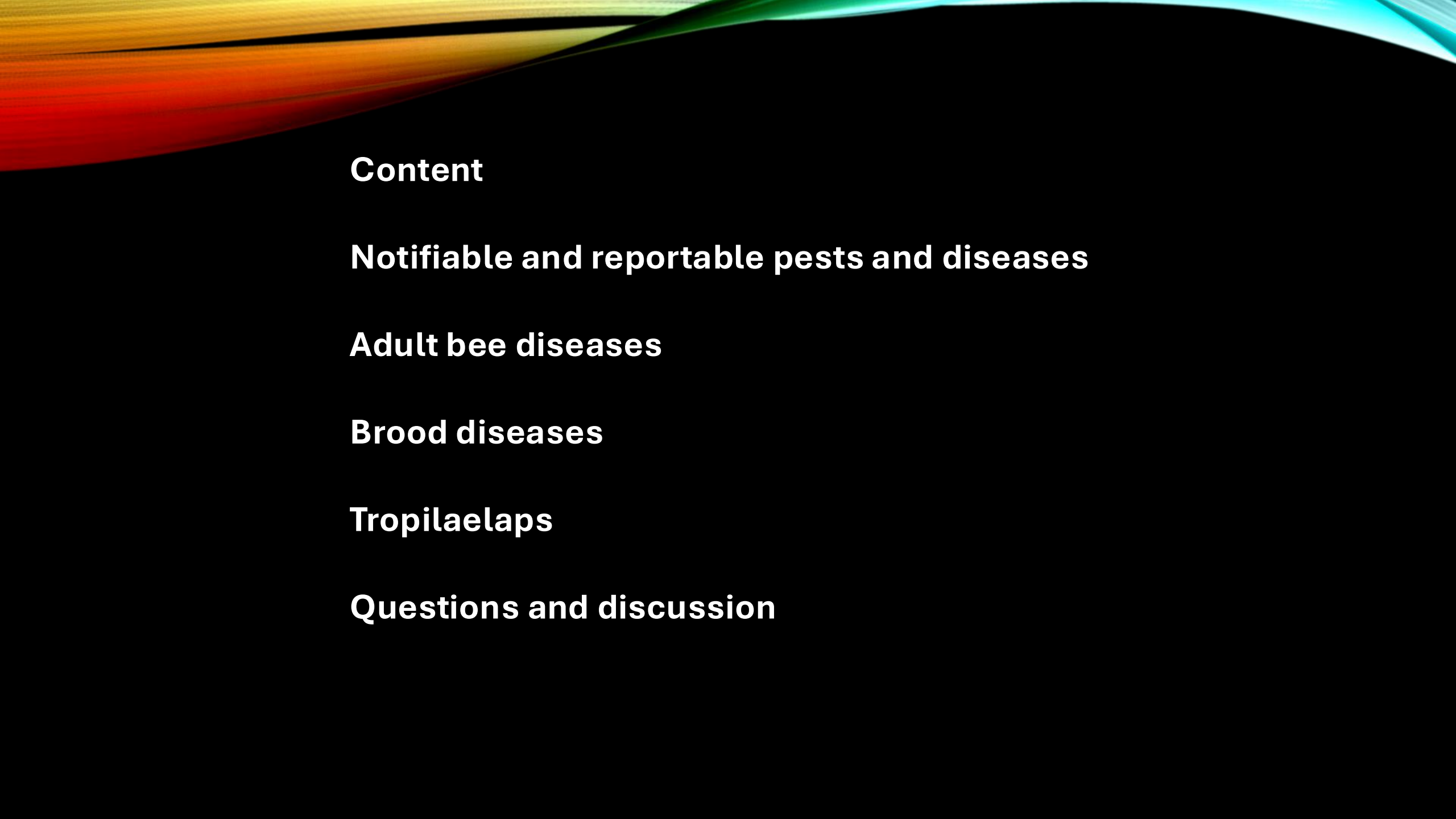


HONEY BEE PESTS AND DISEASES

By Alan Baxter





Content

Notifiable and reportable pests and diseases

Adult bee diseases

Brood diseases

Tropilaelaps

Questions and discussion



Notifiable

Mandatory by law

Must be reported to a government authority as soon as suspected or detected

Triggers a rapid government response

Reportable

Must be recorded and reported through specific channels

Does not require immediate notification

Less urgent than notifiable

Bee Diseases and Pests Control (England) Order 2006



Notifiable

American foulbrood (AFB)

European foulbrood (EFB)

Small hive beetle (*Aethina tumida*)

Tropilaelaps

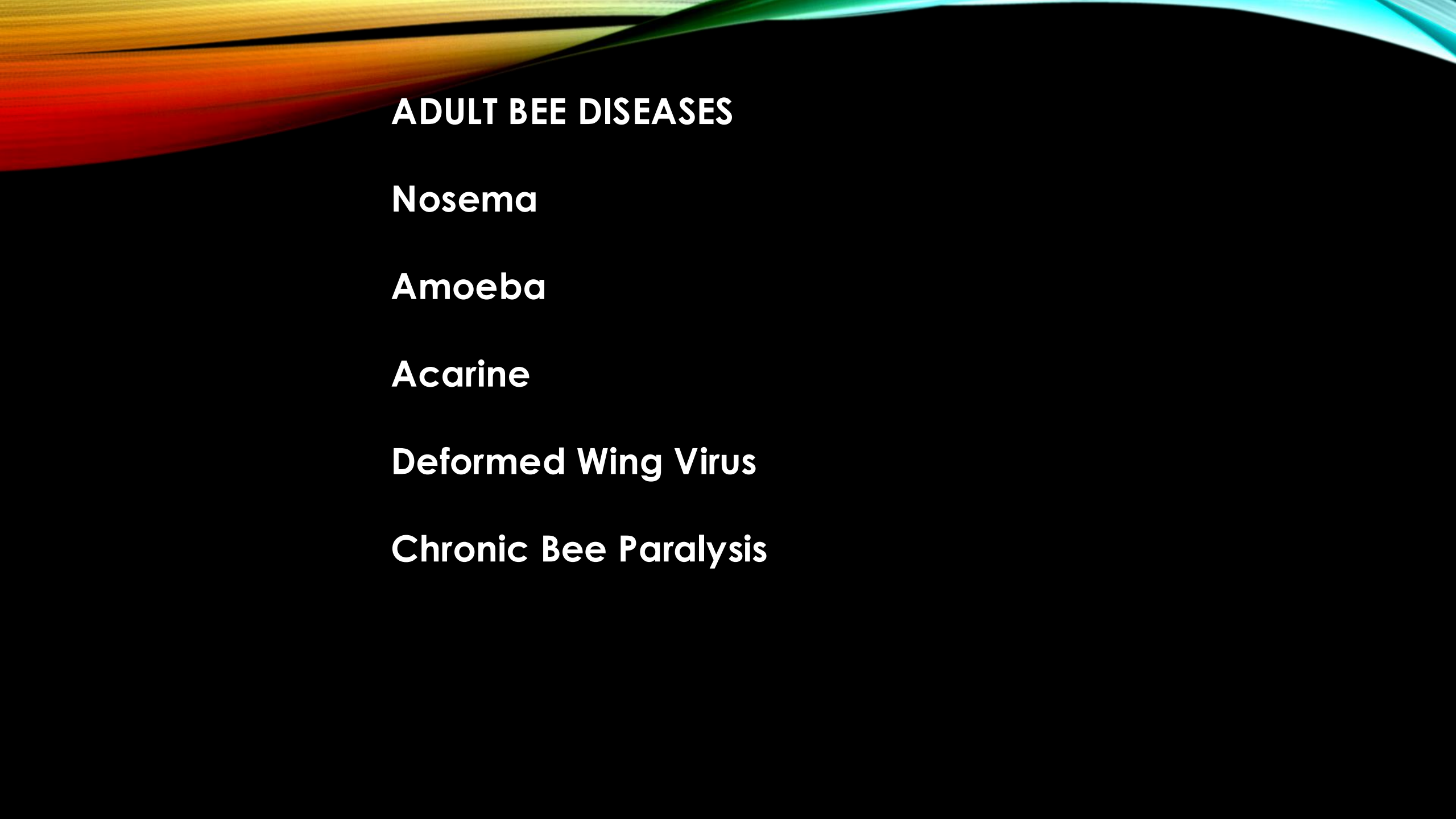
Varroa (considered endemic)

