

## FINAL REPORT FOR 2000

**TITLE:** Plum curculio biology, host range, distribution, and control in Utah

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### SIGNIFICANT FINDINGS:

- Plum curculio (PC) in northern Utah appears to be limited to an approximately 50 sq. mile narrow strip from Honeyville to Willard, centered on Brigham City, in Box Elder County.
- PC infestations are primarily in neglected or unmanaged sites: home yards, roadside wild plum, and neglected orchards. The majority of PC-infested-sites are in the residential areas of Brigham City (74%), and in the majority of these, sweet cherry is the host tree (68% of Brigham City home yards, and 51% of all infested sites).
- In laboratory host tests, PC adults fed and laid eggs in all cultivated pome and stone fruits offered, and in wild plum (*Prunus americana*) and black hawthorn (*Crataegus douglasii*). Although eggs were laid in peach and pear, no larvae developed. No oviposition scars, eggs or larvae were found in ornamental crabapple (*Malus* spp.).
- A single diazinon treatment applied to 23 home yards with host trees just after petal fall of sweet cherry and apple was fairly effective (0-3 larvae/100 fruit per site as compared to 31 larvae/100 fruit in nearby untreated wild plum). Applying the insecticide earlier, at petal fall, and a reapplication 10-14 days later may improve the efficacy of insecticide treatment.

### OBJECTIVES:

1. To better define the boundaries of PC distribution in northern Utah.
2. To determine the potential host range of PC for commercial, ornamental, and wild fruits in the West.
3. To evaluate the effectiveness of PC controls applied to host trees.
4. To continue to test any new or modified lures for PC adults in traps.
5. To evaluate the effectiveness of trunk exclusion devices on the reduction of PC injury to fruit and adult populations in the tree.
6. To evaluate the effectiveness of PC controls that target adults in the spring as they congregate on the ground underneath host trees.

### PROCEDURES:

#### PC Survey

There were 302 new sites surveyed in 2000 to extend the survey area and delimit the boundaries of PC infestation. A total of 657 fruit host sites have been surveyed for PC in Box Elder, Cache and Weber Counties in 1998-2000. Surveys were conducted from mid June to mid July when all types of host fruit were available on trees. At each survey site, 100-200 fruit was examined for feeding and oviposition injury. The survey results have been mapped.

#### PC Host Range

The potential host range for PC in Utah was investigated by placing field-collected adults on green fruits of commercial, ornamental, and wild fruit trees in cages in the laboratory. One each active male and female were placed together on 5-10 fruits attached to a twig kept in floral preservative

inside cages kept at room temperature. Cages were replicated 10 times each. Fruits were evaluated 5-8 days later for the number of feeding and oviposition scars, and eggs and larvae inside.

#### PC Control

The Box Elder/Brigham City Mosquito Abatement District applied diazinon for control of PC to 23 home yards in Brigham City from May 6-19, 2000. The efficacy of diazinon treatment for control of PC was determined by sampling 100 fruit from each site on June 21.

#### Adult Trapping

Circle and pyramid traps with possible adult PC attractants (fruit essence, ethanol, acetic acid, and aggregation pheromone) were evaluated in 3 sweet cherry home yard, 3 wild plum, and 1 sweet cherry orchard sites in 2000. Most trapping sites had a single replication of circle traps (1 home yard) or pyramid traps (2 wild plum) or both types of traps (1 home yard and 1 wild plum). One home yard site consisted of 3 adjacent back yards with 10-15 sweet cherry trees each, and each yard contained a replication of circle traps. The orchard site had 2 replications each of circle and pyramid traps. First traps were placed in mid to late April and PC were collected at approximately weekly intervals through September.

#### Exclusion of PC from Trees

Wire screen collars were placed on five trees each at two sites. Five trees without screen collars at each site were used for comparison of the percentage of PC infested fruit between the two treatments.

#### PC Control on the Ground

This objective was not addressed in 2000.

### **RESULTS AND DISCUSSION:**

#### PC Survey

During 1998-2000, 657 sites in Box Elder, Cache, and Weber Counties were surveyed for the occurrence of plum curculio (PC) and injured fruit. The surveyed area was divided into four regions and the occurrence of PC is reported in the table below and Figure 1.

PC infestations were found almost exclusively in neglected or unmanaged sites: home yards, roadside wild plum, and neglected orchards. The majority of PC-infested-sites were in the residential areas of Brigham City (74%). Sixty-nine percent of the Brigham City home yards infested with PC were sweet cherry, and 51% of all sites infested with PC were found in sweet cherry in home yards.

