

COLONY HEALTH MONITORING PROGRAM

2023 Annual Report





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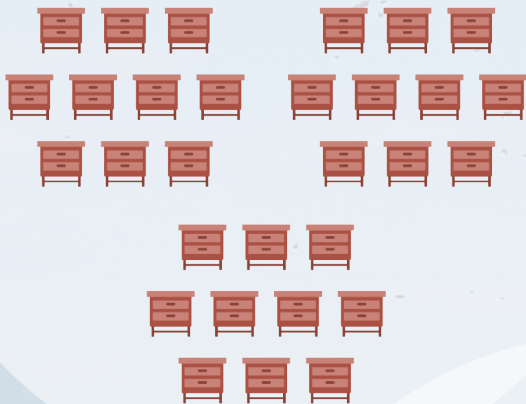
PROGRAM OVERVIEW

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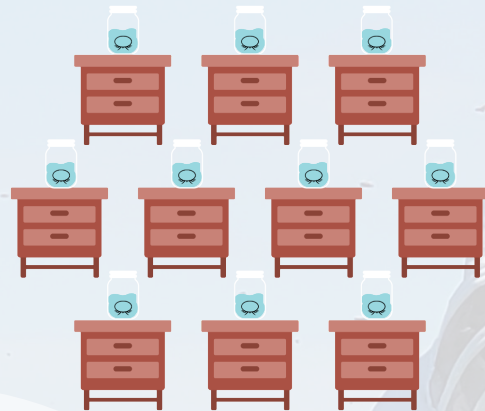
The Colony Health Monitoring (CHM) program provides Alberta beekeepers with apiary disease reports based on colony inspection and laboratory analysis. Beekeepers can then use this information to evaluate their Integrated Pest Management (IPM) plan and make changes if needed.

How it works:

Beekeepers select up to 4 apiaries to be sampled 2-3 times a year (late spring, summer during pollination, & early fall).



10 colonies per apiary are inspected for diseases and sampled for Varroa Mites.



1 pooled live bee sample is taken from 10 colonies per apiary for the analysis of Nosema, AFB, EFB, and viruses.



PROGRAM OVERVIEW

Table 1. Number of apiaries sampled per region each season.

	Southern	North Central	North East	North West	Peace
Spring	21	8	8	16	11
Summer	21	4	2	8	0
Fall	19	14	9	16	8
TOTAL SAMPLING UNITS					165

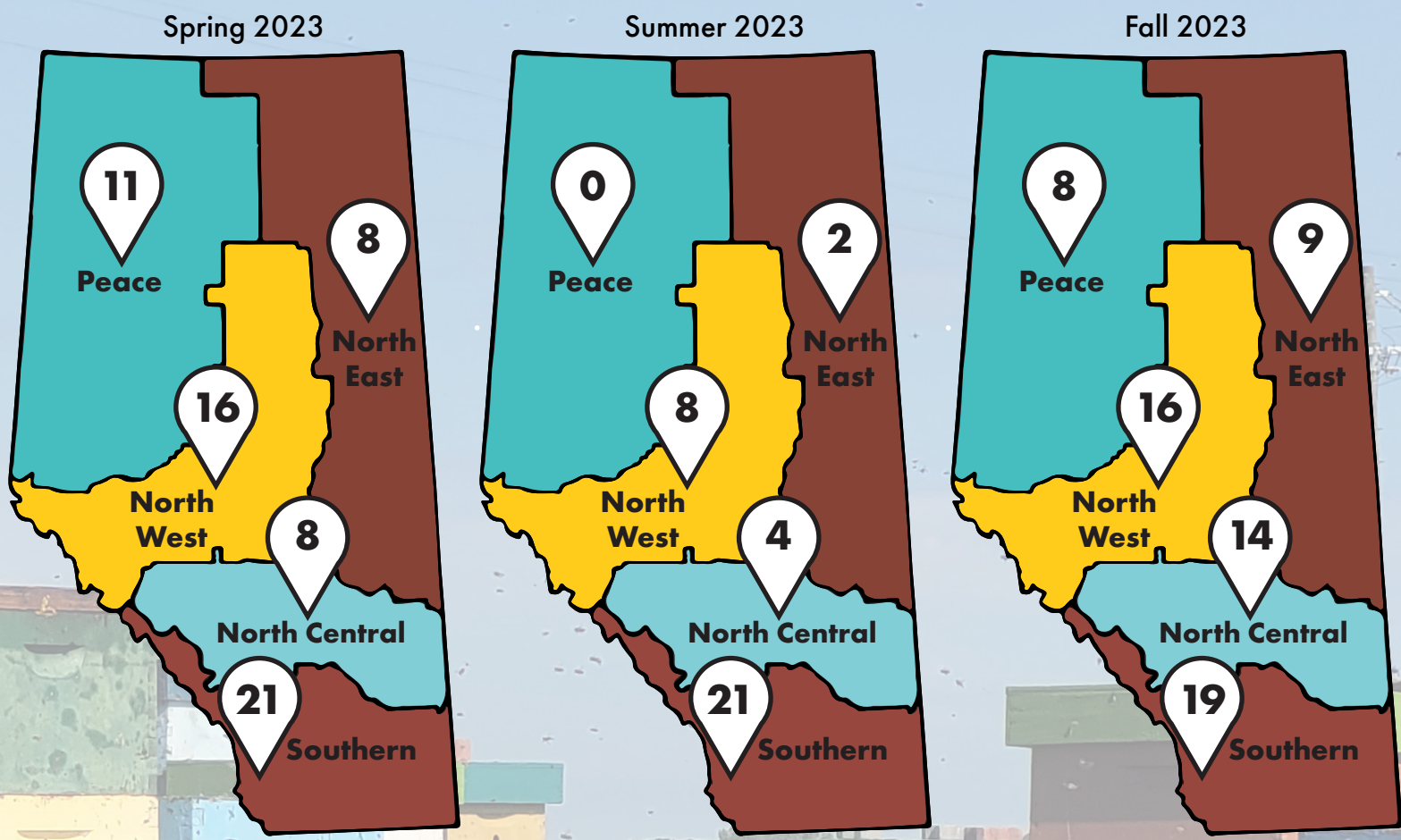


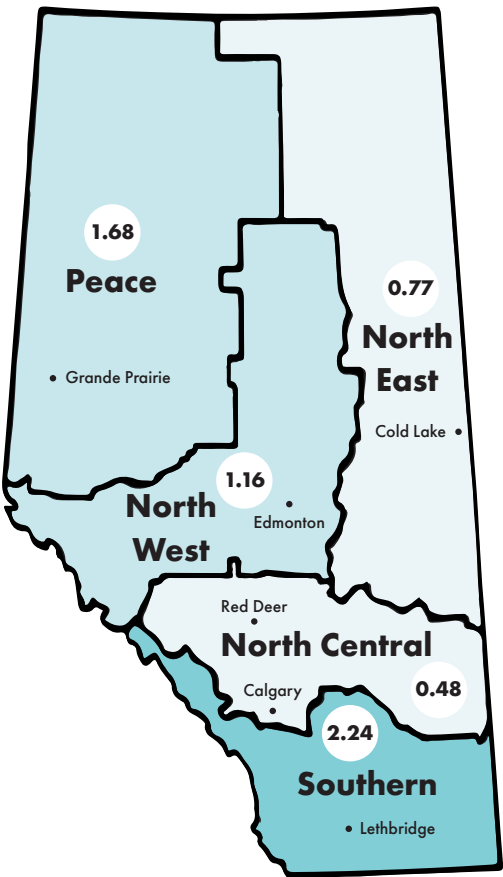
Table 2. List of samples, method of assessment and sample size.

Sample	Method of assessment	Sample size
Varroa	Alcohol wash	300 bees per colony
Nosema	Microscopy	Composite sample of 10 colonies at approximately 150 bees per colony
AFB	Bacterial culture	
EFB	qPCR	
Virus	qPCR	

