- MINUTES -

EIGHTH ANNUAL SOUTHERN
FOREST INSECT WORK CONFERENCE

Raleigh, North Carolina
August 27-28, 1963

Eben A. Osgood, Jr. - Program Chairman
Southeastern Forest Experiment Station
Forestry Sciences Laboratory
Durham, North Carolina

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ANNOUNCEMENT

The Ninth Annual Conference
Downtown Motor Inn, Greenville, Mississippi
August 18-19, 1964

NOTE: The papers submitted for these Minutes were not edited. E. P. Merkel, Secretary-Treasurer.
The following five discussions were presented on the panel entitled: "What Changes in Entomological Training are Needed to Meet Future Demands of Forest Insect Control and Research." Dr. R. F. Anderson, Duke University, was Panel Moderator.

ENTOMOLOGICAL AND OTHER TRAINING NEEDED TO MEET THE FUTURE DEMANDS OF FOREST INSECT RESEARCH AND OF SURVEY AND CONTROL WORK

By

L. W. Orr, Chief
Division of Forest Insect Research
Southern Forest Experiment Station
New Orleans, Louisiana

Forest entomologists are faced with increasing demands for more effective ways of preventing losses caused by insects without at the same time creating unnecessary hazards for fish, birds, wild and domestic animals, and man. This is a natural development resulting from a rapidly growing public awareness of the importance of our forests and the multiple use values that are associated with them. Responsibility for training people who are qualified for the job ahead rests with the schools. A brief discussion of some of the current and probable future trends in forest entomology research, surveys, and control may serve to illustrate the breadth and depth of training that must be provided.

There seems to be general agreement as to the need for increased emphasis on basic research. At present, this emphasis is stimulated by the public clamor for ways of controlling pests without the extensive use of insecticides. Forest entomologists have long recognized the desirability of using silvicultural and biological methods of preventing or controlling insect outbreaks but have never had the staffing and facilities needed for an effective research program. The recent publicity concerning real and imagined hazards associated with the use of pesticides may thus prove to be a blessing in disguise. This is evidenced by the marked change that is taking place in the work programs of most research units and by provision of funds for new, modern laboratories and equipment that will permit intensification of basic research. The problem now is largely one of finding people who are capable of making effective use of our new facilities.

Examples of lines of work that are either new, or that should be greatly strengthened include the following:

1. Taxonomic studies to identify and work out the relationships between species, basic to all other biological studies.

2. Studies of the life histories, habits, and ecological requirements of important species.
3. Accumulation and presentation of mortality and survival data in life tables for individual species.

4. Development of mass rearing techniques, to provide material for other studies.

5. Use of native and introduced parasites and predators.


7. Integration of chemical, biological, and microbial control.

8. Insect physiology, including nutrition, growth hormones, resistance to diseases and insecticides, production of sex attractants, variations in fecundity, host preference, etc.

9. Silvicultural and management practices, including species composition, stand density, site-species relationships, water relations, and tree vigor as they affect tree and stand susceptibility to insect damage.

10. Tree physiology, including such factors as oleoresin pressure and composition, changes in nutritive value of tissues, and production of toxic, repellent, or attractive substances.

11. Development of resistant strains or varieties of trees by selection and breeding; identification of the nature of resistance.


13. Development and use of insecticides that are more selective in action and less toxic to other animals.


15. Improvement of criteria for evaluating the need for direct control measures, including analysis of economic as well as biological factors.

16. Improvement of equipment for applying insecticides, insect pathogens, or other materials used in insect control.

It is thus apparent that forest entomology, like all other professions, is rapidly becoming more highly specialized. This trend is the result of need for greater detail in our knowledge of insect biology, ecology, and control. It does not, however, imply any lessening of the value of broad basic training in undergraduate courses in zoology, botany, chemistry, mathematics, and other sciences. This basic training should provide a general knowledge of the whole field of biology and of the processes of thought and experimentation by means of which scientific knowledge is advanced.
Specialization should not occur too early in a student's training because it is likely to result in a narrow viewpoint and lack of ability to understand and appreciate the objectives and interests of coworkers. It should seldom begin before the senior year. This means that only a relatively small amount of specialized training is received in obtaining an M. S. degree. Modern requirements in most fields of research are such that only those who have continued on to the Ph. D. level are likely to be qualified to do highly technical work. This is not to say that only Ph. D.'s are capable of doing productive research. It does mean that a prospective employee who has received the Ph. D. degree from a school that maintains high standards is likely to be well informed of the latest theories and techniques in his field of specialization.

The above statements should not be interpreted as implying that those of us who do not have the advantage of advanced degrees are incapable of doing excellent research. Many good researchers are largely self-trained and have demonstrated that inherent ability, curiosity, initiative, and perseverance may offset the lack of formal education.

Until recently, most of the people employed in forest entomology were graduates of forestry schools. Forestry training is still an excellent background for much of the work to be done, but we are also finding a need for people who are highly trained in other fields such as insect and plant physiology, soils, bioclimatology, chemistry, genetics, radiology, acarology, and insect pathology. Many people trained in these disciplines will not have training in forestry. Under the present and probable future policy of grouping researchers at well equipped laboratories, this lack of forestry training will not be important because there will be opportunity for association and exchange of ideas with foresters when needed.

The specific subjects taught in our schools are less important than the way in which they are taught. Courses that require the memorizing of a lot of detailed facts about taxonomic characters, life histories, or economic losses have little value unless the student is stimulated to think about the principles and interrelationships that are illustrated by these facts.

More attention should be given in college courses to training in writing and verbally expressing results and ideas. Too many college graduates are woefully inadequate in their ability to prepare study plans, reports, and manuscripts, or even to spell words commonly used in their chosen profession. The basic fault obviously rests with the grade and high schools, but this does not relieve our colleges and universities of responsibility for quality of the final product.
Employers generally realize that they are hiring raw material, but they expect new employees to have a solid background of basic training. Such training will enable new men to quickly learn the practical aspects of a problem and begin to plan ways of contributing to the program to which they are assigned. It is obvious that training must not end with granting of a diploma, whether at the B. S. or Ph. D. level. Modern science is moving so fast that a researcher is soon left behind unless he is willing to continually read and study new developments in his own and related fields. This points up the urgency for employers to provide opportunities for their personnel to attend science meetings and short courses as often as possible. Those who will benefit by advanced training should be encouraged to return to school whenever possible. And oldsters, like myself, who are too old to learn new tricks, should be turned out to pasture.

