H. Graham

PROCEEDINGS

of the Sixth Annual

WESTERN FOREST INSECT WORK CONFERENCE

Berkeley, California
December 2 - 4, 1954.

(For Information of Conference Members only,
Not for Publication)

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1954 - 1955 EXECUTIVE COMMITTEE

R. L. Furniss, Portland	Chairman
M. G. Thomson, Victoria	Secretary-Treasurer
W. G. Mathers, Vernon	Counsellor, 1952-1954
N. D. Wygant, Fort Collins	Counsellor, 1953-1955
C. B. Eaton, Berkeley	Counsellor, 1954-1956
R. W. Stark, Calgary	Counsellor, 1955-1957

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WESTERN FOREST INSECT WORK CONFERENCE*

Berkeley, California

December 2-4, 1954.

The conference was called to order at 9:00 a.m. by chairman R.L. Furniss in the main dining room of the Durant Hotel, 2600 Durant Avenue, Berkeley, California. The 46 delegates present were joined by the delegates to the second Western International Forest Disease Work Conference for the opening session.

The chairman introduced Dr. Willis Wagner, chairman of the Western International Forest Disease Work Conference.

G. M. Jemison, Director of the California Forest and Range Experiment Station extended to the joint delegates a welcome to the San Francisco Bay area and hoped their deliberations would be fruitful.

Dr. M.L. Prebble, Chief, and Dr. J.E. Bier, Associate Chief, of the Division of Forest Biology, Science Service, Department of Agriculture, Canada, Dr. Lee M. Hutchins, Chief, Division of Forest Disease Research, U.S. Forest Service, and Dr. J.A. Beal, Chief, Division of Forest Insect Research, U.S. Forest Service, were then introduced to the delegates.

December 2, 9:30 - 10:00

Preliminary Business Meeting

The secretarial and treasury reports were read by the Secretary-Treasurer and approved by the members.

All the delegates were then introduced in turn.

The chairman reviewed the Executive Meeting of December 1, and appointed the following committees to look into the matters arising therefrom:

1. C.B. Eaton, W.F. Barr and M.G. Thomson, Chairman, to enquire into the most appropriate form of future meetings and the advisability of reviving the Proceedings.

2. W.F. McCambridge, W.G. Mathers and J.W. Bongberg, Chairman, to enquire into the site, time and programme of the 1953 conference.

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* The first three Proceedings of the Western Forest Insect Work Conference were prepared by the original Secretary-Treasurer, Mr. Philip C. Johnson, and the fourth by a transcription service. By a vote of the members at the time, the Proceedings of the Fifth Conference were not distributed. The form of the Proceedings has been revised with the present issue, which has been prepared by the Secretary-Treasurer, Mr. M.G. Thomson, from resumés submitted by the various moderators whose names appear at the head of each section.

3. R.C. Hall and W.G. Mathers, Chairman, to name a candidate for the executive positions of Secretary-Treasurer, and Councilor for 1955 to 1957.

4. J.W. Bongberg and B.H. Wilford, Chairman, to enquire into the circulation of insect condition reports.

All committees were to report at the final business meeting.

December 2, 10:00 - 11:30 B.H. Wilford, Moderator

Specific Forest Insect Outbreaks Current in the Western United States and Canada

Individual reporting of the status and trend of each currently damaging or newly observed forest insect in western United States and Canada, region by region, has given us a good picture of (a) the inter-region problems, problems of common interest to neighboring regions such as develop from spruce budworm and Engelmann spruce beetle outbreaks and (2) the independent nature, from the regional standpoint, of other insects, such as the pine beetles in the southern Rockies.

We have been alerted to new serious and potentially serious pests such as the silver fir beetles (Pseudohylesinus) and chermes on silver fir in the northern and southern Cascades of Washington.

We have been told that the spruce budworm, where control activities were carried out, as in the Northwest, is declining. The budworm will cause heavy defoliation in British Columbia but it is considered a static condition and tending to decline. It is increasing in the northern Rockies but may be static in the central and southern Rockies. In the Intermountain Region the spruce budworm is on the upswing.

The Engelmann spruce beetle is invading or increasing in British Columbia but it is on an apparent decline in Montana and Idaho, and within controlled boundaries, we hope, but still very destructive in Colorado.

