Presentation Topic: Pests and Diseases

TITLE: Comparative Analysis of Pests and diseases that affect Honey bees in Guyana 2013 and 2020.

INTRODUCTION

- Pests and diseases affecting honeybees are becoming a major issue across the world.

- Although, this is the case for many countries across the world, in Guyana it is not commonly known for beekeepers to experience extreme losses due to pests and diseases.

INTRODUCTION

- In Guyana, our main honey producer are Africanized honeybees.

- However, as a nation we are not experiencing major losses

  it is still important to know what pests and diseases may be present in Guyana.

INTRODUCTION

- For this reason the Guyana Livestock Development Authority collaborated with the Partners of America to carry out both surveys.

OBJECTIVES

1. To determine what pests and diseases may or may not be present in Guyana.

2. To determine the prevalence of varroa mites in Guyana.

OBJECTIVES

3.Toverify the absence of ***Tropilaelaps*** a parasitic mite native to Asia that has been causing significant damages to colonies around the world.

4.To verify the presence or absence of other honeybee related pests and diseases such as small hive beetle (***Aethina tumida)*** and ***Nosema ceranae***.

METHODOLOGY

Survey Description

- In 2013 samples were collected from 10 apiaries; between these 10 apiaries there were 30 hives.

- Each apiary was given its own individual identification code also each sample collected was clearly labeled for proper identification when analysis was being carried out.

METHODOLOGY

- In 2020 samples were collected from 16 apiaries; among these sixteen beekeepers there were 659 hives.

- Similarly to the survey carried out in 2013, each apiary was given its own individual identification code also each sample collected was clearly labeled for proper identification when analysis was being carried out.

METHODOLOGY

➢Samples collected were analysed for the following pests and diseases:

- Deformed Wing Virus
- Lake Sinai Virus
- Aphid Lethal Paralysis Virus
- Black Queen Cell Virus
- Chronic Bee Paralysis virus
- Acute Bee Paralysis Virus
- Sac Brood Virus
- Slow Bee Paralysis Virus
- MOKU Virus
- Samples were also analysed for *Nosema, varroa* mite, tracheal mites, small hive beetle and the *Tropilaelaps* mite.

METHODOLOGY

Methods of sampling used were:

Live sampling

- Live samples were collected from each hive.

Fig. 1 live bees collected and stored in a zip lock bag

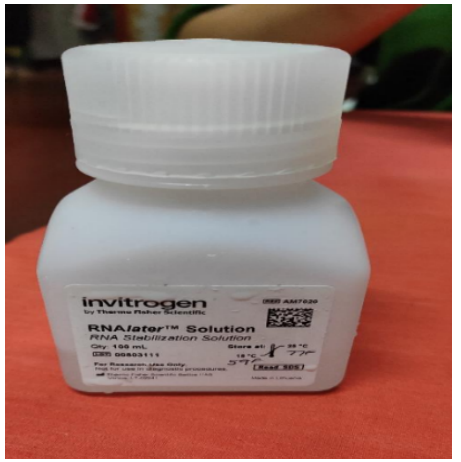


Fig. 2 RNAlater

- ¼ cup of bees were placed into a zip lock bag and stored on ice.

- Bees were subsequently crushed stored in RNA later solution to test for the various viral diseases that affect honeybees.

METHODOLOGY

Alcohol Preserve Sampling

- Samples were collected from each hive.

- ¼ cup of bees were placed into a container of 70% isopropyl aalcohol. This constituted one pooled sample.

- Alcohol preserved bees were used to test for Nosema, small hive beetle and varroa mite.

Fig.3 Bees Preserved in Al cohol

METHODOLOGY

Brood Frame Bump Sampling

- A brood frame was gently shaken to remove the bees that may be present on it.
- Both ends of the frame were bumped on to a pan
- A small amount of water was added to the pan any material that was found in the pan was collected in a cloth with a sieve.
- The collection cloth was stored in alcohol and later analysed for Tropilaelaps.

Fig. 4 & 5 ***depicting the bumping Method.***

METHODOLOGY

Pollen Sampling

- Fresh pollen grains were collected from the hive food storage and placed in a tube.
- This tube was kept on ice while out in the field and stored in the freezer until it could be sent for testing.
- Pollen grains were collected to carry out a chemical test to know if there were any chemicals affecting the bees.

