Controlling crane fly larvae in the Pacific Northwest

Applying some of the newer chemistries to coincide with egg laying by the European crane fly has some advantages and disadvantages.

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The European crane fly (*Tipula paludosa* Meigen) was first reported in the Pacific Northwest in Washington state in 1967 (8) and further described and updated in 1975 (3), and the common crane fly (*Tipula oleracea*) was first found in the Pacific Northwest in 2000 (4) (Figures 1, 2).

The most visible crane fly larvae damage on the golf course appears similar to cutworm chewing damage on the edges of aerification holes as they are healing. This damage has been more visible in the fall, but also can occur in warm spring weather. Damage is much less visible from larvae on tees, fairways and roughs, with damage more often caused from the feeding of predators (for example, crows, raccoons and skunks).

In the past several years, European crane fly infestations have been documented in the province of Quebec, Canada, and along Canada's eastern coast (7) (Figure 3). Although European crane fly and common crane fly larvae usually cause little damage to healthy turfgrass stands (6), heavy infestations can develop in areas that remain continuously wet, creating a hospitable environment for the eggs to hatch and the larvae to mature. Water-saturated grass roots stressed by limited oxygen can be seriously damaged by as few as 12 larvae/square foot (129.1/square meter), whereas healthy turf can withstand up to 20 larvae/square foot (215.2/square meter) without showing damage (2). The treatment threshold for turf areas in Washington state has been set slightly higher, at 25 larvae/square foot (269/square meter), because higher larval populations generally cause little to no visible turf damage (1). Many new turf areas (seeded or sodded) established during the summer have higher larval populations because of the frequent watering needed for adequate grass establishment. These newly established turf areas, comprising immature grass plants, are more susceptible to crane fly damage than more mature stands.

Photo by E. La Gasa

Photo from Ken Gray Collection, Oregon State University

Figure 1. A female European crane fly (*Tipula paludosa* Meigen) (left) and a female common crane fly (*T. oleracea* L.).

Synthetic and biological controls

Because of the loss in recent years of chlorpyrifos from private and public properties for control of both European and common crane fly larvae in the Pacific Northwest, a series of synthetic and biological insecticides have been evaluated for crane fly control.

March and April treatments of beneficial nematodes (*Steinernema carpocapsae* "All" strain and *S. feltiae*, Biosys "27" strain) failed to reduce larval populations of European crane fly (common crane fly larvae were not known to be present at this time) (6). The susceptibility of both European crane fly and common crane fly larvae to *S. feltiae* was examined in laboratory bioassays in Germany. European crane fly larvae were less susceptible than common crane fly larvae, and both species were most susceptible from the first instar through the first molt. Susceptibility of second- to fourth-instar larvae decreased with age (5).

Other materials, including cyfluthrin (Tempo), carbaryl (Sevin SL), bendiocarb Turcam), isophenfos (Oftanol) and chlorpyrifos (Dursban DTI), were applied in the early spring (February-March) for control of third-instar European crane fly with minimal to excellent success (2,6).

Application timing

In late 1999, it was confirmed that the common crane fly, which has two generations per year, was present in Washington and Oregon (4). The common crane fly lays its eggs in March-April and again in August-September, whereas the European crane fly has only one generation per year and lays its eggs in August-October (Figure 4). Taking into account these differences in oviposition timings, turf managers began making a single insecticide application to public and private turf areas between late October and early November in an effort to limit damage from both species. Because commercial applicators received a limited number of callbacks, we thought this application timing showed some promise and therefore included it as a treatment.

Objective

The objective of this research was to identify optimal application rates and timing as well as less toxic insecticides for possible control alternatives for European crane fly and common crane fly larvae in Pacific Northwest turf.

Materials and methods

Seven field experiments were conducted over a four-year period to determine efficacy and optimal application timings for selected synthetic and biological insecticides. The experimental design for all studies was a randomized complete block design with five replications per treatment. Plots were 5 feet × 10 feet (1.5 meters × 3 meters).


