NOTES ON DISPERSAL, LONGEVITY AND OVERWINTERING OF ADULT *PISSODES STROBI* (PECK) (COLEOPTERA: CURCULIONIDAE) ON VANCOUVER ISLAND

L. H. MCMULLEN AND S. F. CONDRASHOFF[1]

ABSTRACT

Observations of dispersal, longevity and overwintering behavior are recorded. Some adult weevils lived up to 4 years, moved at least 1.2 km, and many overwintered in the upper parts of trees as well as in litter.

Pissodes strobi was formerly considered three species: *P. strobi* (Peck), the white pine weevil; *P. engelmannii* Hopk., the Engelmann spruce weevil; and *P. sitchensis* Hopk., the Sitka spruce weevil. The last two have been placed in synonymy (Smith and Sugden, 1969). However, the common names are retained here to designate the regional groups.

The Sitka spruce weevil destroys the leader of regeneration Sitka spruce (*Picea sitchensis* (Bong.) Carr.) and is a pest in coastal Oregon, Washington and British Columbia (Wright, 1960; Silver, 1968). A knowledge of the adult behavior is important in developing approaches to control of the insect. This report presents information on the activity of marked weevils released in the fall and of weevils caged in various locations. It adds to the knowledge of the insect's dispersal, longevity and overwintering behavior.

DISPERSAL

Adult weevils, reared from infested leaders, were mared in groups of 25 to 50 by spraying with fluorescent paint[2]. This treatment did not appear to inferfere with the insect's activity and marked weevils were easily distinguished, although the red paint was difficult to detect in later years. In September 1968, approximately 10,000 adults, marked red, and, the following September, a similar number marked green were released in the San Juan Valley about 14 km inland from Port Renfrew. The weevils were dropped among the branches near the top of 3- to 4-m-tall Sitka spruce trees in a logged-over area with western hemlock (*Tsuga heterophylla* (Raf.) Sar.), Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) and Sitka spruce regeneration. During May and June, 1969 through 1972, adult weevils, handpicked for other purposes from Sitka spruce leaders there and in other areas of regeneration up to 3.6 km away, were examined.

Marked weevils were readily seen the following March to May on the release and surrounding trees. As the season progressed, their proportion decreased to a small percentage of those found in late June. During 1969, weevils released in 1968 were recovered only up to 180 m from the release site. However, in subsequent years, weevils released in both 1968 and 1969 were found up to 1.2 km away (Table I).

The white pine weevil can move several hundred metres (Goodwin *et al.*, 1957), but most individuals do not move that far (Harman and Kulman, 1967a; Dirks, 1964). Our findings indicate that the Sitka spruce weevil can move readily (at lease 1.2 km from September to May), but observations in a newly infested plantation suggest that it generally remains close to its origin. Of 700 spruce trees in the plantation, 3 were infested in 1967; 21 in 1968, and 65 in 1969. Of the infested trees, 62% in 1968 and 77% in 1969 were within 18 m of the previous year's infested trees, whereas only 21 and 45 %, respectively, of all trees were within this area.

LONGEVITY

Although no weevils released in 1968 were found after 1970, four released in 1969 were found in 1972 (Table I), when they were 3 years old. In addition, fourteen weevils (8 females and 6 males), released in 1968 and recovered in spring 1970, were maintained subsequently in 6.3 x 7.1 cm (16 x 18 in) mesh fibreglass sleeve cages on parts of trees which appeared suitable for their seasonal behavior; i.e., on terminals during spring and early summer, on shaded laterals until October and near the base of the stem of 2.5-m tall trees until April or early May. One weevil was still living in the fall of 1972. Establishment of brood in the terminals in each of the 3 years (Table II) shows that surviving adults were capable of reproduction for at least 4 years.

[1]Pacific Forest Research Centre, Victoria, B.C.

[2]Fluorescent fast dry spray paint 501-H110 (red), British America Paint Co., Ltd.; Kem Hi-Gloss Safety green spray paint 649-FR26.

Table I. Numbers of released weevils recovered in collections at different distances from the release center

Year	Dates of collections	Distance from release center (km)											
		0			0.4			1.2			3.6		
		68	69	UN[1]	68	69	UN	68	69	UN	68	69	UN
1970	May 4-15	18	187[2]	154	-	-	-[3]	3	2	366	-	-	-
	May 16-31	-	-	-	2	2	46	0	0	166	-	-	-
	June 1-15	2	12	93	3	4	64	0	1	331	0	0	173
	June 16-30	2	1	59	-	-	-	-	-	-	0	0	157
1971	May 10-17	0	0	8	-	-	-	0	3	415	0	0	91
	May 26-27	0	3	10	0	2	247	0	1	127	-	-	-
	June 15-16	0	0	23	0	0	189	0	2	43	0	0	99
1972	May 8	-	-	-	-	-	-	0	1	14	-	-	-
	May 23-24	0	3	23	0	0	66	0	0	62	0	0	60

[1] 68, 69, UN = 1968-, 1969-released and unmarked wild weevils, respectively.