Fig.6 Pollen grains being collected fro m a colony's food storage.

METHODOLOGY

Observations made in field

- During sampling random colonies were thoroughly inspected for damages.

- These colonies were opened, and brood frames were examined for: **Evidence of brood disease**, ***Varroa* mite**, ***Tropilaelaps***, **Wax moth damage**, **Small Hive Beetle**.

- Hives were also inspected to ensure that the queens were present in the hives and were laying.

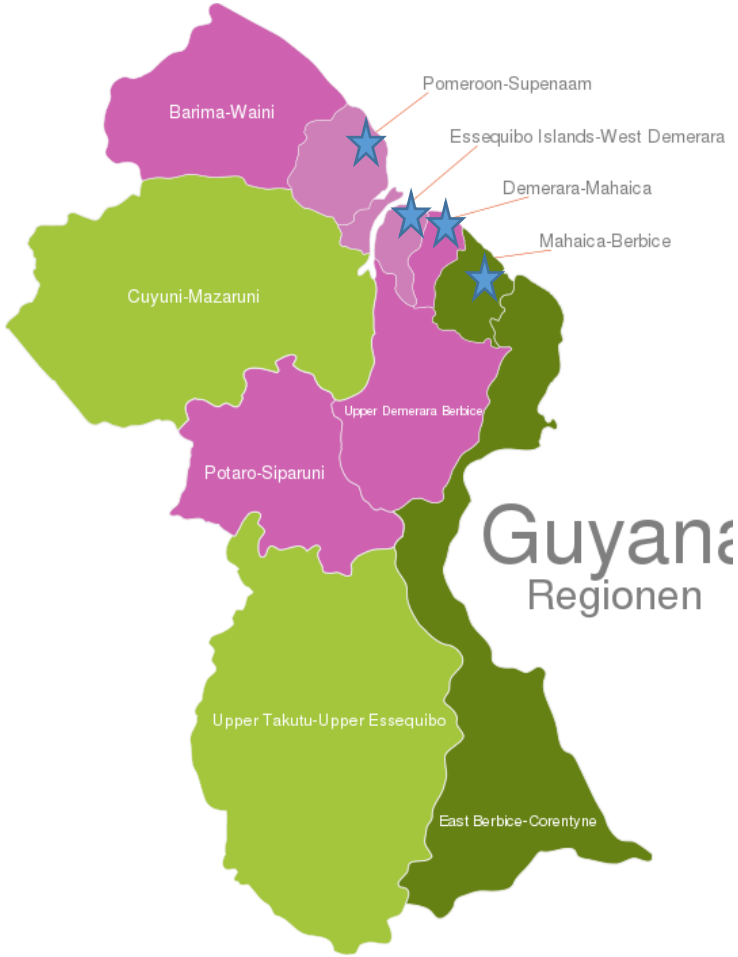
Fig. 6 Brood frame being o served.

METHODOLOGY

Survey Location

Regions that were covered in the 2013 survey:

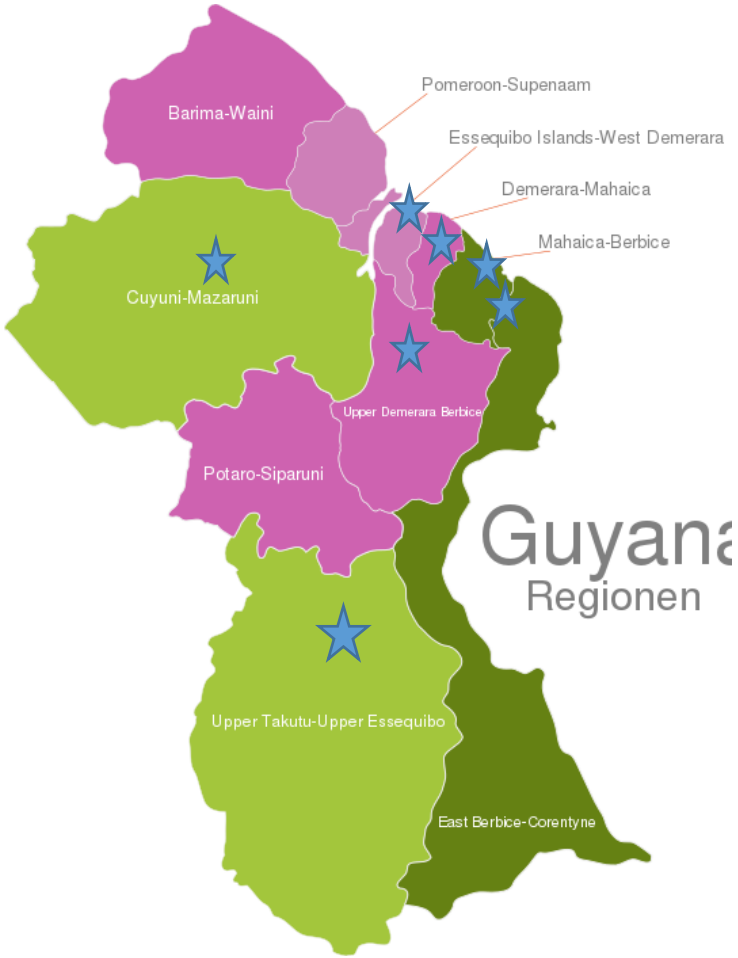
- **Region 2** - Pomeroon - Supenaam
- **Region 3 -** Essequibo Island - West Demerara
- **Region 4** - Demerara Mahaica
- **Region 5** - Mahaica Berbice



