Lesser Peachtree Borer (*Lepidoptera: Sesiidae*): Influence of Water and Chemical Washes on Collection and Hatchability of Eggs

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One of the limiting factors in maintaining a working colony of the lesser peachtree borer, *Synanthedon pictipes* (Grote and Robinson), in the laboratory, is the distribution of eggs on pieces of teased cotton oviposition pad (1) for use in infesting rearing trays. The process is time consuming and laborious. Also, eclosion is often adversely affected by handling.

To improve the efficiency of the rearing program, we needed a better method of egg removal and handling. If all or most of the eggs deposited on the cotton pads could be removed easily without drastically reducing the hatch, they could be distributed more uniformly in the trays and in less time. The problem is the cementing materials on the chorion of the eggs which must be dissolved. The eggs are attached to the cotton fibers and to each other by copious coatings of adhesive that bonds them to the cotton. Tapwater is not a suitable solvent of the cement, but the disinfectant washes of sodium hypochlorite or formalin have been used to remove glued eggs of other species and as surface sterilizers (2, 3, 4, 5). Also, they are reported not to reduce viability materially. Our studies were designed to measure the effect of water, formalin, and bleach on the removal of borer eggs from the cotton oviposition pads and on hatchability of the eggs.

Methods and Materials

Lesser peachtree borers (LPTB) were obtained from a laboratory colony maintained for 9 years on apples (Red and Golden delicious varieties) removed as thinnings (2.5-4.5 cm diam) at the Humid Areas Deciduous Fruit Insects Investigations Laboratory, Vincennes, IN.

Mated females were handled as described by Cleveland et al. (1) except that: (a) two moist medium-sized (non-sterile) absorbent cotton balls, pressed into the bottom fourth of 15 ml jelly cups, were used as an oviposition pad, one female per cup; (b) a paper lid with a sawed slit (1.2 x 0.2 cm) for aeration was fitted into the lip of each cup to confine the female; and (c) females were held at 25.6 ± 2°C and

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[1] Lepidoptera: Sesiidae.

[2] Received for publication ———————.

[3] Mention of a proprietary product in this paper does not constitute recommendation or endorsement by the USDA.

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55 ± 5% RH on the oviposition rack where supplemental fluorescent lighting provided a photophase of 14 h.

After 6 days, females were removed from the cups and discarded. A series of 5 cups was selected at random for exposure to each treatment. The egg pads from these were removed. A corresponding number of cups was set aside as controls. In the latter, eggs were not washed from the pads. Before treatment, eggs on pads that were removed were counted (treatment + controls, average eggs/pad = 242). The egg pads used for treatment with water, formalin, or bleach, as well as the controls, were placed on 6.4-mm mesh hardware cloth racks (30 pads/rack/treatment). Each rack was stored in a plastic box lined with moist paper toweling and covered with a framed muslin lid. Pads were lightly sprayed twice each 24 h with tapwater to prevent dessication.

The test solutions included tap or distilled water; also the following percentages of 6% sodium hypochlorite (Purex^{R}): 0.12, 0.24, 0.46, 0.86, 1.50 and 2.40, in addition to formalin were prepared 24 h before use and stored in closed plastic containers.

Sets of 5 egg pads were placed in each test solution for a 5-min soaking. Also, a 2nd set of egg pads was soaked in each solution for 15 min. During the last 2 min of each soak, the egg pads were agitated with forceps to aid in releasing any eggs still attached. The pads were then removed from the test solutions and placed in marked petri dishes to be examined for eggs left trapped in the cotton fibers. Throughout the soak period and thereafter, controls were left in marked boxes and sprayed twice daily with tapwater.

After soaking and agitations, the solution and eggs from each container were poured through an organdy cloth disc placed in a small plastic funnel and rinsed twice with tepid tapwater. Eggs were dried at room temperature for about 20 min, then transferred with a camel's hair brush to moist, sterilized filter paper in petri dishes. All petri dishes and control boxes were held in the oviposition room at the same temperature and RH described for egg-laying females. Ten drops of distilled water were placed on each filter paper every 3 days until hatching was completed. Checks of all egg dishes and control boxes were made daily for 6 days, which was generally sufficient for 92.3% hatch of the control eggs.

