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FOREST INSECT CONDITIONS  
IN ARIZONA AND NEW MEXICO -- 1956

by

F. M. Yasinski and D. A. Pierce



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by  
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<sup>1/</sup> Rocky Mountain Forest and Range Experiment Station, Forest Service, U. S. Department of Agriculture; central headquarters at Fort Collins, in cooperation with Colorado State University.

About the Cover: The ominous-looking creature shown is an enlargement of a Black Hills beetle with wings spread ready for takeoff



## SUMMARY

The 1956 aerial and ground surveys revealed an increase in insect-caused mortality in Arizona and New Mexico. Based on these surveys and current data from established pine mortality plots, approximately 191 million board-feet of commercial timber, valued at 2 million dollars<sup>2/</sup> was killed by insects in 1955.

Epidemic infestations in 1956 totaled 1.6 million acres. The extent and severity of pine bark beetle damage showed a marked increase. Douglas-fir beetle activity increased. Fir engraver beetle continued to deplete the white fir stand in the Sandia Mountains of the Cibola National Forest. An unidentified needle miner became epidemic on ponderosa pine. Defoliation of Douglas-fir, true fir, and spruce by the spruce budworm declined. The Great Basin tent caterpillar outbreaks remained unchanged.

## INTRODUCTION

This report covers the status of the major forest insect pests in Arizona and New Mexico as determined by aerial and ground surveys conducted in 1956, and from pine mortality plots. Trees killed by bark beetles usually fade 1 year after initial attack; consequently, the figure for bark beetle damage from the 1956 aerial survey is related to 1955 losses. Defoliation damage is current unless stated otherwise. Epidemic infestations in Arizona and New Mexico as recorded by the aerial survey of 1956 are summarized in tables at the end of this report.

## METHODS OF EVALUATING FOREST INSECT DAMAGE

### Aerial Survey

The sawtimber area of Arizona and New Mexico (10,739,000 acres) was completely and systematically covered by an aerial survey for the first time in 1956. Aerial procedures and techniques employed were developed by the Pacific Northwest Forest and

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<sup>2/</sup> Forest Service stumpage prices, 1955.

Range Experiment Station.<sup>3/</sup> Invaluable assistance was given by Mr. W. J. Buckhorn, entomologist from the Portland Forest Insect Laboratory, in the training of aerial observers, A. E. Landgraf and F. M. Yasinski.

The survey began on June 26 and ended August 24. Total flying time was 112.7 hours. The plane used was a Cessna 180. Except for parts of the Carson and Santa Fe National Forests, where some contour flying was necessary, the region was flown on a grid system; flight lines were spaced 4 miles apart. All flying was done during early morning and from an altitude of approximately 800 feet. Tracking and sketching was done on maps scaled 1/4 inch = 1 mile.

The overall distribution of the needle miner epidemic was mapped from the air; the appraisal of the seriousness of the damage was made by ground examinations.

The degree of defoliation of aspen by the Great Basin tent caterpillar was impossible to determine in certain localities, since refoliation had occurred at the time of the survey. For the most part, however, refoliated areas could be recognized from the air, making it possible to delineate the 1956 infestation and obtain a useful picture of current overall distribution.

Classification standards used in aerial mapping of spruce budworm damage are:

<u>Degree of defoliation</u>	<u>Description of classification</u>
Light	Defoliation light, barely visible from air
Moderate	Top one-fourth of tree defoliated
Heavy	Half of tree defoliated; topkilling in progress
Very heavy	Three-fourths of tree defoliated; severe; some tree killing in progress
Dead	Defoliation complete; general tree killing

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<sup>3/</sup> Wear, J. F., and Buckhorn, W. J. Organization and Conduct of Forest Insect Aerial Surveys in Oregon and Washington. U. S. Forest Serv. Pacific Northwest Forest and Range Expt. Sta., 40 pp., illus. March 1955. (Processed)



Classification standards used in aerial mapping of the intensity of bark beetle infestations are:

<u>Intensity of infestation</u>	<u>Description of classification</u>
	(Ponderosa pine)
Light	20 to 50 trees per section; 5 trees or less per group
Moderate	50 to 100 trees per section; 10 trees or less per group
Heavy	100 to 200 trees per section; 20 trees or less per group
Very heavy	200 or more trees per section; large groups
	(Mixed conifer -- predominantly Douglas-fir or true firs)
Light	20 to 50 trees per section; 5 trees or less per group
Moderate	50 to 150 trees per section; 15 trees or less per group
Heavy	150 to 300 trees per section; 30 trees or less per group
Very heavy	300 or more trees per section; large groups
	(Spruce)
Light	20 to 50 trees per section; 5 trees or less per group
Moderate	50 to 150 trees per section; 15 trees or less per group
Heavy	150 to 300 trees per section; 30 trees or less per group
Very heavy	300 or more trees per section; large groups

