

OR
HE0/F76/2
48P3
:4
C.3

SPECIAL PUBLICATION 4

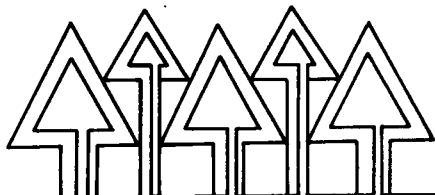
SEPTEMBER 1982

DISCARD
OREGON
OCT 17 1982
STATE LIBRARY

**INVERTEBRATES OF THE
H.J. ANDREWS EXPERIMENTAL FOREST,
WESTERN CASCADE MOUNTAINS, OREGON:**

**A SURVEY OF ARTHROPODS ASSOCIATED
WITH THE CANOPY OF OLD-GROWTH
*Pseudotsuga Menziesii***

D.J. Voegtlin



FOREST RESEARCH LABORATORY

SCHOOL OF FORESTRY

OREGON STATE UNIVERSITY

Since 1941, the Forest Research Laboratory--part of the School of Forestry at Oregon State University in Corvallis--has been studying forests and why they are like they are. A staff of more than 50 scientists conducts research to provide information for wise public and private decisions on managing and using Oregon's forest resources and operating its wood-using industries. Because of this research, Oregon's forests now yield more in the way of wood products, water, forage, wildlife, and recreation. Wood products are harvested, processed, and used more efficiently. Employment, productivity, and profitability in industries dependent on forests also have been strengthened. And this research has helped Oregon to maintain a quality environment for its people.

Much research is done in the Laboratory's facilities on the campus. But field experiments in forest genetics, young-growth management, forest hydrology, harvesting methods, and reforestation are conducted on 12,000 acres of School forests adjacent to the campus and on lands of public and private cooperating agencies throughout the Pacific Northwest.

With these publications, the Forest Research Laboratory supplies the results of its research to forest land owners and managers, to manufacturers and users of forest products, to leaders of government and industry, and to the general public.

The Author

David J. Voegtlin is Assistant Taxonomist at the Illinois Natural History Survey, Champaign, Illinois.

Disclaimer

The mention of trade names or commercial products in this publication does not constitute endorsement or recommendation for use.

To Order Copies: Copies of this and other Forest Research Laboratory publications are available from:

Forest Research Laboratory
School of Forestry
Oregon State University
Corvallis, Oregon 97331

Please include author(s), title, and publication number if known.

CONTENTS

2	INTRODUCTION
2	STUDY AREA
3	CANOPY ACCESS
3	SAMPLING TECHNIQUES
4	Sticky screens
4	Trunk sticky screens
4	Pitfall traps
4	Tullgren sampling
5	Filtration
6	Vacuum
6	Blacklight
7	Cookie Cutter
7	REFERENCE SPECIMENS
7	DISCUSSION
8	ARTHROPOD LIST
8	Key
9	Collembola
9	Ephemeroptera
9	Orthoptera
10	Isoptera
10	Plecoptera
10	Psocoptera
10	Thysanoptera
11	Hemiptera
11	Homoptera
12	Neuroptera
13	Coleoptera
16	Trichoptera
17	Lepidoptera
19	Diptera
22	Hymenoptera
23	Acari
25	Araneae
27	LITERATURE CITED
29	ACKNOWLEDGMENTS

The first of a group of papers on invertebrates of the H.J. Andrews Experimental Forest was published in 1981 by the Pacific Northwest Forest and Range Experiment Station (Robert E. Lewis and Chris Maser, Invertebrates of the H.J. Andrews Experimental Forest, Western Cascades, Oregon. I. An Annotated Checklist of Fleas, Research Note PNW-378). The present paper is the second in this group.

INTRODUCTION

Research on arthropods associated with the crowns of large trees has been limited because of the difficulty of access. The variety of methods that has been used to collect canopy arthropods includes insecticidal treatment by airplane (Martin 1966, Gagne 1979, Wolda 1979), hoisting traps on ropes placed by shooting lines over branches with a bow and arrow (Sweeney and Jones 1975), beating beech stems with clubs (Nielsen 1975a,b), and beating branches throughout a tree to drop the arthropods onto large sheets (Horegott 1960). Lepointe (1956) covered branches with large cylindrical bags, then severed them and fumigated the contents to knock down the insects. Dahlsten (1979) severed and carefully lowered one-third of the branches of white fir trees, then removed the insects by beating the branches over large collecting sheets. Engel (1941) cut down entire pines onto large sheets and beat the branches to obtain the arthropods. Direct access to the canopy has been made by scaffoldings (Morris 1955), by a small elevator attached to a large *Sequoiadendron gigantea* (Stecker 1973), and more recently, by an easy, nondestructive method using modified rock-climbing techniques (Denison et al. 1972, Perry 1980).

Investigations into the structure of the canopy of old growth *Pseudotsuga menziesii* (Mirb.) Franco and the species, distribution and biomass of macro- and microepiphytes within the canopy were begun in the early 1970's in the H. J. Andrews Experimental Forest on the west slope of the Cascade Mountains in Oregon (Denison et al. 1972, Pike et al. 1972, Pike et al. 1975). In 1975, studies

were begun in the same area to examine nutrient movement within the canopy, which was of special interest due to the abundance of *Lobaria oregana* (Tuck.) Mull. Arg., a nitrogen-fixing lichen. Included in these studies was a survey of the arthropods associated with the canopy.

Other surveys of arthropods associated with Douglas-fir or the Douglas-fir forest area have been made (Bedard 1938, Deyrup 1975, Deyrup 1981, Mispagel and Rose 1978) and are continuing to be made in the H.J. Andrews Experimental Forest. But these surveys are confined to the soil, aquatic, and shrub strata, or to trees whose canopy can be reached without the major climbing technology required for Douglas-fir.

An old growth Douglas-fir canopy is extensive. It might best be viewed as a truncated cone, approximately 10 m in diameter at its base, starting as low as 20 m from the ground and reaching nearly 80 m (Franklin et al. 1981). Examination of epiphyte distribution has shown that the canopy can be divided into several habitats, each characterized by certain epiphytic species (Pike et al. 1975). A similar set of distinctive arthropod habitats occurs in the canopy: the trunk with its deeply fissured bark and scattered epiphytes, the large moss bolsters found on some of the lower branches, the large clumps of epiphytes on branches throughout the tree, the twig and needle surfaces, and the accumulated debris (lodged litter) often found on the upper surface of the large branch systems. The goal of this project was to collect the arthropod taxa associated with these habitats.

STUDY AREA

The study sites are located in the H. J. Andrews Experimental Forest (an Ecological Environmental Reserve, approximately 75 km east of Eugene, Oregon) in the Cascade Mountains. The three trees used were located in relatively undisturbed old growth stands of *Pseudotsuga menziesii*, *Tsuga heterophylla* (Raf.) Sarg. and *Thuja plicata* Donn. corresponding to the Tshe/Rhina/Bene community of Franklin and Dyrness (1973).

Two of the trees, El Capitan and Neptune, were located in Watershed 2 (T15S R5E Sec 31 SE1/4) near Lookout Creek, elevation 450 m. The third, Fangorn, was located about 0.5 km south of Lookout Creek along the Mack Creek road (T15S R5E Sec 28 SE1/4), elevation 625 m. The trees were approximately 450 years old, 1.5 m diameter at breast height, and 75-78 m tall. El Capitan and Neptune had been documented as to structure, epiphyte

presence, biomass, and surface areas of all major components (see Pike et al. 1977 for a description of an old growth Douglas-fir similar to those used in this survey). When

possible, sampling was designed to correlate with the previous data base and sampling techniques of the detailed studies of El Capitan and Neptune.

CANOPY ACCESS

With the aid of stirrups and body harness attached to jumars clipped on a top-anchored rope and a safety belay, climbers made rapid, easy, and repeated access to the canopy with minimum habitat disruption (Denison 1973).

Safety precautions limited the movement of the climbers within the canopy, as they remained attached to the ropes at all times. Lateral access was essentially limited to 3 m or less in any direction from the trunk.

SAMPLING TECHNIQUES

The techniques used were standard methods adapted for use in the canopy. The variety of within-canopy habitats necessitated sever-

al specific sampling methods and regimes (Fig. 1).

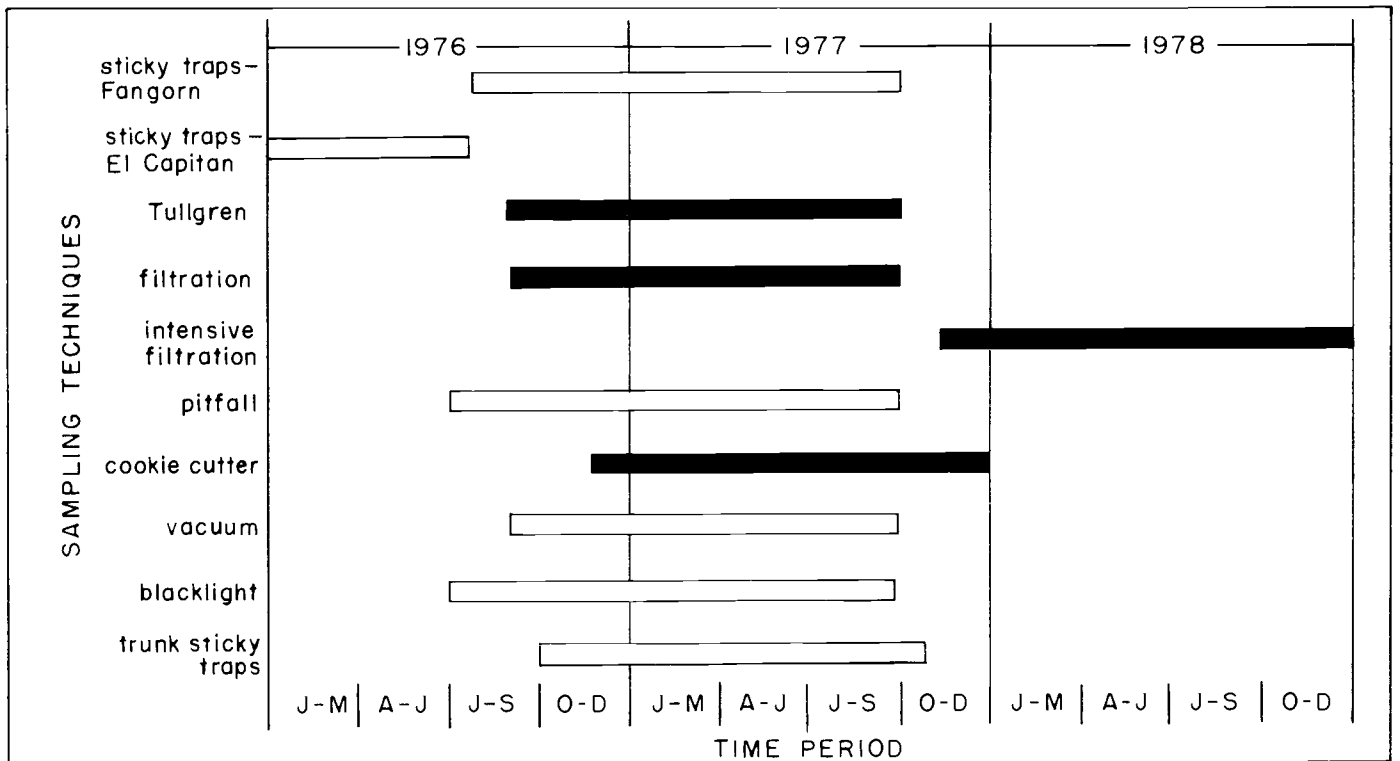
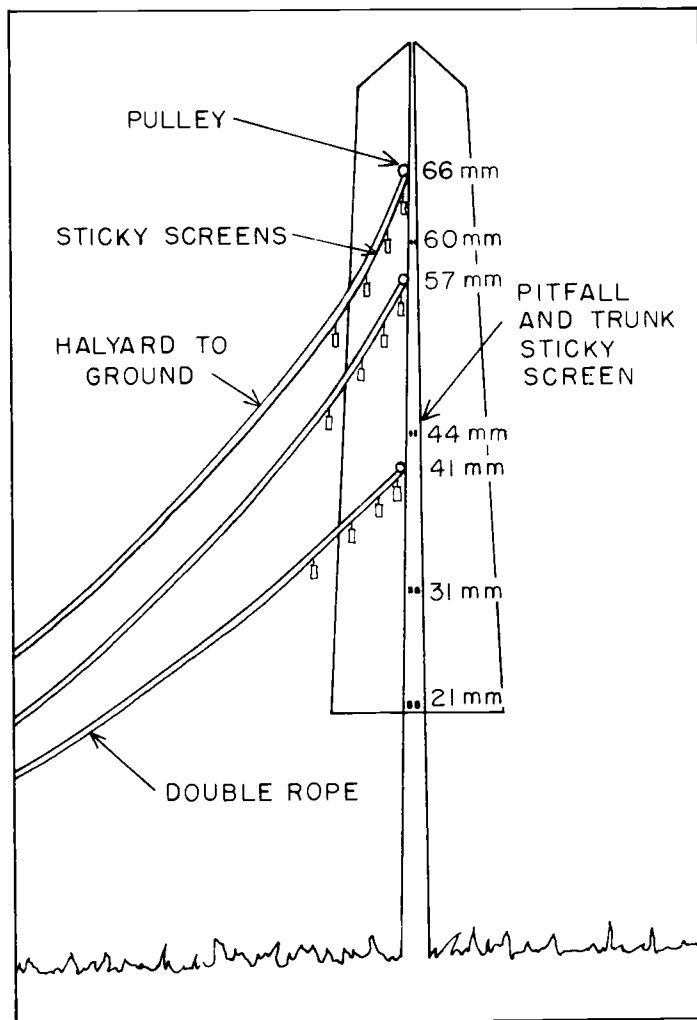


FIGURE 1
 ARTHROPOD SAMPLING IN THE CANOPY OF OLD GROWTH DOUGLAS-FIR IN THE H. J. ANDREWS EXPERIMENTAL FOREST, OREGON, 1976-1978. SOLID BARS REPRESENT DATA SETS THAT CAN BE DIRECTLY CORRELATED TO A SPECIFIC HABITAT QUANTITY (BY WEIGHT).