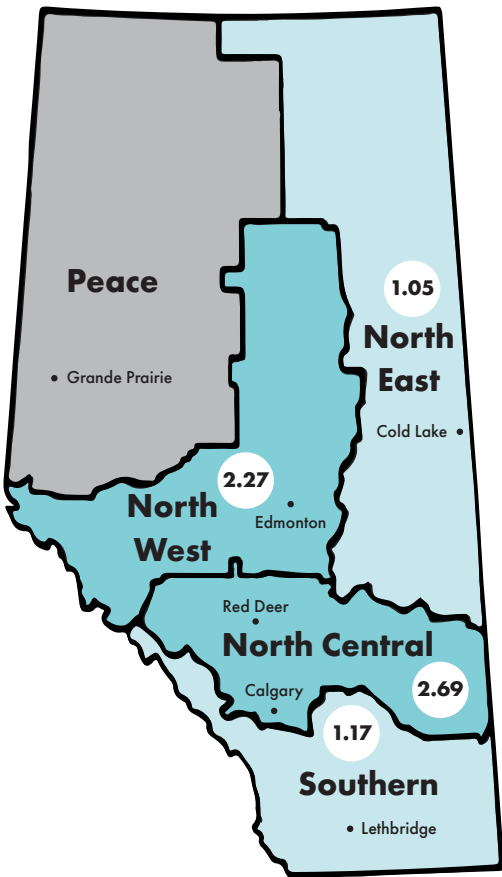


Regional Nosema Infection Averages by Season

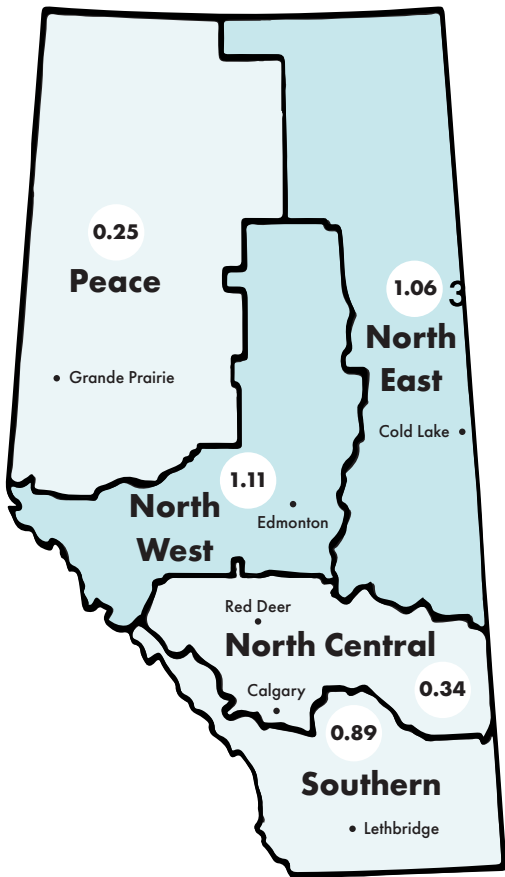
Spring 2023



Summer 2023



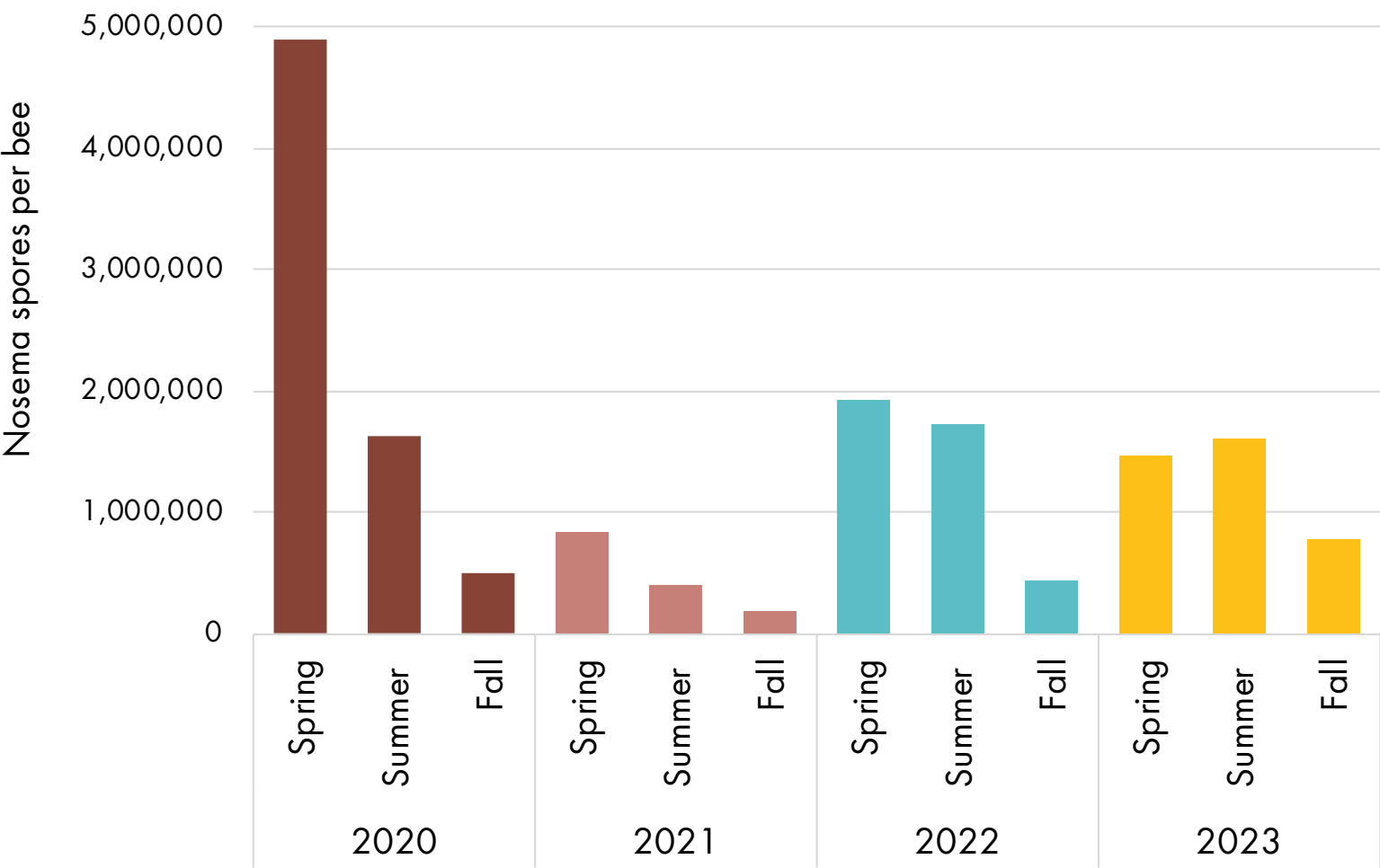
Fall 2023



Millions of spores/bee



Average Nosema Infection (2020-2023)



Spring of 2020 remains the highest average level of Nosema seen in the CHM program.

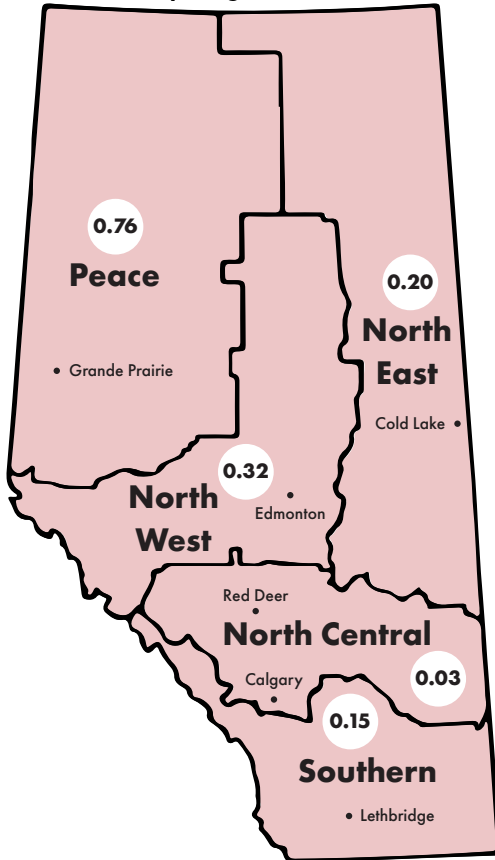
An unusual trend was observed in 2023 where nosema levels actually increased going into summer in many apiaries.

VARROA RESULTS

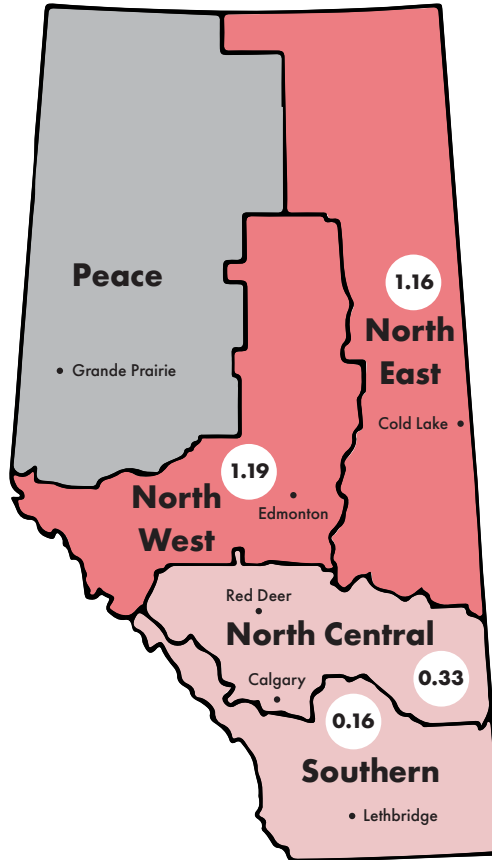
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Regional Varroa Infestation Averages by Season