The mountain pine beetle is tied in with lodgepole needle miner activities in California and presents a serious problem; it remains as a serious pest and is increasingly active in parts of the Pacific Northwest, the northern Rockies, and the Intermountain Region. In the Canadian Rockies it is increasing in severity but it is working independently of the needle miner.

The Douglas-fir beetle is increasingly serious in California; in eastern Oregon it is remaining very serious, budworm-weakened trees are being attacked. The Douglas-fir beetle is on a continuing increase in British Columbia, a probable aftermath of logging. It is static but causing considerable tree mortality in the northern, central, and southern Rockies. While static in Montana and Idaho, it reportedly is the number one forest insect pest in that region.

The Black Hills beetle is not currently serious, nor is the western pine beetle, with a possible exception in the Intermountain Region. The

seriousness of and extent of damage by the several pine beetles in the southern Rockies was pointed out.

There is a decline in the activities of the pine butterfly in the Intermountain Region and a slight decline of the black-headed budworm in Alaska. This latter pest, however, has spread to or has increased in southern British Columbia.

The extensive defoliation of aspen by the Great Basin tent caterpillar in northern New Mexico and southern Colorado and the activities of the forest tent caterpillar in British Columbia and Alberta were reported.

We heard the reports on the Douglas-fir needle miner, the silver-spotted halisidota, the western hemlock looper, and ambrosia beetles in British Columbia, the California flatheaded borer and the Jeffrey pine beetle in California, the lodgepole pine sawfly and the spruce aphid in the Pacific Northwest, the Alaska spruce beetle, the hemlock sawfly, and the western rusty tussock moth in Alaska, the larch sawfly in Alberta, the pine and fir engraver beetle in New Mexico and the Pacific Northwest, the cone and seed insects of California and the northern Rockies, and the Douglas-fir needle midge, Douglas-fir tussock moth, and black-horned pine borer in the northern Rockies.

That is a resumé of the presentations by members of the panel reporting on forest insect conditions.

December 2, 1:15 - 5:00 J.W. Bongberg, Moderator

Review of Forest Insect Survey Practices and their Application to Current Problems

The session was devoted to discussion of insect survey practices and their application to current problems. Specific surveys were discussed on the basis of sampling forest insect populations or sampling insect-caused damage. Each specific survey discussion encompassed objectives, methodology, compilation, and use of survey results.

In setting the stage for discussion of specific surveys based on sampling insect populations or insect-caused damage, background information of the two approaches to surveys were presented.

Mr. Stark reviewed the overall forest insect survey program in Western Canada by relating details of inception and growth since 1936. In brief, Canadian Forest Insect surveys first involved collection and identification of forest insect pests, later encompassing similar procedures for forest tree diseases. Entomological Rangers stationed throughout the forested regions of the Provinces made collections from established collection points in prescribed manner and forwarded insects to central headquarters for identification. Large volumes of material were collected in initial years of survey program. Most or all of major pests are now known and survey practices are gradually developing into sampling of populations in specific outbreak areas although collections from specific collection points, or

sample plots, is a continuing program. Mr. Richmond and Dr. Prebble pointed up details of survey procedures as practiced in Canada in answer to specific questions raised by Conference members.

Mr. J. C. Evenden reviewed the overall forest insect survey program in the Western United States. In many ways, initial forest insect surveys in the Western United States were comparable to current Canadian procedures. Gradually, as major pests were identified and their importance determined, surveys of extent and amount of damage were made to determine need and scope of control operations. Currently, forest insect surveys in the Western United States are two-fold; sampling insect-caused damage and trend of populations. Mr. Evenden answered specific questions raised by Conference members. Discussion of specific surveys were as follows:

A. Sampling insect populations.

1. Feasibility of sampling Douglas-fir beetle populations.

Mr. V. F. McCowan, Forester, Weyerhaeuser Timber Company discussed current work in sampling Douglas-fir beetle populations in Oregon and Washington. The extreme of variables affecting populations was presented. Despite findings that current populations are much reduced from levels occurring in 1952-1953, sampling procedures which employed removal of bark samples from infested trees, failed to reveal source of population reductions. Difficulties in sampling immature broods and relating sample data to adult population was discussed. Mr. McCowan expressed hope that positive results could be obtained from population sampling work. However, several of the Conference members expressed doubts as to whether population counts would be reliable as an indication of trend of infestation without supplemental information such as abundance of blow-down trees to serve as host material, general level of parasitic and predacious insect populations, duration of epidemic, etc. Mr. McCowan re-emphasized difficulties being encountered in sampling Douglas-fir beetle populations, but his study is to be continued and results reported upon at conclusion of the study.

