1971
FOREST PEST REPORT

MINNESOTA

DEPARTMENT OF AGRICULTURE

DIVISION OF PLANT INDUSTRY

The mature larvae of the forest tent caterpillar on the cover reaches about two inches in length. Note the "keyhole" on the dorsum of each segment.

Can you tell which end is the head?

MINNESOTA DEPARTMENT OF AGRICULTURE
Division of Plant Industry
670 State Office Building
St. Paul, MN 55155

Introduction

The 1971 forest pest report is a condensation of much of the field and laboratory work from January 1, 1971 to December 31, 1971. Most of the content is from surveys and observations by members of the forest pest section, Division of Plant Industry, but also includes reports and information by other cooperative agencies, such as the Minnesota Division of Lands and Forests, University of Minnesota, private industries of Minnesota and the U.S. Forest Service.

Members of the forest pest section are:

Gerald Beach	St. Paul
Ray Dolan	Cloquet
Gerald Hecht	St. Paul
Gene Schmidt	Virginia
Robert Tiplady	Brainerd
Jordan Wheeler	St. Paul

Other members of the Division of Plant Industry that have helped in field surveys and laboratory counts are:

John Berends	St. Paul
Bob Hoger	St. Paul
Gary Miller	St. Paul
Milton Marinos	St. Paul
Gary Kuyava	Duluth
Al Pruszinske	St. Paul
Ken Blanchard (Soil Samples)	St. Paul

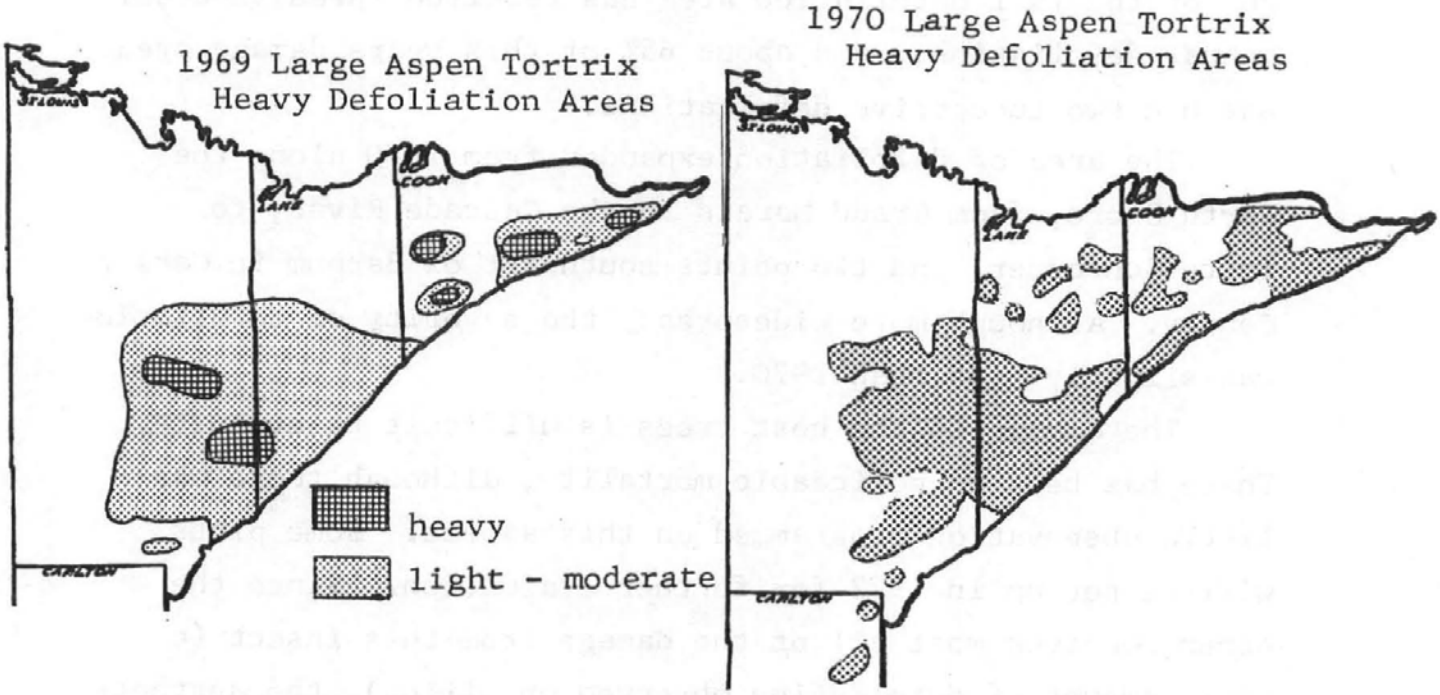
Extra special credit for various segments of this report should be given to Ray Dolan for considerable field information on both old and new forest pest problems, Gerald Hecht for innumerable hours of aerial survey, K. L. Blanchard for a number of forest soil analyses, Dr. J. A. Witter for coordination and help on diseases of the forest tent caterpillar, Dr. H. M. Kulman for help and cooperation in many categories and to the U.S. Forest Service Laboratories located at Hampden, Connecticut for help on insect disease identification.

Gerald Beach, Supervisor
Forest Pest Survey and Control

Large Aspen Tortrix

Choristoneura conflictant (Walker)

1971 is the third successive year of defoliation of large areas of aspen in St. Louis, Lake, and Cook Counties. In 1970, the heavy defoliation area covered 1.5 million gross acres, or somewhat over 500,000 acres of aspen type.



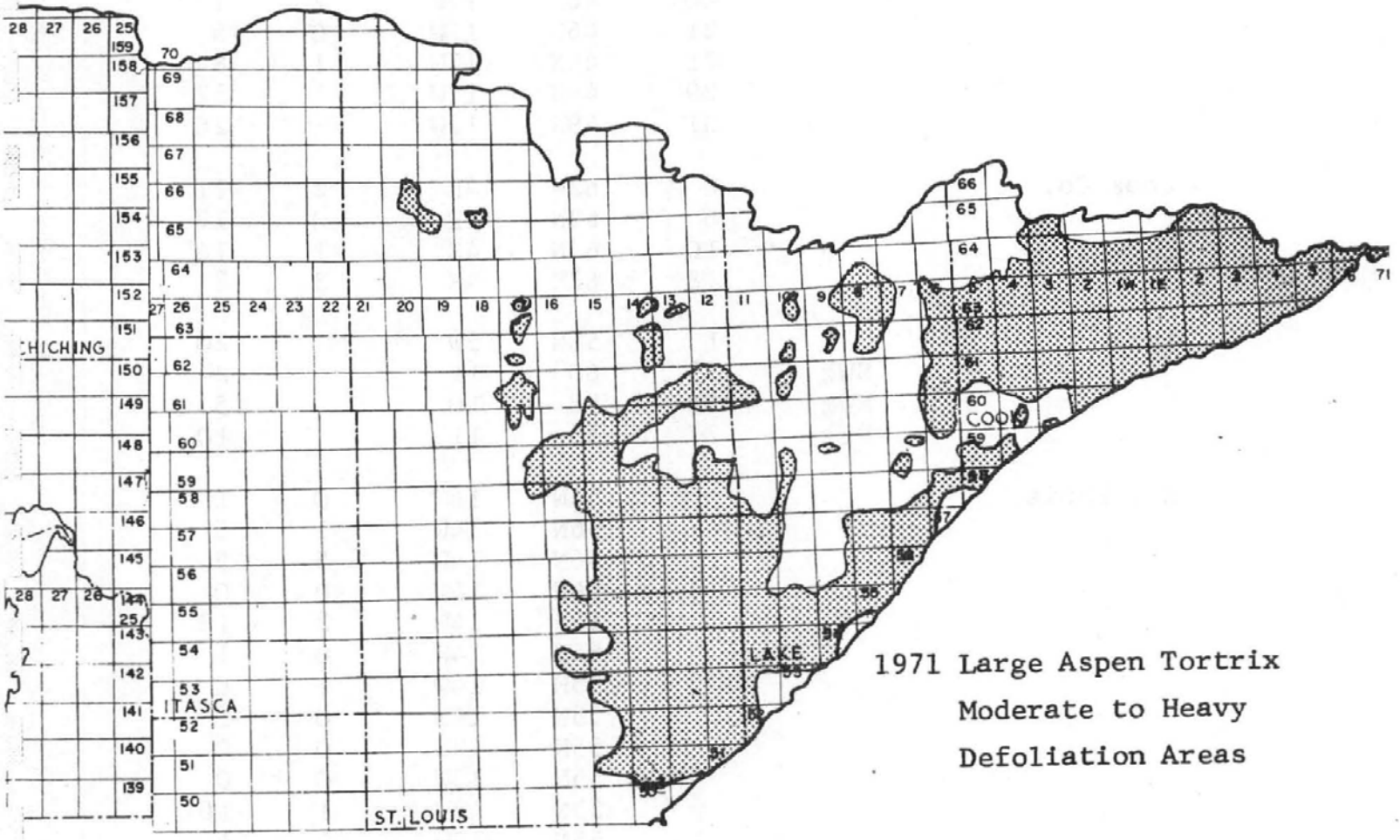
Larvae of the large aspen tortrix overwinters in the second instar and started emerging from dormancy on May 7-12, 1971. On May 16, third instar larvae caused some rolling of leaves with slight feeding damage. On May 24, the larvae were mainly in the fourth-fifth instar stages with defoliation light to moderate. June 11, larvae were largely in the sixth instar with about 3% pupated. June 15, 85% pupation; June 20, adults commonly observed on foliage ovipositing; July 6, eggs common, in green stage; July 10-15, eggs hatching.

An aerial survey was conducted over Koochiching, St. Louis, Lake, Cook and Carlton Counties on June 28-30 to observe defoliation of aspen by the large aspen tortrix. Approximately two million gross acres were defoliated from 40 to 100 per cent, with over one million acres of defoliation less than 30%. The light defoliation locations are more scattered in St. Louis, Lake, Cook, Carlton, Koochiching, Itasca, Lake of the Woods, and Beltrami Counties. The heavier defoliation area only is depicted on the map. As was noted above, about 20% of the 1971 defoliation area has received three successive annual defoliations, and about 65% of this years damage area has had two successive defoliations.

The area of defoliation expanded from 1970 along the North Shore, from Grand Marais to the Cascade River, to Tofte-Schroeder, and two points southwest of Barnum in Carlton County. Although more widespread, the severity of defoliation was slightly less than 1970.

The damage to the host trees is difficult to evaluate. There has been no noticeable mortality, although there was little observation programmed on this aspect. Some plots will be set up in 1972 for further evaluation. Since the aspen receives most all of the damage from this insect (a small amount of defoliation observed on willow), the aesthetic loss from such a defoliator is less than from a problem like the forest tent caterpillar that defoliates many species of forest and shade tree broadleafs. Still, there are many resorts in the northern portions of the state where defoliation by the large aspen tortrix would have some aesthetic effect. The larvae, at least, do not "rain" down on silken threads, nor do they migrate to new foliage by the millions.

