A. Graham

PROCEEDINGS

of the Ninth Annual

WESTERN FOREST INSECT WORK CONFERENCE

Corvallis, Oregon

February 26-28, 1958

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of the Ninth Annual
WESTERN FOREST INSECT WORK CONFERENCE*
Corvallis, Oregon
February 26-28, 1958.

EXECUTIVE COMMITTEE (Ninth Conference)

M.G. Thomson, Victoria	-	Chairman
R.L. Furniss, Portland	-	Immediate Past Chairman
A.D. Moore, Berkeley	-	Secretary-Treasurer
R.W. Stark, Calgary	-	Councilor (1955)
D.E. Parker, Ogden	-	Councilor (1956)
C.L. Massey, Albuquerque	-	Councilor (1957)

J.A. Rudinsky, Corvallis	-	Program Chairman

EXECUTIVE COMMITTEE ELECT

R.W. Stark, Calgary	-	Chairman
M.G. Thomson, Vancouver	-	Immediate Past Chairman
J.M. Kinghorn, Victoria	-	Secretary-Treasurer
D.E. Parker, Ogden	-	Councilor (1956)
C.L. Massey, Albuquerque	-	Councilor (1957)
E.C. Clark, Moscow	-	Councilor (1958)

H.A. Richmond, Nanaimo K. Graham, Vancouver	-	Program Co-chairmen

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* Prepared by the Secretary-Treasurer, J.M. Kinghorn, from summaries submitted by the Discussion Leaders named under each section. Stenographic and duplicating assistance was provided by the Forest Biology Division, Canada Department of Agriculture, through the services of Misses D.E. White, D.L. Fraser, and M.V. Mitchell of the Victoria Laboratory.

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TABLE OF CONTENTS

Page

Minutes of the initial business meeting 1

Review of current forest insect conditions in Western United States, Canada and Alaska 3

Insecticides, systemics and attractants 6

Laboratory studies and techniques 10

Legal and other aspects of spray programmes 12

Insecticides against defoliators 15

Insecticides against bark beetles 21

Chemical control of wood borers 23

Minutes of the final business meeting 26

Appendix

Report of the Chairman 28

Report of the Common Names Committee 29

Report of the Committee on Indexing of Reports and Publications 31

Membership roster 32

Index of conference members 43

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TABLE OF CONTENTS

Page

Minutes of the initial business meeting 1

Review of current forest insect conditions in Western United States, Canada and Alaska 3

Insecticides, systemics and attractants 6

Laboratory studies and techniques 10

Legal and other aspects of spray programmes 12

Insecticides against defoliators 15

Insecticides against bark beetles 21

Chemical control of wood borers 23

Minutes of the final business meeting 26

Appendix

Report of the Chairman 28

Report of the Common Names Committee 29

Report of the Committee on Indexing of Reports and Publications 31

Membership roster 32

Index of conference members 43

MINUTES OF THE INITIAL BUSINESS MEETING
February 26, 1958

The Chairman, M.G. Thomson, called the meeting to order at 9:15 a.m. in Room 206, Memorial Union, at Oregon State College.

J.A. Rudinsky introduced the conference hosts:
W.F. McCulloch, Dean, School of Forestry, Oregon State College
P.O. Ritcher, Head, Department of Entomology, Oregon State College
Dick Berry, Head, Oregon Forest Land & Forest Products Research Center

Each briefly, but very cordially, welcomed the conference participants to Corvallis.

Adoption of the minutes of the 1957 meeting at Calgary, as presented in the Proceedings, was moved by E.C. Clark and seconded by J.M. Whiteside. The motion was carried.

The Chairman pointed out, for those members that did not attend the Calgary meeting, the new gavel in his possession donated by J.M. Whiteside.

The Secretary-Treasurer read the secretary's report and the financial statement for the period since the last meeting. Adoption of these reports was moved by R.C. Hall and seconded by E.C. Clark. The motion was carried.

The Chairman introduced the following guests:

J.A. Beal
W.V. Benedict
B.M. McGugan
J.J. Fettes
L.C. Terriere

The remaining participants then introduced themselves in turn.

The Secretary gave a brief summary of the Executive Committee meeting on February 25.

The Chairman stated that there would be no changes in appointments to the following committtees:
Common Names Committee
Constitution Committee
Committee on Indexing of Research Reports
Education Committee

He presented the membership of these committees as follows:

<u>Common Names Committee</u>
R.L. Furniss, Chairman
E.C. Clark
F.P. Keen
C. McGuffin
D.E. Parker
D.A. Ross
N.D. Wygant

Constitution Committee

A.D. Moore, Chairman
R.R. Lejeune
G.R. Struble

Committee on Indexing of Research Reports

G.R. Hopping, Chairman
W.K. Coulter
C.B. Eaton
P.C. Johnson
C.L. Massey
D.A. Ross
G.T. Silver
R.I. Washburn
N.D. Wygant

Education Committee

A.D. Moore, Chairman
E.C. Clark
C.B. Eaton
K. Graham
J.A. Rudinsky
R.W. Stark
J.P. Vité

The Chairman appointed the following to serve on the nominating committee:

G.R. Hopping
P.C. Johnson
R.L. Furniss, Chairman

He announced that, due to other commitments, it would be impossible for the Secretary-Treasurer to accept an appointment for another year, and that the committee should consider candidates for the following offices:

Chairman
Secretary-Treasurer
1958-1961 Councilor

He then appointed a new committee on ethical practices composed of:

J.M. Kinghorn
G.T. Silver
K.H. Wright
J.M. Whiteside

The announcement was made that two invitations had been received by the Chairman for the next meeting. One from H. Richmond and K. Graham for the Vancouver area and one from D.E. Parker for Ogden.

G.R. Hopping moved that the 1959 Conference be held at Vancouver. The motion was seconded by E.C. Clark and passed.

J.R. Rudinsky moved that the 1960 Conference be held at Ogden. The motion was seconded by R.L. Furniss and passed.

J.R. Rudinsky moved that "Biological control of forest insects" be adopted as the topic for discussion at the 1959 Conference. The motion was seconded by C.L. Massey and passed.

The Chairman reminded the moderators on the program that they should plan to submit summaries of their sessions to the Secretary for inclusion in the proceedings.

The meeting was adjourned at 10:30 a.m. on a motion made by C.B. Eaton

Cone and seed insects. - Cone beetles, cone moths and seed chalcids have all but wiped out the seed crops of Jeffrey and ponderosa pine and Douglas-fir in California.

INSECTICIDES, SYSTEMICS AND ATTRACTANTS

Feb. 26, 11:00 a.m. - 3:00 p.m. Discussion Leader: R.H. Nagel

A. The Toxic Action of Insecticides

11:00 - 11:55 a.m. L.C. Terriere

What happens after the airplane pilot releases the gallon of DDT emulsion over the acre of trees and the insect pest encounters the resulting DDT residues on the foliage and bark? What is the mysterious power possessed by this molecule which makes it so toxic to the insect? Why is it that of the more than 500,000 organic compounds now known, only a few dozen are poisonous enough to insects to be useful as insecticides? The forest entomologist will find his work more interesting and his results more rewarding if he can get some answers to these questions.

To be able to visualize what is going on after the insect contacts the pesticide, we must review our knowledge of physiology. First, let's recall that living processes operate in cycles involving a few simple steps, each step moderated by one or more enzymes. These enzymes are chemical molecules often partially made up of vitamins. Several cycles working together on a "production line" basis enable the living cell to utilize carbohydrates, proteins, and fats so as to get energy from them and to build and repair tissues. The key items in these series of cycles are the enzymes. They are also cyclic in action, that is, each enzyme does its job on one molecule of sugar, fat, or protein, and then repeats the process on another such molecule. In this manner a few enzymes can handle a lot of molecules. When one of these enzymes is put out of action, the entire process breaks down because the enzyme is a bottleneck through which the process must operate. This explains the importance of the enzymes, and, incidentally, of the vitamins we eat, since they are utilized in making enzymes.

It is easy to see, with this concept of the role of enzymes in living processes, how some chemical which interferes with enzyme action can be fatal to the organism in such small amounts. Not all, but many of our poisonous materials act in this way. Thus arsenic, lead, cyanide, sodium fluoride, and many other common poisons, react with some enzyme in one of these vital cyclic processes, stopping the process at the enzyme bottleneck, and leading to the death of the organism depending upon the process. It is fairly certain that the organic phosphate insecticides operate in this way. By tieing up the enzyme, choline esterase, so that it can't carry out its regular assignment of splitting acetyl choline, the nerve processes of the organism are upset and the organism dies.

Another way in which poisons are thought to act is by interfering with some vital diffusion process such as by disturbing a membrane which protects nerve tissue. Normally, such a membrane must allow the passage of certain ions, such as calcium ions, so that the nerve metabolism can proceed. It is thought that DDT and gamma BHC, by virtue of their peculiar chemical structure, get inside one of these membranes and rupture it in some way so that it "leaks" thus causing a "short circuit" with resulting nervous excitation, exhaustion, and death. According to this theory, molecules closely related to DDT and BHC cannot rupture the membrane to the same extent as DDT and gamma BHC and hence are not as toxic.

