New York Western Bean Cutworm Monitoring Program
Progress Report (2010-2014)

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The Pest Problem

Western bean cutworm (*Striacosta albicosta* [Smith]) attacks corn (*Zea mays* L.; including field, sweet and popcorn) and dry beans (*Phaseolus vulgaris* L.), feeding on developing kernels or beans inside husks and pods, respectively. Western bean cutworm (WBC) infestations can cause significant yield losses and may facilitate subsequent colonization by pathogens, furthering damage and impacts. WBC moth, egg mass and larva images are shown below (Fig. 1, 2 and 3).


Figure 1. WBC Moth


Figure 2. WBC egg mass


Figure 3. WBC Larva in corn ear

Western bean cutworm (WBC) is native to North America, but has historically been restricted to the Great Plains and westward. Over the past decade, WBC has expanded its range through the Midwest into the northeastern United States and Canada. As WBC has moved eastward, its caterpillars have caused economic damage, particularly in Michigan and Ontario, where growers have reported 8-10% losses in dry beans and 40% losses in field corn. WBC moths were first discovered in Pennsylvania and New York in 2009 and Vermont in 2011. Pheromone trapping was initiated in NY and PA in 2010 and in VT in 2011 in collaboration with scientists from Penn State University and University of Vermont. The trap network has revealed western bean cutworms are becoming more widely distributed and populations are increasing, posing a potential risk to dry beans and the over 3.5 million acres of corn grown in NY, PA, and VT. Thus far, only non-economic larval infestations have been found in the Northeast. However, this season there are reports of some WBC damage to untreated fresh market sweet corn in northern NY and trace amounts of suspected WBC damage to dry beans in western NY.

Monitoring Procedure

WBC male moths are trapped using a green or yellow and white bucket trap hung on posts at the edge of corn or dry bean field sites (Fig. 4). The traps contain a WBC pheromone lure to mimic a female and attract male moths. In addition, an insecticidal strip is placed in the traps to kill the moths once they enter the trap. WBC trapping was initiated the second week of June and continued until early September. Traps were checked weekly with number of moths collected per week recorded and a record of accumulated moths over time kept. Moth capture data was entered in PestWatch (www.pestwatch.psu.edu) and shared with the local and regional agricultural community through timely newsletters.


Figure 4. Bucket trap used to collect WBC moths

2010-2014 Results
A New York volunteer-based WBC pheromone trap monitoring network has been in place since 2010. This report summarizes WBC collection data from several sources including Cornell Cooperative Extension coordinated field corn, sweet corn and dry bean pheromone monitoring networks and data provided by private agricultural consultants and agribusinesses. A total of 11,353 WBC moths were collected in 2014, nearly double 2013's captures of 6,110 WBC moths.

NY WBC populations have increased annually since 2010 as indicated by the average and maximum range in number of WBC moths captured per location (Table 1). Relative moth counts for 2014 locations are shown in Figure 5. On average, higher WBC counts have been observed in northern and western counties with the majority of high captures occurring in locations north of the NYS thruway (Interstate 90). Late stage WBC larvae drop to the ground after feeding and burrow into the soil to overwinter in the prepupal stage under ground. WBC have been reported to overwinter in Michigan and other Midwestern states and in Ontario Canada. Moth wings are covered with fine scales that can rub off over time with use. The relatively undamaged condition of wings of many WBC moths captured in NY over the last several years indicate WBC populations are becoming locally established here as well.

Pheromone trap data has documented WBC moth activity, peak flight and enhanced timing of monitoring fields for egg masses and larvae. Peak WBC moth flights have occurred the last week of July thru the first week of August (Figure 6). Trapping data is being used to evaluate accuracy of a mid-western US WBC moth emergence prediction model for its application in the Northeast.