Sticky screens

The use of sticky material is a familiar and effective way to collect insects, but the data are difficult to relate quantitatively to the habitat. Damage to the insects captured on sticky materials is also a problem, but with care it can be minimized for many orders.

The structure of the large trees is such that sticky screens could not be pulled up and down on ropes running along the trunk. Rather, halyards were attached at three levels within the canopy and operated from points at some distance from the base of the tree. The location of each halyard was determined by available access points. One-fourth-inch (0.64 cm) mesh hardware cloth was cut to 20 x 25 cm pieces and 20 x 20 cm of each piece was covered with Stickem Special®. Four screens were attached to each halyard (Fig. 2), the attachment points such



that the bottom screen on each halyard was completely outside the canopy, the third at the outer edge, the second in the middle, and the first near the trunk. Because of the slope of the rope halyards, the bottom screen of the upper halyard was slightly below the top screen of the middle halyard. However, specimens taken on this screen were still considered to be from the upper canopy. Samples were initially taken on halyards attached to El Capitan, but later the halyards were moved to Fangorn. On both trees sticky screens were changed every 2 weeks.

Insects were removed by soaking the screens in hot kerosene until the specimens dropped off. The hot kerosene and insects were then filtered through a Buchner funnel and the filter paper and specimens allowed to air dry. For sorting, specimens were rehydrated in 70% alcohol. By this method they received little mechanical damage during removal.

Trunk sticky screens

Screens of the same size and structure as those on halyards were held in place a small distance away from the trunk (Fig. 3). Four screens, located on Fangorn (Fig. 2), were changed every 2 weeks.

Pitfall traps

Bark was chipped away on Fangorn to form hollows for one-liter round plastic containers attached to the trunk with a large flat-head nail at the same heights as the trunk sticky screens (Fig. 2). Water and ethylene glycol were placed in the containers, which were emptied every 2 weeks. Tiny holes below the rim allowed water to escape in heavy rain.

Tullgren sampling

Samples of epiphytes occurring on the large branches were taken at biweekly intervals. On each sampling date, a branch was randomly chosen from each stratum (upper, middle,

FIGURE 2

SCHEMATIC OF AN OLD GROWTH DOUGLAS-FIR TREE, SHOWING THE ARRANGEMENT OF HALYARDS AND STICKY SCREENS, PITFALL TRAPS, AND TRUNK STICKY SCREENS.

lower), and three samples were taken on each branch. Each sample, consisting of all epiphytes on a 1 dm section of the branch, was bagged separately in a plastic bag and taken to the laboratory for extraction in Tullgren funnels (Fig. 4). Collecting bottles contained tap water. Extraction was effected in less than 1 week, most specimens being extracted in 2 to 3 days. All epiphytes were taken from Neptune.

Filtration

The needle and twig (branchlet) habitat has the highest surface area of all the tree components ($3,000 \text{ m}^2/\text{tree}$) (Pike et al. 1977). A sampling method called "Filtration" extended from the third quarter of 1976 to the third quarter of 1977, and a method called "Intensive Filtration" from the last quarter of 1977 through 1978 (Fig. 1). During filtration, one living and one dead branchlet were taken from each of three

branches every 2 weeks. During intensive filtration, three living branchlets were taken from each of three branches every 2 weeks, one branchlet near the trunk, one at the outer limit of access, and one between. Each was bagged separately. Removal of arthropods was effected in the laboratory by washing a branchlet under a high pressure jet of water. The wash was then filtered through a set of nested sieves (Fig. 5) consisting of 16-, 40-, 100-, and 200-mesh stainless steel cloth (pore size 1.13mm, 380 μm , 140 μm , and 74 μm respectively). The contents of each sieve were washed into petri dishes for

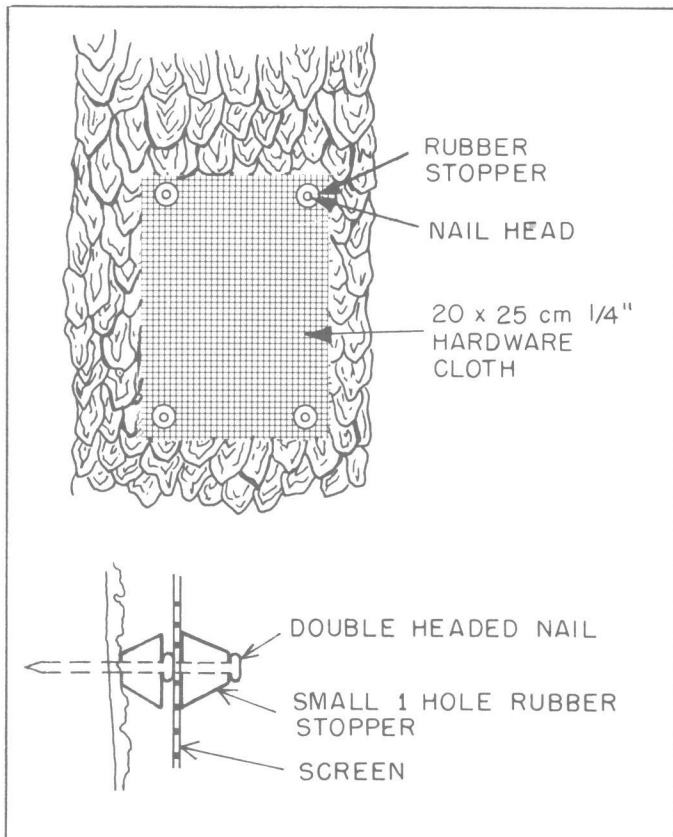


FIGURE 3

DETAIL OF ATTACHMENT OF TRUNK STICKY SCREENS. HOLES IN OUTER RUBBER STOPPERS MUST BE SMALL ENOUGH TO GRIP THE NAIL HEAD TIGHTLY.

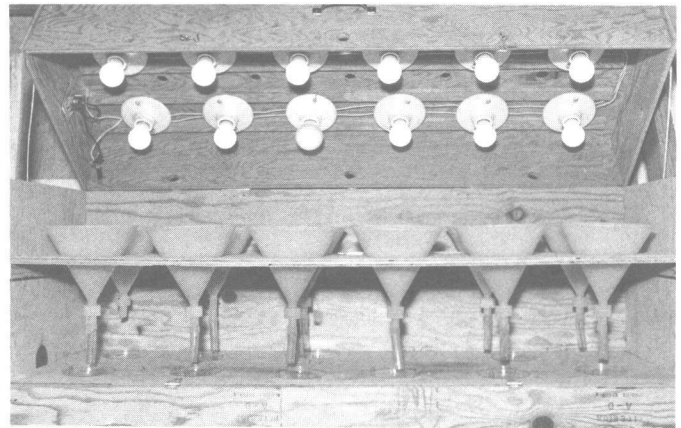


FIGURE 4

TULLGREN FUNNEL BOX WITH VENTILATION HOLES IN THE COVER AND RHEOSTATICALLY CONTROLLED LIGHTS. SAMPLES WERE COLLECTED INTO BOTTLES WHICH SCREWED INTO THE CAP FIXED TO THE BOTTOM OF EACH FUNNEL.

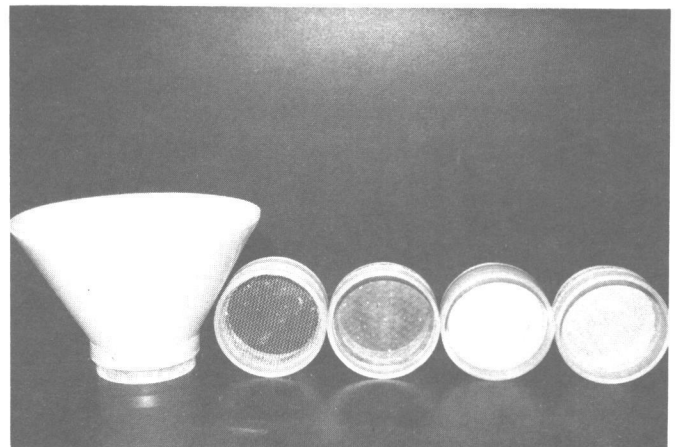


FIGURE 5

NESTED SIEVES USED FOR FILTRATION OF BRANCHLET WASH. (PORE SIZES: 1.13 mm, 380 μm , 140 μm , 74 μm).

counting, which proved to be an effective method. The sieves collected organisms as small as tardigrades and rotifers. All samples were taken from Neptune.

Vacuum

A portable vacuum system, made with an Echo PB-9® blower, could be carried into the canopy without much difficulty. A sheet metal box was built to fit over the air intake (Fig. 6) and joined by a short length of wire-reinforced hose to the air tube. Womens' knee length nylon stockings were used for collecting bags because they stretched into the air intake tube, were easily removed and tied, were cheap and durable, and collected even very small mites. Samples were taken biweekly from Neptune on the same live branches chosen for the filtration samples. All foliage surface that could be reached was vacuumed.

Blacklight

A large funnel-shaped blacklight trap (Fig. 7) constructed with components taken from a light fixture designed for campers, was pulled to the 40-45 m level by halyard. The light was set in the funnel so that it could be seen only from above. Power was supplied

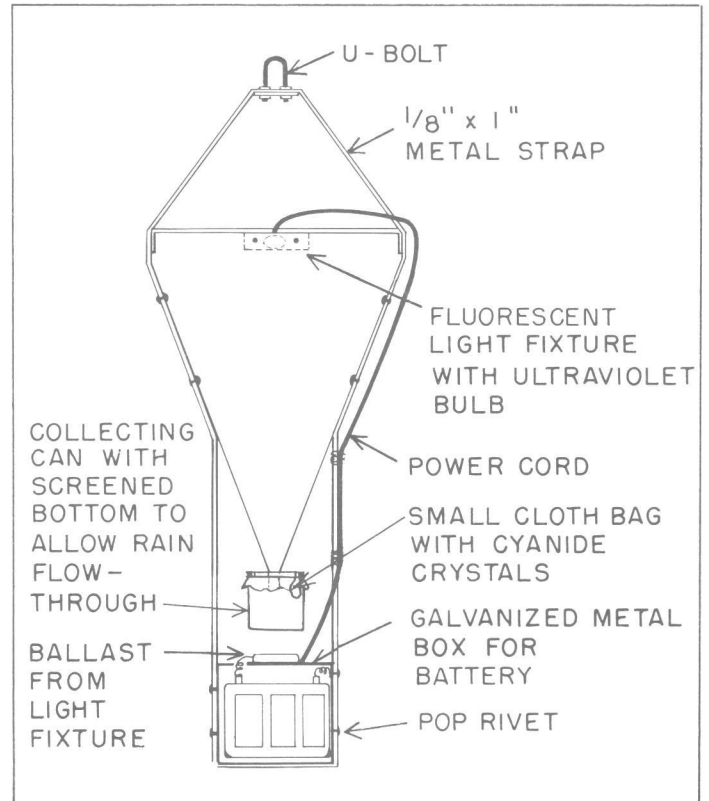


FIGURE 7

BLACKLIGHT TRAP. THE U-BOLT WAS FASTENED TO THE HALYARD BY A LOCKING CARABINER WHEN THE TRAP WAS PULLED INTO THE CANOPY.