Another question which intrigues is why are poisons often quite selective, i.e. kill one species in the presence of another? This is due to the existence of differences in morphology, habits, and physiology which allow one organism to escape the poison while another is killed by it. Insects, for example, are protected from dessication by a lipoidal cuticle. Modern pesticides are usually soluble in this type of system. Hence, this "weakness" in the insect's morphology is exploited by the modern contact insecticides. Also, since many modern insecticides are nerve poisons in one manner or another, and since the insect possesses many sense organs in or near its outer body surface, the distance an insecticide must travel to reach a sensitive site is relatively short. Contrast this with the situation in vertebrates and one can see why a certain amount of selectivity exists in current usage of insecticides.

B. Attractants

1:00 - 2:00 p.m.

K. Graham introduced the topic with the following remarks:

We know that most insects are highly responsive to odors of various kinds, and that odors play important roles in the lives of insects. The roles are basically four in number: food finding, mate finding, fellow finding (social insects) and oviposition site finding.

How can a knowledge of attractants aid in the handling of insect problems? The following points are suggested: (1) It may aid further research by identifying a precise material for further study; (2) It may aid control in several ways:

(a) It may clarify the understanding and definition of criteria for tree and log susceptibility to insects.
(b) Specific attractants may be useful for detection of populations. Sex attractants for moths are sometimes used for this purpose.
(c) Specific attractants may be used to lure insects to traps.
(d) Understanding of the genesis of attractants in trees may suggest possibilities for inhibiting metabolic or other processes that produce them.
(e) Understanding chemical properties of attractants in trees may suggest a means of altering them by special applications to the trees.
(f) Repellents and masking substances may be discovered.

Problems encountered in the study of attractants fall into three main categories, viz. 1) isolation and chemical identification of volatile materials given off by host trees; 2) biological testing of volatile materials of possible olfactory significance; and 3) chemical origin of attractants in host trees.

In the extraction process there is the task of collecting sufficient quantities of volatile materials for identification and biological testing without provoking changes in the host material and altering the constituents and extractives during the procedures. Steam distillation may destroy labile substances, or produce pyrolysis products. Solvent extraction introduces an organic liquid which may be difficult to remove entirely from the extractives. Grinding of material may cause release of large quantities of materials of no significance for the study. Extraction with inert gas may promote formation of products of metabolic fermentation.

Once the essential attractants-containing substances are extracted, the separation into constituents can be achieved by gas chromatography.

Biological testing of the ambrosia beetle Trypodendron lineatum is complicated by modifying factors in their behavior. Whereas the reactions of populations in nature can be anticipated with reasonable certainty, the study of individuals does not offer a simple clear indication of their intentions.

The chemotropic responses of Trypodendron may be suppressed or obscured by strong photic or geotropic reactions. Chemotropic responses vary with temperature and humidity. We may have to allow for the beetles acting in a sequence of reactions, none of which is decisive and irrevocable. Experiments must allow for two or more possible influences of odor. One possibility is that the beetles are activated by a suitable odor stimulus, and find their way to a host by flight against an airstream carrying the odor stimulus. Another possibility is that an odor may deactivate beetles that have arrived at a source of stimulus by random or other movements. It is thus possible that either one or the other of two contradictory influences could account for the same final effect.

R.H. Smith then presented the following resumé of attraction studies that have been conducted at the Berkeley Forest Insect Laboratory. Dendroctonus brevicomis and materials of Pinus ponderosa were used in the work.

From 1919 to 1926 there were incidental field observations, primarily by Miller, Patterson, and Person, that attacked trees--even those on which the attacks had been forced--were more attractive than other trees.

From 1927 to 1929, Person and Mirov conducted field examinations and gross attraction lab tests and found a possible correlation between attractiveness and slow growth. It was also noted that though the beetles were attracted to current Ips top-killed trees they were not attracted to similar mechanically topped trees. In the lab the gross attraction studies showed the following preferences: (a) Inner bark $>$ outer bark [$x > y$ = more beetles to (x) than to (y)], (b) slow growth $>$ fast growth, (c) fresh cut $>$ 3-weeks old material, (d) 1 to 4 day old $>$ fresh cut material, (e) fresh cut $>$ older than 4-day material, (f) fermented phloem $>$ fresh phloem. The change in preference caused by the passage of time seems quite important.

In 1929 three other works were accomplished which contributed to the general knowledge of attraction. Jeffrey found that there was a correlation between changes in the concentration of various sugars and (a) the rate of growth, (b) the time after felling, and (c) movement of D. brevicomis larvae. Dubrow could find no association between pH and the general health of the tree as expressed by rate of growth. Beal tentatively concluded that there was a correlation between phloem moisture aontent and tree susceptibility as expressed by slow growth.

In 1931 Gordon developed an olfactometer in an effort to improve the gross selection procedure of Person and Mirov. He also found that attraction to phloem changed with time after cutting and also depended on the fermented condition of the phloem.

In 1944 Struble used D. monticolae and materials from P. lambertiana. His results did not agree with Gordon's.

In 1952 Callaham enlarged Gordon's apparatus about 10 fold with the objective of allowing selection by the beetle to be made while in flight. Though he used D. brevicomis and P. ponderosa materials, his results did not agree with Gordon.

D.G. Allen discussed the association of yeasts with the Douglas-fir beetle and mentioned slight modifications of results of this work recently published in detail in Forest Science 3: 336-343.

The effects of log aging and log position on attack rate of the Douglas-fir beetle were then described by L.H. McMullen. The attack rate on ten-foot logs of Douglas fir which had been aged for intervals of 15, 30 and 45 days under field conditions prior to exposure to attack by the natural population of the Douglas-fir beetle was compared to that on logs from freshly felled trees during four periods of the season. The beetles always attacked the fresh host material more heavily than the aged material. There was no constantly discernible differences between host material that had been aged for 15, 30 and 45 days prior to exposure to beetle attack.

The attack rate on upright and horizontal four-foot logs on the ground was compared. Two trees were felled, bucked, and alternate sections stood upright. Daily counts showed that attacks were much heavier on the horizontal than on the upright logs. Ten days after felling, the number of attacks per square foot on the horizontal sections from each tree averaged 8.7 and 6.3 and on the upright sections from the same trees 0.6 and 1.8, respectively. Six additional sections from another tree were later treated similarly with the same general results except that one of the three upright sections was more heavily attacked than any other section.

G.R. Hopping described the relation between strikes of the mountain pine beetle and such variables as bark character, height above ground, and tree diameter.

C. Systemic Insecticides

2:00 - 3:00 p.m.

J.P. Vité discussed fundamental studies designed to contribute to the use of systemics which may protect trees by absorption through foliage, bark or roots. He cited his published studies on control of thrips and casebearers on European larch with systemic insecticides.

In the eastern United States, trees could be completely protected against the casebearer by trunk injection of 20-30 per cent metasystox. Injections can be made by one of four techniques: 1) Trunk wrapping, with insecticide filled cloth; 2) Tube cut into the cambium and liquid fed in from a reservoir; 3) liquid run into a bore hole; and 4) A special steel injection point with perforations in its walls and with liquid being fed into its hollow core from a reservoir.

At low concentrations protection is in a spiral around the tree. This was explained by dye-absorption studies using acid fuchsin. Five distinct patterns have been discovered, these differing according to the species of trees. Slides were used to illustrate the injection techniques and the types of distributions obtained. In some tree species the spiral conduction of liquid injected at a single point near the base results in complete distribution of the poison through the crown. Protection given by point injection of metasystox is thus not restricted to a small part of the foliage, but is complete.

Experiments with systox and OMPA against the mountain pine beetle in lodgepole pine were described by J.M. Kinghorn. Several injection techniques were mentioned but the one used for most of the tests was cloth, paste, or absorbent cotton saturated with the toxicant and applied to girdles cut through the bark around the whole circumference of infested trees. Some mortality was achieved in broods within five feet above the injection level in pine treated a week after attack. Mortality higher in the treated trees was no greater than in corresponding controls. Brood mortality was negligible in trees treated three weeks after attack even at five feet above the girdles. Concentrated OMPA applied to frill girdles at the base of standing healthy Douglas-fir failed to reduce the density of Douglas-fir beetle attacks subsequent to felling. It was concluded that the rapid invasion of sapwood by bluestains associated with scolytids with the subsequent occulusion of the conducting tissues, seriously reduces the usefulness of systemics for bark beetle control.

R.H. Nagel summarized the experimental results with diefox, Thimet, and Systox in translocation studies with Engelmann spruce and American elms in Colorado. The systemic chemicals were applied by the implantation and soil drench methods. In the first method, undiluted solutions of each compound were poured into holes drilled into the sapwood just above the ground. In the other, 1-per cent emulsions or water solutions were poured around the base of trees, usually in inch-deep grooves scraped out with a stick or shovel.

In elms, implanted at the rate of 1 and 2 ml. of 50 per cent diefox per inch of girth, the European elm scale was effectively controlled. Some phototoxicity occurred at the 2- and more at the 4-ml. dosage. Soil drenches have been unsuccessful in dry soils, and in wet soils when applied in late July instead of in April or May.

LABORATORY STUDIES AND TECHNIQUES

Feb. 26, 3:30-5:00 p.m.
Feb. 27, 9:00-10:30 a.m. Discussion Leader: C.B. Eaton

C.B. Eaton opened the discussion by stating that few forest entomologists are engaged in laboratory studies of insecticides. Even fewer are conducting studies involving all phases of the subject. The most extensive work currently in progress is centered at two locations: Corvallis, Oregon, and Berkeley, California.

