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Lessons from Canada's Varroa Experience?

by Peter Armitage¹

We humans can claim responsibility for spreading any number of exotic species: cane toads, carp, Eurasian watermilfoil, European green crab, European starling, Giant hogweed, gypsy moth, Japanese knotweed, zebra mussels, and more. Many of them are serious threats to biodiversity and have significant ecological and economic consequences.

In the case of the Western honey bee, itself an Old World species now established in the New, it too has been threatened by exotic species, something we all learned in our beginning beekeeping courses. These unwanted invasions include greater and lesser wax moths, *Nosema ceranae*, small hive beetle, tracheal mite, and...varroa mites. BC provincial apiculturist Paul van Westendorp refers to *Varroa destructor* as “the most destructive pest ever to have been inflicted upon the honey bee. Getting it is like losing your innocence. Life is never, never the same again. There is no return. It's a never ending battle.”

Virtually all honey bee stocks throughout the world are now infested with varroa. Apart from Australia, there remain only a dozen or so varroa-free locations, almost all of them isolated and/or surrounded by water.² Only the old-timers remember the pleasures of managing bees in those halcyon varroa-free days. Beekeepers are now unhappily habituated to varroa's dark gifts: reduced productivity, high levels of colony loss resulting from ineffective management, and trapped on a perpetual treadmill of monitoring and treating.

How did varroa get here in the first place? Were any efforts made to prevent its establishment and spread in Canada? And can the hard-won wisdoms gained in our varroa experience be applied to new biological threats like the *Tropilaelaps* mite?

Based largely on reports by members of the Canadian Association of Professional Apiculturalists (CAPA), this article summarizes the history of varroa's arrival in Canada. As detailed in the proceedings of CAPA's annual meetings from 1978 to 2012, provincial apiculturists (apiarists) in conjunction with the federal government were on the front lines of the varroa battle, along with hundreds of hobby and commercial beekeepers.

“The arrival of varroa was a disaster waiting to happen. We weren't properly prepared for it. Once it hit, it was very traumatic...it was just brutal. It divided communities, it divided families. We were so angry. There was a lot of what we see as part of a disaster response, with distress, that can actually lead to PTSD. We blame others, point the finger, shaming, anxiety, tears. I saw grown beekeepers cry. Because lots changed when this disaster happened. It [beekeeping] got more intensive, more expensive, some people went out of business, a lot of people were depressed, just the loss of bees” - Heather Clay, former provincial apiarist, *New Brunswick, 2019*

Our varroa history starts in the late 1970s, with the development of a national Varroa Action Plan (VAP). Fact-

finding and monitoring efforts by CAPA and Canadian Honey Council (CHC) traced the spread of varroa worldwide, with a particular focus on Europe and the USA. In 1978, CAPA member, Don Gray, of Agriculture Canada's Health of Animals Branch, noted that “the serious spread of *Varroa jacobsoni* [*Varroa destructor*] has been reported. The threat posed by this mite demands intensified screening if its importation is to be prevented” (CAPA 1978: 3).

Varroa-related activities by CAPA and the CHC intensified following the 1987 establishment of varroa in the US. Working closely with Agriculture Canada in domestic monitoring and planning initiatives, they drafted a “Varroa Action Plan” with the assistance of William Sterritt of the Animal Health and Protection Branch at Agriculture Canada (Canadian Honey Council 1988: 59). In October 1987, the federal government imposed a country-wide ban on the importation of packaged bees from the US in an effort to prevent the cross-border spread of the parasite (Clay 1996: 132).

The following year, Agriculture Canada conducted a “Varroa Survey,” sampling honey bee colonies across all Canadian provinces, excepting only Newfoundland and Labrador. In total, 8,422 colonies were sampled and all were negative for varroa (CAPA 1988: 7). The VAP was ready for a “test run” by November 1988 (ibid.: 13; Canadian Honey Council 1988: 14; Clay 1996: 132). It provided “guidelines and actions for the detection and control” of the mite. The federal Minister of Agriculture was assigned a key role: to establish a “national mite advisory committee,” undertake detection surveys, and coordinate communications, detection strategies, and responses among provinces with respect to varroa incursions (CAPA 1990: 37-44). The main components of the plan were:

- Quarantine areas called “Primary Control Zones” and “Secondary Control Zones,” in which honey bees could not be moved. Hive equipment could not be moved without an Agriculture Canada permit. The Primary zones were 8 km in radius while the Secondary ones were 24 km in diameter (Canadian Honey Council 1988: 62).

- Three types of surveys; a “detection survey” to determine whether a varroa infestation had occurred in an area, a “delimiting survey” to determine the geographic extent of an infestation, and a “monitoring survey” to evaluate the success of any eradication measures taken (ibid.: 64).