Monitoring and Management:
Pre-tassel corn is the preferred WBC egg laying site and egg masses may be found on the upper surface of leaves at or near the tassel whorl. WBC larvae quickly move from the egg site to corn ears where they can be found feeding on silks or kernels. By contrast, in dry beans WBC lay their egg masses on the undersurface of leaves and larvae feed on pods at night and hide in the soil during the day making them very difficult to detect. Midwestern experience suggests crops at risk be monitored closely for WBC activity when accumulated trap catches approach 100 moths or more. Midwestern and Ontario WBC corn monitoring guidelines recommend carefully searching for egg masses on 10 corn plants in a row in 10 areas of the field.

Our management guidelines reflect what is recommended in Midwestern states and Ontario. E.g. When possible plant corn early, use short season hybrids to get past pre-tassel stages before peak flight (typically end of July). Bt corn hybrids containing the Cry1F (e.g. Herculex 1, Xtra, Optimum AcreMax1, SmartStax), or Vip 3A (Agrisure Viptera) hybrids have efficacy against WBC. Refer to WBC pheromone trap data, if available, to time WBC monitoring activities. Monitor fields to assess risk and need for control. Prioritize fields for monitoring dependent on plant stage (Pretassel corn highly attractive to WBC for egg laying). Follow threshold guidelines: field corn 5% of plants with egg masses; sweet corn – processing 4%, fresh market 1%; and dry beans – 1st signs of pin feeding, watch nearby corn for signs of WBC activity.

Midwestern and Ontario entomologists suggest an insecticide foliar spray is warranted if 5% of non-Bt corn, or transgenic corn without WBC protection, have WBC egg masses on them. Ontario recommends timing an insecticide foliar spray application for just after egg hatch when small larvae are present at the top of the plant. Egg hatch occurs a day or two after the egg

masses turn purple (typically 5-7 days after being freshly laid). (See more at: http://fieldcropnews.com/2013/07/western-bean-cutworm-thresholds-for-high-risk-fields-in-ontario/#sthash.crBkKtBo.dpuf). A summary of hybrids containing Bt traits effective against WBC can be found at: Handy Bt Trait Table (http://www.msuent.com/assets/pdf/28BtTraitTable2014.pdf).
Late season activities - monitor corn for ear molds and need for early harvest.

Thresholds are not currently available for WBC in dry beans. Dry bean fields adjacent to corn fields that have reached WBC threshold should be considered at risk and monitored closely for signs of foliar or pod feeding by WBC larvae. If bean pods are present and fresh signs of pod feeding are easily found, Michigan and Ontario entomologists recommend that a spray application is necessary.

There are a number of factors that can impact the severity of damage from WBC. These may include: the size and survival of over-wintering WBC population; type of Bt gene if a Bt trait hybrid is being used; synchronization between corn silking date and timing of moth flight; use of insecticide sprays for 2nd generation European corn borer or other late season ear worms; number of WBC egg masses & survival of young larvae; competition/predation/parasitism/diseases such as: European corn borers or corn earworm larvae in the ear, presence of Trichogramma, nuclear polyhedrosis viruses or entomopathogenic fungi affecting egg or larval stages and environmental factors influencing ear mold development.

Recent observations of note:
In 2013, heavy populations of WBC in "hotspot" areas in western Ontario were reported to be challenging the effectiveness of some Bt hybrids and significant damage was found on SmartStax and Herculex hybrids (http://fieldcropnews.com/2013/09/alert-fields-in-high-risk-western-bean-cutworm-regions-need-to-be-scouted/).

In 2014, WBC larvae were found feeding in sweet and field corn in northern and western NY. In 2014 there were some reports of WBC larvae in sweet corn sold at farm stands resulting in rejection by consumers. Some suspected WBC damage was observed on dry beans harvested in western NY.

WBC populations were reported causing economic damage in Ontario province this year. Typical WBC hot-spot areas had heavy infestations this year but damage was reported all over SW Ontario. Ontario entomologists suspect more WBC were seen outside its typical range due to later planting dates outside the hot-spot areas that were attractive to female moths looking for pre-tassel corn to lay their eggs. This was also the first year Ontario has had multiple fields of edible dry beans with easily visible WBC damage (http://fieldcropnews.com/2014/09/scout-for-western-bean-cutworm-and-ear-mould-now/).