2. Sampling procedures for spruce budworm in British Columbia.

Mr. M. G. Thomson discussed 1954 survey of spruce budworm population in outbreak area in British Columbia. Objective of the survey was to determine population density and population trend. Survey methods included estimating population from degree of defoliation and by count of egg masses on 18" twigs. Plot location for sampling were mechanically set and at each plot location 10 trees were used to estimate population density as related to degree of defoliation. The 11th tree at each plot location was felled and 18" twig samples were examined for egg masses. Egg mass density was related to each 100 square feet of surface foliage. Eggs per egg mass were found to average 45-50 as compared to 20 in infestation area in Eastern Canada. Results of the budworm survey during 1954 indicated a normal decline of populations and a decision against initiation of artificial measures for control. Dr. Prebble explained egg mass counts as related to each 100 square feet of surface foliage and Malcolm Furniss requested explanation of usefulness of sequential sampling in appraising severity of budworm damage. Question was

also raised as to value of sampling numbers of buds in per cent of damage by defoliation versus length of stripping of twigs. Discussion on these questions pointed up needs for uniformity of sampling spruce budworm populations where objectives and use of survey results are similar. Uniformity of procedures between regions in the Western United States and in Canada does not now exist.

3. Lodgepole needle miner surveys.

Mr. R. W. Stark discussed the 1953 survey of lodgepole needle miner in Alberta and in British Columbia as a three-phase program, namely: (1) Detail sampling of needle-miner populations from 50 to 100 tips per tree from many trees; (2) determining sequential limits in sampling damage; and (3) aerial survey of scope and extent of infestation. Trend of needle-miner populations as related to scope and amount of damage was determined by methods employed in the survey.

Mr. George R. Struble discussed sampling of lodgepole needle-miner populations as a tie-in to determination of biological factors affecting population trends. Sampling procedures made use of plots; each plot contained 25 trees and was located in areas of varying amounts of defoliation ranging from light to heavy. Three plots were established in each damage-condition class. Samples included four twigs per tree from each of the 25 trees per plot. From each sample twig, larvae population was counted and density related to biological factors affecting the population.

Dr. R. C. Hall discussed sampling of lodgepole needle miner populations as related to assessing benefits resulting from aerial spray control program. Dr. Hall compared the reliability of size of sample in determining population by analyzing 100 twigs vs. 50 twigs, vs. 10 twigs per tree. By selection of 10 random needles per tip from 10 tips on 100 trees, sample results gave less than 10 per cent error at the 95% confidence level. The discussion of sampling lodgepole needle miner populations brought out the need for uniformity in sampling procedures where objectives of the surveys are similar.

4. Pine butterfly survey.

Mr. Walter Cole discussed the survey and sampling of pine butterfly populations in southern Idaho during 1953. It was found that egg deposition was uniform throughout the crown of the tree, hence lower branches were used to select twigs for egg counts. Due to accessibility of branches from trees, ridges were found to be most suitable sites for egg collection and counts. Sampling of egg population was done by selecting 5 twigs at random from 20 trees at each sample location. On the basis of populations developing in the outbreak area, sampling results showed that 5 or more eggs per twig indicated epidemic conditions. By relating numbers of adult butterflies observed hovering above tree tops during aerial surveys, it was concluded that 6 adult butterflies per tree top would constitute epidemic infestations. Group discussion brought out that density of egg population and numbers of adults counted per tree top would not necessarily indicate epidemic status in other areas or in other years.

5. Black Hills beetle surveys.

Dr. Wilford discussed sampling of Black Hills beetle populations in relation to determining need for control despite level of tree mortality in given areas. In some years, artificial measures for control have been undertaken when populations obviously were on the decline from natural causes. Population has been sampled in spring of year after natural mortality has occurred. It has been determined that 50 samples, two 6" x 6" bark samples, from 25 trees will yield results within 10% error at the 65% confidence level. In order to sample population density and relate population density to level of resultant tree mortality, bark samples are made three times each year, October, April, and July. Brood is counted in each sample as to numbers of larvae, pupae, and adults, living or dead. Results of the study in sampling Black Hills beetle populations and relating findings to prediction of amount of tree-killing to be expected the following year is incomplete but will be reported upon by Mr. Fred Knight at a later date.

