

2021



Report

**POLLINATOR
PARTNERSHIP**

Prepared by Pollinator Partnership
May 13, 2022

2021 Mite-A-Thon Analysis

Introduction

Following the fifth annual Mite-A-Thon, this document is a report on both the May and August session results of the Mite-A-Thon 2021, with some brief comparison to previous years. This report attempts to answer the questions:

- 1) What does the data show us concerning mite levels and participation across North America?
- 2) Did we continue to see increased participation as a result of conducting a second session?
- 3) Is this a useful project for beekeepers and leadership team partners?
- 4) Is there anything more that should be added to this project in future years?

The project was led by the Pollinator Partnership and the North American Pollinator Protection Campaign (NAPPC), and funded by following sponsors and leadership team as of April 2022.

- Almond Board of California
- American Beekeeping Federation
- American Honey Producers Association
- Bee Friendly Farming
- Bee Informed Partnership
- Canadian Honey Council
- Dadant
- Honey Bee Health Coalition
- Manitoba Ministry of Agriculture and Resource Development
- Michigan State University
- NAPPC
- Newfoundland and Labrador Beekeeping Association
- Pollinator Partnership
- Project Apis m.
- Saskatchewan Ministry of Agriculture
- University of Maryland
- University of Minnesota Bee Lab and Bee Squad
- USDA



Background

The varroa mite, *Varroa destructor*, is a leading cause of colony mortality in North American honey bee colonies. Honey bees face multiple stressors (pests, pathogens, pesticides, poor nutrition, and weather extremes). The combined effects might be more damaging than the individual effects of each stressor. Among all those stressors, varroa is arguably the single most important driver of colony mortality. It is both extremely damaging to the bees and widely spread, detected in over 90% of the colonies sampled by the APHIS National Honey Bee Disease Survey in the US. Varroa is an ectoparasite of the honey bee that was inadvertently introduced into North America 30 years ago from Asia. In addition to the direct damage inflicted from the parasite, mites serve as a vector for a series of viruses. They also cause bees to have a higher risk of infection by compromising their immune systems. There are significant data showing that low rates of varroa mite infestation make overwintering success more probable. The management of varroa mites implies both the monitoring of load levels in colonies and the use of control techniques (both prophylactic and therapeutic). However, even the first step, monitoring of varroa mite prevalence and load, can be rare in the beekeeping community, resulting in a large portion of beekeepers unaware of the level of infestation present in their colonies.

Approach

Pollinator Partnership and NAPPC organized the Mite-A-Thon, a citizen science initiative, to promote the practice of monitoring varroa levels and to gather data on varroa mite infestations across North America for all types of beekeepers. The two weeks in early May and two weeks in late August were chosen because they represent critical periods for monitoring varroa mites in North America, early in the season and just before the start of the overwintering period. Initial iterations only focused on the period before overwintering, then beginning in 2020, the approach emphasized learning monitoring techniques early and monitoring throughout the summer. The first Mite-A-Thon took place in 2017 (September 9 to 16), and was repeated in 2018 (September 8 to 22) with the addition of a second week so that beekeepers affected by hurricanes along the Atlantic coast could participate. Previously, in 2019 (September 7-21), a second week had been added so that beekeepers attending Apimondia could participate. In 2020 the format continued with the first week taking place in the spring (May 1 to 16) and a second in the fall (August 14 to 29). In addition to the intensive outreach during the Mite-A-Thon, an online tool allowing the entry of varroa monitoring results (www.mitecheck.com) is available year-round. The website also allows the public to view a dynamic, county level map displaying the highest mite counts reported.

In both periods of 2021 (spring and fall), participants were encouraged to test the level of mites in their colonies via standardized protocol utilizing two common methods of assessment (alcohol wash or powdered sugar roll) and then to upload their data (www.mitecheck.com). Uploads included data on location, total number of colonies, number of colonies tested, management methods that have been used and that are being considered, and number of varroa mites counted from each colony.

Commercial, sideliners, and hobbyist beekeepers were all encouraged to participate in order to create a rich distribution of sampling sites in Canada, Mexico, and the United States. To this end, all partner organizations participated in outreach across North America.

In addition to general outreach, 2021 was the third year of the Mite-A-Thon Giveaway. An additional survey was open during each two-week period for officers of beekeeping organizations to submit additional data on their club's participation and educational efforts surrounding the event. One of these entries were chosen to win \$100 Dadant gift certificates to thank them for their participation and to encourage others to strive for greater participation in the future.

Objectives

The primary objectives for this annual project are 1) to teach effective varroa mite monitoring methods and encourage testing and 2) to make management strategies available for discussion within bee organizations utilizing Mite-A-Thon partner-developed information and outreach materials.

Survey Results

1. Number of mites - **May**.

The result of the combined partner outreach initiatives was participation from beekeepers across the continent who sent 84 submissions which tested 209 colonies for mites. Of the 209 results submitted in May, 63.16% detected varroa, and 11.96% were found above the 3 mites per 100 bees (sample) action threshold.

Table 1. Number of May samples having each number of varroa mites.

Number of Mites	Number of Samples
0	77
1	72
2	24
3	12
4	7
5	5
6	4
7	3
8	2
9	0
10	1
11+	2
Total Colonies	209

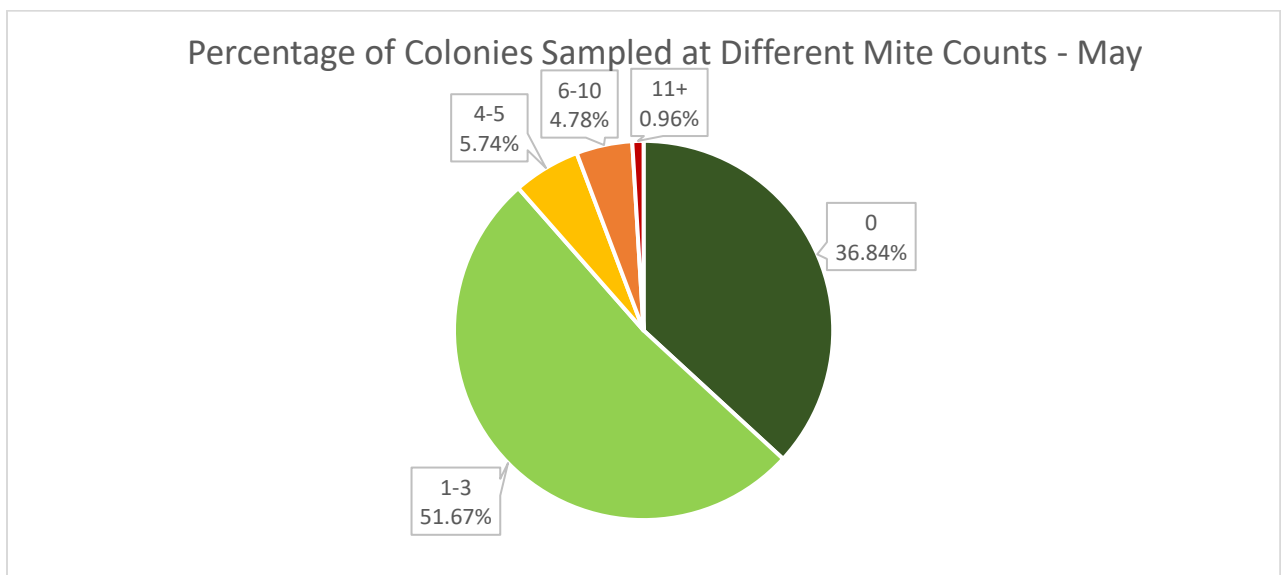


Figure 1. Percentage of May samples recorded at each of 5 levels of varroa mite infestation

1. Number of mites – **August.**

In August 2021, 252 submissions were sent from across the continent which tested 809 colonies for mites. Of these results, 71.32% detected varroa, and 25.83% were found above the sample action threshold.

