EVALUATION OF LOG SUBMERGENCE TO CONTROL EAB AND PRESERVE BLACK ASH FOR NATIVE AMERICAN BASKETRY

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ABSTRACT

Many Native American cultures use black ash, *Fraxinus nigra*, for basket-making because its ring-porous wood allows the annual layers of xylem to be easily separated. The emerald ash borer (EAB, *Agrilus planipennis*) is threatening North America's ash resource including black ash, and a centuries-old native art form. Native tribes are gravely concerned about the availability of large black ash trees for basket making and about movement of black ash from areas where it is cut to tribal lands where it is pounded and split to make baskets. We evaluated the practice of storing black ash logs submerged in water to maintain their moisture as a possible method for simultaneously killing EAB. In 2010, we submerged EAB infested black ash logs in running water in the spring and evaluated EAB mortality as well as the color and quality of wood splints from the submerged ash logs at different time periods after submergence. In 2011, we evaluated the efficacy of submergence for different time periods in winter and in spring.

In 2010, five black ash trees infested with overwintering EAB larvae were felled in southern Michigan in late April 2010 and cut into 60-cm bolts. Bolts were randomly divided among 5 treatments with 8 logs per treatment: a) unsubmerged control bolts; or bolts submerged for b) 1 week; c) 1 month; d) 2 months; or e) 3 months. Logs were submerged on 10 May in the Red Cedar River, Okemos, Ingham County, MI. After treatment, half of the logs were dissected within 24 h to determine larval mortality then pounded and peeled into splints to assess splint color and quality. Larvae from dissected logs were held at room temperature for 24 h and observed periodically for movement. The remaining logs were placed into rearing tubes to determine survival and adult emergence. After 1 week of submergence, there was very little mortality of EAB larvae. Mortality was higher after 1 month of submergence; however, there were still several live EAB larvae and a few pupae. While some larvae had died, it appeared that others had fed and continued to develop. By 2 months and 3 months of submergence, all of the larvae had died. Similarly, the number of live EAB adults that emerged from logs decreased with length of submergence time and no adults emerged from logs that were submerged for 2 or 3 months. Water in the river was about 1.5 m deep with a flow rate of 0.88 to 1.05 m/s and average temperature of 13.5 ºC during the first month of the study. The temperature increased to 21.1 ºC while flow rate and depth decreased to 0.33 m/s and 36 cm, respectively, over the following 2 months. The spectral reflectance patterns for black ash splints were similar after submergence for different periods of time. Quality and pliability of splints did not decrease after 3 months of submergence.

In 2011, we conducted two experiments (winter submergence and spring submergence) to evaluate efficacy of log submergence at different times of the year with different water temperature and to refine the period of time required for complete mortality. Infested black ash trees were felled in February 2011 and cut into 60-cm bolts. For the winter submergence experiment, infested logs were submerged in the Red Cedar River during the first week of March when water temperature was freezing (0 ºC). We hypothesized that longer periods of submergence may be required at colder temperatures because larvae would remain dormant and would not attempt to feed and be affected by the saturated conditions. Therefore, we selected longer time periods for the treatments of this experiment. Logs were randomly divided among 5 submergence time treatments with 6-8 replicates per treatment: a) 2 months, b) 4 months, c) 6 months, d) 12 months (on-going), and e) 18 months (on-going). All logs were dissected within 24 h of removal from the river then pounded and peeled into splints in order to assess the impact of prolonged submergence on splint quality. Larvae dissected from logs were held for 48 h at room temperature and observed periodically for movement. Very few larvae died after 2 months of submergence at which time water temperatures had reached 5.6 ºC. All larvae had died after 4 or 6 months of submergence, when water temperatures had reached 21.5 ºC and 25.6 ºC, respectively. Splint pliability and quality did not deteriorate after 2-4 months of submergence; however, by 6 months the outer 1 or 2 rings of sapwood began to darken and decay and crumbled from the log during dissection. Interior rings of sapwood remained intact and pliable.

For the spring submergence experiment, infested logs were submerged in the Red Cedar River on 12 May 2011 when water temperature was 14.4 ºC. We wanted to refine our estimate based on 2010 results indicating that some larvae were alive at 1 month but all were dead after 2 months of submergence. Therefore, we selected weekly time periods between 1 and 2 months. Initially, we assigned 8 logs per treatment with 4 logs designated for dissection and 4 logs for rearing. However, by week 6 when we still found little mortality of larvae during log dissection, we decided to prolong the experiment by pulling only 4 logs for dissection each week and foregoing rearing, allowing those logs to remain submerged for a longer period. As a result the experiment had 9 treatments: a) unsubmerged control, or submerged for b) 4 weeks, c) 5 weeks, d) 6 weeks, e) 7 weeks, f) 8 weeks, g) 9 weeks, h) 13 weeks, or i) 14 weeks. For submergence periods up to 6 weeks, 4 logs were dissected to determine larval mortality and 4 logs were placed in rearing tubes to determine survival and adult emergence. For logs submerged 7, 8, 9, or 13 weeks, only 4 logs were dissected and no logs were placed in rearing tubes. After 14 weeks of submergence, the final logs were removed from the river and placed in rearing tubes to determine survival and adult emergence. After 6 weeks of submergence some live larvae were found in dissected logs and adults emerged from rearing logs. Some live larvae were found in logs submerged for 7 or 8 weeks, but by 9 and 13 weeks of submergence all larvae had died. No adults emerged from logs submerged for 14 weeks.

Although all EAB larvae had died and no adults emerged from logs submerged for 2 months in 2010, some larvae survived and adults emerged from logs submerged during winter for 2 months and during spring for up to 9 weeks, in 2011. It is possible that greater larval survival was found in 2011 because larvae were observed over a 48 h period after dissection rather than only 24 h as in 2010, allowing them more time to adjust after removal from the saturated logs. Different temperature conditions during the different experiments may also have influenced EAB survival. Based on our two years of data, 4 months of submergence during winter or spring should ensure complete mortality of EAB larvae and no emergence of adults while still preserving wood quality for basket making.