An egg mass survey was conducted adjacent to and within the extensive 1971 defoliation locations. The counts were considerably higher than in 1970, giving an impression that there could be a widespread 4th consecutive year of defoliation in 1972. Some of the smaller trees especially, had extremely



1971 Large Aspen Tortrix
Moderate to Heavy
Defoliation Areas

high egg mass counts. One example was a tree 10 to 12 feet in height with more than 35 egg masses in St. Louis County. For an indication of the numbers of egg masses per tree, the following tabulations are counts from the summer survey. The counts were from forest type trees, and are a total of three 36 inch branch samples per tree.

Egg Mass Survey - Aspen Tortrix 1971

Co.	40	S	T	R	Totals 1970	Totals 1971
Carlton		10	48N	17W	3	35
		11	48N	17W	1	16
		20	47N	16W	3	4
		26	47N	17W	2	9
		23	46N	17W	1	2
		20	46N	17W	2	1
		21	46N	17W	0	5
		21	46N	17W	1	8
		29	49N	17W		52
		31	49N	17W		26
Cook Co.		8	62N	4E	2	11
		6	62N	4E	0	17
		10	62N	4E	1	14
		18	62N	4E	3	2
Lake		1	58N	5W		20
	SW¼	33	60	11		2
	NW¼	30	58	10		5
	SE¼	27	56	11		10
St. Louis			56N	14W	0	1
			56N	14W	1	5
			56N	14W	5	5
			56N	14W	0	0
			55N	14W	2	12
			55N	14W	0	1
			55N	14W	3	6
			55N	14W	0	1
			55N	13W	0	0
			55N	13W	0	0
			55N	13W	1	16
			55N	13W	1	4
			54N	13W	0	0
			54N	13W	1	2
			54N	13W	0	0
			54N	13W	0	3
			51N	12W		30
	NE¼ SE¼	9	56	21		12
	SE¼ NE¼	30	56	21		1
	SW¼ SW¼	18	56	21		0
	NW¼ NW¼	8	57	19		6
	NW¼ SE¼	23	58	18		0

Egg Mass Survey (Cont)

Co.	40	S	T	R	Totals 1970	Totals 1971
St. Louis	NE¼ SE¼	22	58	17		5
	SW¼ SE¼	10	58	15		11
	NW¼	35	59	14		24
	SE¼	17	60	15		3
	SE¼	26	62	15		0
	NW¼	3	62	13		0
	SE¼	32	62	12		6
	SE¼	33	56	12		3
	SW¼	12	55	13		18
	NE¼	16	55	14		23
	SW¼	33	57	15		19
	NE	26	66	19		0
	SE	9	65	19		1
	SE	22	66	20		4
	SW	10	61	17		5
	SW	34	61	17		5
	NW	24	60	18		3

1500 pupae were collected for evaluating parasites and other natural controls with the following results:

Cloquet Plot

78% emerged adults
7% parasitized pupae
15% unknown mortality

St. Louis County, Cloquet Valley Forest

31% emerged adults
23% parasitized pupae
46% unknown pupal mortality

Cook County, near Hovland

37% emerged adults
27% parasitized pupae
36% unknown pupal mortality

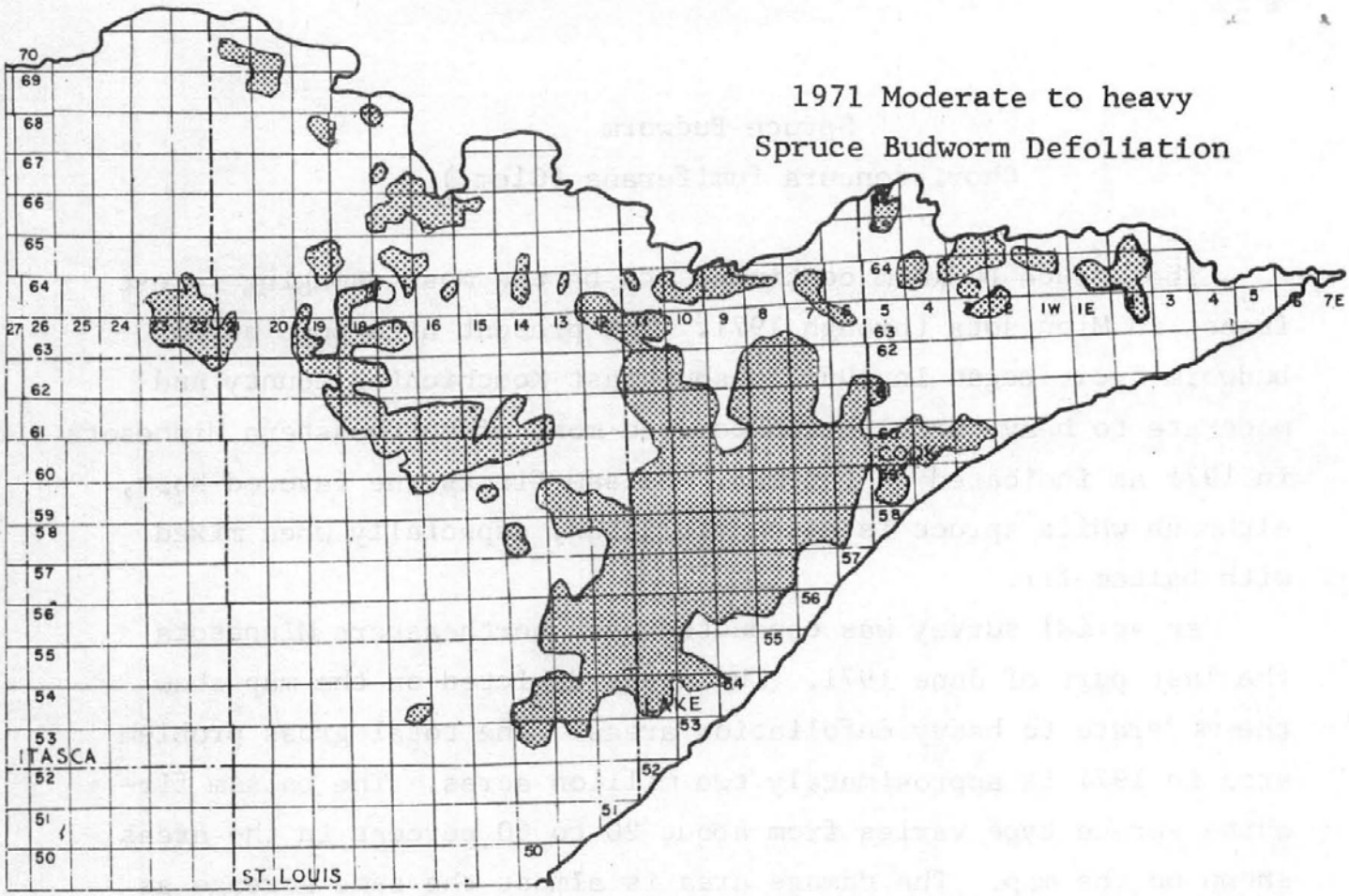
The pupal mortality was less than expected with at least two successive years of defoliation in the plot areas. The 1970 counts were 26% parasitized and 49% unknown pupal mortality, totaling 75%. 1971 counts averaged 19% parasitism and 32% dead from other causes, totaling 51%. In addition, there was observable "sacking out" of larvae in a number of location in 1970 and virtually no such observations in 1971. The combination of these factors could be partially responsible for the apparent increase of egg masses in 1971.

Spruce Budworm
Choristoneura fumiferana (Clem.)

The spruce budworm continued to be the most damaging forest insect in Minnesota through 1971. The present high population budworm cycle began in 1967 in southeast Koochiching County and moderate to heavy defoliation covered most of northeastern Minnesota in 1971 as indicated on the map. Balsam fir is the favored host, although white spruce is also defoliated, especially when mixed with balsam fir.

An aerial survey was conducted over northeastern Minnesota the last part of June 1971. The areas depicted on the map show the moderate to heavy defoliation areas. The total gross problem area in 1971 is approximately two million acres. The balsam fir-white spruce type varies from about 20 to 60 percent in the areas shown on the map. The damage area is almost the same acreage as in 1970 with a light spread eastwards and a slight reduction on the western edge. The principal difference from last year is in the intensity of defoliation with a population reduction in Koochiching and northwestern St. Louis Counties and a much higher population in Lake and Cook Counties. The flight lines were flown in an east-west direction from four to twelve miles apart. The aircraft was a Cessna 180 with two observers mapping defoliation on large scale maps.

Extensive growth loss and some mortality, principally to balsam fir resulted from 1971 defoliation. Mortality was usually resultant from two or three years successive defoliation but droughty weather and shallow soils were also factors. Top kill and mortality were very scattered, and it is difficult to differentiate between this year's loss and that of previous years without doing involved ground checking. It is estimated that more than 100,000 cords of balsam fir were lost in 1971, which is much less than the 1970 estimate. Part of the reason for this may be the reduced budworm population



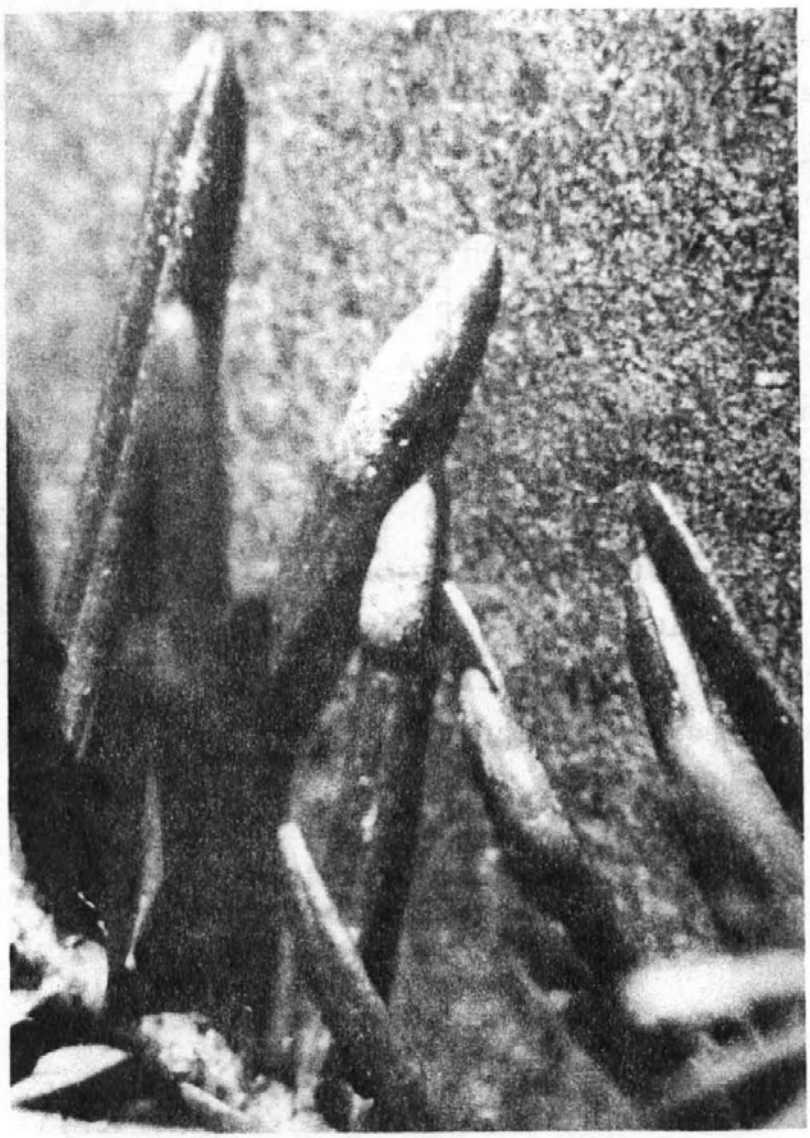
on the west side of the infestation area, which has sustained more consecutive annual defoliations up to this point and the build-up in areas which had received little or no previous heavy defoliation.