Photo from Ken Gray Collection, Oregon State University

Figure 2. As few as 12 crane fly larvae/square foot may cause significant damage in turf that is stressed.

Studies were conducted at two locations. Grass species varied and included a Kentucky bluegrass (*Poa pratensis* L.) and fine fescue (*Festuca rubra* L.) mixture at the TPC at Snoqualmie Ridge Golf Course in North Bend, Wash. The second site, the Washington State University-Puyallup Farm 5 research facility in Sumner, Wash., had a mixture of perennial ryegrass (*Lolium perenne* L.), colonial bentgrass (*Agrostis tenuis Sibth.*) and annual bluegrass (*Poa annua* L. var. *annua*).

Early fall applications (oviposition)

Application of imidacloprid at crane fly oviposition was suggested by field efficacy trials conducted in Europe (Chris Olsen, personal communication, 2003). Insecticides were applied Sept. 25, 2001, and Sept. 22, 2003, which coincided with oviposition of European crane fly females and the presence of second- and third-instar common crane fly (common crane fly females lay their eggs about a month earlier). Treatments included Merit (imidacloprid), Tempo (cyfluthrin), Dylox (trichlorfon) and thiamethoxam (Table 1).

Late-fall applications (first to second instar)

Late-fall applications of Dursban DTI (chlorpyrifos), Talstar (bifenthrin), Orthene (acephate), Scimitar (lambda-cyhalothrin), Dylox (trichlorfon), Merit (imidacloprid), Tempo (cyfluthrin), thiamethoxam, Distance (pyriproxyfen), Balsamo (*Beauveria bassiana*), Mach 2 (halofenozide), Altosid (methoprene) and Mavrik (fluvalinate) were evaluated for efficacy against first-instar European crane fly. Products were applied on Nov. 15, 2000, and Nov. 20, 2001. Rates and formulations of these treatments are presented in Tables 2 and 3.

Spring applications (third instar)

Over a four-year period, treatments were applied in spring to control overwintered

OVIPOSITION TIMING, 2001

			Application rate active ingredient		Average no. larvae/*	
Treatment	**Active ingredient**	**Formulation**	**Pounds/acre**	**Kilograms/hectare**	**Square foot**	**Square meter**
Untreated					26.1 a	280.5 a
Dylox	trichlorfon	6.2 G	8.14	9.11	12.3 b	132.0 ab
Merit	imidacloprid	0.2 G	0.25	0.28	7.3 b	78.3 b
	thiamethoxam	25WG	0.27	0.30	7.3 b	78.3 b
Tempo	cyfluthrin	0.1 G	0.13	0.15	4.2 b	45.4 b
Merit	imidacloprid	0.2 G	0.33	0.37	3.1 b	33.0 b
LSD					16.6	179

*Means within columns followed by the same letter are not significantly different.

Table 1. Oviposition timing for control of larval crane flies at WSU-Puyallup on colonial bentgrass, applied Sept. 25, 2001.

third-instar European crane flies. Selected insecticides were applied on March 15, 2001 (Talstar, Scimitar); Feb. 18, 2002 (Orthene; Sevin SL [carbaryl]; Talstar PL; Dursban DTI); March 5, 2002 (Talstar EZ); and Jan. 15, 2004 (Sevin SL; Talstar EZ, One, Onyx, Talstar PL [bifenthrin]; Dursban DTI) (Tables 4, 5 and descriptions below in "Late-spring applications (late third instar)").

Applications made in spring were categorized as early and late spring because of the four-month spread. Early-spring applications were made in January and February, and late-spring applications were in March. Results will be separated using these categories.

Methods

For all applications, liquid insecticides were applied using a CO_2-powered boom sprayer equipped with 8003 flat-fan nozzles operating at a pressure of 30 psi (206.8 kilopascals) and a spray volume of 3 gallons/1,000 square feet (122.2 liters/square meter). Granular treatments were applied by hand with a shaker bottle. All plots were irrigated with approximately 0.12 inch (3 millimeters) of water immediately after application to move the materials into the thatch-soil interface where the larvae were located. Treatments were evaluated by extracting six cores, each 4 inches (10.2 centimeters) in diameter, from the center of each plot and counting the number of surviving crane fly larvae. Oviposition and fall treatments were evaluated eight weeks after treatment, but spring treatments were evaluated four weeks after treatment.