Table 2. Number of August samples having each number of varroa mites.

Number of Mites	Number of Samples
0	232
1	205
2	90
3	81
4	46
5	43
6	31
7	18
8	13
9	6
10	7
11+	37
Total Colonies	809

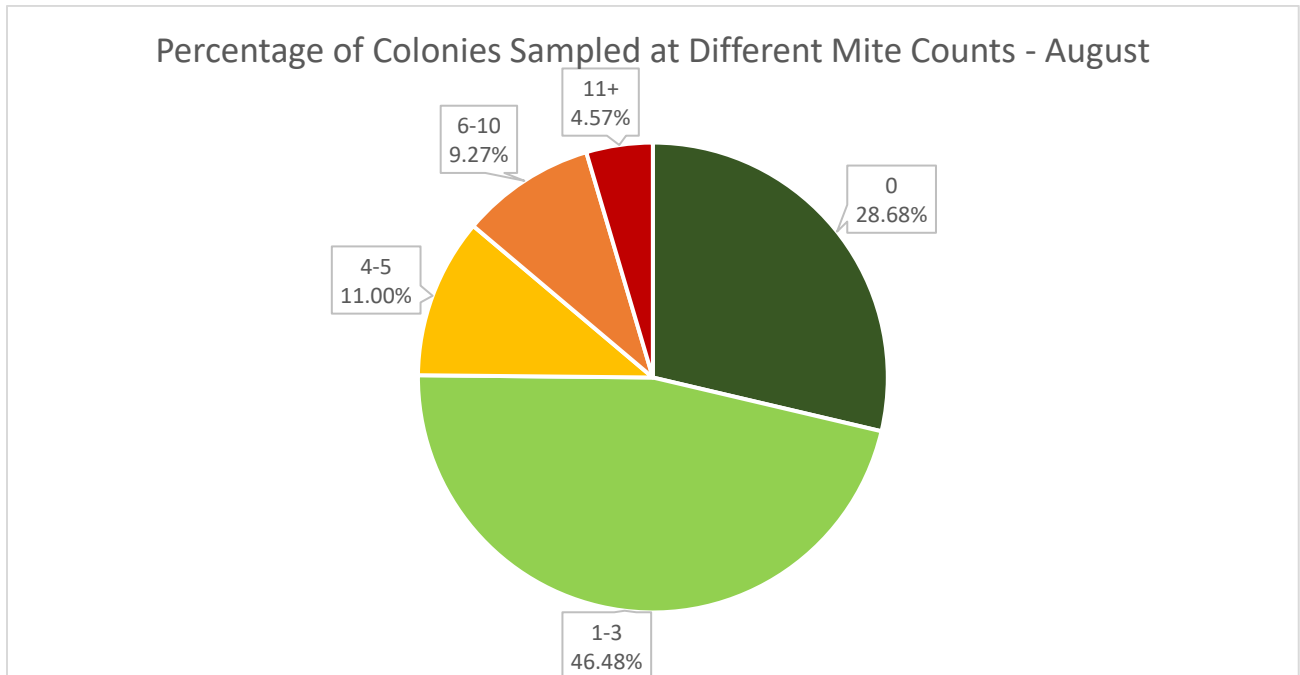


Figure 2. Percentage of August samples recorded at each of 5 levels of varroa mite infestation.

2. Number of submissions at each level of mite infestation – **May**.

69.05% of May submissions had at least one positive sample, and 9.52% had an average varroa count above the 3 mites per sample action threshold.

Table 3. Number of May submissions at each varroa mite count level.

Average Number of Mites	Number of Submissions
0	26
1	36
2	10
3	6
4	1
5	0
6	1
7	1
8	1
9	0
10	0
11+	2
Total Submissions	84

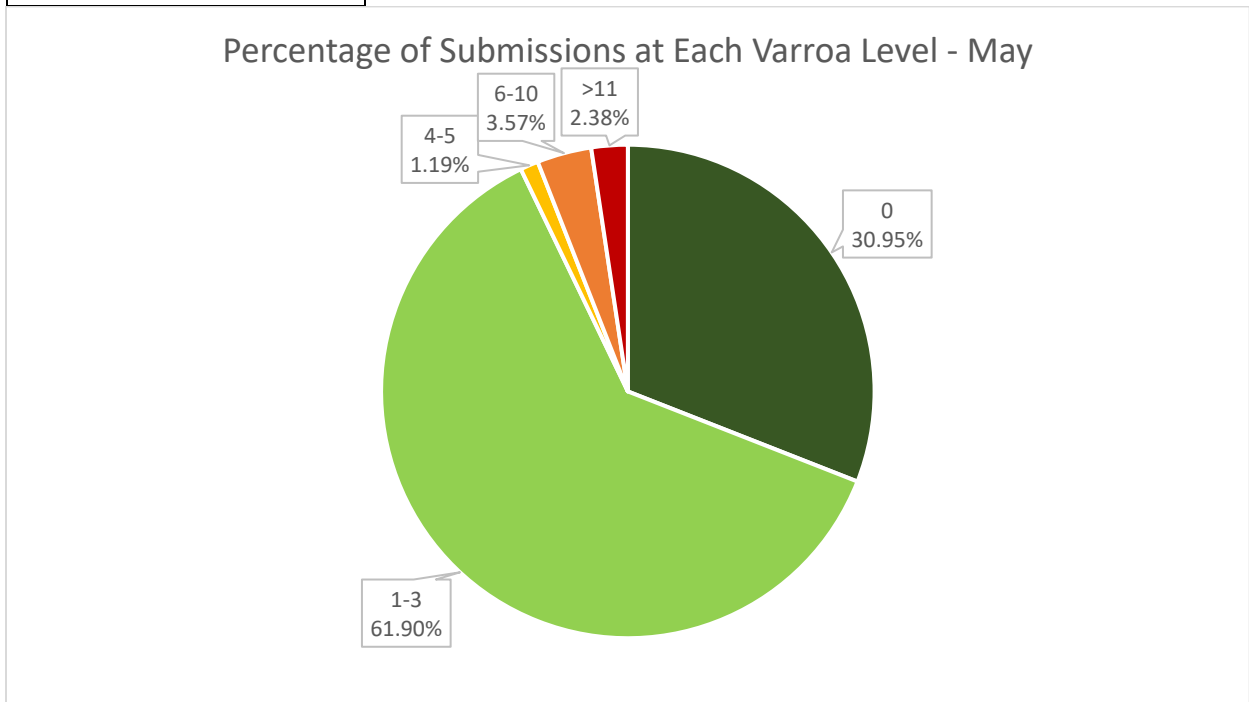


Figure 3. Percentage of May Mite-A-Thon submissions with average varroa levels at each of 5 infestation levels.

2. Number of submissions at each level of mite infestation – **August**.

87.35% of August submissions had at least one positive sample, and 30.83% had an average varroa count above the 3 mites per sample action threshold.

Table 4. Number of August submissions at each varroa mite count level.