#### Ground Survey

Generally, both aerial and ground examinations are necessary to get a complete picture of an infestation. The degree of insect-caused damage throughout an infested area can be delineated by aerial examination. This does not, however, provide sufficient

information for evaluating insect population where control measures may be required. Supplemental ground checks were made of all major infested areas mapped from the air.

Where detailed quantitative information is desired, an appraisal survey is necessary. During 1956 the Albuquerque Laboratory conducted two appraisal surveys: one on the Black Hills beetle, Navajo Indian Reservation; and the other on the spruce budworm, Mt. Taylor Cibola National Forest.

### Pine Mortality Plots

To determine annual losses caused by insects in the ponderosa pine stands of the region, 43 plots were established in 1953 and 1954. The plots are to be cruised each year and the data will be used in determining annual loss.

## MAJOR FOREST INSECT PESTS

### Pine Bark Beetles

#### Dendroctonus spp.

Several bark beetle species were associated in recently killed ponderosa pine. Egg galleries of the southwestern pine beetle, Dendroctonus barberi Hopk., (fig. 1A) and the roundheaded pine beetle, Dendroctonus convexifrons Hopk., (fig. 1B) were most numerous; those of the Colorado pine beetle, Dendroctonus approximatus Dietz, were occasional. Insects killed 137 million board-feet of pine sawtimber in Arizona and New Mexico in 1955. Southwestern and roundheaded pine beetle epidemics on 210 centers representing the 1955 kill totaled 425,260 acres.

The largest centers of heavy infestation were the Bandelier-Los Alamos area on the Santa Fe National Forest, Datil area on the Cibola National Forest, and Mimbres area on the Gila National Forest. The areas are in New Mexico and have received subnormal precipitation for the past several years.

Sanitation-salvage logging is being advantageously applied in some areas and should be continued in 1957.

Table 1. --Distribution of damage caused by Dendroctonus spp., 1956 data

Class	Arizona	New Mexico	Total
of	(122 centers	(88 centers	(210 centers
infestation	:of infestation)	:of infestation)	:of infestation)
	- - - - - acres - - - - -		
Light	149,980	80,040	230,020
Moderate	20,060	58,060	78,120
Heavy	17,400	55,780	73,180
Very heavy	2,180	41,760	43,940
<b>Total</b>	<b>189,620</b>	<b>235,640</b>	<b>425,260</b>



A. Southwestern pine beetle,  
D. barberi Hopk.

B. Roundheaded pine beetle,  
D. convexifrons Hopk.

Figure 1. --Adult species of Dendroctonus.

### Roundheaded pine beetle

In addition to the damage caused by this insect in association with other pine beetles, pure attacks by the roundheaded pine beetle were found in 2 areas totaling 260 acres in Arizona in 1956.

One area of 100 acres was in Oak Creek Canyon on the Coconino National Forest, and the other 160 acres was on Mt. Graham, Corona National Forest. The latter infestation is apparently static. Results of a small pilot-control project in Oak Creek Canyon during June 1956 will be available in 1957.

### Black Hills beetle

The Black Hills beetle, Dendroctonus ponderosae Hopk., (fig. 2), showed greater aggressiveness in 1955 than previously. Beetle activity was epidemic on 14 centers totaling 17,430 acres of ponderosa pine in northern New Mexico. Distribution of this damage is as follows: 13 centers totaling 10,720 acres of light infestation on the Carson National Forest, and one center (6,710 acres) on the Navajo Indian Reservation.



Figure 2. --Black Hills beetle adult, Dendroctonus ponderosae Hopk.

The increase is confined to the Carson National Forest (fig. 3). Chemical control and control by logging have decreased the long established Tusas outbreaks, but beetle activity has now appeared outside the old infestation boundary. The Navajo Indian Reservation outbreak is subsiding because of direct control action during the past 2 years.



Figure 3. --Ponderosa pine killed by Black Hills beetle, Dendroctonus ponderosae Hopk., Carson National Forest, New Mexico.

