 cm diameter auger-hole in the middle of the second chamber. During the 1979-1980 and 1980-1981 winters the temperature was recorded daily at 08.00 h using thermistors at 54 points in the SW hive in each of the groups. The ambient temperature fell as low as -38.8°C but the lowest hive temperature did not go below a range from -1° to -14°.

All colonies in treatments 1 and 4 maintained a temperature of 30° or higher in the winter cluster throughout both winters. All colonies occupied the upper hive body; colonies in treatment 1 occupied the area

close to the top entrance and in treatment 4 the area close to the auger-hole. The temperature of the cluster in colonies in treatments 2 and 3 fell to 28° or 29° on 2 days in December 1980. Colonies with the side top entrance (treatment 3) appeared to be unable to move consistently to that entrance. Colonies in treatment 2 appeared to move slowly to the upper hive body, whilst ambient temperatures remained relatively high they developed rapidly, but with a consequent drop in temperature they lost more cluster size than other colonies. The large quantity of stored food and absence or scarcity of empty cells appeared not to hinder cluster movement.

## 3. NECTAR SECRETION IN DANDELION

Journal of Apicultural Research 23(4): 204-208 (1984), (Tibor I. Szabo)

**Summary**

Nectar secretion was studied in dandelion growing in a crested wheat-grass field in the Peace River region of Alberta, Canada. The average number of flowers produced daily in an area 1 $m^2$ was 59.2 in 1981 and 8.9 in 1982. Most flowers opened in the morning and closed in the afternoon. Quantity and concentration of nectar were significantly higher in flowers 2 days old than in those 1 day old. Average nectar volume, sugar concentration and sugar value were 7.4 1/flower, 55.1% and 5.2 mg/flower/24 h respectively in 1981 and 3.7 1/flower, 42.6% and 1.9 mg/flower/24h in 1982. Larger flowers produced more nectar. Nectar-sugar concentration and sugar value increased with increasing temperature. High nectar-foraging activity by honeybees coincided with peak nectar-sugar production.

## 4. VARIABILITY OF FLOWER, NECTAR, POLLEN AND SEED PRODUCTION IN SOME CANADIAN CANOLA (RAPESEED) VARIETIES.

American Bee Journal, Apicultural Research, 125(5): 351-354
(Tibor I. Szabo)

**Summary**

Fifteen varieties and breeder's lines of *Brassica napus* (Argentine type canola) and 7 varieties and breeder's lines of *B. campestris* (Polish type canola) differed in characteristics such as number of flowers, amount of nectar, pollen and seed production. A significantly greater volume of nectar was extracted by centrifuge method than with capillary method. The nectar from *B. napus* and *B. campestris* contained 29.8 ± 0.9% and 40.39 ± 2.13% sugar, respectively. The sugar value determined by centrifuge method for *B. napus* was 0.452 ± 0.01 mg/flower/24h and pollen grains/anther (x $10^3$) were 15.84 ± 0.51 while *B. campestris* varieties had a sugar value of 0.285 ± 0.06 mg/flower/24h and 15.91 ± 0.46 pollen grains/anther (x $10^3$). Individual flowers of Regent and Candle cultivars were blooming for approximately 2 days. The sugar production figures for *B. napus* amd *B. campestris* varieties were 7.06 0.41 and 9.47 ± 2.15 kg/ha/24h respectively. Pollen production was 9.33 ± 0.54 and 20.24 ± 1.59 kg/ha/24h and seed production was 3049.8 ± 103.8 and 2673.7 ± 42.8 kg/ha, respectively.

The number of *B. napus* flowers per plant significantly correlated with sugar concentration, nectar volume, sugar value and seed wieght per plot. Nectar volumes and sugar values determined by capillary and centrifuge methods significantly correlated with each other.

The number of flowers per ha was significantly correlated with the production of sugar, pollen and seed. Sugar production and pollen production per ha were also significantly correlated.

## 5. FLOWERING, NECTAR SECRETION AND POLLEN PRODUCTION OF SOME LEGUMES IN THE PEACE RIVER REGION OF ALBERTA, CANADA

Journal of Apicultural Research 24(2): 102-106 (1985)
(Tibor I. Szabo and Henry G. Najda)

**Summary**

Twelve cultivars of red clover (*Trifolium pratense*) differed in numbers of inflorescences/unit area of row, and in nectar secretion characteristics, but not in number of pollen grains per anther. Inflorescences contained from 8.1 to 34.0 1 nectar with sugar concentrations ranging from 33.1 to 49.3% (from 4.4 to 14.8 mg sugar/inflorescence) and from 267 to 554 pollen grains per anther. All cultivars began to flower within 2 weeks of one another and continued over a 12-week period.

One cultivar of each of 3 species of alfalfa (*Medicago sativa*, *M. falcata* and *M. media*), one cultivar of each of red clover (*T. pratense*), alsike clover (*T. hybridum*), white clover (*T. repens*) and birdsfoot trefoil (*Lotus corniculatus*) were compared for numbers of inflorescences per unit area, nectar secretion and pollen production characteristics. Seasonal nectar-sugar production of Altaswede red clover was estimated at 883 kg/ha, compared with estimated yields of 254-558 kg/ha for the alfalfa cultivars. Dawn alsike, Daeno white clover and Leo birdsfoot trefoil had estimated sugar yields of only 44, 24, and 23 kg/ha respectively. The high nectar yields of red clover in the Peace River region should support a substantial increase in numbers of honeybee colonies.

# BEE RESEARCH AT THE UNIVERSITY OF MANITOBA

Reported by S.C. Jay

## (1) Foraging Behaviour of Honey Bees on Selected Canola Cultivars (N. Bertholet and S.C. Jay)

The behaviour of honey bees on *Brassica campestris* (cv. Candle, Tobin) and *Brassica napus* (cv. Altex, Andor, Regent) was examined to determine their value as pollinators of this valuable crop. Nectar production, pollen trap collections, bagged vs unbagged plant trials, etc. were also included in this study.

Both *B. campestris* and *B. napus* show daily patterns of nectar secretion; Mean daily nectar production for *B. campestris* reached a maximum of 0.68 µl with a maximum mean sugar concentration of 65% while *B. napus* reached a maximum of 2.15 µl with a maximum sugar concentration of 62%.

Honey bees "thieve" nectar from *B. napus* flowers. They sometimes collect pollen from both species of canola. Honey bees spend a maximum of 0.13 min./flower foraging on *B. campestris* and a maximum of 0.12 min./flower foraging on *B. napus*. Bees visit a maximum of 2.8 flowers/plant on *B. campestris* and 2.6 flower/plant on *B. napus*.

Honey bees did not show consistent daily patterns in their foraging behaviour, nor did they show a preference for any one canola cultivar. Honey bees appeared to increase seed yields significantly in both species in bee exclusion trials.

## (2) The Effect of Apiary Relocation on the Orientation of Honey Bees (D. Nelson and S.C. Jay)

The effects of apiary layouts, orientation cues, colony and apiary size, bee age and colony weight gain were evaluated in terms of bee losses and drifting after transportation and, or relocation of apiaries.

Relocated colonies lost significantly more bees and had significantly more drift than occurred in unmoved colonies. There was no significant difference in the rate of bee loss between the horseshoe layout and unmoved controls; also the horseshoe layout significantly reduced bee losses and drifting of 21-45 day old bees compared to the straight line-offset entrance layout. Coloured boards (above hive entrances) significantly reduced drifting of older bees compared to colonies without orientation cues, but tree branches (across hive entrances) increased drifting.

Relocating colonies, and the use of various layouts during the nectar flow, did not affect colony weight gain over a 9-day period following relocation compared to an unmoved control group. In all trials, bee losses occurred over the duration of the tests (which varied from 7-16 days) but the rate of loss decreased significantly after day 1.

### (3) Management Strategies for Use With Palletized Honey Bee Colonies
**(D. Dixon and S.C. Jay)**

Despite the fact that Canadian beekeepers move their hives between 1 and 5 times per season, it appears that only about 10% of them use pallets and mechanical loading devices. Thus we have undertaken an orientation and honey production study based on 5 colony configurations placed in groups of 4 on pallets.

In 1985 three replicates of each of the 5 configurations were used (with 7, 14, and 21 day old marked bees placed in each) to determine drifting patterns of bees. In 1986, 15 beekeepers will determine the honey production of selected configurations of colonies on pallets as well as assist in management technique studies of such systems.

### (4) The Effects of Aerial Application of U.L.V. Malathion for Mosquito Abatement Programs on Honey Bee Colonies
**(T. Pankiw and S.C. Jay)**

Malathion (Ultra Low Volume formulation) is used in some aerial spray programs to reduce insect vectors of Western Equine Encephalitis. In some cases honey bee colonies appear to have suffered damage as a result of these spray programs. Thus a two-year study has been completed in which aerial spraying of colonies, under controlled conditions, has been completed.

The following were included in the study both within and outside the spray area: (a) caged bees and mosquitoes, (b) counts of bees on plots, (c) entrance counts, (d) pollen trap collections, (e) colony populations, (f) dead bee trap collections, (g) honey production, (h) chemical analyses of pollen and nectar in the hives, honey sac contents and dead bees, etc..

The data are being analyzed at present and should provide information about the economic effects of U.L.V. malathion sprays on bees and assist in determining the compensation beekeepers should receive when colonies are damaged.

### (5) Pollination Studies of Faba Beans
**(S.C. Jay)**

The Bee Section (University of Manitoba) has linked with the International Centre for Agricultural Research in the Dry Areas (I.C.A.R.D.A.) in Syria to assist plant breeders of faba beans with problems relating to the pollination of this crop.

Research was initiated in 1985 using various "guard" crops around faba bean plots, and repellents sprayed on crops, in an attempt to prevent pollinators from foraging on the crop and thus reduce or prevent outcrossing. A second series of trials involve the use of young honey bee foragers, and alfalfa leafcutter bees, in cages in an attempt to increase outcrossing for specific genetic lines.