Comprehensive insecticide testing in the laboratory usually involves bioassays. These in turn involve mass rearing insects and problems attendant thereto, common to rearings for many other purposes. Mass rearing defoliators was discussed by G.T. Silver. Dr. Silver pointed out that satisfactory techniques for mass producing most members of this group are not known, except possibly for the spruce budworm. Four common difficulties encountered in defoliator rearings are: disease, parasites and predators, handling problems and food supply. Maintaining adequate stocks of food is a major problem. One way to overcome it is to stockpile food by freezing fresh material when it is available; another is to use a substitute. A special compartmented tray for holding twigs in nutrient solution so as to keep the foliage fresh during rearings was displayed.

D.L. Wood discussed problems in mass rearing bark beetles, particularly pine engravers. Chief problems are the need for handling large quantities of host material, and lack of knowledge of rearing requirements for optimum beetle production. Rearings of Ips confusus at Berkeley involve use of bolts of infested pine stock 6" to 24" in diameter. Material is caged under plastic screens, 20 mesh, and held in the greenhouse at 85°F. By relying on natural populations as a source of supply, production of test insects can be scheduled to some extent. Beetle production depends on degree of infestation in material collected. In the continuous rearing of I. confusus, these points are critical: length of the attack period; number of attacks (too many deplete food supply); size of emerging brood (small broods emerge over a long period); and intensity of attack (log must be fully attacked or reemerging adults will attack uninfested areas).

Problems in rearing Dendroctonus brevicomis were brought out by R.H. Smith. M.M. Furniss commented on rearing D. pseudotsugae. Mentioned were the use of a low temperature room for holding beetles until they are needed, rearing beetles from slabs encased in plastic bags or waxed, etc. R.B. Ryan described a D. pseudotsugae rearing procedure in which bolts of Douglas fir are set on moist sand in a greenhouse. Beetles are liberated and allowed to attack the logs. Chief problem encountered was to get beetles to emerge when they develop to the adult stage. Low temperatures proved to be an important factor, and Ryan described the tests run to determine this. His conclusion is that 3 generations per year probably can be reared by manipulating the temperature properly.

Topical application of insecticides was discussed by A.D. Moore. Before taking up this subject Dr. Moore mentioned that use of ground phloem reduced natural mortality in I. confusus rearings. Topical application studies on residuals for use against bark beetles are in progress at Berkeley. The topical application technique was described, and recently developed apparatus for the rapid treatment of beetles by topical application was demonstrated. Results of work to establish toxicity indices for some residual insecticides against D. brevicomis and I. confusus were presented (details in Jour. Econ. Ent. 50(5): 548-550). Wide differences in the toxicity of an insecticide, not only for different species but for different sexes of the same species, have been found. Improvements in equipment and refinements in technique for topical application tests are being developed. Research being conducted by

R.L. Lyon at Berkeley has shown that differences in the physical states of deposits (crystal size, shape, structure, etc.) markedly affect toxicity.

J.A. Rudinsky spoke about problems in screening insecticides for bark beetle control. He described progress that has been made in developing this work at Corvallis, including the physical plant which conferees later saw. Search has been underway for a suitable test insect that was hardy and could be reared in quantity throughout the year. Of several species studied (including Scolytus, Phloeosinus, Ips, and Pseudohylesinus) D. pseudotsugae is most promising. This beetle seems to have a high tolerance for insecticides, and in rearings natural mortality has been less troublesome than with the other species studied. Topical application procedures patterned after methods worked out in California are being used in the screening tests. Beetles are weighed individually, and the amount of insecticide adjusted according to weight. To eliminate the need for weighings, a different technique involving the use of a wind tunnel is being investigated. The insecticide is sprayed into the airstream and the test insects exposed in a cage inserted in the air-stream. Spray pickup with this method is proportional to beetle size.

LEGAL AND OTHER ASPECTS OF SPRAY PROGRAMMES

Feb. 27, 10:45 a.m. - 12:00 noon   Discussion Leader: J.M. Whiteside

After a brief opening remark by the Discussion Leader, the order of presenting and discussing the subject was outlined as follows: (1) Dr. J.J. Fettes on the Canadian point of view, and (2) Mr. W.V. Benedict on the problem as viewed in the United States. Questions on this important topic were solicited at the end of the presentation.

Fettes explained that administration of forested lands in Canada rests with the Province. Each Province has its own forest laws. Most spray programmes are partly aided by the Canadian Forest Act. This Act is mostly concerned with forest fires and contains relatively little specific regulation of forest spraying. However, one important test case is now before the courts. This case involves two branches of the government (the Department of Fisheries and Forest Protection Ltd.) and concerns the killing of fish by DDT in New Brunswick. It is claimed that 7 years of experimental fish stock has been lost as a result of aerial spraying for budworm control. While the implications are serious and a decision is needed, it is expected that the case will be decided without a financial settlement.

A clause in the Fisheries Act which may have a bearing on forest spraying is as yet not tested. This clause states that the source of any pollution endangering commercial fish populations can be stopped. However, fisheries people are not making much headway against hydro-electric developments and forest production.

At the present time forest spraying legislation is lacking in Canada. This may be a benefit rather than having too many laws. The feeling is that the situation should remain about as it is.

Forest spraying contracts must be approved under the Canadian Forest Act before funds are made available. Clauses in this Act allow money to be set aside for forest spraying. The Act was brought to bear in 1951 in order to make plans for budworm spraying in 1952. Since 1952 about 14 million acres have been sprayed in Canada.

Costs of spraying are usually shared as follows: 1/3 by the Canadian Government, 1/3 by the Province, and 1/3 by private companies. Control organizations are mostly made up of personnel of private companies. Forest Protection Ltd. carries out budworm control operations in Eastern Canada. The Pest Control Committee of the B.C. Loggers' Association conducted aerial spraying operations for black-headed budworm control in B.C. in 1957. The feeling in some parts of Canada is that it is not necessary for all parties to come into a control program. An example was cited where Quebec Province prefer to pay the total costs of control operations.

The role of the Forest Biology Division of the Department of Agriculture in spraying programmes was explained. The Division makes recommendations for control and is available for technical advice. It is the only agency able to make recommendations on the type of aircraft for spraying, when to spray, where to spray, etc. This service represents a heavy drain on Forest Biology Laboratories in the respective provinces. The work involves, among other things, the following services: (1) population damage surveys and a prognosis of trends, (2) calibration of aircraft and evaluation of proper equipment, (3) insecticide formulations, and (4) dosages to be applied. Some difficulties occur when "experts" take on themselves the right to change the original recommendations.

After recommendations are made by the Forest Biology Division, the control committee is the governing body in the conduct of control. This committee has full control over funds. It may, for example, buy insecticide, issue contracts, or subcontract.

In forest spraying, the liability rests with the agency doing the work. Ordinary precautionary rules are followed during control operations. For example, spray planes and observation planes are licensed by the Department of Transport, dump valves on spray planes are mandatory, and crash helmets are worn by spray pilots.

The above procedures appear to have worked well in Canadian forest spraying for defoliator control.

W.V. Benedict stressed the importance of research in control and pointed out that personnel engaged in control are strongly interested in research as research provides the tools for control. In the U.S. some 290 million dollars were spent for insecticide application in 1956. This expenditure has doubled each decade since 1946 and may soon reach the billion dollar mark. These figures lend perspective to the importance of research and the use of chemicals in combatting pests.

Since passage of the Forest Pest Control Act in 1947 (Public Law 110) some 10 million acres have been sprayed in the U.S. This is an average of about 1 million acres per year and is small in comparison with the Canadian spruce budworm program and such programs of the Agricultural Research Services as gypsy moth, fire ant, Mediterranean fruit fly and grasshopper control. The Forest Service Aerial Spraying program during the spring of 1958 will involve about 1-1/4 million acres.

In both the A.R.S. and the Forest Service, spraying is done by contract including the pesticide formulation, its transportation to airstrips and its application by aircraft. The contract is a most important legal document in a control project for it outlines the provisions and administration of control. Many of the technical clauses have been developed from spraying experience. One problem in connection with competitive bidding is the lack of an effective yardstick for keeping unqualified boomers and hot-rodders from bidding and at the same time identifying contractors able and qualified to conduct control. One answer to this problem lies in self-policing action by the aerial applicators themselves. A good forward step has been made through their affiliation with the National Aviation Trade Association. Here representatives of government and the aerial applicators meet annually to discuss together mutual problems. Some points that came up for critical comment at last years meeting are: (1) should acres or gallons be the basic unit of payment, (2) who pays for respraying and under what conditions, (3) differences in contracts between Forest Service regions and between A.R.S. and FS contracts.

The use of "Decca Control" was briefly described and the results of a test in Canada were explained. This is a precise navigation system using low frequency radio beams with 1 master and 2 slave stations and it is portable. It was felt that this system may have possibilities in forest spraying because of pin-point control over spraying. A spray pilot can be directed to resume spraying at the exact spot at which he stopped spraying on a previous spray-run.

The government contract, as now written, is a good document. It has flexibility to meet most situations, allows for adjustments for unforeseen situations and for settling disputes. Most complaints on contractual procedures stem from misinformation, or misunderstandings of contract specifications and the role of contracting officer and project supervisor. The Forest Service through pre-bid meetings, pre-award meetings and meetings with successful bidders attempts to avoid contract difficulties and reduce later misunderstandings. At the field level, the contracting officer is the sole agent of the Forest Service for settling contractual disputes.

