Rain Beetle Grub Control in Orchards of the Mid-Columbia, Oregon, Area: Summary of 1974-75 Field Fumigation Tests

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ABSTRACT

A general review of the distribution and life history of rain beetles (*Pleocoma* spp.) injurious to deciduous fruit trees in the Mid-Columbia, Oregon, area is given with a summary of control attempts with several pesticides and fumigants.

Field tests conducted during 1974-75 with the fumigant methyl bromide and Telone® using caged *Pleocoma* grubs indicated effective control can be obtained with methyl bromide in orchard replant sites under dry soil conditions if the proper procedure is followed in fumigant injection and sealing. Growers are advised to consult with local fieldmen and familiarize themselves with current labeling on fumigants before fumigating tree replant sites.

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R. W. Zwick and G. J. Fields

Introduction

Rain beetle grubs were suspected of being pests of fruit trees as early as 1918 when newly planted pear trees suffered severe root damage (Experiment Station correspondence records). However, it was not until 1953 that species of *Pleocoma,* the large dark scarab beetles known as rain beetles, were identified as major pests in tree orchards in the Mid-Columbia region. It was that year that substantial Newtown apple decline in the Dave McKeown orchard near Odell, Hood River County, brought about close scrutiny of the newly recognized pest. By the end of 1953, 20 orchards had been identified as having widespread rain beetle damage (Ellertson and Ritcher, 1959). Prior to 1953, only one species, *P. minor* Linsley, was known to occur in the Hood River Valley. During the fall of 1953 a second species, *P. crinita* Linsley, was found in the Odell area and *P. oregonensis* Leach, previously known only from Wasco, Oregon (Linsley, 1938), was found in a cherry orchard near The Dalles, Oregon. Tree removal in the cherry orchard in the spring of 1954 revealed many grubs and severe root damage. Recognition of their damage to the root system of fruit trees has resulted in considerable research on distribution, life history, and control of *Pleocoma* in the area.

Pleocoma are unique scarab beetles; females are wingless and adults never feed (Fellin and Ritcher, 1967). They are called rain beetles because males fly early in the morning after and during the autumn rains. Ellertson and Ritcher (1959) provided the following description of the life history: females mate in the fall and lay eggs from May into early July. Eggs hatch from July through August after about 60 days of development. The grub is C-shaped, typical of scarabaeid beetles. Larvae molt once a year and have from 9 to 13 molts. It is during this long feeding stage, 9 to 13 years, that the larvae do their damage. Larvae pupate in June and July and adults emerge with the autumn rains. Eggs, larvae, and pupae can be found at all depths where tree roots grow. Female *Pleocoma* emerge to the surface, then reenter the same hole or dig a new hole where they wait, a few inches below the surface, for the males. The males, upon

