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Occurrence of Gum Spots in Black Cherry after Partial Harvest Cutting

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Abstract

Bark beetles, primarily the peach bark beetle, *Phlosotribus liminoris* (Harris), are the major cause of gum spots in sawtimber-size black cherry, *Prunus serotina* Ehrh. Approximately 90 percent of all gum spots in the bole sections are caused by bark beetles. Gum spots were studied in 95 black cherry trees near Parsons, West Virginia. Over 50 percent of the bark beetle-caused gum spots occurred during the first 2 years following partial harvest cuts. Cambium miners, *Phytobia pruni* (Gross), peach tree borers, *Synanthedon pictipes* (Grote and Robinson) and *S. exidiosa* (Say) caused little degrade in the quality zone of veneer logs or in factory grade 1 and 2 sawlogs.

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Introduction

Black cherry, *Prunus serotina* Ehrh., is a valuable component of the forests in north-central West Virginia. Although second to Pennsylvania in the reproduction of black cherry, West Virginia is a major source of black cherry veneer and sawtimber.

Throughout the commercial range of black cherry, solid wood defects—gum spots or gum—are a serious problem because they reduce the quality of timber lumber and veneer (Rexrode and Baumgras 1984). Abortive attacks by the peach bark beetle, *Phloeotribus liminaris* (Harris), are one cause of gum spots in black cherry. The peach bark beetle is a native insect first recognized as a pest of peach trees in 1850. For the next 65 years, it was a serious pest in peach and cherry orchards in Ohio, New York, and Ontario, Canada (Brooks 1916). Baker (1972) reported that it attacks elm, *Ulmus* L.; mulberry, *Morus* L.; black cherry, wild plum, *Prunus americana* Marsh.; and mountain ash, *Sorbus americana* Marsh. Peach bark beetles have been found in New Hampshire, New York, Pennsylvania, Maryland, Virginia, West Virginia, North Carolina, Arkansas, Ohio, and Michigan; the beetles probably occur throughout the range of *Prunus.*

Gossard (1913) reported that a wild (black) cherry tree 75 feet tall and 14 inches in diameter was killed by peach bark beetles. He also reported that the peach bark beetle and the shot hole borer, *Scolytus rugulosus* (Ratz.), cause gummosis in *Prunus* in Ohio. He stated that although both bark beetles are more commonly associated with weakened and dead trees, it was not unusual for them to attack healthy trees. Attacks on healthy trees were usually unsuccessful, and the beetles were sometimes found in the balls of gum that were abundant on attacked trees (Fig. 1). However, Gossard made no mention of gum spots in wood.

In 1953, near Parsons, West Virginia, C. K. Dorsey observed black cherry trees that produced gum in such large quantities that it flowed from the trees and accumulated on the ground around the tree trunks (Kulman 1964). In 1958, Kulman (1964) found a continuous ring of gum spots in the 1954 and 1955 wood of these trees. About 150,000 board feet of black cherry had been cut from the general area in 1952 and 1953. Tree tops were left intact. Kulman (1964) suspected that peach bark beetles built up in large numbers in the tops and overwintered in nearby healthy trees. Rexrode (1981) described five types of gum spots in the wood of black cherry resulting from abortive attacks of peach bark beetles on healthy trees. Rexrode and Baumgras (1984) found that the peach bark beetles caused 90 percent of all gum spots on the boles of black cherry sampled in West Virginia and Pennsylvania.

The objectives of this study were to determine the occurrence, frequency, and distribution of gum spots by a causal agent in intensively managed stands of black cherry and to determine the effect commercial thinnings have on the occurrence.

