

## Lily Leaf Beetle Biological Control

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The lily leaf beetle (LLB), *Lilioceris lili* Scopoli (Fig. 1), was first reported in North America near Montreal in 1945 (LeSage 1992) and is now found in four Canadian provinces, all New England States, and New York (Gold et al. 2001). The lily leaf beetle defoliates cultivated *Lilium* and *Fritillaria* species, as well as native lilies (Livingston 1996). There are 21 species of lilies native to North America, including three (*L. canadense*, *L. philadelphicum*, and *L. superbum*) that lie within the eastern North American range (Fig. 1) of LLB (Woodcock and Stearn 1950).



Fig. 1. Lily leaf beetle adult.

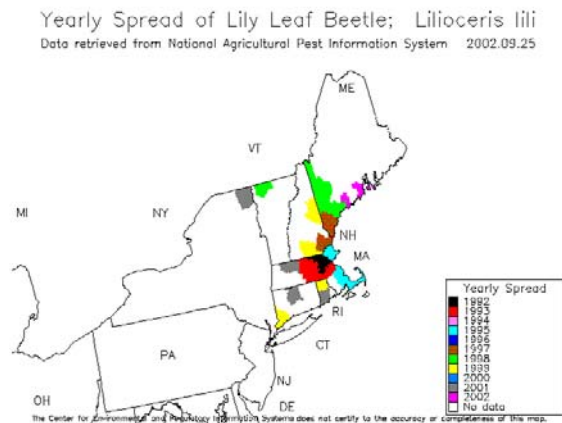


Fig. 2. Distribution and spread of LLB in the USA 2002.

No insect natural enemies have been reported on LLB in North America (LeSage 1992, Livingston 1996). In Europe, nothing was published about natural enemies of LLB until Gold et al. (2001) surveyed France and Switzerland and identified four larval parasitoids. Research on host specificity of these parasitoids (Gold 2003), shows three species: *Tetrastichus setifer* Thomson, *Lemophagus errabundus* Gravenhorst, and *Diaparsis jucunda* (Holmgren) to be host-specific to LLB based upon laboratory tests in North

America and Europe, and field surveys in Europe. We have shown that these species will not survive in other North American insects and thus pose little ecological risk.

*Tetrastichus setifer* (Fig. 3) appears to be our best candidate for controlling the LLB in the Northeast. It is widespread throughout Europe and so far, has been relatively easy to establish in the USA. We last released *T. setifer* in Wellesley, MA in 2001 and it has been parasitizing most of the LLB larvae at that site ever since. This season we found relatively few larvae and very little beetle damage at that site and continued to find parasitism of the larvae (33.3% on May 30, and 27.8 % parasitism on June 14) (Fig. 4). We have found similar results in Cumberland, RI where we last released *T. setifer* in 2002. A total of 14 larvae were dissected from that site on 6/12 (peak larval density for 2005), and 100% of them were parasitized by *T. setifer*, with a total of 120 immature parasitoids found within these 14 larvae.



**Fig. 3. *Tetrastichus setifer* adult.**



**Fig. 4. URI employee Alexandra Villiard looks for lily leaf beetle in our Wellesley, MA field plot.**

*Tetrastichus setifer* has been released in MA, RI, ME and NH (Fig. 5), and is successfully established in all four states. We now know that *T. setifer* is capable of establishment and impacting LLB populations, so the remaining question is how well it spreads and what must be done to enhance this spread throughout New England where lilies can be quite some distance apart. Working through local garden clubs, NALS members, and using the local press, we collected larvae from 27 lily gardens near our release site in Cumberland,

RI in 2006. We dissected the larvae to detect *T. setifer* parasitism. We found *T. setifer* in nine sites with the most distant site over seven miles from the release plot and five of the nine located at least one mile distant. Eight of the nine sites were North to Northeast of the *T. setifer* release site. It appears that the prevailing Southwest wind facilitates distribution of the adult wasps.

LOCATION	1999	2000	2001	2002	2003	2004	2005	2006	TOTAL
Wellesley, MA	100	200	810	0	0	0	0	0	1,110
Waltham, MA	0	422	1,000	719	500	0	0	0	2,641
Cumberland, RI	0	0	984	1,660	0	0	0	0	2,644
Kingston, RI	0	0	0	0	400	394	150	278	1,222
Cotuit, MA	0	0	0	0	515	350	280	0	1,145
Hudson, NH	0	0	0	0	510	500	150	0	1,160
Bridgton, ME	0	0	0	0	237	0	0	200	437
Concord, NH	0	0	0	0	0	0	0	288	288
Hampden, ME	0	0	0	0	0	0	0	279	279
Patch, ME	0	0	0	0	0	0	0	381	381
<b>Total</b>	<b>100</b>	<b>622</b>	<b>2,794</b>	<b>2,379</b>	<b>2,162</b>	<b>1,244</b>	<b>580</b>	<b>1,426</b>	<b>11,307</b>

Fig. 5. Number of adult *T. setifer* released in New England each year by site.

*Lemophagus errabundus* has been released in MA and RI only (Fig. 6), and was detected in a lily garden 1.8 miles from our Plainville, MA release site in 2006, indicating that this parasitoid is not only established from releases in 2003 and 2004, but has spread a considerable distance. *D. jucunda* has been released in RI, ME, and NH (Fig. 7), but is not established in any of the three states.

LOCATION	2003	2004	2005	2006	TOTAL
Kingston, RI	73	25	91	150	339
Plainville, MA	97	32	80	164	373
Falmouth, MA	88	0	0	0	88
Middleboro, MA	0	0	0	37	37
<b>Total</b>	<b>258</b>	<b>57</b>	<b>171</b>	<b>351</b>	<b>837</b>

Fig. 6 Number of adult *L. errabundus* released in New England each year by site.

LOCATION	2003	2004	2005	2006	TOTAL
Kingston, RI	121	117	79	165	482
Cumberland, RI	118	89	40	224	471
Belmont, NH	103	62	0	56	221
Deerfield, NH	0	0	0	106	106
Wells, ME	0	69	37	0	106
Orono, ME	0	0	0	122	122
Stillwater, ME	0	0	0	144	144
<b>Total</b>	<b>342</b>	<b>337</b>	<b>156</b>	<b>817</b>	<b>1652</b>

Fig. 7 Number of adult *D. jucunda* released in New England each year by site.

In 2007 we plan to make additional releases of all three species throughout New England, concentrating on the establishment of *D. jucunda*. We will also work to identify the extent of the current distributions of *T. setifer* and *L. errabundus*. We anticipate that this biological control program will have a significant long-term impact on lily leaf beetle control in the Northeast.