Other Aspects

Prior to issuance of bids and awarding of a contract, there is one important aspect of pest control that is fundamental to planning and initiating control action - authority for engaging in pest control on non-federal lands is vested in the States. Cooperative agreements with the states are thus an essential arrangement wherever non-federal land is involved in a proposed federal spray project. Under such agreements, federal pest personnel function as agents of the state and follow state laws. Where a pest operation is principally on non-federal lands, the administration of the project is usually done by the State, with the federal partner occupying the role of technical advisor and assisting in the payment of the control bill. In cases where the work is done by the federal government, provisions in a cooperative agreement define the responsibilities to be borne by the federal agency.

In the U.S., liabilities in forest spraying are about the same as in Canada. The Federal Tort Act is an important act and is the only authority available to the government or the Department of Agriculture for payment of claims for damages arising from the activities of the Department. If damage is done, an owner has recourse under this act. If damages are less than $1000 and are substantiated, the Department may settle the claim and the amount is charged against the project. If a claim exceeds $1000, it is settled by court action.

Because of its importance and possible impact on forest spraying, the current legal action, in connection with gypsy moth spraying in the East, was discussed at some length. The plaintiffs are objecting to the application of insecticide on their properties as a fundamental principle. In 1957 a temporary injunction was sought to prevent aerial spraying. This was turned down but the door was left open. The case is now being heard. The Department of Agriculture fully recognizes the implications of this important case. The outcome could affect all types of pest control - Forest, crop, range, and orchard. The verdict will determine the right of the state to spray private property against the wishes of the owner.

In conclusion it was stated that we are in business to stop pest damage. To do this we have to get the right amount of pesticide in the right place, at the right time, and do it so safely that injuries and other damage don't interfere with control progress.

Beal asked Fettes whether the reports of damage to fish stemmed from one case or more than one. More than one case was reported in New Brunswick and the incidence of fish killing in British Columbia was causing more serious concern.

Clark asked Benedict whether gypsy moth control was carried out under state or federal laws. It is being conducted under state law.

Furniss asked Fettes whether damage to other forms of wildlife from forest spraying had been reported in Canada. Little, if any, damage has been reported and mostly through crank letters. Most of the land being sprayed is Crown land. There is little privately owned land and this is in remote areas.

Beal commented that DDT is a most important insecticide and that limits are set on DDT tolerance. Considerable pressure is being exerted to get a substitute for DDT for forest spraying.

P.C. Johnson felt that we need to bring better insecticides into practice. A search of the literature reveals a great number of insecticides but their side effects are lacking. We cannot turn overnight to new methods in forest spraying.

Rudinsky asked Fettes what effect the leaching of chemicals, used in protecting logs stored in water, had on fish. There was no authentic case; however, periodic tests of DDT leaching showed negligible amounts. Studies are proposed to test the leaching of DDT through duff.

INSECTICIDES AGAINST DEFOLIATORS

Feb. 27, 1:30 - 5:00 p.m. Discussion Leader: R.R. Lejeune

A. New Developments in Field Application - A.T. Larsen

At present, formulations are relatively standard with 1 lb. of DDT dissolved in 1 qt. of solvent plus enough diesel oil to make one gallon.

Considerable variation has developed in the method of application both in types of planes and height of flight. In the Pacific Northwest and Idaho many types from Stearmans to B-18's to DC3's have been used while in eastern Canada use has been limited to Stearmans. TBM Gruman Avengers were used on the one project in British Columbia. The largest planes (C-82's) have been used on budworm projects in Montana and on other projects in the eastern United States. B-17's have been employed on some eastern projects.

New developments in this phase of the work are limited. Several smaller planes have been designed for spraying and dusting but are not in general use due to cost and availability of surplus aircraft. As for the larger planes, the industry is limited only by the availability of surplus aircraft. More propellor-driven ships are being declared surplus all the time.

With increased use of larger aircraft there has been more emphasis on raising height of flight for two reasons: 1) The larger ships are not as maneuverable and therefore need more altitude for safety; and 2) By increasing height of flight, more planes are allowed on the project and reduce the overall cost. This is where possible work on "new developments" might be emphasized.

For a number of years spray was released from heights of 250 feet or less above tree tops, while some recent work has been done at heights up to 700 feet; under these circumstances not enough is known about the effects of temperature and wind on the dispersion of spray. Research on spraying agricultural crops has shown that temperature and wind drift are major factors, particularly when using certain of the new chemicals. Possibly more emphasis should be placed on these conditions in future work on forest spraying. Perhaps there is also a need for further analysis of spray systems in aircraft.

DISCUSSION. McComb believes that more even distribution is obtained from larger ships. Fettes claimed that formulations have been neglected and described some experimental work to drive home his point. Possibilities of using the new Decca Navigational System for spray operations were reviewed by Benedict and Fettes. It is extremely accurate and its use would cost about 10¢/acre. Johnson, McComb, Fettes and Larsen explored problems of wind drift, temperatures and temperature inversions, barometric pressure and droplet size in relation to effective spraying.

B. Formulations - J.J. Fettes

Research on formulations has been neglected in aerial spraying. This neglect has been made evident by recent agitation in eastern and western Canada to develop insecticides or formulations less toxic to fish.

It has been shown that, in general, the nature of the insecticide solution has a marked bearing on its effect on fish. For example, in an experiment with rainbow trout the following results are reported:

DDT in acetone suspension	30 ppm. not lethal
DDT in fuel oil	20 ppm. not lethal
DDT in xylene	5 ppm. lethal
DDT in emulsion	3 ppm. lethal
DDT in kerosene	0.3 ppm. lethal

This illustration suggests a starting point for investigations to develop insecticidal formulations less toxic to fish and shows the importance of not tampering with acceptable formulations unless further tolerance tests are made before application.

The insecticidal effectiveness of a spray deposit is not related just to volume per unit area; it is also governed by toxicant concentration, particle size distribution, and number of particles per unit area. Despite valuable data from many field experiments a precise definition of "minimum effective dosage" for control of a forest defoliator cannot be made. The original "1 pound per gallon per acre" rule has persisted for 13 years or more with little change although ½ pound per ½ gallon per acre has been used extensively in eastern Canada. Experiments suggest that volume of material is as important as insecticide concentration to a yet unknown lower limit and that number of particles per unit area is a more reliable criterion for effective coverage than volume per unit area.

In aerial spraying the lower limit of particle size is governed by the ability of the particles to fall to the ground. With a 10 per cent DDT solution these minute particles are apparently lethal to spruce budworm larvae. It has been shown that dosages of 0.1 gallons per acre may be adequate, provided at least 20 particles per square centimeter are deposited. The implications of the foregoing are quite clear. Improved techniques for spray breakup and deposit could result in adequate control of insects with reduced hazard to fish.

Data gathered during the course of trials at Kenora, Ontario, brought out an important point in understanding the type of deposit which should be effective against defoliators. A significant correlation was found only in the relationship between drop number and mortality, regardless of drop size distribution. This indicates that all of the drops which were deposited are lethal, and that minute amounts of insecticide will do the job: 100 per cent kill of spruce budworm was produced by only 0.09 lb. of DDT deposited per acre. This occurred wherever the number of droplets per sq. cm. equalled or exceeded 21.

The effect of evaporation on the toxicological aspects of forest insect spraying is important and should be studied intensively. The Chemical Control Section has discovered that droplets of an oil solution around 100 microns in size lose 50 per cent of their weight during the two to five minutes they are in the air. This results in a much higher concentration of insecticide being applied to the foliage than that which leaves the plane. It has been explained earlier that droplets which are large enough to settle into the forest are large enough to kill insects. Therefore much work could be done to minimize evaporation or decrease insecticide to the lowest effective concentration.

DISCUSSION. Many questions centered around this interesting topic, but practically all of them were raised during discussion of subjects presented by the other panel members. Therefore, comments on this topic will be found in the following sections.

C. Evaluating Effectiveness - J.M. Whiteside

A digest of reports in the Portland files showed several interesting facts. Insecticides have been used against 16 species of western forest defoliators. The first tests appear to have been made in 1924-27 against the lodgepole sawfly and lodgepole needle miner in Montana with lead arsenate. First tests against the spruce budworm were in Wyoming in 1929 with lead arsenate spray using fire pumps and hoses. Tests against larvae in tight buds were not successful but fair control was obtained against larvae in open buds.

The first aerial dusting project was in 1931 with calcium arsenate to control hemlock looper in Washington. The first aerial spraying project was in 1945 again against the hemlock looper in Oregon. Twelve thousand acres were sprayed with lead aresenate and DDT (9,300 and 2,300 acres respectively). The first large-scale aerial operation was in 1947 when 413,000 acres were treated with DDT in Idaho, Oregon, and Washington to control the Douglas-fir tussock moth. This was the first project under the Forest Pest Control Act. The bulk of insecticides have been applied since 1949 against four species by aerial application of DDT -

Spruce budworm	8,500,000 acres
Douglas-fir tussock moth	423,000 acres
Pine butterfly	256,000 acres
Black-headed budworm	156,000 acres

From 1949 to 1957 nearly 20 million acres have been sprayed in North America to control the spruce budworm.