Methods and Materials

This study was conducted during 1981-82 on the Fernow Experimental Forest near Parsons in Tucker County, West Virginia. Black cherry trees were selected from three good oak sites (oak SI 70). These second growth stands were initially logged during the 1905-10 logging period. During the late 1930's and 1940's, dead chestnut trees were removed from the area. Then during the 1950's, the initial logging was done by the Forest Service. These 75- to 80-year-old stands contain a variety of Appalachian hardwood species such as red oak, *Quercus rubra* L.; sugar maple, *Acer saccharum* Marsh.; yellow-poplar, *Liriodendron tulipifera* L.; black cherry, white ash, *Fraxinus americana* L.; and basswood, *Tilia americana* L. Annual precipitation averages approximately 55 inches. Study areas are located on northern aspects, and moderate slopes of 40 to 50 percent are common throughout the study areas.

Periodic partial cutting practices were conducted throughout the study period (Table 1). Two areas were harvested using single-tree selection (removing trees 11.0 inches d.b.h. and larger) and a third area was logged using a 17.0-inch diameter-limit practice.

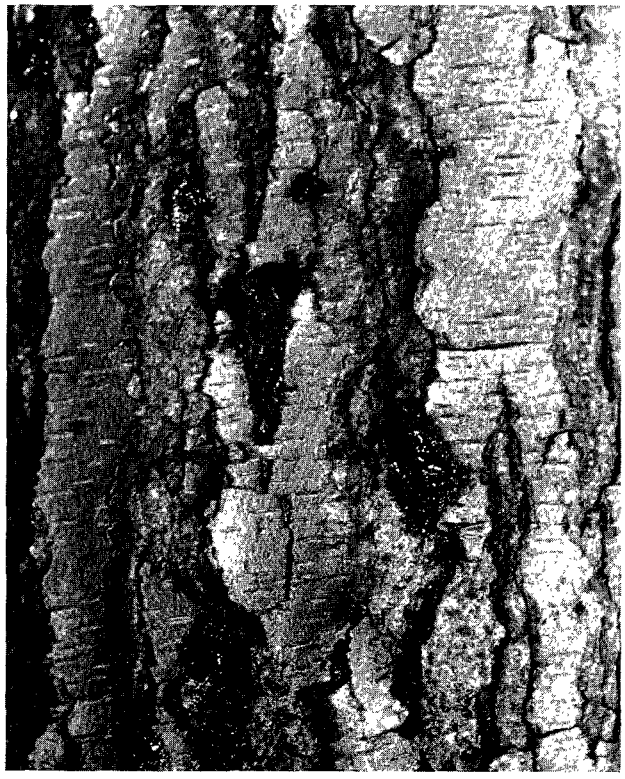

Figure 1.—Balls of gum on black cherry bark, an indication that gum spots occur in the lumber.

Ninety-five trees from the three intensively managed areas were studied for gum production. The trees were felled and a cross section disc, 2 inches thick, was taken from each tree at 1.0 foot and at subsequent 8- to 16-foot log lengths to an 8-inch top, and grouped into six height-class levels—1, 15, 27.5, 37.5, 50, and 56 feet.

One randomly-selected quadrant from each disc was sanded and examined under a stereozoom-binocular microscope. Gum spots were recorded by type and year of occurrence. The total number and area of gum spots on each quarter section were multiplied by four to estimate the number and area of gum spots per disc.

All samples from each study area were combined to determine the average number of gum spots by causal agent for each tree sample-height. To determine the effects of cutting on gum production, the time and intensity of cuttings were compared to the time and occurrence of gum spots. Gum spots were categorized by: bark beetles, peach tree borers, cambium miner, branch stubs, and mechanical wounds.

Results

Gum Spots and Harvest Cutting

Gum spots were present in all trees sampled. Bark beetles caused the most gum spots in the study trees, followed by cambium miner, branch stubs-wounds, and peach tree borers (Table 2).

Gum spots caused by bark beetles occurred nearly every year; however, most occurred during the first 2 years following the partial harvest cutting (Table 2). For the three study areas, number of gum spots caused by bark beetles ranged from 4,179 to 8,968 (Table 2) and 45 to 62 percent of the beetle-caused gum spots occurred within 2 years following logging (Fig. 2). Also gum spots resulting from the lesser peach borer and branch stubs accounted for a minor portion of the total gum spots. For the borers, total gum spots ranged from 0 to 276 while gum spots from branch stubs ranged from 142 to 228. For the borers and branch stubs, no definite gum spot patterns were evident compared with peak years. These data were omitted from Table 2.