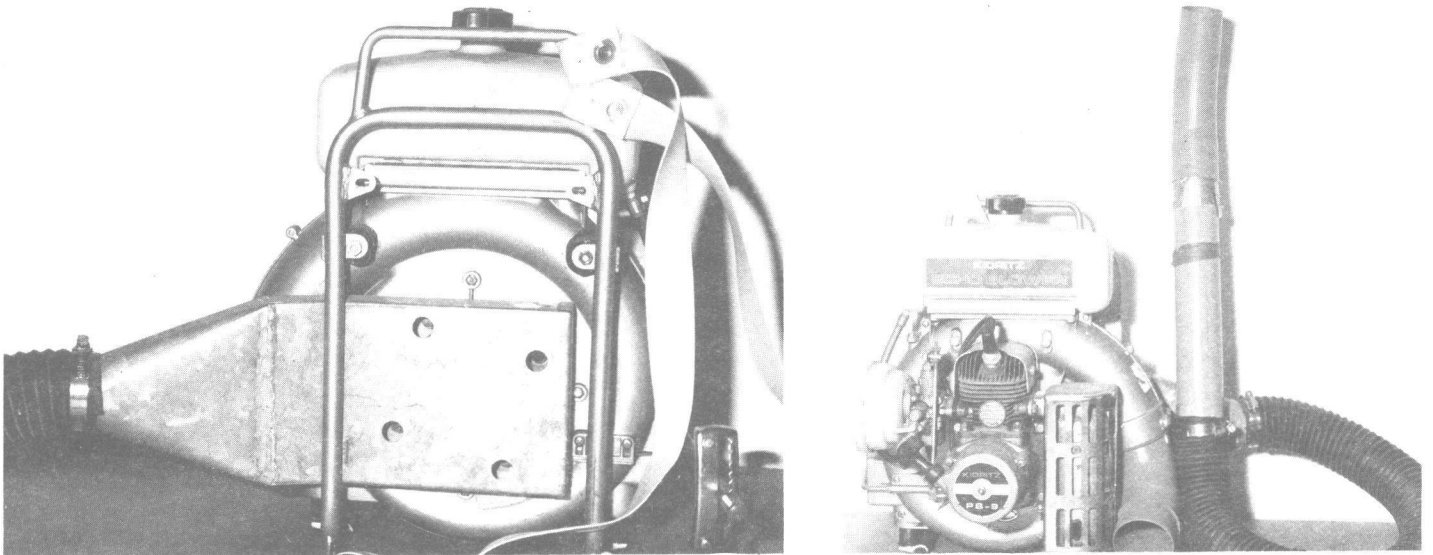


FIGURE 6

FRONT AND BACK VIEW OF THE PORTABLE VACUUM SYSTEM, DEvised WITH AN ECHO PB-9 BLOWER, SHOWING THE ADAPTATION OF THE INTAKE AND THE CONNECTION OF THE FLEXIBLE HOSE WITH THE COLLECTING TUBE. THE COLLECTION BAG WAS HELD IN PLACE BETWEEN THE STRAIGHT TUBE AND THE CURVED END PIECE.

from a 12-volt battery suspended immediately below the trap. Blacklight samples were taken biweekly from Fangorn.

Cookie cutter

Samples 1 dm² were cut from large moss bolsters with a knife, though the original

intention had been to make a square punch similar to a cookie cutter for this purpose. One sample of moss and underlying soil was taken from each bolster every month for 1 year. Arthropods were extracted from these samples with Tullgren funnels. All samples were taken from Fangorn.

REFERENCE SPECIMENS

As new taxa were encountered, a reference bottle containing the specimen was given a four-letter and one-number code (e.g. ACAR 24 was the 24th mite taxon). Reference to a taxon was always by this code. The bottles were kept in racks in front of the sorting microscopes for easy reference. For each

taxon, representative specimens from the reference collection and the biweekly samples were sent to specialists for determination (see p. 29). The reference series and entire canopy collection has been deposited in the Systematic Entomology Laboratory of Oregon State University, Corvallis, Oregon.

DISCUSSION

The sampling techniques were developed to look at the tree from the lowest branch to the top. All of the major habitats were examined with the exception of intermediate size branches that were too large to cut off and bag and which were generally beyond reach. That habitat, however, is not a large percentage of the canopy surface area (Pike et al. 1977). A sampling technique for intermediate branches could not be found that would prevent major disruption of other tree surfaces. Most of the techniques worked well throughout the year, and some arthropods were collected by every method in every sampling period. Taxonomic categories in the reference series number approximately 1,500. In spite of efforts to prevent a category from containing more than one taxon, some of the supposed monospecific categories had as many as three species. In some cases, different categories were conspecific. For many arthropod groups, taxa can be separated only by experts after special preparation, a task beyond the scope of this survey.

Determination was a long, slow process and for some groups impossible. It is hoped that the group of identified taxa contains the main arthropods associated with the canopy of

old growth Douglas-fir, at least in the Cascade Mountains of Oregon. As far as can be determined from the literature and from observations of stages of the life cycle in the canopy, few of the collected species spend their entire life cycle within the tree, and most of those which do are small, e.g. Acarina, Collembola, Araneae, and Psocoptera.

It is difficult to compare this study with the many canopy studies in the literature. Some focus on only one species or specific group of insects or arthropods, and detailed lists are not given. Three studies on canopy fauna that are similarly comprehensive are those by Horegott (1960), Martin (1966), and Wolda (1979). Horegott examined the canopy of *Pinus sylvestris* L. and found 256 species of arthropods. Martin looked at the insect fauna of different-aged stands of *Pinus resinosa* Aiton over a 4-year period and found a composition of insects similar to that observed in the Douglas-fir canopy, but most of the quantitative data are given as percentages. The numbers of species stated, ten species of Collembola, four of mites and two of psyllids, suggest a total number lower than that in the Douglas-fir canopy. Wolda

looked at Homoptera in catches made under *Luehea seemanii* trees in the Panama Canal Zone after fogging with pyrethrum. In the Homoptera alone there were 332 species, which is an order of magnitude greater than the number in the Douglas-fir canopy. He found, however, that the number of species was closely correlated with the number of vines in the canopy, which suggests that not all species were directly associated with the *Luehea seemanii*.

It appears that the Douglas-fir canopy has the greatest diversity of arthropods known of any temperate canopy system yet studied.

This diversity may be a result of the intensive year-round sampling or of the examination of the microhabitats within the tree, or it may be that the methods sampled much of the surrounding habitat as well. The time required for examining the canopy with eight techniques limited the data that could be gathered on any one species. The following species list should, however, enhance our knowledge of faunal diversity in the canopy of old growth Douglas-fir trees, and therefore of the arthropod diversity in west-side midelevation coniferous forests of the Pacific Northwest.

ARTHROPOD LIST

Of the approximately 1,500 taxa collected, about 700 are represented by only 1 or 2 specimens. Some of these are identified, but the priority was to obtain names of the most abundant taxa. The following list contains more than 500 taxa, about 75 percent of all the specimens collected, determined at least to genus.

The Insecta are ordered after the arrangement of Borror, DeLong, and Triplehorn (1976). Genera within a family are arranged alphabetically. Acari and Araneae follow the Insecta. In the Acari, families are arranged alphabetically within each suborder.

Some names are not followed by information because the taxonomic category label was separated from the specimen during determination. Other specimens were taken from multispecific taxonomic categories, therefore no information is available.

After each taxon name, information is given on abundance, canopy location, canopy habitat, sampling technique, season of capture, and stage of maturity (refer to Key).

Key

Abundance	* = one specimen ** = 2-10 specimens *** = 11-100 specimens **** = 101 or more specimens	Sampling technique	ss = sticky screens ts = trunk sticky screens pf = pitfall traps tu = tullgren fi = filtration va = vacuum bl = blacklight trap co = cookie
Canopy location	u = upper canopy m = middle canopy l = lower canopy	Season of capture	1 = 1st quarter (Jan.-March) 2 = 2nd quarter (April-May) 3 = 3rd quarter (June-Sept.) 4 = 4th quarter (Oct.-Dec.)
Canopy habitat	br = branchlet ae = aerial ep = epiphyte tr = trunk mo = moss	Stage	imm = immature

Taxonomic category	Abundance	Location	Habitat	Technique	Season	Stage
Collembola						
Poduridae						
<i>Hypogastrura (Ceratophysella) pseudoarmata</i> (Folsom)	****	u,m	br	fi	3,4	imm,adult
<i>Nearura setosa</i> Canby	****	m	tr	pf	2,3	imm,adult
<i>Onychiurus (Protaporura) voegtlini</i> Christiansen & Bellinger	**	m	br	fi	4	adult
<i>Xenylla humicola</i> (O.Fabricius)	****	u,m	br	fi	2,3,4	imm,adult
Isotomidae						
<i>Isotoma (Desoria) sp. cf. nigrifrons</i> (Folsom)	****	u,m,l	tr,ep	tu,co,ts,pf	1,4	imm,adult
<i>Isotoma (Pseudisotoma) monochaeta</i> Kos.						
<i>Isotoma (Pseudisotoma) sensibilis</i> Tullberg						
<i>Isotoma (Vertagopus) arborea</i> (Linnaeus)						
The four <i>Isotoma</i> species listed above cannot be separated accurately in alcohol (they must be slide mounted). They have been included in one category. An in-depth study of these species might yield interesting data on within-canopy habitat partitioning or even phenological partitioning, though most collections of these species were made during the rainy season.						
<i>Metisotoma grandiceps</i> (Reuter)	**	l	tr	pf	1	adult
<i>Tetracanthella christianseni</i> Cassagnau and <i>Uzellia sp. nov.</i>	****	u,m,l	ep,br	tu,fi	1,2,3,4	imm,adult
These two species fell into one category when sorting from alcohol. They were collected from two rather distinct habitats, and it seems possible that one may be associated with the branchlet habitat and the other with the epiphyte-lodge litter habitat. The <i>Uzella sp.</i> has been sent to Monsieur L. Dehaveng (Universite Paule Sabatier, Toulouse, France), who will describe this new species.						
<i>Tomocerus flavescens</i> Tullberg	*	u	ae	ss		
Entomobryiidae						
<i>Entomobrya triangularis</i> Schott	***	u,m,l	tr,ep	tu,pf,co	1,2,3,4	adult
<i>Entomobrya unostriata</i> Stach	****	m,l	mo	co	3	imm,adult
This immigrant species is spreading across North America.						
<i>Sinella sexoculata</i> (Schott)	*					
Sminthuridae						
<i>Arraphalites diversus</i> Mills	***	m,l	mo	co	4	imm,adult
<i>Dicyrtoma (Ptenothrix) beta</i> Christiansen & Bellinger	****	u,m,l	br	va,fi	1,4	imm,adult
<i>Dicyrtoma maculosa</i> (Schott)	***	l	tr	pf	1,4	imm,adult
<i>Sminthurinus quadrimaculatus</i> (Ryder)	****	u,m,l	tr,ep	tu,co,pf	1,4	imm,adult

Ephemeroptera

Most mayflies were caught by sticky screens and were generally in such poor condition they were not sent out for determination. We recognized six taxa and collected about 100 specimens. Specimens that were sent out were determined only to family: two Baetidae and two Heptageniidae.

Orthoptera

Gryllidae

<i>Pristocevthophilous cercialis</i> Caudell	**	u,m,l	tr	pf,ts	3	adult
<i>Pristocevthophilous sargentae</i> Gurney	**	u,m,l	tr	pf,ts	3	adult

Taxonomic category	Abundance	Location	Habitat	Technique	Season	Stage
Isoptera						
Hodotermitidae	***	m	ae	bl,ss	3	adult
Plecoptera						
Nemouridae						
<i>Sweltsa oregonensis</i> (Frison)	***	u	ae	ss	2,3	adult
<i>Sweltsa fraterma</i> (Frison)	**	m	ae	ss	3	adult
<i>Zapada cinctipes</i> (Banks)	***	u	ae	ss	1,2	adult
Leuctridae						
<i>Paraleuctra occidentalis</i> (Banks)	**	u,m,l	ae	ss	1,2	adult
Capniidae						
<i>Capnia projecta</i> Frison	***	u,m,l	ae	ss	1,2	adult
Psocoptera						
The eggs of two species were collected during filtration sampling of branchlets. One type was predominant in quarters 1 and 4 and the other in quarter 2. They were at times abundant (****) and could be determined easily as Psocoptera. Often it was possible to find eggs hatching. We could not positively match them with the adults.						
Trogiidae						
<i>Cerobasis</i> sp.	***	u,m	tr	pf	3	imm,adult
Liposcelidae						
<i>Liposcelis</i> sp.	****	u,m,l	ep,mo	tu,cc	1,2,3,4	imm,adult
Elipsocidae						
<i>Reuterella helvimacula</i> (Enderlein)	****	u,m	ae	ss	2,3	imm,adult
Lachesillidae						
<i>Lachesilla pacifica</i> Chapman	*					
Ectopsocidae						
<i>Ectopsocus californicus</i> (Banks)	****	u,m,l	ae	ss	3,4	adult
<i>Ectopsocus</i> sp.	***	u,m,l	ae,tr,br	ss,pf,fi	2,3	imm,adult
Amphipsocidae						
<i>Teliapsocus conterminus</i> (Walsh)	****	u,m,l	ae,br,tr	ss,va,pf	2,3	imm,adult
Caeciliidae						
<i>Caecilius boreus</i> Mockford	***	m	ae,br	bl,fi	3	adult
<i>Caecilius burmeisteri</i> Brauer	****	u,m,l	ae	ss,ts	2,3,4	adult
<i>Caecilius perplexus</i> Chapman	**					
Some specimens of this species were mixed with <i>C. burmeisteri</i> .						
<i>Graphopsocus cruciatus</i> (Linnaeus)	**	u,m,l	ae	ss	3,4	adult
Psocidae						
<i>Amphigerontia confraterna</i> (Banks)	****	u,m,l	ae	ss	2,3,4	adult
<i>Leonsia maculosa</i> (Banks)	***	m,l	ae	ss	3	adult

Thysanoptera

Many immature thrips were collected in quarters 2, 3, and 4 on sticky screens and in filtration of branchlet washings. We could not associate them with the adults.

