Research Note

ORNAMENTAL PEST MANAGEMENT USING IMIDACLOPRID APPLIED WITH THE KIORITZ® SOIL INJECTOR

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The Kioritz® (Kioritz Corporation, 7-2, Suehirocho 1-Chome, Ohme, Tokyo 198, Japan) is a handheld soil injector made for injecting fertilizer and systemic pesticides into the root zone of trees and shrubs. It is approximately 1 m (3.3 ft) long with a 25-cm (9.8-in.) injector tip, holds up to 2.8 L (90 oz) of solution, and weighs approximately 2.7 kg (6 lb). A mixed solution, ready for application, is poured in the reservoir, the injector tip is placed 7.6 to 20.0 cm deep in the soil around the base of the plant to be treated, and the dispensing knob is struck with the hand to deliver the required amount of solution around the targeted plant.

The Kioritz has advantages over conventional power soil-injection methods in that no power spray equipment is required. With the Kioritz, a fraction (usually less than 1/100th) of the water is used for making soil injection treatments as compared to conventional power soil-injection treatments.

Imidacloprid, the active ingredient contained in Merit,® is a systemic chloronicotinyl insecticide used for control of insect pests in turf and ornamentals. Soil applications of imidacloprid effectively control a wide range of tree and shrub pests including adelgids, aphids, lace bugs, leafminers, mealybugs, scales, thrips, whiteflies, elm leaf beetles, leafhoppers, and Japanese beetle adults. Imidacloprid controls pests by contact and ingestion (Mullins and Christie 1995). Imidacloprid translocates systemically via xylem and can be effectively applied as a soil treatment to the root system (i.e., soil drench or soil injection) (Tattar et al. 1998). Soil injection with imidacloprid may provide season-long control of pests (Sclar and Cranshaw 1996), and the many disadvantages of foliar sprays are reduced or eliminated.

The objective of this study was to determine if imidacloprid could be effectively applied by this soil-injection method to control certain damaging and commonly occurring pests on ornamental trees and shrubs. Although a few studies have evaluated the effectiveness of the Kioritz (Marion et al. 1990), more research was needed to further broaden the experience and usefulness of this additional method of application for imidacloprid and other soil insecticides.

Material and Methods

Nine separate trials were conducted during 1993 to 1997 to evaluate the effectiveness of imidacloprid applied with the Kioritz soil injector. Two of the trials were performed in California, one in Maryland, and six in Pennsylvania.

Trees and shrubs infested or anticipated to be infested with the birch leafminer (*Fenusa pusilla* [Lepeletier]), hawthorn leafminer (*Profenusa canadensis* [Marlatt]), Japanese beetle adults (*Popillus japonica* Newman), azalea lace bug (*Stephanitis pyriodes* [Scott]), hawthorn lace bug, (*Corythucha cydoniae* [Fitch]), crapemyrtle aphid (*Tinocallis kahawaluokalani* [Kirkaldy]), painted maple aphid (*Drepanaphis acerifoliae* [Thomas]), or hemlock woolly adelgid (*Adelges tsugae* Annand) were treated using imidacloprid applied with the Kioritz soil injector. Either 28.3 or 56.6 gm of Merit 75WP was mixed with 0.89 L of water. For each 2.5 cm of tree diameter at breast height (dbh) or 30.5 cm of plant height, 29.5 mL of solution was applied by striking the Kioritz dispensing knob (on high setting, 5 cc) six times. As a result, 0.75 (low labeled rate) or 1.5 (high labeled rate) gm active ingredient (a.i.) of imidacloprid was applied per 2.5 cm of dbh or 30.5 cm of plant height. Tree injections were placed within 30 cm of the tree root collar and 15 to 20 cm deep. For shrubs, injections were made within 15 cm of the plant base and approximately 7 to 15 cm deep.

Efficacy of treatments was evaluated by determining percent damage, percent infested plant parts, or by number of pests present.