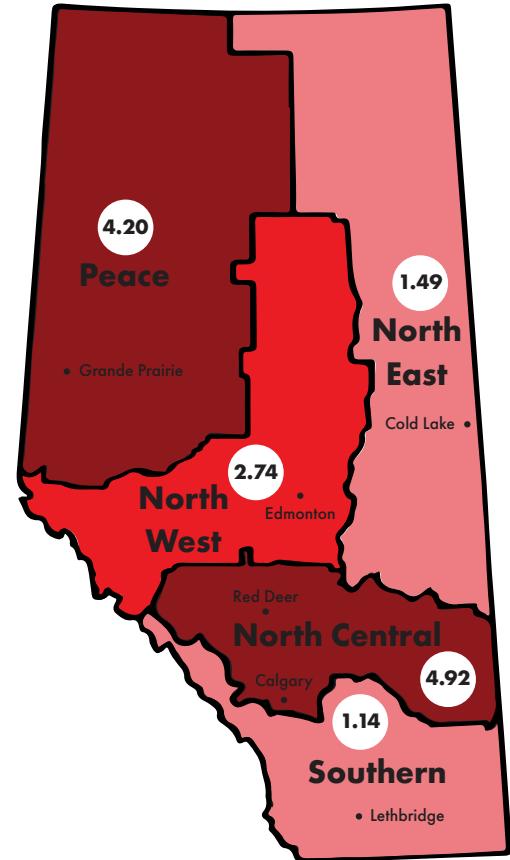
Spring 2023



Summer 2023



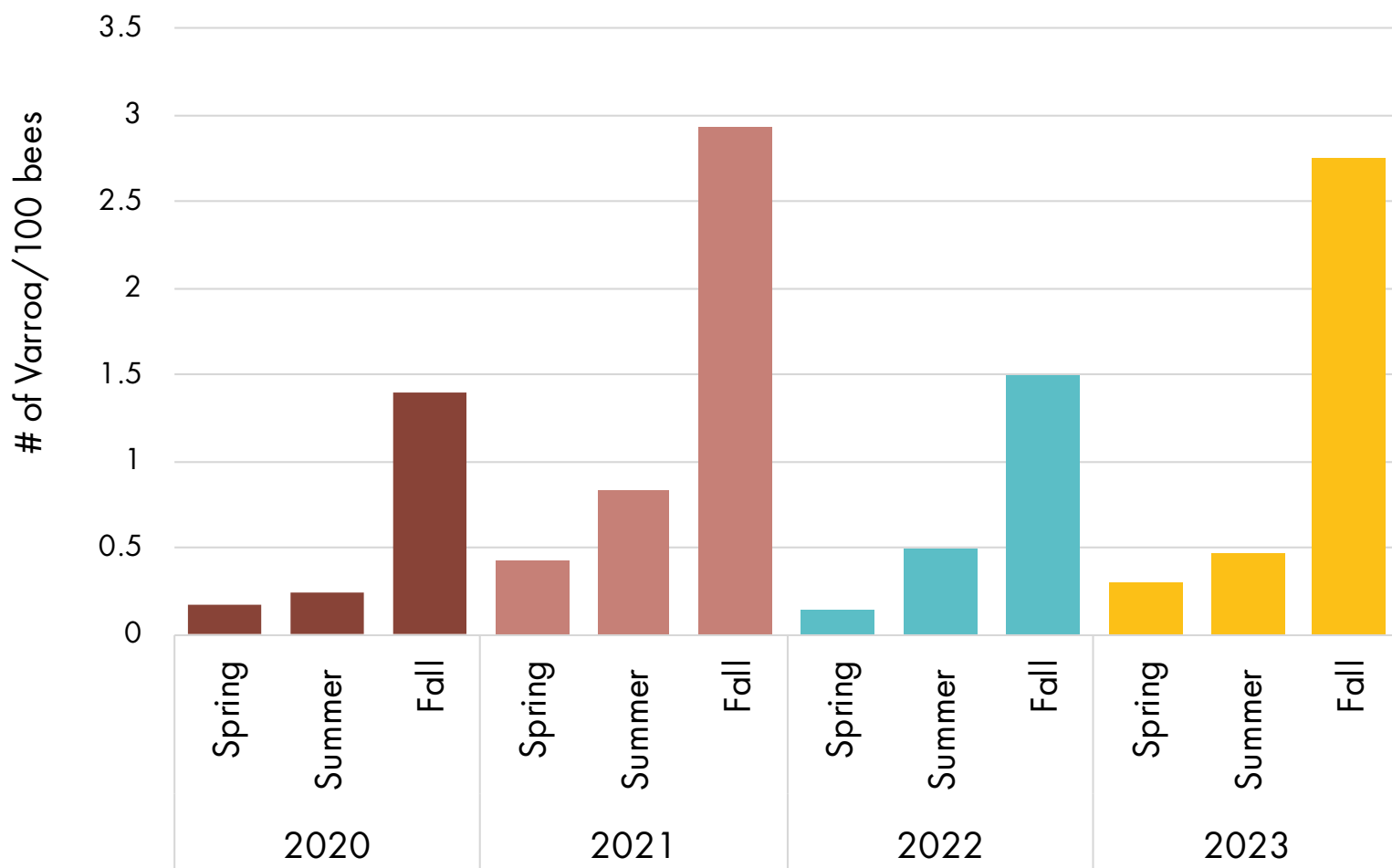
Fall 2023



of Varroa/100 bees

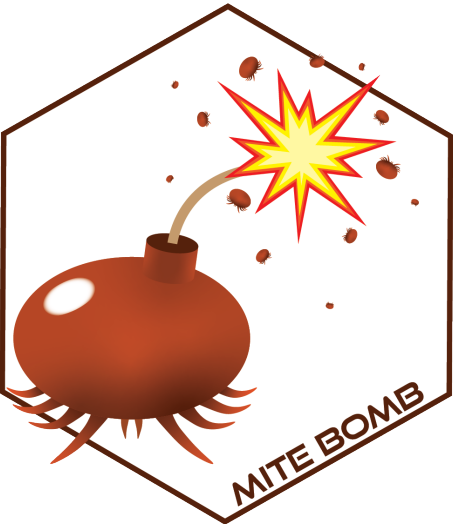


Average Varroa Infestation (2020-2023)

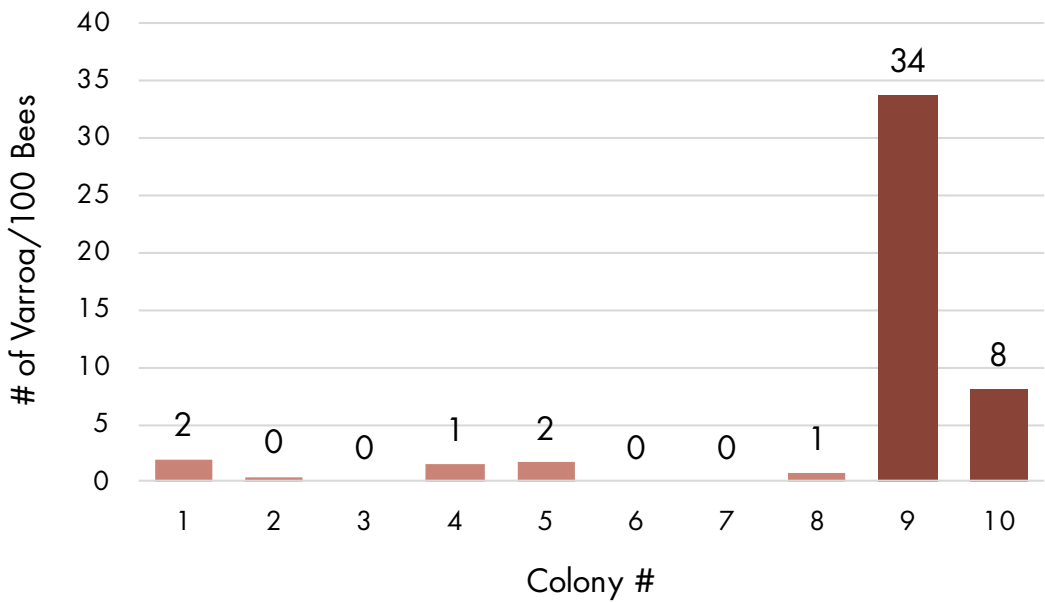


The Varroa infestation population trends have been similar over 4 years, with low levels in spring and the highest levels seen in fall.

The TTP tends to sample in mid-late August for fall, so in the absence of management, the fall Varroa levels seen on this chart would likely double (or more) by late September.



Mite Bomb Apiary Example



The TTP defines mite bombs as colonies with unusually high Varroa infestation levels when nearby colonies have low levels. An example can be seen in the graph above - colonies 9 and 10 would qualify as mite bombs.