This study will continue for two more years through I.D.R.C. funding.

## (6) Factors Affecting the Longevity, Acceptance and Orientation of Drone Honey Bees

(R. Currie and S.C. Jay)

The longevity of adult drones and factors affecting the acceptance of introduced drones have been examined in this study. Drones were evaluated as potential vectors of diseases by determining the proportion of drones that drift, the effects of the age of drones on drift, the distance that drones drift, the number of times that drones drift and the effectiveness of different commercial apiary layouts in reducing drone drift. The possible influence of the sun's position and its apparent westward movement across the sky, on the orientation of different age groups of drones were studied in rows of 5 hives and in paired colonies that faced the four cardinal points of the compass. The ability of colonies with virgin queens to attract drones from neighboring colonies and their ability to retain drones from their own colonies were studied. The effects of the age of virgin queens, the type of queen (queenless, mated, virgin) and Trans-9-oxodec-2-enoic acid on different age groups of drifting drones were assessed. The effects of queen type on the flight behaviour of drifting drones was also studied.

The mean longevity of adult drones during the honey flow period was found to be 13 days. Acceptance of introduced drones can be highly variable and varies with the season, the climatic conditions, the amount of forage collected and stored and the presence or absence of a queen. The best technique for introducing drones was to place a queen excluder between the bottom board and brood chamber for 12-18 hours after the drones were introduced. When this technique was used highest acceptance was achieved when drones were introduced in the afternoon. Fifty drones was found to be the optimal number to introduce into a single storey hive.

Drones began drifting when 5-7 days old. Forty eight percent of drones drifted by the time they were 13-15 days old. Drifting continued in all ages of drones and drones frequently drifted more than once. Drones can drift to colonies spaced up to 150 m. away. The proportion of drones that drifted was reduced slightly by placing colonies in a horseshoe or paired colony layout. The direction that colonies faced did not affect the proportion of drones drifting if colonies were queenright. However, if colonies were queenless or had virgin queens drifting was significantly lower in rows that faced north and south than in east and west facing rows.

The position and apparent westward movement of the sun appeared to influence the drifting of drones along rows. Drift was greater towards the west in north and south facing rows and greater towards the south in east and west facing rows. This response was fairly consistent in all age groups of drones and in colonies with different queen types. Observation of drones in south facing hives indicated that drones drifting towards the west flew on longer flights than drones that drifted towards the east.

The proportion of drones that drifted to a colony was affected by the colonies' queen type. Colonies with virgin queens attracted drones from neighboring colonies. However, colonies with virgin queens did not retain their own drones. The proportion of drones that were attracted varied with the age of the drone and appeared to be related to quantitative and qualitative changes in production of the queen's pheromone.

# UNIVERSITY OF GUELPH

## Evaluation of Canadian Honey Bee Stocks (Gard Otis and Gordon Grant)

Six stocks of bees were established by requeening hives in summer 1984, with queens from the following stocks: B.C. Powell River, B.C. Vernon, Alberta "Peace River", Alberta "Prairie", Hastings Carniolan (from Strachan in California), and Ontario unselected stock. During winter 1984-85 we determined honey consumption and nosema infection in colonies headed by those queens. During summer, 1985, we evaluated the following additional characteristics: brood area and number of frames with brood in late May-early June, late June-early July, and mid August; amount of stored pollen at those three periods; defensiveness; honey bee size (fresh and dry weight), corbicula (pollen basket) area; and queen supersedure. Additional data on winter honey consumption will be obtained during winter 1985-86. Most data will be analyzed by January, 1986 to determine stock characteristics.

## Effect of Winter Cover Design on Overwintering (Gard Otis and Gordon Grant)

In conjunction with the evaluation of Canadian honey bee stocks, hives were fitted with three different inner covers: standard covers (e.g., stock item at F. W. Jones and Sons), Shaparew ventilating inner covers, and insulating inner covers that had 2" of blue styrofoam insulation inside them. Inner covers were randomly assigned within hives of each genetic stock. Colonies with standard and ventilating covers consumed equivalent amounts of honey (13.5 kg and 13.4 kg respectively) during the winter (early November to March), but hives with insulating covers lost significantly less weight (11.8 kg) during the same time period. Nosema infection was least in colonies with ventilating covers and greatest in colonies with standard covers. Spring brood areas were not different between treatments. Overall, it would appear that the insulating cover was slightly better primarily because of the reduction in honey consumption. Insulating and ventilating covers would cost approximately the same to buy fully constructed; standard covers are less than half the price of ventilating covers.

## The Influence of Genetic Relatedness on Worker Visitation to Honey Bee Larvae (Gard Otis and Debbie Randall)

Colonies were established with cordovan queens instrumentally inseminated with semen from one cordovan male and one black male. The resultant workers could be easily divided into "cordovan" and "normal" morphs. Worker visitation by the two types of workers to larvae was recorded. Queen larvae were observed in queenless hives and worker larvae were observed in queenright hives. Once larval cells were capped, they were placed in vials (for queen larvae) or screened (for worker larvae), and the morphs of the adults that subsequently emerged were scored. There was no preference of workers to preferentially care for full-sister larvae. The results suggest that previous studies that reported the operation of kin selection in honey bee colonies were premature and incorrect. Moreover, the results support the general mechanism for learning of nestmate odors that has been found in several species of social Hymenoptera.

Changes in Tracheal Mite Populations During Winter (Gard Otis, Gord Grant, and Debbie Randall)

Tracheal mites are present in hives in a commercial outfit in New York approximately 80 km from Fort Erie, Ontario. Forty hives were sampled on 17 October, and 100 bees from each sample are presently being analysed for presence of mites, approximate mite infestation level, and presence of adult and immature stages of mites. From this initial group of hives, 20-30 hives with varying levels of mite infestation will be sampled regularly throughout the winter at approximately 5-6 week intervals. This research will allow us to evaluate seasonal changes in mite populations, the reproductive cycle of the mite, and the effects of the level of infestation on colony population growth in a climate quite similar to southern Ontario. Levels of mite infestation in bees that have died will be compared with those in living bees from the same hives to estimate the effect of the mites on bee survivorship. A method for rapid analysis of tracheal mites using gas chromatographic techniques will be investigated.

Effects of Larvae on Protein Synthesis Activity of Hypopharyngeal Glands (Zhi-yong Huang and Gard Otis)

Several experiments have now clearly indicated that larvae cause the hypopharyngeal (HP) glands to become activited in honey bees. A new *in vitro* technique was developed to measure glandular protein synthesis. Radioactive leucine is injected directly into bees. After an incubation period, the HP glands are removed from the heads of the bees and the radioactivity in them is measured. By the age of three days, bees that had access to bee brood were synthesizing more protein in the HP glands than were the bees from colonies that lacked brood, and that synthesis remained at a higher level throughout the rest of the lives of the bees as long as they continued to have access to larvae. Experiments on which stage of bee brood activated the glands indicated that only larva are effective. It is likely that larvae possess a pheromone that causes the activity of the HP gland, but this has not yet been demonstrated.

Effects of Hive Size on Colony Demography (Gilberto Morales and Gard Otis)

This experiment investigated the effects of nest size on swarming behavior and colony survivorship. Ten hives were established in each of three hive sizes: small (21 L), medium (42 L), and large (84 L). All the colonies in small hives swarmed, producing a total of 14 swarms. However, all the parental colonies in small hives and most of their swarms died during the winter. Colonies in medium hives had moderate reproduction (6 swarms) and intermediate survivorship. None of the colonies in large hives swarmed, but they did rear numerous queens and half of them superseded their queens. Supersedure was important for survival: all of the colonies with supersedure queens survived whereas none of the colonies with old queens lived. In order to produce a viable population, only hive sizes that allow for both colony reproduction and survival are possible. This corresponds to the medium-sized (42 L) hives in this study. Previous studies on the choice of cavities by swarms have indicated that they prefer nests of intermediate size, which may be related to the influence that cavity size has on swarming and colony survival, as demonstrated by this study.

**Pollination Studies** (Peter G. Kevan)

Pollination research in crop plants in Ontario has concentrated on oil seed crops and small berries. In canola, we found that bee pollination benefits crop yields in 3 varieties tested. Of particular interest is the increases found in the oil yields of out-crossed seeds. In soybean cv. Maple Arrow, we did not find any beneficial effects of insect cross-pollination, although in other varieties grown elsewhere and in Ontario, such benefits are known. Three varieties of sunflower were examined this summer. All showed, as expected, benefits from cross-pollination. In all of the above oil seed crops, full analyses are in progress.

The small berries examined were lowbush blueberries, cranberries, and elderberries. The lowbush blueberries of northern Ontario require insect cross-pollination for fruit set. A variety of native bees, especially andrenids, halictids, and bumblebees seem to be responsible but are in low populations. Honeybees were introduced to a newly started commercial operation but the experiment failed due to the failure of the blueberry bloom. Continued research on cranberries in the Muskoka region indicates that bumblebees are the most important pollinators and that honeybees should be used only as insurance against poor populations of bumblebees on the small commercial bogs. The situation with elderberries conducted in 1984 and 1985 indicate that cross-pollination may be more important than previously realized.

Other pollination studies on native plants have been successful. The prairie rose (<u>Rosa setigera</u>), a rare species in Ontario is a highly sought after pollen plant by bees. It is dioecious, unlike other roses, but has pollen-only flowers. Thus, the flowers of female plants produce a surrogate pollen which is collected by bees, including honeybees. Other plants which have been investigated include wild grapes, Kentucky coffee tree, hop tree, mulberry, pitcher plant, and milkweed.