Reportable

Asian Hornet (*Vespa velutina nigrathorax*)

<https://www.gov.uk/guidance/bee-health>

<https://www.legislation.gov.uk/ukxi/2006/342/contents>



ADULT BEE DISEASES

Nosema

Amoeba

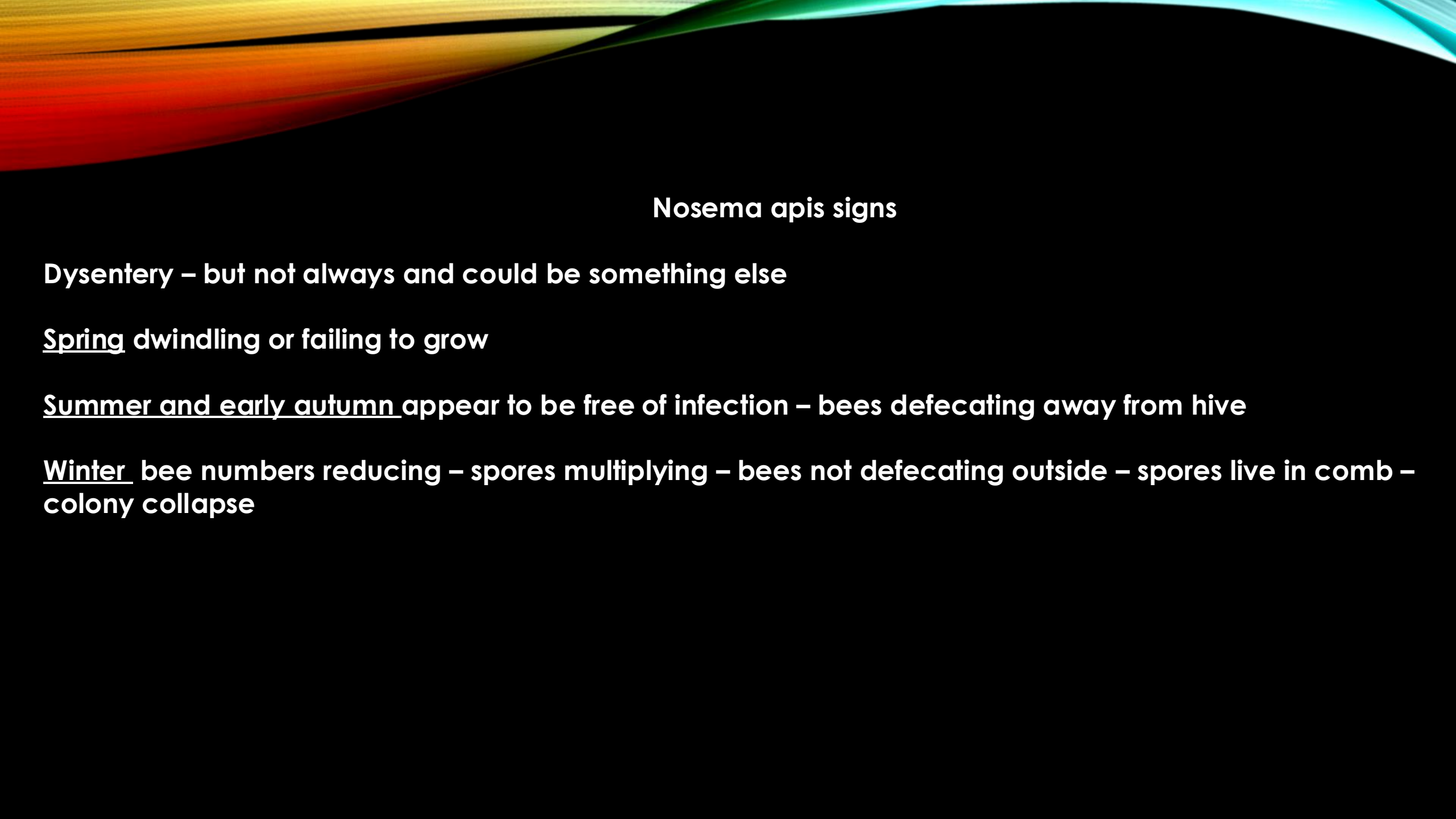
Acarine

Deformed Wing Virus

Chronic Bee Paralysis

Nosema (aka Vairimorpha)

- Two types:
- N.apis
- N.cerana
- Microsporidian – spore-forming fungus
- Directly affects adult bees only
- Nosema is a disease of the alimentary system



