Agriotella Brown, 1933 (*Betarmon* auct.)
*columbiana Brown
occidentalis Brown
Ampedus Dej., 1833 (*Elater* Esch., nec Linn.)
**apicatus (Say)
**behrensi (Horn) (*cordifer* auct.)
bimaculatus (Van D.)
**brevis (Van D.)
carbonicolor (Esch.)
columbiana Brown (*varipilis* auct., *cordifer* auct.)
**hoppingi (Van D.)
**moerens (LeC.)
nigrinus (Hbst.) (*anthracinus* auct.)
oregonus (Schffr.)
phoenicopterus (Germ.)
**pullus (Germ.)
rhodopus (LeC.)
**ursinus (Van D.)
Megapenthes Kies., 1858
caprella (LeC.)
**nigriventris LeC.
**stigmosus (LeC.)
tartareus LeC.
Melanotus Esch., 1829
oregonensis (LeC.)
Cardiophorus Esch., 1829
**fenestratus LeC.
*latiusculus Esch.
*longior LeC. (*longulus* err.)
**mimeticus Horn (*edwardsi* auct.)
**pubescens Bl.
tenebrosus LeC. (*amplicollis* auct.)
**tumidicollis LeC.
Horistonotus Cand., 1860
**sufflatus (LeC.)

References

Walker, Francis, 1866. List of Coleoptera. Lord's Naturalist in Vancouver Island and British Columbia, II:309-11.

LeConte, J. L., 1869. List of Coleoptera collected in Vancouver's Island by Henry and Joseph Matthews. Ann. Mag. Nat. Hist. 4(4):369-385.

—1877. List of Coleoptera. Geol. Surv. Can. Rept. of Prog. 1875-76, pp. 107-109.

Brodie, Bruce, 1888. List of Coleoptera collected by Bruce Bailey in Kicking Horse Pass, Rocky Mts., C.P.R. in 1884. Proc. Canada Inst. Toronto, 5(3):213-215.

Wickham, H. F., 1893. Report of an entomological reconnaissance of southern Alaska and adjacent portion of British Columbia. Iowa Lab. Nat. Hist. Bull. 2:202-233.

Keen, J. H., 1895. List of Coleoptera collected at Massett, Queen Charlotte Island, B.C. Can. Ent. 27:217-220.

—1898. Preliminary catalogue of collection of natural history and ethnology in the Provincial Museum, Victoria, British Columbia. pp. 71-75.

—1905. Beetles from northern British Columbia. Can. Ent. 37:297-298.

Anderson, E. M., 1914. Insects collected in Okanagan Valley. Proc. Ent. Soc. B.C. 4:54-58.

Bush, A. H., 1914. A trip up Mount Cheam. Proc. Ent. Soc. B.C. 4:58-60.

Brittain, W. H., 1914. Report for Okanagan District. Proc. Ent. Soc. B.C. 4:14-19.

Hardy, G. A., 1927. Report of collecting trip to Garibaldi Park, British Columbia. Rept. Mus. Nat. Hist. for 1926, pp. C15-C26.

—1928. Vancouver Island Elateridae. Rept. Prov. Mus. Nat. Hist. for 1927, pp. E16-E17.

Stace-Smith, G., 1929 and 1930. Coleoptera from Copper Mountain, British Columbia. Museum and Art notes, Art, Hist. and Sci. Assoc., Vancouver, B.C., IV, pp. 67-74; V, pp. 22-25.

Hardy, G. A. and G. C. Carl, 1944. Natural history of Forbidden Plateau area, Vancouver Island, B.C. Rept. Prov. Mus. Nat. Hist. for 1943. p. D31.

Clark, M. E., 1949. An annotated list of Coleoptera taken at or near Terrace, B.C., Part 2. Proc. Ent. Soc. 45:21-24.

Fletcher, J., Gibson, A., Criddle, N., and W. J. Brown, 1902-34. Elateridae listed from British Columbia in Entomological Record. Ann. Rept. Ent. Soc. Ont., 32-61 (1902-1930). Ann. Rept. Que. Soc. Prot. Plants, 25 and 26 (1934).

THE EFFECT OF CERTAIN INSECTICIDES ON THE GERMINATION AND GROWTH OF ONIONS
I. INSECTICIDES APPLIED TO THE SOIL[1]

F. L. BANHAM[2]

Field Crop Insect Laboratory, Kamloops, B.C.

Introduction: The onion maggot, *Hylemya antiqua* (Meig.), has for many years caused serious damage to onion crops throughout the interior of British Columbia. In 1950, insecticide trials were undertaken at the Kamloops laboratory to provide a more satisfactory and less expensive control for this pest than the commonly used calomel seed-treatment. As an extensive review of the literature revealed that practically no work had been done on the phytotoxicity of the

1 Contribution No. 2940, Division of Entomology, Science Service, Department of Agriculture, Ottawa, Canada.
2 Assistant Entomologist.

insecticides to this crop, study was also directed toward whether certain insecticides when applied to the soil at commonly used rates would affect the onions.

The results of the latter study are dealt with in this paper. In a following paper, D. G. Finlayson discusses the effects of some of the newer insecticides when applied as seed treatments.

