CORNELL UNIVERSITY TURFGRASS TIMES

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Crane Flies
Where are They Now?

The European crane flies Tipula paludosa Meigen and Tipula oleracea L. (Diptera: Tipulidae) are natives of the West Palearctic Region and are injurious to turfgrass and other horticultural crops in three geographic areas of establishment in North America. In the eastern Canadian Maritimes, T. paludosa was first detected in Nova Scotia in 1955, but was likely established as early as 1880 in Newfoundland. In Quebec, it was detected in 2002 followed by T. oleracea in 2003. In the Pacific Northwest, both species were first detected in British Columbia, T. paludosa in 1965 and T. oleracea in 1998. Both species are now established in Washington and Oregon, primarily along coastal areas west of the Cascades, and have been detected as far south as northern (T. paludosa) and central coastal (T. oleracea) California. In the geographic area of the eastern Great Lakes, T. paludosa was first detected in southern Ontario (1998), followed by New York (2004). The first detection of T. oleracea was coincident with T. paludosa in New York (2004), followed by eastern Michigan (2005) and southern Ontario (2007).

Known as "leatherjackets" for the tough pupal exuvia left behind by the emerging adult, larvae of T. paludosa and T. oleracea can be problematic in any grass-based ecosystem. They inhabit the top layer of the soil where they feed on root hairs, roots and crowns of their hosts. By pruning and disrupting belowground portions of the plant, they cause damage that leads to severe thinning of the sward and extensive dieback when damaged turf is drought stressed. Larvae will also reside in the thatch, emerging at night to feed on aboveground portions of the stems and foliage.

Beyond turfgrass, there is concern about the pest status of invasive Tipula in other horticultural systems of the United States. In the Pacific Northwest, affected production crops include peppermint, turnips and winter wheat, seedling nurseries, grass seed production and pastures and hayfields. In native habitats of Europe, larvae of T. paludosa damage pastures and cereals while those of T. oleracea are reported primarily as pests of winter cereals planted after oilseed rape crops. Other crops reported as food plants in Europe include brassicas, clover, corn, lettuce, sugar beets, strawberries, turnips, other vegetables, and ornamentals.

One reason for alarm about the spread of these invasives in the eastern United States is that the potentially susceptible landscapes are vast. In New York alone, there are 1.4 million acres of managed turf in the form of home lawns, golf

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Editor: Frank S. Rossi, Ph.D.

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The first objective was to establish the current known geographic distribution of each species so that future range expansion can be monitored. The second objective was to describe their local incidence across newly infested golf courses to gauge how widespread their establishments have become locally. By doing this, it is possible to ascertain the scope of potential impact from invasive Tipula in turf, not only to establish a baseline for monitoring future changes

courses, athletic fields, parks and other such landscapes. All turf and forage grass species appear to be acceptable hosts for larvae. Therefore production systems such as sod farms, pastures and hayfields are also at risk. In the Pacific Northwest, invasive crane flies are the most serious economic pest of pastures and hayfields in western Oregon and Washington. In grass seed production fields, they have emerged as pests particularly in new stands of grass. In their native Europe, Blackshaw (1985) estimated crane fly larvae to be responsible for yearly losses of over £15 million in pastures of Northern Ireland, where yields increased 74% after control of larvae. The main ramification of establishment is that infestations will likely impact grasses across the full spectrum of species and management intensity.