Whiteside then discussed factors influencing effectiveness of spraying. The first is seasonal development of the insect. Timing of application is governed by advanced, erratic or delayed development of host and insect. Spring frosts may kill new shoots but not the insect. The second are operational factors such as weather and terrain.

Effectiveness may be evaluated by both direct and indirect methods. Direct methods are essentially measurement of pre- and post-spray populations. This is usually done by comparing populations on 18- or 15-inch branch samples. Per cent mortality is usually calculated from Abbot's formula. Other direct methods are exposure tests, measurement of frass drop, the use of life tables, and measurement of dosage and droplet density.

Indirect methods consist chiefly of surveys to determine residual populations or effect of feeding by the surviving populations. Various types of surveys are annual aerial detection and appraisal, egg sampling, re-examination of permanent plots and ocular estimates of foliage damage.

There is some variation in timing of post-spray measurement. Final counts for spruce budworm are made 10 days after spraying, for black-headed budworm 10-12 days, and for lodgepole needle miner one month after spraying. Frass fall is measured until it stops.

Timing of spraying for different species is recommended as follows:
Lodgepole needle miner - after 75 per cent of eggs have hatched;
Black-headed budworm - after all eggs have hatched;
Douglas-fir tussock moth and spruce budworm - when most larvae are in the fifth instar.

Malathion is the best insecticide known for the lodgepole needle miner; DDT is used for all the others listed.

DISCUSSION. The problem of preserving check areas was raised. In many spray jobs there are none. Fettes emphasized the need for checks to determine natural mortality. P. Johnson emphasized the need for rapid assessment to clear the spray contractors. Whiteside pointed out that a percentage of the payment was usually withheld until final assessment. Another problem is appraising the significance of mortality figures. The percentage kill required for foliage protection varies with light and heavy populations. We also need to know whether the population is increasing or decreasing. Parker outlined the work being done by Cole on this problem and on residual populations. Silver suggested that interpretation of mortality figures depends on the objectives, whether treatment is to save trees or decrease the population. Carolin stated that from 7-year records from spruce budworm control projects there was no evidence of treatment increasing subsequent populations. To a query from Silver about the best time for spraying 2-year cycle spruce budworm, McComb and Hopping recommended the second feeding year. Furniss and Fettes reviewed some problems of screening and bio-assays. Fettes believes complete mortality-dosage curves are required for adequate assessment.

D. Effects on Other Noxious Insects and Parasites and Predators - J.M. Whiteside

Studies in Oregon, Washington, and New Brunswick indicate the following conclusions about spruce budworm parasites and predators: (a) DDT spraying has not adversely affected the primary parasites of overwintering larvae, Apanteles, Glypta and Horogenes; (b) parasitism of full-grown larvae appears to be in general reduced both in total parasitism and species represented and; (c) predators are not adversely affected by spraying.

Miscellaneous defoliators occur in about the same numbers in sprayed and unsprayed areas. Recently in Montana the spruce mite balance seems to have been upset by spraying.

DISCUSSION. Fettes described results from spraying at several places in the outbreak population curve. Treatment did not change the slope of the curve, but it is possible that correct timing of application could eliminate initial outbreak foci. Furniss - when populations are reduced to low levels they sometimes bounce back or may go down in contiguous areas.

P.C. Johnson elaborated on the spruce mite outbreak in Montana, which is apparently associated with DDT spraying against the spruce budworm. Very few outbreaks of the mite have been recorded in forests. Browning due to mites showed up in 1957 in portions of 800,000 acres of Douglas fir sprayed in 1956. This is believed to be caused by killing of predators in 1956 and drought in 1957. Predaceous mites were building up in the fall of 1958. Recorded outbreaks in the past have not lasted more than two years. No budworm spraying was attempted in 1958 because of the serious mite situation which appeared to cause greater damage in one year than two to four years of budworm feeding. Vité referred to similar situations in Switzerland and northern Germany.

E. Effects on Birds, Fish and Mammals - A.F. Larsen

The variety of problems which have evolved in the various parts of North America in regard to DDT spraying are of such importance at this time that several sessions could be spent discussing this one subject.

In Oregon it has been maintained that when the spray is properly applied there is little danger to fish and wildlife and to date this is reasonably true. However, this same type of spray, when applied under similar conditions in other areas, has resulted in the killing of a variety of aquatic life and some forms of wildlife.

As a result, numerous individuals and organizations are raising legal questions as to the validity of certain spray programmes which could eventually create serious problems in any spray project.

Basically, the effects of DDT are determined by the formulation, which includes the amount of toxicant and the carrier used, the amount of spray actually reaching the object, and the susceptibility of the recipient organism.

The susceptibility of the organism, whether it be the budworm, fish, bees, etc., will vary with the formulation, environment, and the particular species. There are still many unknowns in this respect as shown by the studies carried on in both the United States and Canada.

Many streams have been sprayed with little or no effect on the fish, whereas other streams have suffered an almost complete mortality of all types of aquatic life. Crayfish and some minute forms of aquatic life are extremely susceptible to DDT spray and the susceptibility also varies between fish species.

In reviewing the studies to date, it appears that prime emphasis should be placed on an analysis of specific problem areas relative to stream flow, natural variations in aquatic populations, chemical composition of stream and adjacent land areas, temperature relationships and possible other items as determined by the biologists. Needless to say any of this work should be carried on either with the cooperation of, or under the supervision of the Fish and Wildlife agencies concerned. Not only is it their duty to maintain normal or near normal populations but it is also necessary for all of us to help maintain a balance between the forest and the fish and wildlife interests.

There have been very few reported instances of damage to wildlife other than to bees. However, any time any form of animal or vegetable dies during a spray project, it is immediately blamed on the spraying. As a result continued caution must be observed in this respect.

DISCUSSION. <u>Scott</u> summarized studies in Montana on mortality to fish and fish food populations in streams sprayed with DDT. In 1956 small streams were sampled before and after spraying for fish insects. There was no observed decrease in 1956 or 1957. Bio-assays show that in hatcheries the spray killed fingerlings. In 1957 there were losses of up to 70 per cent in two streams but water levels were below normal. Insects in two trout streams were reduced 50 to 90 per cent but the population in one was near normal in 1958 and it was returning to normal in the other. It appears that application of 1 lb./gal./acre was safe in fast streams but not in slow streams.

F. Resistance to Insecticides - J.J. Fettes

There were only a few minutes available for this topic. Fettes stated that it required several to many generations to gain resistance and therefore in forest spraying this was not considered to be a serious problem. The suggestion was raised that resistance in ambrosia beetles might become a problem in booming grounds where sprays are applied year after year.

INSECTICIDES AGAINST BARK BEETLES

Feb. 28, 9:00 - 10:30 Discussion Leader: R.C. Hall

Hall introduced the topic by pointing out some of the problems inherent in such programmes. Although considerable progress has been made in the last decade in improved methods over the old cut-peel-burn method, there still remain many real problems in control of bark beetles through the use of insecticides. Some of the points emphasized were: (1) the relative high cost per tree where costs may run over one hundred dollars per tree, with average costs per tree often exceeding twenty dollars; (2) the relatively high volume of insecticides needed per tree, which means a serious transportation problem in inaccessible areas; (3) the fact that each tree must be treated as a control unit, with no possibility of area-wide treatment such as is used for defoliators; and (4) the need for developing an effective residual type of insecticide, aiming for a substantial reduction in volume of insecticide needed as well as reducing costs.

Nagel discussed the results of tests in Colorado with dichloroethylether (DCEE) to control the Engelmann spruce beetle. Both in the laboratory and in small-scale field comparative tests, DCEE in oil solution was equal, weight for weight, to EDB for killing all stages of the beetle infesting bark of Engelmann spruce. When applied in emulsions, about 20 per cent more DCEE had to be included to be as effective as the EDB emulsion.

A dichloroethylether formulation has not been developed to a stage where it can be recommended as a substitute for the EDB formulation now being used to control the beetle. In a very small pilot control project in 1955, the control crews complained of the odor, which was quite objectionable to some of the men who had been applying EDB earlier in the day. For the lack of a suitable infested stand of spruce, another pilot control test could not be repeated.

As a potential bark beetle fumigant, DCEE has several important advantages over EDB. It is cheaper. Quotations in 1955 were as low as 15 cents per pound in tank car lots. Unformulated technical EDB solidifies at about 50°F, which is somewhat of a problem when formulating in the field early in the season. DCEE remains a liquid down to about -58°F. It is reported to be only half as toxic to humans as EDB. At 35 ppm in air, DCEE has a slightly offensive odor. No industrial poisoning has been reported.

Nagel also stated that two new emulsifiers were recommended as substitutes for Tritons X-100 and B-1956 in the EDB emulsion used to control the Engelmann spruce beetle. They are Rohm and Haas' Tritons X-151 and X-171, blended 1:5, by weight. The new products are cheaper, more efficient with No. 2 fuel oil and soft water, and both remain liquid during cool-temperature treating weather.