An experimental chemical control for the spruce budworm was processed in mid-June using Sevin 4 Oil undiluted at 32 fluid ounces per acre and diluted 1:1 with #2 fuel oil at 64 fluid ounces per acre. The total area sprayed was 560 acres. Pre-and post-spray counts were made with 15-inch twig samples and drop cloths. Rain started falling about three hours after the diluted application and twelve hours after the undiluted test. The pre-spray budworm population was moderate (at best) and averaged about four to seven budworms per fifteen-inch twig sample. In view of the precipitation, control was very good at 88% in the undiluted blocks and 80% in the diluted. Egg mass collections, both inside and outside of the test areas, showed some egg mass reduction within the spray areas.

An egg mass survey was conducted throughout road and aircraft accessible locations in northeastern Minnesota and are as follows (by county):

	# of 15-inch Samples	# of egg masses per 15" twig
N ½ St. Louis County	241	.22
N ½ Lake County	98	.205
Cook County	78	.074
SE Koochiching	236	.19

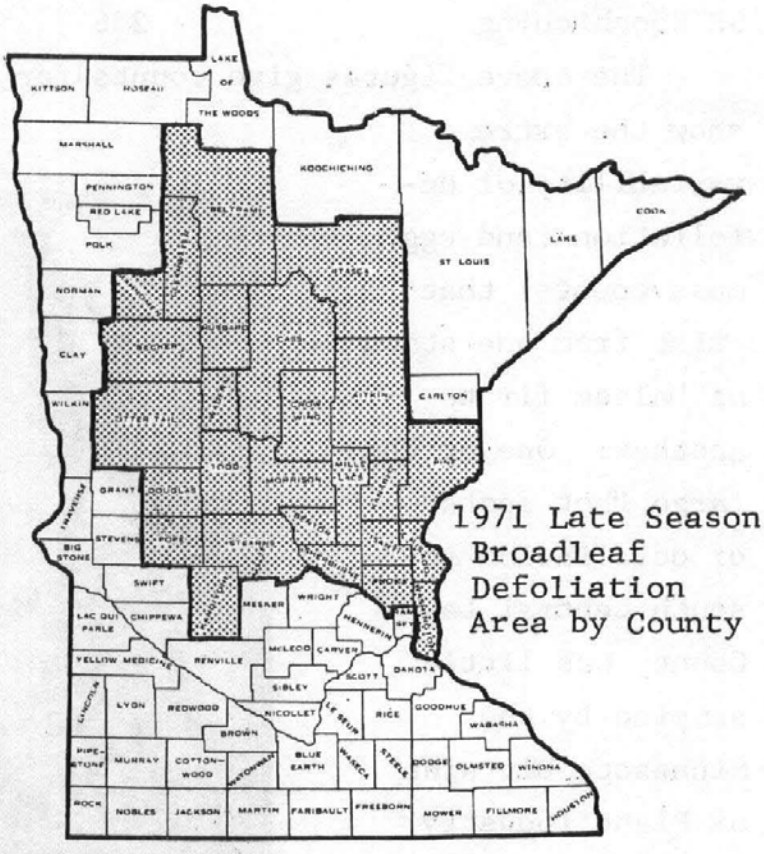
The above figures give counts for large regions and do not show the extreme variability of defoliation (and egg mass counts) that exist from one stand of balsam fir to another. One of the large "hot spots" of defoliation in south central Lake County was little sampled by the Minnesota Division of Plant Industry personnel. The U.S. Forest Service sampled this latter area and counts were as high as 2.0 egg masses per 15-inch twig sample.



Egg Masses (greenish in color) of the Spruce Budworm on Needles of Balsam Fir

Fall Defoliator Complex

The red-humped oakworm, Symmerista canicosta (Francl.), orange-humped mapleworm, Symmerista leucitys (Francl.), and the variable oak leaf caterpillar, Heterocampa manteo (Doubleday) were the three principal defoliators in this complex, varying from 66 to 91% of the populations from collections made at a number of counties within the overall defoliation area. The orange-striped oakworm, Anisota senatoria (Smith), was very common in the vicinity of Stacy, Minnesota and was 27% of the population collected there. A number of lesser species were collected, varying from .2 to 4.7 percent of the population. There was much variation of the minor species in the different counties. This latter group is as follows:



1971 Late Season Broadleaf Defoliation Area by County

Halasidota spp.
Dicentria lignicolor (Wlkr.)
Datana ministra (Drury
Diapheromera femorata (Say)
Anisota stigma (Fabricius)
Automeris io (Fabricius)
Nadata gibbosa (A. & S.)
Fentonia marthesia (Cram.)
Lophodonta angulosa (A. & S.)

The map gives the areas of defoliation by county. Within this large area, the actual defoliation spots vary from several acres in

size to several square miles with several thousand different defoliation locations.

Calls for aid in identifying the problem and to control it were numerous in August and September, especially from private property owners on lakes in central Minnesota. The harm to the host trees from complete defoliation was very little, but the aesthetic and nuisance problem caused concern to many. A beautiful lakeshore location devoid of leaves in latter August and September is appalling to the owner and is very economic to the resort owner and manager. In addition to that, million of caterpillars or "worms" crawling over the countryside in search of foliage had a number of persons shutting up their cabins for the season.

Hosts - This was not completely recorded, but oak was the preferred host by most species followed by birch and basswood, then hard maple, hazelnut, elm, ash and soft maple. Other species were no doubt fed on but to a lesser degree. The various species of defoliators fed on different of the above noted hosts: the orange-striped oakworm was feeding only on oak; the red-humped oakworm and orange-humped mapleworm on oak, basswood, hard maple and hazelnut; and the variable oak leaf caterpillar on all of the above mentioned species.

Regions by County	Principal Hosts	Population Percentages								Total Larvae Collected
		1	2	3	4	5	6	7	8	
Itasca-Cass	Oak-Birch Basswood	40	19	32	1.2	3.7	0.2	3.3	0.0	2025
Anoka-Chisago	Oak-Birch	23	4	39	2.1	2.4	2.3	0.0	27.0	1350
Aitkin-Mille Lacs	Oak-Birch Basswood Hard maple	27	11	44	2.6	3.4	4.1	0.2	0.0	870
Wadena-Crow Wing	Oak-Birch	57	16	18	0.7	2.2	0.4	4.7	0.0	1895

List of scientific names to fit numbers under "Population percentages" on the preceding page.

1. Symmerista canicosta
2. Symmerista leucitys
3. Heterocampa manteo
4. Halasidota spp.
5. Dicentria lignicolor
6. Datana ministra
7. Diapheromera femorata
8. Anisota senatoria

Some of the other larvae identified (only larval identification-none were identified as adults) were:

	No.'s Found
Anisota stigma	1
Automeris io	7
Nadata gibbosa	34
Fentonia marthesia	28
Lophodonta angulosa	16

In comparing larval dropcloth collections to the soil samples, it is very notable that the variable oak leaf caterpillar remained at high populations from soil sample counts and the red-humped oakworm, oranged-humped mapleworm and oranged-striped oakworm did not. The latter three oakworms overwinter as pupae and were put collectively under that category in the soil samples where they will be identified upon adult emergence sometime in March or April of 1972. The variable oak leaf caterpillar overwinters in the larval stage. All four of these defoliators overwinter in the ground in the top three inches of soil or duff. No evaluations were made to lend fact to the decline of the red-humped oakworm, orange-humped mapleworm and orange-striped oakworm, although scattered observations of innumerable "apparently" diseased caterpillars could indicate the major factor. A number of these "diseased" larvae were processed at the U.S. Forest Service Laboratories, Hampden, Connecticut, and although no positive identifications were made, inclusion bodies were recorded that were very similar to a polyhedral virus. It is possible that starvation was another factor in highly defoliated areas. The variable oak leaf caterpillar, with a wider host range, may have been able to feed on tree or shrub

species that the other three oakworms could not survive or develop on.

Soil samples were collected in a number of locations to get information on the overwintering populations of this group of late season defoliators. The sample unit was .1 milacre in area, to a depth of three inches. A number of checks were made below the three-inch mark and no larvae or pupae of this group were found. A number of samples were taken in each forested location at 50-yard intervals.

Additional soil samples will be taken in April of 1972 at the same locations. Population comparisons should help in predicting the 1972 potential in August and September. Results of these evaluations will be released in late July of 1972 to the news media and all cooperative agencies in Minnesota.

The results of the soil samples are as follows:

Location	Variable Oak Leaf Caterpillar	Pupae	# of Soil Samples
One mile SW of Stacy	342	8	9
E. Bethel	135	2	9
NW Princeton	31	1	2
N. of Hill City	8	6	4
SW Grand Rapids	0	6	2
S. of Walker	25	1	9
Whipholt	18	2	5
*E. of Staples	58	12	5
Cambridge	38	2	2
NW of Princeton	0	0	1
Sherburne County	12	0	1
Benton County	0	0	1
Ogilvie	0	0	1

*Samples taken randomly in oak sites

Pine Tussock Moth
Dasychira plagiata (Walker)

The pine tussock moth continued to increase in population in 1971 in east central Minnesota. This was the fourth successive year of build-up in this location in northern Pine County. The center of build-up is almost exactly the same as the 1961 pine tussock moth "population explosion."

The principal host is jack pine but other pines are defoliated to a much lesser degree.

