WHITE PINE CONE BEETLE POPULATION TRENDS IN NORTH CAROLINA AND TENNESSEE SEED ORCHARDS 1986 — 1997

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ABSTRACT

Overwintering white pine cone beetle (WPCB) populations within dead infested cones were sampled from six eastern white pine seed orchards beginning in 1986 and continuing through 1997. Two sampling systems were used on each orchard: 1) 50 Ft.2 Sampling System, and 2) Random Sample System.

Beetle populations peaked on the Edwards Seed Orchard in 1992 and 1995 while populations in most Tennessee orchards peaked in 1992 — 1993 and 1995. In comparison population peaks were noted on the Beech Creek in 1988, 1993 and 1997. During the intervening years, populations were moderate or crashed. Beetles populations were low on the Beech Creek or Edwards Orchards in 1994 while slightly higher populations were present in the Tennessee orchards. These data suggest that in Tennessee during 1994, beetle populations were increasing. The 1995 survey data indicated high populations on the Pickett at 76.6 live beetles per 50 ft ^{2} sample. This was the largest overwintering beetle population recorded during the survey. Populations of WPCB were also high at the Norris and Stephens orchards. In 1996 populations crashed.

In most years, the Picket Seed Orchard in Tennessee had higher sustained overwintering WPCB populations than all other orchards. In comparison, the Edwards Seed Orchard generally had the fewest overwintering beetles. Comparisons between sampling techniques indicate the 50 ft ^{2} method was easier to use for evaluating population trends. No cone crop damage data were collected during many of the sample years, thus no analysis or correlation between cone crop damage and overwintering WPCB populations were possible. However, we observed that few cones were killed when populations were low, but losses approached 100% for high populations without protection.

KEYWORDS: Eastern white pine, white pine cone beetle, seed orchard, *Conophthorus coniperda* (Schwarz), *Pinus strobus* L.

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INTRODUCTION

White pine, *Pinups strobes* L., seed orchards throughout the Eastern United States are continually under attack by an array of insect pests. The most significant pest is the white pine cone beetle (WPCB), *Conophthorus coniperda* (Schwartz) which often causes extensive losses to cone crops. Historically liquid applications of insecticides such as DDT and others have almost always failed (DeBarr et. al 1982). During the 1970's and 1980's carbofuran was registered and used to control this pest but the registration was withdrawn in the early 1990's. Recent tests with Asana XL®, esfenvalerate, indicate that it is effective in WPCB damage reduction (DeBarr and Barber unpublished). The use of prescription fires in late winter to kill overwintering beetles is effective and is used in many white pine orchards (Wade et al. 1989).

A method to predict destructive overwintering white pine cone beetle (WPCB) populations is necessary to effectively manage white pine orchards. During periods when beetle populations are low, it may be possible to not treat the orchard thus reaping economic or environmental benef¹ts from not spraying or burning. During high WPCB populations, all necessary steps to control the beetle may be warranted.

LIFE CYCLE

Beetles emerge around the f¹rst of April in western North Carolina, fly into the treetops and attack developing cones. The beetles bore into the bases of cones at the junction of the petiole and produce a characteristic entrance hole surrounded by a circular mass of resin-soaked frass. Each beetle can attack and kill up to 4 or 5 cones. Mating and egg laying occurs in the attacked cone. The larvae develop in the infested cone and become adults in mid summer. During the summer and fall most of the infested cones fall to the ground where the beetles overwinter.

MATERIALS AND METHODS

There were two sampling systems utilized to measure overwintering beetle populations.

1. Random Sampling System – This system involves walking across the orchard and collecting 150 cones from the top of the orchard duff. The cones collected were ones that were infested and killed the previous year by the WPCB. Of the 150 cones collected, 100 intact cones of varying sizes were dissected and the number of live and dead beetles determined.

2. 50 Ft^2 System – This system involves pre-selecting 20 trees and randomly determining a side of the tree to collect from. After a 5 ft. by 10 ft. area is selected and marked off with string all the cones are removed for later dissection. The cones were dissected and the number of live and dead cone beetles determined.