# APPENDIX I

## Africanized Bee in California

Submitted by:

E. C. Mussen

# AFRICANIZED BEE NEWS
## CALIFORNIA DEPARTMENT OF AGRICULTURE

### THE FIRST SEVEN WEEKS

On July 23, 1985 a sample of bees from Lost Hills, California was confirmed to be Africanized. A machine operator had reported seeing bees swarm from a kit fox den and kill a rabbit. The operator had covered the burrow with dirt and chunks of asphalt. A small cluster of bees remaining at the site was sampled by a Kern County Apiary Biologist.

On July 24 a special task force assembled at the Kern County Agricultural Commissioner's office. The task force included specialists from CDFA, University of California, USDA, Kern County, and biologists loaned by other counties (Tulare and Fresno). By 9:30 am a crew using a helicopter, was mapping the area. Ground survey crews assembled at Lost Hills. By week's end a 400 square mile area had been mapped locating 97 apiaries containing 9,200 commercial bee hives (colonies). Each apiary was placed under hold order and each colony given a kick-test for aggressive behavior. No aggressive behavior was found.

Based on the machine operator's testimony and examination of 24 nest combs found in a cavity between two large timbers below the kit fox den, the first find (1 on map) was determined to be a good-sized colony of Africanized bees which had occupied the nest site for more than a year and at the time of discovery had built at least three queen cells and stopped other brood rearing in preparation to abscond. The colony probably absconded in early June.

A 462 square mile area has been placed under State and Federal Quarantines. One serious violation occurred in which a beekeeper moved supers (boxes) of honey comb containing bees from the quarantine area. The load was intercepted at Riverside and the bees killed. Criminal charges are being pursued against the violator.

Testing of managed apiaries within the quarantine area is in progress. Apiaries which test free of Africanized bees and parasitic mites may be certified for removal of honey supers not containing drone brood or bees, if the apiary is not within two miles of a site where Africanized bees have been found.

A 500 bee composite sample is taken from each apiary and submitted in alcohol to the CDFA Sacramento lab for mite tests. The sample is shaken and the alcohol examined for dislodged Varroa mites. Fifty bees are then dissected and the breathing tubes examined for tracheal mites.

A 50 bee sample is taken from each colony to test for Africanization. Each sample is immediately frozen in dry ice to preserve body weight. The Africanization test which formerly took up to 30 hours per sample has been modified into a four-step screening process. Steps 1 and 2 are done in a field lab at Bakersfield, where 92% of the samples are screened out as European bees by measurement tests which take 15 and 60 minutes each. Samples passed on to step 3 at U.C. Berkeley require up to two hours per test and those going to USDA-ARS Bee Breeding Lab at Baton Rouge, Louisiana, for step 4 and final determination, require four hours per sample.

Additional nests of Africanized bees have been found. The second find (2) August 8, was a swarm which had recently displayed a European bee colony in a managed hive two miles north of the original find. This swarm consisted of a queen, three drones and 3,500+ worker bees. This may have been the swarm which absconded from the nest below the kit fox den. The survey area was extended two miles northward (42 square miles). Aerial and ground surveys revealed five additional apiaries in the northward extension.

The third find (3) August 14, was a well-established Africanized bee colony which had been in a hollow tree stump, seven miles southwest of the original site for more than a year. The southwest survey area was extended 172 square miles. Three apiaries were found in the southwest extension.

Apiaries in the extended survey areas have been placed under hold order until everything within two miles of them has been tested free of Africanized bees and parasitic mites.

The fourth find (4) August 21, is considered to be a "carry-out". Early this spring a Bakersfield beekeeper captured a swarm in the Lost Hills area. The swarm was found occupying previously built combs in an abandoned water tower enclosure (4a). The swarm had brood in early stages of development but none had yet hatched. The beekeeper hived the swarm and placed it with his 25 other colonies at a location near California State College at Bakersfield. The colony was a good producer but was very aggressive at times and kept raising queen cells in an effort to swarm. The beekeeper learned how to manage the colony so as to avoid stings and weekly cut out queen cells to prevent swarming. Surplus brood from this colony was used to make increase but no queens were reared until late July. By preventing swarming he was able to increase the population of this colony until it occupied five hive bodies. His apiary of 25 colonies was taken on May 1 to Kelso Valley (midway between Lake Isabella and Red Rock Canyon on the eastern side of the Sierras) 50 miles east of Bakersfield.

During the six weeks this apiary was on the wild buckwheat nectar flow this colony swarmed (about June 1). The apiary was returned to the southwest Bakersfield area about mid-July where it was increased by raising queens and dividing colonies. Hearing of the Africanized bee descriptions the beekeeper suspected this colony might be Africanized. He contacted the county apiary biologist. Priority testing revealed the colony to be Africanized. All apiaries within two miles of the present apiary site (4), past apiary sites (4b) and extracting plant (4c), have been placed under hold order for testing. A feral swarm survey is underway in Kelso Valley. Beekeepers who normally move apiaries into that area now for fall flowers have been warned to keep managed apiaries out.

The fifth find (5) August 29, was a well-established Africanized bee colony occupying a standard three-story (recently supered) hive in a migratory apiary of 184 colonies just 1.3 miles east of the original Lost Hills find. The apiary had been moved to its discovery site on July 23. Its low testing priority despite its closeness to the original find was due in part to its being a recent move-in.

The sixth find (6) September 6, was an Africanized bee swarm which in early July had moved into unoccupied combs in a dead-out hive among 101 colonies in a migratory apiary located four miles east of the first find. The swarm had a young queen, 8,300 workers, but no drones. The cluster occupied eight comb sides, had produced just enough honey to meet colony needs, and had begun three queen cells in preparation to swarm. There were six comb sides well-filled with healthy brood in all stages.

Feral (wild) bee nests reported within a 50 mile radius of the original Lost Hills site are being killed and sampled. The public is being asked to assist in locating feral nests. Trained crews have inspected all residences and possible nest sites within the quarantine area and are searching extended survey areas for feral nests.

Trap hives have been deployed at the rate of 16 per immediate square mile (core area) and one trap per square mile in the rest of the quarantine area and extended survey areas. These are being checked weekly for swarms. Three swarms have been captured in trap hives and found to be European.

By September 18 the project had sampled 16,295 colonies in the quarantine area (462 square miles), extended survey areas (400 square miles) and two mile radius exposure zones outside quarantine area. Initial step 1 and 2 testing of managed colonies in quarantine area is expected to be completed by early October. Testing of colonies in expanded survey areas, feral nests in 50 mile radius call-in area, and retesting of colonies in two mile radius exposure zone is expected to extend step 1 and 2 testing through mid-November.

Feral nest survey by September 18 had located 41 nests by residential/structural survey and 332 in response to 552 public call-ins.

## COUNTY HELP DURING INITIAL PHASE

It was immediately apparent that each apiary within the intitial 462 square mile quarantine must be tested for Africanized bees. It was decided that a 50 bee sample be taken from each colony in the apiaries. Many counties with strong bee programs were contacted. Those counties able to help (the State provided mileage, per diem and overtime expenses) included: Fresno, Glenn, Kings, Merced, Riverside, Sacramento, San Bernardino, Santa Barbara, Stanislaus, Sutter and Tulare. The professionalism and dedication of these experienced county apiary inspection personnel made it possible for the Africanized Bee Project to rapidly sample apiaries within the project areas. By August 30, samples from 14,623 colonies in 183 apiaries have been collected with this extra help and placed in the freezer for testing.

## AFRICANIZED BEE SCIENTIFIC ADVISORY PANEL

A Scientific Advisory Panel was formed to help guide the Africanized Bee Project. The panel consists of Dr. Norman Gary, University of California, Davis, Chairman; Dr. Orley Taylor, University of Kansas, Lawrence, Kansas; Dr. Tom Rinderer, USDA Bee Laboratory, Baton Rouge, Louisiana; Mr. Steven Park, commercial beekeeper, Palo Cedro, California; Dr. Howell Daly, University of California, Berkeley; and Dr. Eric Mussen, University of California, Davis.

The Scientific Advisory Panel met on July 30, and again on August 29. Following are copies of their recommendations.

### RECOMMENDATIONS OF SCIENTIFIC ADVISORY PANEL
### July 30, 1985

1. IT IS THE OPINION OF THE PANEL THAT, actions taken by State, County and Federal officials, to date, were appropriate.

2. IT IS THE OPINION OF THE PANEL THAT, an Africanized bee colony of unknown origin was established for at least one year at the discovery site. Based on the observed evidence, queens were produced. Swarming and/or absconding may have occurred. There is evidence of subsequent hybridization of the originally discovered colony with European bees.

3. IT IS THE OPINION OF THE PANEL THAT, although reproductive activity leading to the creation of new colonies may have occurred, it is highly improbable that there will be any long term effects because the typically high density of European colonies in the 400 square mile area will cause genetic dilution, leading to the elimination of honey bee colonies with recognizable Africanized bee characteristics.

4. IT IS THE OPINION OF THE PANEL THAT, there is a very low probability of introduction of parasitic mites, namely Acarapis woodi and Varroa jacobsoni. No mites were found on the living bee samples from the Africanized bee colony.

5. IT IS THE RECOMMENDATION OF THE PANEL THAT, all reported feral bee colonies within a fifty (50) mile radius from the original site be appropriately sampled and destroyed. The sample shall consist of fifty (50) adult bees; and, when possible, a central brood comb of at least 5 x 5 inches.

6. IT IS THE RECOMMENDATION OF THE PANEL THAT, when depopulization of individual colonies is required, Resmethrin will be used. Cyanide gas would be used if Resmethrin is not available.

7. IT IS THE RECOMMENDATION OF THE PANEL THAT, the general public be encouraged to report the presence of feral nests and swarms until such time as all colonies have been released and eradication has been announced.

8. IT IS THE RECOMMENDATION OF THE PANEL THAT, colonies within the 400 square mile area be sampled, prior to release, by statistically valid techniques. While the Panel considers it unnecessary to sample 100% of the colonies, the Director may exercise this option to assure the public that Africanized bees do not exist in these apiaries.