Table 1.—Periodic single-tree selection cutting dates and stand per acre data related to intensity of cut for all tree species and black cherry only

Cutting method	Acres	Cutting dates	All tree species						Black cherry					
			Trees[a]		Basal area[a]		Volume[b]		Trees[a]		Basal area[a]		Volume[b]	
			Initial	Cut	Initial	Cut	Initial	Cut	Initial	Cut	Initial	Cut	Initial	Cut
					Ft^2		Ft^3				Ft^2		Ft^3	
Selection	19.6	7-11/55	161	59	115	68	2,662	1,698	15	5	8.8	3.1	192	69
		8/70	172	12	95	15	2,097	387	11	2	9.8	1.9	235	46
Selection	33.6	1-5/52	196	41*	125*	47*	2,808	1,288*	15	3*	9.4	0.9*	209	15*
		9-10/61	170	15	106	16	2,359	380	12	1	9.8	1.1	230	26
		5-6/71	174	15	117	15	2,684	378	10	1	10.3	1.7	252	43
Diameter limit	32.1	2-6/51	186	34	92	37	1,962	919	6	1	3.9	1.0	87	26
		9-10/71	184	22	110	25	2,433	623	5	1	3.9	0.7	96	18

[a]Trees 5.0 inches d.b.h. and larger.

[b]Cubic-foot volumes for trees 5.0 inches d.b.h. and larger to a 4.0-inch top diameter-inside bark (d.i.b.).

*Estimated values.

Table 2.—Occurrence of gum spots[a] by causal agents

Cutting methods	Cutting dates	Sample trees	Bark beetle			Cambium Miner			Lesser peach tree borer			Branch stub-wounds		
			Total gum spots	Peak years	Portion[b] gum spots	Total gum spots	Peak years	Portion[b] gum spots	Total gum spots	Peak years	Portion[b] gum spots	Total gum spots	Peak years	Portion[b] gum spots
		No.	*No.*		*Pct.*	*No.*		*Pct.*	*No.*		*Pct.*	*No.*		*Pct.*
Selection	7-11/55 8/70	36	4,179	1956-57 1971-72 Total	29 16 45	1,288	1910-14 1914-22 1922-32 1932-40 1940-52 1952-74 Total	12 13 9 10 12 15 71	0		—	228	1940-74	70
Selection	1-5/52 9-10/61 5-6/71	29	4,248	1952 1962 1971 Total	27 14 21 62	1,464	1910-14 1914-22 1922-32 1932-40 1940-52 1952-74 Total	12 12 10 13 15 14 76	116	1945-78	82	156	1940-70	70
Diameter limit	2-6/51 9-10/71	30	8,968	1951-52 1972-73 Total	37 19 56	4,916	1910-22 1922-32 1932-40 1940-74 Total	15 13 11 16 55	276	1945-78	80	142	1940-74	68

[a]Includes all sample-tree heights.

[b]Portion (percent) of total number of gum spots occurring during indicated years or time period.

