Ontario

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2017 Apiculture winter loss report

2017 Honey bee colony winter mortality

The number of colonies operated by beekeepers fluctuates throughout a year. After a decrease in colony numbers over the winter months, a beekeeper can build up colony numbers during the summer months by splitting larger, healthy colonies into smaller nucleus colonies. As of December 31, 2016, Ontario beekeepers had registered 97,342 colonies which represents the number of registered colonies that were alive going into winter of 2016-2017.

Overwinter mortality for **2016-2017** for commercial beekeepers operating in Ontario was estimated to be **27%**.

The estimated loss reported for small-scale beekeepers was 29% and the 2017 estimation for honey bee loss averaged between all of Canada was 25%.

Who we surveyed

In the spring of 2017, the survey was distributed to:

- 179 registered commercial beekeepers (defined as operating 50 or greater colonies)
- 400 randomly selected registered small-scale beekeepers (defined as operating 49 or fewer colonies).

Beekeepers had the option of responding to the survey:

- electronically via an online survey
- by submitting a completed hard copy
- by phone

The survey is voluntary and all responses are self-reported by beekeepers. Data is not verified by the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) or any other independent body.

Responses were received from 98 commercial beekeepers and 133 small-scale beekeepers which represents 40% of beekeepers who received the survey.

Of the beekeepers who were registered in Ontario as of December 31, 2016, responses were received from 55% of commercial beekeepers representing 44,183 colonies and from 5% of small-scale beekeepers representing 1,098 colonies (Table 1 and Table 2). Combined, the responses represent 47% of the total number of registered colonies.

Table 1. Number of beekeepers, by region, responding to the 2017 Ontario Apiculture Winter Loss Survey

Beekeeping regions	# of commercial beekeeper respondents	% of commercial beekeeper respondents	# of small-scale beekeeper respondents	% of small-scale beekeepers respondents
Central	40	40.8%	46	34.6%
East	13	13.3%	37	27.8%
North	5	5.1%	12	9.0%
South	29	29.6%	29	21.8%
Southwest	11	11.2%	9	6.8%

Table 2. Estimated overwinter mortality for 2016-2017

Beekeeper type	# of full-sized colonies put into winter in fall 2016	# of viable overwintered colonies as of May 15, 2017	# of non-viable colonies as of May 15, 2017	Overwinter mortality (%)
Commercial	44,183	32,294	11,889	27%
Small-scale	1,098	777	321	29%

Results

Registered commercial and small-scale beekeepers in Ontario reported an approximate 27% and 29% overwinter mortality, respectively, during the winter of 2016-2017 (Table 2). In Canada, 15% is the maximum level of overwinter loss considered to be acceptable and sustainable by the industry (Furgala and McCutcheon, 1992; CAPA, 2007 to 2016).

The estimated overwinter honey bee mortality and the number of respondents varied by beekeeping region (Table 3). Commercial beekeepers reported the greatest losses in the south region while small-scale beekeepers reported the highest losses in the eastern region. Overall, mortality during the 2016-2017 winter differed by approximately 2 percentage points between commercial and small-scale beekeepers (Table 2).

Table 3. Number of commercial and small-scale beekeeper survey respondents and the % overwinter mortality in 2017 for each beekeeping region in Ontario

Beekeeping region	# of commercial beekeeper respondents	Commercial beekeeper overwinter mortality (%)	# of small-scale beekeeper respondents	Small-scale beekeeper overwinter mortality (%)
Central	38	19%	46	29%
East	10	26%	37	40%
North	4	12%	12	22%
South	29	33%	29	25%
Southwest	11	20%	9	18%
Total	92*	27%	133	29%

*Responses were not received from 2 respondents from the central region, 3 from the east region and one from the north region.

When respondents were grouped by operation size (number of colonies managed), the honey bee mortality during the winter of 2016-2017 ranged from 15.4% to 35.1% (Table 4). Beekeepers operating 501 to 1000 colonies reported fewer honey bee colony losses (15.4%) than other beekeepers. Similar to previous years, the number of respondents in the 501 to 1000 colonies category was low and this apparent reduction in mortality among this group could be due to the small sample size.