METHODOLOGY

Regions that were surveyed in 2020:

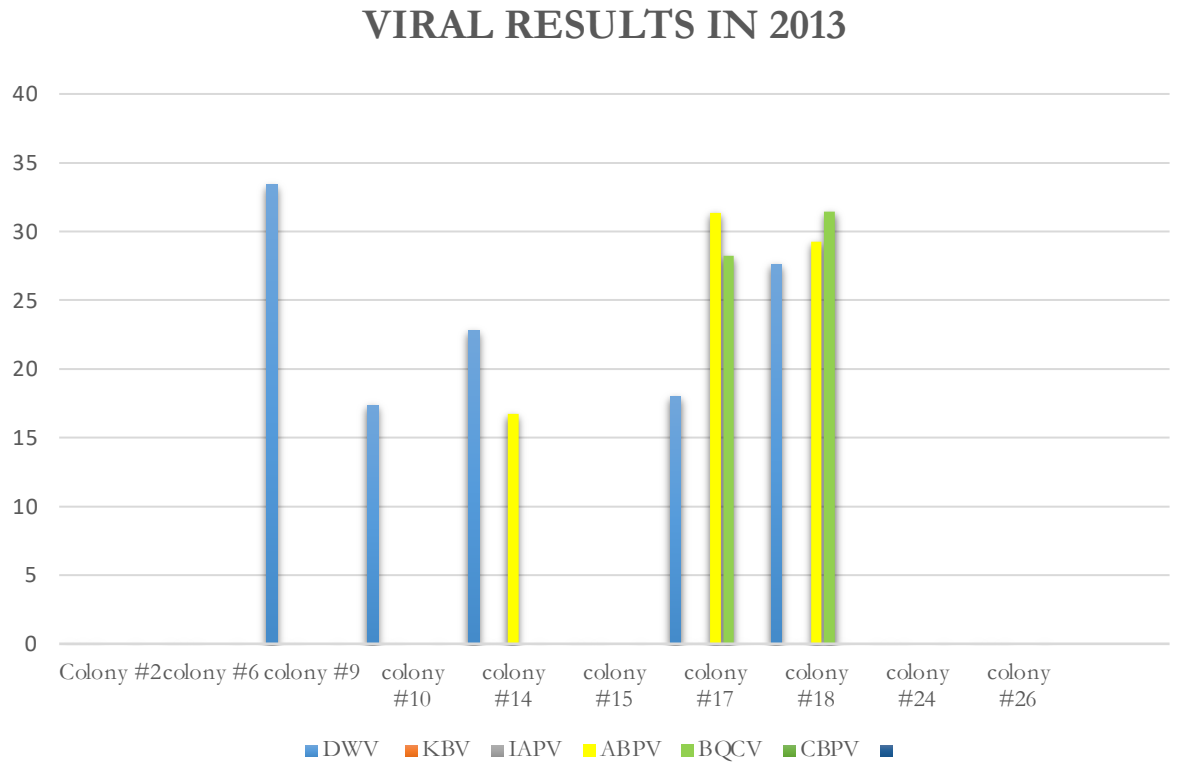
- **Region 3**- Essequibo Island -West Demerara
- **Region 4**- Demerara Mahaica
- **Region 5**- Mahaica Berbice
- **Region 6**- East Berbice- Corentyne
- **Region 7** - Cuyuni Mazaruni
- **Region 9** - Upper Takatu - Upper Essequibo
- **Region 10**- Upper Demerara - Upper Berbice