TRAINING NEEDS TO MEET FUTURE DEMANDS IN INSECT RESEARCH

By
R. J. Kowal, Chief
Division of Forest Insect Research
Southeastern Forest Experiment Station
Asheville, North Carolina

1. Training needs for the present day entomologist in forest insect research have changed considerably in recent years.

2. Training needs will continue to change as we more clearly see what knowledge is needed to answer questions about life processes, environmental relationships, population behavior, and ultimately control of forest insects.

3. All of our men will need a thorough training in the fundamentals of entomology.

4. Most of our men will need a moderate amount of training in forest biology, that is, tree physiology, forest ecology, forest soils.

5. These same men will need thorough training in insect and animal ecology; also moderate specialized training in insect physiology, biological control factors, chemistry, biochemistry, toxicology, and genetics so they can understand, appreciate, and recognize the influence of these disciplines in their research.

6. Some of our men will need, in addition to fundamentals of entomology, advanced training in insect physiology, chemistry and biochemistry, toxicology, and genetics. These will be our specialists.

7. Training in statistics, especially design of experiments, is essential.

8. Last, but of equal importance, is the need for good training in communication: speaking and writing. (Good is underlined because the scholastic records of many of our men show a semester of speech and/or writing—but few are able to communicate well.)
WHAT CHANGES IN ENTOMOLOGICAL TRAINING ARE NEEDED
TO MEET FUTURE DEMANDS FOR FOREST INSECT CONTROL AND RESEARCH

By
H. J. Green, Pest Control Forester
North Carolina Division of Forestry
Raleigh, North Carolina

This workshop has been given the name of "What Changes in Entomological Training Are Needed to Meet Future Demands for Forest Insect Control and Research." I feel that I need to make several qualifying statements before going into this topic. I, of course, represent the North Carolina Division of Forestry as an organization. All of my professional experience has been with this one organization. We are, by legislation, concerned only with control aspects. Therefore, I feel that I should limit my remarks to control aspects and not to research.

The second qualifying statement is that my remarks will apply to the training of forestry students rather than to entomology students. We, as an organization, now have employed approximately 60 foresters. These are the men, rather than entomologists, who have to get entomology across to the private landowners in North Carolina.

The third qualifying statement that I would like to make is that the title infers that changes need to be made in the present training that is being done. It has now been 15 years since I personally studied entomology in school, and I have not been closely related to any of the programs of the different forestry schools. Therefore, I feel that I need present "training needs" as I see them rather than needed changes.

The next qualifying statement that I would like to make is that I realize there are strict time limitations on all training given in the universities. It would certainly be desirable for every forester to also have a degree in entomology but, of course, these limitations prohibit this. The needs that I am going to give are, I feel, the most urgent ones and would involve one 4 or 5 hour course in entomology. I also feel that equal time should not be given each of the different needs but the first two presented should be given more weight than the others. However, before going into these needs, there is one other point that I would like to make. Foresters as a whole have one primary objective, i.e., to manage land for timber production. There are several hazards involved in this management. The better known of these are forest fires, forest insects and forest diseases. Only within the last 10 years has any real emphasis been placed on the scientific approach towards eliminating these hazards. This effort is still extremely weak in many cases. Without proper protection from these forces, nothing can be accomplished through land management. Certainly it is evident that we all need to work towards a more scientific approach to eliminating these hazards and enabling the forester to integrate this entomological training into his overall management objective.

The training needs previously referred to are as follows:
I. BASIC ENTOMOLOGY

This part of the course would be considered introduction to entomology. It would include basic principles such as classification, morphology, ecology, population dynamics and other related topics. This is in a sense everything that was taught when I took entomology 15 years ago but I feel that the time could be reduced if much less stress were placed on insect classification.

II. RECOGNITION OF SYMPTOMS AND IDENTIFICATION OF INSECTS RESPONSIBLE

This need, I feel, would be the "heart" of the course and should be stressed in the laboratory, on field trips and during summer camps. To me, a collection of damaged forest-tree specimens showing typical symptoms with the identification of the insect causing such damage would be of more importance than would a collection of insects most of which might not be related to forestry at all.

The study of these insects by grouping related types of damage would be ideal. Dr. Anderson, in his recent book FOREST AND SHADE TREE ENTOMOLOGY, has done this quite admirably.

III. DETECTION

Under this need I feel that first emphasis should be placed on the value of surveillance. The forester, as he goes about his regular work, is perhaps the only person and certainly the one in the best position to discover insect problems. If he has been impressed with the value of surveillance and has learned how to recognize symptoms of insect attack, he is as valuable in insect control as is the lookout tower in fire control.

Survey, both aerial and ground, is the most obvious method of detection. The use, value and objective of aerial surveys should be covered thoroughly. Especially in connection with this, the proper use of maps, aerial photographs and charts should be considered. The type of information which could best be obtained through ground survey should be considered. For example: egg surveys to predict future populations are oftentimes quite important.

IV. CONTROL

The first thought one usually has when considering insect control is the use of insecticides. Probably here is where the average forester has more misinformation than anywhere else concerning pest control. Training should emphasize the point that chemicals are the last, rather than the first, approach to control.
Training should be given in the general usage of insecticides for different groups of insects. For example: the use of DDT by aerial application for defoliators; BHC for bark beetles, malathion for aphids, etc. The type of insecticide available on the open market, and the formulation needed for certain insects, and types of application should be considered. Certainly the mixing and application of insecticides is a problem that all foresters have to face eventually if it be only for an individual tree.

The theory of biological control should be gone into in some detail. Also, examples of this approach to control should be given. Finally, the economics of control should be considered, especially as applied to the use of insecticides.

V. PREVENTION AS RELATED TO PROPER MANAGEMENT PRACTICES

The primary job of every forester, as stated in the beginning, is to act as land manager. He, of course, hopes to have no losses from fire, diseases and insects, or any of the other hazards of timber production. The easiest and most efficient way to do this is by reaching the ultimate in forest management. The proper tie-in in entomology to these silvicultural practices as they fit into the over-all management plan should be a primary objective in entomological training. Here, of course, logging methods, site conditions, timber species, and many other factors would all have to be considered as they are influenced by forest insects.

After considering these five needs of basic entomology, symptom recognition, detection, control and prevention, I wonder whether or not more than one course in entomology is needed. As I have stated before, I feel that the key to these five needs, when presented as a course in entomology, would be the proper emphasis placed on each individual need. In my opinion, the most important of these needs is basic entomology, and symptom recognition with identification of the responsible insect.