Discussion by Conference members on sampling insect populations touched upon all subjects presented. Dr. Prebble intimated that sampling of insect populations, per se, probably had reached a point of diminishing returns in current type surveys in Canada. Dr. Prebble stressed that more work is needed on dynamics of insect populations and that more professional help in surveys would greatly strengthen the overall program. In current Canadian surveys, only a few plots and sampling points are now used as insect occurrence is not directly related to host type. Mr. R. L. Furniss asked how spruce budworm surveys were conducted in connection with the large infestation being given benefit of control in eastern Canada. Dr. Prebble answered that survey employed aerial methods to delineate infestation supplemented by ground checking at specific points throughout the infestation. Mr. Evenden re-emphasized that since insect species causing damage in known, amount of damage caused (number of trees killed, degree of defoliation, etc.) should reflect a measure of population density. Mr. McCowan made mention that methods now used for sampling Douglas-fir beetle probably were not adequate and Mr. Wright expressed his doubt as to usefulness of procedures due to difficulties in locating infested trees for sampling. Mr. Thomson indicated that trapping of adults in barriers might offer possitilities as a sampling technique. Mr. Hopping stressed that standardized sampling procedures should be developed before methods are used in survey practice.

B. Sampling of insect-caused damage.

1. Intensive appraisal surveys of forest insect damage.

Mr. Paul Lauterbach, Forester, Weyerhaeuser Timber Company presented procedures used in appraisal of scope and intensity of insect infestations on company-owned lands. Weyerhaeuser Timber Company purchased Cessna airplane and majority of insect survey work employs aerial methods. Intensive appraisal made of Douglas fir beetle, silver-fir beetle, and bark aphid in Oregon and Washington during 1954. Areas of infestation were

delineated on aerial photographs and plans developed for salvage of affected areas. Interest of management was stimulated by reviewing infested areas from the air and as a result large shifts in emphasis of salvage was initiated during 1953 and 1954. Mr. Lauterbach's presentation was descriptive of survey operations to detect and delineate insect-caused damage as performed by the Weyerhaeuser Company rather than a discussion of sampling of insect-caused damage.

2. Spruce budworm surveys.

Mr. Walter Buckhorn described in detail methods developed for surveys of damage caused by spruce budworm in Oregon and Washington. Aerial procedures predominate. A three-man crew, including pilot, fly at 800-1,000 feet above terrain and "map-in-place" all areas of timber defoliated by the budworm. The Chief observer occupies the front seat of the plane adjacent to the pilot and maps all areas visible. Supplemental information as to defoliation is provided by the second observer seated on the left side of the plane immediately behind the pilot. Flight lines are usually spaced at four-mile intervals until the entire susceptible type is surveyed. Degree of defoliation is recorded separately by color codes using colored pencils on planemetric maps of a scale 1" to 4 miles. During the past several years, budworm infestations on approximately 4 million acres have been surveyed in Oregon and Washington each year. Mr. Buckhorn made mention of ground checking of status of defoliation as delineated by aerial means and the use that was made of survey results in the large-scale control operations since 1949. Mr. Buckhorn pointed out that through experience in aerial survey operations it is now possible to positively identify, determine scope and intensity, and map locations of 21 separate species of forest insect pests of major importance in the timbered areas of Oregon and Washington. Several questions were asked of Mr. Buckhorn by Conference members, all of which were answered.

3. Engelmann spruce beetle surveys.

Mr. T. T. Terrell described the methods used in surveys of Engelmann spruce beetle in Montana and Idaho. Amount of tree killing caused by the beetles is determined by line strip sampling in susceptible type. Information as to number of trees infested and desirability of salvage as a measure of control is furnished the land-managing agency. Much of Mr. Terrell's discussion of Engelmann spruce beetle surveys included information as to numbers of trees removed for control during the 1954 season, the number of trap trees used as an aid in control, and other details of the 1953 and 1954 spruce beetle control project in Montana and Idaho.

Mr. Yasinski discussed the Engelmann spruce beetle survey in southern Colorado during 1954 and related details of how and when the outbreak was detected; the promptness of control operations following initial detection, and accomplishments in control to date. Methods employed in the surveys were primarily designed for the benefit of the control operation; location of infested trees and numbers of trees requiring control treatment in unit areas.