RESULTS

Results

Sample Information	Deformed Wing virus Ct	Kashmire Bee virus Ct	Israeli bee paralysis virus Ct	Acute Bee Paralysis Virus Ct	Black Queen Cell Virus Ct	Chronic Bee Paralysis virus Ct
Colony #2	0	0	0	0	0	0
Colony #6	0	0	0	0	0	0
Colony #9	33.38	0	0	0	0	0
Colony #10	17.37	0	0	0	0	0
Colony #14	22.8	0	0	16.71	0	0
Colony #15	0	0	0	0	0	0
Colony #17	17.96	0	0	31.33	28.2	0
Colony #18	27.6	0	0	29.24	31.45	0
Colony #24	0	0	0	0	0	0
Colony #26	0	0	0	0	0	0



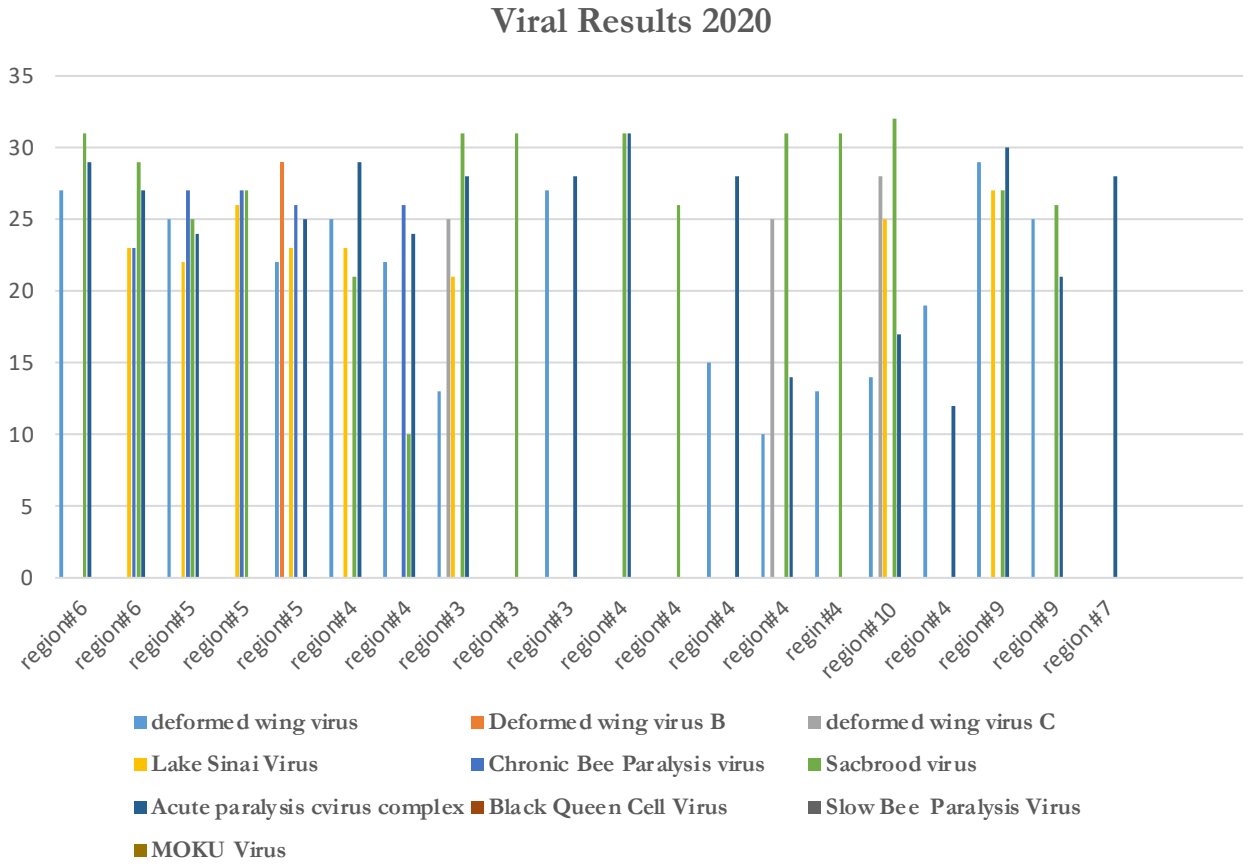
Viruses Detected inn 2013

- **Deformed wing virus**
- **Acute bee paralysis virus**
- **Black Queen cell virus**

