Grooved board traps for monitoring the black vine weevil (Coleoptera: Curculionidae) in raspberry fields

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ABSTRACT

A grooved board trap was tested to determine the effects of trap size (two sizes) and bait (apple pomace) on capturing the black vine weevil, *Otiorhynchus sulcatus* on raspberries, *Rubus idaeus*. Large traps (30 x 30 cm) caught significantly more weevils than small ones (15 x 15 cm). Large traps were also more sensitive in capturing weevils than small ones, which will be important when the weevil density is low. Apple pomace bait did not significantly enhance the attractiveness of grooved board traps to the black vine weevil. Grooved board traps may also be useful for weevil monitoring in other crops.

Key words: black vine weevil, board trap, raspberry, apple pomace.

INTRODUCTION

The black vine weevil, *Otiorhynchus sulcatus* (F.), is one of the most important pests of raspberries, *Rubus idaeus* L., in the Fraser Valley of British Columbia. This parthenogenetic species overwinters primarily in the larval stage. Overwintering larvae resume development in spring and emerge as adults in June. Adult weevils are nocturnal, feeding on foliage during the night and hiding in the debris or in the soil during the day. However, some weevils hide in the dense raspberry foliage during the day. These weevils often contaminate machine-harvested fruit because the mechanical harvester is indiscriminate in its collection of dislodged berries and insects. Although leaf-feeding by adults is not economically significant, contamination by adults greatly downgrades the harvested berries.

Monitoring is the first step in effective weevil control. In British Columbia, the two techniques most commonly used to detect weevils are visual searches for leaf notching and shaking or tapping bushes to dislodge weevils. Visual searches are accurate early in a growing season but, as the season advances, fresh notches are difficult to distinguish from old ones. Shaking or tapping bushes is most accurate when done after dark, which is inconvenient. As fruit ripens, shaking may also dislodge many berries. Weevil monitoring could be improved if a convenient, non-destructive, daytime monitoring method were developed.

Traps are alternatives to visual searches and shaking. Maier (1983) and Hanula (1990) discuss the relative efficiencies of different types of traps. Maier (1983) concluded that board traps, which shelter weevils during the day, were more effective than pitfall traps, but Hanula (1990) found that pitfall traps were more effective. Growers in Hanula's (1990) study area were reluctant to use high-maintenance pitfall traps so he tested and recommended a deep-pan trap, which is easier to install and maintain.

Neither pitfall nor deep-pan traps are as easy to use as board traps. In British

Columbia, many growers and entomologists have remarked that the effectiveness of board traps seems correlated with several factors, including weather and the type of board used. Rough or creviced boards have seemed to be more reliable weevil monitoring tools than smooth plywood. Therefore, it is possible that board traps can be improved.

Here we report tests of two sizes of a grooved board trap for monitoring black vine weevils in raspberries. Within a trap size, we tested the addition of apple pomace bait on trap effectiveness. Apple pomace has long been recognized as an attractive bait for weevils (e.g., Smith 1932).

MATERIALS AND METHODS

All tests were done in a 6-ha field of 10 year-old Chilcotin raspberries (about 1.6 m high) in Langley, British Columbia, in June and July 1995. Clear, dry fir (2-cm thick) was used to make traps of two sizes: 30 x 30 cm (large) and 15 x 15 cm (small). Parallel grooves (1-cm deep, 0.8-cm wide, 2-cm apart) were cut with a Dado saw in the underside of each trap. One set of grooves ran in one direction (e.g., north to south) and the other set was perpendicular (e.g., west to east). This provided weevil access from all four edges (Fig. 1). Twenty-three large and 23 small traps were baited with apple pomace wrapped in cheesecloth pinned to the centre of the underside of the trap.