Movement of infested sod, container stock and other soil media could occasion spread of invasive Tipula locally and regionally. Building awareness and establishing safeguards to curb range expansion would benefit from more precise information on the nature of their threat to turf management. Most importantly, divergence in certain aspects of biology and behavior could strongly influence the outcome of their ultimate repercussions. For instance, female T. paludosa mate and lay most of their full complement of eggs the first night they emerge. Gravid females are also extremely poor fliers because of their low wing to abdomen length ratio, lessening the role of dispersal under natural conditions. Due to this, the species may tend to rapid buildup of local populations. In contrast, female T. oleracea will lay eggs over the course of 3-17 days after emergence, and owing to a relatively high wing to abdomen length ratio, they are more capable fliers when gravid. This species is therefore expected to have a higher rate of range expansion, but potentially a lower pest status due to slower buildup of local populations. Superimposed on this scenario is another major difference: T. paludosa is univoltine, with adult flights in the autumn, while T. oleracea has flights in spring and autumn and is probably bivoltine. In addition to the selection and timing of interventions for pest management, interspecific variation in natural history is relevant to gauging the rate of range expansion, local outbreak potential and overall pest status.

The first objective was to establish the current known geographic distribution of each species so that future range expansion can be monitored. The second objective was to describe their local incidence across newly infested golf courses to gauge how widespread their establishments have become locally. By doing this, it is possible to ascertain the scope of potential impact from invasive Tipula in turf, not only to establish a baseline for monitoring future changes, but to coalesce information relevant for transmission to stakeholders in areas of future range expansion. Our experience is that outside affected areas, very few turfgrass managers and entomologists are familiar with crane flies as pests since so few taxa are of economic concern.

Geographic Distribution. Based on at least one positive identification from 27 locality entries, T. paludosa was detected in four counties and 11 municipalities over the 3 years (Table 1). In 2004 it was originally reported from two counties (Erie, Niagara). Two more counties were added in 2005 (Monroe, Ontario) and none was added in 2006 (Fig. 1). Combining data collected over all 3 years, T. paludosa was collected from two parks, 11 golf courses and 14 residential home lawns (11 were individual residences in a single municipality [Pittsford, NY]).

Based on positive identification from 26 locality entries, T. oleracea was detected in 12 counties and 23 municipalities (Table 1). In 2004 it was originally reported from one of the same counties as T. paludosa (Niagara) (Fig. 1). Two more counties were added in 2005 (Monroe, Oswego) and nine were added in 2006 (Erie, Livingston, Nassau, Onondaga, Ontario, Seneca, Suffolk, Wayne, Wyoming). Pooling data collected over all 3 years, T. oleracea was collected from 23 golf courses and two residential home lawns. The most notable addition in 2006 was the detection of T. oleracea at two residences and one additional site on Long Island. One report was made by a home owner in New Hyde Park, NY (Nassau Co.) due to nuisance swarms of adults after spring emergence. The second residential report was based on a single individual caught at a residence in Riverhead, NY (Suffolk Co.) during the fall emergence. In addition, a single female was recovered from an exotic bark beetle trap in Babylon (Suffolk Co.) that was included in a survey conducted by the Cooperative Agricultural Pest Survey of New York (det. E. R. Hoebeke, Cornell). Both species were sympatric at five localities (all golf courses) situated in five municipalities and two counties (Niagara, Monroe) (Fig. 2).

In western New York, all localities fell within the Great Lakes Ecoregion, one of seven ecoregions that occur in New York based on boundaries defined by The Nature Conservancy with respect to similarities in soil, physiography, climate, hydrology, geology and vegetation (Sotomayor 2004) (Fig. 2). The most outlying locality (T. oleracea, Collins, Erie Co.) was at the boundary with the Western Allegheny Plateau and the High Allegheny Plateau Ecoregions. All localities outside of western New York were from Long Island within the North Atlantic Coast Ecoregion.

Based on the detection criteria, 22 localities situated in 21 municipalities and 14 counties were recorded as sites where invasive Tipula were absent (Table 2). For the spring and autumn flight periods, mean date of those surveys was 18 May (range 5 May-8 June, n=10) and 23 September (range 12-30 September, n=14), respectively. Those periods of time were comparable to when live adults were collected from other localities. For T. paludosa, mean date of collection was 23 September (range 1 September-11 October, n=33). For T. oleracea, mean dates of collection were 17 May (range 24 April-1 July, n=19) and 20 September (range 1-29 September, n=7).