Ct- Cycle Threshold
The lower the Ct value the higher the viral load

Results

Sample Information	Species	DWV-A Ct	DWV-B Ct	DWV-C Ct	LSV Ct	CBPV Ct	SBV Ct	AKI Ct	BQCV Ct	SPV Ct	MOKU Ct
Region #6	Stingless	27	ND	ND	ND	ND	31	29	ND	ND	ND
Region #6	AHB	ND	ND	ND	23	23	29	27	ND	ND	ND
Region #5	AHB	25	ND	ND	22	27	25	24	ND	ND	ND
Region #5	Stingless	ND	ND	ND	26	27	27	ND	ND	ND	ND
Region #5	AHB	22	29	ND	23	26	ND	25	ND	ND	ND
Region #4	AHB	25	ND	ND	23	ND	21	29	ND	ND	ND
Region #4	AHB	22	ND	ND	ND	26	10	24	ND	ND	ND
Region #3	AHB	13	ND	25	21	ND	31	28	ND	ND	ND
Region #3	Stingless	ND	ND	ND	ND	ND	31	ND	ND	ND	ND
Region #3	Stingless	27	ND	ND	ND	ND	ND	28	ND	ND	ND
Region #4	Stingless	ND	ND	ND	ND	ND	31	31	ND	ND	ND
Region #4	Stingless	ND	ND	ND	ND	ND	26	ND	ND	ND	ND
Region #4	AHB	15	ND	ND	ND	ND	ND	28	ND	ND	ND
Region #4	AHB	10	ND	25	ND	ND	31	14	ND	ND	ND
Region #4	AHB	13	ND	ND	ND	ND	31	ND	ND	ND	ND
Region #10	AHB	14	ND	28	25	ND	32	17	ND	ND	ND
Region #4	AHB	19	ND	ND	ND	ND	ND	12	ND	ND	ND
Region #9	AHB	29	ND	ND	27	ND	27	30	ND	ND	ND
Region #9	AHB	25	ND	ND	ND	ND	26	21	ND	ND	ND
Region #7	AHB	ND	ND	ND	ND	ND	ND	28	ND	ND	ND