4. Use of color photography in Douglas-fir beetle surveys.

Mr. John F. Wear gave an excellent presentation, assisted by visual aids, of color photography as used in sampling damage caused by Douglas-fir beetle in Oregon. Mr. Wear pointed out that color photography far exceeds the usefulness of any black and white film-filter combination in rendition of infestations recorded on film. Optimum scale photography for maximum definition of infestations is 1:8200. By repeat photographs of long narrow photo plots, accuracy of determining level of infestations present has exceeded 90%. Mr. Wear demonstrated a portable divided light table for use in stereoscopic viewing of color transparencies. The portable viewer used a 12 volt battery or electric current. Considerable discussion followed Mr. Wear's presentation of subject material as to applicability of methods to other insects affecting other tree species. Considerable interest was stimulated in Conference members by Mr. Wear in use of aerial photographic methods as an integral phase of annual forest insect surveys in all regions.

Due to limitations in time, discussion of planned subjects dealing with Douglas-fir beetle surveys in California, Oregon, and Washington and pine bark beetle surveys in the western states was omitted from the topics brought up for discussion.

Discussion on sampling of insect-caused damage was restricted due to time limitations. Mr. Downing related that a helicopter was of extreme help in mapping and counting Douglas-fir trees infested by Douglas-fir beetle in the north coast area of California during 1954. Accuracy of estimates exceeded that obtained by ground methods due to steep terrain that severely hampered ground survey parties. Time did not permit discussion of new developments in survey procedures during 1954.

Conclusions:

As a result of afternoon presentation of a review of forest insect survey practices and their application to current problems, the following conclusions might be drawn:

1. The sampling of insect populations as practiced in Canada rapidly approaching the point of saturation. Sampling of insect-caused damage is now supplementing population sampling. Improvement of survey procedures in Canada could be made by addition of professional survey personnel and study of population dynamics.

2. The sampling of insect-caused damage as practiced in most surveys in the Western United States is reaching the saturation point and current survey practices now include sampling of insect populations in conjunction with damage appraisals.

3. Current survey practices in both Canada and the Western United States are a composite of procedures needed for the sampling of insect-caused damage and insect populations.

4. There is considerable divergence in procedures used for sampling insect populations and insect-caused damage between survey personnel in the United States and Canada, even for surveys of identical insect species.

5. There is considerable divergence in procedures used in surveys between the several regions in the Western United States.

6. Divergence of survey methods should be resolved and co-ordinated wherever possible.

7. There is urgent need on the part of survey personnel to apply recent developments and techniques in surveys. As an example, sequential sampling could be used to much greater advantage than is being done at present. Also, aerial methods of appraising insect infestations could be put to wider use than is now being done in some regions.

8. Aerial color photography appears to have wide application as a survey tool. Apparatus has now been developed to adapt color transparencies to field use thus allowing wider application in surveys than is now being done.

9. Aerial survey procedures in Oregon and Washington have been developed to the point where 20 or more insect species can be identified by character of damage observed from the air. Training of survey personnel in aerial survey methods is needed in other regions to advance survey operations.

10. Aerial surveys have proven to be of extreme value to land-managers as a means of appraising the overall seriousness of insect outbreaks and in planning operations for control by salvage logging and other methods.

11. Aerial methods have been adapted to the sampling of insect populations viz., pine butterfly. Aerial methods might be adapted to sampling of other insect populations through research.

12. Preliminary exploration has shown that aerial methods are suitable for initial detection of Engelmann spruce beetle surveys.

Suggestions for improving subsequent Work Conference meetings as related to discussion of forest insect surveys:

Time available for survey discussion should be used for specific subjects such as:

1. Methods to be employed in sampling spruce budworm populations.

2. Methods suitable for sampling bark beetle populations.

3. Surveys as related to an appraisal of damage caused by specific insects of major importance.

4. Use of color photography in annual appraisal of damage caused by pine bark beetles.

The squirrel seemed to escape from the cage in most subject presentations. Although objectives of specific surveys were outlined prior to discussion of methods used, survey discussion soon was lost in detail of methodology without specific findings being related to Conference members.

December 3, 8:30 - 12:00 — E. Wright, Moderator

Forest Insect and Forest Disease Inter-relationships

A joint meeting with the pathologists on problems of mutual concern.