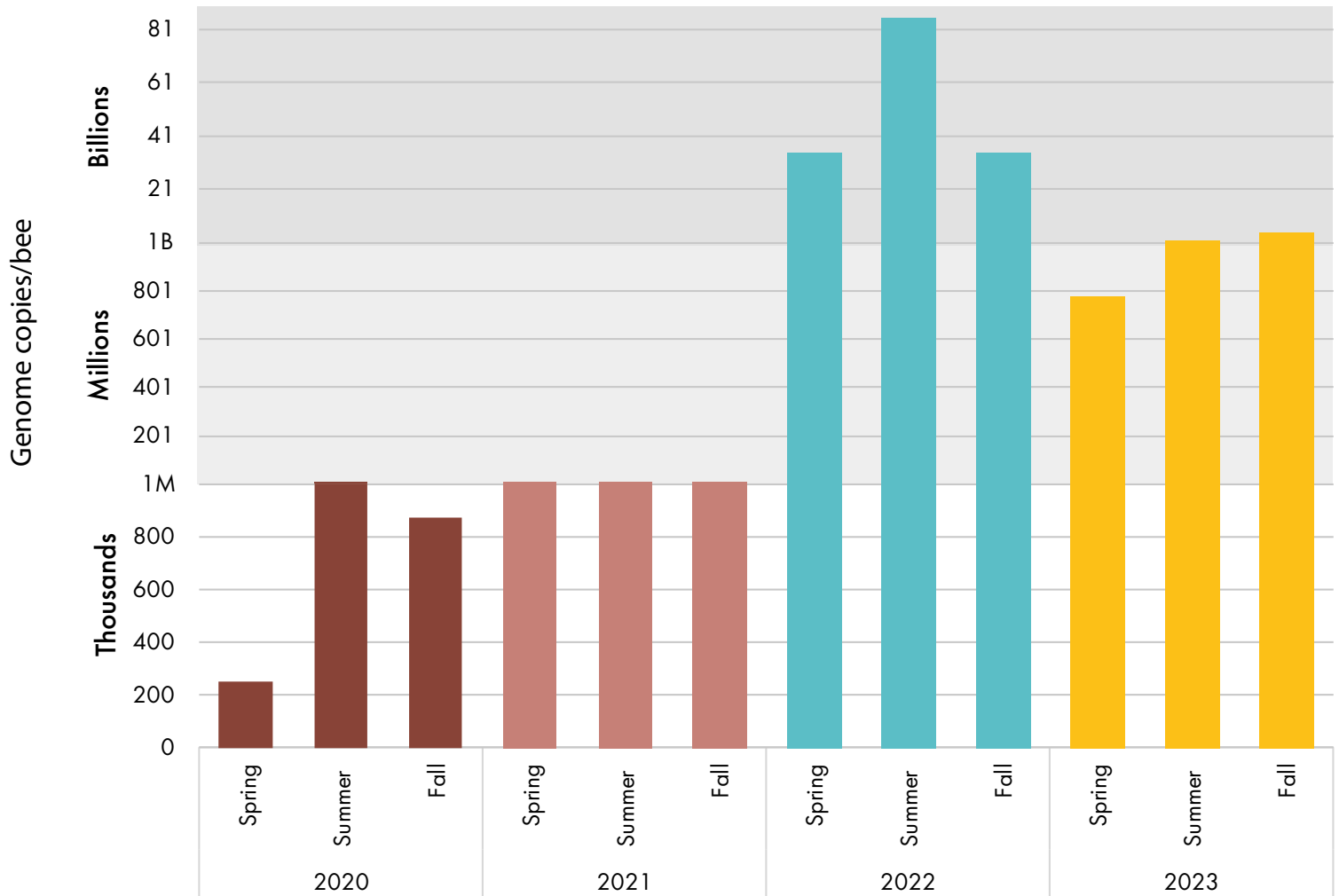
In 2023 the CHM sampling showed that more apiaries had mite bombs than in 2022.

*For this analysis a mite bomb was defined as when the Apiary max - Apiary median was greater than 5 mites/100 bees.

Table 2. Percentage of mite bombs sampled (2022-2023).

	2022	2023
# of mite bomb apiaries	18/207	34/165
% of mite bomb apiaries	9%	21%

Average Black Queen Cell Virus Infection (2020-2023)

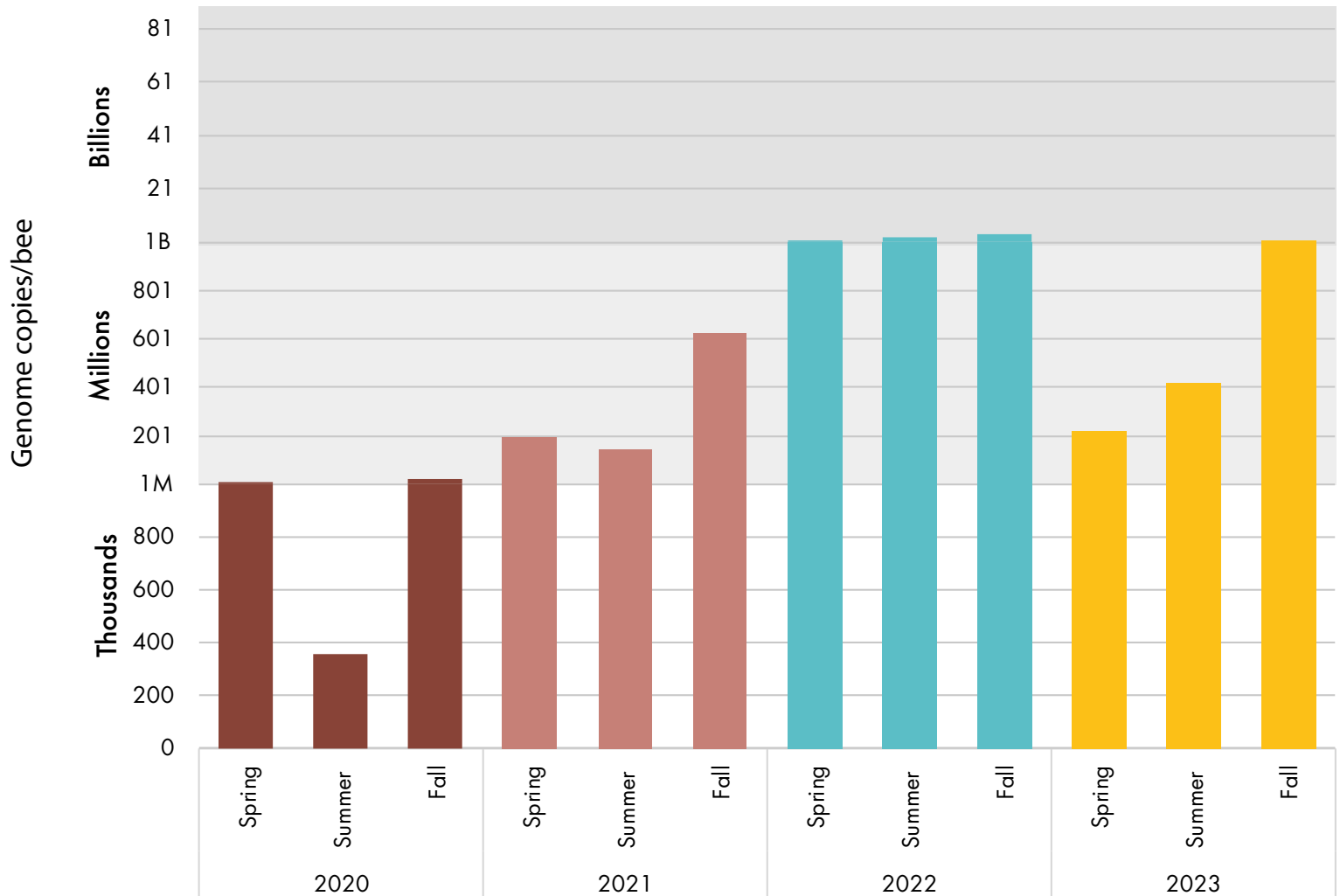


This graph has a CUSTOM NON-LINEAR Y-AXIS in order to accurately communicate how much virus levels have increased since 2020.

Black Queen Cell Virus has exponentially increased 337 THOUSAND FOLD in Alberta from its low point (252 thousand, Spring 2020) to its high point (85 billion, Summer 2022).

Thankfully, in 2023, this trend showed signs of leveling off.

Average Deformed Wing Virus Infection (2020-2023)