Average Number of Mites	Number of Submissions
0	32
1	103
2	29
3	16
4	23
5	15
6	8
7	4
8	5
9	3
10	1
11+	13
Total Submissions	252

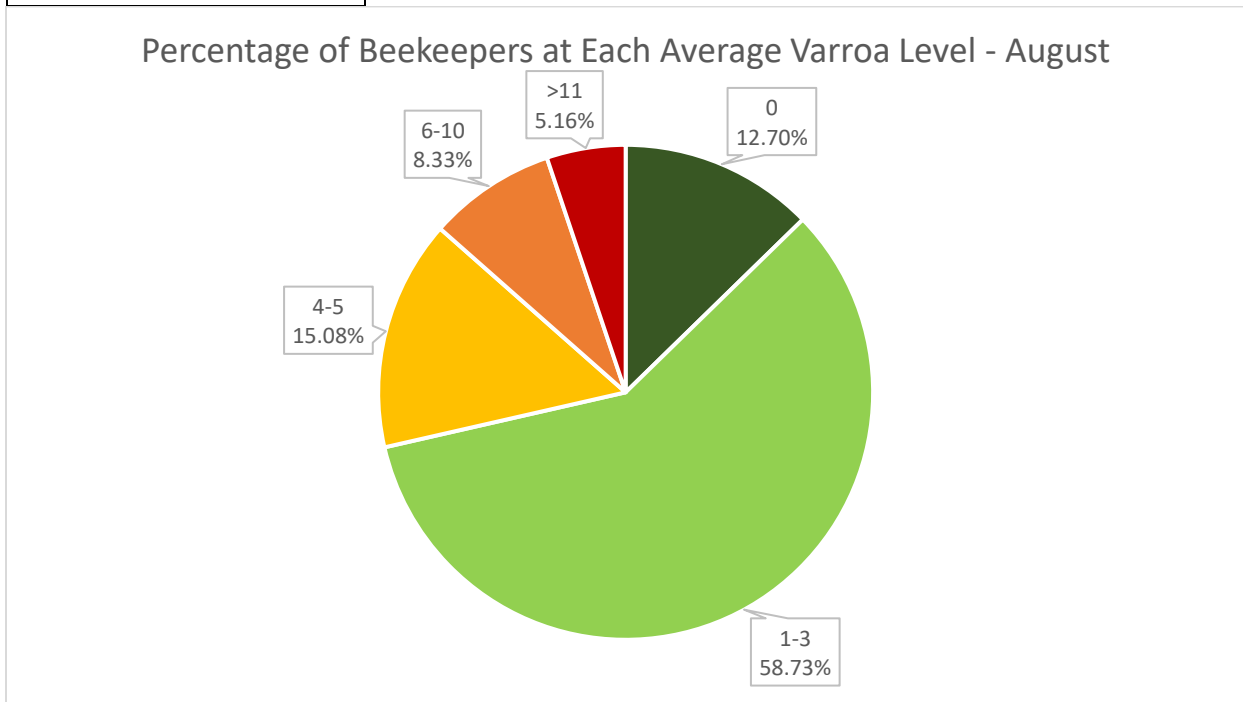


Figure 4. Percentage of August Mite-A-Thon submissions with average varroa levels at each of 5 infestation levels.

3. Individual comparisons – **May and August.**

An estimated eight beekeepers participated in both the May and August events (**approximately 2.4%**). Of these beekeepers, average mite counts found in May **1.27** mites per sample. August saw average mite counts of **2.64** mites per sample among the same beekeepers.

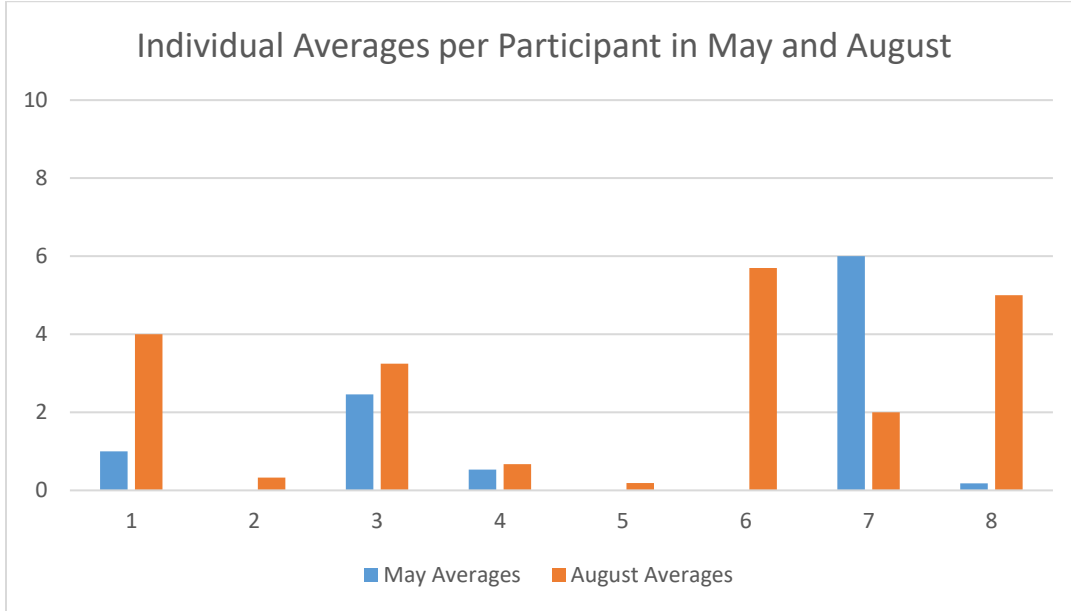


Figure 5. Individual mite averages per participant in both May and August.

4. Hive movement – May.

The survey asked the following question: “Have you moved the majority of these colonies in the last 2 months?” In May, 48 submissions answered the question on hive movement, with 4.76% having moved their hives in the last 2 months. Of this 4.76%, average varroa counts were 1.59 mites per sample. The average count of those who did not move their hives was between 1 and 2 mites per sample (1.26), which is below the action threshold. Approximately 42.86% of submissions chose not to answer this question.

Table 5. Number of “yes,” “no,” “don’t know” and no answer responses to the question, “Have you moved the majority of these colonies in the last 2 months?” and average mite counts for each May submission.

Hives Moved in the Last 2 Months	Number of Responses	Average Mite Counts
Yes	4	1.59
No	44	1.26
Don’t Know	0	0
No Answer	36	1.73