9. IT IS THE OPINION OF THE PANEL THAT, the introduction of these African bees is related to acts of man, and is not associated with the natural spread of Africanized bees in Central America.

## RECOMMENDATIONS OF SCIENTIFIC ADVISORY PANEL
## August 29, 1985

1. IT IS THE OPINION OF THE PANEL THAT, the project is proceeding satisfactorily and that extremely valuable information has been generated. We recommend that the project be continued, according to the recommendations of July 30, 1985, as well as the recommendation herein.

2. THE PANEL REAFFIRMS its previous recommendations of July 30, 1985.

3. IT IS THE OPINION OF THE PANEL THAT, there is adequate scientific evidence that genetic dilution is in progress and Africanized bee traits will disappear eventually, as a consequence of regulatory activities and natural processes. Samples of bees analyzed to date indicate mixed parentage.

4. THE PANEL RECOMMENDS, expansion of the survey area around the perimeter of the existing quarantine area, as proposed by the project and shown on the attached map.

5. THE PANEL RECOMMENDS, based on data obtained during the identification of bee samples from the currently regulated area, that the probability criteria for European bees be changed by appropriate federal and state scientists, in order to accelerate the identification process.

6. THE PANEL RECOMMENDS THAT, no additional trap hives be deployed at this time because the season for swarming has essentially ended. The project should continue to service presently deployed trap hives.

7. THE PANEL RECOMMENDS THAT, all managed bee colonies be removed immediately from Kelso Valley and that the Valley shall remain free of managed bee colonies until June 1, 1986, because there is circumstantial evidence that an Africanized swarm may have escaped recently into Kelso Valley. Furthermore, foraging bees should be sampled and identified at appropriate intervals prior to June 1, 1986. Any feral colonies detected in the Valley, prior to the release date, must be processed identically to feral bee colonies found in the current regulated areas.

8. THE PANEL WISHES TO COMMEND Mr. Charles Brewer for his actions in helping to detect and abate Africanized bees in his Apiary. In view of the extremely helpful contributions of beekeepers to detection of suspected Africanized bee colonies, the panel recommends that the names of cooperative beekeepers be kept anonymous, if they wish. Beekeepers are urged to report any of their colonies suspected of being Africanized to the local Agricultural Commissioner or the Africanized Bee Project at (805) 392-0853.

**ADDITIONAL AFRICANIZED BEE FINDS**

The seventh find (7), confirmed September 27, was a feral bee colony nesting in a 6" steel pipe used to support a retaining wall at an oil processing facility in the Kern River Oil Field. The site is 5 miles north of Bakersfield and 1.4 miles north of the Kern River just east of Oildale. It is 2.2 miles southeast of the honey extracting plant associated with find number four. The oil company safety officer who reported the feral nest said the bees had occupied the pipe since February or March of this year and had shown no aggressive behavior.

Because this feral colony showed definite signs of genetic dilution, no additional quarantine area will be established at this time. Apiaries within a two mile radius of the new find will be kept under hold order to prevent removal of any bees until these colonies can be tested for Africanization. A 40 square mile area around the discovery site will be surveyed for additional feral nests. If the survey turns up additional colonies showing Africanization without signs of genetic dilution, the need for the additional quarantine area will be reevaluated.

The eighth find (8), confirmed Octover 2, was in an apiary of 147 colonies located five miles southeast of the original Lost Hills find. This hive had contained a fall divide made with a mated European queen at a location in the Buena Vista Lake Bed (33 miles southeast of Lost Hills), during 1984 cotton nectarflow. Before being moved to Lost Hills area on April 28 this apiary was on oranges near Famosa (33 miles east of Lost Hills). This colony had shown no aggression, but was found to be a poor honey producer and requeened for that reason shortly after sampling. All other colonies in the apiary tested European. No expansion of the quarantine area is required.

**MORE AFRICANIZED BEE FINDS WITH MIXED PARENTAGE**

Three genetically diluted Africanized bee finds were confirmed on November 6. These were the last of 20,552 samples tested since the project began.

The ninth find was a feral bee colony nesting 30 feet above ground on a tree limb at a residence located just south of Bakersfield College in the northern part of that city. The swarm was first observed the week before Easter. At the time of collection, on September 22, the largest of three nest combs was about 18 inches long. There was nothing unusual about the size, color or disposition of the bees which were tightly clustered on combs with all stages of healthy brood, but very little honey. Thirty-two other nests of feral bees had previously tested European within a two-mile radius of this nest. A survey is being made of this area to find additional colonies for testing.

The tenth find was in a managed apiary of 153 colonies first sampled September 4. The apiary is located in the extended area just south of the southeast corner of the quarantine survey areas (T29 R23 S6). Nine other apiaries within a two-mile radius are being tested or retested to determine if any of the other 928 colonies in the area are Africanized.

The eleventh find was a football-size swarm without comb found clustered on a 10 inch pump discharge pipe 50 feet from a trap hive (T29 R23 S1) 5 miles east of find number ten and 1.5 miles south of the water tower from which find number four was collected as a swarm. There was nothing unusual about the appearance of the queen or bees which remained calm while being scraped off the pipe into a plastic bag on September 13. A farm laborer said the bees had been there about a week.

**APIARIES WITHIN QUARANTINE AREA**

All but two of the 124 apiaries within the 462 square mile quarantine area have been tested and cleared for certification to move from the area. The remaining two apiaries are within two miles of find number ten and must be retested. If no more Africanized bees are found, the quarantine will be lifted after testing is completed.

**TESTING PROCEDURE**

The procedure to identify honey bees for the Africanized Bee Project is comprised of four steps. Steps One and Two are performed at the project's field lab in Bakersfield. Step Three is performed at U.C. Berkeley and/or CDFA Entomolgoy lab at Sacramento which also performs Step Four with final determinations confirmed by the USDA-ARS Bee Breeding Lab at Baton Rouge, Louisiana.

Steps One and Two require 35mm slide projectors and 25 feet of projection space. Step Two requires a direct reading milligram scale. Steps Two, Three and Four require computers. Steps Three and Four require dissecting microscopes and mounting materials.

In the field 50 live bees are taken from each colony or swarm to be tested for Africanization. The sample is immediately frozen with dry ice in portable coolers and transported to a freezer at the Bakersfield facility where the bees are kept frozen until ready for testing. Freezing is necessary to preserve the body weight for Step Two testing. Otherwise, samples could be collected and kept in alcohol.

Step One

The single character which most rapidly discriminates European bees is forewing length. The right forewings from 10 bees are mounted between 20mm x 40mm microscope slide cover glasses and inserted into a plastic 35mm slide projection mount. The slide projector is adjusted to accurately project a calibration scale. The image of the mounted wings is then projected and measured. An average wing length of 9.070mm or longer discriminates the sample as "European". Averages between 9.069mm and 8.946mm go to Step Two. Averages shorter than 8.945mm go directly to Step Four. Of samples tested at Bakersfield 88% of the managed colony samples and 66% of the feral samples were discriminated as "European" at Step One which requires about 20 minutes per sample.

Step Two

The second Step is based on computer analysis of four characters: forewing length, hindwing length, hindleg femur length, and clean weight (bee after intestinal-crop contents and pollen-loads are removed by squeezing). Insect parts are mounted, projected and measured as in Step One, and the data entered into a computer program with the average clean weight of three lots of 10 squeezed bees each (30 bees total). The computer is programmed to evaluate data and read-out probability of sample being either European or Africanized. Step Two at Bakersfield discriminates an additional 9% of managed colony samples and 10% of feral samples as European so that only 3% or 4% of the samples are forwarded for Step Three or Four testing. Step Two testing requires about one hour per sample.

Step Three

Sample preparation for Step Three requires the mounting of the forewings from 10 bees on standard microscrope slides. These are projected by a microprojector onto a digitizing pad capable of reporting to the computer the exact coordinates of indicated points on the pad's surface. Using the pad, 16 points on each projected wing are digitized for the computer to compare 47 lengths and angles with wing veins with a known data base to compute the probability of the sample's being European or Africanized. Probabilities are determined for individual bees as well as the composite sample. Step Three testing requires about two hours per sample to mount and digitize.

Step Four

Samples not receiving a definitive determination at Step Three are followed to Step Four testing. Microscope slide mounts are prepared using the left forewing, left hindwing, right hindleg and third abdominal sternite (wax mirror) from each of ten bees. The preparation of dissections for mounting on slides is time consuming and difficult, especially the wax mirror which must be cleaned and stained. After mounting, the slides are projected onto a digitizing pad and read, as in Step Three. Thirty-nine points on the wings, hind femora and basitarsi, and wax mirrors of the sternites are used in the multivariant morphometric analysis performed by the computer to determine the statistical probability of the sample's being European or Africanized. Probabilities are determined for individual bees and the composite sample as in Step Three. Step Four testing requires four hours per sample and provides the final determination for samples collected by the Africanized Bee Project.

**KELSO VALLEY**

Project personnel with the help of local beekeepers have located 12 feral bee colonies in Kelso Valley. Six of these were within a mile of the apiary site from which an Africanized colony may have swarmed in June. All tested European as have 63 composite samples (10-15 bees each) collected from flowers and watering sites in various parts of Kelso Valley.

**WE'LL GET IT RIGHT YET!**

The last newsletter erroneously credited Roger Birdsall of San Bernardino County with sending David Chang and Laniel (should be Daniel) Leung, who were sent by Ron Gilman of Santa Barbara County. We failed to name Allen Fleming and Rob Miller who were sent by Roger Birdsall. (Our word processor can't spell or stay on track!)