Results and discussion

Early fall applications (oviposition)

In the oviposition study (Table 1), Merit (0.25 and 0.30 pound a.i./acre [0.28 and 0.33 kilograms/hectare]), Tempo and thiamethoxam significantly reduced larval numbers, providing 72%, 88%, 84% and 72% reductions, respectively. Because the larvae of the common crane fly and the European crane fly cannot be readily distinguished in the field, larval counts do not reflect separate species. When this oviposition timing study

LATE-FALL APPLICATION, 2000

			Application rate active ingredient		Average no. larvae/†	
Treatment	**Active ingredient**	**Formulation**	**pounds/acre**	**kilograms/hectare**	**square foot**	**square meter**
	Beauveria bassiana JW1	7.2 FL	$6.62 \times 10^{10*}$	$7.42 \times 10^{10*}$	107.3 a	1,154.6 a‡
Merit	imidacloprid	0.2 G	0.25	0.28	75.9 ab	816.7 ab
Untreated	---	---	---	---	75.0 b	808.1 b
	Beauveria bassiana JW1‡	7.2 FL	$6.62 \times 10^{10*}$	$7.42 \times 10^{10*}$	70.0 bc	762.9 bc
	thiamethoxam	25 WG	0.27	0.30	66.3 bcd	713.4 bcd
Tempo	cyfluthrin	0.1 G	0.13	0.15	65.6 bcd	705.9 bcd
Merit	imidacloprid	0.2 G	0.33	0.37	64.8 bcd	697.3 bcd
	Beauveria bassiana JW1‡	7.2 FL	$3.3 \times 10^{10*}$	$3.71 \times 10^{10*}$	66.0 bcde	717.7 bcde
Merit	imidacloprid	0.5 G	0.30	0.34	57./ bcde	614.4 bcde
Dylox	trichlorfon	1.5 G	1.51	1.69	51.8 bcdef	557.4 bcdef
Distance	pyriproxyfen	11.2 EC	0.18	0.20	49.8 bcdef	535.9 bcdef
Tempo	cyfluthrin	0.1 G	0.09	0.10	48.7 bcdef	524.0 bcdef
Merit	imidacloprid	0.5 G	0.39	0.44	42.6 cdef	458.4 cdef
Dylox	trichlorfon	6.2 G	5.43	6.08	37.6 def	404.6 def
Scimitar	lambda-cyhalothrin	10 WP	0.12	0.13	30.3 efg	326.0 efg
Dylox	trichlorfon	6.2 G	8.14	9.11	29.1 efg	313.1 efg
Talstar FL	bifenthrin	7.9 FL	0.22	0.25	26.1 efg	280.8 efg
Orthene 97	acephate	97 WG	3.69	4.13	21.5 fg	231.3 fg
Talstar PL	bifenthrin	0.2	0.40	0.45	3.8 g	40.9 g
Dursban DTI	chlorpyrifos	4 EC	1.0	1.12	2.0 g	21.5 g
LSD						340.0

*Rate is expressed as spores/hectare (2.3 x 10^7 spores/milliliter of product).
†Means within columns followed by the same letter are not significantly different.
‡Two applications 10 days apart.

Table 2. Late-fall crane fly larval control study on Kentucky bluegrass-fine fescue, applied Nov. 15, 2000.

was repeated in September 2003 (data not shown), the trends were similar to those in 2001. In 2003, the number of larvae was low and variable, so it was not possible to determine whether treatments were statistically significant.