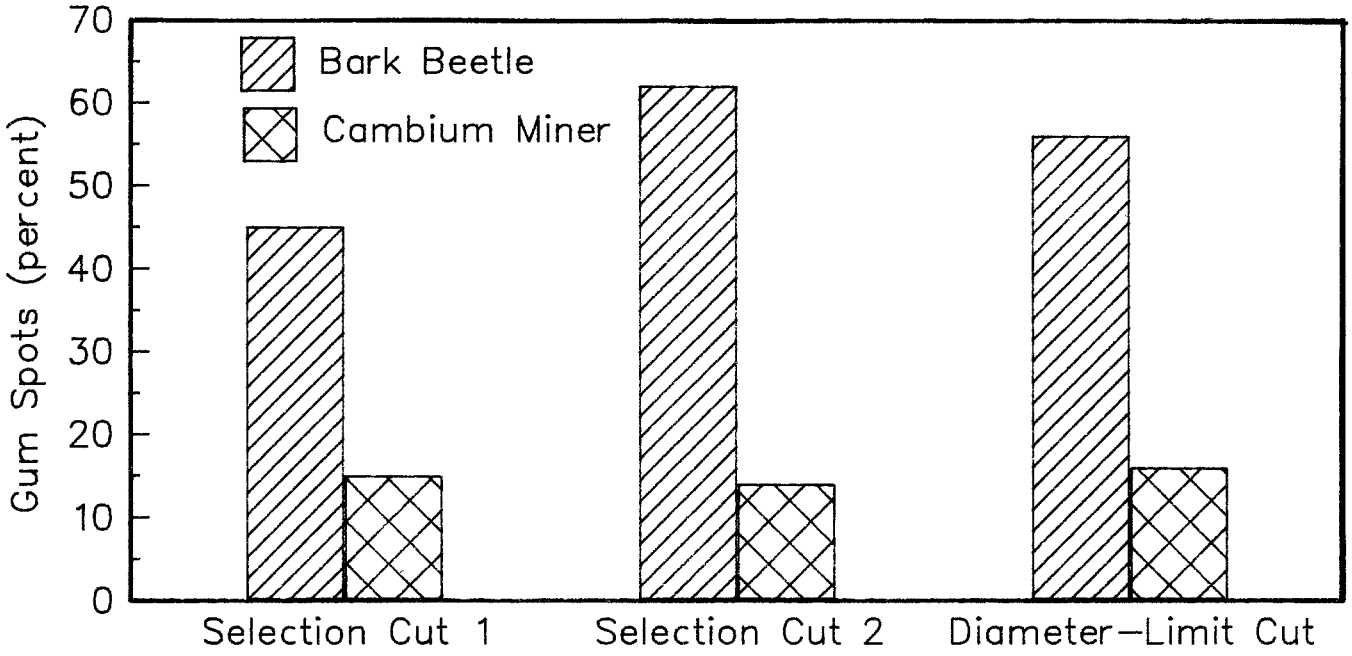

Figure 2.—Gum spots following logging activity as a percentage of total number of gum spots occurring during a 64-year period. Sample period for bark beetles was two growing seasons immediately following two harvest cuts (4 years). The sample period for cambium miner was much longer (24 to 34 years).

The number of beetle-caused gum spots increased in residual trees when the intensity of cut increased. On all three study areas, the cutting intensity was greatest for the initial cut. The highest portion of the gum spots occurred within 2 years after cutting. The cut basal area ranged from 38 to 59 percent of the total and nearly all the basal area was confined to sawtimber-size trees—trees 11.0 inches d.b.h. and larger. Since black cherry slash provides the breeding habitat for beetles, information on black cherry trees removed during each cutting period is summarized in Table 1. In general, the data also indicate that the number of beetle-caused gum spots in residual trees vary with the time of year that cuttings are made.

Gum Spots and Tree Height

Gum spots resulting from abortive attacks or hibernating niches of bark beetles were similar to those that Kulman (1964) and Rexrode (1981) described for *Phloeotribus liminaris* (Harris). Bark beetles caused 90 percent of all gum spots within the log quality zone (sapwood area) defined by (Rast et al. 1973). Over 50 percent of the beetle-caused gum spots occurred in the lowest 16 feet of the boles (Table 3). Bark beetle-caused gum spots decreased with the height of the tree.

Gum spots caused by the cambium miner, *Phytobia pruni* (Gross), were similar to those described by Hough (1963), Kulman (1964), Rexrode and Baumgras (1980, 1984), and Rexrode (1982). The results of this study are similar to the results of an extensive study on cambium miners and gum spots in black cherry by Rexrode and Baumgras in 1980. The number of cambium miner-caused gum spots increased with the height of the tree (Table 3, Fig. 3) with most occurring in the top 32 feet of the trees. Less than 5 percent of the cambium miner-caused gum spots occurred within the log-quality zone. The intensity and time of cut seemed to have no effect on the occurrence of cambium miner-caused gum spots.