# APPENDIX II

Sampling Apiaries for Honey Bee Tracheal Mite

with permission of Dr. F. A. Robinson

# SAMPLING APIARIES FOR HONEY BEE TRACHEAL MITE (*Acarapis woodi*): EFFECTS OF BEE AGE AND COLONY INFESTATION

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When the honey bee tracheal mite was detected in the U.S. in 1984 for the first time, there was speculation that infestations were isolated. Beekeepers as well as state and federal regulatory officials agreed that erradication was desirable, though maybe not possible. Some states established embargos in order to prevent the movement of bees from infested areas to or even through their states. As in erradication, such actions would be appropriate and effective only if the infestation was new and limited to a few small areas. Otherwise, erradication attempts and quarantines would not only be ineffective, but could cause disruption and loss in honey and pollinated crops by preventing the normal operations of migratory beekeepers.

To determine the feasibility of erradication or the need to establish more appropriate actions, deliminating surveys around known infested apiaries as well as a national survey were needed. The need for prompt

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action to limit mite spread and to limit interruption of normal operations plus the limited personnel available emphasized the necessity of small, reliable samples. To establish the reliability of sampling and to detect the distribution of infested bees within an apiary, a sampling study was initiated at the University of Florida's Institute of Food and Agricultural Sciences in Gainesville, Florida.

## OBJECTIVES

1. To determine the differences and effects of colony infestation rates within an apiary.
2. To determine if the differences and effects of infestation rates are dependent on bee age.

## METHODS

Four apiaries known to be infested with the honey bee tracheal mite were selected for this study. These apiaries had been declared infested by the Division of Plant Industry of the Florida Department of Agriculture and Consumer Services during the Florida survey. However nothing was known as to the distribution of infestation within the colonies or the apiaries. The apiaries were located in central Florida and were being managed according to common commercial beekeeping practices. Three of the apiaries were palletized with four colonies per pallet. The number of colonies in the apiaries ranged from 46 to 62.

Samples were collected using a modified battery powered hand vacuum cleaner. Upon collection, samples were preserved in 75% alcohol and comments about colony condition were recorded along with an estimation of colony population.

REP 2

The statistical analysis is based on a single collection date for each apiary. However the colonies of Apiary 4 were resampled for a total of two collections. Within an apiary, samples were collected from every other colony, and two samples were taken from each colony. The first colony sample consisted of bees collected from screens blocking colony entrances so that the proportion of older bees was greater. The second colony sample consisted of bees collected from the combs in the center of the brood nest so that the proportion of younger bees was greater. These bulk samples of 300-500 bees were reduced to four samples of 25 randomly selected worker bees for a total of 8 samples per colony.

All samples were processed by standard dissection procedures (Ministry of Agriculture, Fisheries and Food, 1956). In this method the thoracic tracheal system is examined after clearing the associated muscle tissue. After removing the bee head, a second cut is made through the thorax to include the first pair of spiracles in a disc. In this study particular care was taken to include the tracheal system leading from the main trunks to the head as well as the thoracic air sacks. The discs were placed in a glass petri dish, covered with potassium hydroxide (KOH) and warmed to 34-35C for clearing. Using a 5% KOH solution the clearing process was completed in approximately 30 minutes. With thick discs, 2% KOH and a longer heating time proved to be more satisfactory for large samples.

The cleared discs were then examined individually using a variable powered binocular dissecting microscope with 60-80 power being the most preferred range among the four technicians involved in this research. All the technicians completed an intensive period of training before processing and examining the experimental samples. To prevent bias, samples were labeled by number rather than colony or bee age, and the samples from each

REP 3

colony were distributed among the technicians. To make certain that efficiency and accuracy were maintained, check samples were included in the sequence of experimental samples. These contained a number of bees from colonies in which the infestation rate was known to exceed 80%.

The numbers of infected and non-infected bees in each sample were recorded. Comments about the numbers of mites were noted, along with which stages were present (eggs, immatures or adults), condition of the trachea and location of the mites.

Apiary infestation levels were estimated from the product of sample infestation percentage and colony population which provides the number of infested bees on a colony basis. The total number of infested bees from all colonies in an apiary in proportion to the apiary population is the estimated apiary infestation rate (Cochran 1977).

In addition to analyzing apiary infestation levels, the entire populations of two colonies were collected and processed. These populations were divided into samples consisting of 100 bees each and divided among the four technicians. After these had been processed and examined after the infestation rates of both colonies were determined, the rates were compared with the rates based on the original 200 bee samples.

At the time of depopulation, both colonies were restocked with bees and brood from an uninfested apiary. Samples from the restocked colonies were collected along with the resampling of the other colonies in Apiary 4.

After the first collection from Apiary 4 had been processed, another set of samples was collected from the apiary to monitor infestation changes. Prior to collecting these samples, the colonies were renumbered so that the original colony number could not be identified, and the apiary

REP 4

was moved twice to take advantage of different nectar and pollen sources. Each sample consisted of bees collected directly from the inside of the cover. Ten of the bees in each sample were dissected and examined and the number of infested bees recorded on a per colony basis. When non infested bees were found, the remaining bees in the samples were processed.

## RESULTS AND DISCUSSION

At the completion of this research project almost 35,000 bees had been dissected and the trachea examined for the presence of the honey bee tracheal mite, *A. woodi*.

The data from the samples of the four apiaries (Table 1) shows a wide range in the infestation rate of colonies within the different apiaries. The apiaries with the higher infestation rates included colonies with high rates of infestation, but, whether from the lower estimated infestation levels as in Apiary 1 or from the more highly infested Apiary 4 (Table 2), samples from all apiaries included colonies in which no mites were found along with colonies in which a relatively high rate of infestation was detected. This implies that the initial spread of mites is within the colony. Also indicated is that apiary level detection increases when more colonies are included in the sample, thereby increasing the chance of including infested colonies.

In three of the four apiaries there were no statistically significant differences in the infestation rates of field versus hive bees (Table 2). However in Apiary 3 the field bees were statistically more highly infested (Table 2), but at the colony level there were no consistent age differences (Table 1). Most of the colonies with infested field bees also had infested hive bees and all colonies had young, emerging bees available for infestation by the mites. The factor that caused higher infestation of field bees is unknown.

REP 5

The results of dissection and examination of the entire adult population and subsequent restocking and resampling of two colonies from Apiary 4 introduced new questions as to the distribution and spread of mites within a colony. The populations of both colonies were estimated to be 2500 adult bees. The original sample infestation rate was 45% and 25% for colony 1 and colony 5, respectively. The actual retrievable populations were 2800 adult bees in Colony 1 with a 40% infestation rate and 2780 adult bees in Colony 5 with a 31% infestation rate. The infestation in the 28 samples of about 100 bees each varied widely from the average colony infestation in Colony 1, while in Colony 5 the infestation rates of the 28 samples were close to the colony average. Subsequent sampling of the restocked colonies detected a rapid rise in colony infestation level. The infestation rate of Colony 1 rose from 0 to 80% in 75 days, while the infestation rate of Colony 5 rose from 0 to 50% in the same time period.

The other colonies of Apiary 4 demonstrated a similar change in infestation level when they were also sampled 75 days after the original sample. By this time the apiary had been moved twice and during this interval four colonies had died or become so weak that they had to be united with other colonies. Whether the loss of these colonies was due to the mites or some other cause is not known. Several colonies had been heavily infested when the first samples were taken while others were not. After 75 days, one colony sample was free of mites and, again, within the apiary there was a wide range of sample infestation. In the original collection the average colony infestation rate was 16%, while in the second collection the average colony infestation rate was 26%. The reason for the mite population increase is not known but is included as an indication of limits of the original estimation of apiary infestation. The swing in mite

REP 6

populations is not understood, but is documented (Giavarini and Giordani (no date)).

In processing these samples it became apparent that finding bees with heavily stained or discolored trachea did not always indicate the presence of mites. There were numerous instances in all four apiaries where no mites could be found in bees with heavily stained trachea. Alternatively, lack of tracheal discoloration did not indicate the absence of mites. This same observation had been reported by Giavarini and Giordani (ND). Nor was it unusual to find pollen grains or other types of foreign matter inside the trachea of some bees, including one trachea with a plant mite wedged inside.

Giavarini and Giordani (ND) had also reported that mites are not restricted to the main tracheal trunks but are frequently found in the head and in some of the smaller branches of the tracheal system. This occurrence was confirmed in this research since mites were frequently found in the secondary trachea (Fig. 1). The presence of mites in such locations was not related to the number of mites within the trachea nor to scattering. In many instances only one or two mites were found while in other samples many mites were found and yet none were in the main tracheal trunks.

There were also a number of instances when eggs were found in the farther reaches of the trachea without the presence of adults or nymphs anywhere in the trachea. This indicates that the mite does not become attached to any certain feeding spot but is quite mobile. The occurence of mites in locations other than the main tracheal trunks in at least 5% of the samples processed made it necessary to modify the dissection procedure so that more of the tracheal system could be recovered. The improvement in

REP 7

accuracy compensated for the increased time involved which was double the time for examination of the main trunks alone.

The mobility of the adult mites was clearly evident when observing the activity of adult live mites dissected from live bees. As had previously been reported by Giavarini and Giordani (ND), when transferred to artificial media or placed on the surface of older bee larva, the adult mites move easily over the surface. Mites were also observed crawling on the surface of naturally infested adult bees and here, too, they moved quite easily with the hairs on the bees body posing no obstacle to their movement. This emergence form the trachea has been observed by Lee (1963).

Though the experimental results depended on data derived from samples of worker bees, drones were occasionally examined for presence of the tracheal mite. Generally, the trachea of drones are rarely infested, so it was with special interest that the high infestation of the drones from Apiary 2 was met. Though the estimated apiary infestation level was 3.4% with no difference between field and hive bees, more than half of the 25 drones which were collected from throughout the apiary were infested. The location of the mites was also an exception to previous findings. The mites were often located very near the spiracular opening and dislodged upon cutting of the scleratized ring of the thorax. The location was also unusual in that infestation was most often bilateral though very few mites were present. Mites have also been found in distal portions of the trachea of drones.