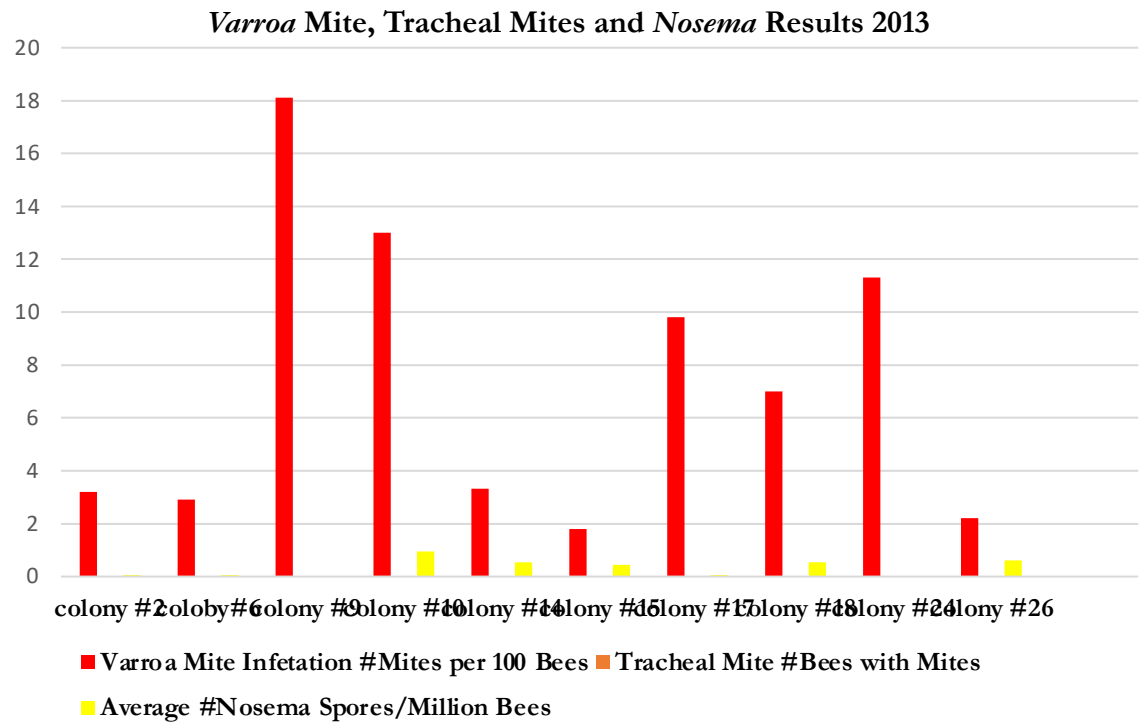
Viruses Detected in 2020

- Deformed wing virus A,B,C
- Acute bee paralysis virus
- Lake Sinai Virus
- Chronic Bee Paralysis Virus
- Sac brood virus

Ct- Cycle Threshold
The lower the Ct value the higher the viral load

Results

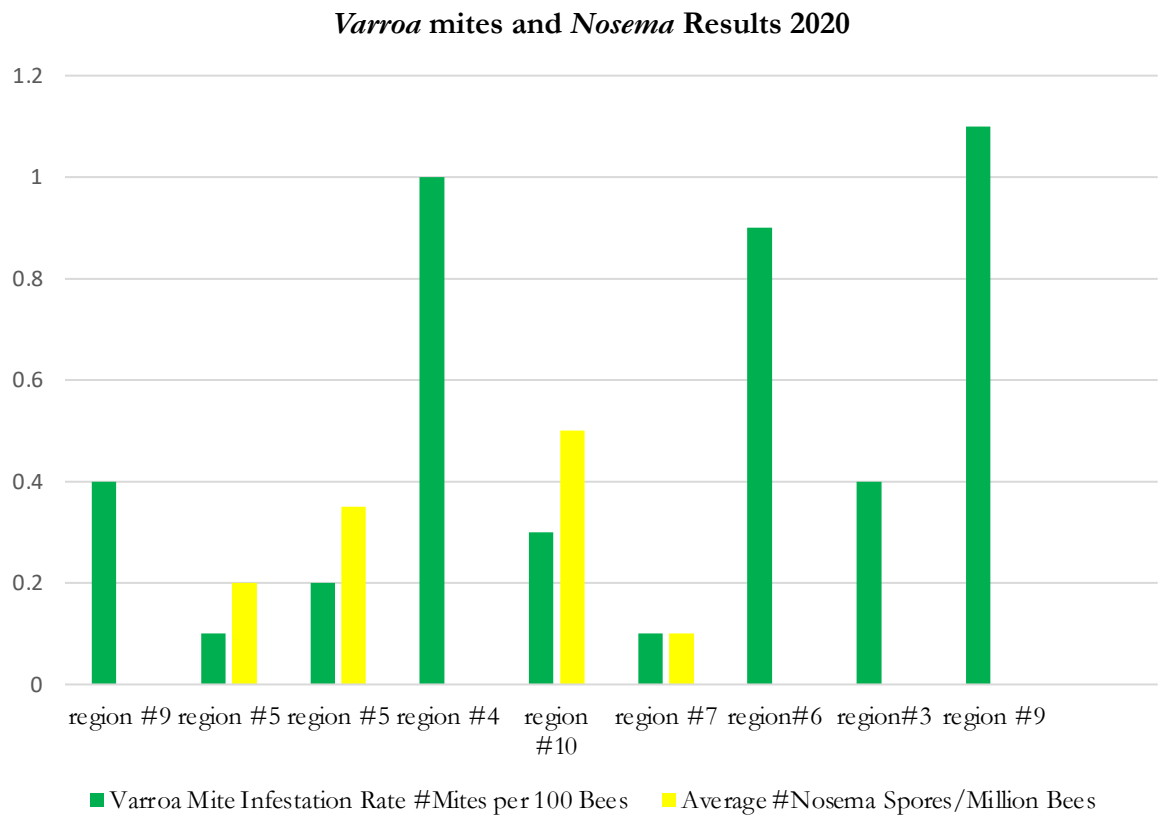
Sample information	Varroa mite infestation rate #mites per 100 bees	Tracheal mite #bees with mites	Average #Nosema spores/million bees
Colony #2	3.2	0	0.05
Colony #6	2.9	0	0.05
Colony #9	18.1	0	0
Colony #10	13	0	0.95
Colony #14	3.33	0	0.55
Colony #15	1.8	0	0.45
Colony #17	9.8	0	0.05
Colony #18	7	0	0.55
Colony #24	11.3	0	0
Colony #26	2.2	0	0.6