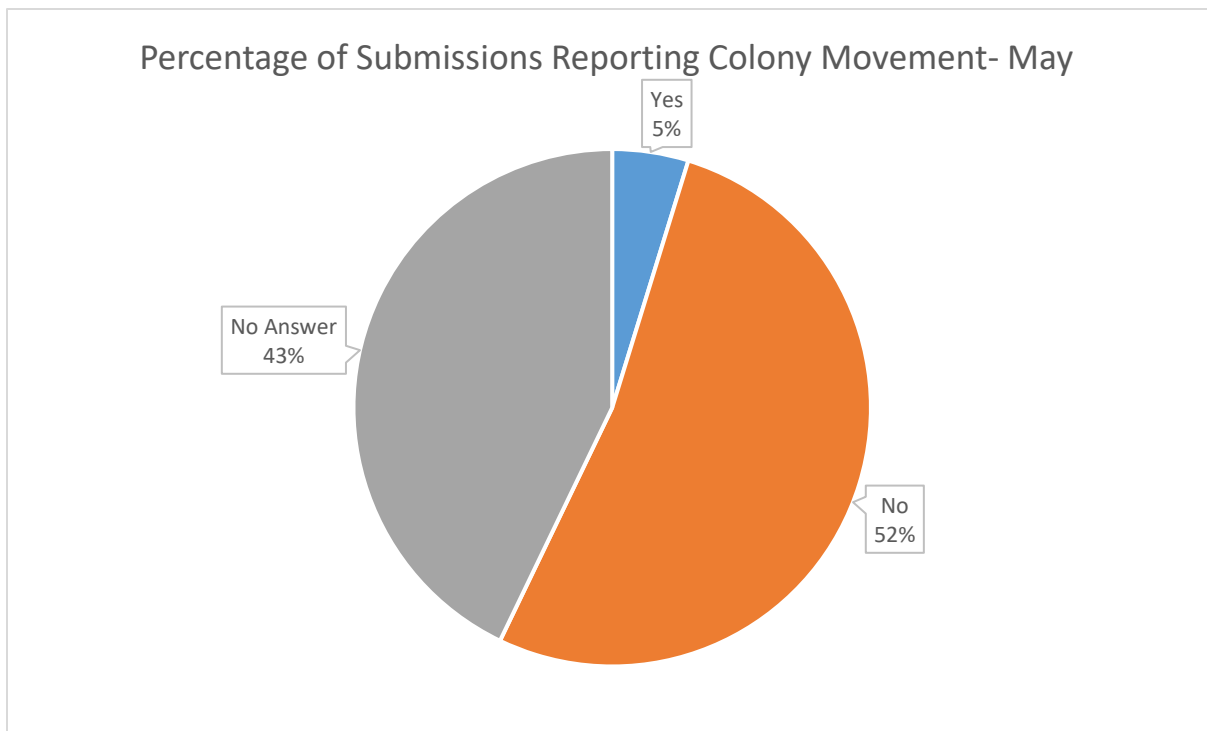


Figure 5. Percentage of May responses recorded for “yes,” “no,” “don’t know” and no answer to the question, “Have you moved the majority of these colonies in the last 2 months?”

4. Hive movement – August.

The survey asked the following question: “Have you moved the majority of these colonies in the last 2 months?” In August, 144 submissions answered the question on hive movement, with 1.19% having moved their hives in the last 2 months. Of this 1.19%, the average varroa count was 2.5 mites per sample. The average count of those who did not move their hives was between 2 and 3 mites per sample (2.77), just below the action threshold. Approximately 42.86% of submissions chose not to answer this question.

Table 6. Number of “yes,” “no,” “don’t know” and no answer responses to the question, “Have you moved the majority of these colonies in the last 2 months?” and average mite counts for each August submission.

Hives Moved in the Last 2 Months	Number of Responses	Average Mite Counts
Yes	3	2.5
No	140	2.77
Don’t know	1	0
No Answer	108	3.45

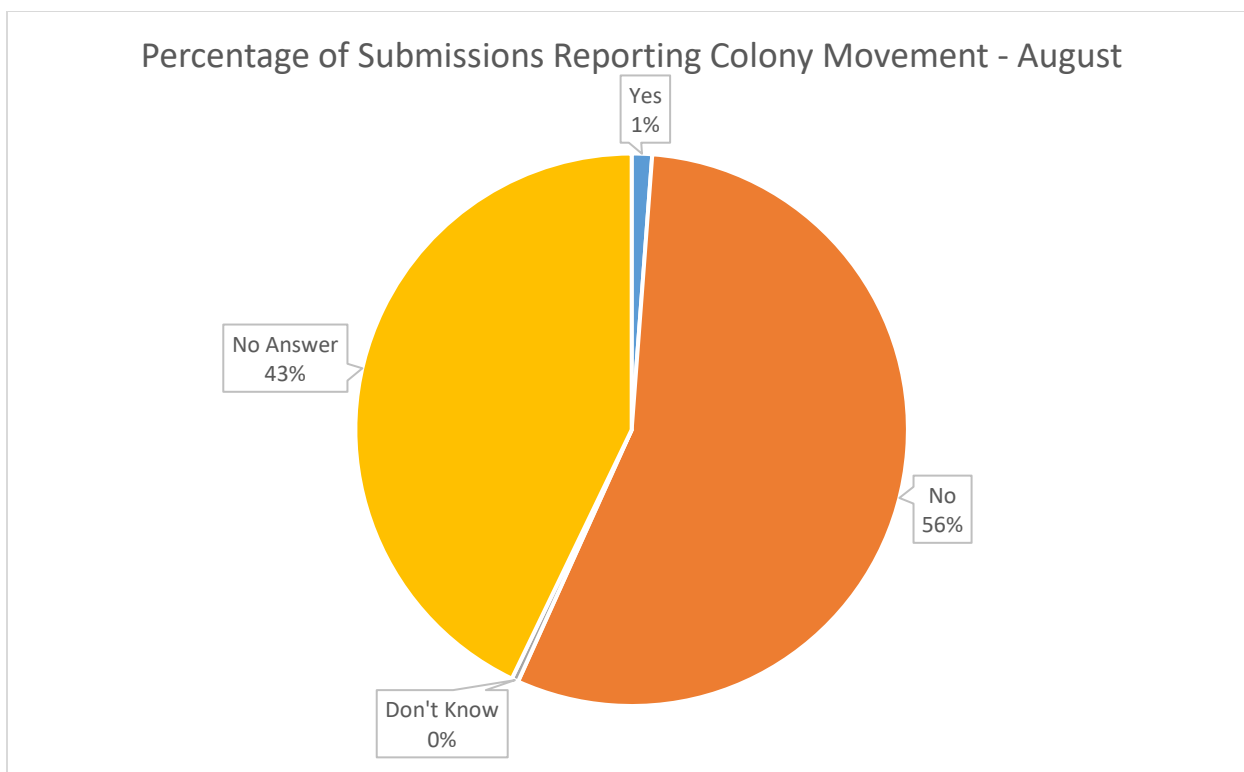


Figure 6. Percentage of August responses recorded for “yes,” “no,” “don’t know” and no answer to the question, “Have you moved the majority of these colonies in the last 2 months?”

5. Management methods used and intended to use – **May**.

In May, 81 submissions provided answers to the management questions associated with the sampling event. The most popular management method used in the past 2 months was **No Treatment**, followed by **Formic Acid** and **Oxalic Acid**.

With respect to future management practices, 31.32% of submissions that answered said they would use **No Treatment** in the weeks following their monitoring. The next highest method considered for future use was **Oxalic Acid**, reported by 21.69% of those who answered. Interestingly, 3 reports declined to answer the management methods-used question; however, only 1 declined when asked which methods they were considering.

Table 7. Number of submissions that used each varroa management method over the past 2 months and number of submissions that are considering each management method for the next 2 months.

Management Methods	Number Used in the Past 2 Months	Number Considering for the Next 2 Months
No Treatment	40	26
Oxalic Acid	12	18
Formic Acid (e.g. Mite Away Quick Strips, Formic Pro)	13	17
Break Brood Cycle	10	12
Drone Comb Removal	10	14
Powdered Sugar	3	3
Amitraz (e.g. Apivar)	9	8
Thymol (e.g. ApiLifeVAR, Apiguard)	4	10
Fluvalinate (e.g. Apistan)	0	0
Hop Oil (e.g. Hop Guard)	1	5
Coumaphos (e.g. CheckMite+)	1	0
Other	0	0
No Answer	3	1