The greatest number of survey respondents had beekeeping operations with fewer than 10 colonies. As in previous years, operations with fewer than 10 colonies reported the greatest overwinter honey bee mortality (35%). This group may be comprised of new beekeepers and persons who keep bees as a hobby. Therefore, this group may not have as much experience as commercial beekeepers which could contribute to the increased overwinter mortality.

Table 4. Overwinter honey bee mortality during the winter of 2016-2017 by size of beekeeping operation (number of colonies operated)

# of respondents	# of colonies reported in the fall of 2016	Overwinter mortality (%)
97	<10	35.1%
35	10-49	26.8%
56	50-200	29.2%
19	201-500	22.5%
6	501-1000	15.4%
9	>1000	29.1%

Main factors of bee mortality

Beekeepers were asked to report on what they believed were the main factors contributing to their overwinter honey bee mortalities; they were able to select as many reasons as they felt were applicable. These opinions may be based on observable symptoms or beekeeper experience, judgment or best estimate.

The most commonly reported factors influencing overwinter mortality (Table 5) by commercial beekeepers included:

- poor queens
- starvation
- weak colonies in the fall

The most commonly reported factors influencing overwinter mortality (Table 5) by small-scale beekeepers included:

- weather
- weak colonies in the fall

Table 5. Contributing factors to honey bee colony mortality during the winter of 2016-2017 as reported by commercial and small-scale beekeepers

Suspected cause(s) of colony loss	# of commercial beekeepers reporting	# of small-scale beekeepers reporting
Starvation	33	21
Poor queens	40	15
Weather	26	28
Ineffective varroa control	30	23
Nosema	9	2
Weak colonies in the fall	32	26
Other	23	25
Don’t know	23	20

Management practices for pests and disease

There are many theories which aim to explain the observation of increased overwinter honey bee mortality in recent years. The scientific literature suggests that honey bee health is complex and that there are many factors that contribute to honey bee colony health. For example, colonies may be weakened or killed by pests and/or diseases, such as infestation by the parasitic mite, *Varroa destructor*. Poor management practices, including small cluster size, inadequate food stores and inadequate control of varroa mites may contribute to winter losses. Other factors such as severe weather, habitat loss and exposure to pesticides are environmental stressors which may potentially impact colony health.

While some factors contributing to colony mortality, such as severe weather, are not within the direct control of the beekeeper, monitoring for and the treatment of pests and diseases can be controlled by the beekeeper. For this reason, the 2017 winter loss survey focused on the surveillance, management and monitoring of three major pest and disease threats to colony health:

- varroa mites
- nosema
- American foulbrood

Varroa mites (*Varroa destructor*)

In this survey, beekeepers were asked how they monitored for varroa mite infestations (Figure 1) and which treatments were used at the beginning (spring) and the end (fall) of the 2016 beekeeping season (Table 6).

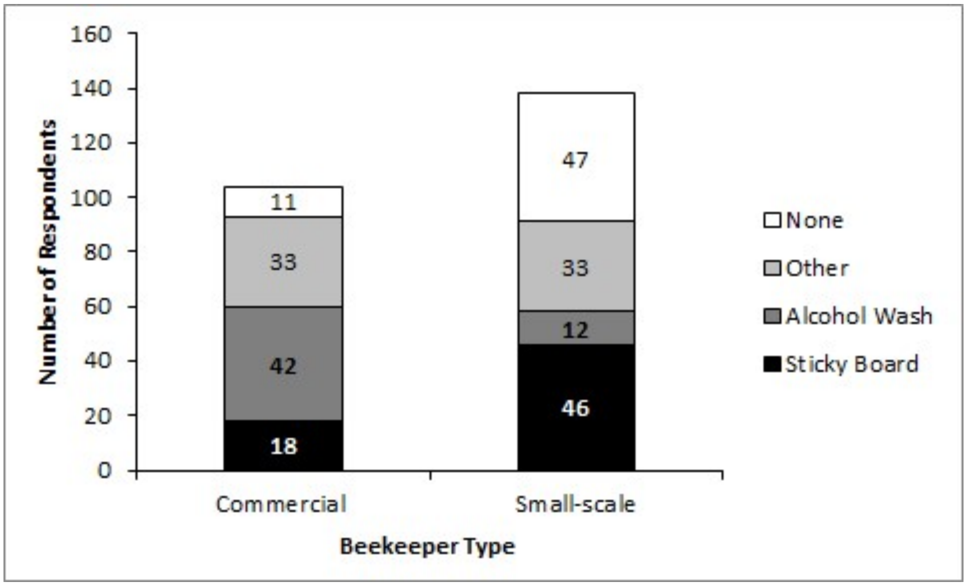

Figure 1. Type of varroa mite monitoring method used by commercial and small-scale beekeepers in 2016. Survey respondents could reply with more than one answer.
Accessible description of figure 1

Proportion of beekeepers monitoring for varroa mites

Of the beekeepers who responded to the varroa mite monitoring question, 89% of commercial beekeepers and 65% of small-scale beekeepers advised that they monitor for varroa mite infestation in their colonies. Of those, a number of methods were used, the most common being either an alcohol wash or a sticky board.

Some beekeepers used more than one method to monitor for varroa mites. When the response “other” was selected, the beekeeper commonly reported that they visually checked their colonies for varroa mites or used the sugar shake method. However, neither of these methods are recommended as visually checking for mites is not proven to yield usable information and the sugar shake method can be unreliable and it is not tied to established thresholds for Ontario.

Treatments used to control varroa mites

Ontario beekeepers use a variety of treatment options to manage varroa mites (Table 6). In spring and fall of 2016, the most common method of varroa mite treatment reported by commercial beekeepers was Apivar®. Commercial beekeepers also reported using 65% liquid formic acid (40 ml multiple application), Mite Away Quick Strips™ and Apistan®. Small-scale beekeepers indicated a preference for Mite Away Quick Strips™ over other forms of mite control options. Although there has been documented resistance to some mite control products such as Apistan® and Checkmite+™, there have been no documented cases of Apivar®-resistant varroa mites in Ontario to date.

The two least commonly used treatments by both commercial and small-scale beekeepers were Checkmite+™ and Thymovar. To slow the development of resistance to chemical treatments, Ontario beekeepers are advised to rotate varroa mite treatments as part of an integrated pest management strategy.

Table 6. Treatments reported by commercial and small-scale beekeepers used to control varroa mites in the spring and fall of 2016. Survey respondents could select more than one answer.

Varroa mite treatment	Spring 2016	Spring 2016	Fall 2016	Fall 2016

(active ingredient)	# of commercial beekeepers	# of small-scale beekeepers	# of commercial beekeepers	# of small-scale beekeepers
Apistan® (fluvalinate)	7	7	14	15
CheckMite+™ (coumaphos)	1	1	1	2
Apivar® (amitraz)	23	7	46	19
Thymovar (thymol)	1	3	3	3
65% formic acid – 40 ml multiple application	16	20	15	20
65% formic acid – 250 ml single application	4	6	6	3
Mite Away Quick Strips™ (formic acid)	13	26	21	36
Oxalic Acid	6	5	30	19
Other	3	7	1	4
None	32	57	7	28

Nosema spp. (*N. apis* and *N. ceranae*)

The majority of survey respondents did not treat for nosema during 2016 (Table 7). Seventy-three% of beekeepers (both commercial and small-scale) who responded to this survey question indicated that nosema treatment was not applied in the spring and 71% of respondents did not treat for the disease in the fall of 2016.

Table 7. Treatments reported by commercial and small-scale beekeepers used to control nosema in the spring and fall of 2016

Nosema treatment	Spring 2016 # of commercial beekeepers	Spring 2016 # of small-scale beekeepers	Fall 2016 # of commercial beekeepers	Fall 2016 # of small-scale beekeepers
Fumagillin	16	35	21	34
Other	0	3	0	3
None	76	92	72	92

American foulbrood (*Paenibacillus larvae*)

The majority of commercial beekeepers (78%) who responded to this survey question treated for American foulbrood (AFB) during 2016 and the most common treatment reported was oxytetracycline (Table 8). Forty-one% of small-scale beekeepers reported treating for AFB in the spring and 44% of small-scale beekeepers used AFB treatments in the fall (Table 8). Although oxytetracycline-resistant AFB has been detected in other jurisdictions such as the USA, there have not been any documented cases of resistant forms in Ontario to date.