In 2013 Varroa mite was very prevalent among samples among samples that were analysed with the highest infestation rate being 18.1 mite per 100 bees. *Nosema* was detected 8 samples at relatively low spore loads.

Results

Sample information	*Varroa* mite infestation rate #mites per 100 bees	*Nosema* disease Negative Positive	Average #Nosema spores/million bees
Region #9	0.4	-	0
Region #5	0.1	+	0.2
Region #5	0.2	+	0.35
Region #4	1.0	-	0
Region #10	0.3	+	0.50
Region #7	0.1	+	0.10
Region #6	0.9	-	0
Region #3	0.4	-	0
Region #9	1.1	-	0



In 2020 *Varroa* mite was found in each sample that was analysed, however the infestation rate was relatively low with highest infestation rate being 0.9 mite per 100 bee. *Nosema* also detected 4 samples at relatively low spore loads.

Results

United States Department of Agriculture
Agricultural Marketing Service
Science & Technology
Laboratory Division

National Science Laboratory
801 Summit Crossing Place, Suite B
Gastonia, NC 28054
Phone: (704) 867-3873
Fax: (704) 853-2800

Applicant Identifier:
Amy Weeks

1498 Mock Rd.
West Monroe, LA 71292

Sample Description: **Pollen**
Date Received: **09/19/2013**
Date Completed: **10/03/2013**
Date Issued: **10/03/2013**
P.O. #
Method: AOAC 2007.01

REPORT OF ANALYTICAL TEST RESULTS **Original Report**

Applicant Sample ID: **Guyana NW-02** ***Laboratory ID:*** **AK41145**

Pesticide Residue	Result PPB	LOD PPB	Pesticide Residue	Result PPB	LOD PPB
Carbaryl	43.9				
Naphthol	33.2				
Cypemethrin	Trace				
Carbendazim	Trace				
Imidacloprid	180				

Results

Pollen grains analysed for chemical residues in 2020.

UNITED STATES DEPARTMENT OF AGRICULTURE NATIONAL Science Laboratories
AGRICULTURAL MARKETING SERVICE
SCIENCE & TECHNOLOGY PROGRAMS
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801 Summit crossing Place, Suite B
Gastonia, NC 28054
Phone: (704) 867-3873
Fax: (855) 296-1230

Applicant Identifier:
Amy Weeks (Volunteer, Partners of the Americas)
myfavoritehoney@gmail.com
Attn: Amy Weeks

Sample Description: **Pollen**
Date Received: **07/21/2020**
Date Completed: **08/07/2020**
Date Issued: **08/07/2020**
P.O. #
Method: MET-104

REPORT OF ANALYTICAL TEST RESULTS Original Report

Applicant Sample ID: **LO_GU_XL Composite** ***Laboratory ID:*** **AT32004**

Pesticide Residue	Result PPB	LOD PPB	Pesticide Residue	Result PPB
Thymol	64	25		

Results

Liquid Nitrogen Freeze Killed Brood 24 Hrs.-Hygienic test

(Coastal) Guyana, South America August 12-18, 2013

	Start		**24 hrs. check**	#Uncapped	%Removed
	#unsealed	**#sealed**	**#uncapped**		
Colony #2	5	0	115	100%	43%
Colony #6	15	24	56	88%	61%
Colony #14	78	17	33	87%	61%
Colony #15	0	0	15	100%	93%
Colony #17	16	109	43	44%	20%
Colony ID	13	22	5	89%	86%
Colony #19	7	17	7	92%	58%

DISSCUSSION

DISSCUSSION

- From both surveys that were conducted it was established that there are several pests and diseases that affect the honeybee population in Guyana.