Pheromone trapping 2010 – 2014 has created a data set of when WBC moths are active. This information is being related to a growing degree model to help fine-tune crop monitoring activities. Peak WBC flight this year was recorded during the week of August 1 (Figure 6).

The ranges of accumulated WBC moths captured per trap in New York by year (2010 – 2014) are shown in Figure 7. In 2010, the majority of accumulated trap catches in NY were less than 25 per trap. WBC trap catches have increased every year since. While there were some WBC "hotspots" in northern and western NY locations monitored in 2014, four sites did not catch any WBC moths, 40% of traps caught less than 25 moths, and only 35% of traps caught more than 100 moths per trap. The highest WBC trap count to date, 1,019 WBC moths, was collected from a St. Lawrence county trap this year. Accumulated New York WBC trap catch data by 2014 location are shown in Table 2.

There has been a trend of more WBC moths being captured per location each year as seen in Figure 7. While actual accumulated trap counts ranged from 0 to 1019, the statewide average WBC moth catch per location this year was 118 shown in Figure 8.

Pennsylvania and Vermont WBC populations have fluctuated annually, but have consistently remained far less than New York (Table 3, J. Tooker (PSU) and M. Skinner (UVM) personal communication). More WBC moths are being trapped on average in New York than in either Pennsylvania or Vermont. 2014 WBC trap captures for New York, Pennsylvania and Vermont within a range are shown in Figure 9. Regional WBC trap captures during 2013 and 2014 are shown in Figure 10.

2015?

Weekly WBC pheromone trap survey will continue into the summer of 2015. WBC trap catches are expected to increase, but *by how much* and *under what conditions*? Field monitoring for WBC in 2015 is highly recommended - *especially* in areas that had high trap counts in 2014 and fields with sandy soil types that would allow easier burrowing and may affect overwintering survival. WBC trap count updates will be provided during the field season at NYS IPM Weekly Pest Report: http://blogs.cornell.edu/ipmwpr/#, the NY Sweet Corn Pheromone Trap Network: http://sweetcorn.nysipm.cornell.edu/, and the Penn State "Pest Watch" – regional map of WBC trap catches over time: *www.pestwatch.psu.edu/*.

Summary:

Western bean cutworm populations are widespread across New York and have continued to increase annually. On average, relatively higher WBC counts have been observed in northern and western NY counties. The relatively undamaged wing condition of most moths captured indicates WBC populations are becoming locally established, while others continue to be migrants from other sources. To date there have been no reports from New York of economic damage caused by WBC to corn (sweet or field) or dry beans although a few growers have reported WBC larval presence and some damage. WBC pheromone trap monitoring efforts are planned for summer 2015.

Acknowledgements:

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For more information on WBC catches and distribution, please visit:
NYS IPM:

- Weekly Field Crop Pest Report: http://blogs.cornell.edu/ipmwpr/#
- Sweet Corn Pheromone Trap Network: http://sweetcorn.nysipm.cornell.edu/

Eastern NY Sweet Corn Monitoring Program: http://blogs.cornell.edu/jentsch/sweet-corn/

Pestwatch*:* Sweetcorn *IPM Visualization Tool*: www.pestwatch.psu.edu/sweetcorn/tool/tool.html

Penn State Field Crop News: http://extension.psu.edu/plants/crops/news

Photo credits: Keith Waldron, NYS IPM Program

Table 1. New York Western Bean Cutworm 2010 – 2014 Collection Data Summary*

	2010	2011	2012	2013	2014
No. Counties	29	37	44	39	41
No. Traps	54	67	88	89	96
Avg. No. WBC / Location	13	23	42	66	117
Range in Totals	0 - 99	0 - 165	0 - 344	0 – 853	0 – 1019
Peak Flight	2-Aug	2-Aug	25-Jul	21-28-Jul	3 – Aug

*Data compiled from WBC trap catch information provided by field corn, sweet corn, and dry bean monitoring networks across NY.