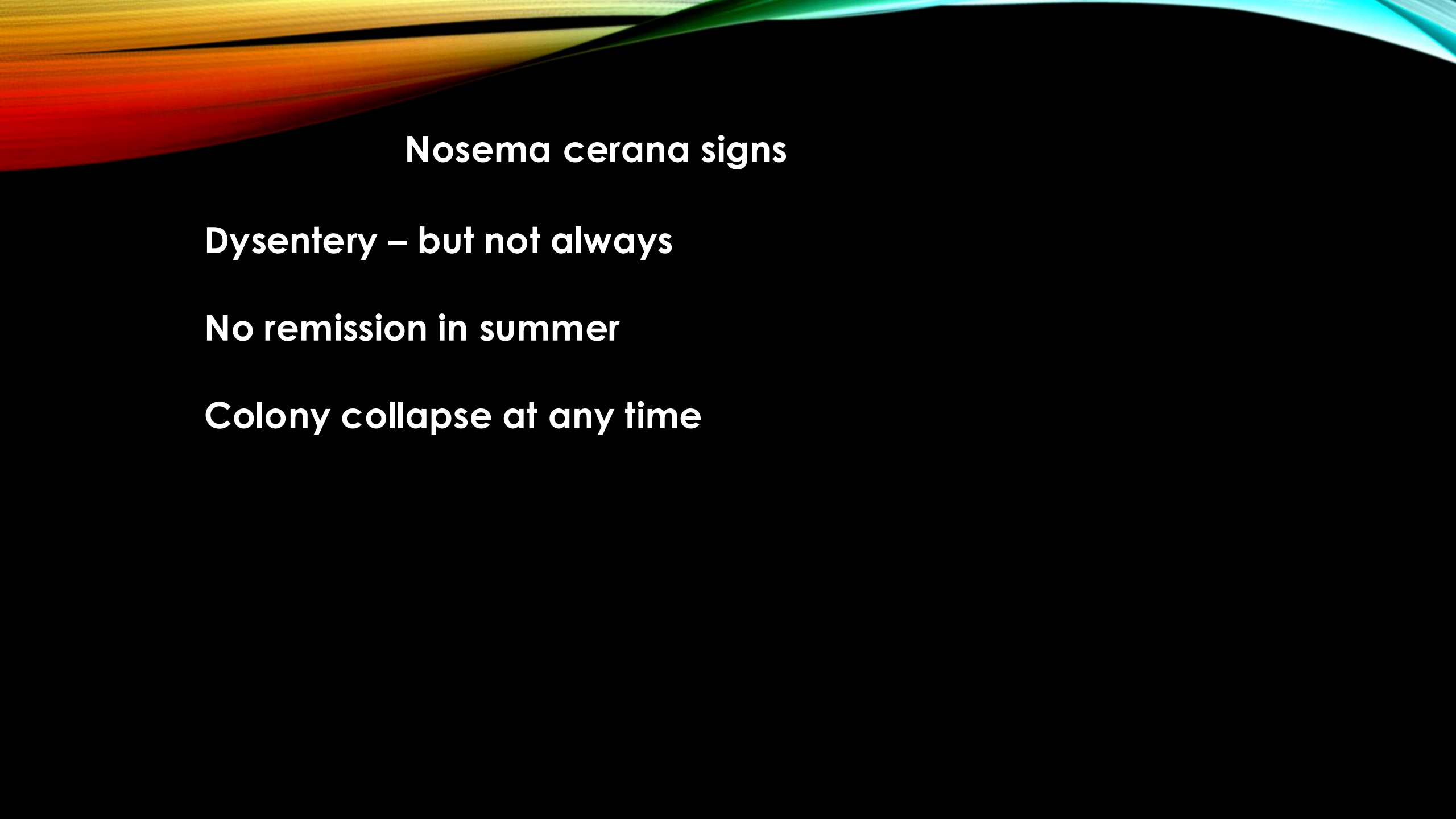
Nosema apis signs

Dysentery – but not always and could be something else

Spring dwindling or failing to grow

Summer and early autumn appear to be free of infection – bees defecating away from hive

Winter bee numbers reducing – spores multiplying – bees not defecating outside – spores live in comb – colony collapse



Nosema cerana signs

Dysentery – but not always

No remission in summer

Colony collapse at any time

Nosema effects

Individual

Physiological

Nutritional and energetic

Gland atrophy

Behavioural

Reduced lifespan

Colony

Reduced population

Decline in foraging and honey production

Queen problems

Susceptibility to other stressors

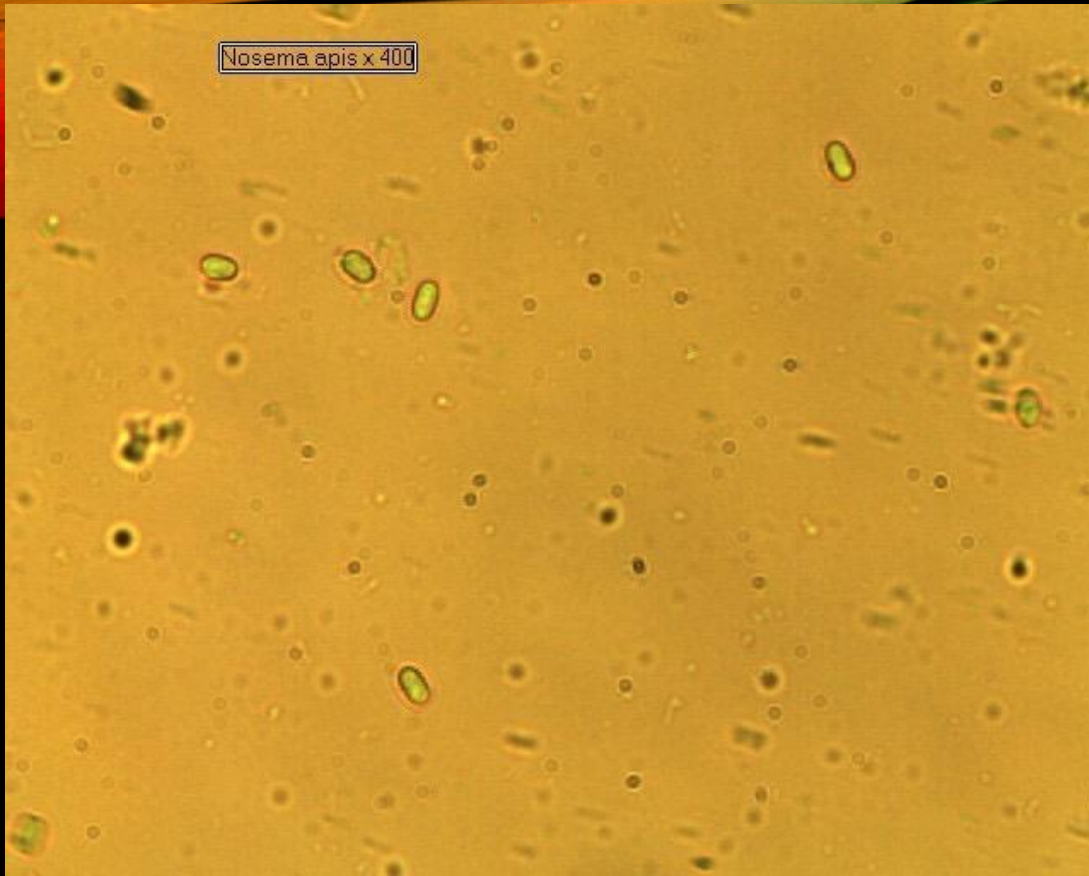
Increased winter/spring losses

- Nosema diagnosis
- In the Field
- Take a worker bee and kill it with ethyl alcohol or nail varnish remover
- With pair of tweezers pull out contents of abdomen
- Gut normally yellow/brown has white masses indicating areas of nosema



NOSEMA DIAGNOSIS

- In the Laboratory
- 30 freshly-killed forager bees –
- Why foragers and why 30?
- Crush abdomens in bag or mortar & pestle
- Add drop water and mix to make a soup
- Transfer a drop to a slide, allow to dry
- Examine at x 400 size 5–7 μm
- Spores like grains of rice



Nosema spores x 400

Nosema spores x 1,000



Nosema - treatment

N specific treatment for Nosema but can be reduced by:

strict apiary hygiene,

feeding

comb change to remove the infection in the comb

queen change to more resistant strain

A less stressful method is a Bailey Comb Change for a Weak Colony

Amoeba disease - *Malpighamoeba mellificae*

Single cell parasite

Affects the excretory system

Affects mainly workers

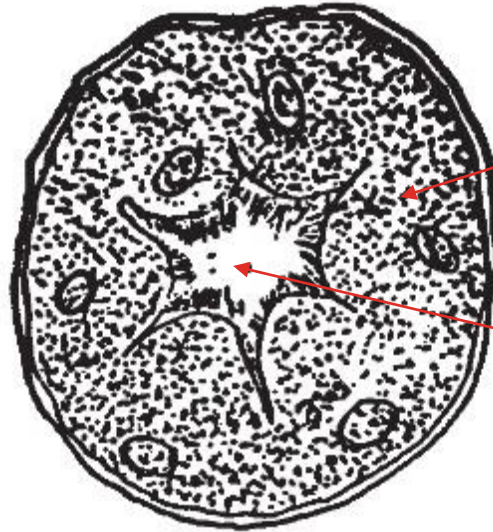
Effects not clearly understood

Often associated with Nosema

Treatment – good apiary hygiene

**Diagnosis by laboratory
microscopic
examination**

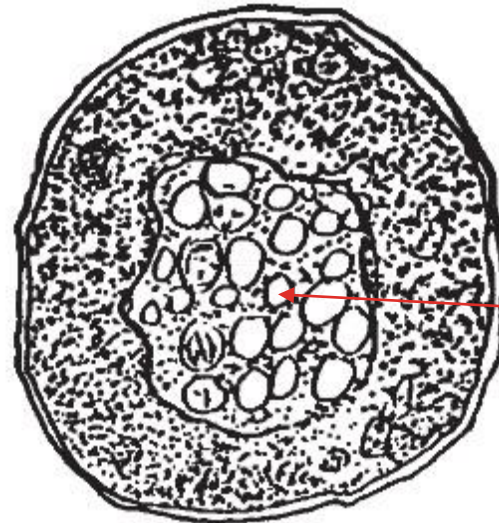
Normal Malpighian tubule



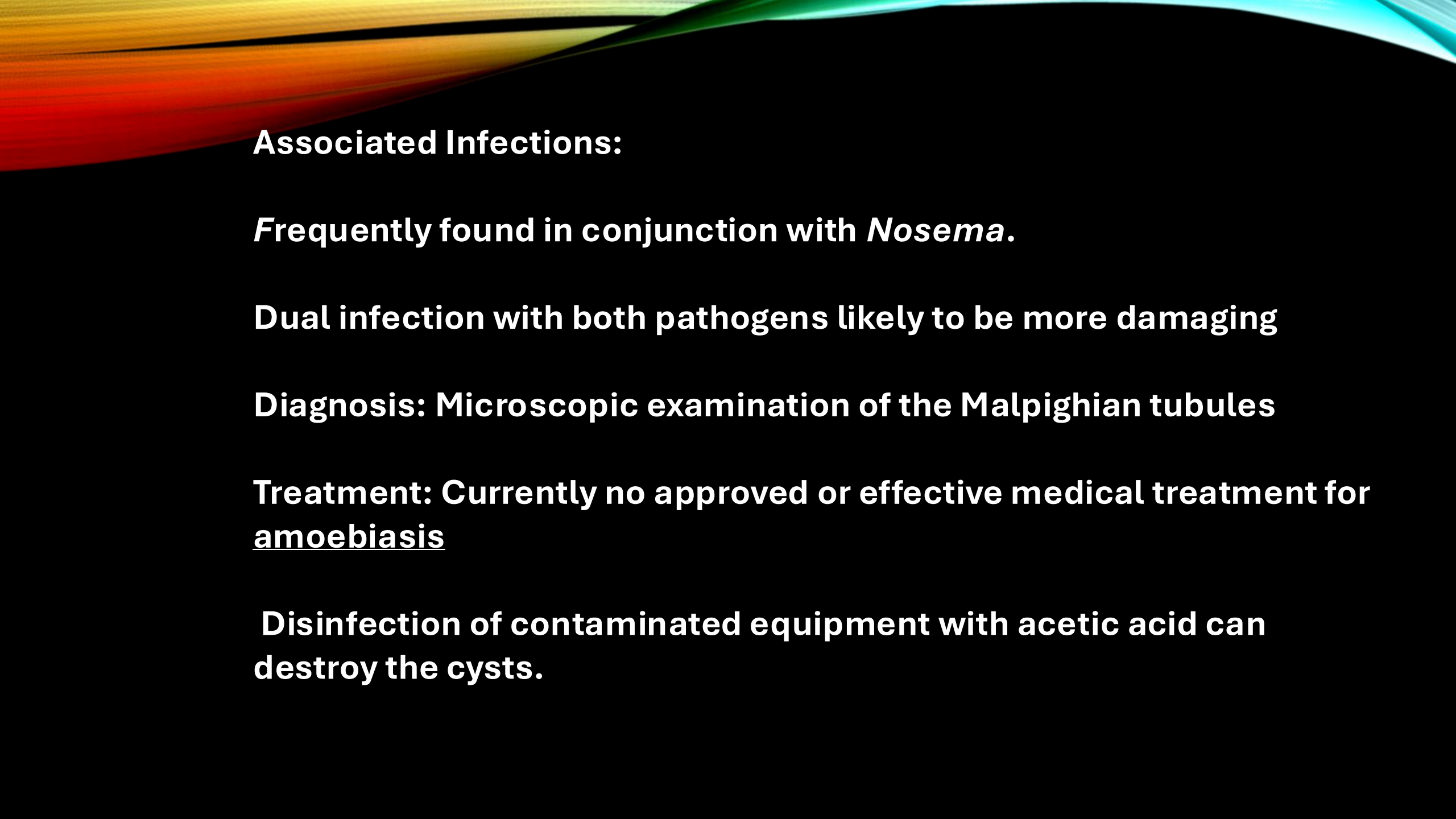
Epithelial lining

Lumen

**Malpighian tubule
infected with
malpighamoeba**



**Amoebae
8-10 μ**



Associated Infections:

Frequently found in conjunction with *Nosema*.

Dual infection with both pathogens likely to be more damaging

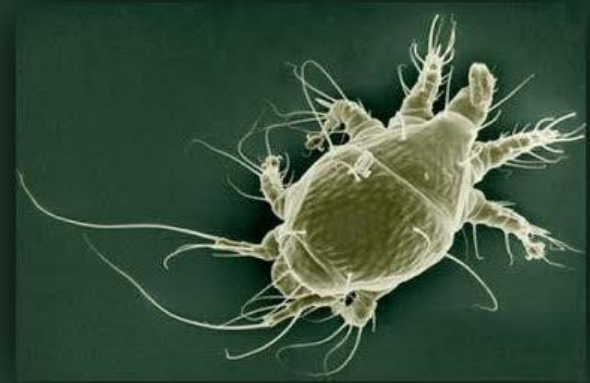
Diagnosis: Microscopic examination of the Malpighian tubules

Treatment: Currently no approved or effective medical treatment for amoebiasis

Disinfection of contaminated equipment with acetic acid can destroy the cysts.

ACARINE DISEASE OR ACARIOSIS

- Condition of adult honey bees
- Caused by the microscopic, ectoparasitic mite *Acarapis woodii*
- Infests the tracheal breathing tubes via the thoracic spiracles in young bees less than 24 hours old.
- Sometimes called Tracheal mites



TRACHEA INFESTED WITH ACARINE

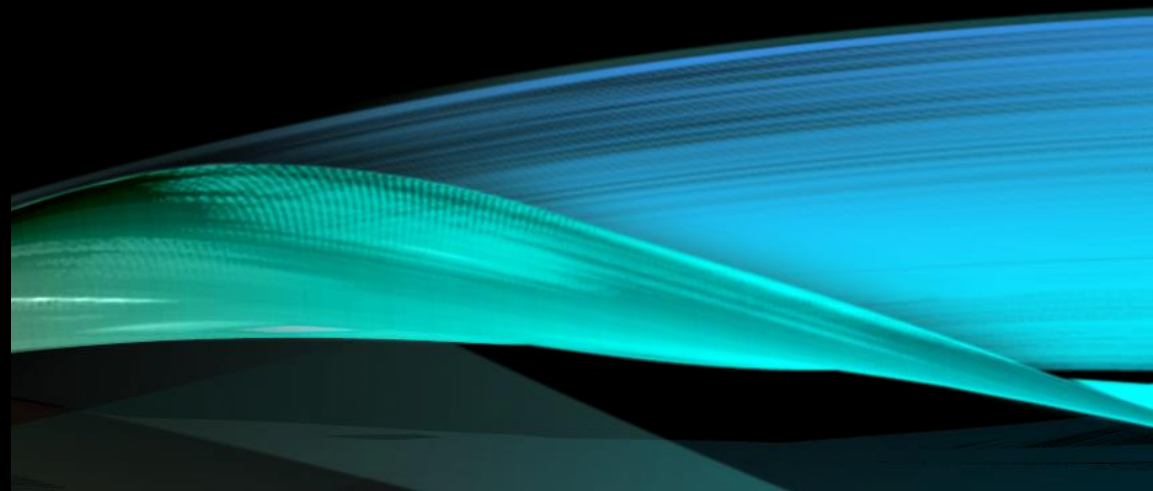


ACARINE - SIGNS

- Bees cluster in front of the hive
- Confused and disorientated
- Unable to return to the hive.
- 'K-wings', where the rows of hooks holding the pairs of the bee's wings together become detached.
- Not always seen and can be due to other factors not linked to Acarapisosis
- Shorten the lifespan of over-wintering bees
- 'Spring dwindling' as a result of the winter bees dying early in the spring.
- Expanding brood cannot be supported sufficiently by the remaining adult population
- Leading to the demise of the colony.
- If the colony goes into winter with $> 30\%$ infestation the colony is unlikely to survive.