## CONCLUSIONS

Because of the wide range of colony infestation within an apiary, emphasis is placed on collection from a large number of colonies. Through

REP 8

increasing the colonies in a sample, not only is the effect of a mite free colony reduced, but the chance of including a heavily infested colony is increased, therefore improving apiary level detection. While in one instance there was a statistically higher infestation rate for field bees compared to hive bees, suggesting a preferred sample collected from colony entrances, the tendencies in other apiaries towards higher infestation of hive bees compared to field bees indicates that a sample collected from within the colony is equally representative og colony infestation. Therefore, if reduced flight activity makes field collection difficult or too time consuming, samples from inside the hive are equally good.

Infestation is spread at the colony level, but even at this level, infestation changes with time and possibly with manipulations to the apiary within that time.

Finally, in examining the trachea reliability of detection is dependent upon examining more than merely the main trunks of the trachea. Furthermore, examination for mites rather than just for the tracheal discoloration associated with mites must be emphasized along with the need to examine both sides of the tracheal system since infestation is often unilateral regardless of the apiary infestation level.

## ACKNOWLEDGEMENTS

The authors would like to extend their sincere appreciation to James Hall, State Apiary Inspector; Linda Nelson; Mark Mercadante; and W. Rodney Wilson for their assistance in collecting and processing samples.

REP 9

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REP 10

TABLE 1. Number of mite infested bees in 100 bee samples of hive and field worker bees

| | Apiary I | | Apiary II | | Apiary III | | Apiary IV | |
|---|---|---|---|---|---|---|---|---|
| Col. No. | H. | F. | H. | F. | H. | F. | H. | F. |
| 1 | 0 | 0 | 13 | 9 | 0 | 0 | 49 | 41 |
| 2 | 0 | 0 | 3 | 4 | 0 | 2 | 25 | 25 |
| 3 | 0 | 1 | 2 | 4 | 1 | 3 | 37 | 25 |
| 4 | 0 | 1 | 5 | 1 | 1 | 1 | 46 | 42 |
| 5 | 0 | 0 | 2 | 4 | 0 | 0 | 29 | 16 |
| 6 | 0 | 0 | 4 | 1 | 1 | 1 | 6 | 15 |
| 7 | 22 | 17 | 2 | 3 | 0 | 0 | 39 | 33 |
| 8 | 5 | 6 | 3 | 2 | 2 | 2 | 6 | 20 |
| 9 | 0 | 0 | 3 | 2 | 0 | 4 | 50 | 51 |
| 10 | 2 | 1 | 0 | 0 | 3 | 4 | 11 | 9 |
| 11 | 0 | 3 | 0 | 2 | 8 | 8 | 0 | 0 |
| 12 | 0 | 2 | 1 | 1 | 8 | 4 | 2 | 0 |
| 13 | 0 | 1 | 3 | 2 | 7 | 13 | 6 | 1 |
| 14 | 0 | 0 | 1 | 0 | 8 | 12 | 12 | 7 |
| 15 | 0 | 1 | 2 | 3 | 6 | 8 | 0 | 2 |
| 16 | 0 | 0 | 3 | 5 | 17 | 20 | 0 | 1 |
| 17 | 0 | 0 | 8 | 6 | 3 | 4 | 1 | 0 |
| 18 | 0 | 0 | 1 | 1 | 3 | 1 | 30 | 9 |
| 19 | 2 | 0 | 17 | 19 | 2 | 0 | 4 | 2 |
| 20 | 0 | 0 | 5 | 10 | 1 | 3 | 16 | 9 |
| 21 | 0 | 0 | 2 | 3 | 1 | 4 | 13 | 22 |
| 22 | 0 | 0 | 1 | 3 | 0 | 0 | 52 | 38 |
| 23 | 1 | 0 | 2 | 1 | 1 | 2 | 7 | 7 |
| 24 | 0 | 1 | 3 | 7 | -- | -- | 5 | 7 |
| 25 | 0 | 0 | 2 | 9 | -- | -- | 10 | 9 |
| 26 | 0 | 0 | 3 | 2 | -- | -- | 8 | 9 |
| 27 | 3 | 0 | 4 | 3 | -- | -- | 20 | 14 |
| 28 | -- | -- | -- | -- | -- | -- | 1 | 6 |
| 29 | -- | -- | -- | -- | -- | -- | 27 | 25 |
| 30 | -- | -- | -- | -- | -- | -- | 11 | 11 |
| 31 | -- | -- | -- | -- | -- | -- | 3 | 6 |

REP·12

TABLE 2. Estimated infestation rates

| Apiary designation | Apiary infestion level Average | Percent of infestation based on bee age Field | Hive |
|---|---|---|---|
| | (%) | (%) | |
| 1 | 1.7 | 1.6 | 1.9 |
| 2 | 3.4 | 3.7 | 3.1 |
| 3 | 4.1 | 4.5[a] | 3.6[a] |
| 4 | 12.8 | 11.8 | 13.7 |

[a] these values are statistically different

REP 1.3

## Evaluation of APHIS Sampling Plan

### INTRO

A proposed sampling plan is (give APHIS plan).

The probability of seeing at least 1 infested bee in a random sample of 100 bees taken from a population having an infestation rate p is

$$P|\text{detection}| = 1-(1-p)^{100}$$

For p>.03, the probability of detecting infestation is greater than 0.95; however, the probability of detection decreases rapidly for infestation rates below 3% (Fig. 1). For infestation rates lower than 3%, a high probability of detecting infestation is attained only with much larger sample size, e.g., for p=0.01, to attain a .95 probability of detection a sample of about 300 bees is needed.

Robinson et al (1985) showed that infestation rates of colonies within an apiary differed significantly. In fact, in some infested apiaries mites were not detected in several colonies, implying a better chance of detecting infestation if more colonies within an apiary are sampled.

In subsampling 100 bees from the pooled samples from 5 colonies, the probability of detecting infested bees is, approximately,

$$P|\text{detection}| = 1-\left(\frac{\sum_{i=1}^{5}(1-P_i)}{5}\right)^{100}$$

In sampling 20 bees from each of 5 colonies, without pooling,

$$P|\text{detection}| = 1-\prod_{i=1}^{5}(1-P_i)^{20}$$

It can be shown that

$$P|\text{detection/pooling}| \leq P|\text{detection/not pooling}|.$$

Therefore, a computer simulation of various sampling plans was performed in order to evaluate the effect on the probability of detecting infestation in an apiary of (i) pooling, (ii) sampling an increased number of colonies in an apiary, and, (iii) increasing total sample size.

## Methods

Data were collected from 4 apiaries in Florida (Robinson et al, 1985) and the proportion of infested bees for each colony within an apiary was estimated. Apiary infestation rates were estimated to be:

| Apiary | Infestation Rate |
|---|---|
| 1 | 0.017 |
| 2 | 0.034 |
| 3 | 0.041 |
| 4 | 0.128 |

Although all apiaries were infested, no infestation was detected in half the colonies in apiary 1. Distribution of infestation among colonies for the apiaries are shown in Figure 2. These distributions were used as models for computer simulation to assess the ability to detect infestation in apiaries for each of eight sampling plans.

The sampling plans consisted of the combinations of values of the following factors:

| Factor | Values |
|---|---|
| 1. total sample size (# bees) | 100, 200 |
| 2. # colonies sampled within an apiary | 5, 10 |
| 3. pooling of samples from colonies within an apiary | yes, no |

Note that the APHIS plan is the one with total sample size = 100, # colonies per apiary = 5, with pooling.

One thousand simulation runs per plan were performed for each apiary. Colonies were randomly selected within each simulation run. The number of bees sampled from each colony within an apiary was the same for each colony when no pooling was used, e.g., if sample size = 200 and the number of colonies sampled = 10, then 20 bees were randomly sampled from each colony. The probability of detecting infestation was calculated for each plan and apiary as (# runs in which at least 1 infested bee was sampled)/1000. Simulation was performed using the programming language and random number generation functions in the SAS system.

STA 2

## Results

Results of the simulation are presented in Table 1. Due to relatively high infestation rates in all colonies, apiary 4 was insensitive to changes in sampling plan; for this apiary, P|detection| was virtually 1 in all plans. Apiaries 2 & 3 showed some response to changes in sampling plan, however P|detection| was always greater than 0.92. Apiary 1, because of overall low infestation, and a large number of infestation-free colonies, in no case has a P|detection| greater than .773.

There was virtually no effect due to pooling; in all cases the difference between pooled & not pooled plans was less than 3%. Sampling 10 colonies, rather than 5 colonies, with the same total number of bees per apiary improved the detection rate. This was especially true for apiary 1, which had the lowest infestation rate, making detection most difficult, and therefore having the greatest need for improved detection rate. Increasing sample size of course increased detection rate. The improvement was especially important in apiary 1. The best of the tested plans was 10 colonies, total n = 200, for which detection rate was virtually 1 for apiaries 2 & 3, and the highest for apiary 1.