December 3, 1:15 - 5:00 — K. H. Wright, Moderator

Current Developments in Forest Insect Research.

1:15 - 2:30 - Host Resistance to Bark Beetles
(Discussion Leader - R. Z. Callaham)

One of the primary objectives of forest entomologists in the West has been to develop and apply indirect control of bark beetles through manipulation of silvicultural measures. Such measures must arise from studies of insect-host relationships. Progress in this field has been greatly hampered by the lack of fundamental knowledge on host specificity, variation in individual tree susceptibility to attack, and variability in brood development in different types of host material.

Mr. Callaham stressed the desirability and importance of standardizing the vocabulary used in host resistance work, and mentioned the text by Painter as a good reference. Examples of true resistance, pseudo-resistance, mechanisms of resistance, host specificity and host selection as exhibited in the forest were given.

In expanding on the subject of host specificity, considerable discussion was given to the degree of specificity shown by various bark beetles. The conclusion was that many of our so-called specific beetles are not as specific as they are generally credited to be, and may attack a variety of hosts.

The current status of tree and stand susceptibility classifications was discussed. New or improved developments in classification of ponderosa pine are of significance. The need for similar work with other tree species, particularly Douglas-fir was stressed.

The current status of tree and stand susceptibility classifications was discussed. New or improved developments in classification of ponderosa pine are of significance. The need for similar work with other tree species, particularly Douglas-fir was stressed.

The current movement in forest research on genetics and tree improvement has recognized that development of insect and disease resistant strains of trees is of great importance. In both Canada and the United States forest entomologists are now helping to develop these programs.

In summarizing the discussion, three recommendations for solving some of the problems in the field of host resistance were presented as follows:

1. Everone should try to speak the same language, through standardization of terminology.

2. A strong attempt should be made to secure better balance and cooperation between studies of the host and the insect.

3. A stronger effort is needed toward incorporating host resistance research with tree improvement research throughout the West.

2:30 - 5:00 - Problems in Mass-Rearing Forest Insects for Experimental Purposes.

(Discussion Leaders: Carolin, Coulter, Hopping, Massey, Mathers, Moore, Prebble, Thomson)

In introducing this subject it was pointed out that there has been increased emphasis or new work on such activities as screening insecticides, systemic poisons, dispersal habits of forest insects and host resistance. In this work there is often a need to maintain a supply of insects the year round for testing. Without maintaining a supply of the insects work may be confined to a short period during the year when they can be collected in nature. The present feeling is that we lag far behind the other branches of entomology in developing techniques for mass rearing the insects with which we work.

In pointing up the importance of this problem more specifically, it was mentioned that in the United States there is considerable pressure from chemical companies on forest entomologists to screen insecticides against representative forest insects. Before this can be done on any scale, we must work out rearing techniques for test insects.

For some testing purposes such as with systemic poisons and contact insecticides, easy-to rear insects, that may not be forest insects, and also other animals can and are being used in some instances. For example a very small fresh water crustacean, Daphnia sp., is being used at Columbus, Ohio, in some of the systemics work on forest trees.

In other studies such as those on feeding habits, dispersal, and host resistance we are concerned with the activities of specific forest insects and need supplies of them for testing. One of the insects that falls in this category is the spruce budworm. The technique recently worked out by Stehr in Canada for rearing consecutive generations of the budworm in the laboratory is a real step forward, and makes this insect available for testing at any time of the year.

Major discussion of rearing for experimental purposes centered around the following topics, which were presented by discussion leaders (in parentheses).

1. Mass rearing of spruce budworm in Canada and the United States. (Prebble, Carolin, Coulter)

2. Methods of rearing bark beetles in California for toxicity testing. (Moore)

3. Techniques in obtaining and storing Engelmann spruce and Douglas-fir beetles for dispersal tests. (Massey, Mathers)

4. Techniques in rearing hemlock looper. (Thomson)

In discussing the above topics several specific problems were brought out as follows:

1. With bark beetles, there is usually a lack of infested material in the field at the right stage of development that can be collected and reared through to get beetles for testing at a certain time. The answer to this question seemed to be that the beetles should be secured when available and techniques worked out to store them until needed.

2. Brood failure of bark beetles in infested logs brought in for rearing is common. Study is needed to determine if success or failure can be predicted, and also to devise better techniques for handling and storing the infested material.