K-WING



ACARINE DIAGNOSIS

Microscopic examination

Dissect section of thoracic trachea

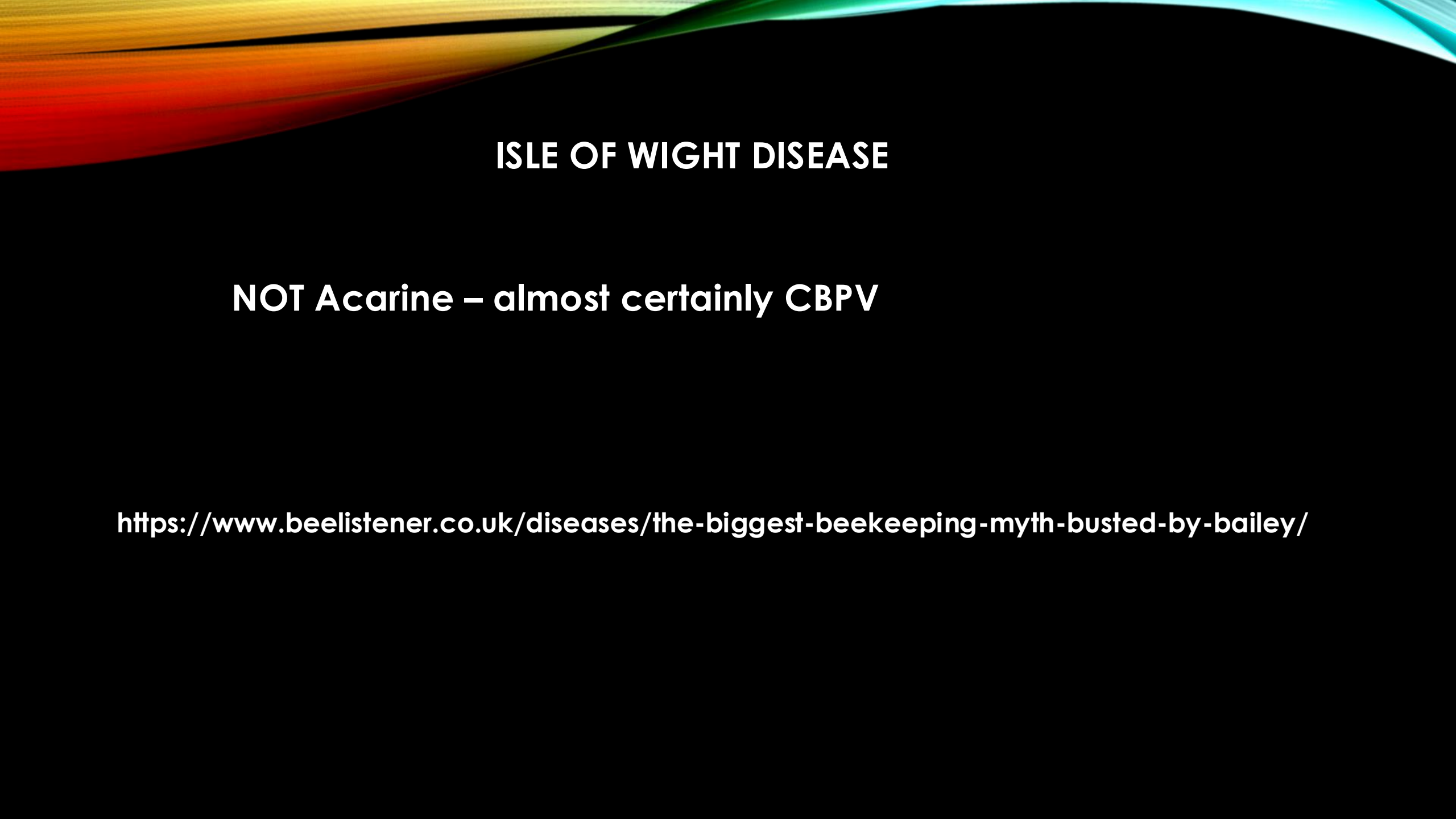
Remove prothoracic collar

Normal trachea appears white

Stain & examine at x 40

Eggs, larvae and adult mites visible





ISLE OF WIGHT DISEASE

NOT Acarine – almost certainly CBPV

<https://www.beelistener.co.uk/diseases/the-biggest-beekeeping-myth-busted-by-bailey/>

Thanks to treatment for varroa, acarine is rarely seen

But treatment free colonies may show signs of it



- **VIRUSES**

- A number of viruses but the most common are
- Deformed Wing Virus
- Chronic Bee Paralysis Virus
- Sacbrood virus



Deformed Wing Virus

Various types



DWV-A: First identified in Japan in the 1980s
classic variant with shrunk wings, reduced lifespan shortened abdomens.

DWV-B : Formerly known as VDV-1

- **often more virulent than Type A,**
- **linked heavily to overwintering colony losses**
- **become dominant in Europe and the USA.**

• **DWV-C: Less common compared to A and B.**

• **Recombinants (e.g., A/B): Hybrids of A and B been reported in the UK, France,**

• **Kakugo Virus: variant within DWV-A , often associated with aggression**

DWV Signs and Diagnosis

Persists at low levels in infected colonies without symptoms

Healthy bees' immune system is able to cope with it.

When mite populations increase immune system is weakened

DWV causes clinical symptoms in developing pupae

Newly emerged bees deformed wings and bloated, shortened abdomens

DWV – TREATMENT

Currently no direct cure or vaccine for DWV

Management focuses on controlling its primary vector:

Use of IPM to keep Varroa populations low

Hive Hygiene: Regular comb replacement and providing ample space

High-quality pollen can help reduce stress and viral spread.

Requeening: from a line known for "hygienic behaviour" or higher resistance

Emerging Treatments: Researchers investigating antibody treatments and RNA interference (RNAi) technologies to directly reduce viral loads in bees.

<https://pmc.ncbi.nlm.nih.gov/articles/PMC11580425/#:~:text=Varroa%20and%20DWV%20appear%20to,of%20disease%20in%20honey%20bees.>

DWV FURTHER READING

<https://www.nationalbeeunit.com/diseases-and-pests/other-bee-diseases-and-viruses/honey-bee-viruses>

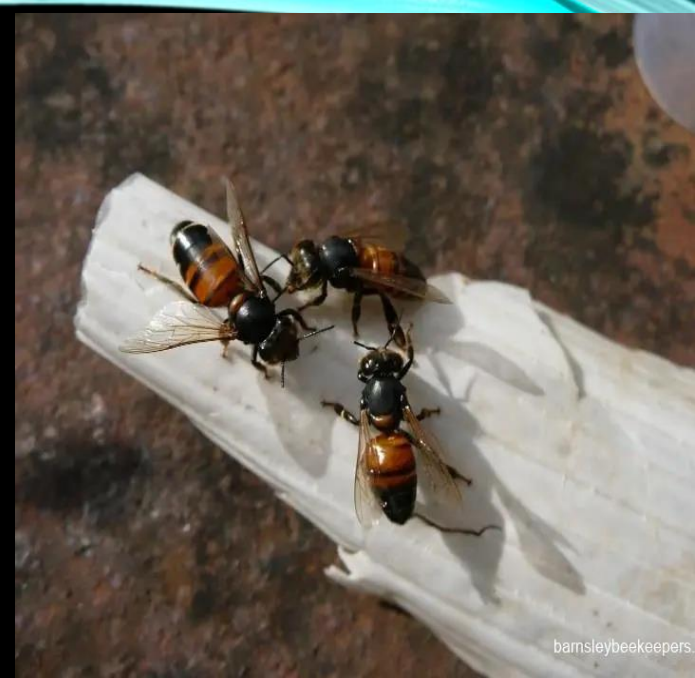
<http://scientificbeekeeping.co.uk/DWV.html>