All white pine seed orchards in North Carolina and Tennessee were sampled during January or February during each year of this survey. The orchards listed by agency are as follows: 1) USDA Forest Service, Beech Creek Seed Orchard, Murphy, NC, 2) North Carolina Forest Resources , Edwards Seed Orchard, Morganton, NC, and 3) Tennessee Division of Forestry, Norris Seed Orchard , Norris TN, Knoxville Seed Orchard - Knoxville, TN, Stevens Seed Orchard – Oak Ridge TN, and Picket Seed Orchard – Jamestown, TN.

RESULTS AND DISCUSSION

In Figures 1-5, data are displayed that show the seasonal fluctuations of overwintering WPCB populations at eight seed orchards in Tennessee and North Carolina. On the Beech Creek, populations were higher during 1988, 1993 and 1997. Beetle populations were the lowest from 1990 – 1992 and again in 1994 - 1995. While both sampling methods detect peak populations, the 50 ft^2. sampling method more clearly identif¹es the two peaks when both sampling methods were used simultaneously.

On the North Carolina Division of Forest Resources' Edwards Seed Orchard located in Morganton, NC, beetle populations peaked during 1992 and 1995. These data are difficult to interpret because of conflicts between yearly totals among sampling systems. Overall, the peak populations detected were less than found on the Beech Creek or most Tennessee orchards.

Data from the Stephens, Norris, and Pickett Seed Orchards in Tennessee all indicate peak populations in 1992 and 1995. In contrast, data from the Knoxville orchard indicate a peak in 1993. In 1997 the 50 ft^2. System indicated an increasing population while data from the random sample showed only a slight increase over the previous year. Generally beetle populations at the Pickett, Norris and Stephens orchards reached peak populations that were higher than recorded for the other f¹ve orchards of the survey.

Unfortunately, annual cone crop loss data was not collected during most of this period. We were therefore, unable to analyze the data to determine thresholds for economic damage or correlation's between overwintering WPCB populations and damage. We have observed, however, that low WPCB populations are usually responsible for minimal cone losses and that conversely high populations such as found on the Beech Creek in 1997 result in nearly total crop losses if untreated.

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LITERATURE CITED

DeBarr, G. L., L. R. Barber and A. H. Maxwell. Use of carbofuran for Control of eastern white pine cone and seed insects. Forest Ecology and management, 4(1982) 1-18. 18p.

Ebel, H. E. , T. H. Flavell, L. E. Drake, H. 0. Yates III, and G. L. DeBarr. 1980. Seed and cone insects of southern pines. USDA Forest Service General Technical Report SE-8. Atlanta, GA. 5p.

Wade, **D. D.,** G. L. DeBarr, L. R. Barber, and E. Manchester. 1989. Prescribed Fire – A cost effective control for white pine cone beetle. Proceedings 10th Conference on f¹re and forest meteorology, April 17-21, 1989, Ottawa, Canada. p. 117-121.