Results

Egg Removal

Some eggs were removed from the cotton oviopsition pads by all Fig. 1(A) solutions. Fig. 1(A) shows the varying percentages of eggs removed. Bleach was clearly the most successful agent for removing the eggs. The highest percentages of eggs were removed as a result of the soaking in dilute bleach solutions. There was also a direct correlation between the decreasing concentrations of bleach, duration of soaking, and improved egg removal. The remaining washes were less satisfactory. Egg removal using formalin washes was quite irregular, although the highest percentages of eggs removed occurred with more

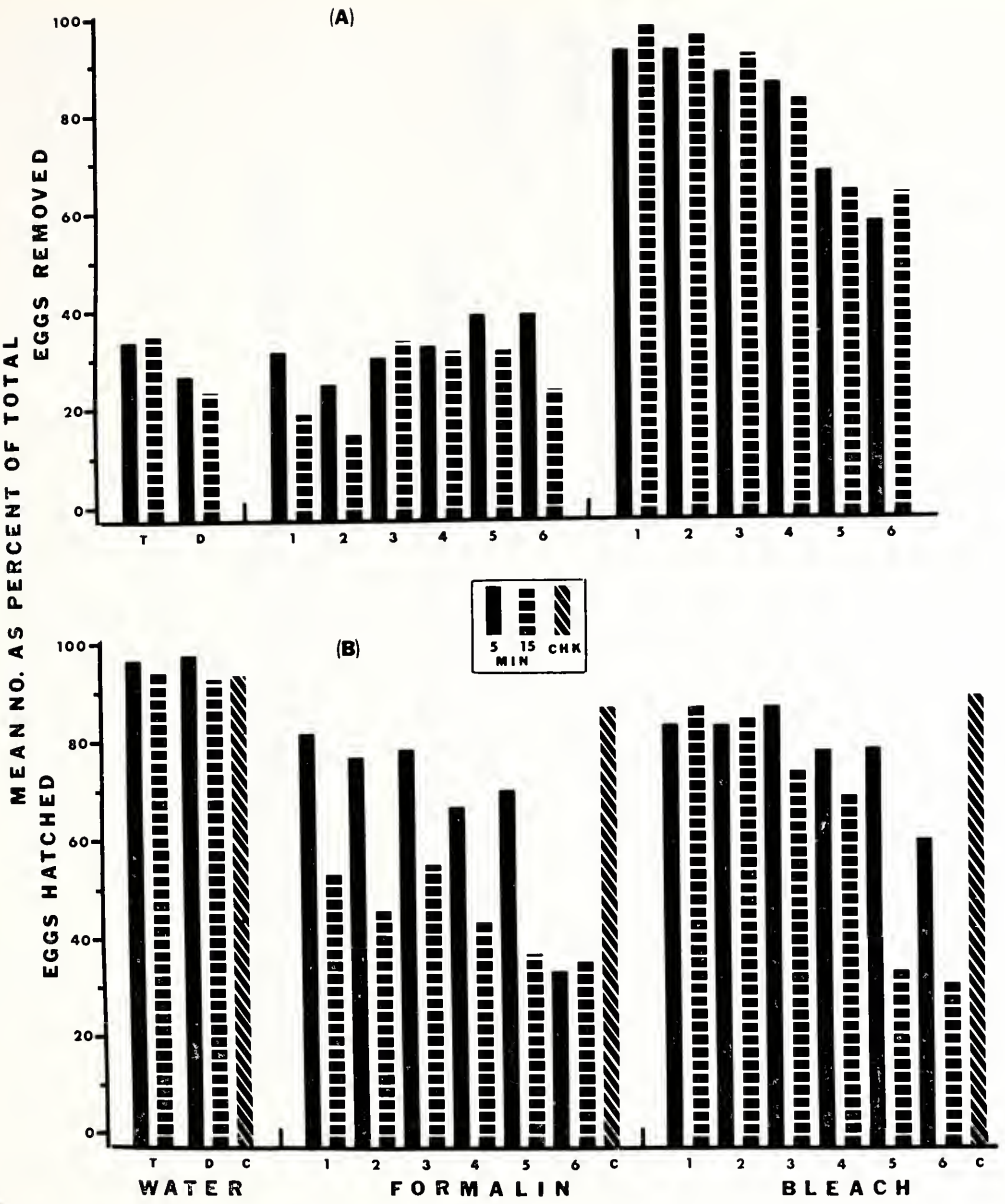

FIGURE 1(A). *Pecentages of eggs that were loosened by tapwater (T), distilled water (D), formalin washes, and bleach washes.*

FIGURE 1(B). *Percentages of hatch from checks (C) and from eggs washed for 5 and for 15 min. Percent concentrations of each chemical wash (formalin or bleach) were as follows: 1 = 0.12, 2 = 0.24, 3 = 0.46, 4 = 0.86, 5 = 1.50, 6 = 2.40.*

concentrated solutions. However, 5-min soakings were more successful in loosening eggs than 15 minutes. There was little difference in the numbers of eggs removed by soaking for 5 or 15 min in distilled water and tapwater.