Taxonomic category	Abundance	Location	Habitat	Technique	Season	Stage
Aeolothripidae						
<i>Aeolothrips</i> sp.	**	m,l	ae	ss	2,3	adult
Thripidae						
<i>Limothrips</i> sp.	****	u,m,l	ae,br	ss,fi,va	1,2,3,4	adult
<i>Oxythrips</i> sp.	****	u,m,l	ae,br	ss,va,fi	1,2,3	adult
<i>Scritothrips</i> sp.	****	u,m	ae	ss	2,3	adult
Phlaeothripidae						
<i>Leptothrips</i> sp. 1	****	u,m,l	ae,br	ss,fi,va	2,3,4	adult
<i>Leptothrips</i> sp. 2	****	l	ae	ss	2,3	adult

Hemiptera

Corixidae						
<i>Callicorixa vulnerata</i> (Uhler) and <i>Cenocorixa wileyae</i> Hungerford	***	m	ae	bl	3	adult
Miridae						
<i>Ceratocapsus</i> sp.	**					imm,adult
<i>Eurychilopterella</i> sp. nov.	**	u,l	ae	ss	3	adult
This species is being described by V. Razafimahatratra and J. D. Lattin.						
<i>Irbisia serrata</i> Bliven	*	l	ae	ss	2	adult
Orthotylinae	****	u,m,l	ae,br,tr	ss,bl,va,pf	3	adult
<i>Paraproba nigrinervis</i> Van Duzee	*	l	ae	ss	3	adult
Phylinae	***	u,m,l	ae	ss	2,3	imm,adult
<i>Phytocoris</i> spp.	***	u,m,l	ae	ss	3	adult
<i>Plagiognathus</i> sp.	****	u,m	ae	ss,bl	3	adult
Reduviidae						
<i>Empicoris</i> sp.	*					adult
<i>Zelus</i> sp.	*					adult
Tingidae						
<i>Corythucha scitula</i> Drake	**	m	ae	ss	3	adult
Aradidae						
<i>Aradus</i> sp.	*	u	ae	ss	2	adult
Lygaeidae						
<i>Crophius</i> sp.	*	l	ae	ss	2	adult
<i>Eremocoris</i> sp.	**	m,l	ae	ss	2,4	adult
<i>Gastrodes</i> sp.	*		ae	ss		imm
<i>Kleidocerys</i> sp.	**	m,l	ae	ss	3	adult
<i>Neacoryphus</i> sp.	*	u	br	va	2	adult
<i>Nysius</i> sp.	**	m	ae	bl	3	adult
<i>Sphragisticus nebulosus</i> (Fallén)	*	m	ae	bl	3	adult
Coreidae						
<i>Leptoglossus occidentalis</i> Heidemann	*					adult

Homoptera

Cercopidae						
<i>Aphrophora permutata</i> Uhler	**	u,m	ae	ss	3,4	adult
Cicadellidae						
<i>Aceratagallia californica</i> (Baker)	***	u,m,l	ae	ss,va,ts	1,2	adult
<i>Amblysellus grex</i> (Oman)	*	u	ae	ss	3	adult
<i>Balclutha punctata</i> (Fabricius)	****	u,m,l	ae	ss	1,2	adult
<i>Cuerma</i> sp.	*	m	ae	ss	2	adult

Taxonomic category	Abundance	Location	Habitat	Technique	Season	Stage
<i>Empoasca elongella</i> Metcalf	***	u,m,l	ae	bl,ss	3,4	adult
<i>Empoasca filamenta</i> DeLong	**	u,m	ae	ss	3	adult
<i>Euscelidius variegatus</i> (Kirschbaum)	*					adult
<i>Exitianus exitiosus</i> (Uhler)	*	m	ae	bl	3	adult
<i>Idiocerus alternatus</i> Fitch	**	u,m	ae	ss	1,2	adult
<i>Japananus hyalinus</i> (Osborn)	*	m	ae	ss	3	adult
<i>Osbornellus borealis</i> DeLong & Musgrave	**	u,l	ae	ss	3	adult
<i>Scaphytopius acutus cirrus</i> Musgrave	*	l	ae	ss	3	adult
<i>Stenocoelidia lineata</i> (Baker)	**	u	ae	ss	4	adult
<i>Typhlocyliinae</i> sp.	*	u	ae	ss	3	adult
Cixiidae						
<i>Cixius</i> sp.	**	m	ae	ss,ts	1,2	adult
Achilidae						
<i>Epiptera fusiformes</i> (Van Duzee)	*	u	ae	ss,ts	3	adult
<i>Synedoche nemoralis</i> (Van Duzee)	***	u,m,l	ae	ss,ts	2,3	adult
Psyllidae						
<i>Aphalara</i> sp.	**	m	ae	ss	4	adult
<i>Craspedolepta</i> sp.	**	l	ae	ss	3,4	adult
<i>Psylla</i> sp.	**	u,m	ae	ss	4	adult
Psyllinae	**	m,l	ae	ss	4	adult
<i>Trioza</i> sp.	**	u	ae	ss	4	adult
Some species identified from canopy material were separated from the reference code number so they cannot be associated with particular data: <i>Psylla minor</i> Crawford, <i>Trioza frontalis</i> Crawford, and <i>Trioza minuta</i> Crawford.						
Aphididae						
<i>Cinara pseudotaxifoliae</i> Palmer	**	m	br	fi,ss	2,3	imm,adult
<i>Essigella wilsoni</i> Hottes	***	u,m,l	ae,br	ss,fi,v	2,3,4	imm,adult
<i>Mindarus</i> sp.	**	u,m,l	ae	ss	3,4	adult
<i>Uroleucon</i> sp.	***	u,m,l	ae	ss	3	adult
Miscellaneous alatae	****	u,m,l	ae	ss	2,3,4	adult
<i>Acyrtosiphon pisum</i> (Harris)	**					
<i>Aphis</i> sp.	**					
<i>Cavariella</i> sp.	**					
<i>Disaphis</i> sp.	*					
<i>Forda formicaria</i> von Heyden	**					
<i>Forda marginata</i> (Koch)	**					
<i>Mindarus obliqueness</i> Cholodkovsky	*					
<i>Metapolophium dirrhodum</i> (Walker)	*					
<i>Nearctaphis bakeri</i> (Cowen)	*					
<i>Periphyllus californiensis</i> (Shinji)	**					
Adelgidae						
<i>Adelges cooleyi</i> (Gillette)	****	u,m,l	ae,br	ss,v,fi	1,2,3,4	imm,adult
Coccidae						
<i>Nucolaspis californica</i> (Coleman)	****	u,m,l	br	fi,v	1,2,3,4	imm,adult
Pseudococcidae						
<i>Puto cupressi</i> (Coleman)	***	u,m,l	ae,br	ss,fi	1	imm,adult
Many immature mealy bugs were collected, but they could not be determined.						

Neuroptera

Immature Stages	***	u,m,l	ep,tr	co,tu,pf	1,2,3	imm
-----------------	-----	-------	-------	----------	-------	-----

Taxonomic category	Abundance	Location	Habitat	Technique	Season	Stage
Raphidiidae						
<i>Raphidia (Agulla) assimilis</i> Albarda	**	u,m	ae,tr	ss,pf,ts	2,3	adult
<i>Raphidia (Agulla) herbsti</i> Esben-Petersen	*	l	ae	ss	2	adult
Coniopterygidae						
<i>Coniopteryx latipalpis</i> Meinander	**	u,m,l	ae	ss	2,3	adult
<i>Coniopteryx</i> sp.	**	u,m,l	ae	ss	2,3	adult
<i>Cowentzia pineticola</i> Enderlein	*	m	ae	bl	3	adult
<i>Helicoconis similis</i> Meinander	*					adult
<i>Semidalis angusta</i> (Banks)	*					adult
Hemerobiidae						
<i>Hemerobius bistrigatus</i> Currie and <i>Hemerobius kokaneeanus</i> Currie	***	u,m,l	ae	ss	1,2	adult
<i>Hemerobius readelphus</i> Gurney and <i>Hemerobius stigmaterus</i> Fitch	***	u,m,l	ae	ss	1,2,4	adult
<i>Hemerobius ovalis</i> Carpenter	***	u,m,l	ae	ss	1,2,4	adult
<i>Hemerobius pacificus</i> Banks	***	u,m,l	ae	ss	1,4	adult
<i>Micromus variolosus</i> Hagen	**	m	ae	ss,bl	2,3	adult
Chrysopidae						
<i>Chrysopa carnea</i> Stephen	***	u,m,l	ae	ss,bl,ts	1,2,3,4	adult

Coleoptera

Staphylinidae						
<i>Acrolocha crenulata</i> Hatch	***	u,m	ae	ss	3	adult
Aleocharinae						
Many species of this difficult group were collected throughout the canopy.						
<i>Amphichroum maculatum</i> Horn	***	u,m,l	ae	ss	1,2	adult
<i>Anthobium sinuosum</i> Hatch	****	u,m,l	ae	ss	3,4	adult
<i>Atheta</i> spp.						
Several species were collected, but all were rare.						
<i>Ephelinus arizonensis</i> Bernhauer	***	u,m,l	ae	ss	4	adult
<i>Lordithon</i> sp.						
<i>Mycetoporus</i> sp.	**	u,l	ae	ss	4	adult
<i>Olophrum stouti</i> Hatch	****	u,m,l	ae,tr	ss,pf	1,3,4	adult
<i>Olophrum</i> sp.	***	u,m,l	ae,tr	ss,ts	3,4	adult
Omalini						
Several species were collected, most on sticky screens, quarters 1 and 2.						
<i>Omalium</i> spp.	**	u,m	tr,ep	pf,tu	1,4	adult
<i>Pelecomalium testaceum</i> Mannerheim	*	m	ae	ss	2	adult
<i>Pseudohaida ingrata</i> Hatch	***	u,l	ae	ss	1,2	adult
<i>Xylodromus depressus</i> Gravenhorst	***	u,m,l	ae,tr	ss,ts,pf	1,2,4	adult

A large number of what we consider to be Staphylinidae larvae were collected but not identified.