WATCH

https://youtu.be/NgKRQbFXsKQ?si=_AmeMqllex9nYwkw3

- **CHRONIC BEE PARALYSIS (CBPV)**
- Severe infectious disease of the adult honey bee
- Caused by the RNA* single-strand Chronic Bee Paralysis Virus
- Widespread in Asia, Europe and the Americas
- Causes very heavy losses of adult honey bees
- Characterised by piles of dead and dying bees on the ground outside and on hive floor

* Ribonucleic acid. Some viruses like Covid-19 use RNA as their genetic material rather than DNA



Typically presents in two distinct syndromes, which can occur simultaneously in the same colony:

Type 1 (Trembling & Paralysis):

Abnormal trembling or shivering of wings and bodies.

Bees found crawling on the ground or up grass stems, unable to fly

Bloated abdomens (due to a fluid-filled honey sac) and partially spread "dislocated" wings.

Don't react to smoke

Type 2 (Hairless Black):

Bees appear smaller, darker, hairless and shiny

loss of abdominal hairs often caused by healthy bees nibbling at the infected ones

Can fly in early stages

Rejected by the guard bees when trying to re-enter the hive (Black robber disease)

Sign 1

Shivering

Crawling on top bars

Bloated abdomens

Unable to fly

Don't react to smoke

Dead bees on ground and hive floor

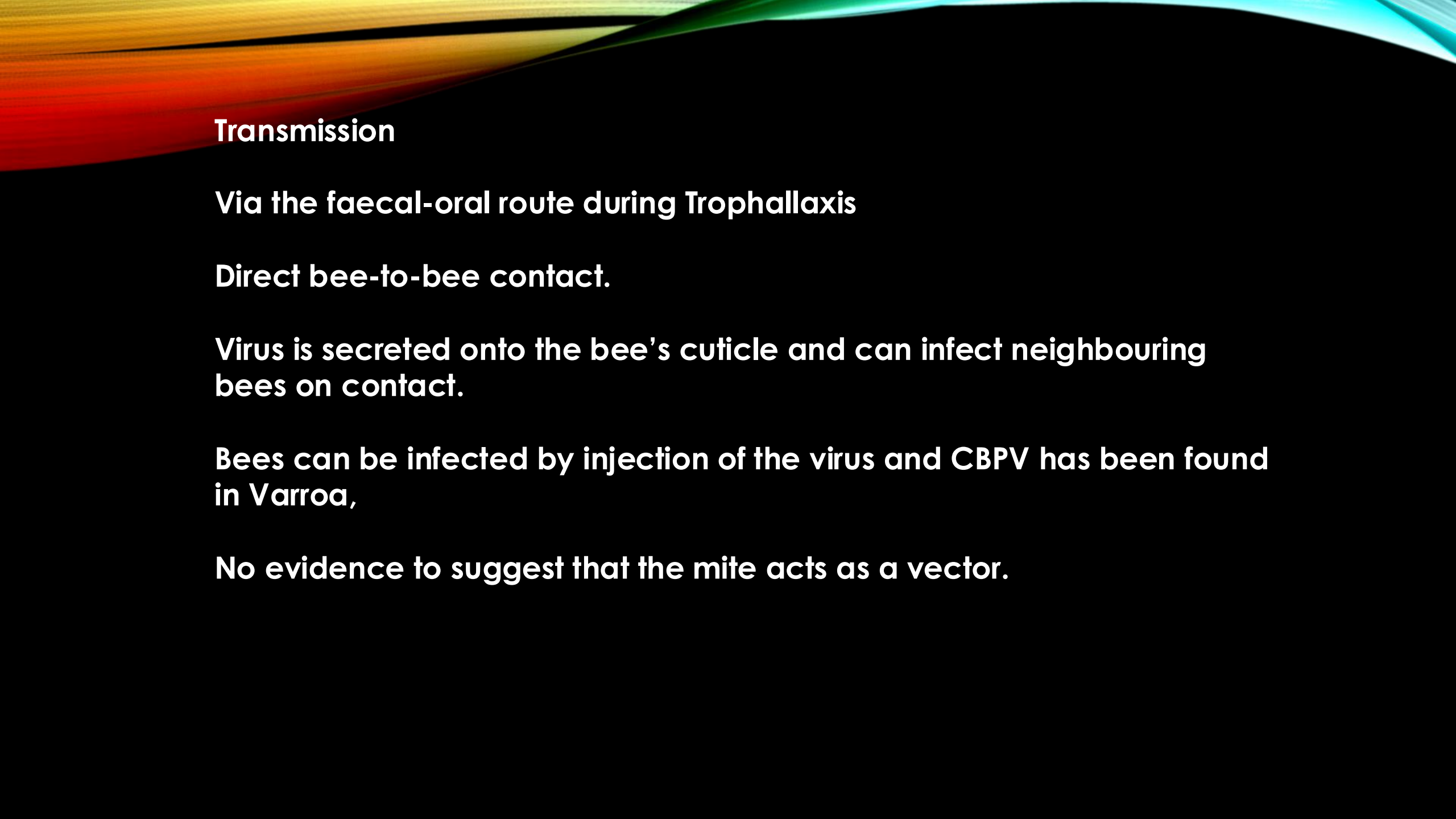
Occasionally poo stains on brood box



- **Signs 2**

- **Black shiny hairless bodies - nibbling and rubbing**
- **Can fly in early stages**
- **Fighting with guard bees**
- **Black robber disease**
- **Dead bees on ground and floor**
- **Queen superseded**





Transmission

Via the faecal-oral route during Trophallaxis

Direct bee-to-bee contact.