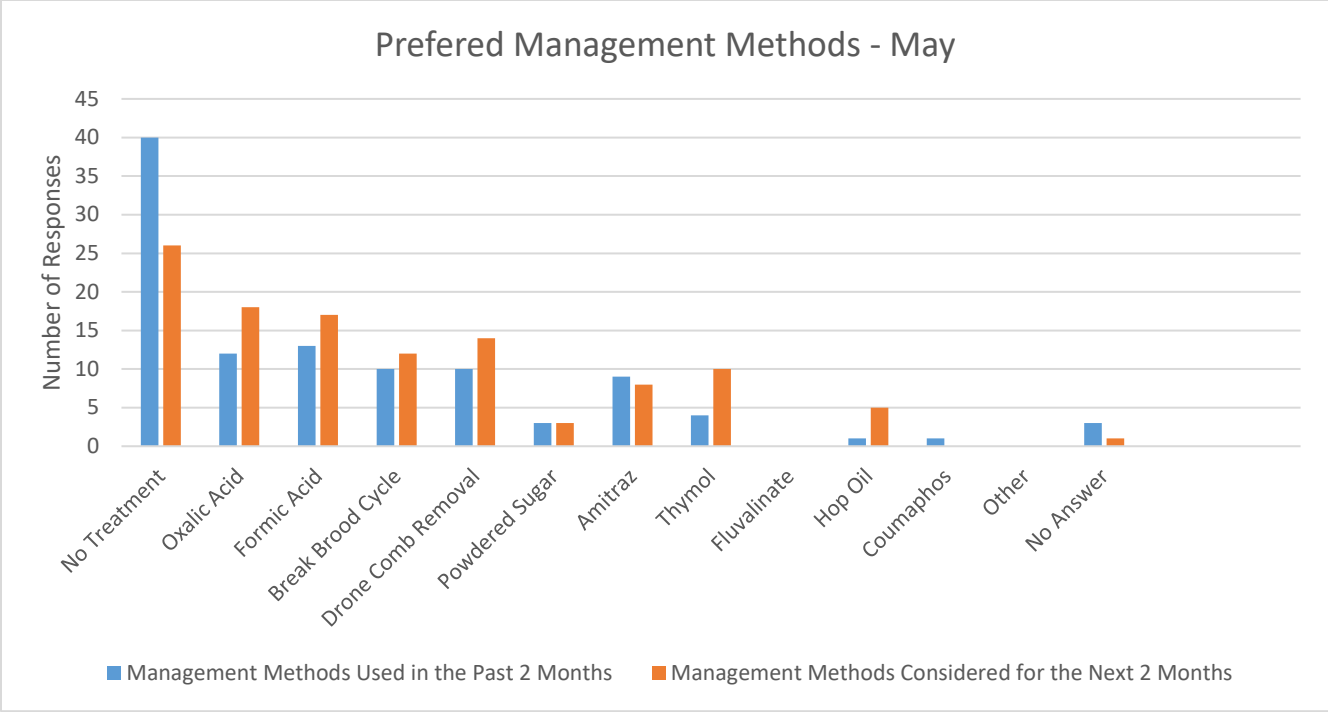


Figure 7. Number of submissions that used each varroa management method over the past 2 months and number of submissions considering each management method for the next 2 months.

5. Management methods used and intended to use – **August.**

In August, 235 submissions provided answers to the management questions associated with the sampling event. The most popular management method reported was **No Treatment**, followed by **Formic Acid** and **Oxalic Acid**.

With respect to future management practices, 39.75% of reports that answered said they would use **Oxalic Acid** in the weeks following their monitoring. The next highest method considered for future use was **Formic Acid** reported by 38.52% of reports that answered.

Table 8. Number of submissions that used each varroa management method over the past 2 months and number of submissions that are considering each management method for the next 2 months.

Management Methods	Number Used in the Past 2 Months	Number Considering for the Next 2 Months
No Treatment	111	30
Oxalic Acid	28	97
Formic Acid (e.g. Mite Away Quick Strips, Formic Pro)	53	94
Break Brood Cycle	0	5
Drone Comb Removal	26	14
Powdered Sugar	0	2
Amitraz (e.g. Apivar)	23	41
Thymol (e.g. ApiLifeVAR, Apiguard)	18	41
Fluvalinate (e.g. Apistan)	0	1
Hop Oil (e.g. Hop Guard)	2	11
Coumaphos (e.g. CheckMite+)	0	0
Other	7	9
No Answer	17	8

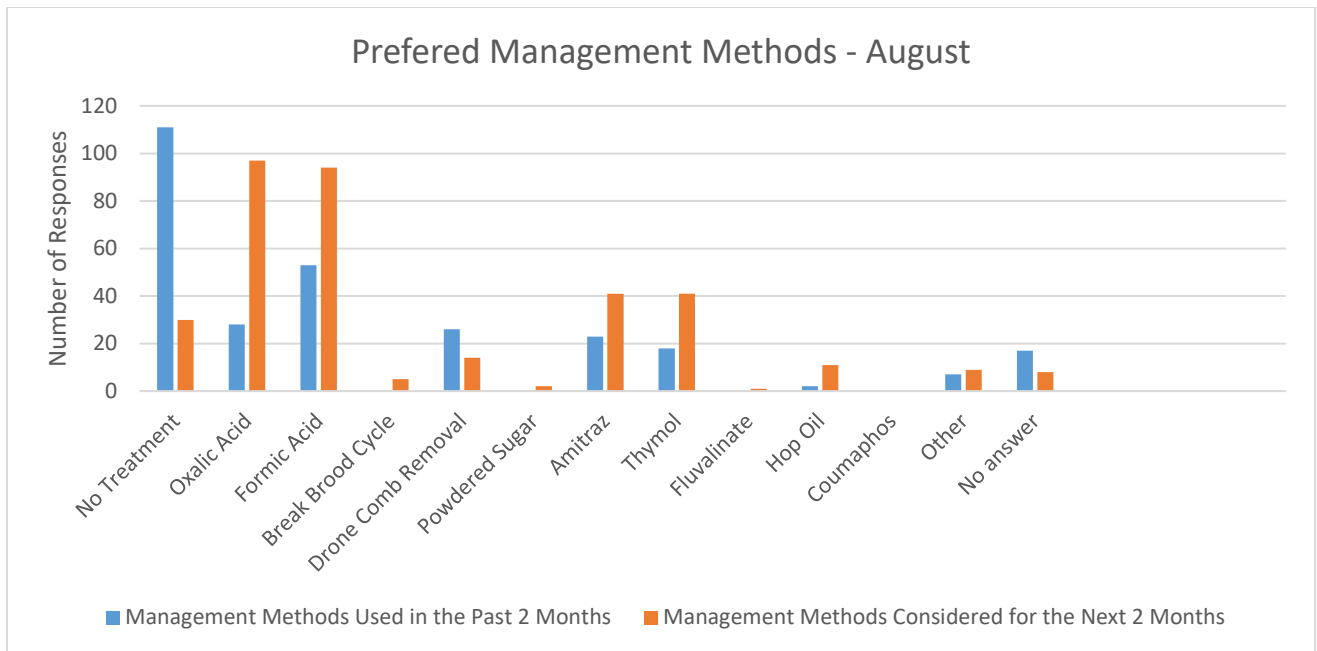


Figure 8. Number of submissions that used each varroa management method over the past 2 months and number of submissions considering each management method for the next 2 months.

6. Density of varroa within sample areas.

A density map was created, showing the average varroa mite load per square kilometer in North America during the event's timeframe. This shows a snapshot of the reporting regions, and while it illustrates the variability in mite pressure observed throughout the continent, it also must be recognized that higher mite densities may simply be reflecting the amount of responses received from those geographic areas. Likewise, areas with lower density could be the result of low response rates from those areas. The interpretation of these maps should be considered in the context of the program's stated objectives – to increase knowledge and use of testing protocols and to secure data from individual beekeepers about their colonies.