Late-fall applications (first to second instar)

Of the materials applied on Nov. 15, 2000, only Dursban DTI, Merit 0.5G (at 0.39 pound ai/acre [0.44 kilogram/hectare]), Dylox 6.2G (5.43 and 8.14 pounds ai/acre [6.08 and 9.11 kilograms/hectare]), Scimitar, Talstar 7.9FL at 0.22 pound ai/acre (0.25 kilogram/hectare) and 0.2 at 0.40 pound ai/acre (0.45 kilogram/hectare); and Orthene 97 provided statistically significant crane fly reduction when compared with the untreated plots (Table 2). For the Nov. 20, 2001, applications, the number of larvae were significantly reduced by Dursban DTI (99% reduction), Talstar PL (93%) and Talstar FL (86%) (Table 3).

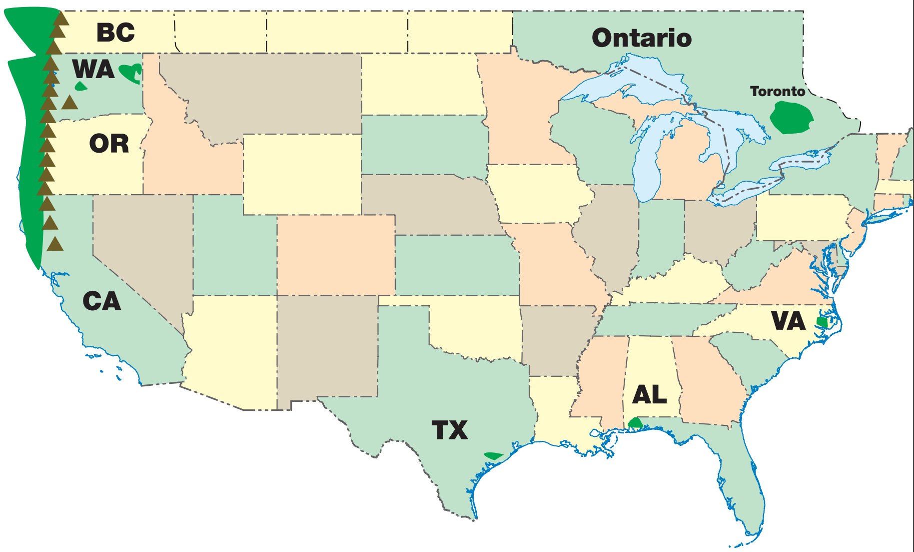

Figure 3. Both the European and common crane fly are expanding their ranges in the United States and Canada.

Illustrations by Kelly Neis

LATE-FALL APPLICATION, 2001

			Application rate active ingredient		Average no. larvae/*	
Treatment	**Active ingredient**	**Formulation**	**Pounds/acre**	**Kilograms/hectare**	**Square foot**	**Square meter**
Merit	imidacloprid	0.5 G	0.39	0.44	93.5 a	1,006.4 a
Mach 2	halofenozide	22.3 FL	1.6	1.78	93.1 a	1,002.3 a
Altosid	methoprene	20 EC	0.57	0.64	82.4 ab	886.8 ab
Mavrik	fluvalinate	0.2G	0.16	0.18	81.3 ab	874.5 ab
Mach 2	halofenozide	1.5G	2.0	2.21	74.4 abc	800.2 abc
Tempo	cyfluthrin	0.75 EW	0.13	0.14	73.6 abc	791.9 abc
Merit	imidacloprid	0.5 G	0.30	0.34	69.4 abc	746.7 abc
Mach 2	halofenozide	1.5 G	1.51	1.69	65.5 abc	705.3 abc
Tempo	cyfluthrin	0.1 G	0.13	0.15	59.0 bc	635.2 bc
Orthene 97	acephate	97 WG	3.69	4.13	57.5 bcc	618.7 bc
	thiamethoxam	25 WG	0.27	0.30	56.7 bc	610.4 bc
Dylox	trichlorfon	6.2 G	8.14	9.11	56.3 bc	606.3 bc
Untreated					55.2 bc	594.0 bc
Scimitar	lambda-cyhalothrin	10 WP	0.12	0.13	47.2 c	507.3 c
Talstar FL	bifenthrin	0.2 FL	0.40	0.45	7.7 d	82.5 d
Talstar PL	bifenthrin	0.2 G	0.40	0.45	3.8 d	41.2 d
Dursban DTI	chlorpyrifos	4 EC	1.0	1.12	0.8 d	8.3 d
LSD					33.4	359.4

*Means within columns followed by the same letter are not significantly different.