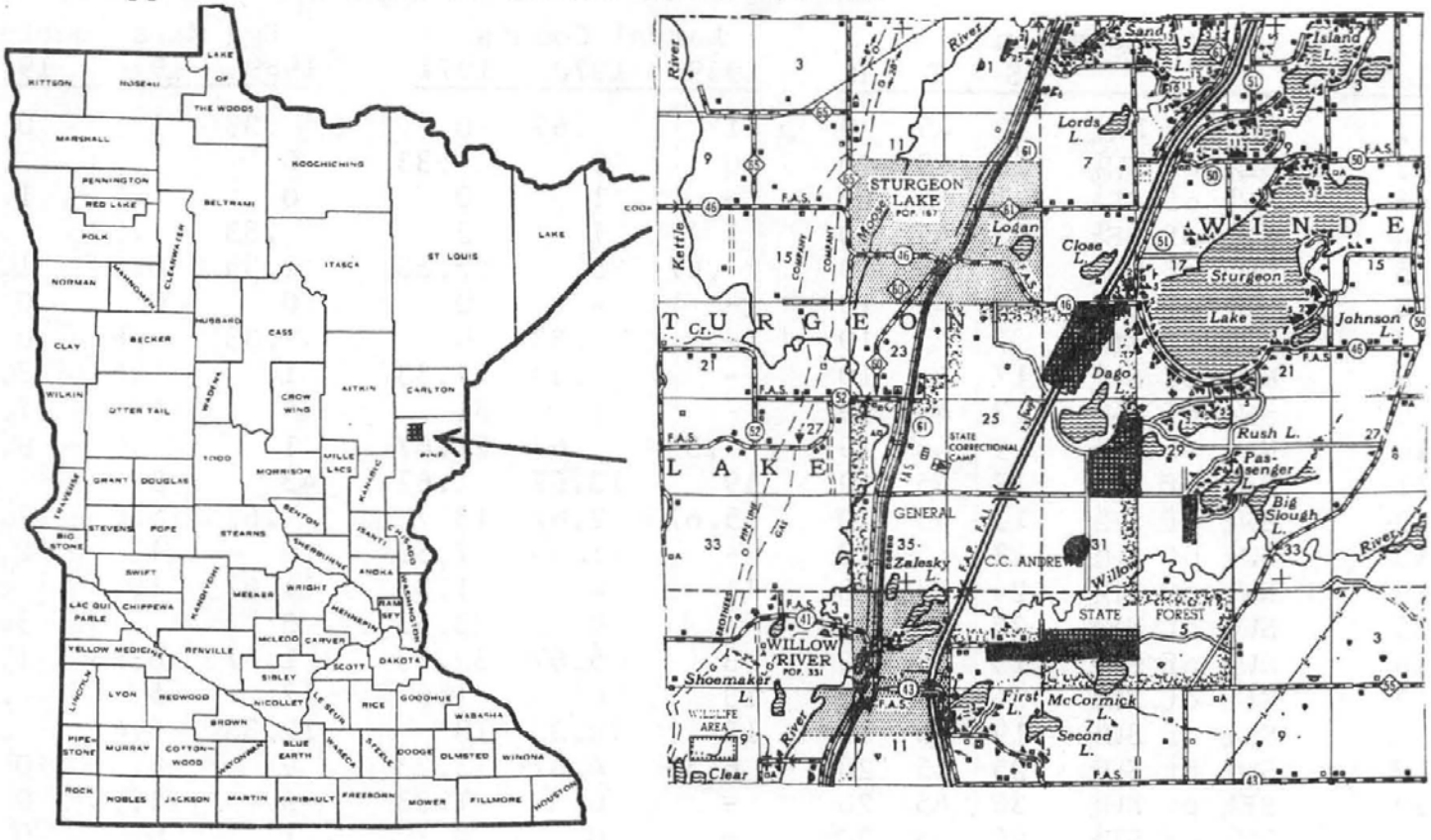
On May 14 about 95% of the pine tussocks were in the second instar with about 50% of the population still emerging from dormancy. On June 11 most were in the fourth instar; June 26 most in the fifth instar; July 2 in the fifth and sixth instars with heavy defoliation showing up on more than 500 acres; July 16 most were in pupated; and July 23 about 16% adult emergence with a few egg masses observed.

As was noted above, there was about 500 acres of jack pine located northeast of Willow River, Minnesota that would have received considerable mortality and top kill without chemical control. This situation was kept under close observation until it was determined that control was necessary to save the forest locations. The trees were of varying sizes with only a few spots where mature or merchantable trees existed. The insecticide used was one pound Sevin in 1.5 gallons of water per acre. The total of 500 acres of jack pine needed two applications to control the larvae thus totaling 1,000 acres of application. Control was very successful with no top kill showing up. Dropcloths were posted in four locations to check counts daily after the chemical application. Dropcloths were large enough to cover an area broader than the branch-foliage base to receive all affected larval drop.

	Counts to July 3	Counts to July 9
Plot #1	93% control	96% control
Plot #2	83%	No counts made past 7/3
Plot #3	84%	No counts made past 7/3
Plot #4	61%	91% control

All remaining larvae and pupae were picked off the trees after July 9 and counted. Application of the insecticide was made on June 29 and 30.

Some apparently disease affected larvae were sent into the U.S. Forest Service Laboratory at Hampden, Connecticut for virus analysis but were negative on virus particles of nuclear and cytoplasmic polyhedral viruses. In the field, there was little evidence of apparent diseases on larval observations.



1971 Pine Tussock Control Area June 29-30

On evaluations throughout the balance of the range of jack pine in Minnesota, there was no evidence of any additional locations where the pine tussock populations were increasing.

Following is a tabulation comparing pine tussock larval and egg mass counts from 1969, 1970 and 1971 from northern Pine County. The larval counts are on 8 X 6 foot dropcloths and the egg masses are per fifteen-inch branch samples taken randomly. Such comparisons enable the Minnesota Department of Agriculture to compare population increases from year to year, thus helping to predict

what the potential is for 1972. In addition to this, collections of three to five year old cones, duff, and bark on the lower three feet of the trunk were made to evaluate further the overwintering populations of the pine tussock. These evaluations will be done in February, March and April of 1972.

Larval and Egg Mass Counts in Willow River Area - A Comparison of 1969, 1970 and 1971 Counts

Plot #	Location	S	T	R	Larval Counts 1969	1970	1971	Egg Mass Counts 1969	1970	1971
1	NE¼ of NW¼	12	45	20	1	.67	0	.33	1	0
2	SE¼ of NW¼	12	45	20	0	0	.33	0	.33	.33
3	SE¼ of SE¼	11	45	20	-	1	0	0	.33	1.33
4	SW¼ of NE¼	12	45	20	1	1	3	.33	.33	.33
5	SW¼ of NW¼	7	45	19	.67	5	22.33	2.33	6.67	1.33
6	NE¼ of SW¼	6	45	19	-	-	0	0	0	0
7	NE¼ of SE¼	7	45	19	-	.33	0	.33	.67	0
8	NW¼ of SW¼	17	45	19	-	.33	17.33	1	.67	3.67
9	SW¼ of SW¼	17	45	19	-	1	81	5	2	17.67
10	NW¼ of NE¼	19	45	19	.33	.67	21.67	1	.67	6.33
11	SE¼ of SW¼	18	45	19	19	13.67	1.67	43	8	.33
12	SW¼ of SE¼	13	45	20	5.67	2.67	13	7.67	5.67	2.67
13	SW¼ of SW¼	18	45	19	-	1.33	7.33	6	1	2.67
14	NW¼ of SE¼	24	45	20	11	4	1.33	11.67	1.33	.33
15	SW¼ of NE¼	23	45	20	-	0	23.33	3	.33	5.67
16	NW¼ of NW¼	13	45	20	3	5.67	32.33	1.67	6.33	1.33
17	NE¼ of SW¼	24	45	20	13	8	1.67	17	5	.67
18	SW¼ of SW¼	19	45	19	15	10.33	18	12.33	6.67	.67
19	SW¼ of SW¼	25	45	20	6.33	4.67	3.33	9	6.33	0
20	SE¼ of NW¼	36	45	20	-	6	1.33	5	8.33	0
21	SW¼ of SE¼	26	45	20	-	0	0	1	0	0
22	SW¼ of NE¼	35	45	20	-	0	0	0	0	0
23	NW¼ of NE¼	2	44	20	.33	0	0	.67	.67	0
24	NE¼ of NE¼	2	44	30	1.33	1	0	.33	.67	0
25	NE¼ of NW¼	11	44	20	-	0	0	.33	0	0
26	SE¼ of NE¼	11	44	20	0	0	.33	0	0	0
27	NW¼ of SW¼	12	44	20	-	.33	3.33	0	1.67	2.67
28	NE¼ of NE¼	13	44	20	.33	0	0	.33	2.33	.33
29	NE¼ of SW¼	7	44	19	-	0	0	0	0	1.33
30	NE¼ of NW¼	8	44	19	-	0	.33	.67	0	4.33
31	NE¼ Of SW¼	5	44	19	0	2.67	4	1.67	3.33	4.67
32	NW¼ of NW¼	4	44	19	-	0	1.33	.33	.67	16.67
33	SW¼ of NW¼	5	44	19	-	5	5.33	2.33	8	11.33
34	SE¼ of NW¼	6	44	19	-	15.67	120.33	10	18.33	25
35	SW¼ of NW¼	6	44	19	.33	13.67	273.67	13	16.33	42.33
36	NE¼ of NE¼	12	44	20	-	1.67	-	2.33	4	-
37	SE¼ of SW¼	27	45	19	0	2	8	0	2.67	9.33
38	NE¼ of NW¼	29	45	19	-	1	1.33	.33	1	5.33

Plot #	Location	S	T	R	Larval Counts 1969	1970	1971	Egg Mass Counts 1969	1970	1971
39	SE¼ of NW¼	30	45	19	2.33	5.67	16.33	8.67	13	1.67
40	SW¼ of SW¼	29	45	19	1.33	4.67	94.67	2	6	5.33
41	SE¼ of SE¼	25	45	20	20	23	32.67	44.33	21.33	1.33
42	SE¼ of SE¼	15	44	20	-	0	0	0	0	0
43	SW¼ of NE¼	2	44	20	-	.33	0	-	1.67	0
44	SE¼ of SE¼	27	45	19	-	1	1.67	-	2	5.67
45	NE¼ of NE¼	29	45	19	-	1.67	16	-	11.33	10.33
46	SW¼ of NW¼	28	45	19	-	.67	9.67	-	.67	7.33
47	NE¼ of NW¼	32	45	19	-	1.67	3.67	-	17.67	13.67
48	SE¼ of NW¼	31	45	19	-	2.67	3.67	-	7	6
49	SW¼ of NW¼	31	45	19	-	.67	8	-	6.67	4
50	SE¼ of NE¼	12	45	20	-	2.33	14.67	-	10	2.67
51	SW¼ of SE¼	31	45	19	-	1.33	6.33	-	5.67	12.67
52	NW¼ of NW¼	6	44	19	-	4.67	80.33	-	7.67	33
53	SE¼ of NE¼	11	44	20	-	.33	0	-	0	.67
54	SW¼ of SE¼	18	45	19	-	1.67	-	-	1	-
55	NE¼ of NW¼	19	45	19	-	8.33	44	-	2	8
56	NE¼ of NW¼	19	45	19	-	8	7.67	-	2	1.33
57	SE¼ of NW¼	19	45	19	-	6.67	31	-	2.33	1.33
58	NE¼ of SW¼	29	45	19	-	9.33	79	-	9.33	10.33
59	SW¼ of SE¼	24	45	20	-	3	16.67	-	3	1
60	SW¼ of SW¼	24	45	20	-	.33	33	-	1.67	1
61	SW¼ of NW¼	25	45	20	-	3.33	1	-	3.33	0
62	NE¼ of NE¼	31	45	19	-	-	24	-	-	7

It appears, although sampling and counting is not completed on the pine tussock, that there are enough population "hot spots" where approximately 1,000 to 1,500 acres of jack pine stands will need control in June of 1972.

To complete the development of the pine tussock, 44% of the moths had emerged on August 1. Some eggs were hatching on August 6, and all were hatched on August 17. During the period of July 16-22, pupae were collected for a parasite evaluation. From 40 to 73% were parasitized or diseased and from 27 to 60% successfully emerged as moths. During the tussock moth egg stage, no chalcid egg parasites were noted.