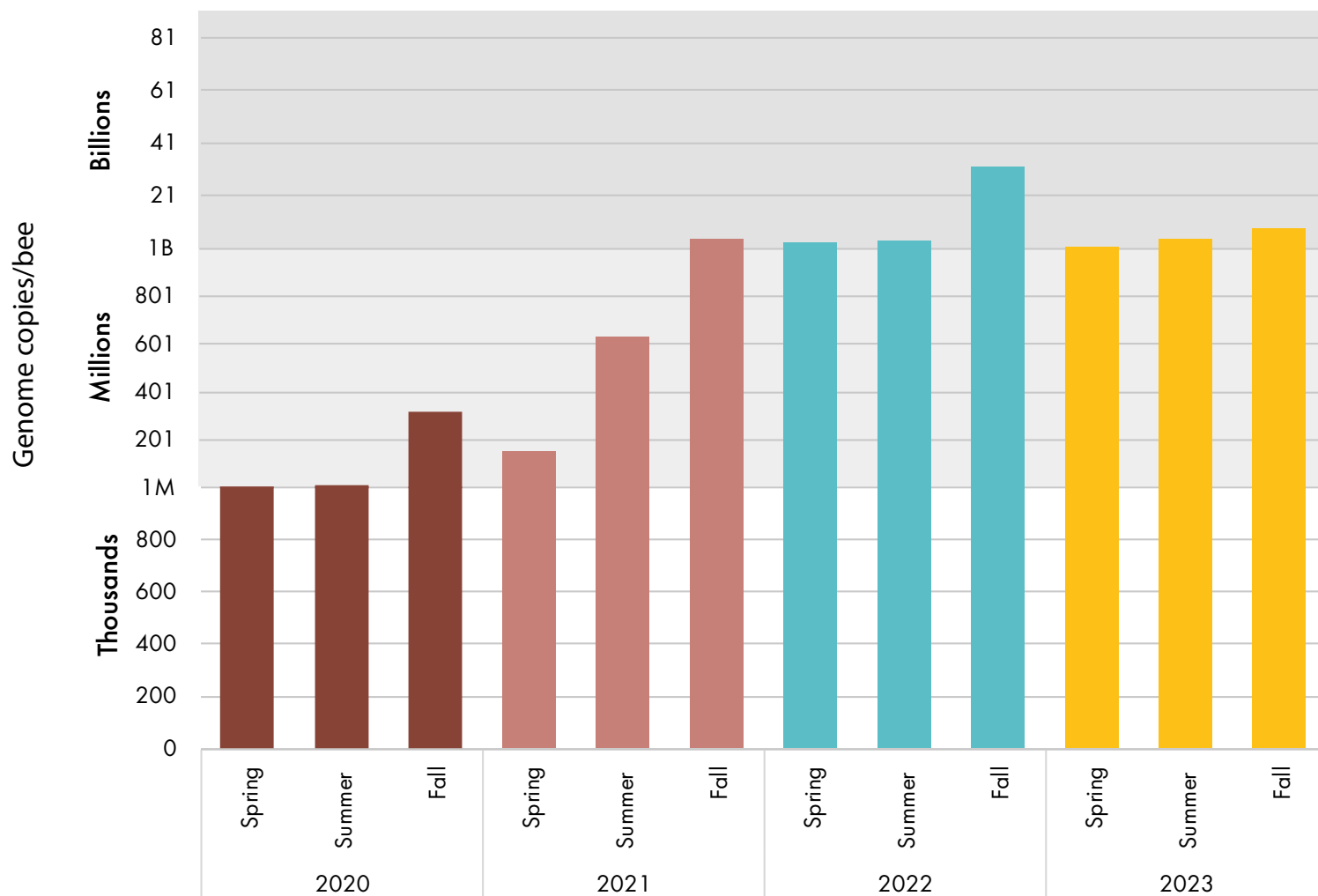


This graph has a CUSTOM NON-LINEAR Y-AXIS in order to accurately communicate how much virus levels have increased since 2020.

Deformed Wing Virus A (DWV) has increased greatly in Alberta, with the high point last summer (3.7 billion) being 10,000 fold higher than the low point (350 thousand) seen in Summer 2020.

After remaining flat in 2022 DWV dropped in spring 2023, and then slowly rose to be similarly high by fall 2023.

Average Varroa Destructor Virus Infection (2020-2023)



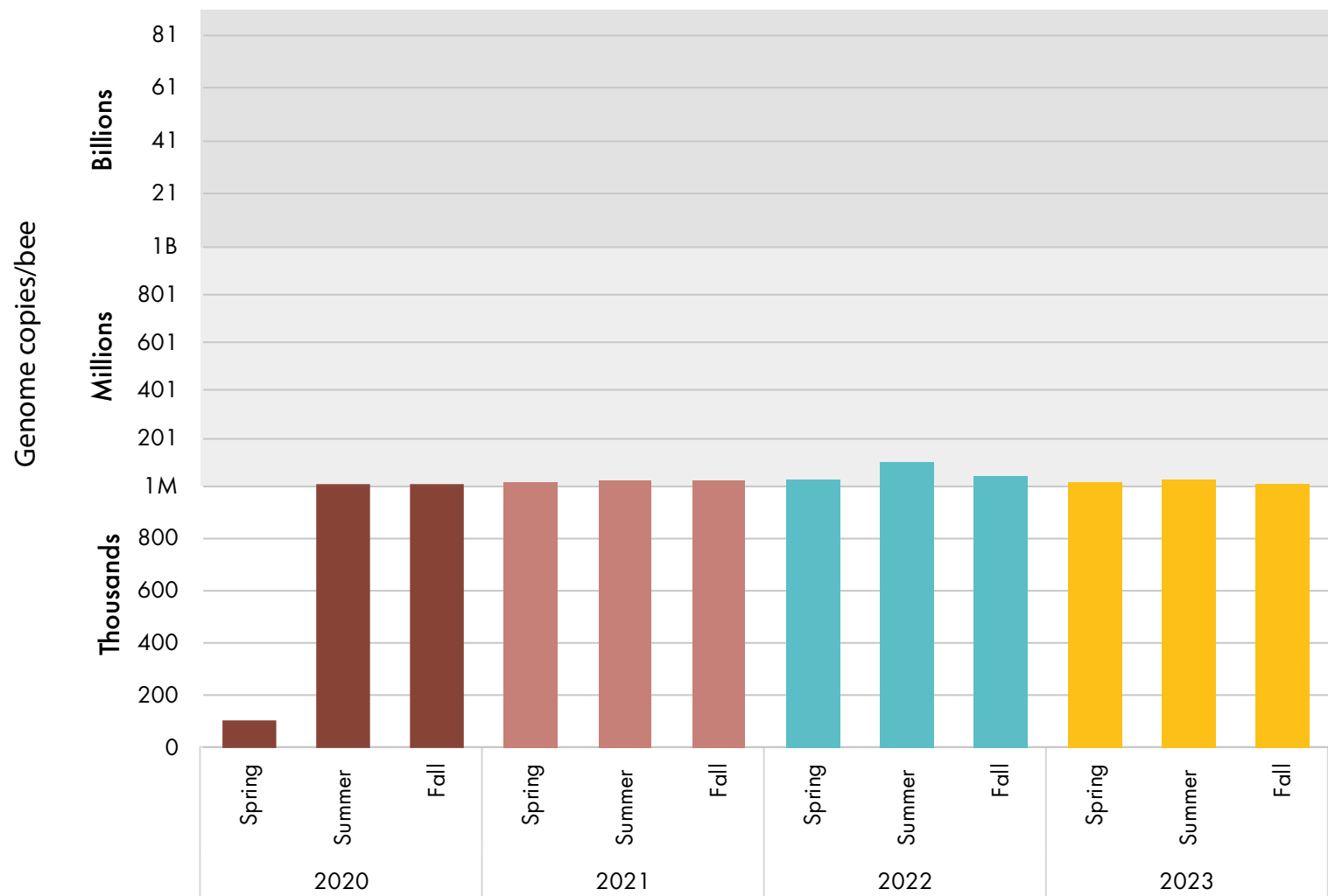
This graph has a CUSTOM NON-LINEAR Y-AXIS in order to accurately communicate how much virus levels have increased since 2020.

Varroa Destructor Virus (VDV) is also known as Deformed Wing Virus B, and has become more prevalent than DWV-A in many parts of the world.

This graph shows that VDV increased 4,000 fold in Alberta from its low point (Spring 2020, 8 million) to its high point (Fall 2022, 32 billion).

Thankfully, in 2022-2023, VDV showed signs of leveling off.

Average Sacbrood Virus Infection (2020-2023)