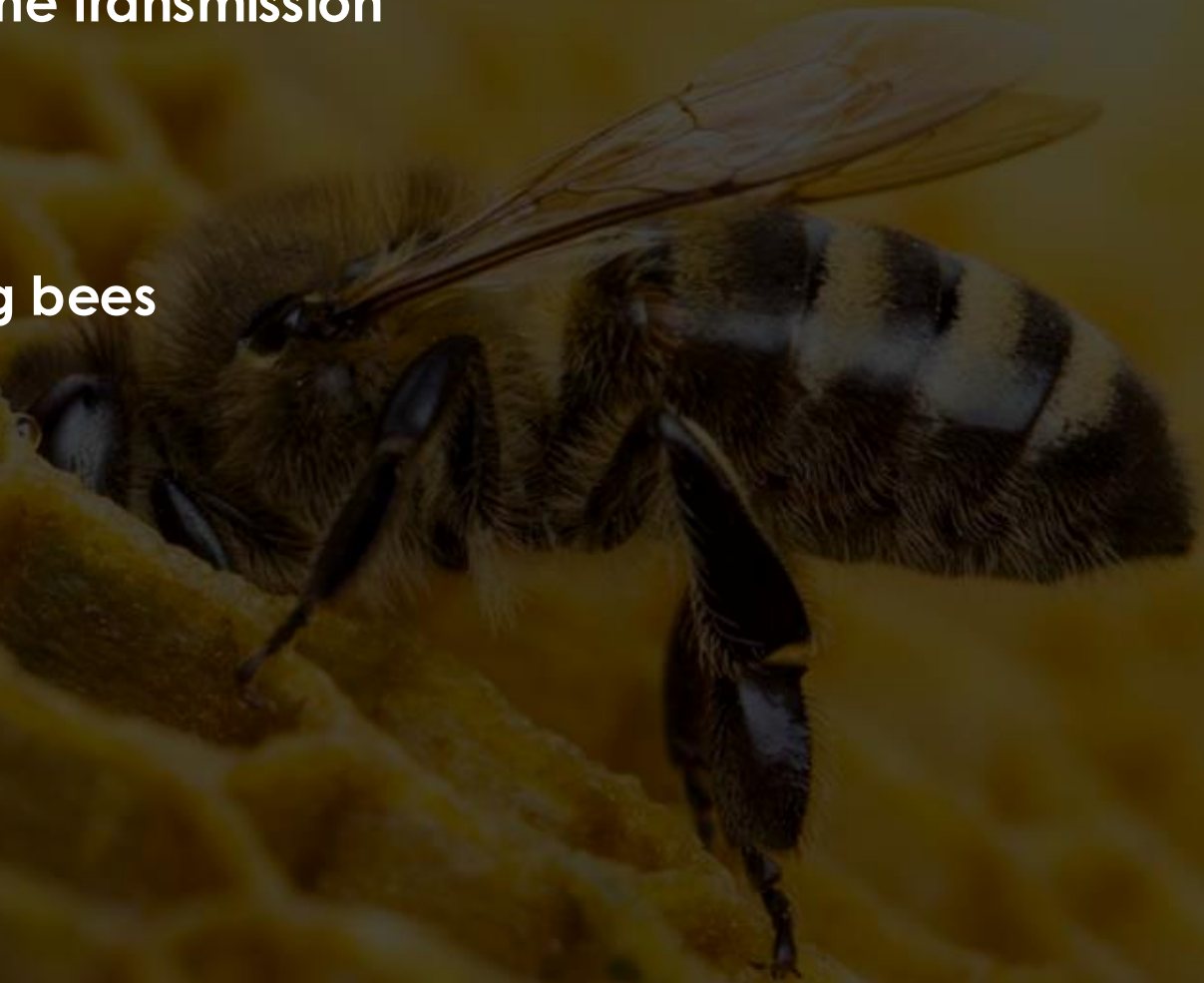
Virus is secreted onto the bee's cuticle and can infect neighbouring bees on contact.

Bees can be infected by injection of the virus and CBPV has been found in Varroa,

No evidence to suggest that the mite acts as a vector.

Management

- Crowded conditions exacerbate the transmission
- Give more space
- Remove and burn dead and dying bees
- Remove poillen traps
- Feed pollen
- Check queen is laying



CHRONIC BEE PARALYSIS SUMMARY

Highly infectious, deadly virus disease affecting the brain and nervous system.

Dead bees still transmit the virus.

Two types often found together.

Strong overcrowded colonies.

Can be in remission

Comes back at a later date

Euthanasia is probably the best option, but decision is agonising



Any questions?

Brood diseases



BROOD DISEASES

American Foulbrood (AFB)

European Foulbrood (EFB)

Sacbrood

Chalkbrood



American foul brood

- *Paenibacillus larvae*

AFB field diagnosis - signs

- **AFB – A for After the cell has been capped**
- **Pepperpot brood pattern**
- **Dark, sunken greasy-looking cappings**
- **Contents pull out into a rope – clear diagnosis**
- **Dead larva dries into hard, dark scales in base of cell that bees cannot remove**
- **Heavily infected with spores**
- **Spores can last up to 50 years**
- **Bee Inspector might carry out LFT and send sample to lab for analysis.**

- Healthy cappings are biscuit-coloured

- Cappings become sunken, greasy and dark

Developing brood inside dies

- Adult bees nibble holes to try to remove infected larvae

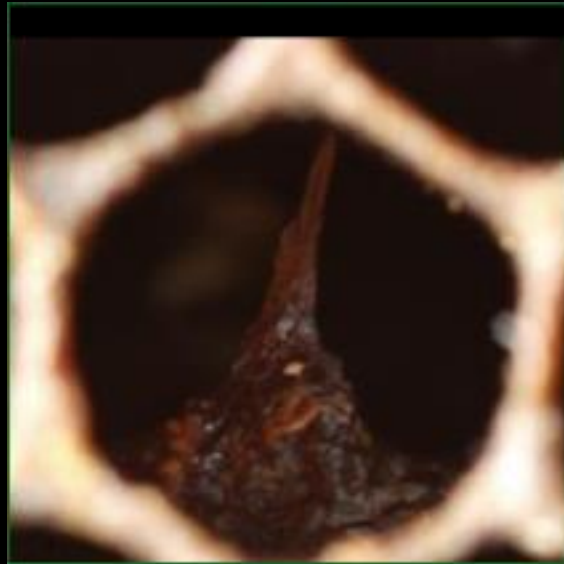


Remains light to dark brown in colour

Matchstick in dark slimy looking capping

Remains pull out into a dark, mucus-like rope 10-30mm long

Dark scale in base of cell



What should I do if I suspect Foulbrood ?

- **Contact the NBU immediately by emailing: NBU@apha.gov.uk or calling: 0300 303 0094.**
- **Or contact your local Seasonal or Regional Bee Inspector.**
- **Self impose standstill on your apiary and don't move any equipment or bees until it has been inspected by an inspector.**
- **Do not move any bees to or from the colony. Disinfect all equipment that may have come into contact with the suspect colony.**
- **Reduce the entrance on the suspect colony.**
- **If possible, take photos of the suspicious cells to show the Bee Inspector.**
- **Destroy gloves**
- **Sterilize hive tool and all other equipment**
- **Wash beesuit in strong soda crystals and bleach solution**

Actions by Bee Inspector

- **Impose immediate standfast order**
- **Primary confirmation of diagnosis with rope test**
- **Lateral Flow Test**
- **Samples taken and sent to Fera Science Ltd for official confirmation**
- **Burn and bury all the infected hive and contents**
- **Inspect stored equipment**
- **Will issue certificate of proof if requested for insurance claim from BDI**
- **Return min 6 weeks**

Prognosis

- At present incurable due to high resilience of spores
- Only treatment is total destruction of all stock and equipment
- Close attention to biosecurity – quarantine

The background is a close-up photograph of a honeycomb. The hexagonal cells are filled with a mixture of dark, almost black, and lighter, yellowish-brown substances. Some cells contain small, white, circular marks, which are likely pupae or eggs affected by the disease. The overall texture is granular and uneven. Overlaid on the image are several semi-transparent, wavy bands of color: a red band at the top left, a green band at the bottom right, and a blue band at the bottom right. The text "EUROPEAN FOULBROOD (EFB)" is centered in the middle of the image in a white, bold, sans-serif font.