- ***Varroa*** mite was detected in all samples collected from both 2013 and in 2020, ***Nosema*** was also identified in both surveys carried.

- Viruses that were detected included: **Deformed Wing Virus, Acute Bee paralysis Virus, Black Queen Cell Virus, Lake Sinai Virus, Chronic Bee Paralysis Virus, Sac Brood Virus, Acute Bee Paralysis Virus.**

DISSCUSSION

- In 2013 only three of these viruses were identified :
  - **Deformed Wing Virus,**
  - **Acute Bee Paralysis Virus**
  - **Black Queen Cell Virus**
- ***Varroa* mite** and ***Nosema*** were also detected.

- Samples that were analysed in 2020 did not detect any **Black Queen Cell Virus;** however, **Deformed Wing Virus and Acute Bee Paralysis Virus was detected along with Lake Sinai Virus, Chronic Bee Paralysis Virus, and Sac Brood Virus. *Varroa* mite** and ***Nosema*** was also detected in samples analysed in 2020.

DISSCUSSION

Varroa

- From the results obtained, varroa mite was very prevalent in 2013 with colonies 2,9,10,17,18 and 24. These results exceeded the consensus which states that less than 3% infestation rate is safe.

- In 2020 none of the samples that were analysed exceeded the safe infestation percentage.

DISSCUSSION

Nosema

- In 2013 and 2020 ***Nosema*** was not very prevalent in colonies that were surveyed. Out of the colonies that were surveyed in 2013 8 of them came back positive for nosema this was also the case for samples that were collected in 2020.

- These samples had relatively low Nosema spores and there was no cause for alarm; however the (Bee Informed) Partnership diagnostic services team recommends that beekeepers be concerned when their colonies exceed 1 million spores per bee.

DISSCUSSION

Viruses

- In 2013 the viral load per sample was not very high with 17.96 being the highest viral load recorded.

- In 2020 however, there were a few samples were a bit high especially in deformed wing virus samples. The highest viral load that was recorded was 10.

- Deformed wing virus may exist within a bee population and may remain asymptomatic all its life with the absence of the *varroa* mite (Chen *et al*., 2006)

DISSCUSSION

chemicals

- Both of these samples were analysed for over a hundred different chemicals, five chemicals were identified these chemicals were: **Napthol**: 33.2ppb, **Carbaryl**: 43.9ppb, **Carbendazim**: , **Cypemethrin**: Trace and **Imidacloprid**: 180ppb.

- Out of these five pesticides that were detected four were present at low loads below (50ppb) except for imididocloprid which was 180 ppb.

- Imidacloprid is a neonicotinoid an it is acutely toxic to **honeybees** with acute oral LD_{50} ranging from (0.004–0.005) μg per **bee**[23].

CONCLUSION

- Honeybees are very important and vital for pollination and is also important for the maintenance of our ecosystem.

- Pests and diseases are one of the leading of the decline in the honeybee population across the world.

- knowing what pests and diseases are present in Guyana will help beekeepers to manage their apiaries well and also to know what course of action they should take.

CONCLUSION

- From the surveys carried out both in 2013 and 2020 showed that there are many viruses and pests that are affecting the honeybee population in Guyana.

- However, these pathogens that were identified are not at an alarming amount.

LIMITATIONS

- These results may only be applicable to the honeybee species used in Guyana.

- This survey may not reveal the full extent to the pest and disease that are present in Guyana seeing that it was not applied to all the regions preset in Guyana. Also feral hives were not included in this survey.

LIMITATIONS

- Pesticide exposure might not be fully understood because samples were not collected from every region because to run this test was very costly. Thus only a few samples were collected.

RECCOMENDATIONS

- This survey should be carried out biannually so to keep an update of the pests and diseases that affects honeybees in Guyana.

- More training should be done by the GLDA apiculture unit since there are a lot of beekeepers that are still not familiar with how they can run and maint ain an effective apiary.

RECCOMENDATIONS

- Beekeepers need better location for their bees; areas that are reserved from the public and a lot of nectar producing plants.

- More training should be carried out focusing on the various pests and diseases that affect bees and how they can be identified.

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