Massey discussed control problems in the Southwest where ethylene dibromide is used almost exclusively for the chemical control of bark beetles. It is used either as an emulsion or as an oil solution. The chemical is used as follows to formulate the emulsifiable concentrate:

ethylene dibromide	2 lbs.
emulsifier	8 oz.
No. 1 fuel oil to make	1 gallon

One gallon of the concentrate is used in 4 gallons of water. The emulsifier consists of a blend of 3 oz. of Triton X-100 and 5 oz. of Triton B-1956. This concentration of emulsion has been used against all stages of D. convexifrons, D. ponderosae and Scolytus ventralis, although 1.5 lbs. of ethylene dibromide in 5 gallons of fuel oil is also effective against these insects. Green ponderosa pine trees have been successfully protected from attacks by D. barberi and Ips lecontei by the application of a 2 per cent DDT emulsion.

Parker discussed some of the problems in the Intermountain area where bark beetle control jobs for the past few years have been concerned with Black Hills beetle in ponderosa pine on the Dixie National Forest and Bryce Canyon Park in southern Utah, and with mountain pine beetle in lodgepole pine in the Teton country in Wyoming.

In both cases the EDB emulsion formulation has been used--3 lbs. of EDB technical grade, 0.25 lb. of Triton X-100, 0.25 lb. Triton B-1956 with fuel oil q.s. to make one gallon. The finished emulsion consists of one volume of stock to 4 volumes of water.

Spray is applied with a stirrup pump with an extension rod and smooth bore nozzle. Areas are string-lined about 4 chains wide. Crews consist of 3 or 4 men, depending upon concentration of infested trees and accessibility of areas. Trees are sprayed standing, starting at the highest point that can be reached with the spray (approximately 30 feet). Spray is applied heavily and allowed to run downward. The spraying continues downward to insure thorough application. Trees are then felled and the upper portions of infested boles sprayed. If the trees are small they do not have to be felled. In estimating amounts of insecticide for procurement, a figure of 5 gallons of finished emulsion per tree is used for lodgepole and 12 for ponderosa pine.

Effectiveness is checked by cutting 16-inch billets at three positions: 5 feet above ground, 5 feet from upper limits, and midway between these points. Thus the lower stem where bark is thickest is sampled, as well as the upper limits of standing spraying, and the area sprayed after felling. In a large operation the amount of checking is limited, but 3 to 5 trees in a unit area has been satisfactory to check crew performance and reveal variations between crews, mortality by position on stems or between standing treatment and portions sprayed after felling.

Contract treatment has been successful. Contractors are furnished equipment and materials and their personnel receive training in methods. Inspection is important and penalty provisions in case of poor treatment is effective. The caliber of work has been high.

Moore discussed the use of insecticides for bark beetle control in California. Penetrating oil sprays are being used extensively for the control of all Dendroctonus species. A number of different types of equipment are being used to apply the sprays, but the common garden sprinkling can has proven most efficient. The cost of the treatment is high - averaging about $20 per tree. Also, the effectiveness of the treatment varies greatly which is probably the result of differences in the efficiency of treating crews.

While penetrating oils are being used in the absence of anything better, a concerted attempt is being made to develop a more satisfactory method of treatment. Insecticide research is being concentrated on the potentialities of residual-type insecticides.

Kinghorn in the discussion of regional operational problems in bark beetle control, noted that in Canada, bark beetle chemical control operations have not been carried out in the past, and none are planned for the immediate future. Therefore, in lieu of discussing operational problems, he suggested the following reasons for this lack of large-scale control programs: (1) lack of concern on the part of forest owners in bark beetle outbreak areas, presumably due to the abundance and relatively low value of susceptible forests; (2) high cost of chemical control, aggravated by large areas of inaccessible forest; and (3) the questionable value of direct control in curbing bark beetle outbreaks. Almost no research on bark beetle chemical control is being continued in Canada; instead, efforts by workers at the Calgary and Victoria laboratories are being devoted to population studies. The ultimate objective is to develop methods of assessing the effects of both natural and applied controls.

CHEMICAL CONTROL OF WOOD BORERS

Feb. 28, 10:45 - 12:15 Discussion Leader: K. Graham

Graham introduced the subject with a review of important current problems. In British Columbia, ambrosia beetles are the wood boring insects causing principal damage to sawlogs. Forest industries are becoming increasingly concerned as restrictions against damaged lumber in export markets mounts. Buprestid and cerambycid damage in logs is occasionally significant but it rarely represents a serious problem. On the other hand, termites, powder post beetles, and other insects affecting wood in service are becoming more serious as the distribution of various species spreads, and as the number of older, poorly built wooden structures increases in western cities.

As a background for the need of chemicals in preventing ambrosia beetle damage, logging operational methods of control were outlined. Modified logging schedules can reduce damage, but where these are impractical it becomes necessary to resort to chemicals. Although reduced felled and bucked inventories, and rapid removal of logs from the forests reduce damage, these methods often fail because large volumes of logs must be cut well in advance of logging. Large inventories are necessary in regions where the terrain requires skidder and slack line settings, and where mid-winter snowfall is excessive. At times much wood must be left on the ground when fire closures, strikes, or shutdowns occur unexpectedly. Truck logging in west coast forests has given greater versatility to operations, but the proportion of logs exposed on road right-of-ways under construction has also increased. These logs are frequently damaged because lack of ballasted roads in spring, and conflicts between main hauling and right-of-way logging allow them to be exposed to attack before they are removed from the forest.

Graham also outlined chemical control methods used against various wood borers and the types of problems encountered. The principal considerations may be grouped as follows: methods of application as governed by the type and circumstances of infestation; timing in relation to preventive treatments; gallery structure and wood anatomy in relation to insecticide penetration; weathering and surface absorption or retentiveness in relation to control; type of toxicant required for specific purposes (e.g. residuals for protections and fumigants for infestation control); and formulation as related to effectiveness.

The economic basis for chemical prevention of ambrosia beetle damage was discussed by Kinghorn. A few results of a recent mill study of damaged logs in British Columbia were presented. Lumber cut from attacked logs was graded as it was, and as it would have been had beetle damage not occurred. For both fir and hemlock log value was strongly related to percentage degrade. Lumber cut from high-value logs was seriously degraded (15-25 per cent of the value of the log) even where the attack was light, but degrade of lumber from low value logs with a heavy attack was light (0-4 per cent). By taking log value into account it was possible to demonstrate a relation between degrade and density of attack. An example of a regression relationship between damage, log value and density of attack was shown. Degrade studies such as this help to form economic limits for chemical protection costs. High costs can be justified where valuable logs are jeopardized, whereas it is questionable if preventive expenditures on low value material is warranted.

A few results of preventive chemical experiments were given. The gamma isomer of BHC (lindane) remains unsurpassed for the purpose by other insecticides. Of the types of formulations tested, wettable powder gave better protection than oil solutions which in turn were superior to emulsions. Emulsions do, however, have the advantages of low cost, low fire hazard and reasonable stability. Increasing the concentration of lindane from 0.4 to 1.0 to 1.5 per cent did not proportionately improve protection. Neither a decomposable emulsifier nor chlorinated resin additives improved the protection given by lindane emulsions tested. Future studies are aimed at developing surface residues available to the beetles rather than trying to achieve a high degree of bark penetration.

R.H. Smith gave the following account of the use of insecticide against termites and powder post beetles:

The increased value of wood products caused by processing and the relative increase in the percentage of sapwood on the market are two reasons for the consideration given to powder-post beetles and termites. The attention given to these pests is reflected in the time and money currently spent for controlling them and the great number of inquiries reaching public agencies for advice and recommendations.

The methods of application of insecticides against wood borers are varied and depend on such factors as value of the product, type of chemical used, the condition, location, and use of the wood, and the type and condition of the infestation. Surface application in the form of sprays, fogs, and brushings have been successfully used. With more research, these procedures could be made more useful and effective than currently possible. Of the impregnation procedures, pressure treatment is the most effective though also the most expensive. Brief dips and various tree treatments have proven to be comparatively effective. Barrier treatments, such as trench or surface drenches, are widely used against termites. Toxicants have been applied as both oil solutions and aqueous emulsions.

Though there has been considerable work on the use of various insecticides, evaluation is difficult because of the long residual effectiveness required. Some of the toxicants used are as follows: (1) Sodium arsenite is very effective as a barrier against termites; however, it is hazardous to use. (2) Copper sulfate and zinc chloride have been effectively used as standing-tree injections for protecting poles and posts against termites. (3) Pentachlorophenol, though widely advertised as a wood preservative, has not proven an effective barrier against termites or as an effective, superficial surface treatment against powder-post beetles. Copper naphthenate acts quite similarly. Fortification with a chlorinated hydrocarbon is usually recommended for these two chemicals. (4) Chlorinated hydrocarbons present the fortunate combination of high toxicity and long residual effectiveness. DDT, Chlordane, and BHC have looked best the longest against termites and powder-post beetles. Concentrations frequently used are 8 per cent, 2 per cent, and 0.5 per cent respectively. They are commonly applied as oil solutions and as aqueous emulsions. (5) Fumigants such as EDB, ortho, and trichlorobenzene have limited use because of the hazard and lack of residual effectiveness. Trichlorobenzene has looked quite good for remedial control of powder-post beetles and drywood termites. It can be easily fortified with a chlorinated hydrocarbon. The use of HCN and methylbromide is limited to experienced operators. (6) Creosote, though still widely used through pressure applications, does not appear to be consistently effective as a soil barrier against termites. The lack of a precise definition of the chemical mixture could be the reason.

The time of application of an insecticide usually depends more upon the condition of the wood than upon the development of the insect.