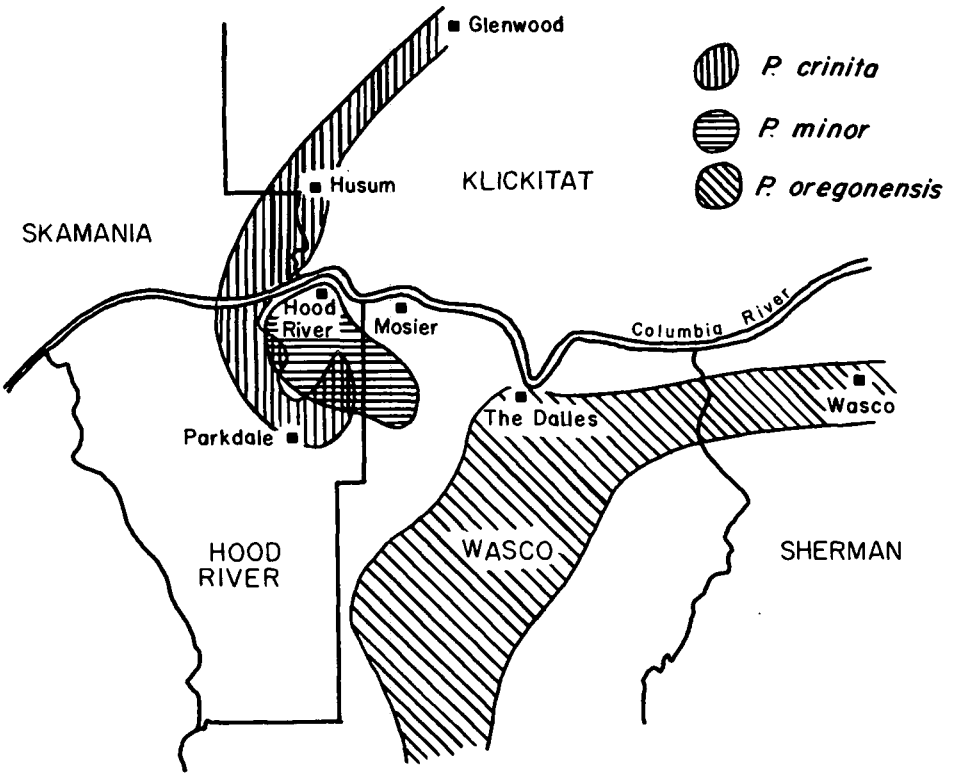

Figure 1. Distribution of *Pleocoma* species in the mid-Columbia area.

emergence, fly until they detect a female. Males land on the ground and crawl to the waiting female and burrow in after her. Up to nine males have been observed entering a burrow after one female. It is likely that a sex attractant given off by females guides males to them. Mating occurs in the burrow, and females may mate with more than one male.

Grub damage is the result of surface chewing or feeding on the bark of the roots. Root hairs and small feeder roots are often entirely consumed. Larger roots are scoured in patches or winding bands that often girdle the roots. Infested trees are low in vigor, have scant foliage, small leaves, and grow poorly. Fruit is small in size and yields are greatly reduced. Finally, the trees become uneconomical and must be removed from the orchard.

Early reports indicated that only the Newton cultivar was attacked (Ritcher and Olney, 1953), but subsequent investigations have shown that sweet cherries (Ellertson, 1956), other apple varieties, and pears are also fed upon. All three species of *Pleocoma* are indigenous to the Mid-Columbia area in mature forest lands where their primary hosts are

coniferous tree roots, and in the case of *P. oregonensis,* east into the sagebrush country of Wasco County. Figure 1 shows the known distribution of *Pleocoma* in the Mid-Columbia area. Contrary to previous reports (Fellin and Ritcher, 1967), *P. crinita* and *P. minor* are found together in two separate areas in the west side of the Hood River Valley.

History of Control Efforts

Since 1953, numerous control methods and insecticides have been used in efforts to control rain beetles. The first control efforts were made by rotovator. The soil around trees was rotovated to a depth of 5 inches in an effort to physically destroy the adults before they emerged. The results were poor, even when the depth was increased to 8 inches, since excavation of orchards soils showed many beetles within that depth of soil. The only known predators of rain beetles are skunks which dig up adults from the shallow mating burrows.

Because adult beetles do not feed and because they are above the ground for such a short time, most chemical control efforts have been aimed at the larval stage. The insecticides used to control white grubs in the 1950s in strawberries and other field crops were also evaluated against *Pleocoma.* Early materials used included DDT, BHC, aldrin, and heptachlor. Application of insecticides is difficult because grubs are found up to 5 feet below the surface. In 1957 heptachlor was used at a rate of 2 lb ai/40 gallons of water. On small newly planted trees, three injections of 1 gallon each were made 18 inches from the trunk. A 500-psi injection tool was used to inject at a depth of up to 5 feet (Zwick et al, 1970). Heptachlor was also injected into the soil around fully grown trees. Experiments were conducted laying out an 18-inch grid around a tree. Up to 40 injections were made per tree using a gallon of liquid per injection site (Experiment Station correspondence records). Insecticides applied by methods other than injection gave poor results and mixing heptachlor with the soil at an effective rate to a 5-foot depth would amount to an application of 480 lb ai/acre. This rate would be many times greater than the registered rate for heptachlor at that time.