Pselaphidae						
<i>Batrissodes albionicus</i> (Aube)	*		ae	ss	2	adult
<i>Oropus</i> spp.	**	u,m,l	ae	ss	2,3	adult
Ptiliidae						
<i>Acratrichis</i> sp.	**	u,m	ae	ss	1,2	adult
Scydmaenidae						
<i>Lophioderus</i> sp.	*					adult
Dascillidae						
<i>Macropogon piceus</i> LeConte	*	u	ae	ss	2	adult

Taxonomic category	Abundance	Location	Habitat	Technique	Season	Stage
Scarabaeidae						
<i>Aphodius</i> sp. 1	*	1	ae	ss	1	adult
<i>Aphodius</i> sp. 2	*	1	ae	ss	3	adult
<i>Serica</i> sp.						
Buprestidae						
<i>Anthaxia deleta deleta</i> LeConte	***	u,m	ae	ss	2,3	adult
<i>Anthaxia expansa</i> LeConte	*	1	ae	ss	2	adult
<i>Melanophila drummondi</i> Kirby	**	u,1	ae	ss	3	adult
Throscidae						
<i>Pactopus hornii</i> LeConte	*					adult
<i>Trixaqus mendax</i> (Horn)	**	m	tr	ts,tu	2,3	adult
Elateridae						
<i>Ampedus carbonicolor</i> Eschscholtz	**	u	ae	ss	2,3	adult
<i>Ampedus rhodopus</i> LeConte	**	1	ae	ss	2,3	adult
<i>Ctenicera falsifica angularis</i> LeConte	**	1	ae	ss	2	adult
<i>Ctenicera opacula</i> (LeConte)	**	u,m,1	ae	ss	2,3	adult
<i>Ctenicera</i> sp.	***	m	ae	bl	3	adult
<i>Megapenthes caprellus</i> LeConte	***	u,m,1	ae	ss	3	adult
Eucnemidae						
<i>Dromaeolus basalis</i> (LeConte)	**	u,1	ae	ss	3	adult
Lycidae						
<i>Diclyopterus simplicipes</i> Mannerheim	*					adult
Cantharidae						
<i>Malthodes flexuosus</i> Fender	***	u,m,1	ae	ss	2,3	adult
<i>Podabrus cavicollis</i> LeConte	***	u,m,1	ae	ss,bl	2,3	adult
<i>Podabrus piniphilus</i> Dejean	***	u,m,1	ae	ss	2,3	adult
<i>Podabrus pruinosis diversipes</i> Fall	**	u	ae	ss	2	adult
<i>Podabrus</i> sp.	*	1	ae	ss	3	adult
<i>Silis lutea</i> LeConte	****	u,m,1	ae	ss	2	adult
Dermestidae						
<i>Trogoderma</i> sp.	*	m	ep	tu	3	adult
Derodontidae						
<i>Laricobius nigrinus</i> Fender	**	u	ae	ss	2	adult
<i>Laricobius</i> sp.	*	m	ae	ss	1	adult
<i>Peltastica tuberculata</i> Mannerheim	***	u,m,1	tr	pf,ts	1,4	adult
Anobiidae						
<i>Ernobius</i> sp.	**	u	ae	ss	3	adult
<i>Stegobium paniceum</i> (Linnaeus)	**	u,m	ae,ep	ss,tu,co	2,3	adult
<i>Xyletinus</i> sp.	**	u,1	ae	ss	2	adult
Ptinidae						
<i>Ptinus fallax</i> Fall	*	1	ae	ss	3	adult
Cleridae						
<i>Cymatodera decipiens</i> Fall	**	u	ae	ss	3	adult
<i>Enoclerus eximius</i> Mannerheim	***	u,m,1	ae,tr	ss,pf	2,3	adult
<i>Enoclerus schaefferi</i> Barr	***	u,1	ae	ss	2,3	adult
<i>Phyllobaenus humeralis</i> (Say)	***	u,m	ae	ss	3	adult
Several clerid larvae were taken in pitfall and Tullgren samples. They were collected primarily in quarters 2 and 3.						
Melyridae						
<i>Anthocomus mirandus</i> LeConte	***	u	ae	ss	2	adult

Taxonomic category	Abundance	Location	Habitat	Technique	Season	Stage
<i>Anthocomus mixtus</i> Horn	***	u,m,l	ae,tr	ss,ts	2,3	adult
<i>Anthocomus</i> sp.	*					
Cryptophagidae						
<i>Cryptophagus tuberculosus</i> Maklin	**	m,l	ae	ss	3	adult
<i>Eronyxa pallidus</i> Motschulsky	*	u	br	va	2	adult
Nitidulidae						
<i>Epuraea avara</i> Randall	**	u,m	ae	ss	1,2	adult
<i>Pocadius fulvipennis</i> Erichson	*	u	ae	ss	2	adult
Rhizophagidae						
<i>Rhizophagus</i> sp.	**	u,m	ae	ss	3,4	adult
Cucujidae						
<i>Pediacus depressus</i> Herbst	*	u	ae	ss	2	adult
<i>Silvanus</i> sp.	*					
Coccinellidae						
<i>Anatis rathvoni</i> LeConte	***	u,m,l	br	fi,va	1,2,3,4	adult
<i>Chilocorus</i> sp.	*					
<i>Hippodamia convergens</i> Guerin-Meneville	**	m	ae	ss	1	adult
<i>Mulsantina picta minor</i> Casey	***	u,l	ae	ss	2,3	adult
<i>Pentilia misella</i> LeConte	*	l	ae	ss	3	adult
<i>Psyllobora vigintimaculata taelata</i> LeConte	**	u,l	ae	ss	2,3	adult
<i>Scymnillus aterrimus</i> Horn	**	u,m,l	ae,br,tr	ss,va,ts	2,3,4	adult
<i>Stethorus picipes</i> Casey	*					adult
Endomychidae						
<i>Mycetina idahoensis</i> Fall	*					adult
Lathridiidae						
<i>Aridius nodifer</i> Westwood	*					adult
<i>Corticaria</i> sp.	**	m	ae,tr	pf,bl	3	adult
<i>Enicmus</i> sp.	**	m	ae	ss,bl	3	adult
<i>Melanophthalma</i> sp.	**	m	ae,br	ss,va	1,2	adult
Alleculidae						
<i>Hymenorus meqops</i> Hatch	**	u,m	ae	ss,bl	3	adult
<i>Hymenorus</i> spp.	**	l	ae	ss	3	adult
Melandryidae						
<i>Emmesa testaceae leeperi</i> Malkin	*	l	ae	ss	2	adult
<i>Xylita laevigata</i> Hellenius	**	l	ae	ss	3	adult
Oedemeridae						
<i>Ditylus gracilis</i> LeConte	**	m	tr	pf	2	adult
<i>Oraxis bicolor</i> (LeConte)	***	m	ae	bl	3	adult
Mordellidae						
<i>Anaspis atrata</i> Champion	**	u,l	ae	ss	3	adult
<i>Anaspis rufa</i> Say	**	u,m	ae	ss,bl	3	adult
Euglenidae						
<i>Phomalus brunnipennis</i> LeConte	*					adult
Cerambycidae						
<i>Callidium</i> sp.	*	u	ae	ss	2	adult
<i>Clytus pacificus</i> Van Dyke	**	u,m	ae	ss	2	adult
<i>Emichthus oedipus</i> LeConte	**	u,m	ae	ss,bl	2,3	adult
<i>Megasemum asperum</i> LeConte	*					adult

Taxonomic category	Abundance	Location	Habitat	Technique	Season	Stage
<i>Molorchus longicollis</i> LeConte	**	l	ae	ss	2	adult
<i>Ortholeptura valida</i> (LeConte)	**	m	ae	bl	3	adult
<i>Tragosoma depsarius</i> Linnaeus	**	m	ae	bl	3	adult
Chrysomelidae						
<i>Bromius obscurus</i> Linnaeus	*					adult
<i>Syneta hamata</i> Horn	**	l	ae	ss	2	adult
Curculionidae						
<i>Cimberis comptus</i> LeConte	*					
<i>Dyslobus</i> spp.	**	m,l	tr	pf	2,3	adult
<i>Euclptus rutilus</i> Fall	**	u	ae	ss	2	adult
<i>Magdalis</i> spp.	**	u,m	ae	ss	3	adult
Scolytidae						
<i>Carpoborus vandykei</i> Bruck	***	u	ae	ss	2	adult
<i>Dendroctonus pseudotsugae</i> Hopkins	**	u,m	ae	ss	2,3	adult
<i>Gnathotrichus sulcatus</i> (LeConte)	**	m	tr	pf	3	adult
<i>Platypus wilsoni</i> Swaine	*					adult
<i>Pseudohylesinus nebulosus</i> (LeConte)	***	u,m,l	ae,tr	ss,pf	1,2	adult
<i>Scolytus oregoni</i> Blackman	***	u,m,l	ae	ss	2,3	adult
<i>Scolytus unispinosus</i> LeConte	***	u,m	ae	ss	2,3	adult
<i>Trypodendron lineatum</i> (Olivier)	**	u,l	ae	ss	2	adult

Trichoptera

Glossosomatidae						
<i>Agapetus occidentalis</i> Denning	*	m	ae	bl	3	adult
<i>Glossosoma califica</i> Denning	**	m	ae	bl	3	adult
<i>Glossosoma pyroxum</i> Banks	**	u,l	ae	ss	3	adult
Hydroptilidae						
<i>Agraylea saltesea</i> Ross	*					adult
<i>Hydroptila</i> sp.	*	m	ae	bl	3	adult
Philopotamidae						
<i>Dolophilodes dorcus</i> (Ross)	*	m	tr	pf	3	adult
Polycentropidae						
<i>Polycentropus halidus</i> Milne	*	m	ae	bl	3	adult
Hydropsychidae						
<i>Hydropsyche andersoni</i> Denning	**	m	ae	bl	2	adult
This species was named and described as new from specimens collected in the canopy.						
<i>Hydropsyche</i> sp.	****	m	ae	bl	3	adult
Limnephilidae						
<i>Allocosmoecus partitus</i> (Banks)	***	m	ae	bl	3,4	adult
<i>Apantia sorex</i> (Ross)	*	u	ae	ss	2	adult
<i>Hydropsyche</i> sp.	****	m	ae	bl	3	adult
<i>Lenarchus vastus</i> (Hagen)	**	m	ae	bl	3	adult
<i>Limnephilus noxus</i> Ross	**	m	ae	bl	2,3	adult
<i>Neophylax occidentis</i> Banks	*	l	ae	ss	2	adult
<i>Neophylax riskeri</i> Milne	**	m	ae	bl	2,3	adult
<i>Oligophlebodes sierra</i> Ross	***	m	ae	bl	2,3	adult
<i>Onocosmoecus unicolor</i> (Banks)	**	m	ae	bl	3	adult
<i>Pedomoecus sierra</i> (Ross)	*	m	ae	bl	3	adult
<i>Psychoglypha subborealis</i> (Banks)	**	u,m	ae	ss	1,4	adult
Lepidostomatidae						
<i>Lepidostoma cascadeense</i> (Milne)	**	m	ae	ss,bl	2,3	adult

Taxonomic category	Abundance	Location	Habitat	Technique	Season	Stage
<i>Lepidostoma mira</i> Denning	*	m	ae	bl	3	adult
<i>Lepidostoma recina</i> Denning	*	m	ae	bl	3	adult
<i>Lepidostoma roafi</i> (Milne)	*					adult
Brachycentridae						
<i>Amiocentrus aspilus</i> Ross	**	u	ae	ss	2,3	adult
<i>Brachycentrus americanus</i> (Banks)	*	m	ae	bl	3	adult
<i>Micrasema oregoni</i> Denning	*	m	ae	bl	3	adult
Named and described from specimen collected in the canopy.						
<i>Micrasema</i> sp.	*	m	ae	bl	3	adult
Leptoceridae						
<i>Oecetis inconspicua</i> (Walker)	**	m	ae	bl	3	adult
<i>Oecetis</i> sp.	*	m	ae	bl	3	adult
<i>Triænodes tardus</i> Milne	*	m	ae	bl	3	adult
<i>Triænodes</i> sp.	**	m	ae	bl	2	adult
Lepidoptera						
Pyralidae						
<i>Dioryctria reniculella</i> (Grote)	**	m	ae	bl	3	adult
<i>Ephestiodes gilvescentella</i> Ragonot	*	m	ae	bl	3	adult
<i>Scoparia biplagiata</i> Walker	**	m	ae	bl	3	adult
Tortricidae						
<i>Archips argyrospilus</i> (Walker)	*	m	ae	bl	3	adult
<i>Argyrotaenia provana</i> (Kearfott)	*	m	ae	bl	3	adult
<i>Commophila</i> sp.	*	m	ae	bl	2	adult
Olethreutidae						
<i>Dasypyga alternosquamella</i> Rag.	**	m	ae	bl	3	adult
Gelechiidae						
<i>Coleotechnites</i> sp. nr. <i>atrapietella</i> (Dietz)	*	m	ae	bl	3	adult
<i>Coleotechnites</i> sp. nr. <i>milleri</i> (Busck)	***	m	ae	bl	3	adult
<i>Chionodes</i> spp.						
Seven species of this genus were collected in quarter 3 by the blacklight trap. All were collected one or two times.						
Oecophoridae						
<i>Decantha stonda</i> Hodges	*	m	ae	bl	3	adult
Blastobasidae						
<i>Holococera (Holococerina)</i> sp.	**	m	ae	bl	3	adult
Coleophoridae						
<i>Coleophora</i> spp.						
Two species were collected, each only a single time during quarter 3.						
Geometridae						
<i>Amphidasis cognataria</i> (Guenee)	**	m	ae	bl	2,3	adult
<i>Campaea perlata</i> (Guenee)	*	m	ae	bl	3	adult
<i>Caripeta aequaliaria</i> Grote	*	m	ae	bl	3	adult
<i>Chloroclysta citrata</i> (Linnaeus)	*	m	ae	bl	3	adult
<i>Drepanulatrix unicalcararia</i> (Guenee)	*	m	ae	bl	3	adult
<i>Dysstroma</i> sp.	*	m	ae	bl		adult
<i>Ecliptopera silaceata</i> (Denis & Schiffermuller)	**	m	ae	bl	3	adult
<i>Ennomos magnarius</i> (Guenee)	*	m	ae	bl	3	adult
<i>Enyppia packardata</i> Taylor	*	m	ae	bl		adult