Table 3. Late-fall crane fly larval control study at North Bend, Wash., on Kentucky bluegrass-fine fescue, applied Nov. 20, 2001.

Early-spring applications (early third instar)

Several newer formulations of bifenthrin as well as Sevin SL were applied in early spring on Jan. 15, 2004, and all significantly reduced the number of larvae compared to the untreated control (Table 4). There were no significant differences among any granular or liquid applications.

Except for Orthene, all treatments applied Feb. 18, 2002, provided statistically significant crane fly reduction when compared with the untreated plots (Table 5). Talstar PL gave equivalent control of larvae (91%) in early spring and in late fall (93%) (Tables 2, 3), and Sevin SL at the rate of 8.0 pounds active ingredient/acre (9.0 kilograms/hectare) provided 85% control.

Late-spring applications (late third instar)

A new formulation of bifenthrin, Talstar EZ, provided 86% crane fly control when applied on colonial bentgrass-annual bluegrass-perennial ryegrass in late spring (March 5, 2002), reducing the number of crane fly larvae from the untreated level of 16.1/square foot (173.2/square meter) to 2.3/square foot (24.8/square meter).

Talstar PL applied on March 15, 2001, significantly reduced larval numbers (67%) as compared to the untreated control. The average number of crane fly larvae were reduced from 11.5/square foot (123.7/square meter) to 3.8/square foot (40.9/meter), but this result was not significantly different from plots treated with Scimitar, which reduced the average number of crane fly larvae to 7.3/square foot (78.6/square meter), a result not statistically different from the untreated plots.

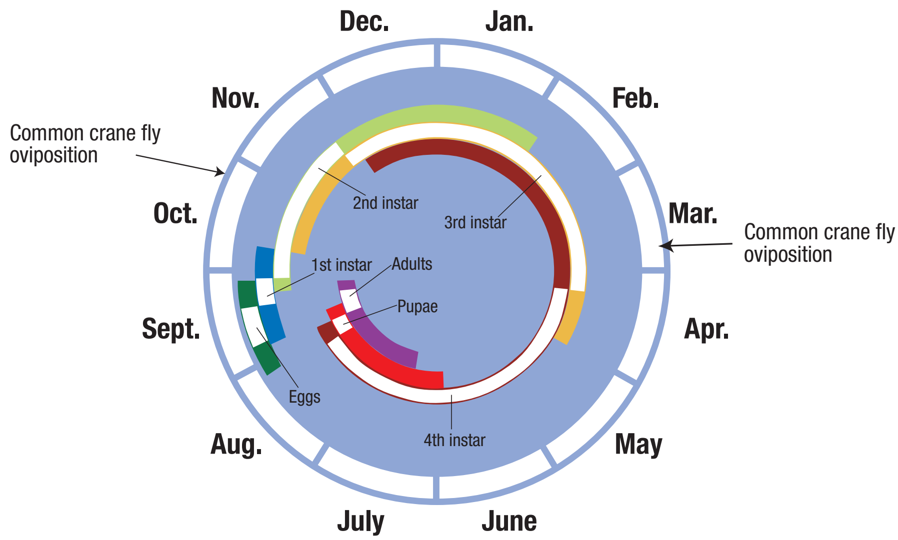

Figure 4. Each part of the crane fly life cycle is represented by a band of colored and white segments. Each white segment indicates when a particular life stage is most likely to occur. Redrawn from Jackson and Campbell (1975).