Gum spots caused by two species of peach tree borers, the clear-winged moths, *Synanthedon pictipes* (Grote and Robinson) and *S. exitiosa* (Say) occurred in 42 percent of the sample tree, but accounted for less than 2 percent of the total gum spots. Most spots occurred at the 1- and 50-foot levels of the tree (Table 3). Eight percent of the peach tree borer-caused gum spots occurred between 1945 and 1978 when the trees were 35 to 68 years old.

Gum spots associated with branch stubs and mechanical wounds generally occurred between the 27.5- and 37.5-foot levels of the trees, causing about 2 percent of the total gum spots. Most gum spots associated with branch stubs and mechanical wounds occurred between 1940 and 1970 when the trees were 30 to 60 years old.

Discussion and Conclusions

Results of this study indicate that bark beetles, primarily the peach bark beetle, are the major cause of gum spots in the log-quality zone of black cherry trees sampled in West Virginia. Approximately 90 percent of all gum spots in the bole sections were caused by bark beetles. These results are also similar to those reported by Rexrode and Baumgras (1984) for black cherry in the same geographic area.

Bark beetle-caused gum spots are grade defects in both veneer and factory grade sawlogs because most occur in the log-quality zone. The degree of degrade that gum spots cause in veneer- or factory-grade sawlogs depends on the buyer's objective for the finished product and current market conditions. The value of veneer logs usually can be increased if gum defects are reduced.

High-quality black cherry can be maintained and improved in West Virginia if bark beetles are controlled. Bark beetles use the tops (slash) of cut trees for breeding material after commercial partial-harvest cuts are made. The new broods of beetles probably emerged from the cut tree tops and made abortive breeding attacks on the residual crop trees causing gum spots in the wood. Study data indicate that the number of gum spots in residual trees is directly related to the intensity of the previous cutting practice.

The time of year that cuttings are made can affect the size of bark beetle populations and the occurrence of gum spots in residual trees. For example, one would expect higher beetle populations emerging from spring slash than from fall slash. This can be explained by the seasonal history and habits of peach bark beetles (Rexrode 1982). This seasonal history of peach bark beetles (Rexrode 1982) and observation by the senior author, indicate that logging residue from harvest cuts in mid-July to January produces small populations of peach bark beetles because some stages of the developing broods cannot survive the winter. Also, bark beetle broods in the slash are exposed to biological control agents, such as clerid beetles, for a long period of time. Logging residue made during September and October are not attractive for beetle breeding in the fall, probably because it is high in wood moisture content and by spring the residue is too dry to be attractive for breeding. Also, by spring, the residue is usually infested with saprophytes such as *Hypoxylon* spp. which indicates that the material is no longer attractive for beetle breeding.

Results of this study support previous findings that gum spots caused by the cambium miner are not a serious problem in West Virginia black cherry. These results are similar to those reported by Kulman (1964) for black cherry near Parsons, West Virginia. Rexrode and Baumgras (1980) explained why few cambium miner-caused gum spots occur in the log-quality zone and why cambium miners largely can be disregarded by timber managers when producing veneer and factory grade 1 and 2 sawlogs.

Since bark beetles are the major cause of gum spots in black cherry, cultural practices should focus on reducing

Table 3.—Average number and area of gum spots per sample by height and causal agent (average of 95 sawtimber trees from three areas)