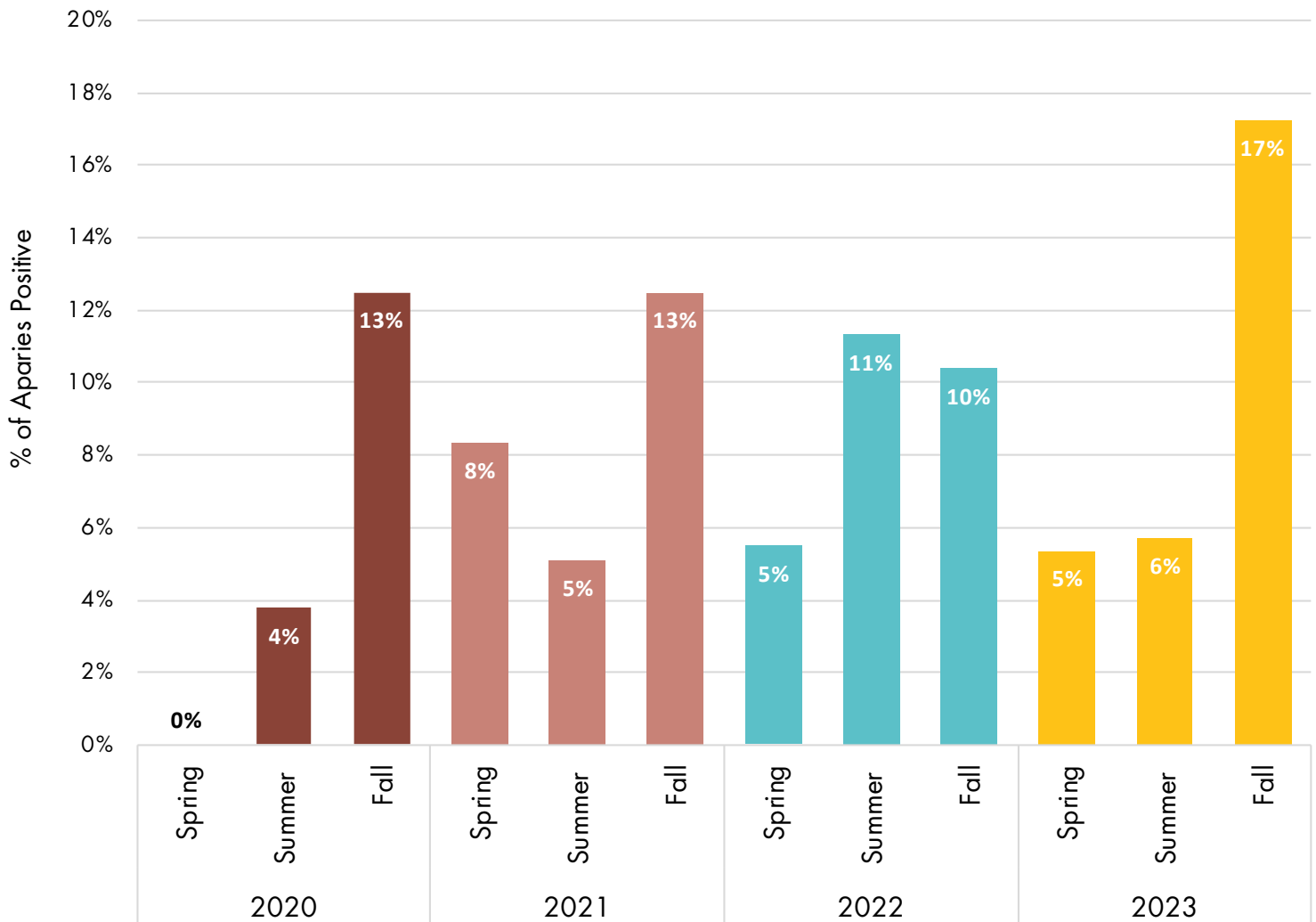


This graph has a CUSTOM NON-LINEAR Y-AXIS in order to accurately communicate how much virus levels have increased since 2020.

While the other viruses have increased, Sacbrood Virus (SBV) has largely held steady since an initial increase from its low point in spring 2020 (105 thousand). The highest average was seen last summer at 101 million.



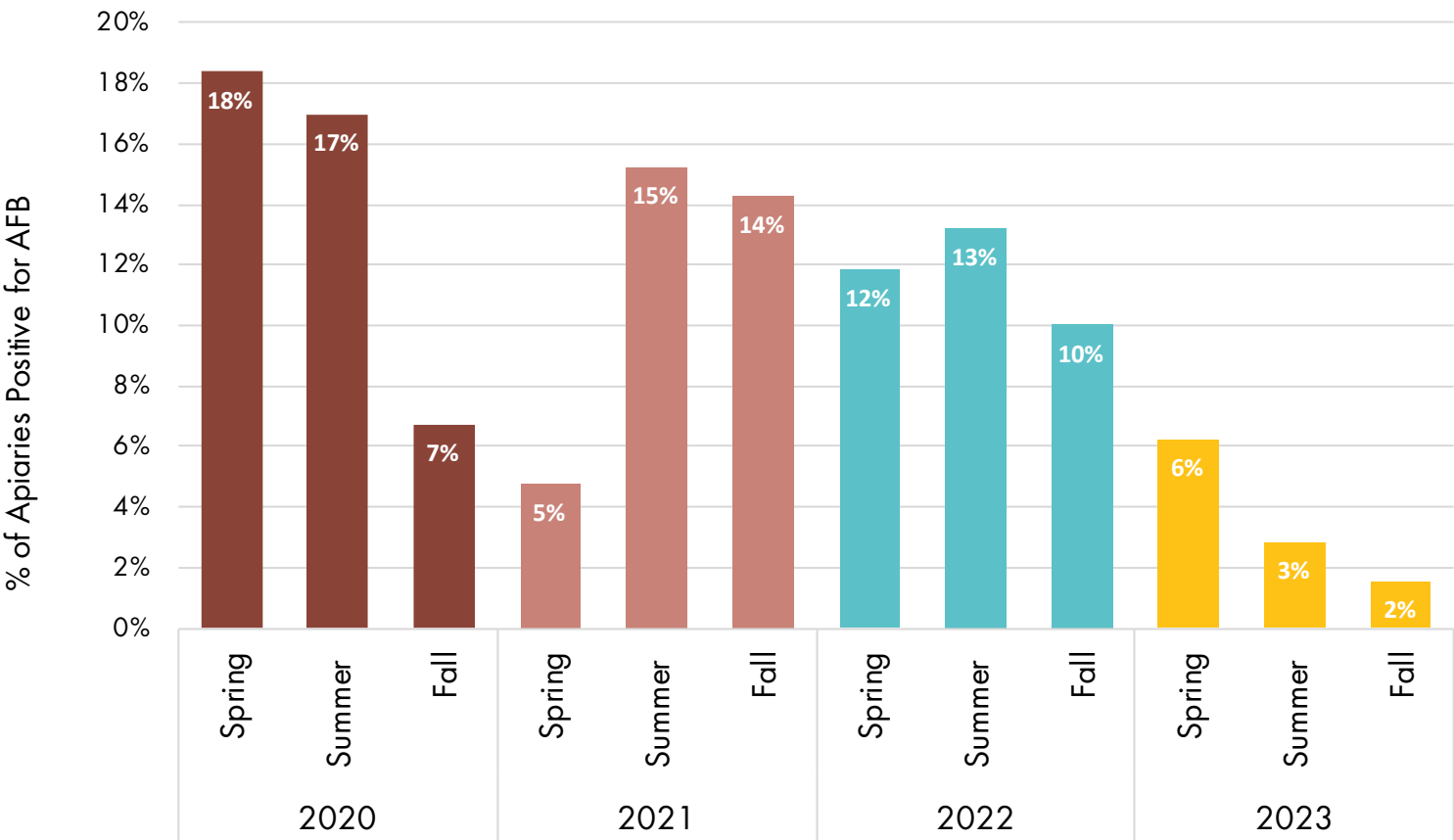
Percent Positive Chronic Bee Paralysis Virus Samples (2020-2023)



Chronic Bee Paralysis Virus (CBPV) is the rarest virus that is tested for in the CHM program, so it is shown here as the percentage of positive samples rather than the overall average as seen for the other 4 viruses.

This fall 17% of samples were positive for CBPV, which was a high point for the past four years.

Percentage of AFB Positive Apiaries (2020-2023)

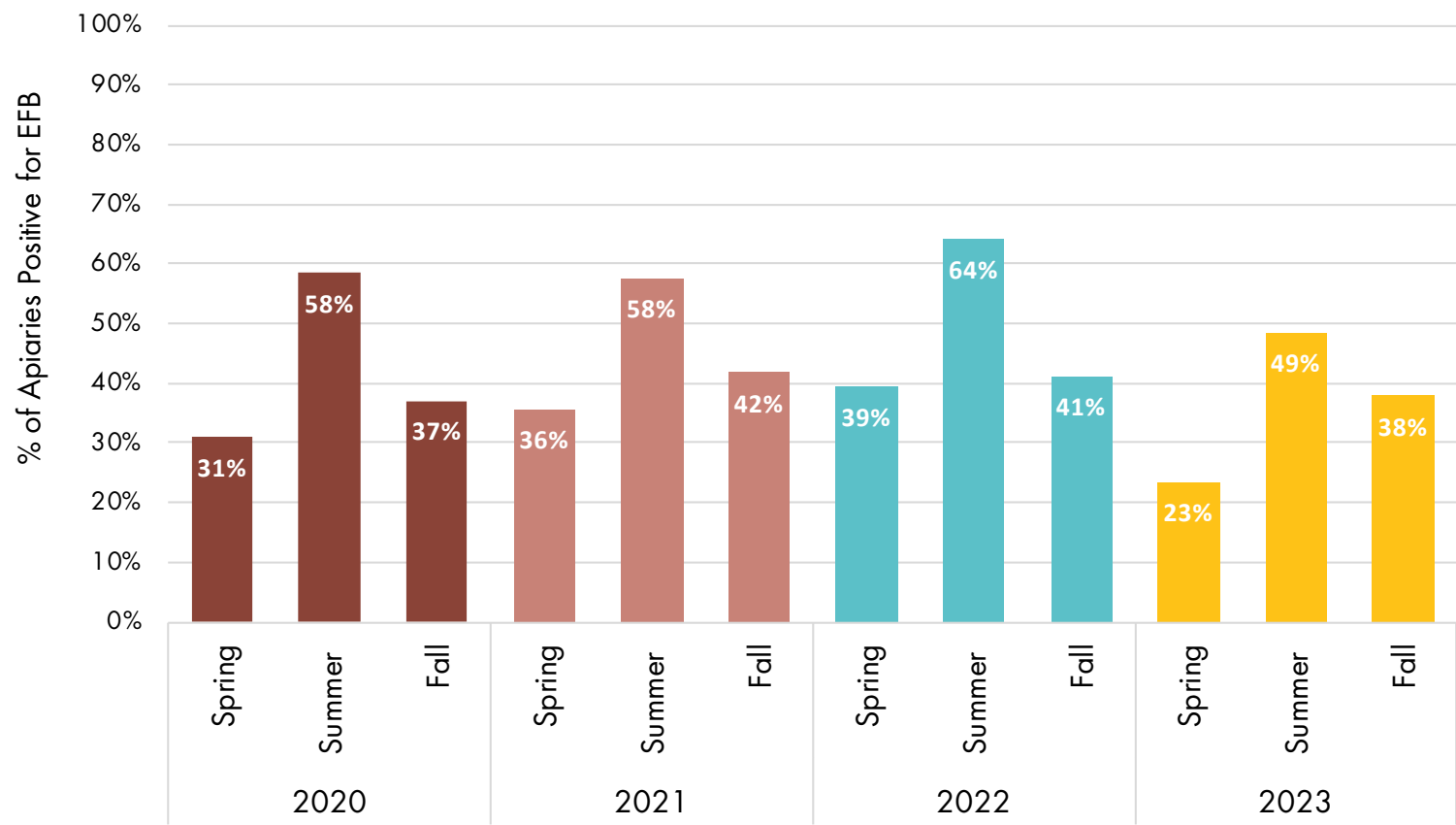


The number of apiaries found positive for AFB has steadily declined through 4 years of the CHM Program. In 2023 we saw the lowest levels of apiaries positive for AFB. Only 4 distinct apiaries tested positive throughout 2023.