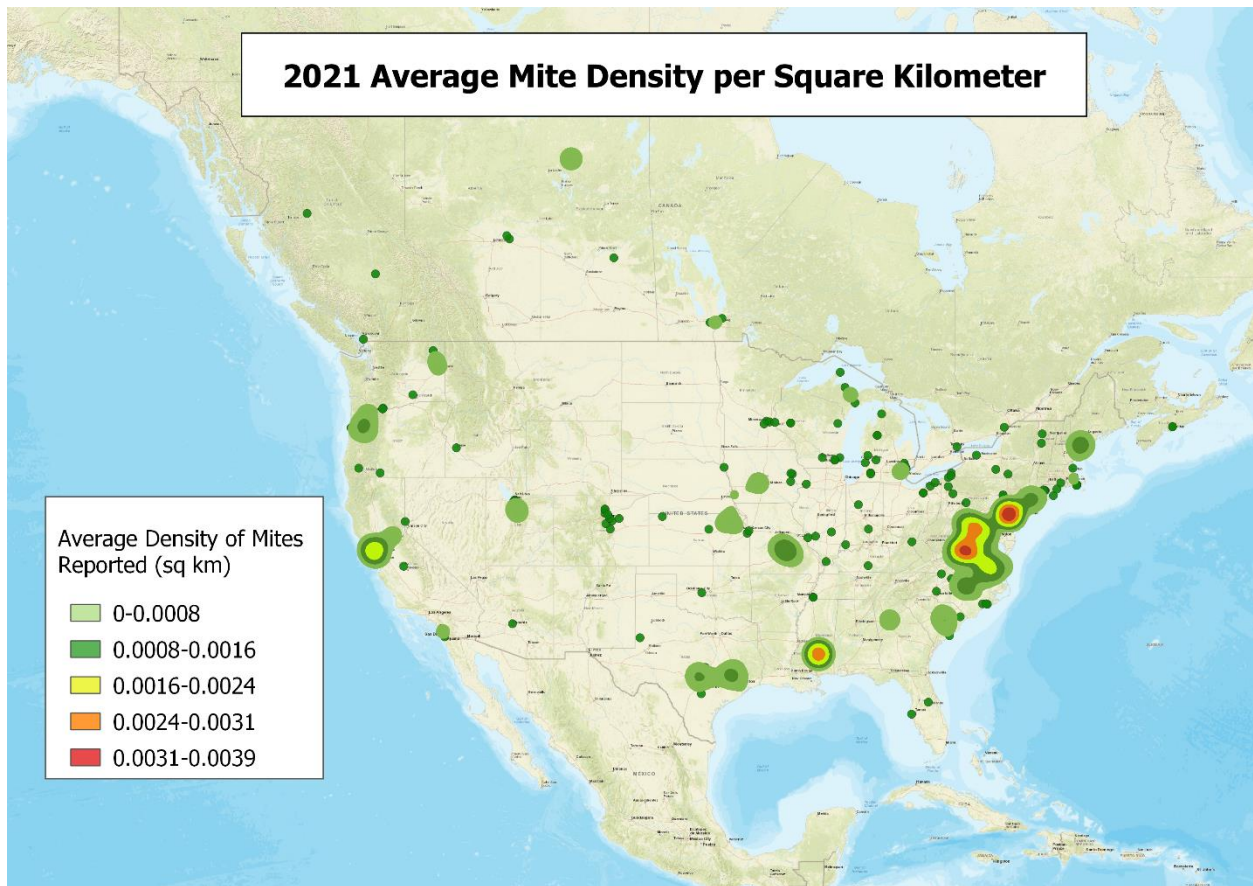


Figure 9. Average density of mites reported per square kilometer in North America.

7. Location of participants.

This year, as in previous years, the majority of samples came from the United States. Virginia had the most participation, followed by Pennsylvania and California (Table 9). This is only a slight difference from 2020, for which the top regions for participation were Pennsylvania, Michigan, and California (Table 10). Additionally, 8 beekeepers participated in both the May and August events.

Table 9. Top 10 participating states and provinces for 2021 with number of participants.

State or Province	2021 Samples
VA	48
PA	43
CA	24
NC	20
MI	19
ME	15
CO	12
CT	12
TX	10
NY	9
OR	9

Table 10. Top 10 participating states and provinces for 2020 with number of participants.

State or Province	2020 Samples
PA	90
MI	53
CA	41
NC	38
VA	27
MB	23
NY	21
IL	19
TX	17
MN	16

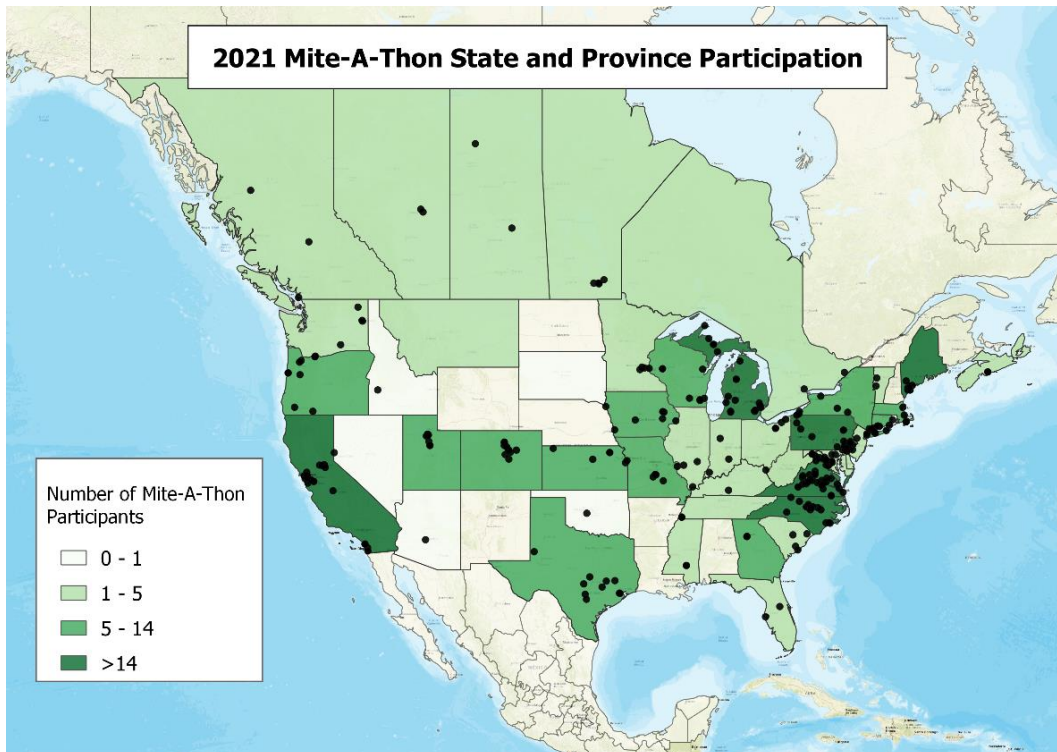


Figure 10. Distribution of Mite-A-Thon Participants across North America aggregated by state or province.

8. Number of hives managed by participants.

Of May submissions, 92.86% had 10 hives or fewer. 89.29% of August submissions had 10 hives or fewer.

Table 11. Number of hives owned by Mite-A-Thon submissions.