I hope that each of you will realize that I am not a professional educator, and that my remarks have been made primarily as I see this topic as an employee of the North Carolina Division of Forestry.
WHAT CHANGES IN ENTOMOLOGICAL TRAINING ARE NEEDED TO MEET FUTURE DEMANDS FOR FOREST INSECT CONTROL AND RESEARCH?

By Caleb L. Morris
Virginia Division of Forestry
Charlottesville, Virginia

If we can assume:

1. Insect outbreaks are not a matter of chance but are made possible by combinations of favorable climatic, edaphic and biotic effects.

2. That it is possible to develop methods to predict accurately increases of insect populations prior to outbreak periods.

3. Prevention of insect damage rather than merely control remains the ultimate objective.

Then we need: First, intensified effort to develop suitable, accurate survey methods.

Solution: More training in the development and application of sampling methods. Additional training in practical statistics applicable to biological studies is mandatory.

Granted that a thorough knowledge of the biology and ecological relationships of a particular pest is desirable, for many pests reliable sampling methods can be developed without waiting for such detailed information.

Second, in spite of the exceptions mentioned in the preceding statement there must be continuing emphasis on long-term studies of forest pests--through periods of low and high populations. In both Canada and the United States this need has been recognized and is currently being implemented.

The well-known Canadian entomologist, Balch, has said that insect control is essentially a matter of population dynamics. These long-term studies will better enable us to understand the population dynamics of our important forest pests.

Because such studies involve a number of interrelated disciplines, there is a natural tendency to develop specialists in rather narrow fields of endeavor.

Edward Cliff, Chief of U.S.F.S., stated recently that, "the U.S.F.S. now uses 70 distinctly different classifications of professional jobs (in forestry)." There is "... an increasing need for highly specialized men in narrow fields of interest ... yet skilled men to guide and synthesize the many interrelationships associated with the forest complex are vitally necessary."

The emphasis on a broader background in the forestry curriculum was voiced by Sam Dana and Earl Johnson in a recent article in JOURNAL OF FORESTRY on forestry education. They said:
"Foresters in the United States face increasingly rigorous demands on their professional ability."

"The forest is a complex organism—a community." And they go on to emphasize the interrelationship and interdependence of the various components (both organic and inorganic).

An understanding of how a change in one component changes the others requires a well-rounded knowledge of the "biological, physical and earth sciences."

Dana and Johnson recommend a strengthening throughout the educational program in forestry. "The forester of tomorrow must be more firmly grounded in the basic and applied biological, physical, and social sciences and the humanities."

Keeping in mind that the authors considered graduate schools in their analysis, cannot we assume that graduate entomologists would benefit from a broader training base in the first 4 years in college?

Look closely at the recently adopted objective for all National Forest management: Timber production must now "syncromesh" smoothly with demand for watershed protection, wildlife and recreation. Won't you agree that to successfully carry out this task, managers with a well-grounded background in all fields are called for?

Direct measures of insect control have now become feasible in many cases. To determine whether control is feasible or desirable often calls for a decision based on meager data, hurriedly gathered. Realizing that this is not the most desirable of situations, it points up the fact that we are in need of (1) experienced personnel, or (2) reliable background information on the pest which inexperienced personnel can draw upon to make accurate evaluations.

The U.S. Forest Service has chosen to call these studies "biological evaluations." Can you see the implications here? The entomologist is often expected to make a 3-day field study of the pest—involving all aspects of its biology—upon which control decisions may be based.

Stark, in an article in the JOURNAL OF FORESTRY in 1961, states that one of the most important needs of improving biological evaluations is "more research to develop more refined methods of sampling and damage assessment for more forest insects." Stark goes on to stress a point I mentioned earlier: "Basic knowledge on destructive insects that are currently 'benign' in their attitudes must be gathered before the outbreaks occur to determine the controlling factors. Conversely, the biological evaluation should be carried through to its logical conclusion to include study of the insect after its peak population has been reached."
Third, forest entomologists have long been told that silviculture offered the only economical method available for long-term control of forest insects. The era of "silvicultural control only" is past. In many cases it has failed to provide us the answers we have been seeking—and understandably so. Nonetheless, the long-term implications of changes in patterns of forest management practices must be considered, since such changes can encourage or discourage various forest insect pests.

A good grounding in forest management practices is obviously desirable.

Finally, the economics of both long and short-term forest insect control must be documented. I have long felt strongly that the practicality of any particular forest management practice must be substantiated by dollar and cents figures. Certainly if "prevention" is to become an ultimate objective in forest pest control, we must be able to substantiate our recommendations in the same "dollar and cents" figures.

In conclusion, then, from the point of view of "State" entomology, I present a "pitch" for increased educational emphasis on the three "E's":

1. Ecology—for a better understanding of the relationships of the insect with his environment.

2. Economics—pest control, like other forestry practices, must be rooted securely in the soil of practicality.

3. Education—meaning a broader-based education, whether obtained in basic study, or acquired afterwards by special study.

**ENTOMOLOGICAL TRAINING NEEDED TO MEET DEMANDS OF THE INDUSTRIAL FORESTER**

*(Summary of a brief discussion)*

By

Richard R. Mason, Entomologist
Bowaters Southern Paper Corporation
Calhoun, Tennessee

At the present time there are no full time forest entomologists employed by the forest industries in the Southeast. The current economic status of the pulp and paper industry in general has forced many companies actually to reduce the size of their forestry organizations. The result has been that few companies are able to justify the employment of a specialist on their staff unless it is concerned with a particularly serious problem of high priority.
Graduate foresters who are normally employed by industry for general administrative positions are expected to be broad in their training and possess the skills to handle a multitude of jobs of which entomology may be only one small part. A single solid course in forest entomology which emphasizes the basic principles of classification, identification, populations, surveys and direct and indirect control, should, in most cases, satisfy the needs of the average forester planning to work for private industry. For students particularly interested in insects, an additional course at the undergraduate level in general entomology or advanced forest entomology may be desirable.

The industrial forester who is employed for a staff or research position in some specialized capacity usually has fewer administrative responsibilities and may expect to be more technically trained in one or more specialized fields than the administrative forester. This position, for example, may call for a man specialized not only in forest entomology, but also somewhat familiar with forest diseases, animal damage, tree physiology and general methods of experimental design. Such a job would require considerably more advanced training at the graduate level than is needed by the general administrative forester. A forester in this position who is particularly interested in forest entomology may find many opportunities to carry on practical studies in entomology in addition to his other investigative work. He should not be discouraged if he is not able to work with insect problems exclusively. In many ways such a position offers an unusual challenge as it allows one to become familiar with the other aspects of forest management and perhaps have a better view of forest entomology in its proper perspective.