Taxonomic category	Abundance	Location	Habitat	Technique	Season	Stage
<i>Eustropma semiatrata</i> (Hulst)	*	m	ae	bl		adult
<i>Gabriola dyari</i> Taylor	**	m	ae	bl	3	adult
<i>Hesperumia sulphuraria</i> Packard	**	m	ae	bl	3	adult
<i>Hydriomena renunciata</i> (Walker)	*	m	ae	bl	3	adult
<i>Iridopsis emasculata</i> Dyar	*	m	ae	bl	3	adult
<i>Itame</i> sp.	*	m	ae	bl		adult
<i>Lambdina fiscellaria somniaria</i> (Hulst)	*	m	ae	bl		adult
<i>Melanolophia imitata</i> (Walker)	**	m	ae	ss,va	2,3	adult
<i>Nematocampa limbata</i> (Haworth)	*	m	ae	bl	3	adult
<i>Nepytia phantasmaria</i> Strecker	*	m	ae	bl	4	adult
<i>Nepytia umbrosaria nigrovenaria</i> (Packard)	***	m	ae	bl	3	adult
<i>Oporophtera occidentalis</i> (Hulst)	*	m	ae	bl	4	adult
<i>Perizoma grandis</i> (Hulst)	*	m	ae	bl	3	adult
<i>Pero mizon</i> (Rindge)	**	m	ae	bl	3	adult
<i>Semiothisa granitata</i> Guenee	*	m	ae	bl	3	adult
<i>Semiothisa signaria dispuncta</i> (Walker)	*	m	ae	bl		adult
<i>Semiothisa unipunctaria perplexa</i> (McDonnough)	***	m	ae	bl	3	adult
<i>Sericosema juturnaria</i> (Guenee)	*	m	ae	bl		adult
<i>Sparpania magnoliata quadripunctata</i> (Packard)	**	m	ae	bl	3	adult
<i>Stenoporpia pulmonaria albescens</i> (Hulst)	*	m	ae	bl	3	adult
<i>Synaxis pallulata</i> (Hulst)	*					adult

A few geometrid larvae were collected by filtration and vacuum. None were determined past family.

Thyatiridae

<i>Habrosyne scripta</i> (Gosse)	**	m	ae	bl	3	adult
----------------------------------	----	---	----	----	---	-------

Arctiidae

<i>Clemensia albata</i> Packard	***	m	ae	bl	3	adult
<i>Diacrisia virginica</i> (Fabricius)	*	m	ae	bl		adult
<i>Halisidota argentata</i> (Packard)	***	m	ae	bl	3	adult
<i>Halisidota maculata agassizii</i> (Packard)	*	m	ae	bl	3	adult
<i>Isia isabella</i> (J. E. Smith)	**	m	ae	bl	3	adult

Noctuidae

<i>Achytonix epipaschia</i> (Grote)	*	m	ae			
<i>Acronicta hesperida</i> Smith	**	m	ae	bl	3	adult
<i>Agrostis ipsilon</i> (Hufnagel)	*	m	ae	bl		adult
<i>Amathes oblata</i> (Morrison)	*	m	ae	bl	3	adult
<i>Apamea castanea</i> (Grote)	*	m	ae	bl		adult
<i>Aseptis adnixa</i> (Grote)	*	m	ae	bl	3	adult
<i>Aseptis fumosa</i> (Grote)	*	m	ae	bl	3	adult
<i>Autographa californica</i> (Speyer)	*	m	ae	bl		adult
<i>Dargida procincta</i> (Grote)	**	m	ae	bl	3	adult
<i>Epizeuxis americanalis</i> (Guenee)	**	m	ae	bl	3	adult
<i>Eurois nigra</i> (Smith)	*	m	ae	bl	3	adult
<i>Feltia herilis</i> (Grote)	*	m	ae	bl		adult
<i>Lacinipolia cuneata</i> (Grote)	*	m	ae	bl	2	adult
<i>Panthea portlandia</i> (Grote)	***	m	ae	bl	2,3	adult
<i>Panthea virginaria</i> (Grote)	**	m	ae	bl	2,3	adult
<i>Polia adjuncta</i> (Boisduval)	*	m	ae	bl	3	adult
<i>Polia subjuneta</i> (Grote & Robinson)	*	m	ae	bl	2	adult
<i>Protothodes rufula</i> (Grote)	**	m	ae	bl	3	adult
<i>Pseudorthosia variabilis</i> Grote	**	m	ae	bl	3	adult
<i>Spaelotis havilae</i> (Grote)	*	m	ae	bl		adult
<i>Xylomyges simplex</i> (Walker)	**	m	ae	bl	2	adult
<i>Zale lunata salicis</i> (Behr)	*	m	ae	bl	3	adult

Taxonomic category	Abundance	Location	Habitat	Technique	Season	Stage
Notodontidae						
<i>Oligocentria pallida</i> (Strecker)	*	m	ae	bl	3	adult
<i>Nadata gibbosa</i> (J. E. Smith)	*	m	ae	bl	3	adult
Lymantriidae						
<i>Dasychira grisefacta</i> (Dyar)	*	m	ae	bl	3	adult
<i>Orgyia pseudotsugata</i> <i>morosa</i> Ferguson	*	m	ae	bl	3	adult
Lasiocampidae						
<i>Tolyte distincta</i> French	***	m	ae	bl	3	adult

Diptera

Nematocera

Flies belonging to this suborder were by far the most abundant taxa collected in the canopy. At times they blackened sticky screens. Unfortunately many families are difficult to separate accurately in alcohol under a dissecting microscope. Though every effort was made to keep taxonomic categories homogeneous, it was not possible. Categories thought to be homogeneous often had as many as three species. The data for this large group of flies is offered primarily to show presence.

Trichoceridae						
<i>Trichocera columbiana</i> Alexander	****	u,m,l	ae,tr	ss,pf,ts,bl	1,4	adult
Tipulidae						
<i>Antocha</i> (<i>Antocha</i>) <i>monticola</i> Alexander	**	m	ae	bl	3	adult
<i>Chionea</i> sp.	*	m	tr	ts	4	adult
<i>Dicranoptycha stenophallus</i> Alexander	*	m	ae	bl	3	adult
<i>Erioptera</i> (<i>Symplecta</i>) <i>cana</i> (Walker)	*	m	ae	bl	3	adult
<i>Limonia</i> (<i>Limonia</i>) <i>nubeculosa</i> <i>sciophila</i> (Osten-Sacken)	*	m	ae	bl	3	adult
<i>Pedicia</i> (<i>Tricyphona</i>) <i>aperta</i> (Coquillett)	*	m	ae	bl	3	adult
<i>Tipula</i> (<i>Trichotipula</i>) sp.	*	m	ae	bl	3	adult
Psychodidae						
<i>Psychoda phalaenoides</i> (Linnaeus)	***	u,m,l	ae	bl,ss,ts	1,2,3,4	adult
<i>Psychoda umbracola</i> Quate	**	u,m	ae	ss,ts	3	adult
<i>Psychoda</i> sp.	*	m	ae	bl	2	adult
<i>Trichomyia sequoiae</i> Quate	*	m	ae			
Culicidae						
<i>Aedes sierrensis</i> (Ludlow)	*	m	ae	bl	3	adult
Ceratopogonidae						
<i>Atrichopogon</i> spp.	****	u,m,l	ae	ss,bl	2,3	adult
<i>Culicoides</i> sp. <i>piliferus</i> group	*					adult
<i>Culicoides</i> sp.	***	u,m,l	ae	ss	2,3	adult
<i>Forcipomyia</i> (<i>Forcipomyia</i>) <i>cilipes</i> (Coquillett)	***	m	ae	bl	3	adult
<i>Forcipomyia</i> (<i>Forcipomyia</i>) <i>macswaini</i> Wirth	***	u,m,l	ae	bl,ss	2,3	adult
<i>Forcipomyia</i> sp. <i>cinctipes</i> group	*					adult
<i>Forcipomyia</i> (<i>Forcipomyia</i>) sp.	***	m	ae	bl	3	adult
<i>Palpomyia armatipes</i> Wirth	*					adult
<i>Serromyia</i> sp.	****	u,m,l	ae	ss	2,3	adult

Chironomidae

Although specimens of this family were separated into 38 "taxa," it is unlikely that all

Taxonomic category	Abundance	Location	Habitat	Technique	Season	Stage
categories are homogeneous. Determination of adults can be made only after slide preparation. Approximately 7 percent of all the arthropods collected belonged to this family.						
Dixidae						
<i>Dixa</i> sp.	*	m	ae	bl	3	adult
Anisopodidae						
<i>Sylvicola fenestralis</i> (Scopoli)	***	u,m	tr	pf	4	adult
Bibionidae						
<i>Biblio xanthopus</i> Wiedemann	**	u,m,l	ae	ss	2	adult
Mycetophilidae						
<i>Allodia</i> sp.	**	u,m,l	ae	ss,pf	1,4	adult
<i>Bolitophila</i> sp.	****	u,m,l	ae	ss	1,2,4	adult
<i>Cordyla</i> sp.	**	u	ae	ss	1	adult
<i>Exechia</i> sp.	*					adult
<i>Macrocera</i> sp.	*					adult
<i>Mycetophila falcata</i> Johannsen	****	u,m,l	ae	ss,pf	1,4	adult
<i>Mycetophila fatua</i> Johannsen	***	u,m,l	ae	ss	1,4	adult
<i>Mycetophila fungorum</i> (DeGeer)	***	u,m,l	ae	ss,ts	1,4	adult
<i>Mycetophila ocellus</i> Walker	****	u,m,l	ae	ss,ts	1,2,4	adult
<i>Mycetophila caurina</i> (Laffoon) and <i>Mycetophila paula</i> (Loew)	****	u,m,l	ae	ss	1,4	adult
<i>Mycetophila nr. sertata</i> (Laffoon)	***	u,m,l	ae	ss	1,4	adult
<i>Mycetophila signatoides</i> Dziedzicki	*					adult
<i>Mycetophila</i> sp.	****	u,m,l	ae	ss,pf	4	adult
<i>Mycomya</i> sp.	****	u,m,l	ae	ss	1,2,4	adult
<i>Phronia flavipes</i> Winnertz	**	l	ae	ss	2	adult
<i>Phronia matilei</i> Hackman	***	u,m,l	ae	ss,ts	1,4	adult
<i>Phronia willistoni</i> Dziedzicki	**	u,m,l	ae	ss	4	adult
<i>Rymosia</i> sp.	**	m	ae	ss	1,2	adult
<i>Sceptonia</i> sp.	**	u	tr	pf	4	adult
<i>Sciophila</i> sp.	***	u,m	ae	ss	1,4	adult
<i>Trichonta</i> sp.	***	u,l	ae	ss	1,4	adult
<i>Trichonta</i> sp. nov.	****	u,m,l	ae	ss	1,4	adult
Sciaridae						
<i>Bradysia</i> spp.	****	u,m,l	ae,tr	ss,bl,pf,ts	1,2,3,4	adult
All Sciaridae collected belonged to this genus. Five of the eleven categories were represented by more than 1,000 specimens. These were the most abundant of the Nematocera in the canopy.						
Scatopsidae						
<i>Anapausis</i> sp.	***	u	ae	ss	2,3	adult
Cecidomyiidae						
<i>Contarinia</i> spp.	***	u,m,l	ae,tr	ss,pf,ts	2,3	adult
<i>Contarinia</i> spp.	****	u,m,l	br,tr	fi,pf	1,4	imm
<i>Dasineura</i> sp.	***	u,m,l	ae,tr	pf,ss,ts	1,4	adult
<i>Lestodiplosis</i> spp.	****	u,m,l	br	fi,va	1,2,3,4	imm
Xylophagidae						
<i>Bolbomyia</i> sp.	**	u,l	ae	ss	2	adult
Dolichopodidae						
<i>Medetera</i> sp.	***	u,m,l	ae	ss,ts	3	adult
Phoridae						
<i>Gymnophora</i> sp.	*					adult
<i>Megaselia</i> spp. (five)	****	u,m,l	ae	ss,ts	1,2,3,4	adult
Syrphidae						
<i>Dasysyrphus</i> sp.	**	u,l	br	fi	1,2,3,4	imm