Soil fumigants, Vapam®[1] and ethylene dibromide, were both field and laboratory tested between 1959 and 1966. Both materials gave some degree of control (Zwick et al, 1970), but there were problems of effective application, distribution, and phytotoxicity to existing trees.

Recent Control Research

During 1974 and 1975, experiments were conducted on fumigant application methods and their effective distribution within the soil. Two

[1] Vapam: sodium methyldithiocarbamate

fumigants, Telone®[2] and methyl bromide[3], were applied in soil using three methods: backhoe or crawler tractor excavations, 3-inch augered holes, or 12-inch augered holes. Excavations were approximately 4x4x5 feet deep or as a 4x5-foot deep trench the length of the replant row. The delivery end of the methyl bromide injection probe was positioned in the bottom of the excavation and the dirt replaced in the hole. Methyl bromide was then injected into the site from individual pressurized containers and the probe was removed. Telone was measured as a liquid and poured into the excavation immediately before refilling it.

Augered holes were made with a 3-inch hand soil auger, a 3-inch PTO driven drill-type auger, or a 12-inch power posthole digger. Telone® was poured into the holes and they were refilled with dirt. Methyl bromide was injected into the bottom of the augered holes with an injection probe after the soil was replaced in the hole. In all augered holes, the top 4 to 6 inches were plugged with a mudpack to prevent loss of the fumigant as the injection probe was removed.

Pleocoma minor and *crinita* grubs in their third to seventh instar, one grub per cage, were confined in perforated salve tins filled with untreated soil. A wire was secured through the cage to facilitate recovery and the grubs were buried for 7 to 10 weeks in 3-inch hand-augered holes at various depths and distances from the fumigation injection point. Grubs were buried in undisturbed soil near the augered fumigation sites (Figure 2), in the backfill soil, and outside the excavated holes (Figure 3). Results of the 1974-75 tests are presented in Tables 1 and 2.

In addition to the buried grub tests, methyl bromide was injected at a rate of 1 pound under one mature cherry tree to determine the feasibility of treating existing plantings. Several beetle emergence holes were observed within the dripline of this tree after treatment. The tree was killed by the fumigant within several weeks.

In a backhoed trench test in this same orchard, Telone®, applied at 1 to 2 quarts per 5x4x4-foot-deep trench prior to backfilling, failed to prevent some fall emergence of adult *P. crinita* two months later. Young grafted apple cultivars planted at this site the following spring were killed in several instances by residual Telone® fumigant, the odor of which could be detected at a 2-foot depth in the replant holes six months after application.

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[2] Telone: 1,3-dichloropropene—100 percent

[3] Methyl bromide: methyl bromide—98 percent; chloropicrin—2 percent

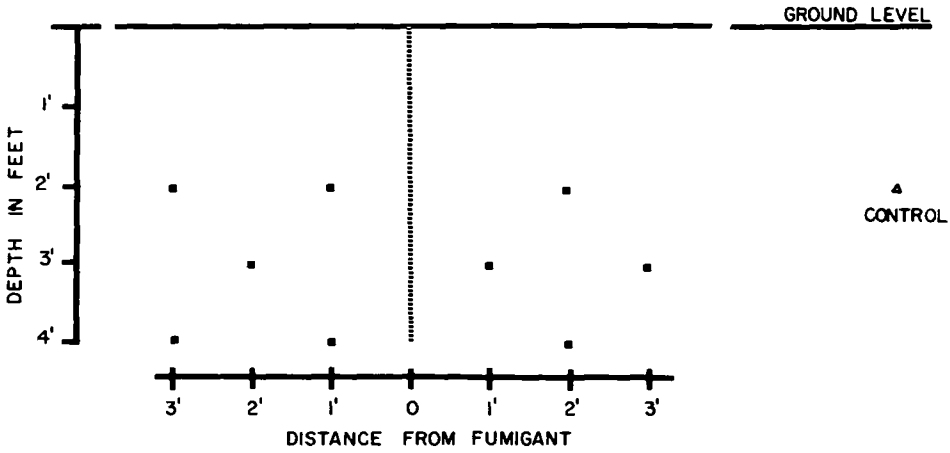

Figure 2. Methyl bromide (or) Telone fumigation at replant site against rain beetle grubs.