Pupal Parasitism

Date	Location #1 Dead Pupae	Emerged Adults	Location #2 Dead Pupae	Emerged Adults	Location #3 Dead	Emerged
7 - 22	298	202	468	32	467	- 33
7 - 25	255	245	424	76	457	- 43
7 - 27	220	280	330	170	441	- 48
7 - 29	203	297	295	205	422	- 78
8 - 1	193	307	280	220	363	- 137
	25% parasitized 15% Disease or Unknown		40% parasitized 16% disease or Unknown		59% parasitized 14% disease or Unknown	

Forest Tent Caterpillar
Malacosoma disstria (Hubner)

The present high population cycle of the forest tent caterpillar began in 1964 in northwest St. Louis and northeast Koochiching Counties. Since that initial upsurge, the heavy defoliation area has virtually stagnated within Koochiching County, although small outbreaks were recorded in Ottertail County in 1969-1971 and in Douglas County in 1970-1971. The area of defoliation within Koochiching County has remained almost constant after 1964 through 1971. In the first few years there was a gradual spread eastward into northern St. Louis County and the last several years the "eastern front" has been gradually collapsing with a gradual spread in a west-southwest direction. The Ottertail outbreak collapsed largely in 1970 with larvae difficult to find in 1971, although some defoliation existed on one peninsula of Clitherall Lake and an area adjacent to Battle Lake.

In 1971, forest tent caterpillar eggs began hatching on May 6 in Koochiching County. By May 28 the larvae were 3/8 of an inch in length, although there was considerable variation in size. Many first and second instars were still observed. There was also much variation in the leafing out of aspen. Some buds were still expanding after May 20. Defoliation first started to show up in early June. Scattered spots showed almost complete defoliation on June 10 in the Ray-Littlefork-International Falls triangle. By June 18, many of the larvae were reaching two inches in length and a small percentage were beginning to spin cocoons. Moth emergence started approximately July 9 and continued for three weeks.

In Ottertail and Douglas Counties the larvae were about ¼ inch in length on May 17 and about 90% of the larvae were in various stages of pupation on June 24.

An aerial survey of northern Minnesota was conducted during the last part of June and early July over Koochiching, Lake of the Woods, northern St. Louis, Ottertail, Douglas and portions of

Beltrami, Itasca, Cass, Pope and Hubbard Counties. The heavy defoliation area in Koochiching with leaf loss from 60 to 100% covered 225,000 to 250,000 gross acres. The heavy defoliation in Ottertail was a very small spot a few acres in size and the Douglas County problem area increased from 1,000 to 2,000 acres adjacent to Lobster Lake. The latter defoliation area was a several-fold increase over 1970 and may indicate another major outbreak area. In the follow up ground surveys, supplemented by larval reports from cooperators, light to very light defoliation extended west, south and east to a considerable distance from Koochiching County. Individuals in Lake of the Woods, Beltrami, Itasca and St. Louis Counties did not notice the problem unless caterpillars were observed on apple or shade trees and this occurred to a minor degree. In contrast, there was hardly any boundary of moderate to light FTC populations surrounding the Douglas County defoliation area. The map gives the overall picture for 1971.

A pupal parasitism evaluation was made in late June-early July with the following results:

Location	# of Pupae Counted	Moth Emergence	Living Pupae	Parasitized Pupae	Dead Unknown	Dead Pre-pupae
Koochiching Cty.	1500	251	46	277	609	317
Douglas County	35			28		

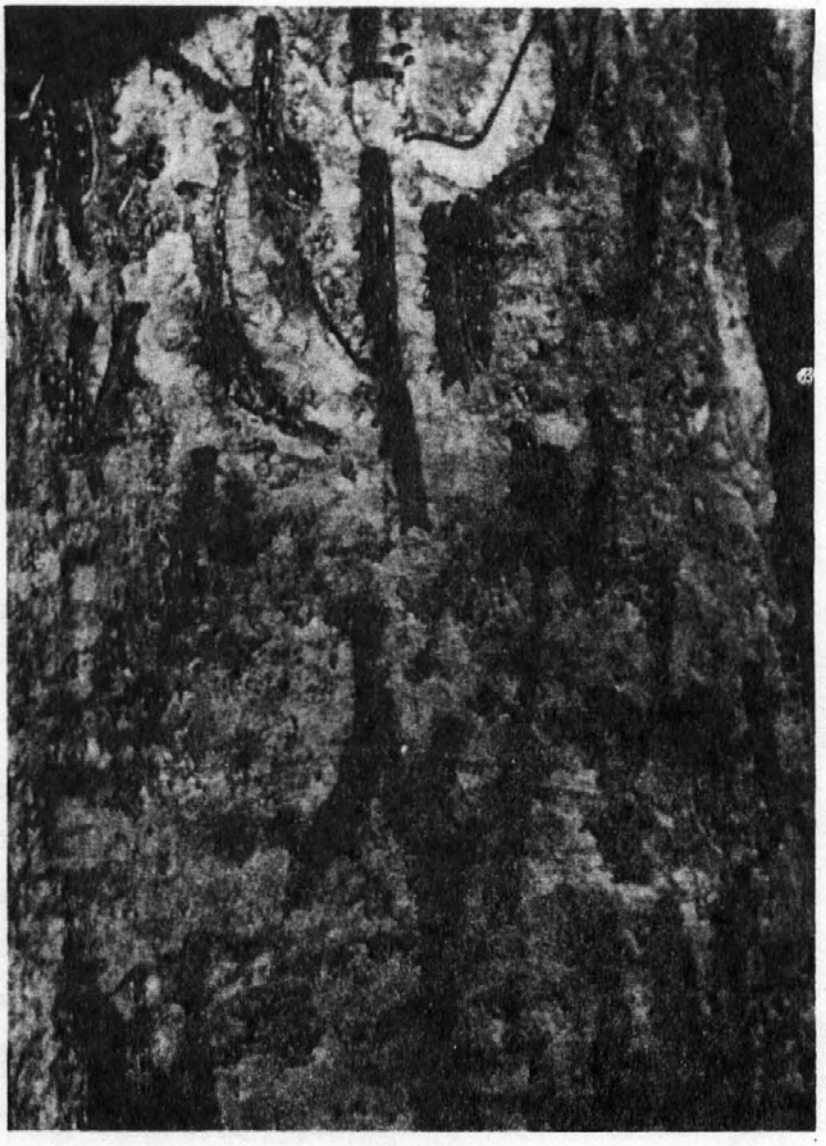
Many of the pupae in the columns "Dead Unknown" and some of the "Dead Pre-pupae" were parasitized, but the parasites had already dropped out. Thus, it is impossible to say just what percentage of the FTC pupae were parasitized this year. Most of the dead pre-pupae were unparasitized and presumably were killed by disease or a combination of factors including disease. A description of a fair percentage of the "Dead Unknown" pupae are:

1. Mouldy appearance; tan brown and gray areas on exterior surface of pupae.
2. Internal portion very fluid, grayish-brown in color.
3. Internal fluids fibrous, vicous, sticky-black.
4. Internal fluids lumpy, corpuscular.

The total percentage of dead pupae and pre-pupae (including parasitism) for 1971 was approximately 80%. This still is not

to the level where FTC population reduction could be expected from this complex of natural controls.

Some investigations were made on the disease of the forest tent caterpillar in 1971 in cooperation with Dr. H. M. Kulman and Dr. J. A. Witter, University of Minnesota. In addition to this, a number of affected larvae were sent to the U.S. Forest Service laboratories at Hampden, Connecticut. There were several locations near Ray and Ericsburg, Minnesota where apparent diseased larvae were numerous. Although original objectives were to process field symptoms of polyhedral virus diseases, larval collections were made where large numbers of "affected" caterpillars were observed and attempts were made on all diseases.



Numerous Diseased FTC Larvae at the Base of an Aspen Tree

There was considerable diversity of disease causal agents where larvae were collected from different locations. The laboratory determinations included Entomophthorus sp. (a fungus), Microsporidia (protozoans), nematodes, Streptococcus faecales

(bacteria) and polyhedral virus inclusions. The microsporidia (as well as the viruses) were extremely common in the older defoliation areas in 1971. The effects of the disease are difficult to measure but probably contribute to the decline of the FTC population in the following manner:

1. Retardation of larval development
2. Reduction in size and weight
3. Reduction in fecundity
4. Reduced vigor of population

An egg mass survey was conducted in October-December of 1971 to check potential 1972 FTC distribution and populations. The locations and number of egg masses found are given below and a 1972 distribution map was based on these tabulations.

County	Section	Township	Range	Tree Total	Location
Beltrami	22	151	30	.3	1 mi. W. of Shooks
Koochiching	28	70	25	8.3	1 mi E of Pelland
	30	70	25	29.3	W of Pelland
	17	69	25	24.0	So. Pelland 4 mi.
	22	158	27	3.3	10 mi So. Birchdale
	19	69	26	7.7	4 mi. N. of Lindford
	26	159	27	2.7	4 mi S. Birchdale
	7	68	24	8.0	4 mi. E. of Littlefork
	3	159	25	12.3	E of Indus
	13	158	25	6.0	1 mi E Loman
	24	68	25	14.6	5 mi. SE Littlefork on Co. 8
	28	160	28	0.7	1 mi E. of Frontier
	2	159	27	0.3	E. of Birchdale
	4	159	26	2.0	1 mi E. of Manitou
	5	68	25	7.0	5 mi. W of Ray
	36	71	23	1.3	E. of Int'l Fal Hwy. 11
	1	69	24	6.7	Ericsburg
	13	70	24	7.3	So. Int'l Falls
	5	68	25	5.7	Littlefork
	31	155	25	.5	5 mi. W Big Fall on Co. 30
	34	64	22	.5	2 mi. N. of Rauch

County	Section	Township	Range	Tree Total	Location
Koochiching	26	65	26	1.0	8 mi. SE of Big Falls
	25	155	27	1.0	12 mi. W. of Big Falls on Co. 30
	16	153	26	1.5	2 mi. SW Margie
	17	65	26	2.5	7 mi. S Big Falls
	33	68	25	26.7	4 mi. S. of Littlefork
	6	67	26	11.3	8 mi. SW of Littlefork
	20	67	24	1.7	11 mi. S Littlefork Co.8
	5	69	22	3.0	Ray
	24	157	25	1.0	Lindford
Ottertail County	25	128	39	1.7	Alexandria
St. Louis	17	68	21	1.2	Lake Kabetogama
	31	68	20	.7	53 near Ash River
	31	64	12	.7	Echo Trail
	9	60	20	.3	6 mi. No. of Chisholm on 73
	16	59	17	.3	169 and 53 Jct. on 169