The Forest Service and Bureau of Indian Affairs treated 180 infested trees during 1956; 100 on the Carson National Forest and 80 on the Navajo Indian Reservation. No control is planned by the Forest Service for the Carson National Forest in 1957. The Bureau of Indian Affairs plans to treat approximately 60 trees with a water emulsion of ethylene dibromide during 1957.

## Pine Engraver Beetle

Epidemic centers of pine engraver beetle, Ips spp., are increasing throughout the region. In 1955 there were 7,860 acres of epidemic damage, most of which is in ponderosa pine reproduction and pole-sized timber. Heavy infestations cover 5,500 acres of reproduction on Glorieta Mesa, Santa Fe National Forest, but no control is warranted.

## Fir and Spruce Beetles

### Douglas-fir Beetle

The Douglas-fir beetle, Dendroctonus pseudotsugae Hopk., continues to be a serious enemy in Douglas-fir stands throughout Arizona and New Mexico. This insect killed 30.6 million board-foot in 1955, or about double that in 1954. The difference of board-foot loss in the 2 years may not be entirely due to increased beetle activity, but to the more complete coverage by the 1956 aerial survey of forested areas in both States. Much of the area is inaccessible or of low economic value.

Table 2. --Acreage of epidemic infestation of Douglas-fir beetle, 1956

Class	Arizona	New Mexico	Total
of	(55 centers	(157 centers	(212 centers
infestation	: of infestation)	: of infestation)	: of infestation)
	- - - - - acres - - - - -		
Light	3,860	134,890	138,750
Moderate	3,660	172,870	176,530
Heavy	300	116,520	116,820
Very heavy	0	4,460	4,460
Total	7,820	428,740	436,560

## Fir Engraver Beetle

Intensive aerial survey of the fir engraver beetle, Scolytus ventralis Lec., (fig. 4) infestation in white fir in the Sandia Mountains in July and the latter part of August defined the epidemic area and intensity of kill. Comparison of the 1955 damage to 1953-54 losses reveals little change in the trend of the infestation. The board-foot loss for 1955 is 5.2 million on 6,880 acres. Localized areas have suffered 80-percent mortality since the beginning of the outbreak in 1948. Limited salvage of dead and dying white fir is in progress.

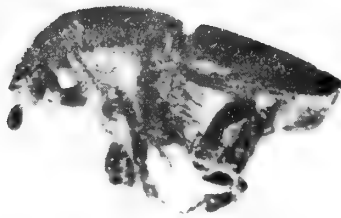


Figure 4.--Adult fir engraver beetle,  
Scolytus ventralis Lec.

## Western Balsam Bark Beetle

Little is known about past loss of alpine and corkbark fir caused by the western balsam bark beetle, Dryocoetes confusus Sw. in Arizona and New Mexico. This insect destroyed 14.2 million board-feet of timber in 1955. In 1956, epidemic infestations covered 121,930 acres, with serious losses on the Santa Fe and Carson National Forests.

## Engelmann Spruce Beetle

The small outbreak of the Engelmann spruce beetle, Dendroctonus engelmanni Hopk., on the Tres Piedras District, Carson National Forest, decreased from 500 attacked trees in 1955 to 250 in 1956. Heavy woodpecker feeding is keeping the beetle population in check. This insect killed approximately 3.2 million board-feet of Engelmann spruce in 1955.

Summary of estimated volume of sawtimber killed annually by major bark beetles in Arizona and New Mexico for the years 1952-55 is shown in figure 5.