Number of Hives	May Participants	August Participants
1-3	45	113
4-10	33	112
11-100	5	26
>100	1	0

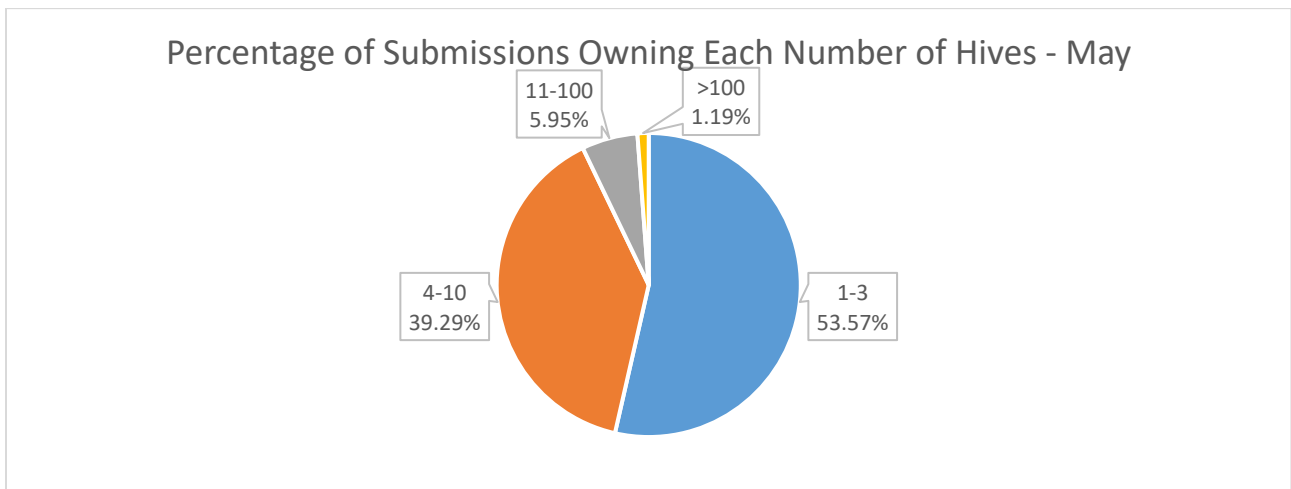


Figure 11. Percentage of May Mite-A-Thon participants who own each number of hives.

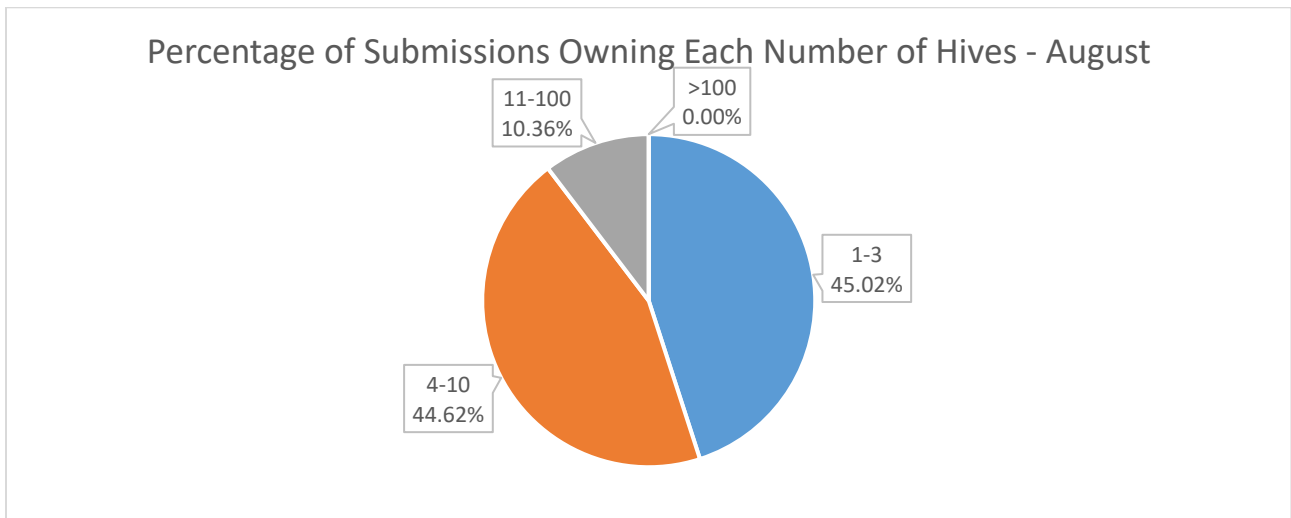


Figure 12. Percentage of August Mite-A-Thon participants who own each number of hives.

9. Number of new and returning participants.

Interestingly, 80% of 2021 participants were new to the Mite-A-Thon, meaning almost 270 beekeepers participated for the first time (Figure 13). Because recurring participation was determined by calculating duplicated email addresses from 2017-2020, it does not take into account the participants who were unwilling to share their contact information or those who may have changed email addresses.

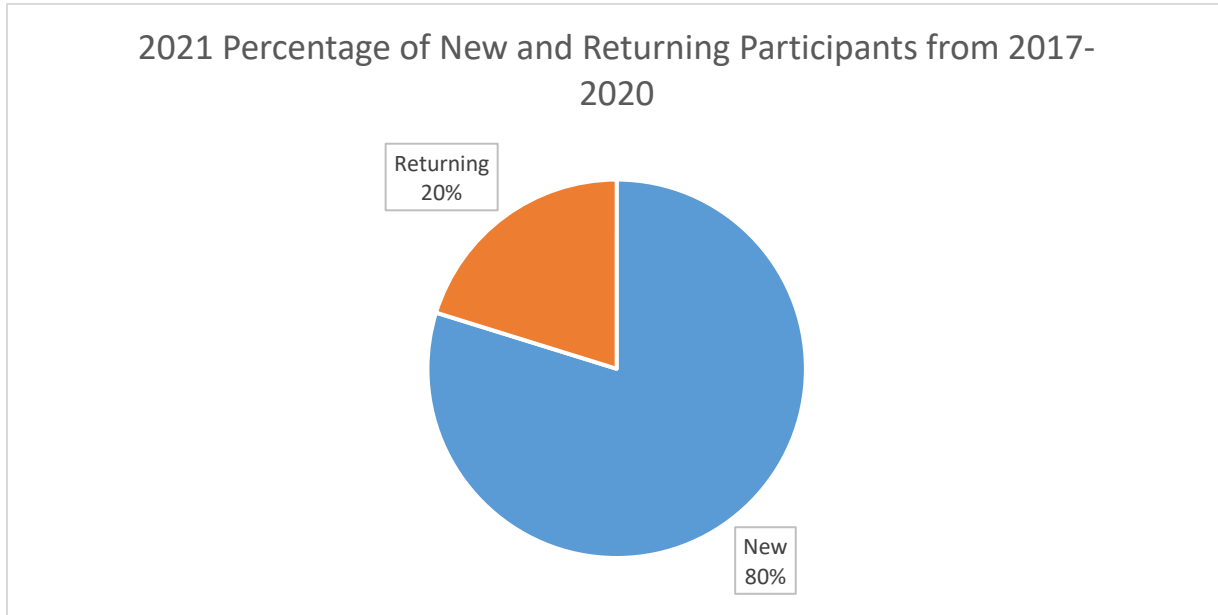


Figure 13. Number and percentage of new Mite-A-Thon participants in 2021 and returning participants from 2017-2020.

Compared to 2020, 2021 had approximately 168 fewer participants and 684 fewer colonies tested. Estimating using the 80% new participation rate for 2021 and the rates of 74.52% and 80.05% for 2020 and 2019 respectively, the Mite-A-Thon has seen about 2,570 different participants over 5 years and 9,894 colonies have been sampled. The 2021 results showed a similar distribution in the numbers of mites found in each sample, average varroa counts for each sample and highest mite counts reported by each submission compared to 2020. However, the May 2021 submissions showed that 9.52% of samples were above the action threshold compared to 17.69% in May 2020. The percentage of samples above the action threshold in August 2021 (30.83%) was similar to August 2020 (26.33%).

Table 12. Yearly participation comparison with projected new participants for each year.