Figure 5. Western Bean Cutworm trap location and relative accumulated moth capture for 2014.

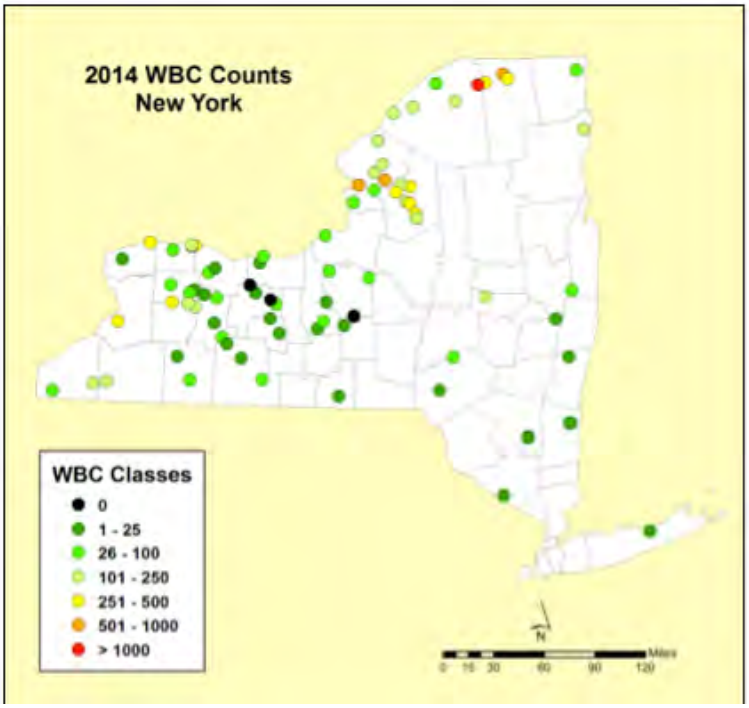

Figure 6. Average Western Bean Cutworm moths per trap, New York 2010 – 2014.

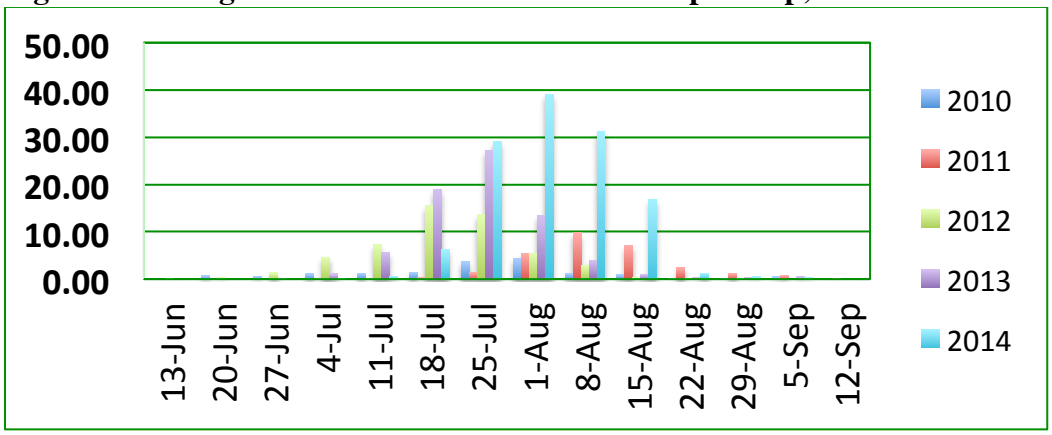

Figure 7. New York WBC total catch per trap (2010 – 2014)