Taxonomic category	Abundance	Location	Habitat	Technique	Season	Stage
Tephritidae <i>Neotephritis finalis</i> (Loew)	**	u	ae	ss	1	adult
Sciomyzidae <i>Pherbellia nana</i> (Fallén)	*	m	ae	ss		adult
Lauxaniidae <i>Homoneura</i> sp.	*					adult
<i>Minettia flaveola</i> complex	***	u,m	ae	ss	3	adult
Piophilidae <i>Piophila (Mycetaulus) costalis</i> (Melander)	***	u,m	ae	ss	3	adult
Palloppteridae <i>Pallopptera terminalis</i> Loew	**	u,l	ae	ss	3	adult
Lonchaeidae <i>Lonchaea albitarsis</i> Zetterstedt	***	u,l	ae	ss	2,3	adult
Sphaeroceridae <i>Copromyza equina</i> Fallén	*					adult
<i>Leptocera</i> spp.	*					adult
Milichiidae <i>Desmometopa manigrum</i> (Zetterstedt)	*					adult
<i>Leptomotopa latipes</i> (Meigen)	*					adult
<i>Neophyllomyza</i> spp. (3)	****	u,m,l	ae	ss	2,3	adult
<i>Phyllomyza</i> spp. (2)	****	u,m,l	ae	ss	2,3	adult
Ephyridae <i>Ditrichophora argyrostoma</i> (Cresson)	***	u,l	ae	ss	1,2	adult
<i>Hydrellia griseola</i> (Fallén)	***	u	ae	ss	1,2	adult
<i>Philygria debilis</i> Loew	**	u	ae	ss	1,2	adult
Drosophilidae <i>Drosophila</i> sp.	*					adult
<i>Scaptomyza</i> spp. (2)	***	m,l	ae	ss	1,3,4	adult
Chloropidae <i>Fiebrigella</i> sp.	****	u,m,l	ae	ss	2,3,4	adult
<i>Hapleginalla conicola</i> (Greene)	****	u,m,l	ae	ss	2,3	adult
<i>Thaumatomyia annulata</i> (Walker)	**	u,m,l	ae	ss	2,3	adult
Heleomyzidae <i>Borboropsis steyskali</i> Mathis	**	u,m	ae	ss	1,4	adult
<i>Suillia nemorum</i> (Meigen)	**	m,l	tr	pf	3,4	adult
<i>Tephrochlamys rufiventris</i> (Meigen)	***	u,m	ae	ss	1,2,4	adult
Trixoscelididae <i>Trixoscelis</i> sp.	***	u,m,l	ae	ss	2,3	adult
Agromyzidae <i>Liriomyza</i> sp.	**	u,m	ae	ss	1	adult
Muscidae <i>Lasiops diaphanus</i> (Wied.)	***	l	ae	ss	2,3	adult
<i>Spilogona</i> sp.	**	u,m	ae	ss	3	adult
Anthomyiidae <i>Alliopsis</i> sp.	*					adult
<i>Eremomyia humeralis</i> Stein	**	m	ae	ss	3	adult
<i>Pegomya (Pegomya) trisetata</i> Malloch	*					adult

Taxonomic category	Abundance	Location	Habitat	Technique	Season	Stage
Calliphoridae						
<i>Calliphora terraenovae</i> Macquart	*	m	tr	pf	3	adult
Hymenoptera						
Tenthredinidae						
<i>Neodiprion</i> sp.	***	u,m,l	ae	ss	2,4	adult
Tenthredinidae	***	m,l	br,tr	va,fi,pf	2,3	adult
Braconidae						
<i>Apanteles</i> spp. (5)	***	u,m,l	ae	ss	2,3	adult
<i>Heterospilus</i> sp.	**	u,m	ae	ss	2,3	adult
<i>Paesia</i> sp.	**	m	ae	ss	1,2,3	adult
<i>Rogas</i> sp.	*	m	ae	bl	3	adult
Ichneumonidae						
<i>Allontus cinctus</i> (Linnaeus)	***	u,m,l	ae	ss	2,3,4	adult
<i>Banchus</i> sp.	*	l	ae	ss	2	adult
<i>Enytus montanus</i> (Ashmead)	***	u,l	ae	ss	1,2	adult
<i>Ethelurgus</i> sp.	**	u,m,l	ae	ss	1,3,4	adult
<i>Eusterinx</i> sp.	**	u,m,l	ae	ss	3,4	adult
<i>Gelis tenellus</i> (Say)	**	u,m	ae	ss	2,4	adult
<i>Gelis</i> sp.	**	u,l	ae	ss	2,3	adult
<i>Hyposoter fuscitarsis</i> (Viereck) and <i>Hyposoter</i> sp.	***	u,m,l	ae	ss	1,2	adult
<i>Itopectis evetriae</i> (Viereck)	**	u,m	ae	ss,ts	2,3	adult
<i>Lissonota</i> sp.	***	u,m,l	ae	ss	2,3	adult
<i>Mastrus</i> sp.	**	u,m,l	ae	ss	1,2,3,4	adult
<i>Mesochorus</i> sp.	**	l	ae	ss	2	adult
<i>Ophion</i> sp.	**	u,m	ae	ss,bl	3	adult
<i>Orthocentrus</i> sp.	***	u,m,l	ae	ss	2,3,4	adult
<i>Triclistus podagricus</i> (Gravenhorst)	***	u,m,l	ae	ss,ts	2	adult
Signiphoridae						
<i>Thysanus</i> sp.	***	u,m,l	ae	ss,ts	3	adult
Eulophidae						
<i>Achrysocharis</i> sp.	***	u,m,l	ae	ss	1,2,3,4	adult
<i>Cirrospilus</i> sp.	**	u	ae	ss	3	adult
<i>Diglyphus</i> sp.	***	u,m,l	ae,br	ss,va,ts	1,2,3,4	adult
<i>Melittobia</i> sp.	**	u,m,l	ae	ss	2,3	adult
<i>Tetrastichus</i> spp.	***	u,m,l	ae	ss	2,3	adult
Encyrtidae						
<i>Cheiloneurus</i> sp.	**	u,m,l	ae	ss	3	adult
<i>Copidosoma</i> spp.	****	u,m,l	ae,br	ss,va	1,2,3,4	adult
<i>Metaphycus</i> sp.	***	u,m,l	ae	ss	1,2,3	adult
<i>Pseudaphycus</i> sp.	***	u,m	ae	ss	3	adult
Eupelmidae						
<i>Calosota</i> sp.	****	u,m,l	ae	ss	2,3	adult
Pteromalidae						
<i>Gastrancistrus</i> sp.	****	u,m,l	ae	ss,ts	2,3	adult
Torymidae						
<i>Megastigmus</i> sp.	****	u,m,l	ae	ss	2,3	adult
Ceraphronidae						
<i>Aphanogmus</i> sp.	****	u,m,l	ae,br,ep	ss,va,tu	1,2,3,4	adult
<i>Ceraphron</i> sp.	*	l	ae	ss	2	adult
<i>Conostigmus</i> spp.(6)	***	u,m,l	ae	ss	2,3,4	adult

Taxonomic category	Abundance	Location	Habitat	Technique	Season	Stage
Scelionidae <i>Telenomus</i> spp. (7)	***	u,m,l	ae	ss	2,3	adult
Platygasteridae <i>Platygaster</i> spp. (2)	****	u,m,l	ae,br	ss,ts,va	2	adult
Formicidae <i>Camponotus noveboracensis</i> (Fitch)	***	u,m,l	ae	ss	2,3	adult
<i>Leptothorax rugatulus</i> Emery	****	m,l	ep,mo,tr	tu,co,pf	2,3	adult
<i>Leptothorax</i> sp.	**	u,m,l	ae	ss	3	adult
<i>Lasius</i> sp.	**	m	ae	bl,ss	3,4	adult
<i>Myrmica</i> sp. and <i>Aphaenogaster</i> sp.	***	u,m,l	ae	ss,ts	3	adult
<i>Tapinoma sessile</i> (Say)	***	u,m,l	ae	ss	2,3	adult
Vespidae <i>Dolichovespula maculata</i> (Linnaeus)	*	m	tr	pf	4	adult
<i>Vespula vulgaris</i> (Linnaeus)	**	u,m	ae	ss	4	adult
Sphecidae <i>Passaloecus melanocephalus</i> Rohwer and <i>Passaloecus melanognathus</i> Rohwer	***	u	ae	ss,ts	2,3	adult

Acari

Gamasida

Parasitidae

Schizothetus vicarius Athias-Henriot ** m,l mo,tr co,pf adult

Phytoseiidae

Typhlodromus sp. **** u,m,l br,ep,mo fi,va,tu,co 1,2,3,4 adult

Zerconidae

Zercon sp. ** m br fi 1,4 adult

Actinedida

Bdellidae

Bdella sp. and
Cyta cf. *latyrostris* and
Spiribdella sp. **** u,m,l br,ep,mo fi,va,tu,co 1,2,3,4 adult

Calligonellidae

Calligonella sp. **** u,m,l ep,mo tu,co 1,2,3,4 adult

Chelytidae

Cheletogenes sp. *** m,l br fi 1,2,3,4 adult

Cryptognathidae

Cryptognathus (imbricatus group) **** u,m,l br,ep,mo fi,tu,co 1,2,3,4 adult
Cryptognathus sp. **** u,m,l ep,mo tu,co 1,2,3,4 imm

Cunaxidae

Cunaxoides sp. *** u,m,l ep,mo tu,co 1,2,3,4 adult

Endeostigmata

1 species ** m,l mo co 1,4 adult

Nanorchestidae

Nanorchestes sp. **** u,m,l ep,mo tu,co 1,2,3,4 imm,adult

Taxonomic category	Abundance	Location	Habitat	Technique	Season	Stage
Paratydeidae <i>Tarytydeus</i> sp.	****	u,m,l	ep,mo	tu,co	1,2,3,4	imm,adult
Penthalodidae <i>Penthalodes</i> sp.	***	u,m,l	ep,mo	tu,co	1,3,4	adult
Rhagidiidae 1 species	****	u,m,l	ep,mo,tr	tu,co,pf	1,2,3,4	imm,adult
Smarididae <i>Sphaerotarsus</i> sp.	**	m,l	tr,ep	pf,tu	2,3	adult
<i>Sphaerotarsus</i> sp.	***	m,l	tr	pf	2,3	imm
Terpnacaridae gen. nov.	***	m,l	ep,mo	tu,co	1,2,3,4	adult
Tetranychidae 1 species	**	u,m,l	tr	pf	2,3	adult
Tydeidae <i>Homotydeus</i> sp.	****	u,m,l	ep,mo,br	tu,co,fi	1,2,3,4	adult
<i>Metatriophytydeus</i> sp.	*					
Acaridida						
Acaridae 1 species	**	u,m	tr	ts,pf	1,3,4	adult
Glycophagidae 1 species	***	u,m,l	br	fi	1	adult
Oribatida						
Camisiidae <i>Camisia carrolli</i> Andre	****	u,m,l	br	fi,va	1,2,3,4	imm,adult
Ceratozetidae <i>Hypozetes</i> sp.	***	m,l	ep,mo	tu,co		
Charassobatidae <i>Ametroproctus oresbious</i> Higgins & Woolley	***	m,l	mo,tr	co,pf	1,2	adult
Cymbaeremaeidae <i>Scapheremaeus</i> sp.	****	u,m,l	br	fi	1,2,3,4	adult
<i>Scapheremaeus</i> sp.	****	u,m,l	br	fi,va	1,2,3,4	imm
Eremaeidae <i>Eremaeus</i> spp. (2)	****	u,m,l	ep,mo	tu,co	1,2,3,4	adult
Eremaeidae	****	u,m,l	ep,mo	tu,co	1,2,3,4	imm
Gymnodamaeidae <i>Gymnodamaeus ornatus</i> Hammer	****	u,m,l	ep,mo	tu,co	1,2,3,4	adult
<i>Gymnodamaeus ornatus</i> Hammer	****	u,m,l	ep,mo	tu,co	1,2,3,4	imm
Liodidae <i>Platyliodes macropriones</i> Woolley & Higgins	***	u,m,l	br,ep,mo	fi,tu,co	1,2,3,4	adult
<i>Platyliodes</i> sp.	****	u,m,l	br,ep	fi,tu	1,2,3,4	imm
Mycobatidae <i>Jugatela tuberosa</i> Ewing	****	u,m,l	br	fi,va	1,2,3,4	adult
<i>Jugatela</i> sp.	***	u,m,l	ep,tr	tu,pf	1,2,3,4	adult

Taxonomic category	Abundance	Location	Habitat	Technique	Season	Stage
Oppiidae <i>Quadroppia quadricarinata</i> (Michael)	***	m,l	mo	co	2,3,4	adult
Oribatidae	***	i	ep	tu	1,4	imm
Oribatulidae <i>Phauloppia</i> spp. (2)	****	u,m,l	br,ep,mo	fi,tu,co	1,2,3,4	adult
<i>Phauloppia</i> sp.	****	u,m,l	br,ep,mo	fi,tu,co	1,2,3,4	imm
<i>Scleroribates</i> sp.	****	u,m,l	ep,br	tu,fi	1,2,3,4	adult
Thyrisomidae <i>Oribella</i> sp.	**	m,l	ep,mo	tu,co	3	adult

Araneae

The majority of the spiders were taken on sticky screens. Our method of processing the collections allowed the spiders to dehydrate, which destroyed the pigmentation patterns and made them difficult, if not impossible, to determine past genus. To prevent the inclusion of erroneous data, all categories except abundance have been deleted from the following list. A. R. Moldenke has examined the canopy-collected spiders and confirmed the abundance category.