Methods and Materials: The experiment was conducted in clay pots in an insectary, so that attack by the onion maggot or other insects was prevented. There were six insecticidal treatments, the amounts being calculated on an area basis as follows:—

1) Dowfume W-85 emulsion (containing 83 per cent. by weight of ethylene dibromide) applied at the rate of nine U.S. gallons per acre.
2) Dowfume W-85 emulsion applied at the rate of 4.5 U.S. gallons per acre.
3) Aldrin, 2½ per cent. dust, applied at the rate of 100 pounds per acre.
4) Technical chlordane, 5 per cent. dust, applied at the rate of 200 pounds per acre.
5) Lindane, 1 per cent. dust, applied at the rate of 100 pounds per acre.
6) DDT, 5 per cent dust. applied at the rate of 200 pounds per acre.

These six treatments and a check were replicated four times, giving a total of 28 pots. Each treatment was applied once, the dust or the emulsion being sprinkled on and thoroughly mixed with sufficient uncontaminated, uniform, sandy loam soil for one seven-inch clay pot. Fifteen onion seeds of the Yellow Globe Danvers variety were planted at uniform depths, and at uniform spacing, in each pot. The pots were then set out in a randomized block design in an insectary that was covered with 14-mesh galvanized wire screen. Equal amounts of water were applied daily to all pots.

In determining the effects of the treatments on the onion seeds and seedlings, emergence of the plants from the soil, weight, height, colour, uniformity of the top growth, and plant survival were the criteria used. The number of emerged plants was recorded from thrice-weekly counts for each pot. Growth was determined by noting the total weight of all the plants in each pot at harvest and calculating the average. Notes were also made during the growing season and at harvest on height, uniformity of top growth, and variations in colour of the top growth.

Results and discussion: Table I shows the effects of the various treatments on total plant weight, average plant weight, and total number of plants. None of the insecticides used with the possible exception of chlordane, adversely affected the emergence or growth of onion seedlings. All treatments, except that of chlordane, exceeded the check treatment in the number of plants emerging and in the total weight of plant material produced. DDT and lindane produced slightly smaller plants than the checks, whereas the other treatments produced plants that were as large as or larger than those in the check. The total plant weights suggest that aldrin and the 4.5-gallon rate of ethylene dibromide stimulated emergence and plant growth. DDT, the nine-gallon rate of ethylene dibromide and lindane, in that order, also showed indications of favourable effects, but to a lesser degree. However, in each instance the favourable effect was due to stimulation of emergence rather than of growth.

Each of the treatments except chlordane stimulated emergence somewhat. During the first three weeks, emergence and plant survival were slightly greater for ethylene dibromide at nine gallons and 4.5 gallons. The chlordane caused a high mortality after emergence. The aldrin had a delaying effect on emergence for the first twelve days, later, emergence and growth appeared to be stimulated.

The DDT and lindane treatments appeared to hinder rather than promote growth.

Although none of the results of this experiment was statistically significant the results of some of the treatments appeared fairly definite. In some instances they support and in other instances contradict, statements made by other workers who have written on the phytotoxicity of insecticides. Much of this published material is so contradictory that it appears to be meaningless. Thorough investigation of such factors as plant species and variety, soil fertility, soil texture, soil moisture, fertilizers, climatic conditions, and their relationship to insecticides is urgently required as a prerequisite to further work on phytotoxicity. A compilation of all the material on the phytotoxicity of insecticides and a set of standard procedures to permit consistent results are necessary before sound experimentation of this type can be undertaken.

Summary: Five insecticides were incorporated into the soil in pots to find the effect on the germination of onion seeds of the Yellow Globe Danvers variety and on the growth of the resulting plants. All of the treatments except one produced more total plant material than the checks, but none was statistically better or worse than the untreated check.

Acknowledgments: The author acknowledges with thanks the assistance given by Dr. R. H. Handford, Officer-in-Charge, Field Crop Insect Laboratory, Kamloops, B.C., in the planning of the experimental work and in the writing of this paper. The author also wishes to express his appreciation to Dr. G. H. Harris, Professor of Plant Nutrition, Department of Horticulture, University of British Columbia, for advice on the statistical analysis of the data.

TABLE I.

Effect of one soil application of each of various insecticides on onion plants in four replications.

Treatment	Application Rate per Acre	Total Number of plants		Weight of Plants at Harvest	
		Emerged	At Harvest[1]	Average[2] (grams)	Total[3] (grams)
Chlordane 5% dust	200 lb.	27	21	0.573	12.0
Check	nil	30	27	0.477	12.9
Lindane 1% dust	200 lb.	34	31	0.465	14.4
Dowfume W-85	9 U.S. gal.	35	32	0.478	15.3
DDT, 5% dust	200 lb.	37	34	0.467	15.9
Aldrin, 2½% dust	100 lb.	36	33	0.507	16.7
Dowfume W-85	4.5 U.S. gal.	38	32	0.559	17.9

[1]Difference necessary for significance at 5% level—14.
[2]Difference necessary for significance at 5% level—0.156.
[3]Difference necessary for significance at 5% level—6.4.