Table 8. Treatments reported by commercial and small-scale beekeepers used to control American foulbrood in the spring and fall of 2016

American foulbrood treatment	Spring 2016 # of commercial beekeepers	Spring 2016 # of small-scale beekeepers	Fall 2016 # of commercial beekeepers	Fall 2016 # of small-scale beekeepers
Oxytetracycline	71	52	70	51
Tylosin	1	0	1	0
Other	1	1	2	1
None	22	79	23	75

Ontario's overwinter mortality

The Canadian Association of Professional Apiculturists (https://capabees.com/) compiles overwinter mortality data provided by each province and publishes an annual report on national honey bee colony losses. Ontario beekeepers have frequently reported overwinter mortalities higher than the national average (Figure 2).

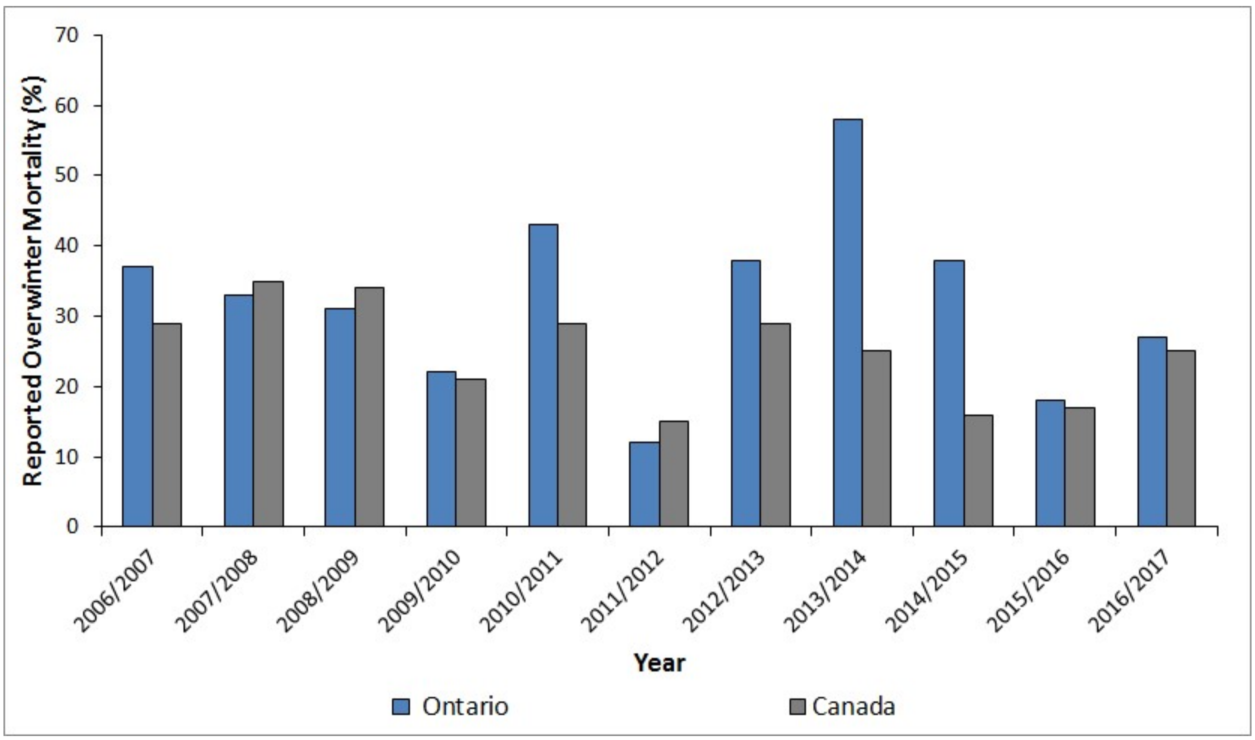

Figure 2. Overwinter mortality (%) reported by commercial beekeepers in Ontario (blue) and Canada (grey) from 2006-2007 to 2016-2017.
Accessible description of figure 2