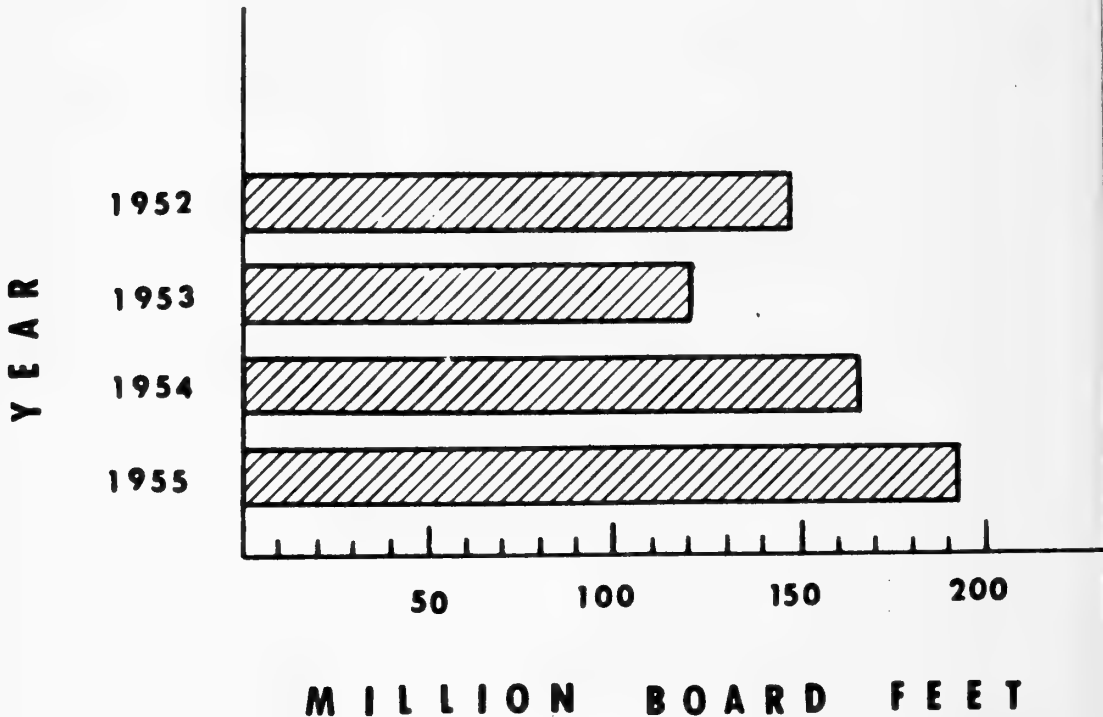


Figure 5. --Estimated volume of sawtimber killed by major bark beetles in Arizona and New Mexico, 1952-55.



## Defoliators

### Spruce Budworm

Spruce budworm, Choristoneura fumiferana (Clem), defoliation has, for the most part, decreased sharply throughout the region (fig. 6).