Graduate training in forest entomology which emphasizes the broad approach by also including such courses as population ecology, experimental design and statistics, tree physiology and forest soils, will provide an excellent background for a forester engaged in investigative work with private industry. If more industrial foresters in staff or research positions were trained along these versatile lines where their usefulness to the company could be demonstrated in many ways, we may actually find that industry would ultimately contribute much more in the way of forest insect research than it does today.
RAINFALL AND TEXAS OUTBREAKS OF SOUTHERN PINE BEETLE
(DENDROCTonus FRONTALIS ZIMM.)

By
Edwin W. King
Department of Entomology, Clemson College
Clemson, South Carolina

Preliminary comparisons of the epidemic years and non-epidemic years for seven recorded outbreaks of D. frontalis in Southeast Texas have been completed as part of a cooperative study on weather and southern pine beetle. Rainfall data for Beaumont, Houston, Nacogdoches, these three localities together, and Liberty, have been grouped by months, by seasons, by January and February together, and by fall and winter together, from 1917-1962. There appears to be a definite tendency for epidemics in this region to follow a high fall-plus winter combined rainfall. There is also indication that high rainfall in January or February or both is a condition favorable to an outbreak the following summer. There is little indication that epidemic years or the years immediately preceding them are marked significantly by lower rainfalls. These analyses will be continued for other southeastern areas.

POPULATION STUDIES OF THE SOUTHERN PINE BEETLE
IN EAST TEXAS 1960-1963

By
Robert C. Thatcher
Forest Insect Laboratory
Alexandria, Louisiana

Systematic sampling of southern pine beetle populations in the 16-county epidemic area in east Texas has revealed that attack behavior and brood survival vary seasonally. Attacks occur on the lower 2/3 to 3/4 of the stem during the colder months of November through March. Thereafter, the attack zone shifts downward. In July and August, only the basal 20-30 feet is occupied.

Southern pine beetle brood survival is highest during the winter and spring months and declines to a low level during the hotter months of July through September.
Several species of parasites and predators associated with cambium-phloem food competitors are important control factors during the summer months. Natural enemies and competitors are relatively unimportant during the winter.

These findings help explain seasonal fluctuations in beetle populations and new infestation development. They suggest that winter control operations are essential if spring population activity is to be held within reasonable limits.

DIFFICULTIES IN SAMPLING SOUTHERN PINE BEETLE POPULATIONS

By

John C. Dixon
Forestry Sciences Laboratory
Southeastern Forest Experiment Station
Athens, Georgia

Sampling methods developed for predicting population trends for Dendroctonus engelmanni and D. ponderosae were discussed.

Difficulties were encountered in applying similar technique to southern pine beetle population sampling due to the following factors:

1. It is impractical to sample a many-generation species more than once during each generation.

2. High densities of southern pine beetle broods.

3. Shifting attack patterns of the southern pine beetle make it difficult to select a standardized sampling location.

4. The sporadic manner in which the southern pine beetle attacks trees. (It may attack nearby trees or move some distance before initiating attack.)

The possibility of applying "key factor analysis" to predicting trends was discussed.
STUDIES ON THE FLIGHT BEHAVIOR
OF SOUTHERN PINE BEETLES TO ATTRACTANTS

By
Robert Gara
Boyce Thompson Institute
Beaumont, Texas

Dendroctonus frontalis, Ips avulsus, I. grandicollis, and I. calligraphus were attracted in large numbers to pine sections recently infested by the respective species. In the absence of material freshly infested by their own species, all three Ips species responded to logs infested with D. frontalis. D. terebrans, various scolytids of minor importance, the clerid and ostomid predators and various Cerambycidae were found to respond to infested and uninfested log sections as well as to various resinous compounds.

Ips grandicollis exhibited a consistent evening response pattern that was only slightly weather dependent. D. frontalis and I. avulsus, on clear days, had a less rhythmic diurnal response pattern with the most dense flight in mid-morning and evening. The diurnal flight pattern of these two species seemed to be influenced by weather conditions. Ips calligraphus possessed an erratic response pattern that apparently fluctuated with the local weather. Response flights of terebrans were synchronized with climatic changes of the progressing season as well as with prevailing weather conditions.

With the use of attractants there was evidence that D. frontalis populations could be ushered from one area to another, depending on the intensity and location of attractive sources.

RESPONSES OF THE SOUTHERN PINE BEETLE TO CERTAIN STIMULI

By
Ching H. Tsao
University of Georgia
Athens, Georgia

1. Adult southern pine beetles were attracted to light. They appeared at the windows in the laboratory, and were caught in the ultraviolet light trap. There were flight activities during both day and night in the laboratory.

2. The beetles showed positive phototaxis and negative geotaxis.

3. Beetles showed avoidance of high surface temperatures from 29 to 39°C. and low temperatures from 21 to 25°C. However, when the insects were allowed to move about on a temperature gradient tray for 5 minutes, a majority were found at lower temperatures ranging from 14 to 25°C., but they appeared sluggish.

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4. The beetles were somewhat attracted to chloroform extract of inner bark from infested trees, but not to that from uninfested material.

Leonce Cambre, Insect and Disease Branch, Division of State and Private Forestry, U.S. Forest Service, Macon, Georgia, recorded highlights of the discussions and presented them in summary form at a later session.

WORKSHOP 3

ECOLOGY AND BEHAVIOR OF TIP MOTH

By
Harry O. Yates, III
Forestry Sciences Laboratory
Southeastern Forest Experiment Station
Athens, Georgia

Studies during the past year have been on the behavior of the larvae, growth and morphological characteristics of the attacked trees, crystallization of oleoresin, and finally a quantitative and qualitative study of the constituent making up pine oleoresin.

This year's work has supported previous observations that the larvae do considerable migration during the early instars. Individual larvae have been observed in the manner in which they cope with pine oleoresin exuding from lesions produced by the feeding immature forms. The gummy oleoresin is actually taken into the mouth with the aid of the mandibles and then deposited on previously produced webs on the outside of the shoots.

Measurements of the number and diameter of resin ducts in growing shoots has revealed that slash and longleaf pines have more ducts of a larger diameter than in shortleaf and loblolly pines. Amount of resin produced from several shoots of the former two pines was greater.

Oleoresin from shortleaf and loblolly pines rapidly crystallize under certain conditions. This is not true of slash pine. A study of this crystallization phenomena revealed that as crystallization occurs there is a loss of weight. This appears to be due to loss of volatile terpenes. Such crystallization is related to the ability of larvae to successfully attack and injure growing shoots.