[2] observed but not collected

[3] - = no collections

	Date		Adults		Number of progeny		
	Caged	Examined	number[1]	age (years)	larvae	pupae	adults
1970	April 3	Aug. 5	3	2	4	6	0
	April 3	Aug. 5	5	2	30	86	8
	June 19	Aug. 5	6	2	0[2]	0	0
1971	May 3	July 2	5	3	13	1	0
	June 21	Aug. 8	5[3]	3	31	10	0
1972	April 29	July 2	2	4	16	4	0

[1] At least 1 male in each cage except 1972 which is uncertain.

[2] Adults oviposited and larvae started mining but appeared to be pitched out.

[3] Same adults as those caged May 3.

Table 2. Brood produced by Sitka spruce weevils in successive years.

This insect lives at least 2 years on eastern white pine (Harman and Kulman, 1967b) and on Sitka spruce (Carlson, 1971). Our tests suggest that adults may survive up to 4 years. Such longevity, if common, would reduce the effectiveness of control measures based on removal of infested leaders prior to emergence of the young adults. The failure of such procedures in the east has been attributed to reinfestation of an area by weevils moving in from outside (Dirks, 1964). However, our experience indicates that even where damage is localized and such reinfestation of treated areas might not be expected, old adults could cause damage for several years.

OVERWINTERING

In late September 1970, approximately 1000 marked weevils were released on each of three 2.5-m-tall Sitka spruce trees in the San Juan Valley, approximately 2.0 (Mainline), 7.2 (Mosquito) and 12.1 (Lens) km, respectively, east of Port San Juan beach. Six-inch lengths of spurce branches to which the adults were clinging were placed next to the stem on branches of the third to fifth whorl. The branches and stem of each tree were carefully examined each month from November to April and the location of observed weevils were recorded. In addition, a sample of duff (15 x 61 cm) from the base of each tree was examined in January and the remaining duff within 61 cm of the base was examined in April.

Glowz fast drying fluorescent spray paint lemon yellow, New York Bronze Powder Co., Inc.

Date	Site		
	Mainline	Mosquito	Lens
Nov. 12	207	407	90
Dec. 11	124	152	69
Jan. 19	87	146	54
Feb. 12	66	91	39
Mar. 12	77	83	42
Apr. 26	37	116	19

Table 3. Number of marked weevils released in late September found on release trees during winter of 1970-71.

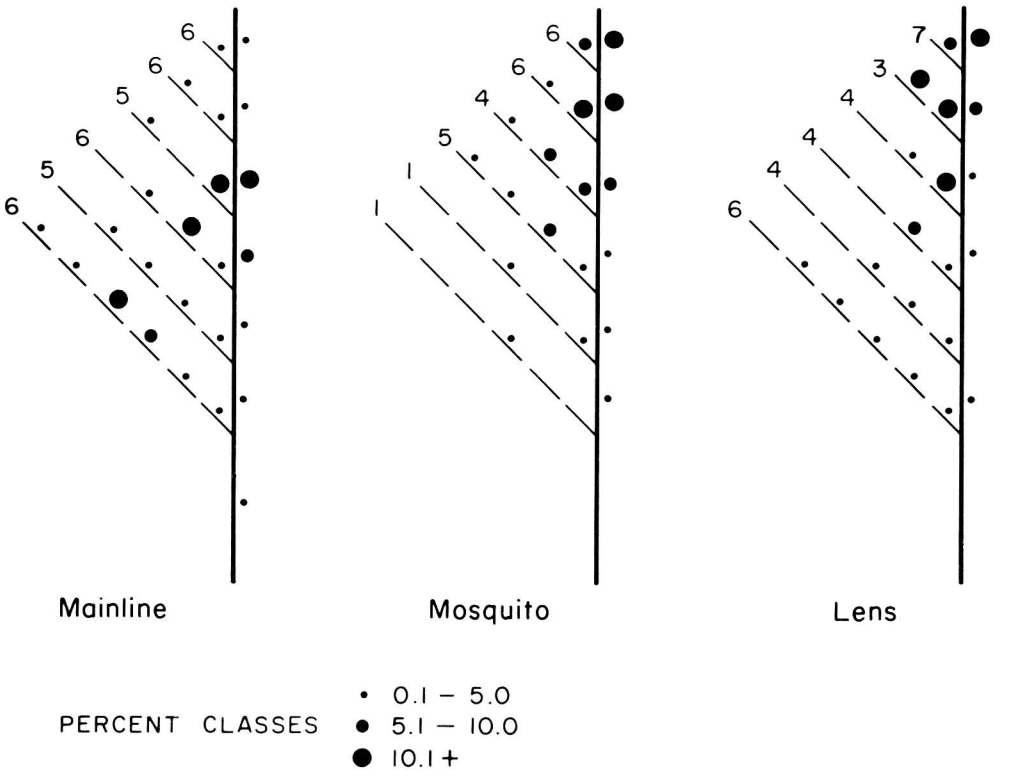

Fig. 1. Distribution of weevils on three trees as percent of total weevils on tree, November to April, 1970-71. Numbers indicate branches in each whorl.