- An eradication plan involving the destruction of “all bees and brood in the infested apiary.” They were to be euthanized only when bees were not flying, and dead bees and brood had to be burned and buried. Exposed equipment was to have been “quarantined and/or stored at 0°C for seven days.” Honey supers could be extracted once bees and brood had been killed (ibid.: 67).

- Market Value Assessment to determine the monetary value of the bees, products or equipment destroyed as a result of eradication. However, the determination would not include compensation for lost honey crops or other beekeeping revenues (ibid.: 63). A National Mite Advisory Committee would be created that would establish policies and procedures

for the determination of market value for bees and equipment destroyed as a result of eradication (ibid.: 69).

The plan was put to the test immediately. In 1989 a varroa incursion was detected in New Brunswick, near the border with Maine. In an effort to contain the spread of the parasite,

“...[s]even colonies in one apiary were destroyed and the beekeeper was indemnified at the rate of \$60.00/hive....The original infestation in N.B. originated in hives moved from Florida to Maine for the pollination of blueberries. These colonies were left in an apiary ½ km from the Canadian border. So, the infestation in N.B. is likely due to drifting or swarming. There are apiaries situated in Canada in the same area only ½ km from the U.S. border.” (CAPA 1990: 17)

What happened next is well known to beekeeping old-timers in Canada; varroa crossed the Canada/US border at multiple points over the next few years and rapidly became established virtually everywhere across Canada with the exception of Newfoundland and Labrador and Thunder Bay, Ontario. The following is an abbreviated chronology of varroa’s invasion of and spread across Canada.

1991 – Varroa arrives in BC, Manitoba, Ontario, and Quebec. “Manitoba Agriculture placed 60 pheromone lure swarm traps at various locations along the international boundary with North Dakota. A total of 13 swarms were captured and two of these tested positive for Varroa. These positive detections were located approximately 6 miles apart, south of Killarney” (CAPA 1992: 89). For Quebec: “Only one Varroa on one beekeeper with fifteen colonies nearest one kilometre U.S. border” (ibid.: 91). Testing in Ontario in the fall of 1991 produced positive varroa findings in Fort Erie, Niagara-on-the-Lake and in the City of Windsor. “195 hives destroyed of 15000 hives surveyed” (CAPA 1993: 72).

For BC, Varroa was first detected in swarm traps near Abbotsford in August 1991.³ Federal government surveys in the fall of 1991 and spring 1992 detected infestations in a number of apiaries. “2 Federal varroa mite surveys in fall ’91 and spring ’92 involved 1187 colonies in randomly selected apiaries using tobacco smoke. Area selected surveys were carried out in the Fraser Valley, Osoyoos area, and the Central & North Okanagan in the fall using Apistan strips. 925 colonies were tested in 78 apiaries where 28 apiaries involving 446 colonies were varroa positive” (CAPA 1993: 80).

1993 – Varroa arrives in Alberta. “A beekeeping operation in north-western Alberta was found to be positive for varroa mites. Fifteen of the forty colonies tested were found to be positive. The colonies in this operation spent the winter of 1992-93 in southern British Columbia. All six colonies belonging to the one hobbyist beekeeper in the same area were tested and two of them were found to be positive for varroa” (CAPA 1994: 80).

Also in 1993, Agriculture Canada served notice that it would “withdraw from participation in varroa mite survey and control activities when a chemical treatment is available” (CAPA 1993: 107; 1994: 43). Federal government involvement in varroa-related affairs continued henceforth

in terms of approving chemical treatments for the parasite (e.g., fluvalinate, flumethrin, coumaphos), and continuing to manage honey bee importations from other countries under the Health of Animals Act and other legislation.⁴

1995 – Varroa discovered in Nova Scotia, established in Saskatchewan. Nova Scotia provincial apiarist, Dick Rogers, reported that, “[e]vidence suggests that Varroa has been in the Halifax/Dartmouth area of Nova Scotia for 3 years. The introduction appears to have been human assisted, but unable to get admissions of involvement or supporting proof.... Eradication is not being considered because of the distribution of Varroa finds. Movement of colonies out of Halifax/Dartmouth area for blueberry pollination are responsible for the rapid and widespread dispersion of Varroa in 1995” (CAPA 1996: 28-29).⁵

For Saskatchewan, provincial apiarist John Gruszka, reported “Varroa mite has been found in three locations in Saskatchewan; the areas around Porcupine Plain, Saskatoon and the Regina -Moose Jaw area. The former infestation was discovered in June and the later two were discovered and confirmed in September and October. The Varroa mite has been found in the operations of 7 commercial beekeepers and 13 hobbyists” (ibid.: 36).⁶

1997 – Varroa arrives on Vancouver Island despite quarantine measures. “In February was first reported on Vancouver Island east of Port Alberni. Since then, varroa has been spreading southward towards Victoria” (CAPA 1998: 31).