STA 3

# PROBABILITY OF DETECTING INFESTED BEES
## *FOR SAMPLE SIZE N=100*

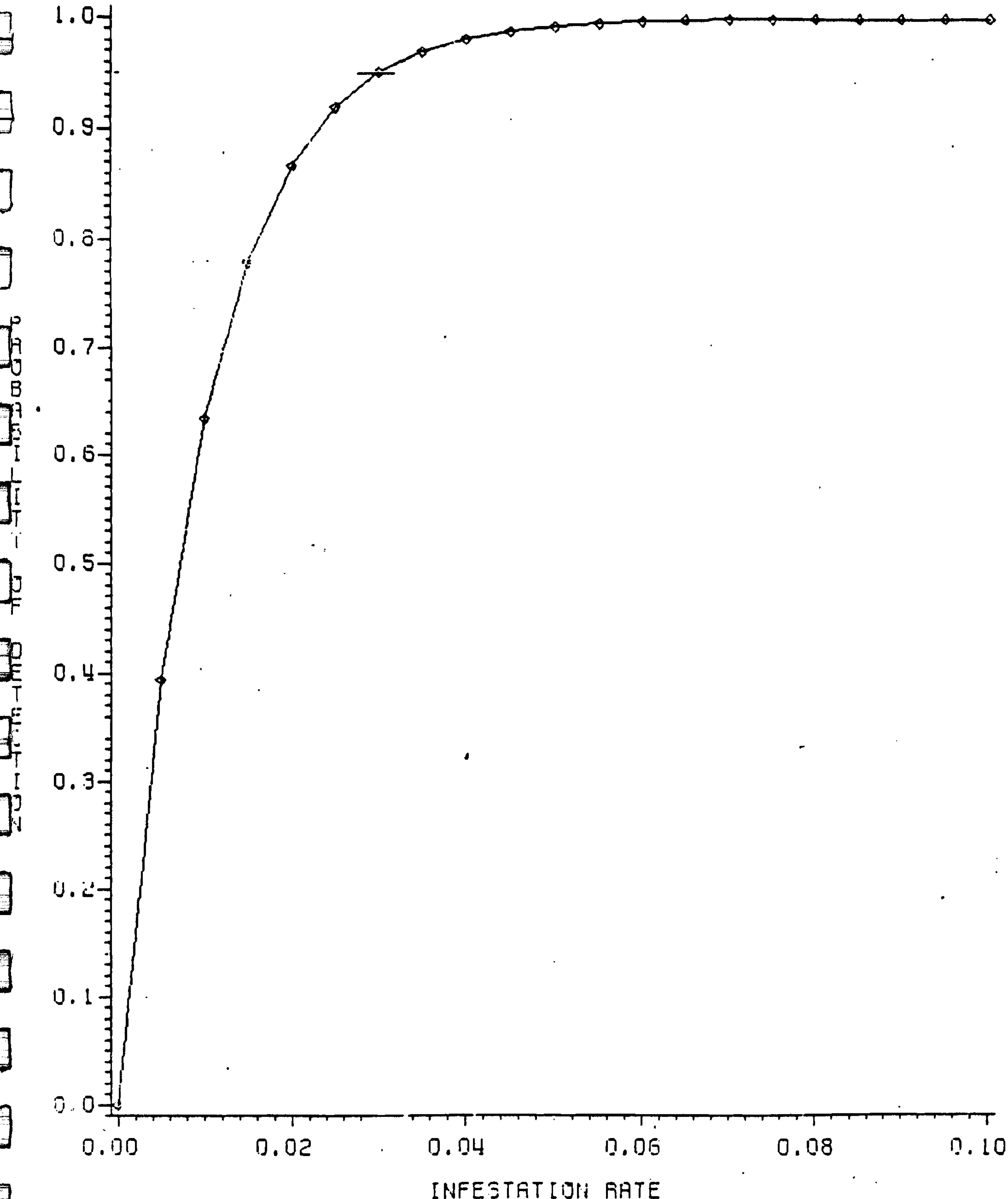


Figure 1 STA 4

Table 1. Detection Rates for Sampling Plans

Five Colonies

| | N = 100 | | N = 200 | |
|---|---|---|---|---|
| Apiary | Pooled | Not Pooled | Pooled | Not Pooled |
| 1 | .506 | .503 | .666 | .66 |
| 2 | .949 | .948 | .997 | .997 |
| 3 | .923 | .929 | .989 | .988 |
| 4 | .999 | 1.000 | .999 | 1.000 |

Ten Colonies

| | N = 100 | | N = 200 | |
|---|---|---|---|---|
| Apiary | Pooled | Not Pooled | Pooled | Not Pooled |
| 1 | .608 | .636 | .773 | .763 |
| 2 | .958 | .974 | .996 | .996 |
| 3 | .963 | .96 | .994 | 1.000 |
| 4 | 1.000 | 1.000 | 1.000 | 1.000 |

STA 5

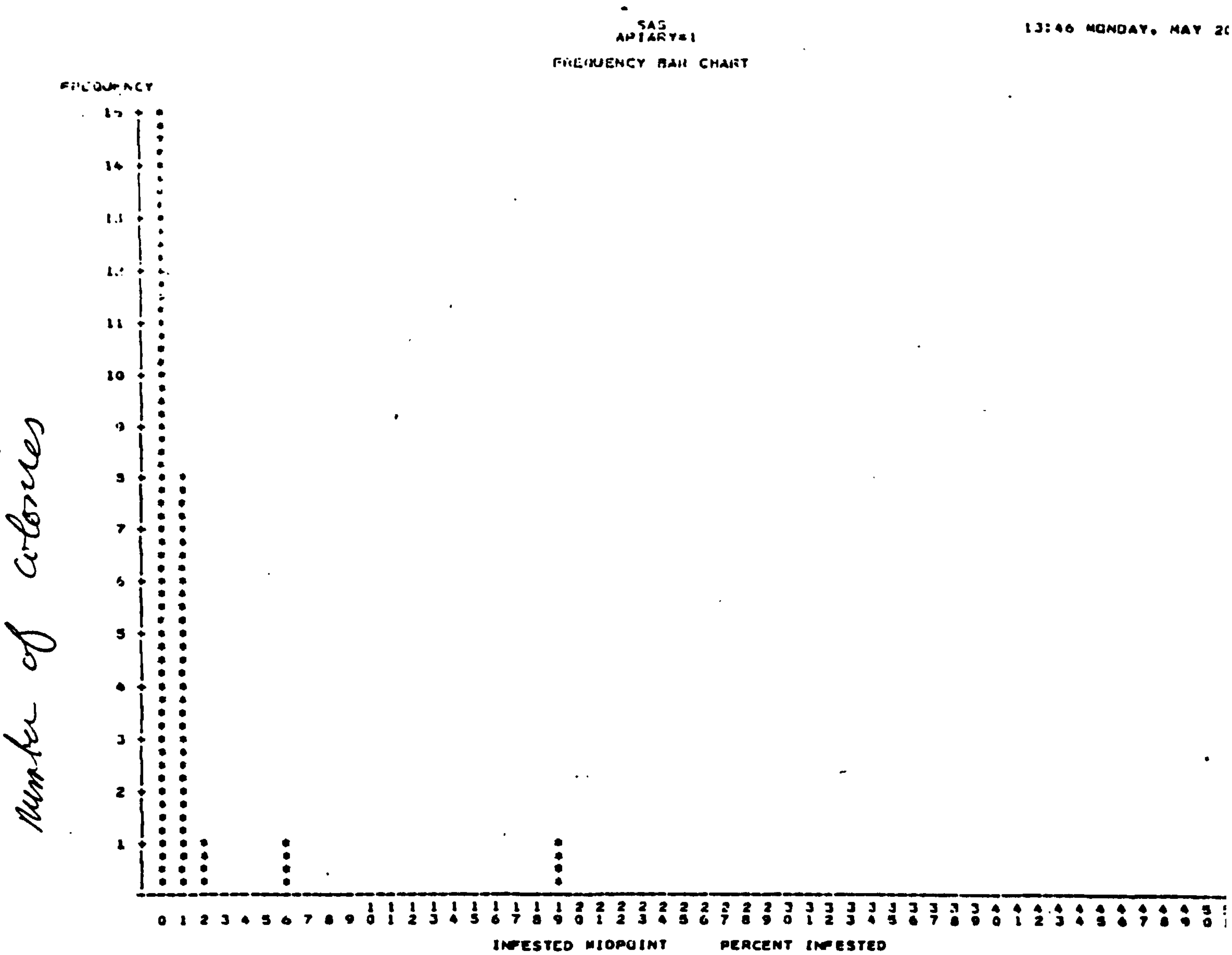
SAS
APIARY=1
13:46 MONDAY, MAY 2
FREQUENCY BAR CHART
FREQUENCY
number of colonies
INFESTED MIDPOINT PERCENT INFESTED