The makeup of pine oleoresin is being studied to determine what accounts for this differential rate of crystallization between slash pine and shortleaf and loblolly pines.
Studies of the European pine shoot moth, Rhyacionia buoliana Schiff., on red pine near Oakland, Maryland, revealed that, prior to crown closure (4 foot trees), the average percentage of buds infested was 85, 50, and 25 on the top, middle, and bottom thirds of the trees, respectively. When the lower branches were closed (7 foot trees) the average percentage of infested tips was 40, 15, and 10.

Results of studies on the Nantucket pine tip moth, Rhyacionia frustrana, on loblolly pine in Brunswick County, Virginia, are shown below:

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<th>Plantations (6' tall trees at about 6 x 8 spacing)</th>
<th>Percent of tips infested</th>
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<th>Old fields (6' tall trees at about 6 x 8 spacing)</th>
<th>Percent of tips infested</th>
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<th>Old fields (6' to 15' tall trees at about 6 x 8 spacing, data taken on 6' tall trees only)</th>
<th>Percent of tips infested</th>
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<th>Dense (6' tall trees at about 3 x 3 spacing)</th>
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<th>Light overstory (6' trees at variable spacing under a light overstory)</th>
<th>Percent of tips infested</th>
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These are first generation figures on 1,250 trees distributed in 50 stands. The higher level of infestation on planted trees is difficult to explain in that these stands were similar in most other respects to the first old field category.

In both studies, preliminary examination revealed that the changes in percentage of infestation were only poorly correlated with changes in total number of shoots or shoots per cluster for each one-third of the tree.

Data will be taken on these trees for all generations for 2 years. Collections are also being made of larvae for parasite studies in all stand categories.

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PINE TIP MOTH INVESTIGATIONS IN ALABAMA

By

L. L. Hyche
Auburn University
Auburn, Alabama

A. Insect Parasitism

Insect parasitism studies conducted in Alabama during the period 1959-63 have resulted in the collection and identification of 17 species of parasites of pine tip moth. These parasitic species represent two orders and nine families. The major species encountered were: Lixophaga mediocris Ald. (Diptera: Tachinidae), Eurytoma pini Bugbee (Hymenoptera: Eurytomidae), and Hyaspis rhyacioniae Gahan (Hymenoptera: Eulophidae). The tachinid fly, L. mediocris, has been, by far, the most common parasite collected. The number of specimens of this species collected in any one season has often been greater than the total number of specimens of all other parasites encountered.

B. Fungi Associated with Tip Moth

In preliminary investigations, a total of 27 different species of fungi was found associated with immature forms of tip moth. Twelve species were isolated from larvae classified as normal; eight from larvae classified as abnormal; and six species were found in association with both abnormal and apparently normal larvae. Eight of the species isolated from normal and abnormal larvae were also found in isolations from pupae. Only one species of fungus was isolated from pupal forms alone and this was from apparently normal pupae.

According to literature on insect pathology, most of the genera of fungi isolated in this work contain species known to be parasitic on various insects; however, the status of these species as possible pathogens of pine tip moth is yet unknown.

ECOLOGY AND BEHAVIOR OF THE NANTUCKET PINE TIP MOTH

By

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These studies were initiated in 1961 at Clemson College and are continuing. Much of the data herein was gathered by Neil H. Anderson, and can be found in an unpublished thesis in the Clemson College library.

Dyar's analysis has revealed five larval stages with larval development lasting for approximately 5 weeks in the Piedmont region of South Carolina. In this same geographic location, three complete generations occur with adult insects emerging in mid-April, mid-June, and mid-August. Approximately 8 weeks is required to complete one generation.
The adult sex ratio was found to closely approximate 0.33, or two males to one female. By dissection of females, it was found that an average female contains no less than 150 potential eggs. When the adults emerge from the pupal skin, they excrete the contents of their hind gut and then remain motionless to expand their bodies and wings. They are capable of flight in 30 to 60 minutes after emergence. The adults are crepuscular, flying from 20 to 65 minutes during the period just prior to and just after dark in the evening. No dawn activity of adults was encountered. Adults are capable of flying to heights of at least 40 feet, and for periods of 100 seconds or more. Laboratory reared adults had an average life span of 10.5 days.

Nantucket pine tip moth larvae were found to be positively phototropic, negatively heliotropic, negatively thigmotropic, negatively geotropic, and variably thermotropic. No positive chromatropism was ascertained.

WORKSHOP 4

CHEMOSTERILANTS AID ATTRACTANTS

By
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The subject suggests two fields of research with a common goal—tools for the control or eradication of insect pests.

The recent wave of interest in insect chemosterilants stems largely from the convergence of two lines of research. The first of these was the demonstration, first on the island of Curacao, and later in Florida, that the screw-worm fly could be eradicated by the release of males sterilized by exposure to gamma radiation. These successful eradication operations established the practicability of Knipling's concept of the sterile-male technique—that is, that insects could be put to use for the destruction of their own species through the induction of sterility in a large proportion of the males which through their normal mating behavior, would reach female insects that would not be reached by the usual insecticide techniques.

Shortly thereafter, the demonstration that both male and female house flies could be sterilized by radiomimetic chemicals directed attention to the possible advantages of chemosterilants over radiation in applying the sterile-male technique.

Perhaps it would be well, at this point, to define what we mean by the term "chemosterilant," since this is a relatively new word. A chemosterilant is a chemical capable of causing sexual sterility, that is, failure to reproduce, in insects or other organisms.
Insect chemosterilants may act in several ways. They may cause the insects to fail to produce ova or sperm; antimetabolites, when they are also chemosterilants, act in this way. Second, compounds that cause the death of sperm and ova after they have already been produced would also be chemosterilants, but we do not know of any compounds of this type that are presently being considered for use in insect control. A third type of action, and the one in which we are most interested at the present time, is that shown by the radiomimetic compounds. These compounds apparently injure the chromatic, or genetic, material in the sperm and ova so severely that, although they remain alive and the sperm retain full motility, the zygotes, if formed, do not complete development into mature progeny. This type of action is desired because the males sterilized in this manner compete readily with normal males for the available females and transfer motile sperm to the spermathecae of the females, with the result that the mating requirements of the females are satisfied to the same extent as in a mating with a normal male.

Chemosterilants might be used in two basic ways—as a substitute for radiation to sterilize insects that had been reared for release in large numbers, or as a means of inducing sterility in a large proportion of the natural population, thus avoiding the necessity for rearing and releasing large numbers of insects.