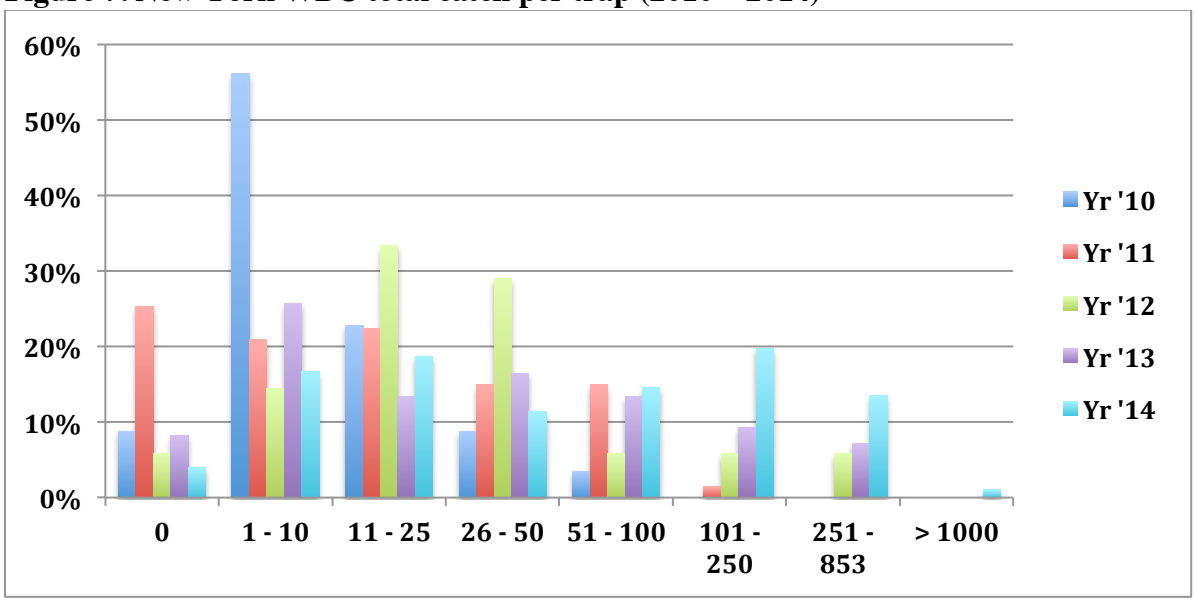

Table 2. 2014 Western Bean Trap count totals for each NY location*.

County	City	Total	County	City	Total	County	City	Total	County	City	Total
Albany	Feura Bush	12	Franklin	Moira	442	Monroe	Hamlin	21	St.Lawrence	Parishville	245
Allegany	Belmont	58	Fulton	Amsterdam	34	Monroe	Spencerport	32	St.Lawrence	Waddington	57
Allegany	Caneadea	13	Genesee	Batavia	63	Monroe	Spencerport	12	Steuben	Avoca	19
Cattaraugus	Randolph	135	Genesee	LeRoy	18	Montgomery	Palatine Bridge	126	Steuben	Wayland	74
Cayuga	Auburn	7	Genesee	Stafford	60	Niagara	Barker	323	Steuben	Wayland	25
Cayuga	Aurora	26	Jefferson	Calcium	226	Niagara	Lockport	9	Suffolk	Riverhead	2
Cayuga	King Ferry	18	Jefferson	Chaumont	165	Oneida	Clinton	6	Tioga	Owego	2
Chautauqua	Clymer	48	Jefferson	Ellisburg	54	Onondaga	Baldwinsville	49	Tompkins	Varna	84
Chautauqua	Kennedy	130	Jefferson	Evans Mills	179	Onondaga	Tully	0	Ulster	New Paltz	3
Clinton	Chazy	74	Jefferson	Hounsfield	603	Ontario	Farmington	26	Ulster	New Paltz	5
Clinton	Chazy	9	Jefferson	Plessis	161	Ontario	Farmington	4	Washington	Easton	42
Clinton	Peru	22	Jefferson	Rodman	46	Ontario	Geneva	81	Washington	Greenwich	5
Columbia	Kinderhook	13	Jefferson	Rutland	633	Ontario	Hopewell	55	Washington	Salem	0
Columbia	Valatie	19	Lewis	Croghan	485	Ontario	Seneca Castle	0	Wayne	Alloway	17
Cortland	Homer	24	Lewis	Denmark	198	Orange	Warwick	4	Wayne	Lyons	0
Cortland	Preble	37	Lewis	Harrisburg	283	Orleans	Kendall	127	Wayne	Williamson	20
Delaware	Oneonta	33	Lewis	Lowville	131	Orleans	Waterport	34	Wayne	Willliamson	74
Delaware	Walton	25	Lewis	Martinsburg	336	Oswego	Oswego	84	Wyoming	Attica	386
Dutchess	Amenia	4	Lewis	Turin	280	Rensselaer	Brunswick	4	Wyoming	Pavilion	164
Dutchess	Millbrook	10	Lewis	Turin	145	Saratoga	Clifton Park	1	Wyoming	Wyoming	105
Dutchess	Tivoli	0	Livingston	Avon	85	Schuyler	Valois	169	Yates	Bellona	17
Erie	Eden	480	Livingston	Caledonia	6	St.Lawrence	Heuvelton	137	Yates	Penn Yan	10
Essex	Willsboro	125	Livingston	Groveland	15	St.Lawrence	Madrid	228			
Franklin	Bangor	510	Madison	Kirkville	65	St.Lawrence	Lawrence	1019			
Franklin	Malone	358	Monroe	Hamlin	296	St.Lawrence	Morristown	235			