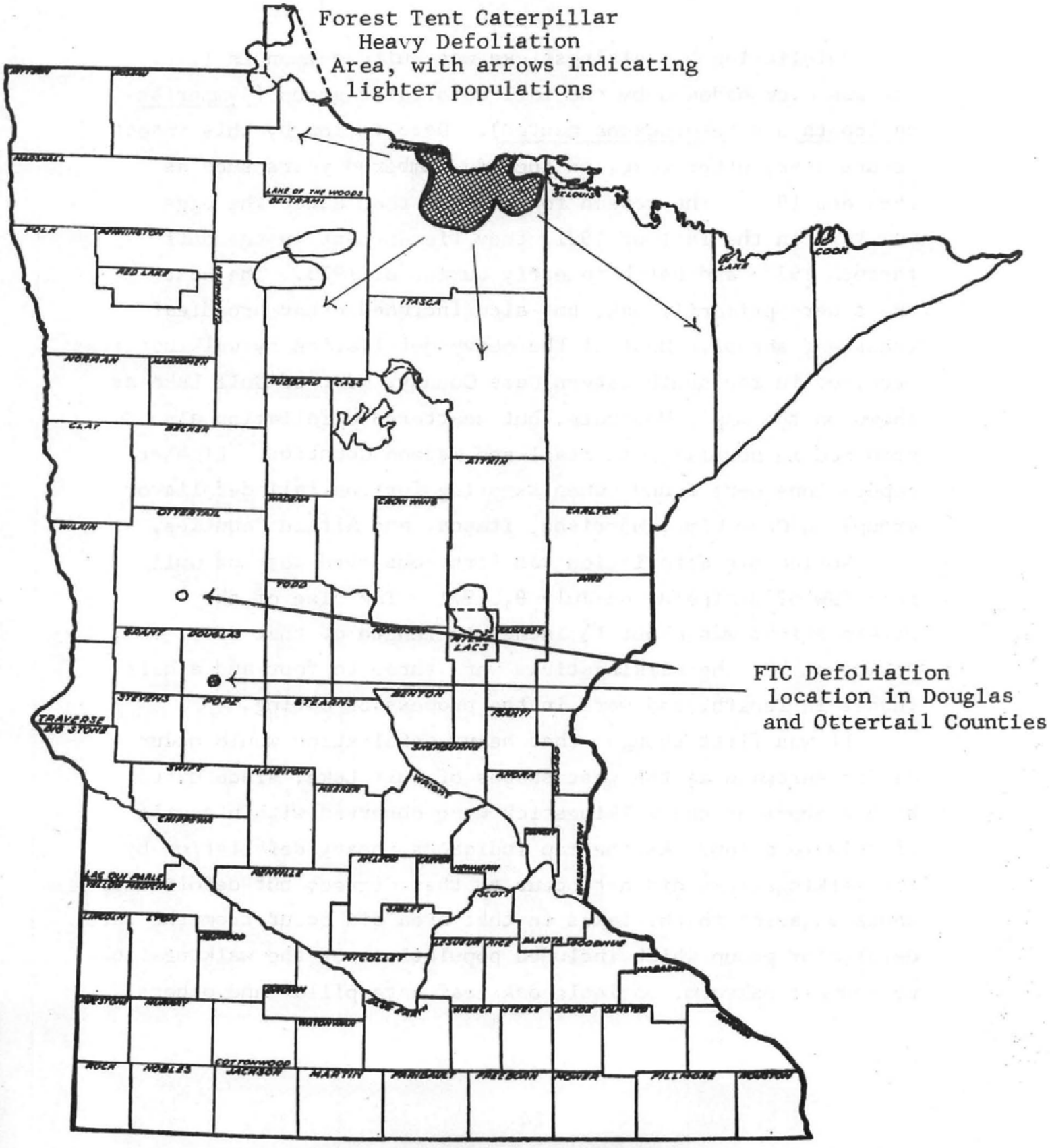
After tabulation of the counts of egg masses, an egg parasite evaluation was made. A maximum of ten egg masses were selected from each tree where they were found; that is, if 17 were found on one tree, the average ten were selected. On counts of 10 or less per tree, all egg masses were checked. The eggs were decapped on two sides of the mass with a razor blade and healthy, parasitized and dead eggs were counted. Tabulations were condensed to the following:

# of Eggs Checked	Healthy Larvae	Parasitized Larvae	Dead Eggs	Dead Larvae
26,600	20,155	2,297	1,485	2663

The percentage of parasitized eggs for 1971 is 8.6%, which is slightly above average. The "spumaline" (hard frothy brown covering over eggs) coverage averaged slightly over 79% for a total of 391 egg masses checked. It appears that there is more pre-larval mortality from this lack of covering than is produced

by parasitism, but there was not enough counts made to completely substantiate this point.

The number of eggs per mass was also tabulated and the average 1971 egg mass contained 207 eggs.

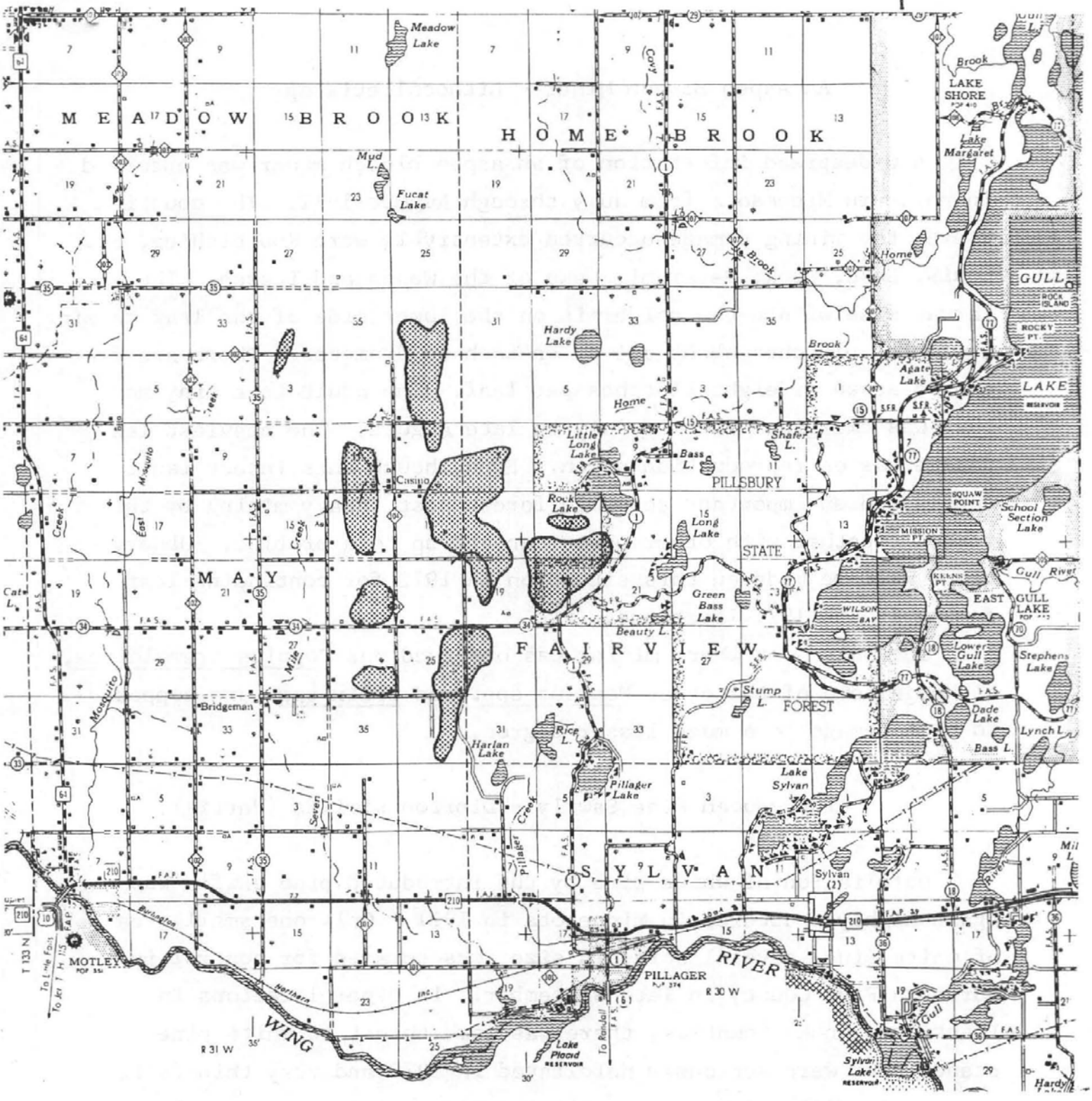


Walkingstick - Diapheromera femorata (Say)

Defoliation by walkingsticks was quite common in 1971, but was overshadowed by the fall defoliator group (Symmerista canicosta and Heterocampa manteo). Defoliation by this insect occurs every other year, on the odd numbered years such as 1969 and 1971. The reason for this is that after the eggs were laid in the fall of 1971, they lie dormant in the duff through 1972, and hatch in early summer of 1973. The host trees were primarily oak, but also included other broadleaf trees and shrubs. Most of the heavy defoliation by walkingsticks occurred in far southwestern Cass County, west of Gull Lake as shown on the map. Moderate, but scattered defoliation also occurred in Douglas, Ottertail and Wadena Counties. Lighter populations were found (when sampling for the fall defoliator group) in Crow Wing, Morrison, Itasca, and Aitkin Counties.

Noticeable defoliation was first observed west of Gull Lake (NW of Brainerd) on July 9, 1971. The size of the walkingsticks was about 1½ inches in length at that date. On August 22, the walkingsticks were three to four and a half inches in length, and were in the process of mating.

It was first thought that heavy defoliation would occur as far eastward as the west shores of Gull Lake, since quite high numbers of the walkingstick were observed within a mile of this location. As the map indicates, heavy defoliation by the walkingsticks did not occur to that degree, but defoliation spots adjacent to the lakes in that area did occur from the fall defoliator group which included populations of the walkingstick, red-humped oakworm, variable oak leaf caterpillar and others.



Heavy Defoliation by the Walkingstick in Southwest Cass County

An Aspen Blotch Miner - Lithocolletis sp

A widespread infestation of an aspen blotch miner was observed in northern Minnesota from July through August 1971. The counties where the mining damage occurred extensively were Koochiching, St. Louis, Lake, Cook, Beltrami, Lake of the Woods and Itasca. The larvae mine within the epidermis on the lower side of the leaf causing yellowish blotches about 3/4 of an inch in diameter. There are from one to seven or eight blotches per leaf. The adult is a tiny moth that was emerging from mid-July to late August. The heaviest leaf damage was on reproduction aspen. Even though this insect isn't considered an important economic forest pest, heavy mining by this insect together with other pests can add up to a problem. Observations will be made on this situation in 1972 for continuing leaf damage in the 1971 locations.

The only host where mining was observed was Populus tremuloides, although some of the other Populus spp. and Salix spp. are supposed to host damage to a much lesser degree.

Introduced Pine Sawfly - Diprion similis (Hartig)

Defoliation of white pine by the introduced pine sawfly was again highly scattered in Minnesota in 1971. Only one small area of white pine, several acres in size, was sprayed for control in northern Pine County in late September. In other locations in Isanti and Anoka Counties, there was some threat to white pine stands that were seriously defoliated in 1970 and very thin foliage existed in 1971. Scattered small locations of damage were also observed in Crow Wing and Aitkin Counties.

White pine plantations in Aitkin, Anoka and Crow Wing Counties had moderate to high populations of the second generation introduced pine sawfly but defoliation was slight.