2023 AFB Positives (CFU per bee)						
Apiary	Region	Spring	Summer	Fall	AFB Nominal Risk	Oxytetracycline Resistance
1	Peace	275,000	Not Sampled	1,875	High	Yes
2	South	5	3	Not Detected	Low	No
3	South	3	Not Detected	Not Detected	Low	No
4	South	3	Not Detected	Not Detected	Low	No



Percentage of EFB Positive Apiaries (2020-2023)

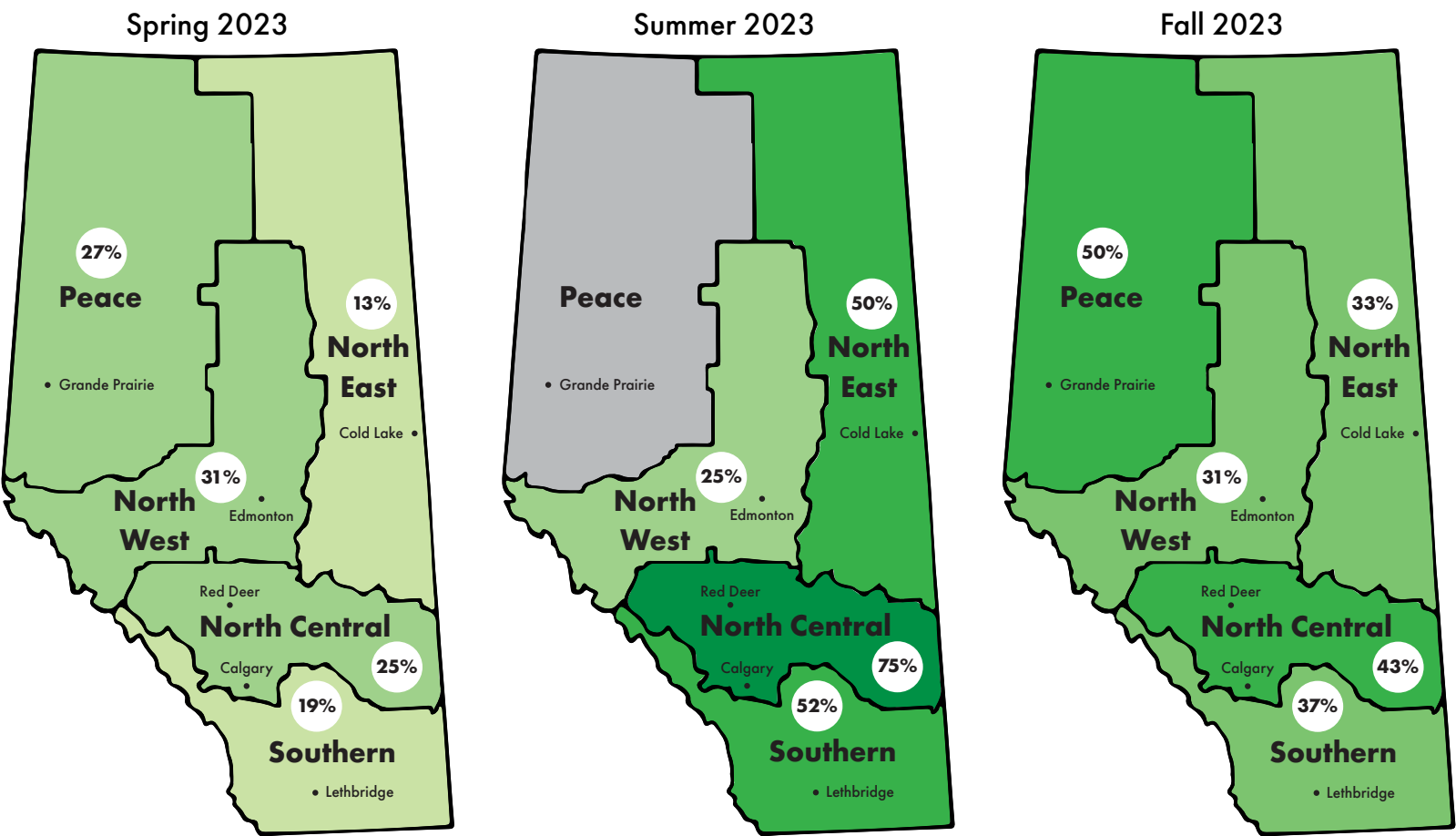


EFB detections have largely been stable with the same seasonal trends through 4 years of the CHM Program.

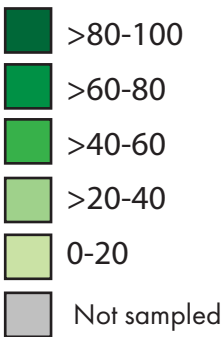
Detections have consistently been highest for the summer sampling period.

This data is from the EFB laboratory tests, but for visual symptoms, the TTP technicians find it easiest to spot EFB when there are large amounts of larvae in spring and summer.

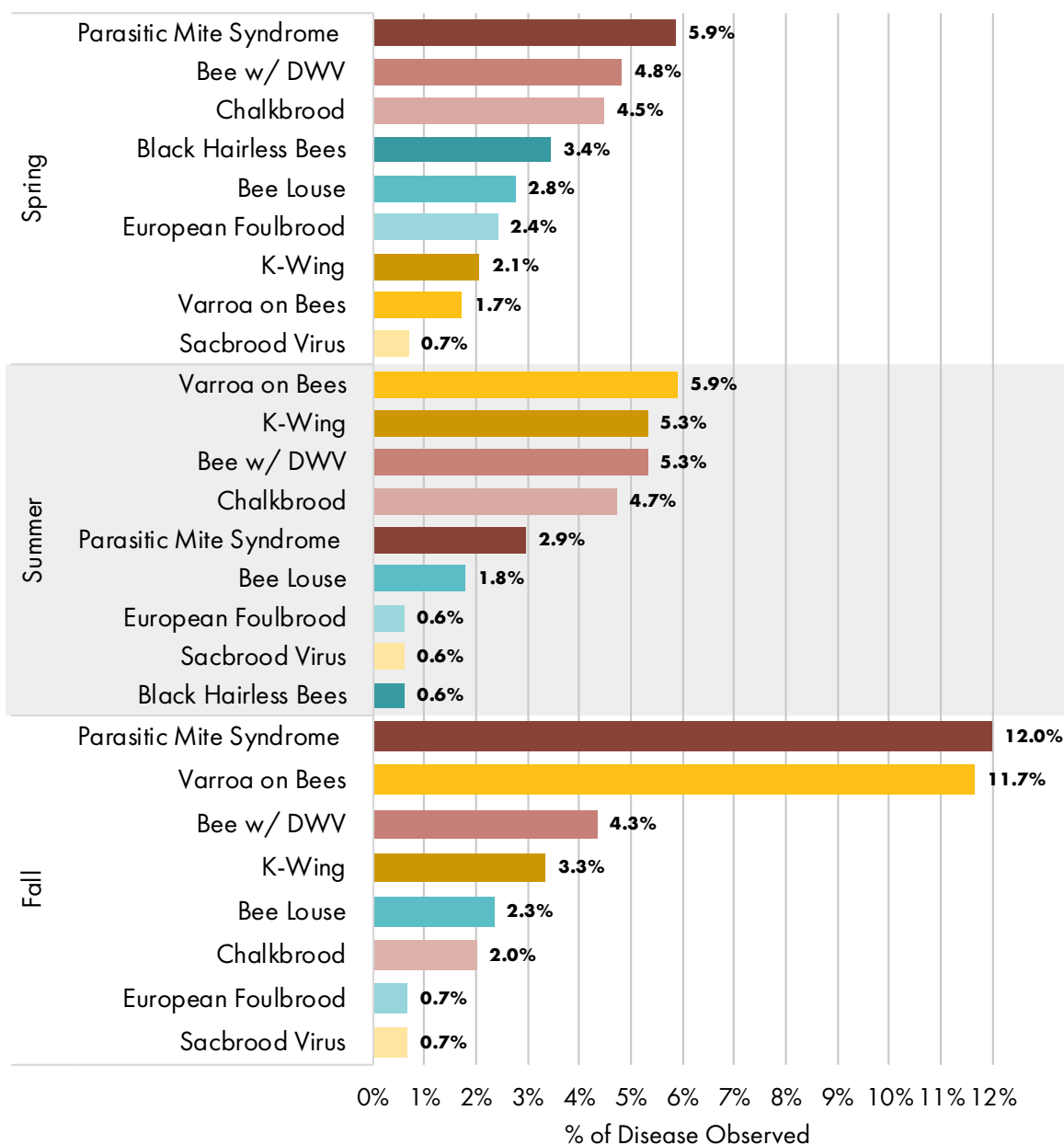
Regional European Foulbrood (EFB) Detections by Season



% of EFB Positive Apiaries



2023 Percent of Diseases Observed Each Season



The TTP sampling technicians record visual disease symptoms observed while going through CHM colonies. This chart shows the percent of colonies that each disease was observed in during the spring, summer, and fall by the Edmonton-based sampling team.