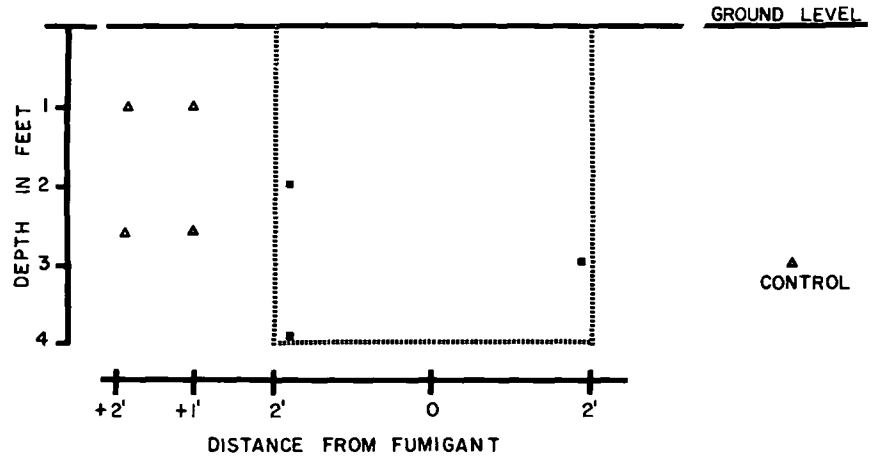

Figure 3. Methyl bromide (or) Telone fumigation in excavated replant site against rain beetle grubs.

Results and Discussion

Tables 1 and 2 detail the mortality counts made on caged *Pleocoma* grubs after varying lengths of exposure in these tests. Cages were retrieved after the exposure period by pulling the wire attached to the cages from the 2-foot depth or digging the cages out at greater depth. Figures 4 and 5 are graphic representations of the results obtained from the augered hole tests of methyl bromide and Telone®, respectively.

Table 1. Summary of 1974 *Pleocoma* Fumigation Tests.

Test no.	Date	Fumigant	Rate	Depth. (ft.)	Method	Soil	
						Type	Condition
1–MB	10/2	Methyl bromide	1.5 lb	3	Augered	Light	Dry
2–T	10/2	Telone	1.0 qt	3	Augered	Light	Dry
3–MB	10/25	Methyl bromide	1.5 lb	4	Backhoe	Light	Dry
4–MB	10/25	Methyl bromide	1.5 lb	4	Augered	Light	Dry
5–T	10/25	Telone	1.0 qt	4	Backhoe	Light	Dry
6–T	10/25	Telone	1.0 qt	4	Augered	Light	Dry
7–MB	11/4	Methyl bromide	1.5 lb	4	Augered	Light	Dry
8–C	Control		–	–	Augered	Light	Dry

Test no.	Distance from injection (ft.)	Depth of caged grub (ft.) 1	2	3	4	Key
1–MB	2	0	0	++ ++ ++	0	+ dead grub – live grub
2–T	2	0	0	++	0	0 not tested
3–MB	in exc.	0	+	+	+	
	1′ outside	–	0	–	0	
	2′ outside	–	0	–	0	
4–MB	1	0	+	+	+	
	2	0	+	+	+	
5–T	in exc.	0	+	+	+	
	1′ outside	–	0	–	0	
	2′ outside	–	0	–	0	
6–T	1	0	+	+	+	
	2	0	+	+	+	
7–MB	3	0	++	++	++	
8–C	control	0	– –	0	0	