Walnut Caterpillar - Datana integerrima (G. & R.)

Defoliation by the walnut caterpillar was somewhat less in 1971 than in 1970. Observed defoliation was recorded in scattered locations in Nicollet, Lac Qui Parle, Wright and in several of the southeastern Minnesota counties. The host in all observations in 1971 was black walnut. Some of the trees have received continuous annual defoliation to the point where the trees are in a low vigor condition.

The Maple Leaf Cutter - Paracleminsia acerifoliella (Fitch)

This insect was mining and skeletonizing leaves of sugar maple trees in Becker County. The infestation was heavy in Section 29, Township 138, Range 40.

The larvae is a leaf miner in the early instars and becomes a case-bearing skeletonizer in the later instars. At the stage of becoming a case-bearer, the larvae cut out two round discs from the maple leaf enwebbing them together. The larvae then carry this case around the surface of the leaves while skeletonizing the surface. The maple leaf cutter pupates within the case before the leaves fall to the ground in autumn and overwinters in this stage.

Such defoliation as occurred in this location in Becker County can reduce the vigor of the sugar maple trees and successive annual defoliations could be an economic problem. Observations will be made in June-July of 1972 for signs of continuing damage by this insect.

Larch Sawfly - Pristiphora erichsonii (Hartig)

The larch sawfly continues to be a problem over most of the tamarack stands in Minnesota, although overall defoliation was less in 1971 than in 1970. Defoliation was slightly reduced in northeast and northwest areas and increased in west central (Ottertail and Wadena Counties) and the more southern larch stands in Minnesota.

OTHER 1971 FOREST PROBLEMS

Forest Insect	Host	Location	Observation Date	Comments
Adelges abietis (Linnaeus) Eastern Spruce Gall Aphid	Spruce	Scattered	June-October	In the egg stage on May 28 in northern Minnesota
Agrilus anxius Gory Bronze Birch Borer	Birch	Statewide	May-October	Adults emerging on July 9 in Twin City area. Adults commonly observed on July 14-18 in north Pine & St. Louis Counties.
Alsophila pometaria (Harris) Paleacrita vernata (Peck) Cankerworms	Various broadleafs	Scattered	May-June	Populations less than in 1970. Larvae 3/4 to 1 inch in length on June 4. Some chemical control in Minneapolis & St. Paul.
Anomala oblivia Horn Pine Chafer	Jack pine	Central Minn.	Late June	Populations lower than in 1970.
Aphrophora parallela (Say) Pine Spittlebug	Conifers	Widespread	May-July	Scattered requests for damage interpretation, especially on Christmas tree plantations. Early instars observed on May 30. Eighty percent adults on June 28 - July 2. Mating on July 8-9.
Aphrophora saratogensis (Fitch) Saratoga Spittlebug	Conifers	Northern Minn.	June-August	Some flagging in Norway pine plantations in Itasca County.

Forest Insect	Host	Location	Observation Date	Comments
Archips cerasivoranus (Fitch) Ugly Nest Caterpillar	Prunus spp.	St. Louis County	July	Common
Arge pectoralis (Leach) Birch Sawfly	Birch	Isanti, Carlton St. Louis Ctys.	June-Sept.	Larvae common on birch in scattered locations.
Bucculatrix ainsliella Murtfeldt Oak leaf Skeletonizer	Oak	Central Minn.	August-Sept.	Skeletonizing much less than 1970. Only scattered spots that could be observed.
Cameraria hamadryadella (Clemens) Solitary Oak Leaf Miner	Oak	Cass, Crow Wing, Beltrami, Itasca, Morrison Counties	June-July	As many as 8 mines per leaf in some areas. Light to moderate damage overall.
Choristoneura pinus Freeman Jack Pine Budworm	Jack Pine	Northern 2/3 of Minnesota	May-July	Larvae from ½ to 1 inch in length on June 24; pupation started on June 27-29; moth emergence started on July 1. The population was still down in 1971, with some spots showing light defoliation in Crow Wing and Pine Counties. Populations are expected to increase sharply in 1972.
Colopha ulmicola (Fitch) Elm Cockscomb Gall Aphid	Elm	Scattered	June-July	Only a few observations, light to moderate populations.
Chrysomela scripta Fabricius Cottonwood leaf beetle	Poplar	West Central & SW Minnesota	August	Severe defoliation on willow in west central Minnesota - widespread
Cryptorhynchus lapathi (Linnaeus) Poplar & Willow Borer	Populus sp.	Carver, Swift Aitkin, Carlton, St. Louis Counties	June-July	In adult stage first part of July; larval & pupal stages June 23.

Forest Insect	Host	Location	Observation Date	Comments
Dendroctonus valens Leconte Red Turpentine Beetle	Pines	Itasca County	July - Oct.	Infesting basal area of Norway pine plantation. Attacking trees dying o: in low vigor.
Dioryctria zimmermani (Grote) Zimmerman Pine Moth	Conifers	Scattered statewide	June-August	Shoot boring in evidence in central Minnesota in mid-July, with drooping laterals. Most damage reported on white and Scotch pine. Larvae about mature the end of June and pupating on July 7-9.
Enargia decolor Aspen Leaf Tier	Aspen	North Central & NE Minnesota	May-August	Very light compared to preceeding several years
Ennomos subsignarius (Hubner) Elm Spanworm	Various broadleafs	Aitkin County	July	Light defoliation on lowland hardwoods on Willow River north of Palisade.
Eriophyes betulae	Paper birch	Northern Minn.	April-October	A small "witch's brooming" very common in 1971.
Eriophyes fraxiniflora Ash flower gall	Green ash	Scattered	June-October	Very common but seldom reported.
Eriosoma americanum (Riley) Wooly Elm Aphid	American Elm	Central & S-central Minn.	Late June-early July	Commonly reported in 1971. Some shade tree control.
Fenusa pusilla (Lepeletier) Birch Leaf Miner	Paper birch	Scattered	June-July	Mining within leaves in Twin City area on June 4
Fenusa ulmi Sundevall Elm Leaf Miner	Elm	Central Minn.	June-July	Very common, although less than 1970. Slippery elm especially affected.
Gobiashia ulmifusus	Slippery Elm	Hennepin County	Late June	A heavy infestation of this gall aphid observed in western Hennepin Cty.

Forest Insect	Host	Location	Observation Date	Comments
Hemerocampa leucostigma (J.E. Smith) White Marked Tussock	Various broadleafs	South central Minnesota	Early July	Moderate to high populations in scattered locations in St. Paul and Minneapolis.
Hylobius radicis Buchanan Pine Root Collar Weevil	Conifers	Widespread	May-October	Almost all reported problems on Scotch pine. Last instar larvae and pupation in mid-July Some private control.
Hyphantria cunea (Drury) Fall Webworm	Shade Trees	Scattered statewide	Mid July and late Aug.	Many more reports and observations in 1971 than in 1970.
Ichthyura inclusa Hubner Poplar tentmaker	Aspen	Koochiching County	June-early July	½ inch long on June 15. One inch in length on June 23. Populations very low.
Lecanium fletcheri Cockerall Fletchers scale	Arbor-vitae	Southern 1/3 of state	July	Fletcher's scale crawlers appearing on July 2.
Lepidosaphes ulmi (Linnaeus) Oystershell scale	Various broadleafs	Scattered	May-October	Eggs collected in east central Minnesota Started hatching on June 1.
Mordwilkoja vagabunda (Walsh) Poplar vagabond aphid	Aspen	Northern Minnesota	May-June	Scattered locations, low populations
Neodiprion pratti banksianae Rohwer Jack Pine Sawfly	Jack pine	Central & east central Minn.	June-early July	First instars observed on June 4; pupation started in late June. Populations were generally low.

Forest Insect	Host	Location	Observation Date	Comments
Neodiprion lecontei (Fitch) Red-headed pine sawfly	Jack Pine Norway Pine	Central to N. Minn.	July-August	Larvae in last larval instar on August 20 in east central Minnesota. Last instar larvae recorded about three weeks earlier than that in Anoka and Washington Counties. Populations very light to moderate except two locations in Anoka Cty. Overall statewide increase from 1970.
Neodiprion nanulus Schedl Red Pine Sawfly	Jack Pine	Cass and Crow Wing Ctys.	Late June-early July	More larvae collected than in 1970.
Neodiprion maurus	Jack Pine	East Central Minnesota	July	Very low numbers
Neodiprion rugifrons	Jack Pine	St. Louis and Aitkin County		Spotty roadside defoliation on old needles. In fifth instar on July 23.
Neodiprion swainei Middleton Swaines Jack Pine Sawfly	Jack Pine	Aitkin County	Mid-July	Several feeding clusters collected from two locations.
Nymphalis antiopa (Linnaeus) Spiny Elm Caterpillar	Various broadleafs	Statewide	June-August	Scattered spots of heavy defoliation, especially in late June on forest and shade trees. The most common host was elm with willow, hackberry, aspen and silver maple also being reported.

Forest Insect	Host	Location	Observation Date	Comments
Petrova albicapitana (Busck) Pitch Nodule Maker	Jack Pine	Central and east central Minn.	April-October	More common in 1971. Larvae ½ inches long on May 13.
Phobetron pithecium (J.E. Smith) Hag moth	Scarlet maple	Sherburne Cty.	Early Sept.	Moderate population on one tree. Larval stage in early Sept.
Pikonema alaskensis (Rohwer) Yellow-headed spruce sawfly		Northern Minn.	June-July	Larvae first observed on May 27. On July 9, larvae in mid to late instars. Damage scattered in spruce plantations and roadside plantings at about the same problem level as in 1970. Some private acreage control.
Pineus strobi (Hartig) Pine Bark Aphid	Pines	Widespread	May-October	Eggs appeared ready to hatch on May 17 in central Minnesota. Populations lower than 1970.
Pissodes strobi (Peck) White Pine Weevil	Conifers	Scattered statewide	May-October	Damage mostly light and scattered. Most requests for help on blue spruce damage.
Pristophora geniculata (Hartig) Mountain ash sawfly	Mountain ash	Carlton County	July-Sept.	
Prociphilus tesselatus (Fitch) Wooly Alder Aphid	Alder-Silver maple	East Central Minnesota	July-Sept.	

Forest Insect	Host	Location	Observation Date	Comments
Retinodiplosis resinicola Pitch Pine Midge	Jack Pine	Northern & east central Minn.	May-July	Light to moderate populations widely scattered. Larvae 1/8 inch long on May 17; in pupal stage on May 28.
Saperda calcarata Say Poplar borer	Poplar	Widespread	July	Adult borers observed on July 16 in central Minn.
Saperda vestita Say Linden borer	Basswood	Southern Minn.	July-August	Present in several nurseries in southern Minn.
Tomostethus multicinctus (Roh.) Brown headed Ash Sawfly	Ash	Central Minn.	June	Scattered light populations, especially in Twin City area. Green Ash main host. Larvae ½ inch in length on June 7.
Toumeyella numismaticum (Pettit and McDaniel) Pine Tortoise Scale	Jack Pine	Central and east central Minn.		Only scattered reports. Some high populations in northern Pine Cty. Eggs started hatching in this area on June 22-24.