Year	Participants	Colonies Sampled	Projected New Participants
2021	336	1018	268
2020	504	1702	376
2019	545	1842	436
2018	683	2322	586
2017	904	3010	904
Total	2972	9894	2570

10. Outreach penetration.

The Pollinator Partnership social media outreach initiative “Mite-A-Thon Mondays” had a total estimated reach of 44,729 from Facebook, Instagram, Twitter, and Mailchimp, with an estimated average reach of 5,591 per post. This included 8 posts on Facebook, Instagram, Twitter and Mailchimp emails. The combined reach for the posts across the 4 platforms was 44.73% of the estimated total potential reach, 100,000.

Table 13. Reach of the 8 Mite-A-Thon Monday posts from Facebook, Instagram, Twitter, and Mailchimp posts.

Outreach Medium	Total Reach (Twitter Impressions and Mailchimp Opens)	Average Reach per Post	Total Potential Reach	Potential Reach per Post
Facebook	10,000	1250	64,000	8,000
Instagram	23,661	2,958	19,000	2,375
Twitter	10,468	1,309	8,500	1,063
Mailchimp	600	75	8,500	1,063
Combined	44,729	5,591	100,000	12,501

11. Social media pageviews.

It should be noted that reach includes unique views of each post or email opens, not unique individuals, because it includes double counting of individuals who viewed more than 1 of the 8 posts on each platform. Of each outreach platform, Mailchimp was the most successful at engaging viewers, with 91.67% engagement. Total engagement for this initiative was 7.23%. Engagement includes likes, shares, comments, and opens. During 2021 promotional periods, 3,002 unique pageviews were recorded on <https://www.pollinator.org/miteathon>, of which 12.26% viewed the giveaway, signup, or resources page (Table 15, Figure 16). Pageviews peaked during the fall session of the event.

Table 14. Total engagement compared to reach of each outreach platform.

Outreach Medium	Total Reach (Twitter Impressions and Mailchimp Opens)	Total Engagement	Average Engagement per Post
Facebook	10,000	500	63
Instagram	23,661	2,004	251
Twitter	10,468	182	23
Mailchimp	600	550	69
Combined	44,729	3,236	405

Table 15. Total unique website pageviews of pollinator.org/mitteathon web pages from 2021 promotional periods.

Website Traffic	Unique Pageviews
Homepage	2,654
Giveaway	100
Resources	175
Newsletter Signup	93
Total	3,002

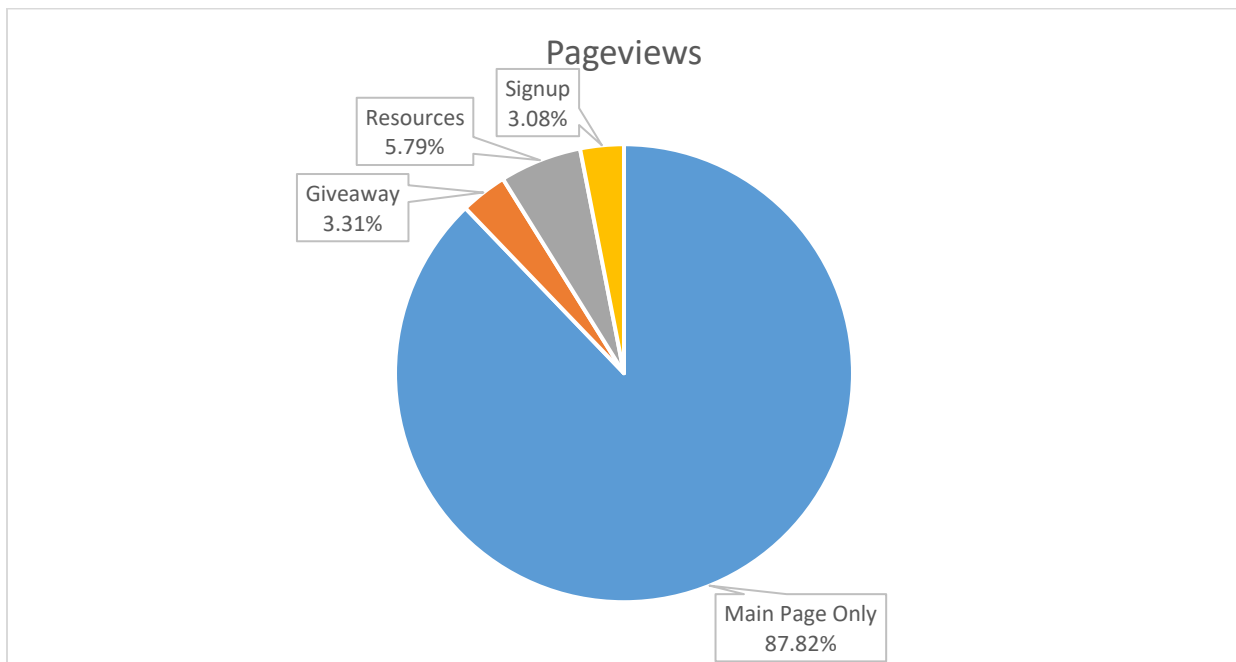


Figure 15. Percentage of Pollinator Partnership Mite-A-Thon pageviews for each webpage.

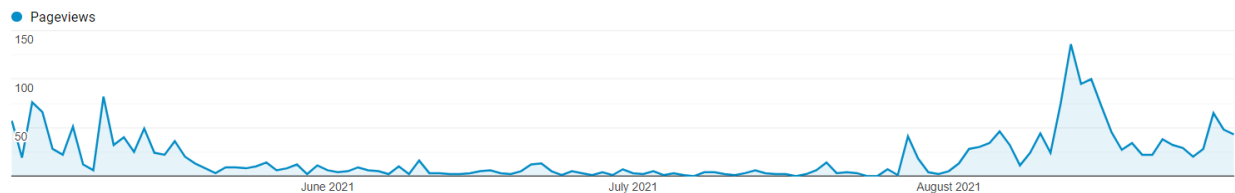


Figure 16. Pageviews per day on <https://www.pollinator.org/mitteathon> during the 2-week period of the Mite-A-Thon.

The Bee Informed Partnership reached over 12,000 social media followers with their posts. Additionally, they saw 435 users access the MiteCheck app during the May event and 510 users access the app during the August event. MiteCheck.com had a total of 824 unique pageviews during the events.

Discussion and Next Steps

In 2021, 80% of participation was from new individuals who had not participated in previous years. This is the first time in Mite-A-Thon's history that the new participation rate has increased from the previous year: 2020 (74.52%), 2019 (80.05%) and 2018 (85.77%). This is encouraging, because it shows that many new individuals are being reached and educated on varroa management and that past participants may now be trained and familiar with testing, lessening their desire to contribute data.

Another encouraging result was that 2021 continued to see low numbers of declined answers to the management methods questions both when asked which methods were used in past months and which methods would be considered for the coming months. Additionally, 2021 saw the addition of broader management categories such as Thymol, which includes ApiLife VAR and Apiguard, and Amitraz, which includes Apivar. This may have contributed to the higher response rate and consequently, continued to make beekeepers aware of available management methods.

Canadian participation continued to decline with an estimated 15 participants in 2021, down from 33 in 2020. While 2020 saw its first Mexican participant, 2021 failed to engage any. A Mexican addition to the leadership team as well as a Spanish Mitecheck survey and a Mexico Mitecheck map will likely help with this. Mexican beekeepers may also benefit from a later sampling date than the US and Canada.

With a better idea of the gaps in currently available data, Pollinator Partnership is seeking to increase effectiveness of the **Mite-A-Thon in 2022**. Increased participation is one indicator of the success of this project, but other criteria need to be established. The timely dissemination of this report to all participants and other beekeepers will be a large impetus for increased effectiveness of the program. Although not the primary priority of the project, collecting a more robust data set in future years may be possible by continuing to reengage those who have already been trained. The timely reporting of results after each year's event to document the year's efforts will help retain and recruit participants.