For the former purpose—rearing and release of overwhelming numbers of sterile insects—(1) chemicals may prove to be more economical than radiation, or (2) cause less general injury in treated males, and (3) they almost certainly will permit greater mobility and dispersion of the rearing and sterilization facilities.

However, there are many species of insects which could not readily be reared and released in overwhelming numbers, either (1) because the species is not adaptable to laboratory rearing, (2) because the numbers required to overwhelm the normal population would be too enormous, or (3) because the released insects would themselves be dangerous, destructive, or annoying. To control or eradicate such species it would be highly advantageous to be able to induce sterility chemically in a large proportion of the natural population in such a way that the sterile males would mate with, and thus render infertile, the females that escaped the sterilizing chemical.

You may wonder why, if we are to treat an insect population with a chemical, we expect it to be more advantageous to sterilize them than it would be to kill them with an insecticide.

Knipping, 1960 (12) and 1962 (13) has discussed in detail the mechanics by which the induction of sterility in a large proportion of the natural population would result in a constant reduction of the population greater than that which would be obtained by insecticidal action of similar intensity.
Assume we have a method of application that will reach 90 percent of the insects in the population. If we kill 90 males out of 100, and 90 females out of 100, the 10 females that escape the treatment will mate with the 10 males that escape, and there will be 10 fertile females to produce the next generation. However, if we reach the same 90 percent of the insects with a chemosterilant, 90 females out of 100 will be sterilized and not reproduce, and in addition, the 10 females that escaped treatment will be subjected to mating competition by 90 sterile males as well as 10 normal males. From this ratio we would expect nine of the normal females to mate with sterile males, and therefore fail to reproduce, and only one normal female to mate with a normal male and thus be available to produce the next generation.

In many species of insects, the females mate only once, but even species with females that mate repeatedly might be susceptible to control with chemosterilants. We have found house flies will mate more than once, but over 75 percent only mate one time.

One would expect the chemosterilant technique to be effective in the control or eradication of most species in which the males and females that are produced over a sizable area mix thoroughly before mating takes place. Chemosterilants would lose much of their advantage over toxicants in the control of species in which both sexes remain near the site of emergence until after mating has taken place.

Chemosterilants may be effective when given (1) in the food of insects, (2) when applied topically, (3) used as residues, (4) when added to the larval medium, and (5) when males contact booby-trapped females. Although not every compound is effective by all the various methods of administration, the range of insects that have been demonstrated to be susceptible to chemosterilization is quite broad.

Reports have been published on the sterilization of house flies (LaBrecque, Smith, Morgan, and others), mosquitoes (Weidhaas et al., and Flapp), Screw-worm fly (Chamberlain), the Mexican fruit fly (Shaw and Sanchez), and drosophila (Goldsmith et al.). Unpublished data by various investigators in the Entomology Research Division have shown that sterility can be induced by chemicals in other flies, moths, beetles, cockroaches, mites, and nematodes.

Two of the past uses of the compounds now being investigated as chemosterilants are of interest to us. Some of the compounds have been used in cancer chemotherapy to support or replace radiation. The experience gained in this way shows that very small quantities may affect the blood-producing systems when given by intravenous injection or orally. On the other hand, a few of the compounds have been used in sizable quantities in the fabric industry without disastrous effect among the workmen.
More information must be available on the toxicity of the promising compounds before the full range of possible methods of application for the control of various species can be determined. As mentioned earlier, they can certainly be used in the control of some species to sterilize reared insects for release among natural populations. No doubt they will also prove acceptable for use with various baits and attractants, which would bring them into contact only with the species concerned. The demonstration of a somewhat greater degree of safety would permit their use in more general, but still highly selective, methods of application. Their most efficient use will almost certainly require more detailed biological information regarding the species concerned than was required with insecticides.

As new compounds are developed and brought into use we may anticipate a wider range of safety and a correspondingly greater number of practical uses. Greater chemical stability would also increase the possible methods of use, but the instability of some of the presently promising compounds might in itself be an advantage for methods of application in which durable residues might be hazardous.

**INSECT ATTRACTANTS**

Insect attractants have many possibilities for improving insect control directly, in connection with research, or in detection and surveys. Attractants might involve the use of such systems as light sources, equipment for producing sound and other radiation, baits for attracting insects and sex lures, both natural and synthetic. The discussion at the Planning and Training Conference of the Entomology Research Division for Research on Insect Attractants, 1962, was limited primarily to research on sex attractants.

Knipling points out ways attractants might be used. Attractants can be of great importance in connection with research and the control of insects. They might be useful as research tools. We need ways of attracting certain insects in connection with studies on migration, ecology, population densities, and for other similar studies. Attractants can be useful in surveys for the purpose of forecasting insect conditions which in turn can serve as a guide for farmers to apply treatments when necessary, and not to make applications when they are not needed. The Plant Pest Control Division has a great need for better ways of detecting the presence of low level insect populations in connection with their control and eradication efforts. Better ways to detect insects might be possible through the use of sex or other attractants. However, the ultimate objective in our research on attractants would be to find ways of using them for more effective or more desirable ways to control or eradicate insects. For example, methyl eugenol, a powerful attractant for the oriental fruit fly, has been demonstrated to be useful for controlling this major fruit pest.
In view of the progress that has been made by our chemists in characterizing and synthesizing the natural sex attractant in the gypsy moth, we have become more interested in research on sex attractants for other major insect pests. The use of sex attractants would seem to offer many possibilities in helping to meet insect problems. If we can demonstrate that chemical sex attractant is possessed by certain insects, and if it can be extracted, identified, and synthesized, we might have a new tool for better survey and better control methods. If the attractant is strong enough, we might achieve insect control through male annihilation. However, with the progress that is being made in our research on chemicals that sterilize insects, we may have a better chance of achieving insect population control through the attraction of males. Knipping commented on the possibilities of using living insects themselves to aid in detection and control. Apparently little consideration has been given to using virgin female insects as a practical means of luring and capturing males. However, in connection with pine saw fly investigations, which are based on some early work on virgin female Hessian flies, a single virgin female insect might have the capacity to lure 100 or more males to a trap.

The use of chemosterilants offers one possibility. Actual destruction of males or females through the use of insecticides applied to the released insects might be considered. In this connection, the ability of insects to develop resistance to insecticides might be turned to our advantage. For example, if we could develop a highly resistant strain of the boll weevil and by some special technique apply enough of an insecticide to both males and females to cause death of males and females in a normal susceptible population during mating attempts, the natural population might be reduced with a relatively few insects per acre. Simultaneously, sterile males of the resistant strain might be released to eliminate the population.