3. There is a general lack of detailed knowledge on the effects of temperature and humidity on rearing success.

4. With most of our forest insects, there is a general lack of knowledge on the effects of interrupted diapause on normal behavior.

5. The complications of parasitism and disease often prevent successful rearing.

In summarizing the discussion on mass rearing, it appeared that three broad recommendations could be made. They are as follows:

1. An attempt should be made to accumulate existing knowledge on rearing forest insects and made available in publication form.

2. Studies should be made of the possibility of using agricultural insects, and techniques for rearing them, for solving some of our problems.

3. New rearing techniques should be made available to other forest entomologists through prompt publications.

December 4, 8:30 - 10:15 W. F. Barr, Moderator

Research on Forest Insect Diseases

A. The Nature of Insect Diseases.
(Discussion Leader - K. M. Hughes)

1. Bacteria - Insects infested with these micro-organisms frequently are diarrhetic and regurgitate considerably. They die in a soft flaccid condition and turn dark brown to black. Smears show bacteria, all of one type, in high concentrations.

2. Fungi - A fuzzy white coating on an insect indicates a fungus infection. The integument of the insect is penetrated and after death the insect is firm, plump and of a powdery nature internally.

3. Protozoa - These organisms are most commonly found in laboratory reared insects. Symptoms are vague; however, a milky or opague appearance or spotting is sometimes evident. Microscopically protozoan diseases are very easy to determine.

4. Virus - This is the most important group of insect disease organisms. They exhibit a high host specificity and have been used with considerable success as biological control agents. Two types of viruses are important:

   (a) Polyhedral viruses
   Chrystalline bodies that can be seen with light microscope are present in body cells of insects. The insect affected has a fragile integument with its internal contents liquified.

   (b) Granuloses
   Virus particles in very small capsules within the body of insect. No definite symptoms are produced.

5. Nematodes - very little is known about the importance of these easily recognized round worms. Massey reported on two species of Nematodes that are associated with bark beetles in Colorado. He has found the egg laying capacity of the bark beetles to be reduced by as much as 90 per cent due to the presence of Nematodes.

B. Current status of Forest Insect Disease Research.
(Discussion Leader - E. C. Clark)

Although there is a great deal of research being conducted throughout the world, e. g. England, Germany, Switzerland, France, Italy, South Africa, Canada, United States, etc., very little of this work is directed against forest insect disease organisms. The current work on the diseases of forest insects is mainly being carried on in Canada and the United States where viruses associated with the European spruce sawfly, the European pine sawfly, the spruce budworm and five species of tent caterpillars are under investigation and are being used as biological control agents.

Against the European spruce sawfly a polyhedral virus has been used with considerable success. Control of the sawfly has been realized following artificial dissemination of the virus. Natural spread of the virus has been good.

Both in Europe and in North America a virus has produced better than 90 per cent control of the European pine sawfly.

In California biological control of five species of tent caterpillars is being attempted. When a virus has been spread from the ground good control has resulted. Disseminating the virus by airplane has not yielded such good results.

C. Insect Diseases and the Forest Entomologist.
(Discussion Leader - M. G. Thomson)

A forest entomologist will be interested in insect diseases:

1. as an important factor in the ecology of the insect he is studying.

   Well known examples of a forest insect in outbreak numbers that was suddenly and effectively brought under control by a disease producing organism that can be cited are the black-headed budworm and the hemlock looper in British Columbia, the Douglas-fir tussock moth in Idaho and the pandora moth in California.

2. because of their possible use in control.

   The importance of insect disease organisms as control agents was discussed by Dr. Clark.

3. as a rearing problem.

   This phase of insect rearing work was discussed by Mr. Hughes.

4. from enlightened self interest in assisting the insect pathologist to extend the information in his field.

Pathological assistance is available from:

Dr. E. A. Steinhaus, Laboratory of Insect Pathology
University of California

Dr. C. G. Thompson, Division of Bee Culture and
Insect Pathology,
Beltsville, Md.

and, in Canada, through the Forest Biology Laboratories in each province or the Insect Pathology Laboratory, Sault Ste. Marie, Ontario.

D. Disease Problems in Insect Rearing.
(Discussion Leader - K. M. Hughes)

In order to reduce the possitility of disease during the rearing of insects the following suggestions are made:

1. Use healthy insects.
2. Do not use plant material with stems in water.
3. Do not overcrowd.
4. Maintain sanitary conditions.
5. Attempt to duplicate the insects' ecological niche especially with regard to temperature and relative humidity.