<u>Region</u>	<u># Sites Surveyed</u>	<u># Sites Positive for PC</u>
1 – Tremonton to northern border of Brigham City	168	14
2 – Northern border of Brigham City to Weber Co.	414	85
3 – Weber Co. line to North Ogden	60	0
4 – Cache Co.: Wellsville to Mendon and Avon to Paradise	<u>15</u>	<u>0</u>
Total	657	99 (99/657=15.1%)

#### PC Host Range

In the field, PC larvae have been found in apple, apricot, cherry (sweet and tart), peach, and plum (cultivated and wild). No PC injury or larvae have been found in pear fruit in the field. Results of

laboratory fruit host trials are reported in the table below. PC adults fed and laid eggs in all cultivated pome and stone fruits offered, and in wild plum (*Prunus americana*) and black hawthorn (*Crataegus douglasii*). Although eggs were laid in peach and pear, no larvae developed. No oviposition scars, eggs or larvae were found in ornamental crabapple (*Malus* spp.). No adult leaf feeding was observed on black hawthorn or ornamental crabapple.

<u>Fruit Host</u>	<u>Number per cage (5-10 fruits) after 5-8 days</u>				
	<u># Feeding Scars</u>	<u># Oviposition Scars</u>	<u># Eggs</u>	<u># Larvae</u>	<u>Leaf Feeding?</u>
<u>Cultivated Stone Fruits</u>					
Apricot	40.6	13.8	--	9.2	Yes
Sweet Cherry	9.7	8.3	0.9	2.4	Yes
Tart Cherry	17.8	17.1	6.3	0.6	Yes
Peach	2.7	0.8	0.9	0	Yes

<u>Fruit Host</u>	<u>Mean number per cage (5-10 fruits) after 5-8 days</u>				
	<u>Feeding Scars</u>	<u>Oviposition Scars</u>	<u>Eggs</u>	<u>Larvae</u>	<u>Leaf Feeding?</u>
<u>Cultivated Pome Fruits</u>					
Apple	9.4	8.6	4.8	1.0	Yes
Pear	2.4	0.4	0.2	0	Yes
<u>Wild and Ornamental Fruits</u>					
Wild Plum	21.1	7.8	6.1	0.2	Yes
Black Hawthorn	7.0	3.0	2.2	0.6	No
Ornamental Crabapple	3.4	0	0	0	No

PC Control

The Box Elder/Brigham City Mosquito Abatement District applied a single diazinon spray for control of plum curculio to each of 23 home yard sites in Brigham City from May 6-19, 2000. Petal fall of cherry and apple, the optimal time to control PC with insecticides, occurred from the last week of April to first week of May in the Brigham City area. Petal fall for apricot and peach was earlier, approximately mid April. The efficacy of diazinon for control of PC was determined by sampling 100 fruit from each site on June 21. The number of feeding and oviposition scars, eggs, larvae, and exit holes are presented below as a mean value for each fruit type. Most of the larvae recovered from fruit were near mature size, indicating that they were close to leaving the fruit to pupate. Although feeding and oviposition scar counts were high for most fruit types sampled, most of these were probably made by PC before the diazinon treatment was applied. Survival of eggs and larvae was low (0-3 larvae/100 fruit) in comparison to a nearby untreated wild plum site (31 larvae/100 fruit) which suggests that control with diazinon was reasonably good. Applying the insecticide earlier, at petal fall, and a reapplication 10-14 days later may improve the efficacy of diazinon treatment. No oviposition scars, eggs or larvae were found in peaches sampled at four sites.

<u>Fruit Host</u>	<u># Sites</u>	<u>Mean number per 100 fruit</u>				
		<u>Feeding Scars</u>	<u>Oviposition Scars</u>	<u>Eggs</u>	<u>Larvae</u>	<u>Exit Holes</u>
Apricot	3	116.7	50.0	0	3.0	0
Sweet Cherry	11	31.1	12.1	0	0.8	0.2
Tart Cherry	1	24.0	23.0	0	3.0	0
Peach	4	17.0	0	0	0	0
Apple	4	37.8	25.5	0	1.3	0
<u>Comparison untreated wild plum</u>						
Wild plum	1	68	115	0	31	0

### Adult Trapping

Pyramid traps caught more adult PC than circle traps in a wild plum site, however, trap catch was lower and similar between trap types in sweet cherry yard and orchard sites (Figure 2). No difference in trap capture between circle and pyramid traps was found in 1999 studies. Circle traps are more appropriate to use in home yard and some orchard sites because they are placed on tree trunks rather than on the ground where they may interfere with landscape or orchard activities. There was no significant increase in adult PC trap catch in circle traps baited with any attractant (fruit essence, ethanol, aggregation pheromone, acetic acid or any combination) as compared to unbaited traps (Figure 3). Circle traps with fruit essence (plum or sweet cherry), ethanol, essence + ethanol, and acetic acid + essence performed as well as no lure at most sites, but the pheromone alone or in any combination generally caught fewer PC than unbaited traps. Slight, but non-statistically different increase in trap catch was also observed for fruit essence in 1999 studies, but no clear or consistent trend in increased catch for any of the attractants stands out.