A chemical insect attractant or lure is a material whose vapor, upon reaching the receptor organs of an insect, will cause an approaching response. An arrestant is a material which, although not an attractant, causes insects to congregate in its vicinity. An example of such a material is sugar; being non-volatile it cannot "attract" flies from a distance by chemical action, but it may give the appearance of an attractant since flies quickly congregate on exposed sugar. This is the result of an action that causes the flies which come in contact with the sugar by random exploratory movements to cease exploration and, in this instance, commence feeding.

Other actions associated with the attraction of insects to food, mates, or oviposition sites may also be elicited by chemicals. A chemical, or other stimulus, may induce locomotion in an insect, but not in itself be an attractant (e.g., in some studies, caged mosquitoes have been stimulated to seek hosts by the release of carbon dioxide on one side of the cage, but once in motion their flight was oriented toward warm, moist air currents entering the other side of the cage). Such chemicals are locomotor stimulants. Chemicals may be designated as feeding, mating, or oviposition stimulants if they elicit feeding, mating, or oviposition attempts from insects that have finally arrived, by whatever process, at the site of the chemical. Any one chemical may function in a combination of these ways. A discussion of the designation of compounds in terms of the responses they elicit from insects has been given by Dethier, Brown and Smith (1960).

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At Orlando-Gainesville Laboratory, no completely satisfactory standard has been found for use in house fly attractant tests. Edamin, a milk enzymatic digest, gave the most consistent results and was selected as a standard. Edamin is more attractive to females than to males.

Many natural food materials and products of fermentation, decay, and digestion of organic materials serve as arrestants for house flies, but none more consistently so than sugar, malt, or molasses. Some of these show a low order of true attractiveness. In general, all are more effective as attractants and arrestants when mixed with water.

Some workers have reported that a "fly-factor" is left on food material by feeding flies which makes it more attractive to other flies. At Orlando, preliminary inadequate and misleading experiments indicated that such a factor might be present, but more complete study revealed that no material more attractive than water was added to sucrose by feeding flies (Acree et al., 1959). In some of the other experiments the conversion of starch to sugar and the visual attraction of feeding flies may have added to the effectiveness of the baits or traps.

Vision is well known to play an important role in the behavior of house flies. Visual patterns such as alternating stripes of different colors, concentric circles, and dotted surfaces have been shown to be attractive, and a simple grid is so attractive that it can be used as an alternate to cloth strips baited with malt solution in making fly counts in infected areas. Flies do not remain on the grids as long as they do on the malt strips, however, since no arrestant or feeding stimulant is present.

A recent news release of U.S.D.A. shows that the presence of chemical in the female house flies attracts males. An abstract of the paper, Rogoff et al., of our Corvallis, Oregon laboratory is:

"By the use of an olfactometer, as well as by the use of simulated, treated fly models ("pseudoflies"), data were derived that demonstrate the presence, in female house flies, of a volatile chemical or chemicals, which can influence the behavior of male house flies. The behavior modification can be in the nature of attraction to a source of the pheromone, or an excitation of mating behavior patterns. The material, which is benzene soluble and relatively stable, was shown to be sex related, and specific to the house fly."

Dr. Murvosh of our laboratory states: "Recently, Rogoff (1962) at Corvallis, Oregon, found some evidence in support of a sex attractant in the female house fly. The results of our experiments at Orlando, during the latter part of 1962, also demonstrated evidence of a similar nature, even though the tests were performed by a different procedure in a large cage-type chemotactometer. Preliminary tests, thus far, indicate that virgin males do not attract other virgin males. Young virgin females (1 - 24 hours old) attracted few or no males whereas 7-day-old virgin females, whether alive or freshly killed, consistently attracted a small percentage of virgin males. The results, although consistent, are of a low order and not as striking as that demonstrated by certain moths."
With mosquitoes, Gilbert and Gouck showed color affected the landing rates of three species of mosquitoes. Paper discs were treated with dyes of the primary and secondary colors in a range of shades. The darker shades of each color attracted the most Aegypti, while the lighter shades attracted the most Taeniorynchus. The darker shades of the brighter colors and the lighter shades of the colors containing blue were most attractive to Sollicitans.

With discs reflecting about 40 foot candles of light, there was a negative correlation between the landing rates and the amount of light reflected in the range of 475 to 525 nm wave length with Aegypti but not with the other species. (Gilbert and Gouck, 1957).

Paired Tests and Round-Robin Series

In critical tests comparing compounds which show some promise as attractants, it has been found, at least with some species, preferable to compare the materials in pairs rather than to test three or more at the same time, if it is desired to rate all the compounds in order of effectiveness, not simply to select the best one. If several compounds are tested at once the most effective compound usually stands out above the others, but compounds of intermediate attractiveness often appear no more attractive than a blank or standard. However, if the compounds are tested in pairs it would ordinarily be necessary to test each one against a single standard, in order to have a valid basis for cross-comparison, and this would necessitate an undesirably large number of tests with the standard. In order to avoid undue testing of the standard a balanced, incomplete block design, or round-robin series of tests with 3 to 7 or 8 materials may be used.

In the round-robin series each material is paired with each other material in the series, so that the standard is tested no more than any other compound. An adjusted average, which compensates for differences between testing conditions in each pair of tests, is computed by a statistical method suggested by J. U. McGuire. From the analysis of variance significant differences between any two materials can be determined.

INSECTICIDE ANALYSIS

By

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Systematic analysis of spray materials and plant residues can take a considerable amount of guesswork out of our chemical control efforts. Recent experiences have clearly demonstrated the importance of such analyses and the advantages of knowing, (1) whether the insecticide used is really what it is supposed to be, (2) whether there has been breakdown or settling in storage or during application, (3) the efficiency and adequacy of the application equipment and procedures, and (4) if the active principal is available to the target insect, in what quantities, and for how long.

Quantitative insecticide analyses (or, more accurately, estimates) have been made in a number of ways—including bioassay; gravimetric, colorimetric, and other conventional chemical methods; paper chromatography; and, in some cases, by using material tagged with a radioisotope. Each have their advantages and disadvantages. A recently developed analytical tool, that probably has more potential and less limitations for insecticide analyses than all others combined is gas chromatography. By using microcolorimetric or electron capture methods of detection, a degree of sensitivity can be attained that would have been unbelievable 3 or 4 years ago. Gas chromatography has also greatly reduced the necessity for rigid clean-up procedures.