2000 – Varroa arrives on Prince Edward Island. “Varroa mites were discovered for the first time in Prince Edward Island. The mites were discovered during the spring inspections in four apiaries belonging to the same operation. This operation accounts for 50% of the hives in the province and 75% of the province’s pollination capacity. A further survey in the fall showed that the mites had spread to four additional operations. Over half the colonies in the province are now in apiaries known to have been infected. No special efforts were made to quarantine or eradicate infected colonies, instead efforts were made to provide beekeepers with information on monitoring and control” (CAPA 2001: 21).

2012 – Varroa crashes the barricades in Thunder Bay, Ontario. “In September 2012 varroa mites were detected in the region of Thunder Bay, in multiple locations. The findings of varroa are significant as varroa mites have not been detected in this region previously” (CAPA 2012: 72).

2020 – Newfoundland and Labrador remains the only varroa-free province in Canada. Informed by the history of varroa in Canada and elsewhere in the world, the Newfoundland and Labrador Beekeeping Association develops a “Varroa Action Plan,” recommending an early detection strategy, measures to control the spread of the parasite should there be an incursion, and training in varroa-treatment should it become established.

In Retrospect

It is easy to criticize the 1988-1990 VAP as a total failure given the fact that it failed to prevent the establishment and rapid

spread of varroa across Canada. The federal government at the time was criticized by beekeepers for not fast-tracking registration of the miticide Apistan (fluvalinate), and not providing adequate funding for inspection and research into treatment options.⁷ Furthermore, the inadequate compensation paid to beekeepers whose colonies were euthanized in newly infested areas generated considerable acrimony in some parts of the country. It was “barely sufficient to purchase a 2 lb package of bees” (Clay 1996: 134; 1999).⁸

There is no doubt that the arrival of varroa was extremely traumatic for Canadian beekeepers, and their concerns about the long-term economic cost and health consequences for their stock were borne out in the years to come. However, the establishment of varroa in Canada was most likely inevitable given the migratory nature of US beekeeping. Migratory beekeepers brought the parasite to the international border at multiple locations; a border that is no barrier to a mite that spreads by way of hitchhiking on drifting, robbing, swarming and absconding honey bees. Varroa-free sanctuaries did not maintain that status for long given the long reach of migratory beekeeping, coupled with questionable ethics of some beekeepers.⁹ In addition to natural spread, the transmission of the parasite was facilitated by both legal and illegal internal movement (quarantine breaches, illegal intra-provincial importation) by both hobby and commercial beekeepers, slow treatment responses, at least one faulty inspection protocol, and in many cases, tardy detection.

An example of how varroa spread in Canada is provided by Paul van Westendorp:

In the spring of 1993, one commercial producer moved an estimated 700 lightly Varroa infested colonies from the south Okanagan Bee District to the (Alberta) Peace River without netting or closed entrances during daytime hours. The beekeeper has been charged by BC for moving bees illegally (still pending) and charged and convicted in Alberta for importing bees into the province illegally. Subsequent Varroa infestations have been found along the principal highway(s) leading to Alberta. Currently, most mite infestations are found in border areas, while the majority of colonies remain mite free (CAPA 1994: 15).

The manner in which varroa spread in New Brunswick is particularly instructive. Working closely with the provincial and federal governments, beekeepers managed to confine the varroa infestation to the eastern and southeastern parts of the province. In 1993 the situation changed dramatically following the importation of nucleus colonies from Ontario. As noted by former New Brunswick bee inspector and provincial apiarist Heather Clay,

...there was a major jump in the spread of the mite in 1993 with the importation of an additional 260 nucleus colonies from Ontario in late May 1993. These were from apiaries in Ontario that had been tested for varroa mite six months earlier. A month after their distribution in New Brunswick, the Ontario inspectors found varroa mites at a low level in one of the apiaries that had shipped 65 of the nucleus colonies (Clay 1996: 137).

The Ontario nucs should have been tested immediately prior to shipment, and they were not labelled with identification codes that would permit tracing them back to their source apiaries. When varroa was discovered in one of these Ontario apiaries, the nucs had already been distributed to numerous locations across New Brunswick, thereby necessitating inspections of all of the colonies in the destination apiaries.

Lessons for the Future?

Canada’s varroa history is open to interpretation, and some aspects of our experience with the mite are hotly contested - for example, how we apportion responsibility for its establishment and spread. Nonetheless, there are lessons that can be applied to future threats to honey bee health. These include the importance of “knowing thy enemy,” which is why US biologist Dr. Samuel Ramsey is currently focusing his energies on *Tropilaelaps* research. Research can find us equipped with robust monitoring and management (e.g., treatment) protocols when that mite arrives on our shores.