The distribution boundaries were defined in Figure 2 with respect to the position of sites where each species was present and absent. The resulting range maps revealed that T. paludosa was limited to western New York, centered around the greater Buffalo/Niagara and Rochester metropolitan areas. Because of the lack of intervening positive sites, these were depicted as disjunct areas of establishment. Overall, this area was estimated to cover 3,881 km^2, or 2,786 in Buffalo/Niagara and 1,095 in Rochester. In contrast, T. oleracea occurred in two geographic regions: western New York and Long Island. In western New York, the area was estimated to encompass 23,122 km^2, nearly 6 times greater than that of T. paludosa. Along the Erie Canal and Interstate 90 corridor it occurred as far east as Manlius, NY (Onondaga Co.), including the Syracuse, NY metropolitan area. It was detected as far north as Sandy Creek, NY (Oswego Co.) along the eastern shore of Lake Ontario, as far south as Ovid, NY (Seneca Co.) in the Finger Lakes area, and as far south as Collins, NY (Erie Co.) along the eastern shore of Lake Erie. The Long Island distribution encompassed another 8,834 km^2 for a total estimated distribution of 31,956 km^2. Long Island was depicted as a disjunct area of establishment because of the absence of T. oleracea in several intervening areas. This included five localities in the eastern Erie Canal and Mohawk River corridor within the eastern arm of the Great Lakes Ecoregion, three in the northern end of the Lower New England-Northern Piedmont Ecoregion, two in the High Allegheny Plateau and two in the Western Allegheny Plateau.

These baseline distribution data allow for certain predictions about range expansion, even without information on the physiogeographic corridors that might be relevant to natural crane fly dispersal. Monitoring priorities should include the remaining areas of the Great Lakes Ecoregion. Beyond that, the prevalence of invasive Tipula in coastal areas, along waterways and at lower elevations suggests specific routes favorable for natural range expansion or successful establishment if introduction were to occur. This would include the eastern shore of Lake Ontario northeast toward the St. Lawrence-Lake Champlain Ecoregion. Along the north shore, T. paludosa occurs as far east as Port Hope and Cobourg, Ontario (P. Charbonneau, personal communication),