Height of collected samples (feet)	Bark beetles		Lesser peach tree borers		Cambium miner		Branch stubs and wounds	
	Gum spots	Area gum spots	Gum spots	Area gum spots	Gum spots	Area gum spots	Gum spots	Area gum spots
	No./sample	In^2	No./sample	In^2	No./sample	In^2	No./sample	In^2
1	80.0	0.33	1.1	0.02	2.4	0	0.3	0.01
15(7-16)	44.0	0.21	0.9	0.01	6.8	0.01	0.6	0.01
27.5(16-32)	33.7	0.23	0.9	0.01	23.0	0.03	2.4	0.06
37.5(32-48)	25.2	0.18	0.9	0.01	30.3	0.05	1.6	0.04
50(48-54)	23.9	0.16	1.4	0.02	61.0	0.07	1.1	0.02
56(54-58)	14.0	0.04	0	0	62.0	0.08	2.0	0.02

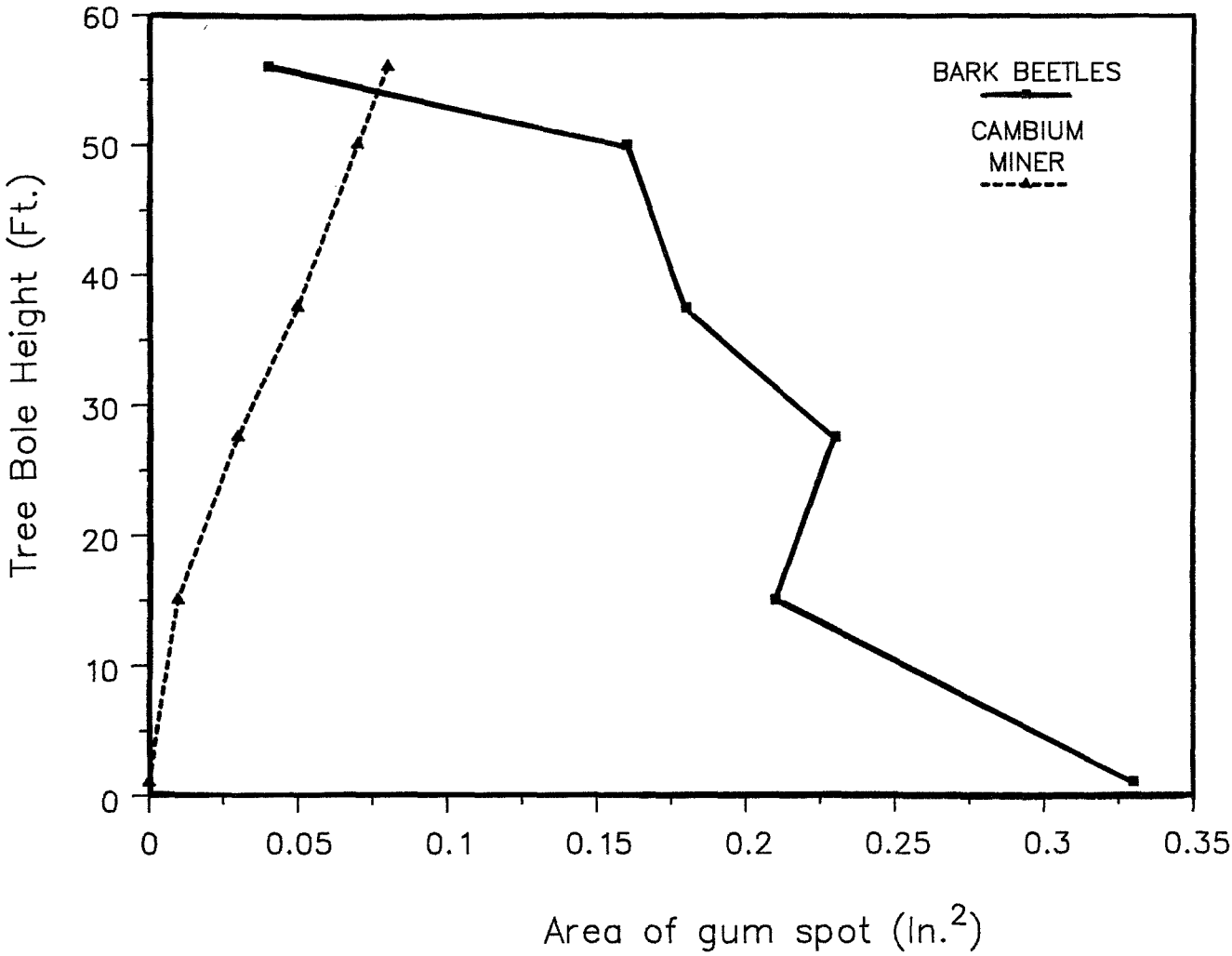

Figure 3.—Number of gum spots per sample caused by bark beetles and cambium miners as related to tree-bole height.