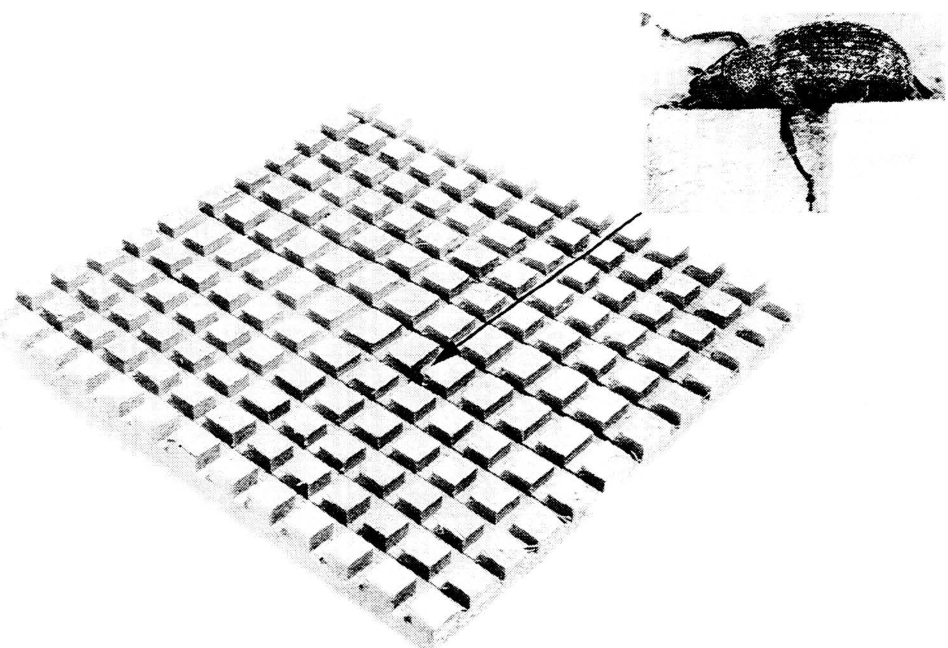

Figure 1. Underside of a large (30 x 30 cm) grooved board trap. Inset shows a closeup of a black wine weevil sheltering in a groove. Arrow shows actual location of weevil in the trap.

Tests were conducted in a 0.3-ha rectangular area (120 x 25 m) along one edge of the field. Considerable leaf notching in this area indicated that weevils were present. Traps were placed at the bases of canes having notched leaves. At each of 23 test locations, 2 large and 2 small traps (one of each size with bait and the other without) were arranged randomly groove-side-down on the soil as close to the canes as possible. Traps were checked the morning after placement. Seven observations (trap checks) were made during the first monitoring period (June 13-23); 9 were made during the second (July 7-20). Trapped weevils were removed from the field. Apple pomace bait was changed every 2-3 days.

Trap-capture data were square-root transformed as $\sqrt{(x+5)}$ before ANOVA, where x is the total number of weevils caught in each trap during each monitoring period of the study. The effects of trap size and bait on weevil capture were determined by a two-way ANOVA, with trap size, bait and block (location and time) as the main effects (Abacus Concepts 1989). There were 46 blocks in the model: 23 locations for two periods of monitoring time. To determine which trap size was more sensitive for capturing weevils, the percentage of traps that caught at least one weevil was calculated for large and small traps for each of the 16 observations, and compared using a *t*-test.

RESULTS AND DISCUSSION

On average, large traps caught significantly more *O. sulcatus* than small ones [large: 0.6060 ± 0.0499 (mean number weevils per trap per observation ± SE), small: 0.3478 ± 0.0349, $F = 37.08$, df = 1, 135, $p = 0.0001$]. More weevils may shelter in large traps because large traps cover more surface beneath the raspberry canopy and provide more shady shelter for weevils than small ones. There was no difference in the numbers of weevils in traps with or without apple pomace bait (with bait: 0.5041 ± 0.0457, without bait: 0.4497 ± 0.0443, $F = 1.70$, df = 1, 135, $p = 0.1941$). This shows that apple pomace does not enhance the attractiveness of grooved board traps to weevils.

On average, 76.89 ± 4.10% (SE) of large traps caught weevils during the 16 observations, while the percentage for small traps was 58.81 ± 4.34% (SE). This difference is significant ($t = 3.03$, df = 30, $p < 0.05$), and suggests that the probability of trapping at least one weevil is greater in large traps. This will be important when the weevil density is low.

The results show that large traps were superior to small ones in terms of monitoring weevil presence in the field. The grooved board traps may replace shaking or tapping the bushes if there is a correlation between numbers captured by these two monitoring methods.

All weevils caught by either large or small traps rested inside grooves which provided shelter for them. Some beneficial insects, such as carabid beetles, were also found in the grooves. Unlike the pitfall traps, all beneficial species were alive in these grooved board traps and easily released to the field. This implies that grooved board traps are not harmful to beneficials. We also found some cutworm larvae in the traps, suggesting that grooved board traps may also be useful for cutworm monitoring. Board traps are easy to set up in the field, easy to check and do not require maintenance. They are readily moved from one location to another, and can be reused for several years. Therefore, the grooved board trap is a useful monitoring tool for black vine weevil in raspberry fields. It may also be useful for weevil monitoring in strawberries and blueberries.

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