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Feature Story

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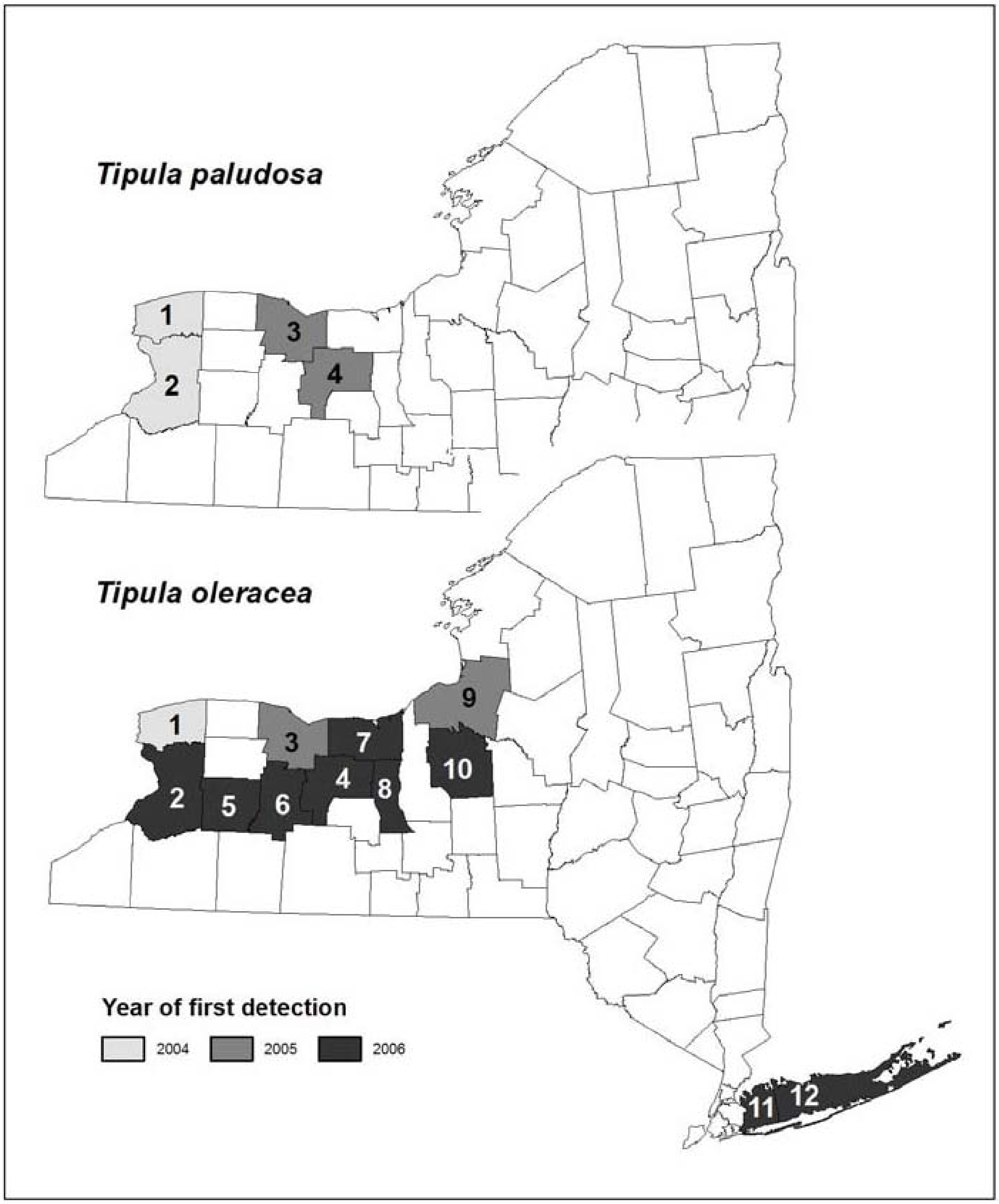
The last invasive insect to threaten turfgrass of the Northeast was the European chafer (R. majalis), which arrived in 1940 and coincidentally first established in western New York. Today it remains one of the most troublesome turf-infesting insects across the state.

The establishment of T. paludosa and T. oleracea will also have serious repercussions for turfgrass management in the Northeast. Besides the scarce regional awareness of crane flies as pests, management will undoubtedly be challenged by (1) diverging natural history

which are situated north of a point approximately equidistant between Buffalo and Rochester. Southward expansion along the eastern and southern shores of Lake Erie might be the most likely source of natural infestation into Pennsylvania and Ohio. Corridors would also include the Mohawk River Valley/eastern Erie Canal toward the Hudson River Valley of the Lower New England/Northern Piedmont Ecoregion. The Lower Hudson River Valley might also be considered a corridor for the northward expansion of T. oleracea from Long Island. Furthermore, Long Island may also be T. oleracea's gateway to New England, New Jersey and the coastal areas of the Mid-Atlantic, parallel to its purported spread from British Columbia south to California.

The last invasive insect to threaten turfgrass of the Northeast was the European chafer (R. majalis), which arrived in 1940 and coincidentally first established in western New York. Today it remains one of the most troublesome turf-infesting insects across the state. The establishment of T. paludosa and T. oleracea will also have serious repercussions for turfgrass management in the Northeast. Besides the scarce regional awareness of crane flies as pests, management will undoubtedly be challenged by (1) diverging natural history that means tailoring control programs



to each species, (2) obvious corridors for range expansion via natural dispersal, (3) likely routes of human-mediated dispersal via infested soil material, (4) isolated but serious manifestations of injury to low and high maintenance turf, and (5) specific gaps in our understanding of habitat associations. Most critically, studies designed to assess habitat invasibility may hold relevance for predicting which environments are most favorable for crane fly establishment and development. Whether T. paludosa and T. oleracea have diverging habitat preferences is unknown, much less what those preferences might be in the face of turf management regimes (e.g. home lawn versus golf course, or putting green, fairway and rough-mown turf).