The best methods to employ for sterilization of contaminated equipment is heat, steam, and boiling. Chemical disinfection and untra violet light are in general not too satisfactory.

Sick insects cannot be cured, although some of the new antibiotics show some promise along these lines.

December 4, 10:30 - 11:30

Summary of the Conference.

Each moderator briefly reviewed the scope of and the conclusions arrived at during his session.

December 4, 11:30 - 12:00

Final Business Meeting.

B. H. Wilford reported on the recommendations of the committee on Regional Insect Condition Reports. The reports should be reduced in size and complexity and should be limited to the name, principal host and trend on current conditions.

The method of presentation in 1954 aided in integrating and understanding the overall status of the various pests, for example, the spruce budworm and Engelmann spruce beetle. It is recommended that in future the discussion of the condition reports be handled by species as in 1954.

W. G. Mathers reported for the nominations committee

Secretary-Treasurer	M. G. Thomson
Counsellor, 1955-1957	R. W. Stark

Moved by R. C. Hall, seconded by R. I. Washburn that nominations close.

The nominees were elected by acclamation.

F. P. Keen reported for the committee on common names.

There was no better qualified group to review, criticize or recommend common names of western forest insects than the members of the Western Forest Insect Work Conference. Keen moved that a committee of five be appointed by the Chair to carry out this programme on behalf of the members and that when approved by the Conference the recommendations of the Committee be forwarded to the Committees on common names of the Entomological Societies of America and Canada. It was seconded by C. B. Eaton. carried.

Chairman
R. L. Furniss appointed D. A. Ross, K. Graham, W. Barr, E. Clark and F. P. Keen, chairman, a committe on common names.

J. W. Bongberg reported for the programme committee:

Moved by Bongberg seconded by W. F. McCambridge that

1. The 1955 meeting be held at Spokane, Wash.
2. That it be held the week following thanksgiving in the United States.
3. That, if the meeting be held in Spokane, Dr. W. F. Barr be appointed Program Committee Chairman carried

M. G. Thomson reported for the Committee on Constitutional Changes.

Moved by M. G. Thomson, seconded by C. B. Eaton that:

1. The programme should contain not more than two topics other than the initial morning and final business session.

2. The programme committee should decide on the broad topics to be covered at the next conference immediately following their appointment.

3. Theme topics should be transmitted to laboratory heads at the same time that the inactive membership roster is reviewed.

4. Laboratory heads should advise the programme committee of the men of their laboratories for whom support to attend is being sought.

5. The programme committee should attempt to introduce these men into the discussion programme by name.

6. The moderators should prepare a short written summary of their sessions.

7. These summaries together with the minutes of the business meetings and the insect condition reports shall constitute the proceedings.

Moved by M. G. Thomson, seconded by C. B. Eaton that:

Article IV, section 3, clause 1, of the constitution be amended by the substitution of "six" for "five" and the insertion of "immediate past chairman" after "chairman"

Article IV, section 3, clause 1, as amended to read:

An executive committee of six members, consisting of chairman, immediate past chairman, secretary-treasurer, and three counsellors elected from the membership.

carried.

Dr. M. L. Prebble and Dr. J. A. Beal were asked to give their impression of the conference.

Dr. Prebble compared and contrasted the Eastern and Central Work Conferences with the Western one. The Central group had no proceedings but because of the many problems discussed and thoughts arising during the present sessions he would like to see a brief summary, as planned, from the West. He felt that the Conference should strive for the least amount of formality.

Dr. J. A. Beal pointed out that this conference draws delegates from greater distances and covers more divergent problems than the other groups.

J. C. Evenden pointed out to the Programme Committee that the spruce budworm and Douglas fir beetle problems were most pertinent in the 1955 Conference area.

Several members expressed the hope that future conferences would explore more specialized topics in greater detail and that the broad coverage of pest topics had achieved its purpose and should be avoided in the future.

The Conference adjourned at 12:00

A roster of conference members is appended. The insect condition reports were distributed prior to the 1954 Conference.

MEMBERSHIP ROSTER
WESTERN FOREST INSECT WORK CONFERENCE

Note: Those members who registered at the Conference at Berkeley, California, December 2-4, 1954, are indicated with an asterisk (*).

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