EUROPEAN FOULBROOD (EFB)

European foulbrood - causative organism

- *Melissococcus plutonius*
- Gram positive bacterium
- Some strains more virulent than others
- Causes death by starvation
- Parasite not pathogen

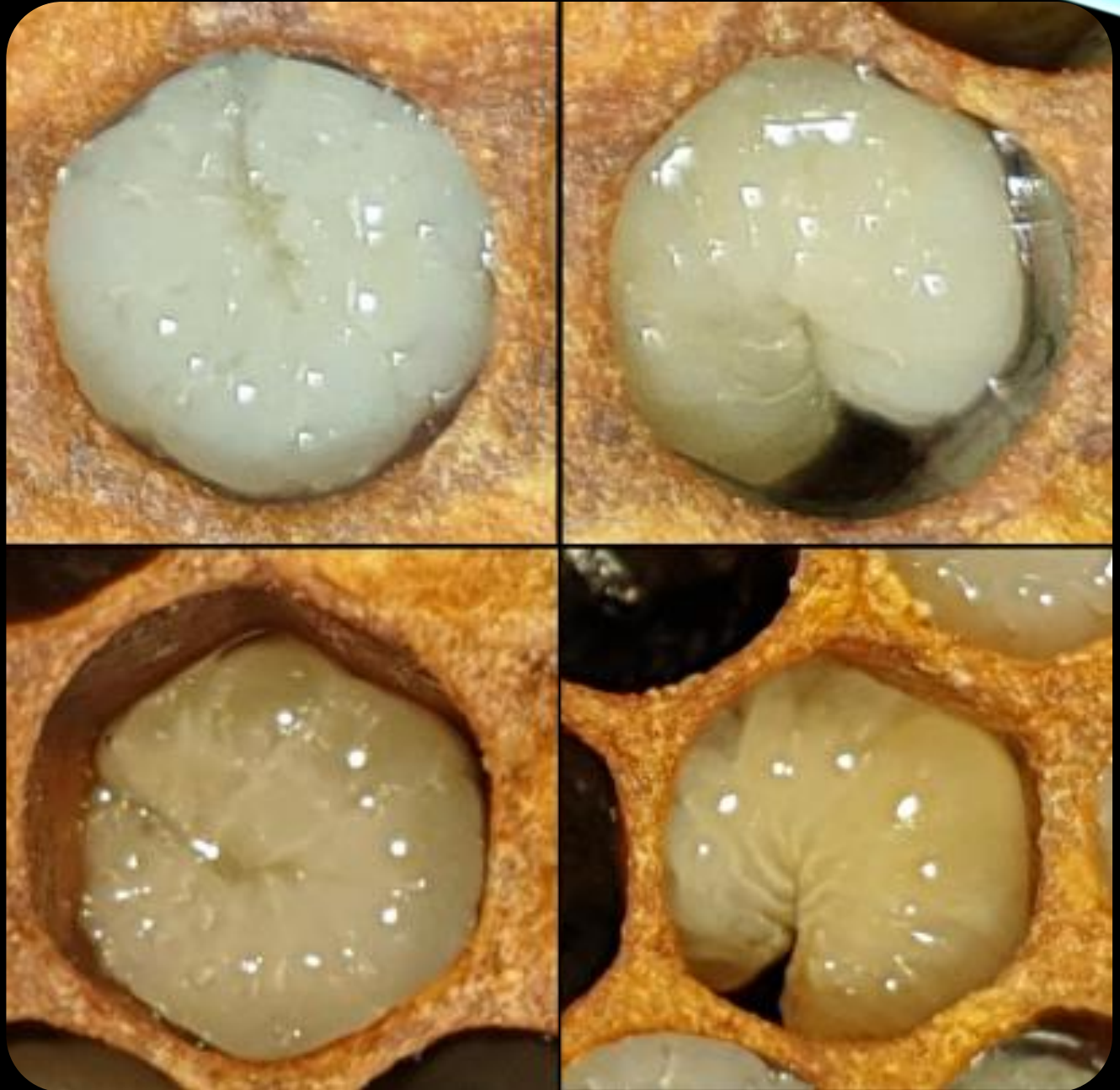


EFB - Signs

- E for early – signs occur before the cell is capped
- Scattered brood pattern where house bees have cleaned out infected cells
- Younger larvae die and become transparent losing their segmentation
- Lying uncomfortably in their cells
- Older larvae twist and become transparent
- Larva turns yellow with white lines visible through the skin
- Larva dries into a loose brown scale that the bees can easily remove

**EFB infected larvae sit
uncomfortably in cells**

**May become twisted
and look melted down**



- Gut of infected larva visible through body wall,
- Creamy colour from mass of bacteria inside.
- Nearby larvae look yellow and not sitting neatly in cell.



Larva gut fills with mass of bacteria.

Mass expands and takes over most of the gut



Dead larvae dry out into brown
rubbery scale.

Bees remove scales –
become contaminated

heavy infection brood pattern patchy



Development of disease

if there's not enough food for larva and bacteria

- **Infected larva dies of starvation**
- **Bacteria remain in dead larva**
- **Dead larva removed from colony by the house bees who become infected**
- **Level of infection in the colony appears to have reduced**
- **BUT:**
- **EFB has not disappeared**



If there is a plentiful food supply

- The infected larva survives
- May only have received a small amount of bacteria
- There may enough food for both the larva and the bacteria to survive together
- Larva pupates and at the fifth moult the gut opens and the pupa defecates
- The new bee emerges and is heavily infected
- Comb contaminated with millions of infective bacteria in the faeces
- House bees clean cell are contaminated and spread the bacteria
- Perversely, larvae that survive perpetuate the disease in the colony
- Bacteria can live in comb for up to 5 years

Actions by beekeeper

- Stop inspection immediately
- Take photo
- Ring Bee Inspector
- Close entrance to one beespace until dusk then close altogether
- Put apiary in quarantine until Bee Inspector arrives
- Sterilize all equipment used
- Destroy gloves
- Wash beesuit in solution of soda crystals and bleach
- Wash boots in same

Actions by bee inspector

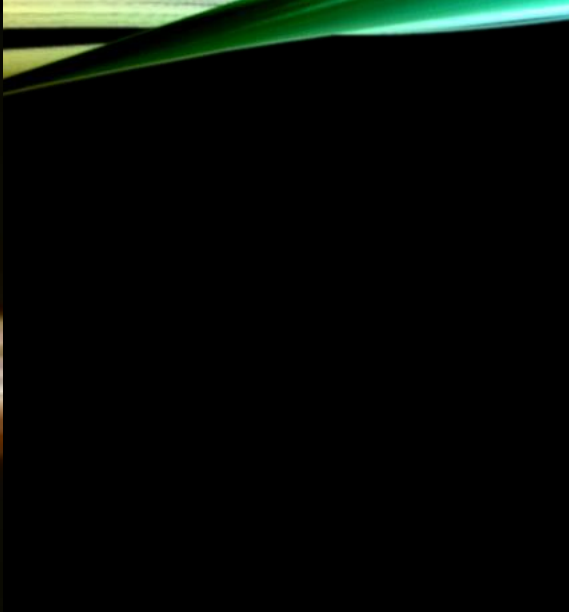
- Carry out LFT
- Take sample for lab analysis
- Order immediate stand still
- Options depending on severity of infection:
 - Change all comb by shook swarm in all the hives or
 - Burn hive and contents and bury 1 metre.
 - Inspect all other hives and apiaries
 - Inspect stored equipment
 - Return minimum 6 weeks later
 - Movement licence *MAY* be granted to allow extraction of honey in exceptional circumstances

SACBROOD

- Causative organism: Sacbrood virus
- Not usually a serious problem but in some cases can lead to death of colony
- Used to be called pickled brood
- Has existed in honey bees for a very long time
- Infected with sacbrood fail to pupate and die just after capping
-

WHAT TO LOOK FOR

- Body wall thickens and the larva can easily be removed from the cell intact
- Bees will uncap the cells and attempt to remove the diseased larvae.
- Common to find uncapped cells containing dead larvae
- In capped cells where the larva has died cappings will be punctured by the bees.
- Larvae upturned in their cells – typical Chinese slipper shape
- Turn yellow during the first stages of decomposition
- Skin toughens and the sac becomes filled with fluid
- Later stages of decomposition, the larval remains begin to dry out
- