Efficacy and Phytotoxicity of Selected Pesticides for the Suppression of the Brown Garden Snail, *Helix aspersa*[1]

Michael P. Parrella[2] and Peter B. Schultz[3]
Department of Entomology
University of California
Riverside, CA 92421

Abstract

Molluscicides for control of the brown garden snail *(Helix aspersa)* were evaluated and liquid formulations of Guthion (azinphosmethyl) and Zectran (mexacarbate) provided the most rapid and greatest kill. With granular formulations, snail mortality was highest (92%) using a 4% metaldehyde formulation at 67 kg ai/ha (60 lbs ai/acre). Applications of Guthion (azinphosmethyl), Zectran (mexacarbate) and Mesurol (methiocarb) at 4 g ai/l (equivalent to 4 lbs/100 gal) to 20 species of woody and herbaceous plant species resulted in no observed phytotoxicity.

Index words: Brown garden snail, *Helix aspersa,* pesticides, nursery crops, quarantine certification

Introduction

Snails and slugs are becoming an increasing problem for those involved in production of landscape plants in California. For the most part, growers are faced with the perennial problem of reducing holes eaten in flowers and foliage, in addition to eliminating the unsightly slime trails that accompany the movement of these molluscs. However, the problem is far more serious for California nurserymen who ship into states where quarantines exist against snails or slugs. These growers must obtain 100% control in order to maintain customers in these areas. If snails or slugs are found at the destination, a grower may be restricted from sending plant material into that area for a period of up to six months. Obviously, 100% control of any pest is very difficult; however, in the face of regulatory action, this is the goal that growers must strive to achieve.

A comparative evaluation of old and new molluscicides was made to better define which materials provide the greatest mortality in the shortest period of time.

[1]Received for publication February 27, 1984; in revised form April 27, 1984. This research was supported in part by the California Association of Nurserymen and the Virginia Nurserymen's Association.

[2]Assistant Professor of Entomology, Department of Entomology, University of California, Riverside, CA 92521.

[3]Entomologist, Virginia Truck and Ornamentals Research Station, Virginia Beach, VA 23455.

The *Journal of Environmental Horticulture* (USPS Publication No. 698-330) is published quarterly in March, June, September, and December by the Horticultural Research Institute. Subscription rate is $25.00 per year in USA; $40.00 per year for others.Second-class postage paid at Washington, D.C. and at additional mailing office. Send address changes to HRI, 1250 I Street, N.W., Suite 500, Washington, D.C. 20005.

Tests were directed toward the brown garden snail, *Helix aspersa* Muller, which feeds on a wide variety of nursery crops in California, and is a quarantined pest in Virginia as well as other states. Phytotoxicity is an important consideration in the selection of a material for snail or slug control. The selection of a pesticide must include information regarding its potential for plant injury. Selected materials were evaluated for phytotoxicity on a variety of woody and herbaceous plant species.

Materials and Methods

Efficacy Studies. Standardized flats 0.2 m^2 (18 in^2) were planted with the ground cover *Osteospermum* (trailing African daisy) or with chrysanthemum cuttings approximately 1 month prior to the initiation of the studies. A 929 cm^2 (1 ft^2) wooden arena was then situated in the center of the flat and placed 2.5 cm (1 in) deep into the soil; perimeter plants on the outside border of the arena were removed. A 2.5 cm (1 in) band of rock salt was glued into place 7.6 cm (3 in) from the top of the arena. This served as a barrier to the snails and kept them in the arena.

Several materials were selected based on earlier research demonstrating their effectiveness against molluscs: metaldehyde, Mesurol (methiocarb), Guthion (azinphosmethyl), Zectran (mexacarbate). The remaining treatments were chosen because they are carbamate insecticides, a class that has shown effectiveness against snails and slugs. These were applied to the 929 cm^2 (1 ft^2) arenas at dosages proportional to those recommended on a per acre basis. After applying materials, 20 mature snails (25 mm diam), collected from a biological control citrus orchard, were added to each arena. For each dosage (0.6, 2 or 4.5 kg ai/ha = 0.5, 2 or 4 lb ai/acre) there were four arenas with 20 snails each. Several different trials were conducted comparing specific formulations. Water-sprayed arenas containing snails served as a check. Arenas were located on raised benches in a lath house. Mortality was recorded 1 day after application and thereafter every 3 days for 15 days. In this way, any snail recovery could be monitored and absolute mortality readings made. Snails were considered dead when they did not move when touched with a probe.

Phytotoxicity Studies. Two sites in eastern Virginia with a large quantity of imported plant material were selected. One site was a 1 acre retail garden center stocked primarily with shrubs and trees for use in landscaping. The second site was a 2 acre complex of plastic houses with bedding and foliage plants from California or Florida, grown for up to 1 year prior to retail marketing. The chemicals applied for phytotoxicity evaluation were Guthion 50WP (azinphosmethyl), Zectran 2E (mexacarbate) and Mesurol 75WP (methiocarb). All materials were applied at 4.8 g ai/L (4 lbs ai/100 gal) with 3 replications of the woody plants and 6 replications of the herbaceous plants. Treatments were applied to runoff on June 27 and July 5, 1983 using a 1 gal compressed air sprayer at 30 psi. Plants were evaluated July 5 and July 11, 1983 using a 0-5 rating (0 = no injury, 5 = plant dead). Plants were irrigated daily at both sites.

Results and Discussion

Efficacy Studies. Materials applied at 0.6 kg ai/ha (0.5 lb ai/acre), the rate most often recommended for insect control, provided 40% control after 15 days. As a result, details of these data are not reported. An examination of liquid formulations (Table 1) reveals that Guthion (azinphosmethyl) and Zectran (mexacarbate) provided the most rapid and greatest kill. Larvin (thiodicarb) provided 60% control after 15 days. The most commonly used molluscicides, Mesurol (methiocarb) and metaldehyde provided 57% and 14% control, respectively. Comparison of granular formulations showed the same pattern; Mesurol provided greater mortality than metaldehyde (Table 2). The greatest mortality was obtained using the highest rate of metaldehyde in the 4% formulation known as Deadline (Table 2). The reduced control obtained at lower dosages of Deadline is deceiving because it does not reflect the material's ability to kill *H. aspersa*. The highest dosage used, 67 kg ai/ha (60 lb ai/acre), represents about 1 tablespoon per arena and lower dosages require proportionately less material. With 20 mature snails per arena, there was not enough Deadline available for all the snails to ingest a lethal dose. The label recommendation is to place a row of dime-sized drops approximately 11 cm (4 in) apart in affected areas. This application method and rate can be quite effective if concentrated in areas where snails and slugs are known to be a problem. In this way control can be achieved, keeping the dosage/area (and therefore the cost) at a low level.

Table 1. Efficacy of selected liquid formulations of pesticides for control of the brown garden snail, 1982.

Treatment	Formulation[y]	Percent mortality (X 100) after[z]					
		Day 1	Day 3	Day 6	Day 9	Day 12	Day 15
Control		0.0 a[z]	1.3 a	1.3 a	2.5 a	6.3 a	6.3 a
Metaldehyde	25 G	0.0 a	6.3 ab	8.8 ab	12.5 a	12.5 a	13.8 a
Advantage	2.25EC	0.0 a	0.0 a	10.0 ab	13.8 a	15.0 a	15.0 a
Ficam	76WP	0.0 a	3.8 ab	25.0 bc	32.5 b	33.8 b	36.3 b
Lannate	1.8L	0.0 a	8.8 ab	35.0 cd	42.5 bc	46.3 bc	46.3 bc
Mesurol	75WP	0.0 a	5.0 ab	46.3 de	51.3 bc	57.5 c	57.5 cd
Larvin	3.2F	0.0 a	15.0 ab	50.0 de	53.8 c	60.0 c	63.8 d
Guthion	25WP	0.0 a	1.3 a	63.8 ef	72.5 d	82.5 d	88.3 e
Zectran	25WP	0.0 a	16.3 b	77.5 f	80.0 d	85.0 d	85.0 e

[z]Means in the same column followed by the same letter or letters are not significantly different at the 5% level using Duncan's Multiple Range Test.
[y]All materials applied at 2 kg ai/ha (2 lb ai/acre) to four 929 cm^2 arenas. Twenty mature snails were added to each arena.

Table 2. Efficacy of selected granular or bait treatments for control of the brown garden snail, 1982.

Treatment	Formulation	Percent mortality (x 100) after					
		Day 1	Day 3	Day 6	Day 9	Day 12	Day 15
Control	—	0.0 a[z]	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
Dycarb	10G	1.3 a	2.5 a	2.5 a	2.5 a	2.5 a	2.5 a
Mesurol	2G	1.3 a	8.8 a	62.5 c	63.8 c	66.7 c	68.8 c
Metaldehyde	7.5G	26.3 b	38.8 a	43.8 b	45.0 b	46.3 b	46.3 b
Deadline (Metaldehyde)							
11 kg ai/ha	4G	0.0 a	0.0 a	1.3 a	7.5 ab	10.0 ab	10.0 ab
22 kg ai/ha	4G	0.0 a	0.0 a	0.0 a	1.3 a	3.8 b	3.8 a
34 kg ai/ha	4G	0.0 a	0.0 a	7.5 ab	15.0 b	20.0 b	20.0 b
45 kg ai/ha	4G	0.0 a	2.5 b	10.0 b	16.3 b	16.3 b	18.3 b
67 kg ai/ha	4G	0.0 a	66.3 c	80.0 c	82.5 c	88.8 c	92.3 c

[z]Means in the same column followed by the same letter or letters are not significantly different at the 5% level using Duncan's Multiple Range Test.
[y]Deadline applied to 1 location within each of four 1-ft² arenas; other materials placed evenly throughout the arenas. Twenty mature snails were then added to each arena.
[x]67 kg ai/ha = 1 tablespoon/ft².

Phytotoxicity Studies. No phytotoxicity was observed on the plant material with any of the 3 treatments. The plants treated were *Liriope muscari, Juniperus chinensis* 'Parsonii' (Chinese juniper), *Cornus florida* (flowering dogwood), *Thuja occidentalis* (arborvitae), *Cupressus sempervirens* (Italian cypress), *Pinus strobus* (white pine), *Buxus sempervirens* (English boxwood), *Hibiscus* sp., *Pyracantha coccinea, Coleus blumei, Senecio cineraria* (dusty miller), *Salvia splendens, Celosia argentea, Petunia* sp., *Tagetes patula* (marigold), *Begonia semperflorens, Beloperone guttata* (shrimp plant), *Asparagus plumosa* (asparagus fern), *Syngonium* sp. and *Pelargonium x hortorum* (geranium).

Significance to the Nursery Industry

Regulatory restrictions on sending plant material infested with brown garden snail make it imperative that growers take steps to be completely free of this pest. The data presented identify both registered and unregistered pesticides that can safely provide good to excellent control of the brown garden snail. It should be noted that none of the treatments provided 100% control, and additional control measures may be needed to satisfy quarantine requirements. Past research has shown that the data for brown garden snail should not be extrapolated to other snail or slug species, as different species react differently to the toxicants (1). Likewise, a small number of each plant should be tested prior to general use of a new pesticide to avoid unpredicted losses from phytotoxicity.

Ed. note: This paper reports the results of research only, and does not imply registration of a pesticide under amended FIFRA. Before using any of the products mentioned in this research paper, be certain of their registration by appropriate state and/or federal authorities.

Literature Cited

1. Singh, O. and R.A. Agarwal. 1981. Toxicity of certain pesticides to two economic species of snails in northern India. J. Econ. Entomol. 74:568-571.