The Great Lakes Entomologist

Volume 17
Number 4 - Winter 1984 *Number 4 - Winter 1984*

Article 7

December 1984

# Detection of Bronze Birch Borer Larvae and Pupae by Radiographs (Coleoptera: Buprestidae)

John Ball
*University of Minnesota Technical College*

Gary Simmons
*Michigan State University*



## Recommended Citation

Ball, John and Simmons, Gary 1984. "Detection of Bronze Birch Borer Larvae and Pupae by Radiographs (Coleoptera: Buprestidae)," *The Great Lakes Entomologist*, vol 17 (4)
DOI: https://doi.org/10.22543/0090-0222.1524
Available at: https://scholar.valpo.edu/tgle/vol17/iss4/7

# DETECTION OF BRONZE BIRCH BORER LARVAE AND PUPAE BY RADIOGRAPHS (COLEOPTERA: BUPRESTIDAE)

John Ball[1] and Gary Simmons[2]

ABSTRACT

Bronze birch borer larvae and pupae were detected in small branches through the use of a portable X-ray unit. The optimum exposure time was 40 sec at 55 kV.

---

X-rays have been used in the detection of phloem and wood-boring insects for several decades. Much of the X-ray research has concentrated on the detection of bark beetles within wood and bark slabs, but some work has been published on the detection of other borers. Knight and Albertin (1965) successfully used a Picker 50 kV X-ray unit to study *Oberea schaumii* LeConte, a poplar (*Populus* spp.) twig borer. They also used the unit to detect various weevils and borers in jack pine (*Pinus banksiana* Lamb.) and aspen (*P. tremuloides* Michx.). John Beaton et al. (1972) used a Picker Ranger 100 for the detection of the red oak borer (*Enaphalodes rufulus* Haldeman).

X-rays can be used to detect phloem and wood-boring insects because generally there is a difference in density between insects and wood (Maloy and Wilsey 1930). When two different objects are radiographed fewer X-rays will pass through the denser object to be absorbed by radiosensitive emulsion of the film. The denser object will appear lighter than the other object when the negative is held before an X-ray illuminator. However, the density, hence the absorption to X-rays, changes throughout the life stages of an insect. X-rays are partially absorbed by water and since larvae contain more water than do pupae and adults they are easier to detect (Havel 1974). Insect galleries are easily detected. Since they have extremely little absorption, they contrast both the borer and the wood (Berryman and Stark 1962). Frass packed galleries do absorb some X-rays but generally there is still adequate contrast among the borer, galleries, and surrounding wood.

The objective of this study was to provide a quick, accurate, and nondestructive method of detecting bronze birch borer (*Agrilus anxius* Gory) larvae and pupae within European white birch (*Betula pendula* Roth) branches.

## METHODS

The X-ray unit we selected was a Philips Practic with a mobile demountable stand. The accompanying control desk had adjustments for voltage and time. Voltage could be varied from 45 to 100 kV at 5-kV intervals. Time was adjustable from 0.08 to 5.0 sec. The exposure current was fixed at 20 mA. At the suggestion of Dr. Wortman of the Michigan State University Veterinary Radiology Clinic the film we used was Kodak RP/M X-OMAT.

During April and May 1982, branches were removed from a dying European white birch. The branches were cut into 25-cm lengths, the diameter measured, then radiographed at various kV's and exposure times. After the negatives were developed, the bark was stripped from the branches to determine if we had detected all the borers.

---

[1]Horticulture Technology Department, University of Minnesota Technical College, Waseca, MN 56093.

[2]Entomology Department, Michigan State University, East Lansing, MI 48824.

## RESULTS AND DISCUSSION

At 65–85 kV, our exposure time was approximately 20 sec; however image contrast was extremely poor. At 45 kV, the exposure time was over 60 sec. Unfortunately, enough low energy rays are produced at that voltage to cause some secondary radiation. To combat this problem, a 3.6-mm lead filter was placed behind the film to absorb the secondary radiation. Stacey and Motherhead (1965) found secondary radiation could be much reduced by placing thin lead filters in front and behind the film, but we found the one filter more than adequate. Our final technique for radiographing bronze birch borer larvae in European white birch branches was, for branches 18–38 mm in diameter, an exposure time of 40 sec at 55 kV, with a target-to-film distance of 75 cm. At this exposure, all larvae and pupae were clearly visible, even those that had formed a cell in the xylem.

Our next step will be to determine exposures for penetrating larger diameter branches. Once these exposure times are obtained, field testing of the unit will begin.

## ACKNOWLEDGMENT

We would like to thank the staff of the Michigan State University Veterinary Radiology Clinic for their time and cooperation.

## LITERATURE CITED

Beaton, J., W. White, and F. Berry. 1972. Radiography of trees and wood products. Material Evaluation. 30(10):14–17.

Berryman, A. A. and R. W. Stark. 1962. Radiography in forest entomology. Ann. Entomol. Soc. Amer. 55:456–466.

Havel, K. D. 1974. X-ray detection of insects in tree seed imports. p. 63–64 *in* Proceedings Seed X-ray Symposium. State and Private Forestry.

Knight, F. B. and W. Albertin. 1965. Portable X-ray equipment in forest research. J. Forestry. 63:543–544.

Maloy, T. P. and R. B. Wilsey. 1930. X-raying trees. Amer. Forest. 36:79–82.

Stacey, S. S. and J. S. Motherhead. 1965. Applicability of radiography to inspection of wood products. p. 307–331 *in* Second Symposium on Nondestructive Testing of Wood Products.