### Exclusion of PC from Trees

The percentage of fruit infested with PC was no different between trees with exclusion collars and without at either of the two study locations. Flight and crawling appear to both be major modes of movement for PC into host trees.

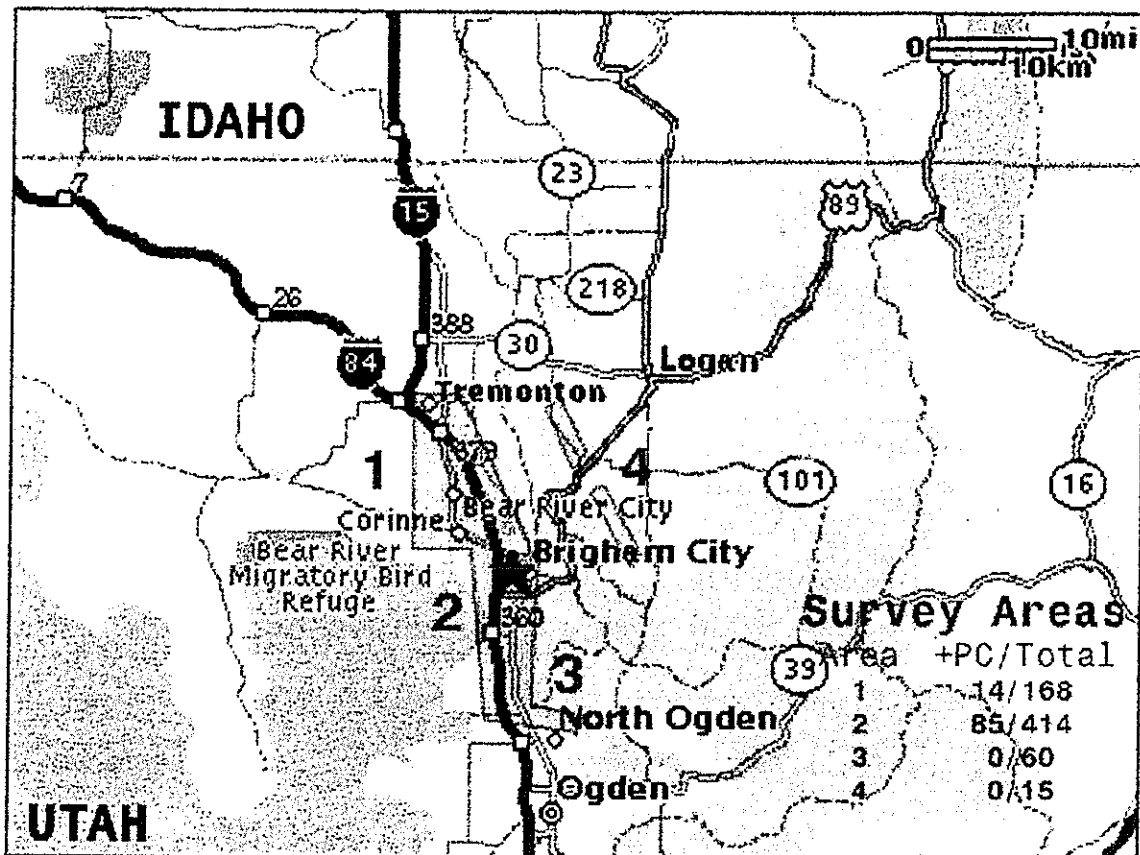


Figure 1. Map of plum curculio survey areas in northern Utah (Areas 1 & 2, Box Elder County; Area 3, Weber County; Area 4, Cache County), 1998-2000. The number of sites infested with PC out of the total number of sites surveyed in the area is indicated in the lower right-hand corner.