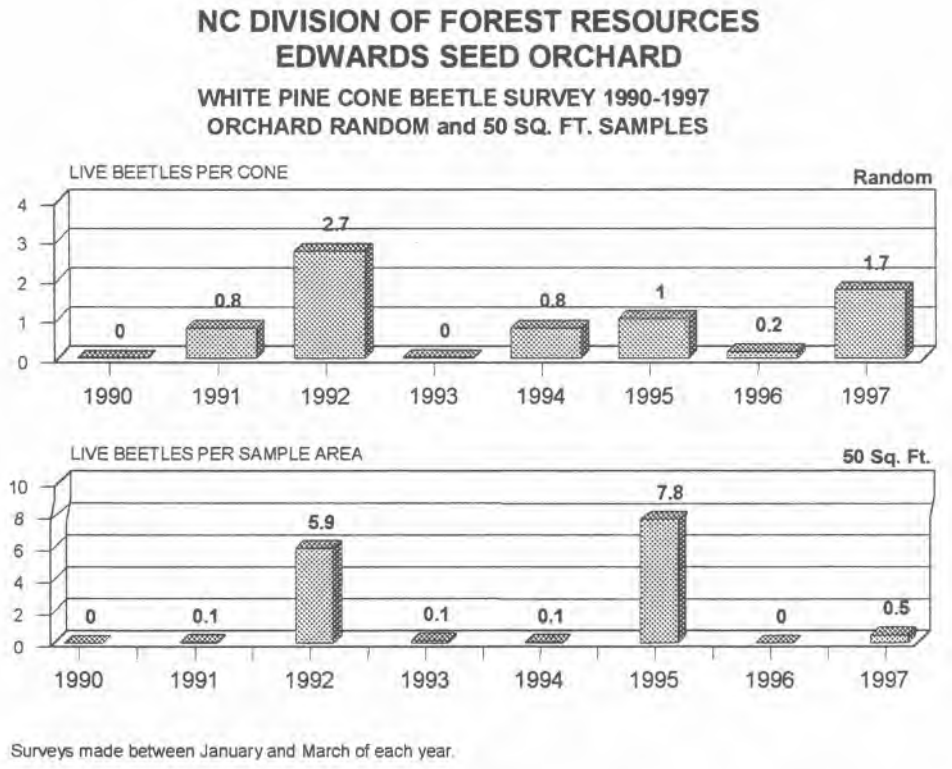
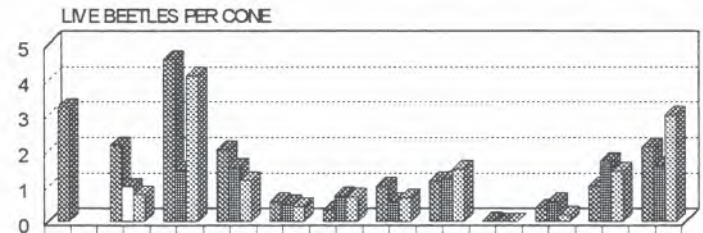


Figure 1. Random and 50 Sq. Ft. sampling data from the NC Division of Forest Resources

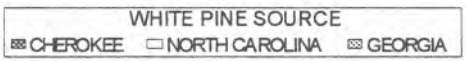
Figure 2. Random sampling data for the Beech Creek Orchard

USDA FOREST SERVICE - BEECH CREEK SEED ORCHARD

WHITE PINE CONE BEETLE SURVEY 1986 - 1997
RANDOM SAMPLE



	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
CHEROKEE	3.2	2.1	4.6	2	0.6	0.3	1	1.2	0	0.4	1	2.1
NORTH CAROLINA		1	1.5	1.5	0.5	0.7	0.6	1.2	0	0.6	1.7	1.6
GEORGIA		0.8	4.1	1.2	0.4	0.7	0.7	1.5	0	0.2	1.4	3

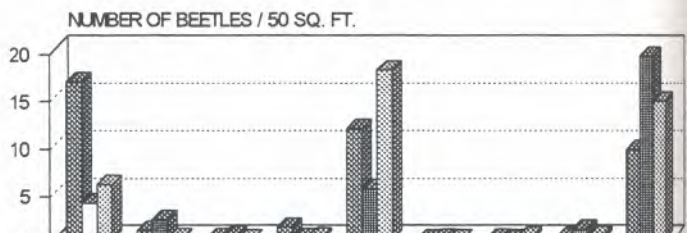


USDA Forest Service, Tusquitee Ranger District, Murphy, NC
Surveys made between January and March of each year.