Fewer weevils were found on the trees (Table III) than were released. In spite of careful search, some weevils were apparently missed, since sometimes more were found in subsequent examinations. The insects were on the bark among the needles, usually on the underside of the main laterals, and among needles or around the base of laterals on the stem. Most were on the laterals, although the number per internode was higher on the stem than on the laterals. The distribution did not change much during the winter. Data from all six observations were combined in Figure 1. The Mainline site tree was next to a main logging road, and the resulting disturbance may have caused many weevils to move lower on the tree. At the other two sites, the majority remained near the stem and in the upper portion of the tree.

Eighteen live marked weevils were found in the duff in January (1 at Lens, 9 at Mosquito and 8 at Mainline) and an additional three were found in duff at each of the Lens and Mosquito sites in April.

In the east, the white pine weevil overwinters within the duff and litter (Belyea and Sullivan, 1956), but neither Silver (1968) nor Carlson (1971) found naturally occurring Sitka spruce weevils overwintering in the duff or on trees. However, Silver released weevils on trees and found some in the duff around the base and on the lower 23 cm (9 in) of the bole; Carolson found released weevils distributed throughout the tree. Gara *et al.* (1971) reported 100% mortality of adults caged in duff but good survival in cages on terminals and laterals. Our data indicate that weevils overwinter in trees but that some may winter in the duff.

Gara *et al.* (1971) assumed that weevils feed actively during winter whenever temperatures are high enough for insect movement. The apparent discrepancies relating to overwintering sites, therefore, may

be due to differing winter conditions. Carolson's work was done in moderate conditions in southwestern Washington, whereas Silver's was in the Nitinat Valley about 36 km from the west coast of Vancouver Island. Our observations were probably in an intermediate winter climate.

Resume

L'auteur rapporte ses observations sur la propagation, la longevite et la facon d'hiverner de ces insectes. Quelques Characons adultes vecurent jusqu'a 4 ans, se deplacerent sur au moins 1.2 km et plusieurs hivernerent dans les parties superieures des arbres ou sur la litiere.

References

Belyea, R. M. and C. R. Sullivan. 1956. The white pine weevil: a review of current knowledge. For. Chron. **32:** 58-67.

Carlson, R. L. 1971. Behavior of Sitka-spruce weevil, **Pissodes sitchensis** Hopkins (Coleoptera: Curculionidae), in south-western Washington. Ph D Thesis, Univ. of Washington, Coll. of Forest Resources, 77 pp.

Dirks, C. O. 1964. The white pine weevil in Maine — its biology and dispersal and the effect of prompt clipping of infested leaders on trunk form. Maine Agr. Expt. Sta. Bull 625, 23 pp.

Gara, R. I., R. L. Carlson and B. F. Hrutfiord. 1971. Influence of some physical and host factors on the behavior of the Sitka spruce weevil, **Pissodes sitchensis,** in southwestern Washington. Ann. Ent. Soc. Amer. **64:** 647-471.

Godwin, P. A., H. A. Jaynes, and J. M. Davies. 1957. The dispersion of radioactively tagged white pine weevils in small plantations. J. Econ. Ent. **50:** 264-266.

Harman, D. M. and H. M. Kulman. 1967a. Flight and dispersal of the white pine weevil. J. Econ. Ent. **60:** 1682-1687.

Harman, D. M. and H. M. Kulman. 1967b. Ovariole development in the white pine weevil, **Pissodes strobi** (Coleoptera: Curculionidae). Ann. Ent. Soc. Amer. **60:** 1146-1150.

Silver, G. T. 1968. Studies on the Sitka spruce weevil, **Pissodes sitchensis** in British Columbia. Can. Ent. **100:** 93-110.

Smith, S. G. and B. A. Sugden. 1969. Host trees and breeding sites of native North American **Pissodes** bark weevils with a note on synonymy. Ann. Ent. Soc. Amer. **62:** 146-148.

Wright, K. H. 1960. Sitka spruce weevil. U.S. Dept. Agr., Forest Service, Forest Pest Leaflet 47, 6 pp.