Amaurobiidae <i>Callobius</i> sp. 1	**
<i>Callobius</i> sp. 2	**
Uloboridae <i>Hyptiotes gertschi</i> Chamberlin and Ivie	**
Oecobiidae <i>Oecobius</i> sp.	*
Dictynidae <i>Dictyna peragrata</i> Bishop and Ruderman	*
Gnaphosidae <i>Sergiolus montanus</i> (Emerton)	**
Clubionidae <i>Clubiona</i> sp.	*
Anyphaenidae <i>Anyphaena pacifica</i> (Banks)	****
<i>Anyphaena</i> sp.	*
Thomisidae <i>Tmarus angulatus</i> Walckenaer	*
<i>Xysticus locuples</i> Keyserling	***
<i>Xysticus</i> spp.	**
Philodromidae <i>Apollophanes margarita</i> (Lowrie & Gertsch)	****
<i>Philodromus rufus</i> Walckenaer	***
<i>Philodromus spectabilis</i> Keyserling	***
<i>Philodromus</i> spp.	**
Salticidae <i>Metaphidippus aeneolus</i> (Curtis)	****
<i>Metaphidippus</i> cfr. <i>harfordii</i>	**

Taxonomic category	Abundance	Location	Habitat	Technique	Season	Stage
<i>Metaphidippus</i> sp.	*					
Marpissinae undet.	**					
Agelinidae						
Species 1	*					
Species 2	*					
Theridiidae						
<i>Euryopsis formosa</i> (Banks)	**					
<i>Theridion differens</i> Emerton	***					
<i>Theridion intervallatum</i> Emerton	**					
<i>Theridion lawrencei</i> Gertsch & Archer	****					
<i>Theridion murianum</i> (Emerton)	***					
Araneidae						
<i>Araneus gemmoides</i> (Chamberlin & Ivie)	**					
<i>Araneus</i> sp.	*					
<i>Araniella displicata</i> (Hentz)	***					
<i>Cyclosa</i> sp.	**					
<i>Meta</i> sp.	*					
<i>Tetragnatha versicolor</i> (Walckenaer)	**					
<i>Zygiella</i> sp.	*					
Linyphiidae						
<i>Erigoneid</i> sp.	**					
Erigoninae undet.	**					
<i>Gnathantes ferosa</i> Chamberlin & Ivie)	***					
<i>Neriene litigiosa</i> (Keyserling)	**					
<i>Pityohyphantes rubrofasciata</i> Keyserling	*					
<i>Pityohyphantes</i> sp.	**					

LITERATURE CITED

- BEDARD, W. D. 1938. An annotated list of the insect fauna of Douglas-fir (*Pseudotsuga mucronata* Rafinesque) in the northern rocky mountain region. *Canadian Entomologist* 70:188-197.
- BORROR, D. J., D. M. DeLONG, and C. A. TRIPLEHORN. 1976. An introduction to the study of insects. Holt, Rinehart and Winston, Inc. Fourth edition. 827 p.
- DAHLSTEN, D. L. 1979. Multicrown level sampling. P. 41 in *The Douglas-fir tussock moth: a synthesis*. M. H. Brooks, R. W. Stark, R. W. Campbell, eds. USDA Forest Service, Technical Bulletin 1585.
- DENISON, W. C. 1973. Life in tall trees. *Scientific American* 228:74-80.
- DENISON, W. C., D. M. TRACY, F. M. RHOADES, and M. SHERWOOD. 1972. Direct non-destructive measurement of biomass and structure in living, old-growth Douglas-fir. P. 147-158 in *Proceedings, Research on coniferous forest ecosystems, a symposium*. J. F. Franklin, L. J. Dempster, and R. H. Waring (eds). USDA Forest Service, Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.
- DEYRUP, M. A. 1975. The insect community of dead and dying Douglas fir. 1. The Hymenoptera. US/IBP Coniferous Forest Biome, Ecosystem Analysis Studies. Bulletin No. 6. 104 p.
- DEYRUP, M. A. 1981. Deadwood decomposers. *Natural History* 90(3):84-91.
- ENGEL, H. 1941. Beitrage zur faunistik der kiefernkronen, *Mitteilungen aus Forstwirtschaft und Forstwissenschaft* 12:334-361.
- FRANKLIN, J. F., and C. T. DYRNESS. 1973. Natural vegetation of Oregon and Washington. USDA Forest Service, Pacific Northwest Forest and Range Experiment Station, Portland, Oregon. General Technical Report PNW-9. 417 p.
- FRANKLIN, J. F., K. CROMACK, Jr., W. DENISON, A. MCKEE, C. MASER, J. SEDELL, F. SWANSON, and G. JUDAY. 1981. Ecological characteristics of old-growth Douglas-fir forests. USDA Forest Service, Pacific Northwest Forest and Range Experiment Station. General Technical Report PNW-118. 48 p.
- GAGNE, W. C. 1979. Canopy associated arthropods in *Acacia koa* and *Metrosideros* tree communities along an altitudinal transect on Hawaii Island. *Pacific Insects* 21(1):56-82.
- HOREGOTT, H. 1960. Untersuchungen uber die qualitative und quantitative Zusammensetzung der Arthropodenfauna in den Kieferkronen. *Beitrage zur Entomologie* 10:891-916.
- LEPOINTE, J. 1956. Methodes de capture dans l'ecologie des arbres. *Vie et Milieu* 7:233-241.
- MARTIN, J. L. 1966. The insect ecology of red pine plantations in central Ontario. IV. The crown fauna. *Canadian Entomologist* 98:10-27.
- MISPAGEL, M. E., and S. D. ROSE. 1978. Arthropods associated with various age stands of Douglas-fir from foliar, ground and aerial strata. US/IBP Coniferous Forest Biome, Ecosystem Analysis Studies. Bulletin No. 13. 55 p.
- MORRIS R. F. 1955. The development of sampling techniques for forest defoliators, with particular reference to the spruce budworm. *Canadian Journal of Zoology* 33:225-294.
- NIELSEN, B. OVERGAARD. 1975a. Sampling of arboreal insects from beech by beating tree stems with clubs. *Entomologische Meddelelser* 43:37-61.
- NIELSEN, B. OVERGAARD. 1975b. The species composition and community structure of the beech canopy fauna in Denmark. *Videnskabelige Meddelelser Fra Dansk Naturhistorisk Forening* 138:137-170.
- PERRY, D. 1980. An arboreal naturalist explores the rain forest's mysterious canopy. *Smithsonian* 11(3):42-53.
- PIKE, L. H., D. M. TRACEY, M. SHERWOOD, and D. NIELSEN. 1972. Estimates of biomass and fixed nitrogen of epiphytes from old-growth Douglas-fir. P. 177-187 in *Research on*

coniferous ecosystems. J. F. Franklin, L. J. Dempster, and R. H. Waring, eds. Proceedings, Symposium Northwest Science Association.

PIKE, L. H., W. C. DENISON, D. M. TRACY, M. A. SHERWOOD, and F. M. RHOADES. 1975. Floristic survey of epiphytic lichens and bryophytes growing on old growth conifers in western Oregon. *Bryologist* 78(4):389-402.

PIKE, L. H., R. A. RYDELL, and W. C. DENISON. 1977. A 400-year-old Douglas-fir tree and its epiphytes: biomass, surface area, and their distributions. *Canadian Journal of Forest Research* 7:680-699.

STECKER, R. 1973. Insects and reproduction of *Sequoiadendron giganteum* (Lindl.) Buchholz. Ph.D. dissertation. University of California, Davis. 96 p.

SWENEY, W. J., and A. E. JONES. 1975. Methods for sampling foliage and insect populations of the beech forest canopy. *New Zealand Journal of Forestry Science* 5(1):110-122.

WOLDA, H. 1979. Abundance and diversity of Homoptera in the canopy of a tropical forest. *Ecological Entomology* 4:181-190.

ACKNOWLEDGMENTS

Those who have seen old-growth Douglas-fir trees or who realize the problems inherent in an extensive arthropod survey, know that a project like this cannot be done alone. I would like to acknowledge the many people who have provided assistance: George Carroll and William Denison for giving me the chance to become well-acquainted with the beautiful old trees; John Christy, Debbie Kosman, Joe Serna, and Bob Beiser, who climbed the trees and sorted the samples; Robert Rydell, for managing the data base; and Terry Montlick for manipulating the data in the computer.

The following people provided expert determination of the arthropods (alphabetically by their institutions): D. E. Bright (Scolytidae), and L. Masner (Proctotrupoidea), Biosystematics Research Institute, Ottawa; P. Bellinger (Collembola), California State University, Northridge; W. E. LaBerge (Formicidae), Illinois Natural History Survey, Champaign; E. L. Mockford, (Psocoptera), Illinois State University, Normal; R. Penrose (Cerambycidae), Oregon Department of Agriculture, Salem; G. F. Ferguson (Vespidae), J. D. Lattin (Miridae), A. R. Moldenke (Araneae), P. W. Oman (Cicadellidae), G. L. Peters (Coleoptera), V. Razafimahatratra (Miridae), L. K. Russell (Coleoptera), M. Schwartz (Miridae), and G. M. Stonedahl (Corixidae), Oregon State

University, Corvallis; G. B. Wiggins (Trichoptera), Royal Ontario Museum, Toronto; R. W. Carlson (Ichneumonidae), D. C. Ferguson (Lepidoptera), R. H. Foote (Diptera), R. J. Gagne (Diptera), E. E. Grissell (Hymenoptera), J. P. Kramer (Homoptera), P. M. Marsh (Braconidae), D. R. Miller (Homoptera), C. W. Sabrosky (Diptera), D. R. Smith (Hymenoptera), G. Steyskal (Diptera), F. C. Thompson (Diptera), D. M. Weisman (Lepidoptera), W. W. Wirth (Diptera), and cooperating scientists D. Vincent (Hymenoptera), and D. W. Wray (Collembola), Systematic Entomology Laboratory, USDA, Beltsville; R. A. Norton (Acarina), State University of New York, Syracuse; C. Griswald (Araneae), and R. Kawin, (Thysanoptera), University of California, Berkeley; H. Andre (Acarina), Universite Catholique de Louvain, Belgium; J. B. Johnson (Psyllidae), University of Idaho, Moscow; G. W. Byers (Diptera), University of Kansas, Lawrence; V. R. Landwehr (Collembola), University of Minnesota, St. Paul; L. Deharveng (Collembola), Universite Paule Sabatier, Toulouse, France; O. S. Flint (Neuroptera), R. C. Froeschner (Hemiptera), and W. N. Mathis (Diptera), United States National Museum, Smithsonian Institution, Washington.

This work was supported by NSF Grants: BMS 7514003 and DEB 78-03583.

Voegtlin, D. J. INVERTEBRATES OF THE H. J. ANDREWS EXPERIMENTAL FOREST, WESTERN CASCADE MOUNTAINS, OREGON: A SURVEY OF ARTHROPODS ASSOCIATED WITH THE CANOPY OF OLD-GROWTH *PSEUDOTSUGA MENZIESII*. Forest Research Laboratory, Oregon State University, Corvallis. Special Publication 4. 31 p.

The canopy of three old-growth Douglas-fir trees was surveyed for arthropods over a 2-year period. Techniques are described for collecting arthropods *in situ* and for laboratory separation of arthropods from habitats removed from the canopy. Species commonly collected are listed with their relative abundance, within-tree habitat, and yearly quarter of collection.

Voegtlin, D. J. INVERTEBRATES OF THE H. J. ANDREWS EXPERIMENTAL FOREST, WESTERN CASCADE MOUNTAINS, OREGON: A SURVEY OF ARTHROPODS ASSOCIATED WITH THE CANOPY OF OLD-GROWTH *PSEUDOTSUGA MENZIESII*. Forest Research Laboratory, Oregon State University, Corvallis. Special Publication 4. 31 p.

The canopy of three old-growth Douglas-fir trees was surveyed for arthropods over a 2-year period. Techniques are described for collecting arthropods *in situ* and for laboratory separation of arthropods from habitats removed from the canopy. Species commonly collected are listed with their relative abundance, within-tree habitat, and yearly quarter of collection.

OR HEO/F76/2 .4Sp3 :4 c.3
Voestlin, D. J.
Invertebrates of the H.J.
Andrews Experimental

Oregon State Library
Salem

As an affirmative action institution that complies with Section 504 of the Rehabilitation Act of 1973, Oregon State University supports equal educational and employment opportunity without regard to age, sex, race, creed, national origin, handicap, marital status, or religion.

**FOREST RESEARCH LABORATORY
SCHOOL OF FORESTRY
OREGON STATE UNIVERSITY
CORVALLIS, OR 97331-5704**

Non-Profit Org.
U.S. Postage
PAID
Permit No. 200
Corvallis, OR 97331

Address Correction Requested