Symptoms associated with Varroa (Parasitic Mite Syndrome, DWV, K-Wing, Varroa on bees) generally trended higher through the season.

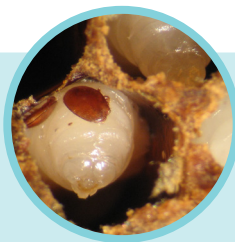
Key Findings



Nosema

Unusual trend of Nosema levels increasing going into the summer.

Levels above economic threshold of 1M in both the spring and the summer.



Varroa Mites

Trends remain the same as previous years. Levels above the economic threshold of 3% in the fall.

Mite bombs were observed more frequently in 2023 compared to 2022.



Viruses

DWV, BQCV, VDV levels showing signs of leveling off after previous exponential growth.

Highest detections of CBPV seen in fall 2023.



AFB

The number of AFB positive apiaries has steadily declined over 4 years.

4/165 apiaries tested positive for AFB in 2023. Only one of the four samples was classified as high risk and resistant to oxytetracycline.



EFB

Stable EFB trends with detections consistently being highest in the summer.



Observations

Parasitic Mite Syndrome, DWV, and Varroa on bees were generally the most observed diseases with large increases in the fall in conjunction with rising Varroa levels.

Colony Health Monitoring (CHM) is one of the main TTP programs. The CHM program is a disease diagnostic service with the goal to provide the beekeeper with colony inspection data and a disease evaluation of their apiary. Beekeepers can then use the data we provide to evaluate their IPM plan and decide if it needs to be adjusted. Our job is not to interfere or police beekeeper's management strategies, but to provide guidance.

Historical data can show us seasonal and annual pathogen trends, and by combining years of data into a large dataset, we can then study the relationship among pathogens and how the increase in one pathogen population can affect another pathogen population. This report contains the data we have collected in the past 4 years from participating CHM colonies.



We would like to thank all the beekeepers who participated in the 2023 Colony Health Monitoring Program.

This year the TTP provided disease diagnostics to 21 beekeeping operations, carried out 165 apiary inspections, and collected over 1650 samples. The success of the program would not have been possible without Alberta beekeepers!



2023 CHM TEAM

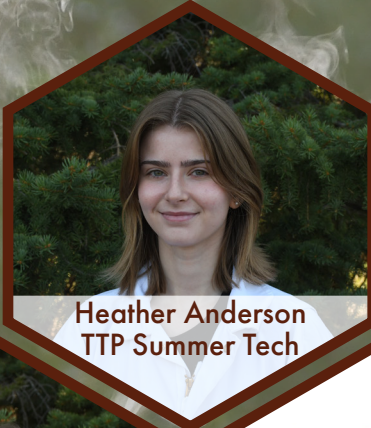
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Lynae Ovinge
TTP Lead



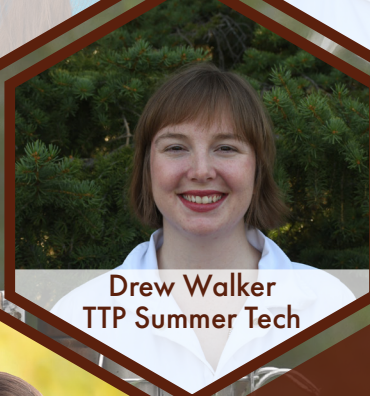
Nicole McCormick
TTP Technician



Heather Anderson
TTP Summer Tech



Kayla deJong
TTP Summer Tech



Drew Walker
TTP Summer Tech



National Bee
Diagnostic Centre
Technology Access Centre



Renata Labuschagne
TTP Lead
(Maternity leave)



Emily Olson
TTP Technician
(Maternity leave)



The success of this
program would not
have been possible
without the hard work
of each CHM team
member



Jeff Kearns
CHM Support



Shelley Hoover
CHM Support



Leslie Holmes
CHM Support



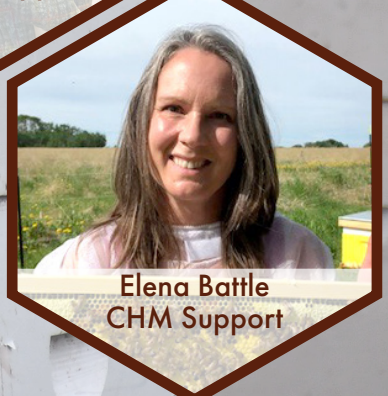
Jemma Todoschuk
CHM Support



Donaya Baker
CHM Support



Matthew McKay
CHM Support



Elena Battle
CHM Support

2023 Regional Nosema Average and Sample Sizes

Season	Region	Average (spores/bee)	# of Apiaries
Spring	North Central	483,398	8
	North East	776,367	8
	North West	1,166,992	16
	Peace	1,686,790	11
	Southern	2,243,304	21
Summer	North Central	2,695,313	4
	North East	1,054,688	2
	North West	2,275,391	8
	Southern	1,179,315	21
	North Central	343,192	14
Fall	North East	1,067,708	9
	North West	1,113,281	16
	Peace	253,906	8
	Southern	892,270	19

2023 Regional Varroa Averages and Sample Sizes

Season	Region	Average varroa (mites/100 bees)	# of Colonies
Spring	North Central	0.03	80
	North East	0.20	80
	North West	0.32	160
	Peace	0.76	110
	Southern	0.15	210
Summer	North Central	0.33	40
	North East	1.16	20
	North West	1.19	80
	Southern	0.16	210
	North Central	4.92	140
Fall	North East	1.49	90
	North West	2.74	160
	Peace	4.20	80
	Southern	1.14	190

Seasonal Averages for Four Viruses (2020 - 2023)
(genome copies/bee)

Year	Season	BQCV	DWV	SBV	VDV
2020	Spring	251,967	1,049,914	104,676	7,951,786
	Summer	1,199,639	358,079	2,727,566	8,543,804
	Fall	874,048	23,752,906	11,686,059	317,045,706
2021	Spring	6,745,306	196,892,768	13,272,974	149,375,344
	Summer	6,954,475	142,195,819	21,071,068	629,396,567
	Fall	12,715,800	622,719,835	23,534,014	4,714,233,594
2022	Spring	34,880,941,179	1,366,556,824	27,025,849	3,605,052,794
	Summer	84,968,390,538	2,567,399,100	101,369,299	4,223,927,280
	Fall	34,707,255,687	3,728,261,235	40,633,069	32,176,683,782
2023	Spring	776,061,956	217,720,025	13,679,017	1,406,208,409
	Summer	1,921,587,695	419,542,060	28,325,635	4,654,136,295
	Fall	4,474,962,346	1,119,415,070	12,094,947	8,627,001,820

Seasonal CBPV Detections (2020 - 2023)

Year	Season	Count Positive	Count Negative	# of Apiaries
2020	Spring	0	81	81
	Summer	2	51	53
	Fall	10	70	80
2021	Spring	6	66	72
	Summer	3	56	59
	Fall	9	63	72
2022	Spring	4	69	73
	Summer	6	47	53
	Fall	8	69	77
2023	Spring	3	53	56
	Summer	2	33	35
	Fall	10	48	58

2023 Regional EFB Detections and Sample Sizes

Season	Region	Count Positive	Count Negative	# of Apiaries
Spring	North Central	2	6	8
	North East	1	7	8
	North West	5	11	16
	Peace	3	8	11
	South	4	17	21
Summer	North Central	3	1	4
	North East	1	1	2
	North West	2	6	8
	South	11	10	21
Fall	North Central	6	8	14
	North East	3	6	9
	North West	5	10	16
	Peace	4	4	8
	South	7	12	19

2023 Regional AFB Detections and Sample Size

Season	Region	Count Positive	Count Negative	# of Apiaries
Spring	North Central	0	8	8
	North East	0	8	8
	North West	0	16	16
	Peace	1	10	11
	South	3	18	21
Summer	North Central	0	4	4
	North East	0	2	2
	North West	0	8	8
	South	1	20	21
Fall	North Central	0	14	14
	North East	0	9	9
	North West	0	16	16
	Peace	1	7	8
	South	0	19	19