Egg Hatch

Eclosion was increasingly reduced as the concentration of chemical Fig. 1(B) in the washes was increased (Fig. 1(B)). For example, the weaker solutions of bleach reduced hatch 2-4% compared with the

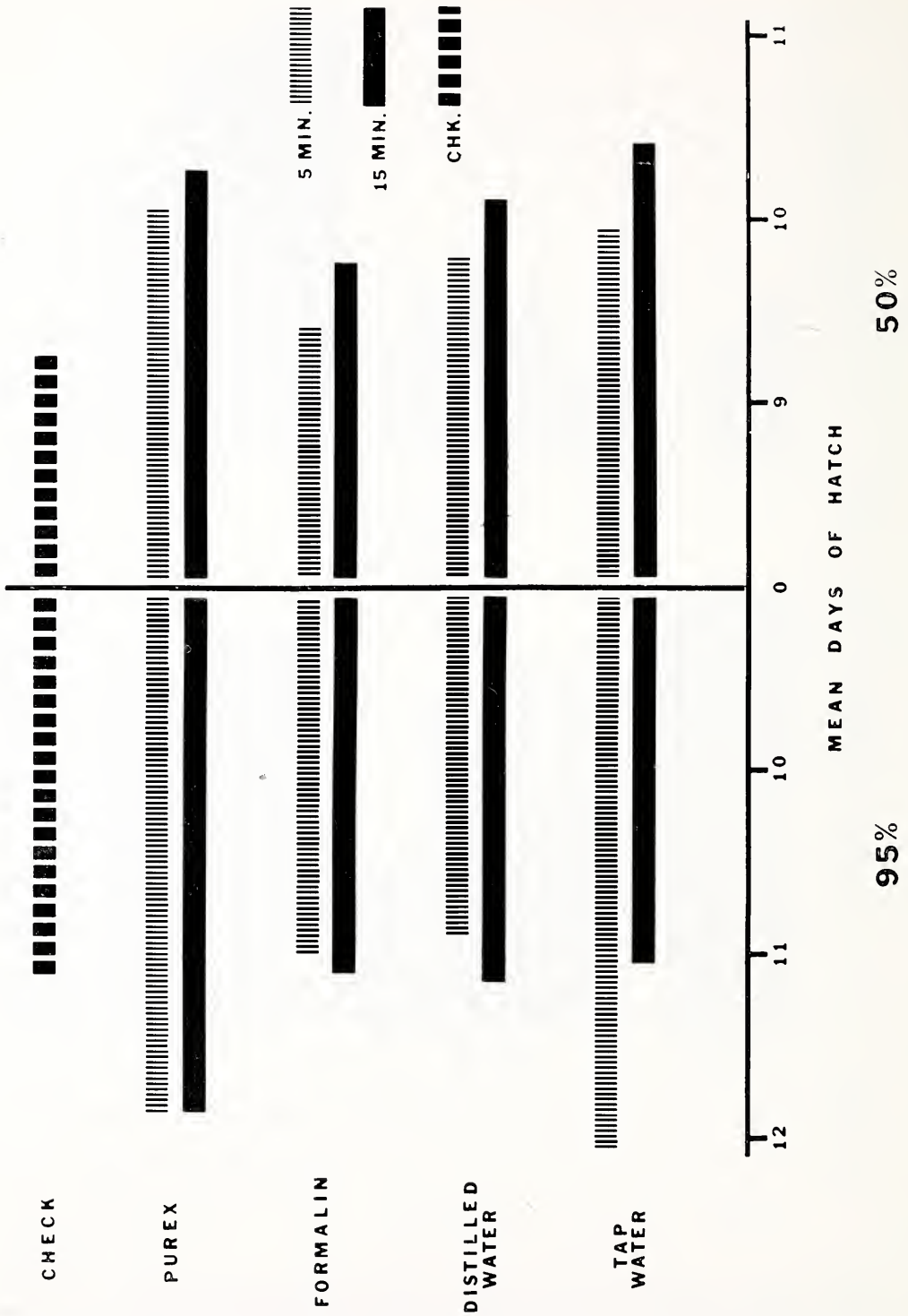

FIGURE 2. *Days to attain 50 and 95% hatch of LPTB eggs exposed to water and chemical washes. Chemical washes are represented as single bars to show the additive effect of all concentrations for each soaking interval. Check is shown by a single bar that shows the combined hatching of all untreated eggs.*