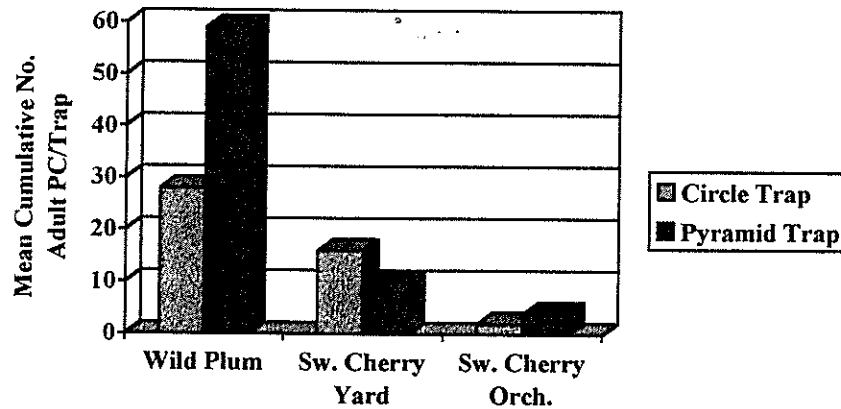


Figure 2. Comparison of adult plum curculio capture in circle and pyramid traps at three sites from May 2 – September 8, 2000.

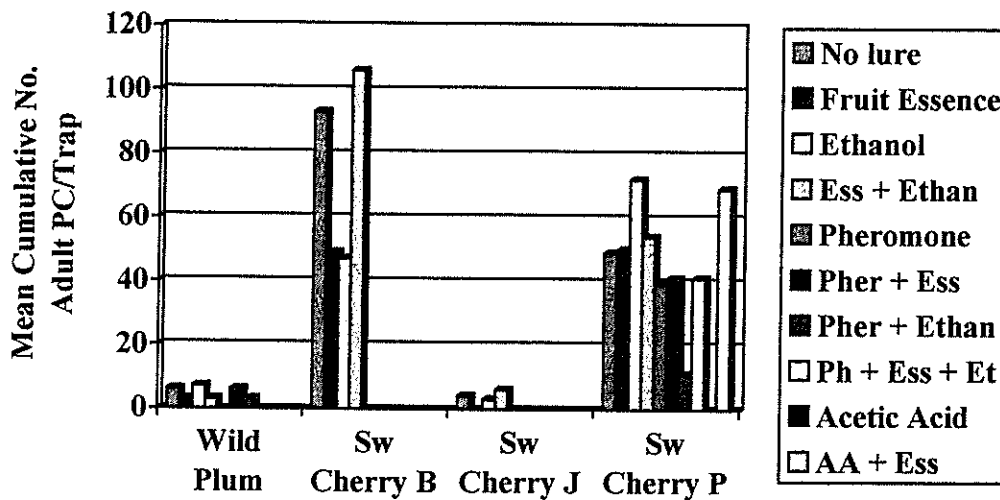


Figure 3. Comparison of adult plum curculio attractants in circle traps at one wild plum and three sweet cherry home yard sites from May 2 – September 29, 2000. The acetic acid and acetic acid + essence lures were only in place from June 9 – September 29.

**CONCLUSIONS:**

- **Where is PC?** The PC population in northern Utah has been delimited to an approximately 50 sq. mile narrow strip along highways 38 and 89 from Honeyville to Willard, centered on Brigham City, in Box Elder County. PC is unlikely to be found beyond this area because of large stretches of vegetation without host trees (dominated by sage brush) surrounding the infested area. Survey traps and fruit injury samples conducted in surrounding areas of Box Elder County and in other fruit producing

counties of northern Utah (Cache, Davis, Weber, Utah Counties) have all been negative for PC.

- **What is PC's primary habitat and host fruit?** 74% of the sites positive for infestation with PC are in Brigham City home yards. In the majority of these (69%), sweet cherry is the host tree. Therefore, the primary target for reduction and elimination of PC should be removal and treatment of home yard trees, especially sweet cherry.
- **What is the potential for PC to attack native, naturalized or ornamental hosts?** In the laboratory, PC demonstrated the ability to attack a native western U.S. pome fruit, black hawthorn (*Crataegus douglasii*). PC did not lay eggs in ornamental crabapple (*Malus* spp.). A non-native, naturalized host, American plum (*Prunus americana*), is a common host of PC in the infested area. All cultivated stone and pome fruits are potential hosts for PC, although peach and pear do not seem to be as readily attacked as others.
- **Can PC be controlled with insecticides?** The primary control of PC in the eastern U.S. is insecticides. Control of PC with diazinon or other insecticides appropriate for home yard use shows promise. Applying the insecticide at petal fall and repeating treatment 10-14 days later may improve the efficacy of diazinon over a single spray applied 1-2 weeks after petal fall.
- **Adult attractants and trapping.** No attractants evaluated show consistent increase in capture of adults in traps. Continued development and improvement of adult attractants, along with increased knowledge of PC host-finding behavior is needed.
- **PC population reduction program.** Removal of PC infested trees is the best approach to reduce and eliminate PC in northern Utah. Application of well-timed insecticides is an additional tool that has been implemented to a degree. Beyond these approaches, development of tactics for long-term population suppression is needed, such a biological control, mass trapping, removal or disturbance of overwintering sites, and others.