Since 2010, Ontario beekeepers have reported annual overwinter honey bee colony losses of 15% or greater in all years except 2012 (12%). In Canada, 15% is the maximum of overwinter losses considered to be acceptable and sustainable by the apiculture industry (Furgala and McCutcheon, 1992; CAPA, 2007 to 2016). During the winter of 2013-2014, Ontario beekeepers reported a record 58% overwinter mortality. In 2014-2015 and 2015-2016, the estimated overwinter mortality declined to 38% and 18%, respectively. This was followed by a 27% overwinter mortality in 2016-2017. While Ontario beekeepers have reported overwinter mortality higher than the national average in recent years, colony losses are lower compared to reported losses for beekeepers in the United States. American beekeepers reported 40.5% losses in 2015-2016 followed by 33% overwinter mortality in 2016-2017 (Steinhauer et al., 2017).

General comments and discussion

The annual Ontario Apiculture Winter Loss Survey is a valuable tool for gathering information on colony mortality and the management practices used by beekeepers to monitor and control pests and diseases. Honey bee colony mortality differs from year to year, among different beekeeping regions as well as between individual beekeeping operations. This survey alone cannot paint a complete picture of honey bee health as honey bee health is complex and it is difficult to attribute overwinter losses to any single cause. The main stress factors influencing declines in the number of pollinators in Ontario have been identified as:

- extreme weather and climate change
- disease, pests and genetics
- reduced habitat and poor nutrition
- exposure to pesticides

Ontario's Pollinator Health Action Plan was developed to help address several of the key stressors on pollinator health. Implementation of the action plan is ongoing and includes:

- investing $1 million in innovative pollinator health research
- working to restore and protect one million acres of pollinator habitat across the province
- developing and delivering a suite of activities and programs designed to enhance beekeeper knowledge of emerging issues and research, best management and integrated pest management practices

Additionally, commercial beekeepers have access to a production insurance plan to help them manage financial loss from overwinter bee colony damage or loss. Bee Health Production Insurance (https://www.agricorp.com/en-ca/Programs/ProductionInsurance/BeeHealth/Pages/Overview.aspx) gives participating beekeepers the confidence and security to reinvest in their operations, encouraging greater innovation, profitability and job creation and provides them with the same financial support that beekeepers in other provinces receive. The government is working to strengthen the apiculture industry. OMAFRA is committed to working with farmers, beekeepers and other stakeholders to implement long-term, sustainable initiatives to improve the health of bees and other pollinators.

References

Canadian Association of Professional Apiculturists (http://www.capabees.com) (CAPA) Statement on honey bee losses in Canada. 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015 and 2016.

Furgala B. and McCutcheon, D.M. 1992. Wintering productive colonies. In Graham J M (Ed). The hive and the honey bee (revised edition). Dadant and Sons; Hamilton, IL, USA pp. 829-868

Steinhauer, a. Rennich, K. Caron, D.M. Ellis, J.D. et al. 2017. Honey Bee Colony Losses 2016-2017: Preliminary Results (http://beeinformed.org) . The Bee Informed Partnership.

Accessible image descriptions

Figure 1. Type of varroa mite monitoring method used by commercial and small-scale beekeepers in 2016

Figure 1 shows the type of varroa mite monitoring method used by commercial and small-scale beekeepers in 2016. Survey respondents could reply with more than one answer. Commercial beekeepers reported 18 cases of the sticky board method, 42 cases of the alcohol wash method, 33 cases of other and 11 cases of no monitoring for varroa mites. Small-scale beekeepers reported 46 cases of the sticky board method, 12 cases of the alcohol wash method, 33 cases of other and 47 cases of no monitoring for varroa mites.

Figure 2. Overwinter mortality (%) reported by commercial beekeepers in Ontario (blue) and Canada (grey) from 2006-2007 to 2016-2017

Figure 2 shows the % overwinter mortality reported by beekeepers in both Ontario and Canada from 2007 to 2017. The reported overwinter mortality in Ontario and Canada (respectively) was the following: 2007 – 37% and 29%; 2008 – 33% and 35%; 2009 – 31% and 34%; 2010 – 22% and 21%; 2011 – 43% and 29%; 2012 – 12% and 15%; 2013 – 38% and 29%; 2014 – 58% and 25%; 2015 – 38% and 16%; 016 – 18% and 17%; 2017 – 27% and 25%.

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