Fig. 2

STA 6

SAS
APIARY=2

13:46 MONDAY, MAY 20,

FREQUENCY BAR CHART

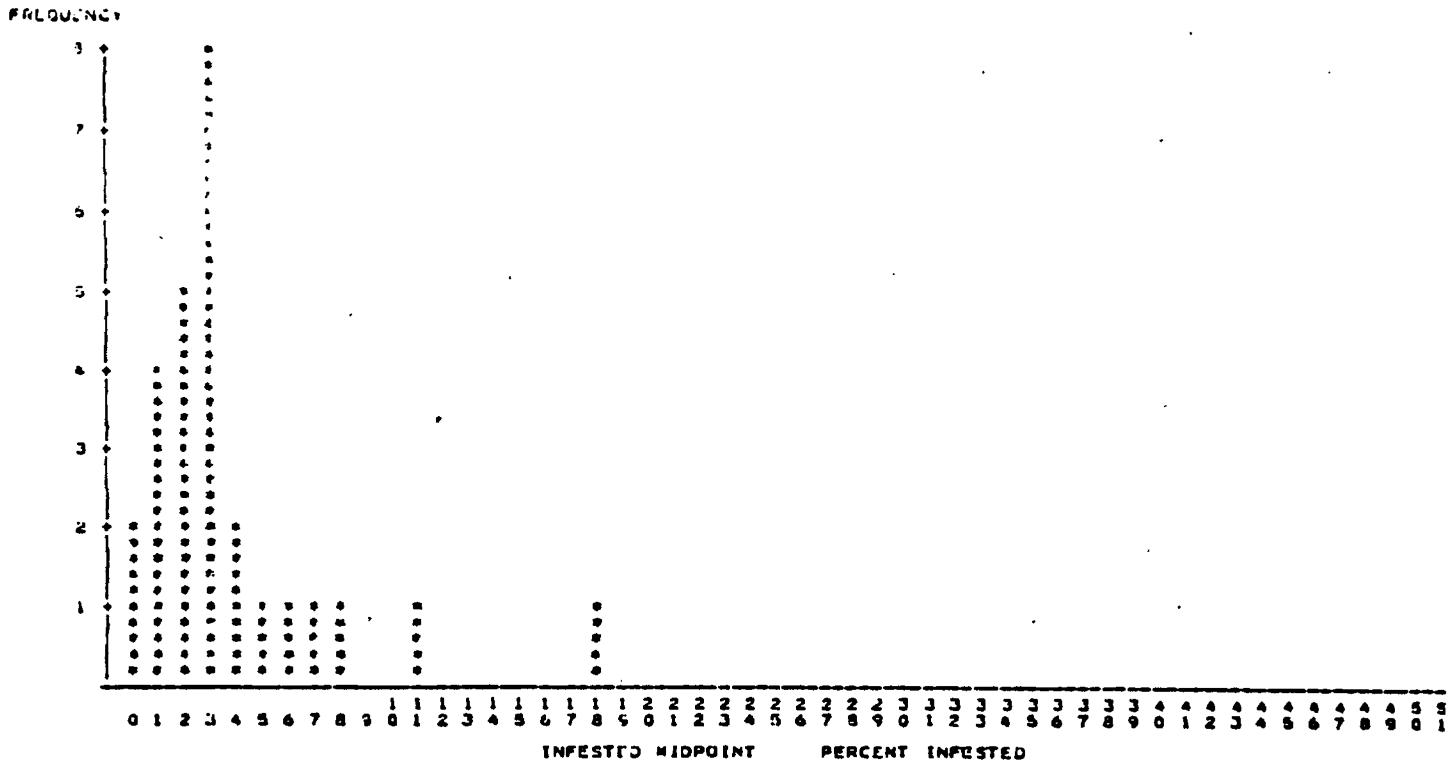


Fig 2 cont'd

STA 7

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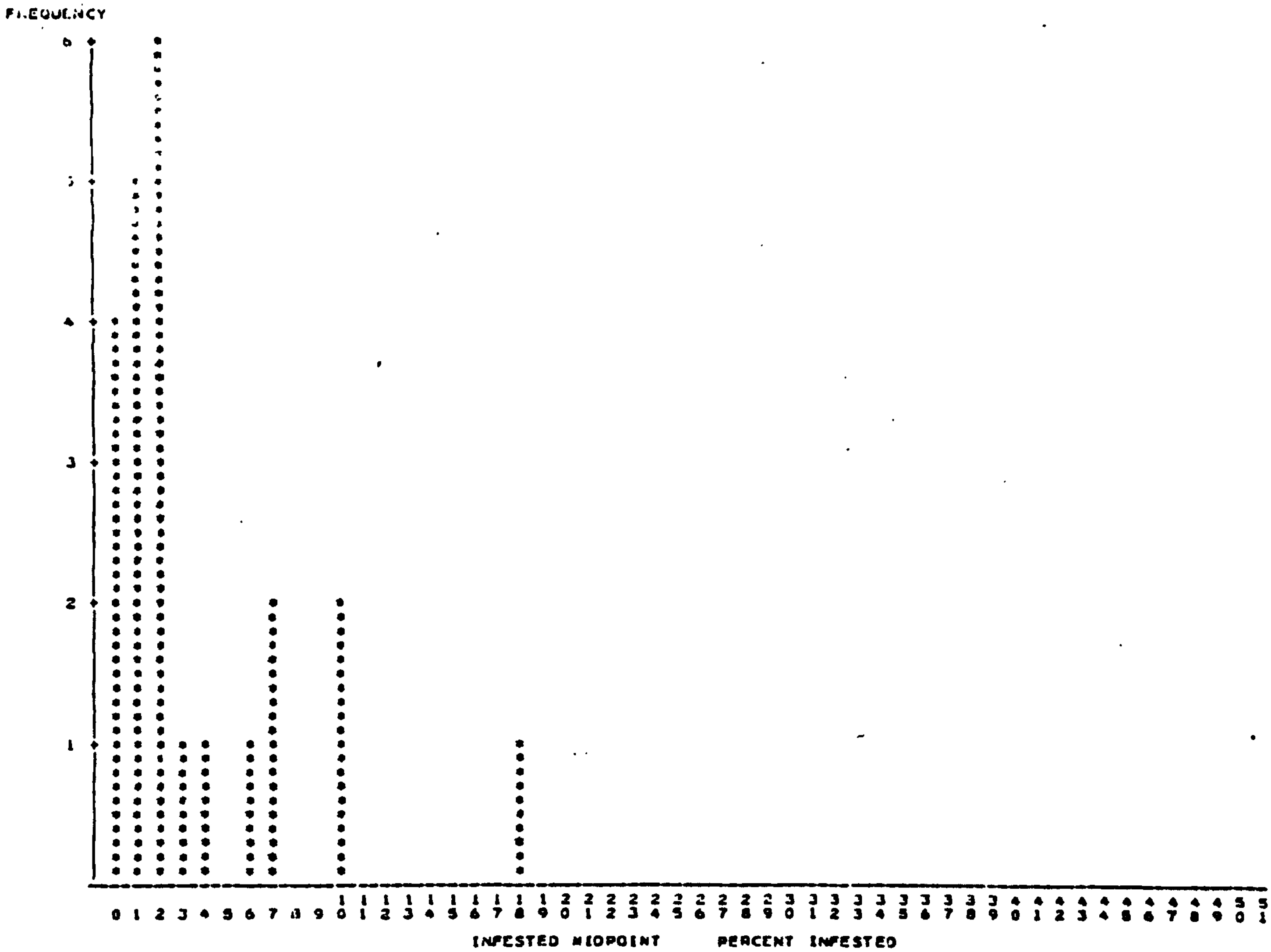


Fig 2 cont'd

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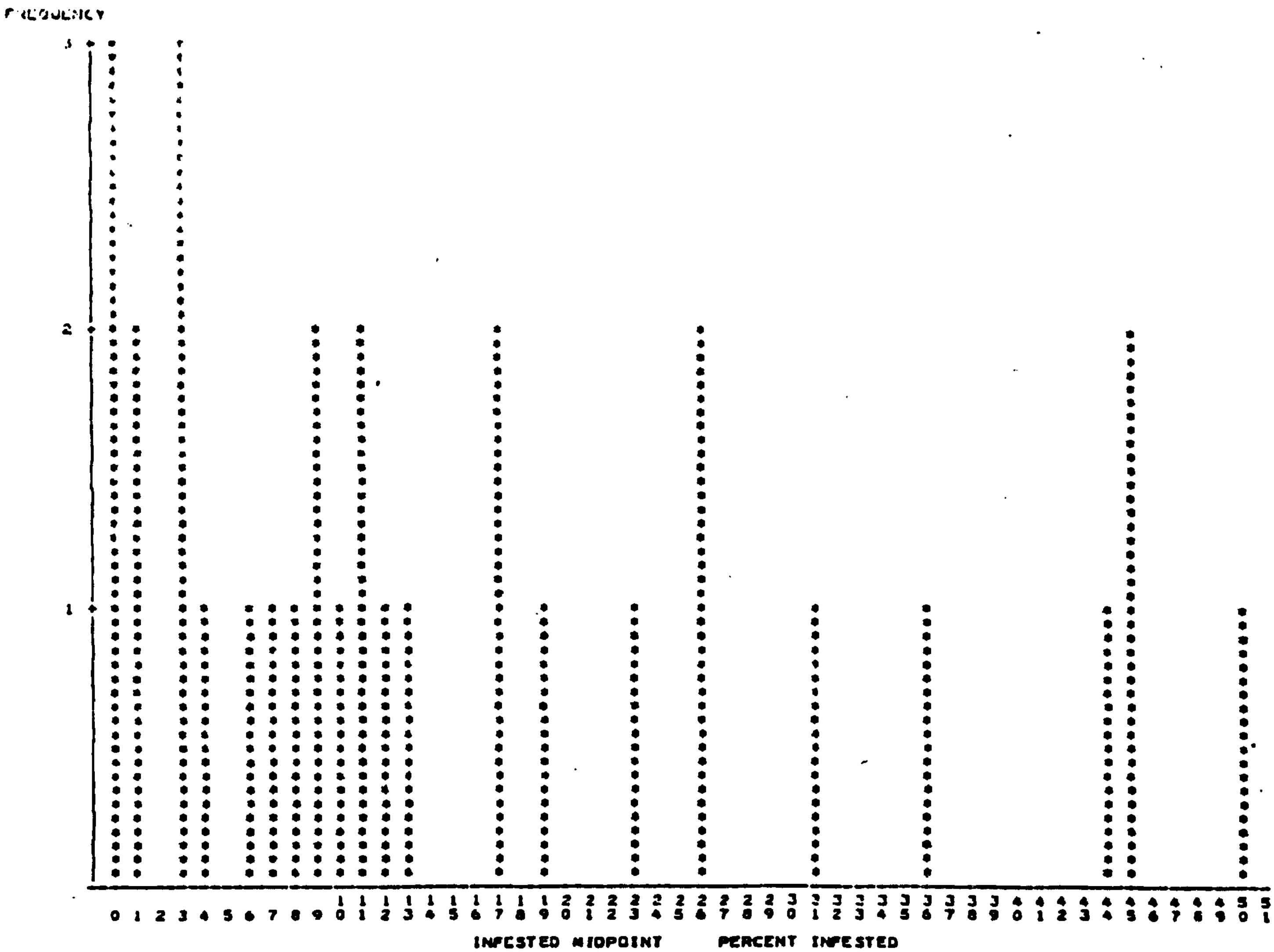


fig 2 cont'd

STA 9

## APPENDIX III

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