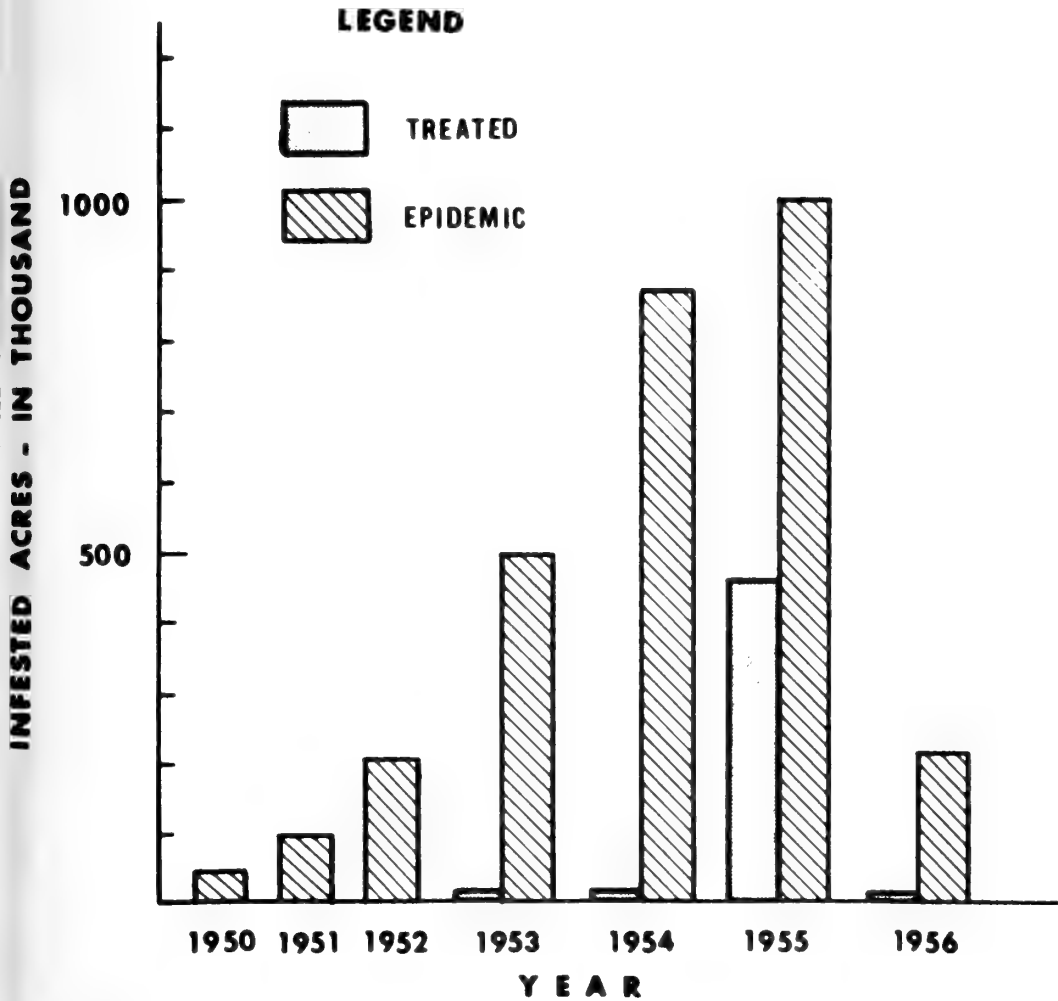


Figure 6. --Progress of spruce budworm in Arizona and New Mexico, 1950-56.

Approximately 11,520 acres of mixed conifers are moderately infested on the Mescalero Indian Reservation. Infested acreage dropped from 434,700 in 1955 to 201,420 in 1956. Defoliation is

light in most areas. During 1956, some 6,000 acres of spruce-fir type, moderately infested with the spruce budworm, were successfully treated by the aerial application of DDT (fig. 7). Budworm mortality was 89 percent. Because of the decline of budworm population and the generally light to moderate intensity of current infestations, control is not contemplated for 1957.



Figure 7. --DC3 spray plane applying DDT on Mt. Taylor spruce budworm infestation, Cibola National Forest, New Mexico, 1956.

### Needle Miner

An epidemic of a needle miner, Recurvari spp., developed in ponderosa pine east of Springerville, Arizona, and near Datil, New Mexico. Total acreage of pine infested is 49,760. Percentage

of 1955 needles mined ranged from 35 to 50. No mortality has occurred.

Surveying needle miner damage from the air was difficult. A needle cast fungus attacking the 1955 needles caused foliage discoloration similar to that caused by the needle miner; consequently, all areas suspected of epidemic needle miner damage required verification by a ground inspection.

### Great Basin Tent Caterpillar

The status of the Great Basin tent caterpillar, Malacosoma fragile (Stretch), infestations remained unchanged in 1956. Aspen was defoliated on 296,600 acres, which approximates the entire aspen type of the region. Mortality increased in stands heavily defoliated for several consecutive years (fig. 8).



Figure 8. --Aspen stands severely defoliated by Great Basin tent caterpillar, Malacosoma fragile (Stretch).

## Miscellaneous Pests

### Red Turpentine Beetle

Red turpentine beetle, Dendroctonus valens Lec., has increased rapidly throughout the ponderosa pine type of the region, especially in the drought-stricken areas. All attacks of infested trees except one were secondary. When populations build up, green trees may die.

### Prescott Scale

A flareup of Prescott scale, Matsucoccus vexillorum Morrison, developed on young ponderosa pine on the North Rim of the Grand Canyon National Park in 1956. Scale activity was first observed in the area in 1934. Since then epidemic populations occasionally developed and caused limited damage. Current infestation is approximately 640 acres, but damage is limited to branch killing.

A pilot test to determine the possibility of controlling the scale insect with malathion spray was conducted on 210 acres of infested pine in June 1956.

### Fall Webworm

Defoliation of various broadleaved trees by the fall webworm, Hyphantria cunea (Drury), was localized throughout Arizona and New Mexico. Heaviest population of this insect was in Oak Creek Canyon on the Coconino National Forest.

### Red Spider Mite

Douglas-fir trees in the vicinity of Lost Lodge on the Lincoln National Forest were heavily infested with the red spider mite, Tetranychus telarius L., in 1956. Except for unsightly appearance of discolored foliage on heavily infested trees, no other damage was evident. Approximately 50 acres of Douglas-fir are infested.

### Tiger Moth

Partial defoliation of young ponderosa pine by the tiger moth, Halisidota ingens Hy Edws., (fig. 9) was observed on the Santa Fe

National Forest. Infested trees were widely scattered, with damage usually limited to terminal foliage.

Caterpillars collected for rearing revealed that 35 percent were infested with unidentified parasites, which appear to keep the insect in check.