control, but the higher concentrations reduced it much more, especially as duration of the soaking time increased. The stronger formalin washes also reduced egg viability more than the weaker solutions and longer soaking time accentuated these differences.

The 2 water washes produced similar hatching results, and length of soaking period had little effect. However, eggs treated with water washes eclosed in larger numbers and had a slightly larger hatch than the untreated controls.

Altered Patterns of Hatching

All eggs treated with water and chemical washes showed some changes in overall egg viability and in pattern of eclosion. Fig. 2 shows the average number of days eggs required to reach 50 and 95% hatch after treatment with the washes. In the check, 50% hatch occurred in 9.3 days and 95% hatch in 11.1 days. With bleach washes, average hatching times were 10.2 days for 50% hatch and 11.9 days for 95% hatch, a delay of 0.2 days. However, the overall hatching pattern produced by the formalin washes was more like that of the check than the patterns produced by other test solutions. Even distilled water washes gave averages of 10.0 and 11.1 days, respectively, for both 50 and 95% hatch, a delay of 0.4 days; and tapwater washes gave averages of 10.2 and 11.5 days for 50 and 95% hatch, once again, a delay of 0.5 days. Fig. 2 also shows that the longer soaking slightly extended the delay in hatching in all treatments and was especially noticeable in days required to reach 50% hatch.

Discussion

Treatments with the various concentrations of bleach aided in releasing the eggs more efficiently than treatments with formalin or water, probably because it removed the adhesive coating of the chorion. Eggs treated in bleach were separated quickly from the cotton pads and sank immediately without sticking to each other or to the sides of the soaking containers. However, the stronger bleach concentrations apparently reacted with the cotton fibers causing a tackiness which trapped portions of the removed eggs. Many eggs treated with formalin or water washes remained cemented to the cotton. Also, eggs soaked in formalin washes for 15 min showed some tendency toward stickiness and entanglement in the cotton fibers.

When egg hatches for the various treatments were compared, chemically-treated eggs had a lower percentage of eclosions than untreated controls. The formalin-treated eggs had the greatest reduction of eclosions. Formalin probably caused some dessication or otherwise reduced viability. The weaker concentrations of bleach also reduced hatch slightly, but the chorions of eggs exposed to the stronger washes showed discoloration and considerably reduced hatch, especially those soaked for 15 min.

Although washes of bleach delayed egg hatching by a day, the washed eggs could be easily distributed into the rearing trays. Also, the weaker concentrations of bleach caused minimum reductions (2-4%)

in hatch. On the basis of these results, we selected the weakest bleach concentration and 5-min soak as the appropriate means of removing eggs of the lesser peachtree borer from cotton oviposition pads.

Literature Cited

1. CLEVELAND, M. L., T. T. Y. WONG, and K. W. LAMANSKY. 1968. Rearing methods and biology of the lesser peachtree borer, *Synanthedon pictipes*, in the laboratory. Ann. Entomol. Soc. Am. **61**:809-814.
2. GETZIN, L. 1962. Mass rearing of virus-free cabbage loopers on an artificial diet. J. Insect Pathol. **4**:486-488.
3. HENNEBERRY, T. J. and A. N. KISHARA. 1969. Cabbage loopers. In C. N. Smith (ed.), Insect colonization and mass production. pp. 461-478. Academic Press, New York. 618 pp.
4. LEPPLA, N. C., S. L. CARLYLE, and T. C. CARLYSLE. 1974. Effects of surface sterilization and automatic collection on cabbage looper eggs. J. Econ. Entomol. **67**:33-36.
5. VAIL, P. V., T. J. HENNEBERRY, A. N. KISHABA, and K. Y. ARKAWA. 1968. Sodium hypochlorite and formalin as antiviral agents against nuclear-polyhedrosis virus in larvae of the cabbage looper. J. Invertebr. Pathol. **10**:84-93.