Although numbers of *Pleocoma* grubs tested were small, only a single grub at each depth and distance from the fumigant injection point in most tests, results were consistent regarding effects of the fumigant, depth, and soil moisture in the several field tests performed. Methyl bromide was consistently the most effective fumigant as it penetrated the soil a greater distance from the point of injection than did Telone®. In dry, light mineral soil (sandy loam), methyl bromide gave 100 percent control to a distance of 6 feet from the injection point when injected at 2- to 4-foot depths. This indicates grubs can be controlled in a replant area of 12-foot diameter to a depth of 4 feet under ideal soil conditions. In heavier soils, however, mortality was only 50 percent at distances of more than 4 feet from the injection site. In wet soils, the gas did not penetrate even 2 feet from the point of injection. Under ideal (dry) soil conditions, Telone® was 100 percent effective only up to 3½ feet from the injection point.

Table 2. Summary of 1975 *Pleocoma* Fumigation Tests.

Test no.	Date	Fumigant	Rate	Depth (ft.)	Method	Soil	
						Type	Condition
1–MB	9/16	Methyl bromide	1.5 lb	4	Augered	Light	Very dry
2–MB	9/16	Methyl bromide	1.5 lb	2	Augered	Light	Very dry
3–T	9/16	Telone	1.0 qt	4	Augered	Light	Very dry
4–T	9/16	Telone	1.0 qt	2	Augered	Light	Very dry
5–C	9/16	Control	–	–	Augered	Light	Very dry
6–MB	8/25	Methyl bromide	1.5 lb	4	Augered	Light	Mod. dry
7–C	8/25	Control	–	–	Augered	Light	Mod. dry
8–MB	1/3	Methyl bromide	1.0 lb	3	Augered	Light	Wet
9–C	1/3	Control	–	–	Augered	Light	Wet

Test no.	Distance from injection (ft.)	Depth of caged grub (ft.)			
		2	3	4	Key
1–MB	3	+	+	+	+ dead grub
	4	+	+	+	– live grub
	5	+	+	+	0 not tested
	6	+	+	+	
2–MB	3	+	+	+	
	4	+	+	+	
	5	+	+	+	
	6	+	+	+	
3–T	3	0	+	+	
	4	0	–	+	
	5	0	+	+	
	6	0	–	–	
4–T	3	0	0	+	
	4	0	0	–	
	5	0	0	+	
	6	0	0	–	
5–C	control	–	–	–	
6–MB	3	++	++	++	
	4	++	– –	– –	
	5	– –	+–	+–	
7–C	control	–	–	–	
8–MB	2	– –	– –	0	
	3	–	–	0	
9–C	control	0	+	0	

In backhoed trenches, complete control was obtained with both methyl bromide and Telone® within the backfilled 5x4x4-foot excavation, but neither gas penetrated through 1 foot of undisturbed soil outside the excavation.

These tests indicate growers can control existing infestations at replant in an 8- to 10-foot diameter area by fumigating with methyl bromide

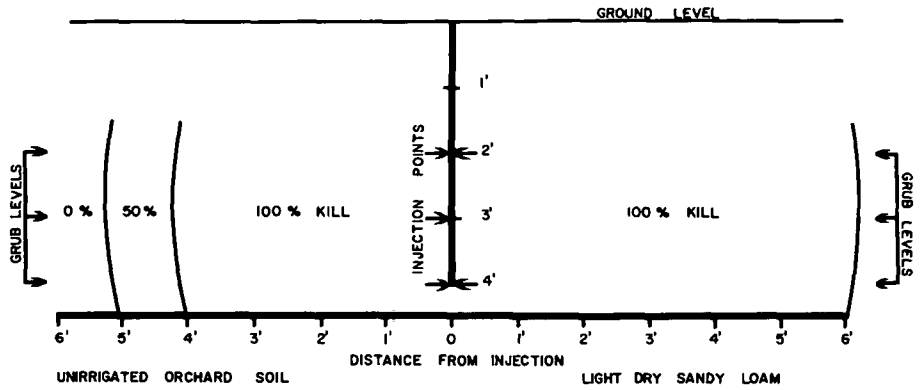

Figure 4. Methyl bromide fumigation of caged *Pleocoma* grubs, 1974-1975.