DUTCH ELM DISEASE**

Two thousand, two hundred and twenty-three samples were processed in the Minnesota Department of Agriculture's Dutch Elm Disease Laboratory in 1971. A total of 873 were diagnosed positive. In addition to this, the University of Minnesota Plant Disease Clinic diagnosed 89 positive, 90 by St. Paul and 116 by Austin, bringing the total positive cases to 1168.

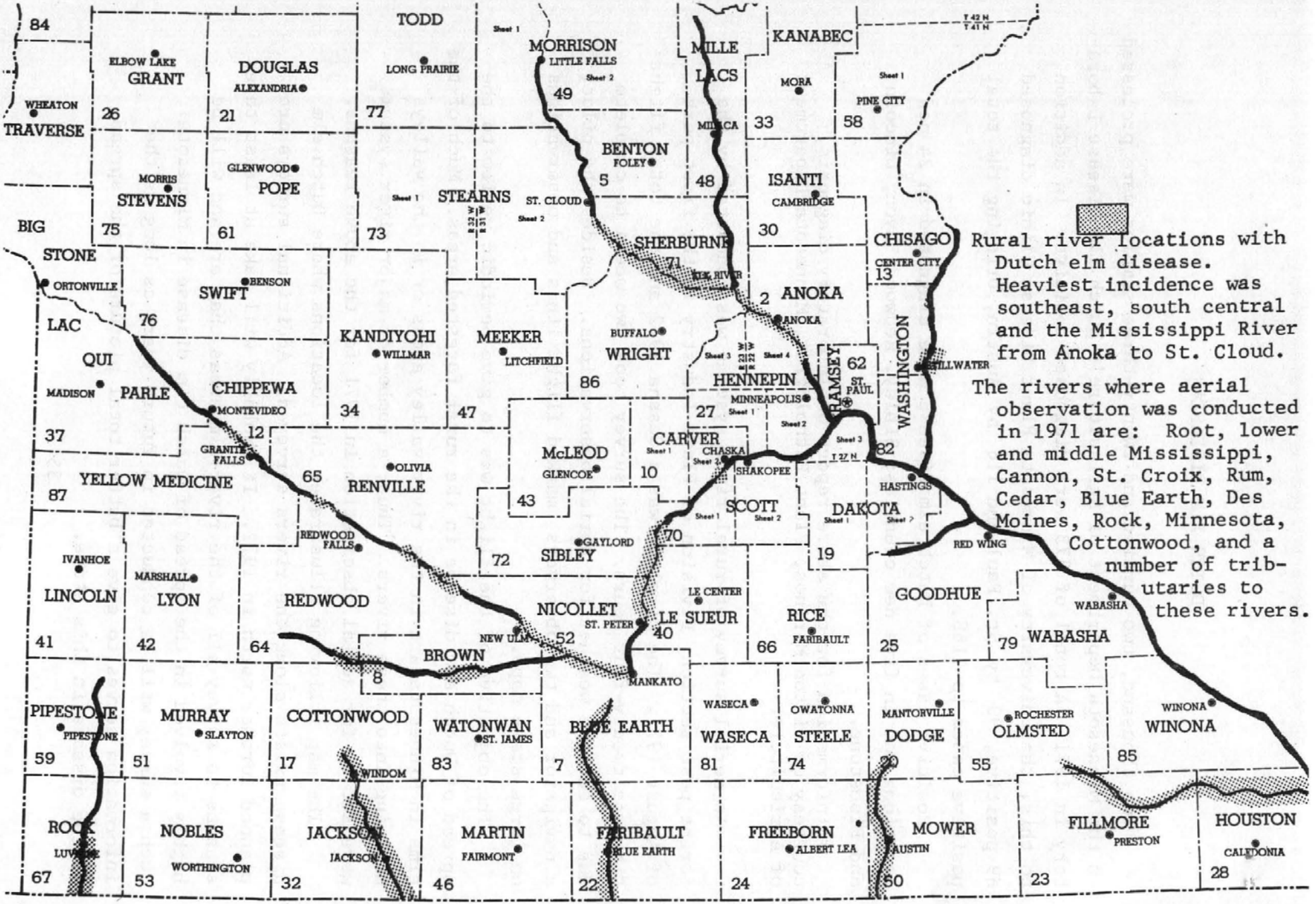
Positive cases of Dutch elm disease were diagnosed in 24 new locations and in five new counties; Sibley, Redwood, Lyon, Lincoln and Pipestone.

**Information for the above report on laboratory diagnosis, courtesy of Milton Marinos, Plant Pathologist, Minnesota Department of Agriculture.

An aerial survey of rural river systems was conducted by the forest pest section, Division of Plant Industry in the first part of August 1971. The airplane was a Cessna 1972 and the total flight time was twenty-four hours. The survey took two weeks to complete due to adverse weather for aerial observations. Besides the pilot, a navigator and two observers marked flight lines and observations on large scale maps.

The objective of the flight was to give periodic review to the spread of Dutch elm disease in the rural forested areas. Much of the elms in Minnesota are in the river valley areas or in the valleys draining into these rivers. Thus, a number of major river systems were set up for aerial observation in 1971 for the above reasons.

The map following illustrates the locations where Dutch elm disease exists along the rivers surveyed. Additional surveys are planned further north in 1972. It probably will take at least three seasons to survey all of the river-elm areas that are and will be highly involved in the spread of Dutch elm disease in Minnesota. Such a survey will be conducted in future years as long as the information serves to give a better total picture of the spread of the disease in this state.



Rural river locations with Dutch elm disease. Heaviest incidence was southeast, south central and the Mississippi River from Anoka to St. Cloud.

The rivers where aerial observation was conducted in 1971 are: Root, lower and middle Mississippi, Cannon, St. Croix, Rum, Cedar, Blue Earth, Des Moines, Rock, Minnesota, Cottonwood, and a number of tributaries to these rivers.

SHOESTRING ROOT ROT

Armillaria mellea (Vahl.)

A number of jack and Norway pine forest plantations were evaluated for pest problems in 1971 when considerable dieback and mortality was taking place. In all cases, both bark beetles and Armillaria mellea were present. In two locations there was moderate to heavy scar damage from the Saratoga spittlebug. Most of the problem areas had moderate to severe drought conditions in 1969 and 1970.

After evaluating the adverse factors that were or had been present in the problem locations, it still appeared that Armillaria could be present as a primary agent. In that respect, it was recommended that the severely affected trees be removed including the larger roots.

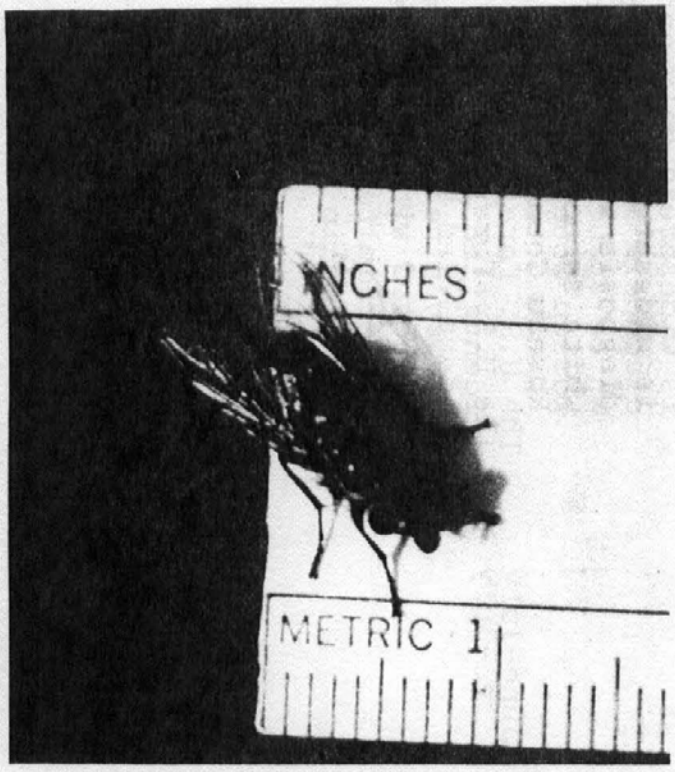
There are many additional forest stands and plantations in Minnesota that have problems similar in appearance to the plantations and stands discussed above. It is a good possibility that with more evaluation in 1972 there will be additional locations that have both primary and secondary damage by Armillaria.

The counties where Armillaria is recorded as causing damage are Itasca, Isanti, Hubbard, Anoka, Mille Lacs and St. Louis.

OTHER DISEASE PROBLEMS IN 1971

Disease	Host	Location	Observation Date	Comments
Gloeosporium sp. Anthracnose	Various broadleafs	Widespread	May-July	Many samples received where this leaf fungus affected oak, linden and maple especially.
Balsam Fir Dieback	Balsam fir	Northern half of Minnesota	April-Nov.	A considerable amount of balsam fir dieback resulted in 1971 in scattered locations throughout northern Minn. Both insect and disease possibilities were evaluated in numerous locations with negative results. It is most probable that the balsam fir trees (mostly on shallow or light soils) were severel affected by drought in 1969 and 1970. Considerable mortality also occurred in 1970.
Coleosporium asterum (Diet.) Pine Needle Rust	Norway Pine	Widespread	May-July	Many reports received on this problem involving plantation Norway pine. The three year old needles contained over 90% of the rust present.
Chrysomyxa ledicola (Lagh.) Spruce Needle Rust	Black Spruce	Northern half of Minnesota	Sept.-Nov.	This needle rust of swamp black spruce is causing spotty, but considerable defoliation which is causing alarm to the Christmas tree industry that buys stumpage in the problem locations.

Disease	Host	Location	Observation Date	Comments
Cronartium quercum Pine Oak Rust (Hedge & Long)	Jack & Scotch Pine	Widespread	May-October	Causing damage in some locations, especially Hubbard County. Zimmerman pine moth in a percentage of the galled areas.
Diplodia pinea (Desm.) Diplodia needle blight	Conifers	Very widely scattered	July-Sept.	One severe case on Austrian pine in southern Washington County. The other report and identification was on blue spruce from Meeker County.
Gnomonia leptostyla (Fr.) Leaf spot	Black Walnut	Southern 1/3 of Minnesota	May-July	Several samples received from walnut in south central and SE Minnesota. Also, a minor problem in new forest plantations.
Rhizosphaera kalkoffi (Bud.) Needle cast	Spruce	Roseau County	Late May	Although this needle cast is widespread only one diagnosis was made from a white spruce sample from Roseau County.
Scleroderris lagerbergii Scleroderris canker (Grem.)	Conifers	Lake & Cook Counties	June-July	The U.S. Forest Service identified additional Norway pine plantations affected with Scleroderris canker in Lake & Cook Counties in 1971.



Sarcophaga aldrichi, the primary parasite of the pupal stage of the forest tent caterpillar and other defoliators.

Labrador tea, very common evergreen shrub in the bogs of coniferous forests, especially black spruce. This is one of the alternate hosts of a spruce needle rust, Chrysomyxa sp.

Leatherleaf in flower, also found in the coniferous bogs with Labrador tea, and also one of the two principal alternate hosts of the spruce needle rust that is a present problem on the smaller sized black spruce trees.