*Items in bold blue or red are those trap sites that reached greater than 100 moths, the time when intensive monitoring should start.

Figure 8. Average Number WBC Moths Per Trap By County Compared to NY State Average in 2014

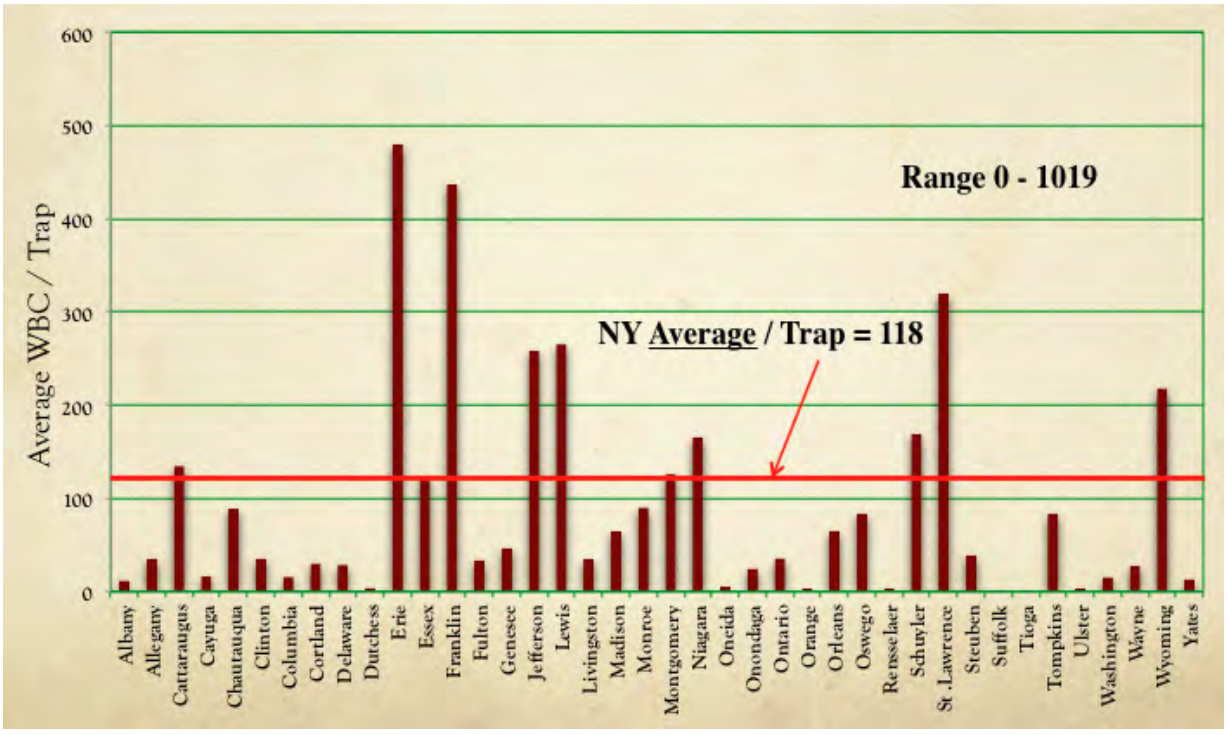

Table 3. New York, Pennsylvania and Vermont WBC trap and moth count summary 2013-2014.

	New York		Pennsylvania		Vermont	
Year	Traps	Total WBC	Traps	Total WBC	Traps	Total WBC
2013	90	6,110	20	373	18	25
2014	97	11,353	25	1,462	12	100