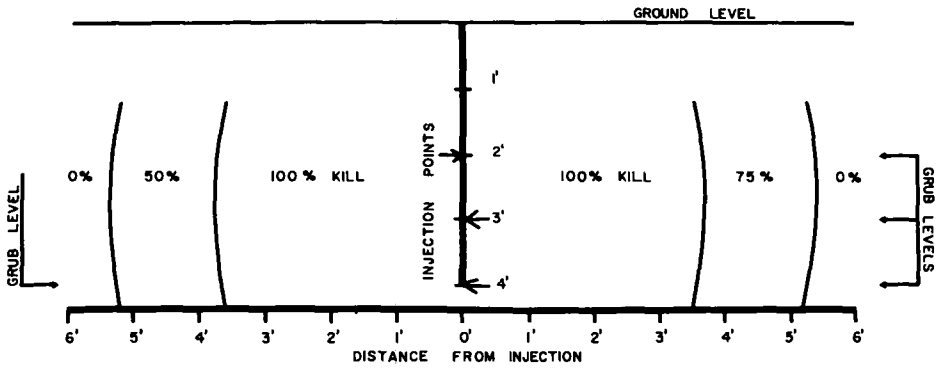

Figure 5. Telone fumigation of caged *Pleocoma* grubs, 1974-1975 (dry unirrigated soil).

under very dry soil conditions if the fumigant is injected 4 feet down and mud seals are used to confine the gas immediately upon its release and withdrawal of the injection probe. Under wet soil conditions, fumigation of replant sites would not be justified for grub control because of lack of penetration of the fumigant into surrounding soil.

As with all gaseous fumigants, no residual toxicity to grubs remains after complete dissipation of the gas and the soil is subject to reinfestation. Little is presently known about the lateral movement of *Pleocoma* grubs and growers should be aware of the possibility for attack of newly planted trees from grubs migrating into the replant area from adjacent nonfumigated soil.

Methyl bromide fumigation is presently registered at 1.5 pound per replant location for deciduous fruit tree crops for control of nematodes, soil insects, and certain disease organisms, but growers contemplating fumigation of replant sites for grub control should consult their fieldman and read latest label directions before fumigation. The results reported here indicate existing grub infestations can be controlled in replant sites if soil conditions are ideal and careful attention is given to proper application and sealing of the fumigant in the ground.

References Cited

Ellertson, F. E. 1956. *Pleocoma oregonensis* Leach as a pest in sweet cherry orchards. Journal Economic Entomology 49(3):431.

Ellertson, F. E. and P. O. Ritcher. 1959. Biology of rain beetles, *Pleocoma* spp. associciated with fruit trees in Wasco and Hood River counties. Oregon Agriculture Experiment Station Technical Bulletin 44. 43 pages.

Fellin, D. G. and P. O. Ritcher. 1967. Distribution of *Pleocoma* species in Oregon with notes on the habitat at *P. simi* and *P. carinata* (Coleoptera: Scarabaeidae). Pan Pacific Entomologist 43(4):251-263.

Linsley, E. G. 1938. Notes on the habits, distribution, and status of some species of *Pleocoma*. Pan Pacific Entomologist 14(2): 49-58, 14(3):97-104.

Ritcher, P. O. and V. Olney. 1953. White grubs as apple tree pests in the Hood River Valley. Proceedings Oregon Horticultural Society 45:41-42.

Zwick, R. W., F. W. Peifer, and F. E. Ellertson. 1970. Field-plot and laboratory screening of chemical control agents against *Pleocoma* larvae. Journal Economic Entomology 63(5):1573-76.