Conclusions

Some of the newer products containing insect growth regulators (for example, Mach 2 [halofenozide]) tend to be effective on early developmental stages and may not be as effective as some of the older chemis-

EARLY-SPRING APPLICATION, 2004

			Application rate active ingredient		Average no. larvae/*	
Treatment	Active ingredient	Formulation	Pounds/acre	Kilograms/hectare	Square foot	Square meter
Untreated					10.0 a†	107.6 a
Sevin SL	carbaryl	43 FL	8.0	9.0	3.0 b	32.3 b
Talstar EZ	bifenthrin	0.2 G	0.40	0.45	1.9 b	20.4 b
One	bifenthrin	7.9 FL	0.20	0.22	1.9 b	20.4 b
One	bifenthrin	7.9 FL	0.10	0.11	1.8 b	19.4 b
Talstar EZ	bifenthrin	0.2 G	0.20	0.22	1.5 b	16.1 b
Dursban DTI	chlorpyrifos	4 EC	1.0	1.12	1.1 b	11.8 b
Onyx	bifenthrin	23.3 EC	0.10	0.11	0.4 b	4.3 b
Talstar PL	bifenthrin	0.2 G	0.40	0.45	0.4 b	4.3 b
Onyx	bifenthrin	23.3 EC	0.20	0.22	0.4 b	4.3 b
Talstar PL	bifenthrin	0.2 G	0.20	0.22	0.0 b	0.0b
LSD					3.1	33.1

*Means within columns followed by the same letter are not significantly different.

Table 4. Early spring crane fly larval control study at North Bend, Wash., on Kentucky bluegrass-fine fescue, applied Jan. 15, 2004.

tries if they are applied against older instars. Because these products show better performance when applied before or during the oviposition period, monitoring for the number of larvae present is not possible. Ideally, it would be desirable to recommend only those products that effectively control crane fly in spring, after superintendents have sampled larval infestations to determine the need for a pesticide application. We have observed natural reductions in larval populations by 30% to 40% on untreated plots, most of which were attributed to bird predation (unpublished data). Applying the newer chemistries at oviposition may reduce bird feeding and associated turf damage. Unfortunately, it could also increase the use of unnecessary applications.

In conclusion, for unthrifty (stressed, such as high traffic, lower fertility) and newly established turfgrass areas, which would be more susceptible to European crane fly and/or common crane fly larval damage, an application of Merit would be effective in reducing larval populations in September at oviposition. With healthy turfgrass that was monitored in late fall or early spring for larval numbers above the threshold of 25 per square foot (269/square meter), an application of bifenthrin (Talstar, Onyx, etc.) or the higher rate of Sevin SL would be effective in reducing larval numbers and would prevent unacceptable turfgrass damage in the Pacific Northwest.

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THE RESEARCH says . . .

- **Three different application** timings, oviposition (September), early first to second instar (mid-November), and early to late third instar (February and March), were explored over a four-year period to evaluate insecticide efficacy in reducing larval infestations.
- **Imidacloprid provided significant** larval reduction when applied at oviposition.
- **Over a two-year period,** Talstar PL treatments applied in November gave an average of 95% control when compared to the untreated check.
- **Larval numbers were** reduced 67% by Talstar PL and 37% by Scimitar 10 WP, when applied against late third instars in March.

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EARLY-SPRING APPLICATION, 2002

			Application rate active ingredient		Average no. larvae/*	
Treatment	Active ingredient	Formulation	Pounds/acre	Kilograms/hectare	Square foot	Square meter
Untreated					24.9 a	268.1 a
Orthene 97	acephate	97 WG	3.7	4.13	21.1 ab	226.8 ab
Sevin SL	carbaryl	43 SL	4.0	4.5	10.0 bc	107.3 bc
Sevin SL	carbaryl	43 SL	8.0	9.0	3.8 c	41.2 c
Talstar PL	bifenthrin	0.2 G	0.40	0.45	2.3 c	24.8 c
Dursban DTI	chlorpyrifos	4 EC	1.0	1.12	1.9 c	20.7 c
LSD					11.2	120.5

*Means within columns followed by the same letter are not significantly different.

Table 5. Early-spring crane fly larval control study at WSU-Puyallup, Farm 5, colonial bentgrass-annual bluegrass-perennial ryegrass, applied Feb.18, 2002.