Regional Western Bean Cutworm Data: Courtesy of J. Keith Waldron, New York State Integrated Pest Management Program, NYSAES, Geneva, NY and Cornell University Collaborators, Dr. John Tooker, Pennsylvania State University, University Park, PA and Dr. Margaret Skinner and Ms. Cheryl Eileen Frank Sullivan, University of Vermont, Burlington, VT.

Figure 9. New York, Pennsylvania and Vermont - WBC trap captures within a range 2014.

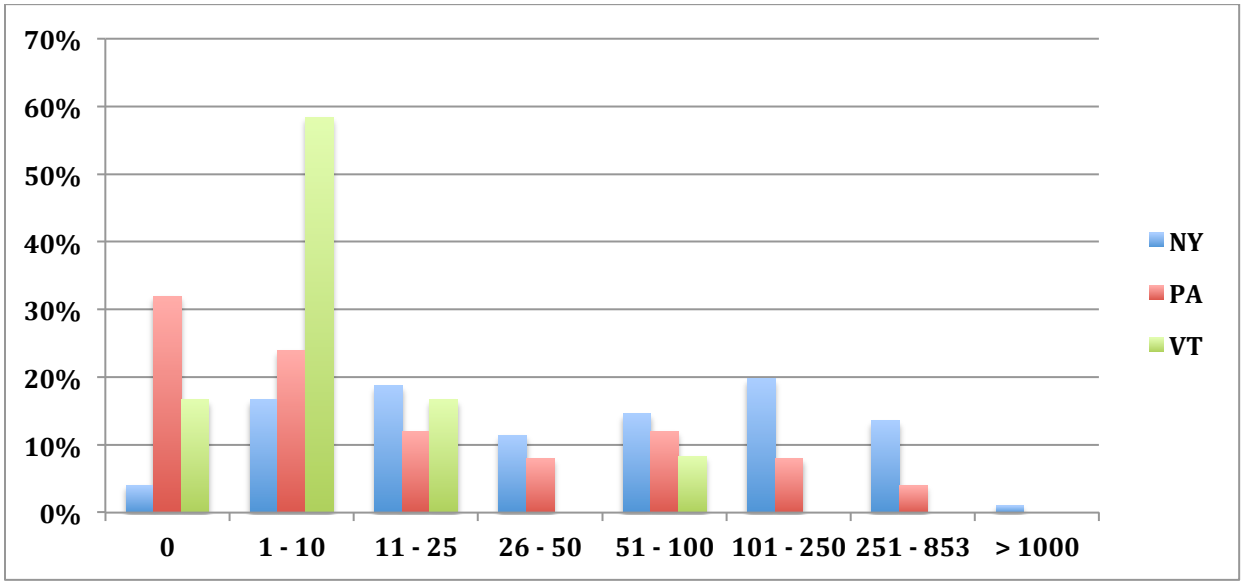

Figure 10. Relative moth counts for 2013 and 2014 New York, Pennsylvania and Vermont WBC trap locations.