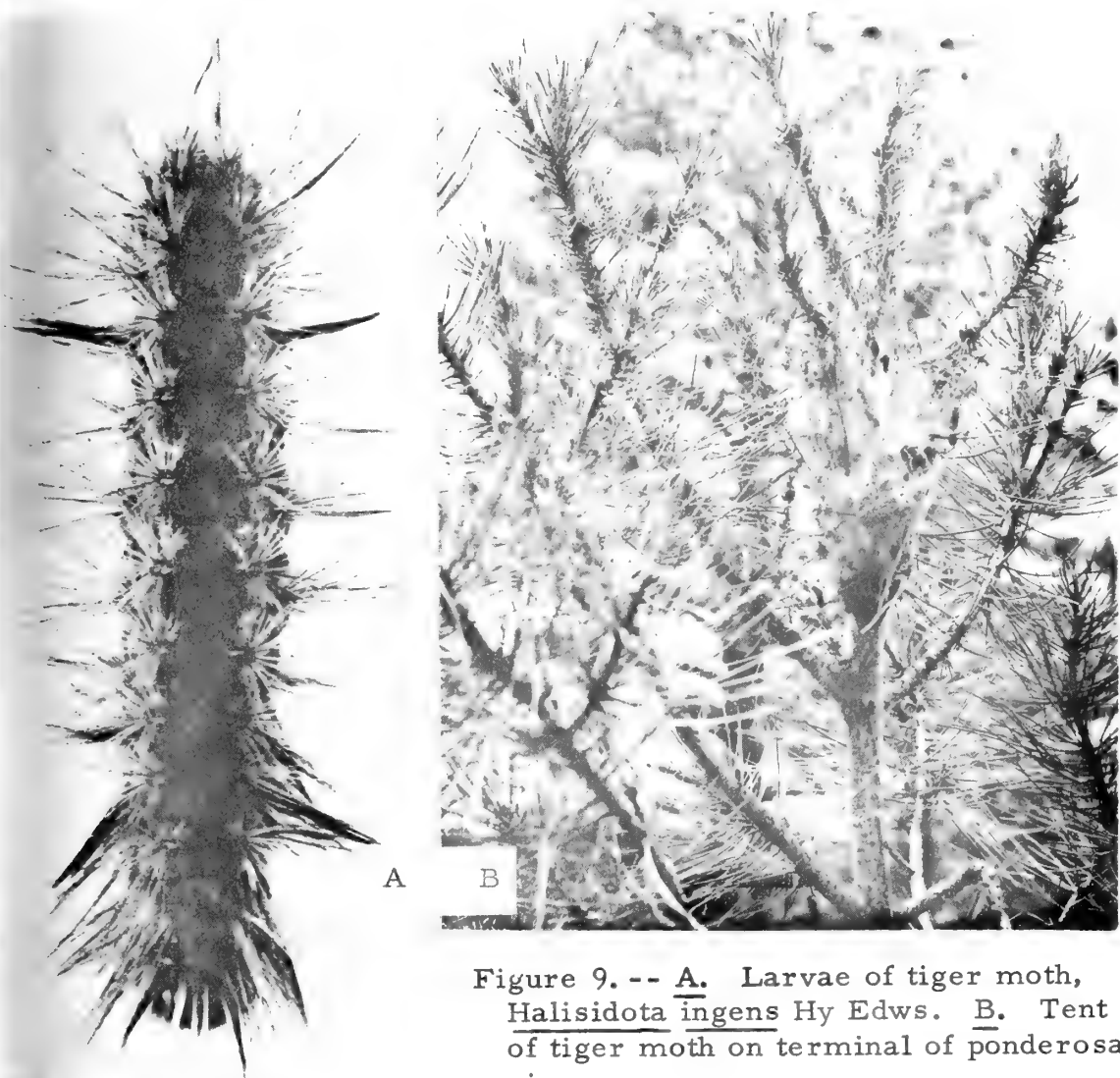


Figure 9. -- A. Larvae of tiger moth, Halisidota ingens Hy Edws. B. Tent of tiger moth on terminal of ponderosa pine.

#### Smaller European Elm Bark Beetle

Dead specimens of the smaller European elm bark beetle, Scolytus multistriatus (Marsh), vector of Dutch elm disease, were collected from a dying Chinese elm tree in Albuquerque. This is believed to be the first record of the insect in New Mexico. Cause of tree death is unknown.