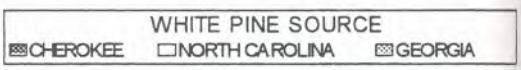
Figure 3. 50 Sq. Ft. sampling data for the Beech Creek Orchard

USDA FOREST SERVICE - BEECH CREEK SEED ORCHARD

WHITE PINE CONE BEETLE SURVEY 1989 - 1997
50 SQ. FT. SAMPLE

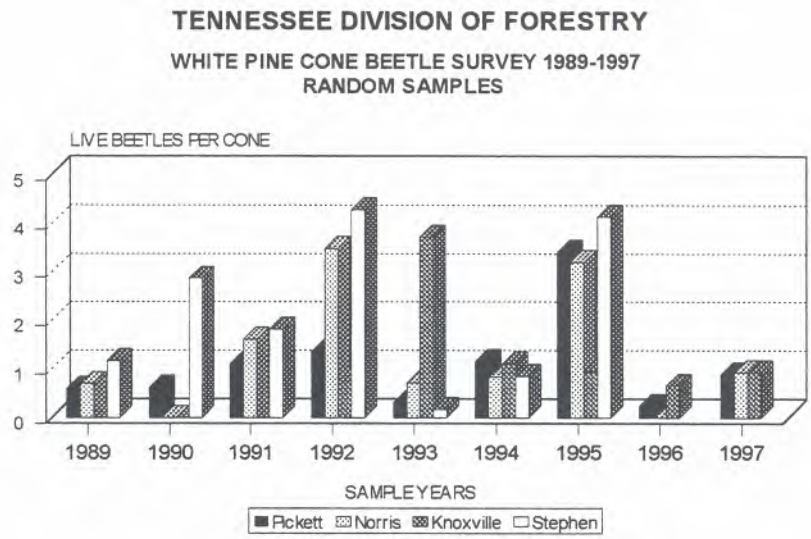


	1989	1990	1991	1992	1993	1994	1995	1996	1997
CHEROKEE	16.6	0.9	0.2	1.3	11.7	0	0.1	0.3	9.5
NORTH CAROLINA	3.8	2.1	0.4	0.1	5.3	0.1	0	1.1	19.3
GEORGIA	5.8	0.1	0	0.2	17.9	0	0.3	0.3	14.6



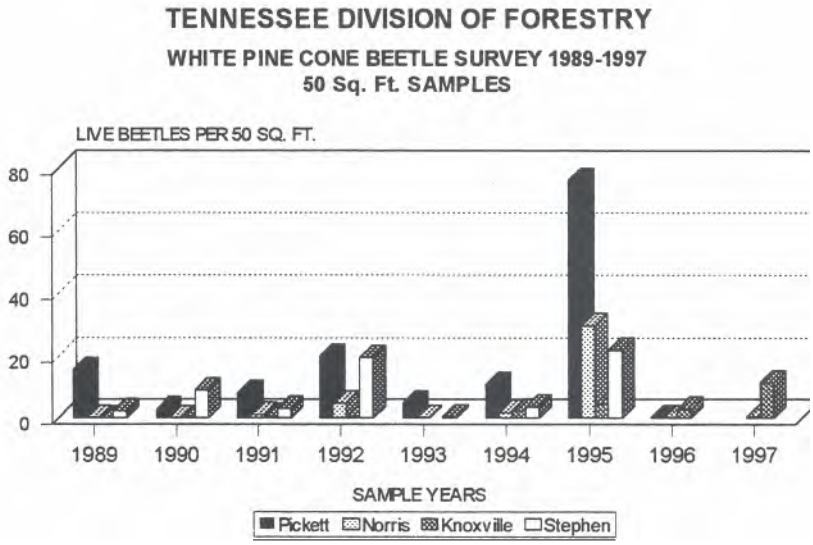
USDA Forest Service, Tusquitee Ranger District. Murphy, NC
Surveys made between January and March of each year.

Figure 4. Random sampling data for Tennessee Orchards



Surveys made between January and March of each year.
Stephens Switch Orchard was dropped from the survey in 1996.

Figure 5. 50 Sq. Ft. Sampling Data for Tennessee Orchards



Surveys made betveen January and March of each year.
Stephens Swtch Orchard was dropped from the survey in 1996.