Results and Discussion

In all nine trials, imidacloprid when applied with the Kioritz soil injector at labeled rates of 1 to 2 gm of Merit 75WP/2.5 cm dbh or 30.5 cm plant height significantly ($P = 0.05$) reduced pest populations or symptom incidence when compared to untreated plants (Table 1). Imidacloprid applied in the spring (April 2) for birch leafminer control did not provide as effective control as compared to the fall treatment (November 22). Sufficient time may not have occurred for imidacloprid to be taken up by the tree following the spring application for control of an early season pest, such as the birch leafminer which usually emerges around the first week of May in southeastern Pennsylvania. Tattar et al. (1998) found that imidacloprid may require 1 to 2 months to translocate in deciduous trees. Thus, fall treatments or early spring treatments (2 months prior to adult birch leafminer emergence) are recommended for effective birch leafminer control.

Table 1. Ornamental pest management using imidacloprid applied with the Kioritz soil injector[1,2].

Pest	Host	Average size (cm)	Treatment date	Rate (gm a.i.)[3]	Evaluation method	Evaluation date	Results[4]
							% mined leaves
Birch leafminer	Japanese birch	13.7 dbh	11/22/96	0.75	300 leaves per tree	6/2 & 6/3/97	0 a
				1.5			0 a
			4/2/97	0.75			8.6 ab
				1.5			18.7 bc
			Untreated	——			31.8 c
							% mined leaves
Birch leafminer	White birch	27.9 dbh	10/31/96	1.5	500 leaves per tree	5/21/97	3.4 a
			Untreated	——			26.4 b
							% mined leaves
Hawthorn leafmining sawfly	"Winter King" hawthorn	6.9 dbh	11/22/96	0.75	300 leaves per tree	6/16/97	17.4 a
				1.5			3.7 a
			Untreated	——			42.1 b
							% stippled leaves
Azalea lace bug	Azalea	45.7 cm tall	11/21/96	1.5	200 leaves per plant	6/16/97	0 a
			Untreated	——			69.5 b
							# nymphs/eggs
Hawthorn lace bug	Cotoneaster	30.5 cm tall	12/2/96	1.5	4 shoots per plant	7/15/97	0.8 a
			3/28/97	1.5			9.6 a
			Untreated	——			582.1 b
							% damaged leaves
Japanese beetle	Serviceberry	150.0 cm tall	11/22/96	0.75	150 leaves per plant	8/5/97	5.6 a
				1.5			2.9 a
			Untreated	——			33.8 b
							Mean # aphids
Crapemyrtle aphid	Crapemyrtle	5.8 dbh	3/24/93	1.5	2 terminals per tree	7/14/93	0 a
			Untreated	——			102.0 b
							# honeydew drops
Painted maple aphid	Silver maple	71.1 dbh	2/28/94	0.75	Honeydew drops per cm^2	9/8/94	0.2 a
				1.5			0.3 a
			Untreated	——			4.2 b
							% infested branches
Hemlock woolly adelgid	Eastern hemlock	50.8 dbh	11/19/96	1.5	25 branches per tree	11/20/97	1.0 a
			Untreated	——			74.0 b

[1]Soil type for all studies was either loam, sandy loam, or silt loam, except for the azalea lace bug study, which was clay. Soil pH for all studies ranged from 6.3 to 8.6 with the average pH = 7.0.
[2]For each treatment there were 3 to 10 replications.
[3]Rate of imidacloprid is presented as gm active ingredient (AI) for each 2.5 cm of dbh, except for the azalea lace bug, hawthorn lace bug, and Japanese beetle trials which are presented as gm a.i. per 30.5 cm of plant height.
[4]Means within a column for a specific pest followed by the same letter are not significantly different by SNK ($P = 0.05$).

Major ornamental pests such as aphids, adelgids, Japanese beetle adults, lace bugs, and leafminers were effectively controlled in these studies when imidacloprid was applied with the Kioritz. Soil moisture and soil type proved to be suitable for allowing proper penetration into the root zone with the Kioritz injector tip during these trials. Typically, during the spring and fall months, moisture is high and the soil conditions are conducive for using the Kioritz soil injector. The primary soil type encountered in these studies was sandy loam, and no difficulty occurred during these studies in inserting the Kioritz injector tip into the soil. Finer-textured soils (such as clay soils) or soils with low soil moisture may make injection with the Kioritz difficult and possibly result in inadequate control.

The Kioritz is not intended to replace conventional treatment methods such as power spraying or power soil injection, but it does offer lawn/landscape professionals and arborists another option for treating trees and shrubs, especially where suitable soil conditions are present.

Literature Cited

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