Other lessons relate to the need for vigilance in the form of monitoring programs informed by our knowledge of transmission pathways. This will facilitate early detection and possible eradication, or at least delay the spread of novel health threats until beekeepers are better prepared to manage them. Furthermore, inspection protocols sometimes turn out to be more robust in theory than in practice. The spread of Small Hive Beetle in eastern Canada is an excellent current example. Can we improve inspection protocols to prevent pest and pathogen transmissions?

The failure of Canada’s VAP quickly showed the weakness of quarantine strategies given the migratory nature of much of our apiculture and ethical lapses in the form of illegal importation and quarantine breaches by both hobby and commercial beekeepers. Critically, stock replacement programs in support of eradication must offer enough compensation to incentivize beekeepers to report infestations. However, when financial resources for apiculture are limited, governments may not be willing to finance stock replacement and the necessary expenses in monitoring and eradicating novel threats.

Lastly, “finger-pointing” and rumour-mongering featured prominently in the response of many beekeepers to catastrophic colony losses due to varroa. This acrimony was not helpful; it did nothing to prevent the establishment and spread of the parasite, and may have frustrated timely, cooperative efforts.

Our challenge for the future is to deter practices that threaten honey bee health while fostering collegial approaches, avoiding the trap of the blame game. ❁

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Footnotes

1. Peter Armitage was born, raised, and introduced to beekeeping in BC. He is a co-author of the Newfoundland and Labrador Beekeeping Association's recently released Varroa Action Plan. Acknowledgement – much thanks to David Peck, Steve Walsh, Janet Wilson, and two other beekeeping colleagues – both witnesses to the varroa invasion - for reviewing a draft of this article. All errors of fact, omission, and interpretation are entirely the responsibility of the author.
2. In addition to Newfoundland and Labrador, they include Aland Islands (Finland), Colonsay (Scotland), Greenland, Quessant (France), Iceland, Isle of Man (UK), the Hawaiian islands of Kauai, Lanai, Molokai and Maui, Chatham Island (New Zealand), Niue Island (South Pacific), parts of Norway, the islands of Comoros, Seychelles and Rodrigues in the Indian Ocean, and the Kufra oasis in southeastern Libya.
3. P. van Westendorp email to P. Armitage 4 Nov. 2020.
4. "It was also noted that the existing 'Varroa Action Plan for Canada' was developed for the detection and eradication of varroasis as a Foreign Animal Disease. Although the Plan initially provided a good program framework, it is no longer applicable as varroasis has been shown to be non-eradicable and must be considered endemic in some pockets near the U.S. border" (Minutes of the Varroa Meeting, Ottawa, 24 June 1992, in CAPA 1993: 34).
5. Apparently, the "human assisted" vector was an illegal import. A local beekeeper with kinship and/or beekeeping connections either in Greece or Turkey smuggled infested queens through Canadian customs, and the mites spread rapidly from his Halifax/Dartmouth apiary (D. Amirault, personal communication to P. Armitage, March 2018).

6. There was an initial varroa incursion in Saskatchewan in 1992 due to illegal importation, which was contained (CAPA 1993: 77). According to former Saskatchewan provincial apiarist, John Gruszka, "Varroa mites arrived via 3 SK beekeepers who, in spite of restrictions, smuggled a semi load of single story hives which had been wintered in a mite infested area of southern BC. We recognized that it would not be possible to eliminate the infestations, but using movement restrictions, we slowed the spread and monitored their spread by providing mite analysis for apiaries from beekeepers who submitted samples province-wide. With these actions beekeepers knew early of infestations and when to start treatments. It took over 12 years before the last area of the province became infested" (J. Gruszka email to P. Armitage 26 Nov. 2019). The commercial operators responsible for the 1995 infestation were also responsible for the 1992 illegal importation.
7. Apistan was officially registered for use 9 March 1993 (Clay 1996: 136; H. Clay email to P. Armitage, et al., 22 Nov. 2019). There were other serious issues concerning the relationship between the apicultural industry and the federal government as well as significant differences of opinion among commercial beekeepers regarding various matters in particular restrictions on the importation of packaged bees from the US.
8. The compensation value was changed from \$60 to \$250 in 1999 re. federal government compensation for colony losses. Such compensation ended when varroa was subsequently removed as a reportable "disease" (H. Clay email to P. Armitage 23 Sept. 2020).
9. By "questionable ethics" I mean a set of beliefs and behaviours that is insufficiently risk adverse with respect to biosecurity hazards, and which prioritizes individual self-interest over the welfare of the beekeeping community as a whole and the long-term health of the honey bee stock. An example of such ethics is the role played by certain migratory beekeepers in spreading Varroa between BC and Saskatchewan (J. Gruszka personal communication to P. Armitage, 5 Dec. 2019). For a comparison with Canada, consider the robust biosecurity culture of Australian beekeepers.



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