This is not meant to imply that the full potential of gas chromatography has yet been realized, that it has in all cases replaced other methods of analysis, or that all (or even most) of the major problems associated with insecticide analyses have been solved. One of the main problems confronting the analyst is the lack of completely reliable methods of residue extraction that are equally efficient for all substrates or for any one substrate at different times after treatment. In fact, recent experience indicates that some of the commonly employed methods may be even less effective than we thought.

Provided with the proper equipment, facilities and personnel, however, we could (and should) be answering each of the questions posed above whenever an insecticide is tested or used in control. The expense and effort required would be small indeed compared to the risks and other investments involved.

Undoubtedly, more and more units associated with forest insect control will be making some sort of insecticidal analyses of their own. Also, arrangements can be made to have some routine analyses (e.g., the insecticidal concentration of sprays) made at some private, State and Federal laboratories. These, however, cannot meet the overall national needs. Probably one of the most satisfactory and efficient approaches would be the development of a central facility that could provide analytical services and advice to both research and control units—perhaps on a reimbursement basis.
INSECTICIDE SCREENING--WHAT, HOW, WHERE?

By
E. W. Clark
Forestry Sciences Laboratory
Durham, North Carolina

I. Why?

A. Only 1 percent of available insecticides are being used in forest pest control.

B. BHC and DDT dominate our recommendations; if they are banned or restricted, we are sunk. President Kennedy's Advisory Committee recommends an orderly reduction in persistent insecticides.

C. Only three projects in U.S. Forest Service, Forest Insect Research, list screening of any type.

II. How?

A. Two phases--Laboratory and Field research

B. Lab research on screening can screen:
   1. Different insecticides against a single insect species.
   2. A single insecticide applied against different species.
   3. A single insecticide applied against a single species with controlled environmental variations.

C. Using LD50 as a criterion screen by means of:
   1. Topical application or injection which is most precise.
   2. Feeding or drinking methods
   3. Precision spraying--most data and most useful

D. Requirements for space vary from area for injection, rearing space and post-treatment holding room to elaborate screening laboratories with greenhouses, etc.

III. Where?

A. Southeastern Experiment Station plans to have one in Athens in the future, but they can be set up anywhere.

B. Complexity would govern the location to a great extent.

IV. What?

A. We need a comprehensive list of problems on forest pest control.

B. Of important problems listed:
1. LD₅₀ of insecticides and relative comparison with DDT
2. New insecticides and formulations
3. Uniform pest control guide
4. Determine new short and long life residual insecticides
5. Systemics
6. Integrated control
7. Screen all adjuvants such as synergists, etc.
8. Microbial insecticides and combinations of chemical and microbial insecticides.
9. Attractants and repellents
10. Growth and development regulators, e.g., chemosterilants

C. In short, most needed is to meet the challenge of President Kennedy's committee recommendations to shift research emphasis to:

1. Selective toxic chemicals
2. Non-persistent chemicals
3. Selective methods of application
4. Non-chemical control methods

REGISTRATION LIST

Eighth Annual Southern Forest Insect Work Conference
August 27-28, 1963
Raleigh, North Carolina

Anderson, Neil H.--Duke University, Durham, N.C.
Anderson, Roger F.--Duke University, Durham, N.C.

Barnes, Gordon--University of Arkansas, Fayetteville, Ark.
Beal, James A.--U.S.F.S., Division of Forest Insect Research, Washington, D.C.
Berisford, C. Wayne--Virginia Polytechnic Institute, Blacksburg, Va.
Buchanan, W. D.--U.S.F.S., R-8, Forest Insect & Disease Control, Atlanta, Ga.
Burns, Denver P.--U.S.F.S., Central States Forest Expt. Sta., Delaware, Ohio

Carter, Edward A.--Auburn University, Auburn, Ala.
Chesser, John--404 2nd Street, Jasper, Tex.
Ciesla, W. M.--U.S.F.S., R-8, Forest Insect & Disease Control, Asheville, N.C.
Cralley, E. M.--University of Arkansas, Fayetteville, Ark.

Schroeder, William J.--Virginia Div. of Forestry, Charlottesville, Va.

Tao, Ching H.--University of Georgia, Athens, Ga.

Vite', J. Peter--Boyce Thompson Institute, Grass Valley, Calif.

Warren, Lloyd O.--University of Arkansas, Fayetteville, Ark.

Yearian, William C.--University of Florida, Gainesville, Fla.

SPECIAL THANKS to Fred Whitfield, Maurice Farrier, Hans Langlitz, and Dameon Kulash for their faithful and efficient work in handling the local arrangements!
The Eighth Annual Southern Forest Insect Work Conference was called to order by Chairman Lloyd O. Warren, University of Arkansas. Brief, general business sessions were held from 9:30 to 10:00 a.m., and 4:30 to 5:00 p.m. on August 27. Chairman Warren appointed a committee composed of L. W. Orr, R. C. Fox, and R. C. Morris, to prepare a list of nominations for the office of 3-year Counselor to replace outgoing Counselor John F. Coyne.

Chairman Warren read a letter from A. E. Landgraf, former Secretary-Treasurer of the Western Forest Insect Conference from Denver, Colorado. Mr. Landgraf extended an invitation to our Conference to join with the Western Forest Insect Work Conference and the International Forest Insect Conference at Denver, Colorado in 1965. It was decided to give this invitation more serious consideration at the August 1964 S.F.I.W.C.

Mr. Robert Talerico made a plea for the formation of a committee to develop and standardize survey methods for the fall cankerworm. Charles Speers suggested that such a committee might consider all the economically important hardwood defoliators. Chairman Warren then appointed a Hardwood Defoliator Committee composed of Caleb Morris, Chairman; Robert Morris, Charles Speers, and Robert Talerico. Robert Heller offered the services of the Beltsville Forest Insect Laboratory, particularly in connection with aerial survey methods.

Chairman Warren appointed a resolutions committee consisting of Richard Mason, Roger Anderson, and Bernhard Ebel.

The final business session was held at noon on August 28, immediately following the presentation of the workshop summaries. The resolutions were presented by the resolutions committee. Robert Thatcher was elected to the office of 3-year Counselor.

Ed Merkel reported that the balance on hand in the treasury as of August 27, 1963, was $151.17. Seventy-two men registered for the Eighth Southern Forest Insect Work Conference.

The meeting was adjourned after a short discussion of proposed meeting places and dates for the 1964 S.F.I.W.C.