The question of penetration and retention was only briefly treated. In addition to wood anatomy and method of application, the role of formulation was mentioned. The oil carrier could be an important factor in penetration.

From recent lab tests conducted in southern California an attempt was made to evaluate various insecticides for controlling termites. The results do not agree with the long-term field tests in the East. This discrepancy could be caused by a radical difference between the eastern and western subterranian termite or the inability of short-term lab tests to be projected into long-term field conditions.

MINUTES OF THE FINAL BUSINESS MEETING
February 28, 1958

The meeting was called to order by the Chairman, M.G. Thomson, at 1:30 p.m. in Room 206, Memorial Union, at Oregon State College.

The secretary read the minutes of the initial business meeting on February 26. H. Ruckes moved adoption of the minutes as read. The motion was seconded by K. Graham and passed.

The Chairman called for committee reports.

R.L. Furniss read the Common Names Committee report (see Appendix B) and moved its adoption. The motion was seconded by M.M. Furniss and passed.

G.R. Hopping read a report by the Committee on Indexing of Research Reports (see Appendix C) and moved its adoption. The motion was seconded by R.R. Lejeune and passed.

A.D. Moore summarized the plans of the Education Committee as follows:

1. On returning from the conference each committee member will prepare a report covering his ideas on:
   A - The place of Forest Entomology in the forestry program.
   B - The status of: (a) forest entomology in the foresters training,
   (b) undergraduate training for forest entomologists, and
   (c) graduate training for forest entomologists.

2. After review by all committee members the material will be brought together in one report and circulated to the conference members for review.

3. Contingent on approval by the program committee a general meeting will be held at the 1959 conference to allow for comments and suggestions on the report.

4. A final report will be prepared for approval by the conference and circulation to the Forestry and Entomology Schools.

He pointed out that comments and suggestions from the conference members would be welcome at any time, but especially so before the deadline for the first draft, June 1, 1958.

K. Wright presented a brief but enlightening report on the activities of the Ethical Practices Committee.

The Chairman appointed H.A. Richmond and K. Graham as Co-chairmen of the 1959 conference.

K. Graham commented on the noon meeting held by the Executive Committee, this year's Program Committee, and representatives from the Vancouver area to discuss the 1959 program. Most of the meeting was devoted to suggestions for conducting the conference. He asked for comments on one matter that had arisen, the desirability of retaining the annual conditions report in the program.

The Chairman opened the discussion to the floor. Following the ensuing discussion, a show of hands indicated that a majority of those in attendance favored retaining the report.

It was suggested that the Program Committee consider shorter sessions (e.g. ending at 11:30 a.m. and 4:30 p.m.) to allow some leeway in the discussions.

R.L. Furniss presented the recommendations of the Nominating Committee as follows:

Chairman - R.W. Stark
Secretary-Treasurer - J.M. Kinghorn
1958 - 1961 Councilor - E.C. Clark

The Chairman called for nominations from the floor for Chairman.

R.C. Hall moved that the nominations be closed. The motion was seconded by B.E. Wickman and passed.

The Chairman called for nominations from the floor for Secretary-Treasurer. No nominations were made and the Chairman declared J.M. Kinghorn, Secretary-Treasurer by acclamation.

Nominations were opened for 1958-1961 Councilor.

K. Graham moved that the nominations be closed. The motion was seconded by D.A. Ross and passed.

The Chairman pointed out that the term of office of the outgoing officers would end at the conclusion of the meeting under revisions made in the constitution at the 1957 conference.

R.L. Furniss moved a vote of appreciation for the outgoing officers and the local program committee. The motion was seconded by C.B. Eaton and passed.

The meeting adjourned at 2:30 p.m. on a motion for adjournment by C.B. Eaton.

APPENDIX A

REPORT OF THE CHAIRMAN

In this my final report to you, I would like to thank all the Conference members for the interest and cooperation they have given myself and the other members of the executive. I know that Ron Stark and Jim Kinghorn will enjoy the same support.

The Western Forest Insect Work Conference is now an established and respected part of western forestry. During our term of office, Art Moore and I have endeavoured to consolidate the "work conference concept" initially developed under Hec Richmond and Phil Johnson's guidance and furthered by Bob Furniss. We have tried to encourage everyone - especially the younger members - to actively participate in both the technical sessions and committee work of the Conference. On the other hand, we have tried to discourage the presentation of papers (excepting a few special guest speakers) and star panels, since both tend to discourage spontaneous discussion from the floor. We hope and believe you have enjoyed the informal nature of the meetings.

I have recently withdrawn from public service and the field of Forest Entomology so as to be able to devote more time to family affairs, and so will take this opportunity to say goodbye to many of you. I shall, however, retain a keen interest in the Conference and will participate in the 1959 meeting in Vancouver where I hope to meet many of you again. To those who will be unable to attend the Vancouver Conference may I say how much I have enjoyed knowing and working with you.

Gerry Thomson
June 26, 1958.

APPENDIX B

REPORT OF THE COMMON NAMES COMMITTEE

During the past year your committee has considered names for 20 species of insects proposed for common names. No final action has been taken, primarily because of questions regarding the rules of procedures adopted on a trial basis at the December 1955 Conference. At our meeting Wednesday night, February 26, 1958, the members present proposed that the Rules of Order be changed to clarify the questions raised. The Committee hereby proposes and moves for adoption the following revised Rules of Order:

1. That the Common Names Committee of the Western Forest Insect Work Conference be a standing committee of seven members appointed for an indefinite term by the Conference chairman. The chairman shall be an ex-officio member. (Unchanged, except for including the statement that the Conference chairman is an ex-officio member, a fact usually taken for granted).

2. That members of the Conference submit all proposed changes in the list of names approved by the Entomological Society of America through the Common Names Committee (WFIWC), and that such changes be kept to a minimum (Unchanged).

3. That members of the Conference likewise submit all proposed new names through the Common Names Committee (WFIWC) on a standard form prescribed by the Committee (General use of the standard form already being used by the committee members is necessary for orderly consideration of proposals from the membership at large).

4. Five or more positive votes by members of the Common Names Committee constitute approval of a proposal, except that two negative votes are sufficient for rejection (A revision to clarify the former 2/3's majority rule. The committee feeling is that practically complete agreement on a name is necessary to warrant committee approval).

5. That lists of Committee-approved names will be submitted annually to the membership at least 30 days prior to the annual meeting. Names not objected to within 30 days after the conference will be referred by the Conference chairman to the ESA Common Names Committee for action. Names receiving objections will be reconsidered by the Common Names Committee (WFIWC) which will sustain or over-ride the objection as provided for in rule 4. (Clears up uncertainties regarding procedure for handling names objected to by members at large; submission time changed because of change in meeting date).

6. That current lists of approved and unapproved common names will be maintained and submitted to the members as needed. (Unchanged).

7. That liaison be maintained with eastern committees on common names of forest insects. (This rule formerly stated that formation of eastern committees be encouraged. At least one such committee exists. The need now is to coordinate activities).

8. Delete. (This rule was a temporary one limiting the period for consideration of a list of names long since acted upon.

The committee members and other members of the conference present at the meeting February 26 felt that, once action is completed on the names now pending, future proposals should come largely from the conference members at large. A statement of the procedure for proposing names and a copy of the standard form will be distributed with each set of the proceedings of the 1958 conference.

Mr. Eaton pointed out that the term "pine reproduction weevil" used for the past 15 years for Cylindrocopturus eatoni is being used indiscriminately in the Southeastern United States to refer to species of Hylobius, Pachylobius and Pissodes. This illustrates why it is very desirable to coordinate with common names committees in other parts of the country. Mr. Eaton has been requested to prepare a statement outlining our interests in this matter.

The ESA Common Names Committee has acted upon the 57 names forwarded by our committee since its beginning (See list dated Feb. 15, 1957). Forty-two of the names were approved (5 with minor changes) and are listed on pages 3 and 4 of the December 1957 issue of the Bulletin of the Entomological Society of America. Fifteen were rejected including the "pine reproduction weevil" and the "balsam woolly aphid", both of which are actually in wide common use. Our committee, through the Conference chairman, will determine the nature of the objections in an effort to find ways to overcome them. The ESA committee will be requested to keep us advised in such cases in the future.

At the Feb. 26 meeting of the committee, Mr. Kinghorn objected to the name "two-striped ambrosia beetle" for Trypodendron lineatum in the ESA list on the basis that it is a misnomer because the beetle has two stripes on each elytron. The committee felt that the objection in this case should be submitted by the objecting member to the ESA Committee, since the name in question had been processed and approved according to WFIWC procedures. The time limit for objections is 30 days after receipt of the ESA bulletin.

Your committee submits this report realizing that progress during the year has been slow; however, we are convinced that action should be slow permitting full consideration of all proposals. We are proceeding on the assumption that approval of names should be nearly unanimous.

Submitted by:

Common Names Committee
Western Forest Insect Work Conference
R.L. Furniss, Chairman

APPENDIX C

REPORT OF THE COMMITTEE ON INDEXING OF REPORTS AND PUBLICATIONS

Through our Chairman, Gerry Thomson, a circular letter was sent to the various laboratories and institutions of the Western Work Conference, asking for a report on progress made in indexing reports and publications. Here are the responses, starting in the frozen north and ending up in the torrid south:

<u>Alaska</u> - Jan. 17/58 expect to have unpublished material indexed, mimeographed and ready for distribution within the next two months - G.L. Downing.