by Daniel Peck, Ph.D.
NYSAES

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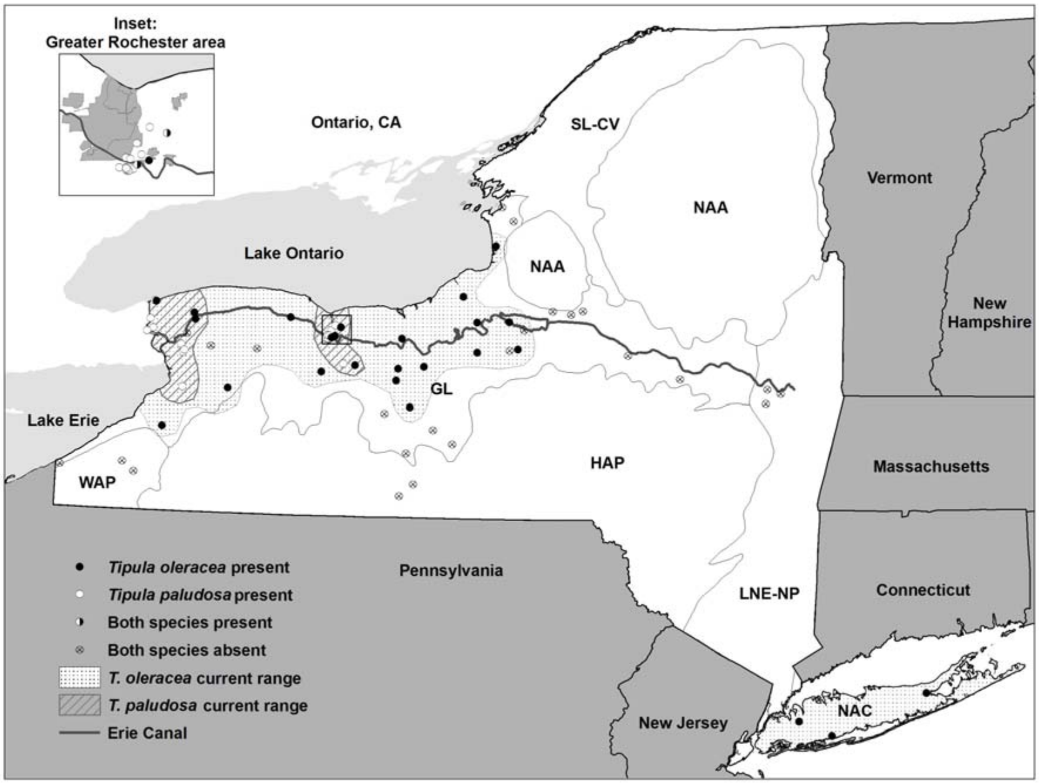

New York State Turfgrass Association
Calendar of Events

2009

January 7-9 — **Empire State Green Industry Show**
Rochester Riverside Convention Center, Rochester, NY

January 19-23 — **Cornell Turfgrass Short Course**
Cornell University Campus, Ithaca, NY

February 23-25 — **Cornell Turgrass Advanced Short Course**
Cornell University Campus, Ithaca, NY

February 24-25 — **Southeast Regional Conference**
Holiday Inn Suffern, Suffern, NY

March 2 — **Western Regional Conference**
The Millennium Hotel, Buffalo, NY

March 19 — **Adirondack Regional Conference**
Crowne Plaza Lake Placid Resort, Lake Placid, NY

2010

January 6-8 — **Empire State Green Industry Show**
Rochester Riverside Convention Center, Rochester, NY