Table 3. --Summary of forest insect epidemics recorded during the 1956 survey in Arizona and New Mexico

Insect	Arizona		New Mexico		Total	
	Centers	Area	Centers	Area	Centers	Area
	No.	Acres	No.	Acres	No.	Acres
<u>Pine Bark Beetles</u>						
(Southwestern pine and roundheaded pine beetles)	122	189,620	88	235,640	210	425,260
Roundheaded pine beetle	2	260	--	--	2	260
Pine engraver beetle	8	2,320	5	5,540	13	7,860
Black Hills beetle	--	--	14	17,430	14	17,430
Subtotal	132	192,200	107	258,610	239	450,810
<u>Fir and Spruce Bark Beetles</u>						
Douglas-fir beetle	55	7,820	157	428,740	212	436,560
Fir engraver beetle	--	--	1	6,880	1	6,880
Western balsam bark beetle	19	9,520	56	112,410	75	121,930
Engelmann spruce beetle	--	--	1	640	1	640
Subtotal	74	17,340	215	548,670	289	566,010
<u>Defoliators</u>						
Spruce budworm	4	154,380	7	47,040	11	201,420
Great Basin tent caterpillar	7	46,000	38	250,600	45	296,600
Needle miner	--	--	2	49,760	2	49,760
Subtotal	11	200,380	47	347,400	58	547,780
Total	217	409,920	369	1,154,680	586	1,564,600

Table 4. --Known infestations of forest insects on forested areas of Arizona by species and intensity of damage, 1956 season

Forested area	Insect	Centers	Intensity of infestations					Total
			Light	Moderate	Heavy	Very heavy	Acres	
			-----					
		No.	-----					
Coconino National Forest	<u>Dendroctonus spp.</u> <sup>1/</sup>	17	1,780	2,120	80	20	4,000	
	Douglas-fir beetle	15	1,160	1,130	--	--	2,290	
	Great Basin tent caterpillar	1	--	--	3,200	--	3,200	
	Roundheaded pine beetle	1	--	100	--	--	100	
	Spruce budworm	1	3,360	--	--	--	3,360	
	Western balsam bark beetle	4	--	660	960	--	1,620	
	Subtotal		39	6,300	4,010	4,240	20	14,570
Coronado National Forest	<u>Dendroctonus spp.</u> <sup>1/</sup>	13	1,070	2,640	4,960	1,920	10,590	
	Douglas-fir beetle	12	70	680	--	--	750	
	Roundheaded pine beetle	1	--	--	160	--	160	
	Western balsam bark beetle	1	180	--	--	--	180	
	Subtotal		27	1,320	3,320	5,120	1,920	11,680
Fort Apache Indian Reservation	<u>Dendroctonus spp.</u> <sup>1/</sup>	23	85,120	2,020	30	--	87,170	
	Douglas-fir beetle	7	1,160	20	--	--	1,180	
	Western balsam bark beetle	7	1,000	240	--	--	1,240	
	Subtotal		37	87,280	2,280	30	--	89,590
Kaibab National Forest	<u>Dendroctonus spp.</u> <sup>1/</sup>	2	330	--	--	--	330	
	Douglas-fir beetle	15	1,140	1,800	300	--	3,240	
	Great Basin tent caterpillar	3	640	1,600	--	13,310	15,550	
	Spruce budworm	1	140,220	1,280	2,240	--	143,740	
	Western balsam bark beetle	3	--	320	480	--	800	
	Subtotal		24	142,330	5,000	3,020	13,310	163,660
Navajo Indian Reservation	<u>Dendroctonus spp.</u> <sup>1/</sup>	16	7,580	980	5,050	40	13,650	
	Great Basin tent caterpillar	3	0	--	--	27,250	27,250	
	Western balsam bark beetle	4	40	3,720	--	1,920	5,680	
	Subtotal		23	7,620	4,700	5,050	29,210	46,580
Prescott National Forest and adjacent land	<u>Dendroctonus spp.</u> <sup>1/</sup>	19	9,880	8,890	2,620	180	21,570	
	Spruce budworm	1	4,780	--	--	--	4,780	
	Subtotal		20	14,660	8,890	2,620	180	26,350
San Carlos Indian Reservation	<u>Dendroctonus spp.</u> <sup>1/</sup>	2	1,610	20	--	--	1,630	
Sitgreaves National Forest	<u>Dendroctonus spp.</u> <sup>1/</sup>	17	41,600	3,340	4,640	--	49,580	
	Douglas-fir beetle	1	10	--	--	--	10	
	Pine engraver beetle	7	--	700	1,600	--	2,300	
	Spruce budworm	1	2,500	--	--	--	2,500	
	Subtotal		26	44,110	4,040	6,240	--	54,390
Tonto National Forest	<u>Dendroctonus spp.</u> <sup>1/</sup>	13	1,010	50	20	20	1,100	
	Douglas-fir beetle	5	320	30	--	--	350	
	Pine engraver beetle	1	--	--	20	--	20	
	Subtotal		19	1,330	80	40	20	1,470
Total		217	306,560	32,340	26,360	44,660	409,920	

<sup>1/</sup> Southwestern pine beetle associated with roundheaded pine beetle.