<u>Calgary</u> - Feb. 1/58. Reports and publications indexed, mimeographed and sent to each center - R.F. Shepherd.

<u>Vernon</u> - Feb. 1/58. Index completed - D.A. Ross.

<u>Victoria</u> - Jan. 7/58. Work has commenced on the index. It is expected that it can be completed and copies made available before the Feb. meeting in Corvallis - E.D.A. Dyer.

<u>Missoula</u> - Jan. 10/58. No progress at present. Phil Johnson believes completion is 2 years away - H.R. Dodge.

<u>Portland</u> - Jan. 16/58. Have not been able to commence indexing and prospects for future not bright - W.K. Coulter.

<u>Ft. Collins</u> - Jan. 13/58. Have done little on index. Hope to begin next year - F.B. Knight.

<u>Ogden</u> - Jan. 20/58. No progress has been made. Work load too heavy to tackle at present - R.I. Washburn.

<u>Berkeley</u> - Jan. 14/58. Little progress to date. Possibility of having more recent reports listed by the time of the work conference - C.B. Eaton.

<u>Albuquerque</u> - Jan. 16/58. We should complete our index list before next meeting - F.M. Yasinski.

Committee on Preparation of Lists of Unpublished Reports:

G.R. Hopping, Chairman
W.K. Coulter
C.B. Eaton
H.R. Dodge
R.I. Washburn
F.B. Knight
G.T. Silver

Submitted by:

G.R. Hopping
February 21, 1958.

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GUIDE TO PHOTOGRAPH OF CONFEREES

Corvallis, Oregon. February 26, 1958

Standing L.-R.

1. Bill Bedard
2. Julius Rudinsky
3. Jim Fettes
4. Blair McGugan
5. Roy Nagel
6. Carrol Williams
7. Biff Telford
8. Bud Ruckes
9. George Hopping
10. Ken Graham
11. Charles Eaton
12. David Evans
13. Bob Furniss
14. James Krygier
15. Paul Ritcher
16. J. H. Rediske
17. Cal Massey
18. Frank Brockman
19. Tom Silver
20. Dick Smith
21. Paul Lauterbach
22. Ray Lejeune
23. Al Larsen
24. Bob Denton
25. Archie Tunnock
26. Les McMullen
27. Mal Furniss
28. Don Parker
29. Jack Whiteside
30. Roger Ryan
31. Dick Bushing
32. Tom Harris

Seated L.-R.

1. Dave Wood
2. Jim Averell
3. Bill Coulter
4. Doug Ross
5. Gerry Thomson
6. Ken Wright
7. Val Carolin
8. Don Allen
9. Pete Orr
10. Warren Benedict
11. Guy Konnersman
12. Ben Howard
13. George Struble
14. Dan Dotta
15. Ernest Pearson
16. Phil Johnson
17. Pierre Vité
18. James Beal
19. Tom Koerber
20. Ralph Hall
21. Bob Stevens
22. Jim Kinghorn
23. Ed Clark
24. Norm Johnson
25. Boyd Wickman
26. Al Hedlin
27. Dave Fellin
28. Dave McComb
29. Art Moore

INDEX OF CONFERENCE MEMBERS

Names and addresses of members are grouped by regional affiliation in the foregoing roster. Numbered regions correspond to those of the United States Forest Service.

Name	Region	Page
Allen, D.G.	6	37
Allen, H.V.	2 & 3	34
Atkins, M.D.	B.C.	40
Averell, J.L.	5	35
Averill, C.C.	2 & 3	34
Baker, W.L.	Wash.	39
Barney, C.W.	2 & 3	34
Barr, W.F.	1 & 4	32
Beal, J.A.	Wash.	39
Bedard, W.D.	5	35
Benedict, W.V.	Wash.	39
Bennett, R.K.	2 & 3	34
Berry, D.	6	37
Bongberg, J.W.	Wash.	39
Brockman, C.F.	6	37
Brown, C.E.	Alta.	40
Buckhorn, W.J.	6	37
Bushing, R.W.	5	35
Carlson, S.T.	2 & 3	34
Carolin, V.M.	6	37
Chamberlain, W.J.	6	37
Chapman, J.A.	B.C.	40
Childs, F.	2 & 3	34
Clark, E.C.	1 & 4	32
Cole, W.E.	1 & 4	32
Condrashoff, S.	B.C.	40
Cook, J.A.	Alta.	40
Cornelius, R.O.	6	38
Coulter, W.K.	6	38
Cox, R.G.	1 & 4	32
Cumming, M.	Alta.	40
Dahlsten, D.L.	5	35
Davis, D.A.	1 & 4	32
DeMars, C.J.	5	35
Denton, R.E.	1 & 4	32
Dobson, R.C.	2 & 3	34
Dodge, H.R.	1 & 4	32
Dotta, D.D.	5	36
Downing, G.L.	10	39
Dyer, E.D.A.	B.C.	40
Eaton, C.B.	5	36
Edwards, D.K.	B.C.	40
Evans, D.	B.C.	40
Evenden, J.C.	1 & 4	32

Name	Region	Page
Farmer, L.J.	1 & 4	32
Fellin, D.G.	1 & 4	32
Fettes, J.J.	Ottawa	41
Furniss, M.M.	1 & 4	32
Furniss, R.L.	6	38
Graham, K.	B.C.	40
Gray, D.E.	Ottawa	41
Hall, R.C.	5	36
Harper, R.W.	5	36
Harper, V.L.	Wash.	38
Harris, T.H.	5	
Hedlin, A.F.	B.C.	40
Hester, D.A.	2 & 3	34
Hopkins, D.R.	6	38
Hopping, G.R.	Alta.	40
Howard, B.	6	38
Jaenicke, A.J.	6	38
James, M.T.	1 & 4	32
Jewesson, R.S.	B.C.	41
Johnson, N.E.	6	38
Johnson, P.C.	1 & 4	32
Keen, F.P.	5	36
Kinghorn, J.M.	B.C.	41
Knight, F.B.	2 & 3	34
Knipling, E.F.	Wash.	39
Knowlton, G.F.	1 & 4	32
Koerber, T.W.	5	36
Kolbe, E.L.	6	38
Konnersman, G.A.	5	36
Krygier, J.T.	6	38
Landgraf, A.E.	2 & 3	34
Larsen, A.T.	6	38
Lauterbach, P.G.	6	38
Lejeune, R.R.	B.C.	41
Linsley, E.G.	5	36
Lyon, R.L.	5	36
McCambridge, W.F.	2 & 3	34
McComb, D.	2 & 3	34
McGugan, B.M.	Ottawa	42
McGuffin, C.	Alta.	40
McKenzie, H.L.	5	36
McKinnon, F.S.	B.C.	41

Name	Region	Page
McMullen, L.H.	B.C.	41
MacSwain, J.W.	5	36
Manis, H.C.	1 & 4	33
Massey, C.L.	2 & 3	34
Mitchell, R.G.	6	38
Mogren, E.W.	2 & 3	34
Moore, A.D.	5	36
Nagel, R.H.	2 & 3	33
Nagle, J.	1 & 4	34
Orchard, C.D.	B.C.	41
Orr, P.W.	6	38
Ostmark, H.E.	2 & 3	35
Parker, D.E.	1 & 4	33
Pearson, E.D.	6	38
Pepper, J.H.	1 & 4	33
Pierce, D.A.	2 & 3	35
Pierce, J.R.	5	36
Popham, W.L.	Wash.	39
Portman, R.W.	1 & 4	33
Prebble, M.L.	Ottawa	42
Rediske, J.H.	6	38
Reid, R.W.	Alta.	40
Richmond, H.A.	B.C.	41
Ritcher, P.O.	6	38
Ross, D.A.	B.C.	41
Ruckes, H.	5	36
Rudinsky, J.A.	6	38
Sager, S.M.	B.C.	41
Schopp, R.	1 & 4	33
Scott, D.O.	1 & 4	33
Shepherd, R.F.	Alta.	40
Silver, G.T.	B.C.	41
Slipp, A.W.	1 & 4	33
Smith, D.N.	B.C.	41
Smith, R.H.	5	36
Spencer, G.J.	B.C.	41
Spilsbury, R.H.	B.C.	41
Stanford, J.S.	1 & 4	33
Stark, R.W.	Alta.	40
Stevens, R.E.	5	37
Struble, G.E.	5	37
Telford, A.D.	5	37
Telford, H.S.	1 & 4	33
Terrell, T.T.	1 & 4	33
Thatcher, T.O.	2 & 3	35
Thomas, G.M.	5	37
Thomson, M.G.	B.C.	41
Trostle, G.C.	5	37
Tunnock, A.	6	39
Vite, J.P.	5	37
Wagg, J.W.B.	6	39
Washburn, R.I.	1 & 4	33
Wear, J.F.	6	39
Weaver, H.	6	39
Wellington, W.G.	B.C.	41
Wellner, C.A.	1 & 4	33
Werner, F.G.	2 & 3	35
Whiteside, J.M.	6	39
Wickman, B.E.	5	37
Wilford, B.H.	2 & 3	35
Williams, C.B.	6	39
Wohletz, E.	1 & 4	33
Wood, D.L.	5	37
Wright, K.H.	6	39
Wygant, N.D.	2 & 3	35
Yasinski, F.M.	2 & 3	35