bark beetle breeding habitat. The following recommendations are made for reducing bark beetle populations to improve black cherry quality:

1. Commercially harvest black cherry when logging residue is least conducive to beetle breeding or when the breeding populations in such residue are exposed to biological and environmental control agents for a long period of time. The best time to harvest black cherry stands is from July to January. Resulting bark beetle populations will be minimal.

2. Utilize as much of the logging residue as possible. When possible, use whole-tree chippers or utilize residue for fuelwood before breeding beetles emerge.

3. Since peach bark beetles tend to breed in weakened and dead trees, maintaining vigorous stands will help reduce the number of breeding sites. This can be accomplished by maintaining proper basal areas and stocking levels.

4. Do not leave girdled or chemically treated trees standing in the woods and do not leave felled trees during thinnings or regeneration cuts. The residues provide breeding habitat for bark beetles.

5. If gum spots are of major concern, it might be better to lengthen the rotation and do only light or no thinnings. The value received for gum-free veneer should more than offset the returns from thinning.

6. If harvesting from July to January or utilizing more of the residue is not possible, an alternative could be to avoid thinning black cherry stands after they have attained sawtimber size. Bark beetle populations would not build up and infest the butt and second logs of the tree. Value for veneer purposes would increase though the log diameter would be smaller for the same rotation period.

Literature Cited

Baker, W. L. 1972. **Eastern forest insects.** Misc. Publ. 1175. Washington, DC: U.S. Department of Agriculture. 642 p.

Brookes, F. E. 1916. **Orchard bark beetles and pinhole borers and how to control them.** Farmers' Bull. 763. Washington, DC: U.S. Department of Agriculture. 16 p.

Gossard, H. A. 1913. **Orchard bark beetles and pin hole borers.** Wooster, OH: Ohio Agricultural Experiment Station Bulletin 264. 68 p.

Hough, A. F. 1963. **Gum spots in black cherry.** Journal of Forestry. 61(8):572-597.

Kulman, H. M. 1964. **Defects in black cherry caused by bark beetles and agromizid cambium miners.** Forest Science. 19(3):258-266.

Rast, Everett D.; Sonderman, David L.; Gammon, Glenn L. 1973. **A guide to hardwood log grading (revised).** Gen. Tech. Rep. NE-1. Upper Darby, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 32 p.

Rexrode, C. O. 1981. **Gum spots in black cherry caused by natural attacks of peach bark beetle.** Res. Pap. NE-474. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 5 p.

Rexrode, C. O. 1982. **Bionomics of the peach bark beetle *Phloeotribus liminaris* (Coleoptera: Scolytidae) in black cherry.** Journal of Georgia Entomological Society. 17:388-398.

Rexrode, C. O.; Baumgras, J. E. 1980. **Gum spots caused by cambium miners in black cherry in West Virginia.** Res. Pap. NE-463. Broomall, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 9 p.

Rexrode, C. O.; Baumgras, J. E. 1984. **Distribution of gum spots by causal agent in black cherry and effects on log and tree quality.** Southern Journal of Applied Forestry. 8(1):22-28.

Rexrode, Charles O.; Smith, H. Clay. 1990. **Occurrence of gum spots in black cherry after partial harvest cutting.** Res. Pap. NE-634. Radnor, PA: U.S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 7 p.

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Keywords: Gum spots; bark beetles; peach bark beetle; Cambium miner; peach tree borer; black cherry

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