Table 5.--Known infestations of forest insects on forested areas of New Mexico by species and intensity of damage, 1956 season

Forested area	Insect	Centers	Intensity of infestations				Total
			Light	Moderate	Heavy	Very heavy	
			No.	Acres			
Apache National Forest and adjacent land	<u>Dendroctonus</u> spp. <sup>1/</sup>	4	3,720	2,720	180	--	6,620
	Douglas-fir beetle	14	13,010	3,760	--	--	16,770
	Needle miner (ponderosa pine)	1	1,760	41,600	--	--	43,360
	Subtotal	19	18,490	48,080	180	--	66,750
Carson National Forest and adjacent land	Black Hills beetle	13	10,720	--	--	--	10,720
	<u>Dendroctonus</u> spp. <sup>1/</sup>	7	--	1,280	--	--	1,280
	Douglas-fir beetle	27	11,840	12,000	6,880	--	30,720
	Engelmann spruce beetle	1	--	--	--	640	640
	Great Basin tent caterpillar	17	1,920	20,480	125,920	1,600	149,920
	Spruce budworm	3	33,920	--	--	--	33,920
	Western balsam bark beetle	32	14,400	23,360	16,320	1,600	55,680
Subtotal	100	72,800	57,120	149,120	3,840	282,880	
Cibola National Forest and adjacent land	<u>Dendroctonus</u> spp. <sup>1/</sup>	32	21,060	16,000	34,200	14,240	85,500
	Douglas-fir beetle	27	35,660	22,820	68,500	3,500	130,480
	Fir engraver beetle	1	--	--	2,720	4,160	6,880
	Great Basin tent caterpillar	10	--	--	29,800	--	29,800
	Needle miner (ponderosa pine)	1	--	6,400	--	--	6,400
	Western balsam bark beetle	2	--	480	1,280	4,480	6,240
Subtotal	73	56,720	45,700	136,500	26,380	265,300	
Gila National Forest and adjacent land	<u>Dendroctonus</u> spp. <sup>1/</sup>	18	35,340	24,650	11,120	12,520	83,630
	Douglas-fir beetle	17	17,190	12,660	--	--	29,850
	Western balsam bark beetle	1	--	10	--	--	10
Subtotal	36	52,530	37,320	11,120	12,520	113,490	
Jicarilla Apache Reservation	<u>Dendroctonus</u> spp. <sup>1/</sup>	3	3,520	1,760	--	--	5,280
	Douglas-fir beetle	19	5,760	18,400	2,880	--	27,040
	Subtotal	22	9,280	20,160	2,880	--	32,320
Lincoln National Forest	<u>Dendroctonus</u> spp. <sup>1/</sup>	6	2,860	4,170	--	--	7,030
	Douglas-fir beetle	22	13,510	37,480	7,680	--	58,670
	Great Basin tent caterpillar	4	--	--	26,720	--	26,720
	Pine engraver beetle	1	--	40	--	--	40
	Spruce budworm	3	5,120	6,400	--	--	11,520
Subtotal	36	21,490	48,090	34,400	--	103,980	
Navajo Indian Reservation	Black Hills beetle	1	6,710	--	--	--	6,710
	<u>Dendroctonus</u> spp. <sup>1/</sup>	1	20	--	--	--	20
	Western balsam bark beetle	3	20	400	--	--	420
Subtotal	5	6,750	400	--	--	7,150	
Santa Fe National Forest and adjacent land	<u>Dendroctonus</u> spp. <sup>1/</sup>	17	13,520	7,480	10,280	15,000	46,280
	Douglas-fir beetle	31	37,920	65,750	30,580	960	135,210
	Great Basin tent caterpillar	7	--	7,200	32,480	4,480	44,160
	Pine engraver beetle	4	--	1,300	4,200	--	5,500
	Spruce budworm	1	1,600	--	--	--	1,600
	Western balsam bark beetle	18	25,340	11,620	10,560	2,540	50,060
Subtotal	78	78,380	93,350	88,100	22,980	282,810	
Total	369	316,440	350,220	422,300	65,720	1,154,680	

<sup>1/</sup> Southwestern pine beetle associated with roundheaded pine beetle.



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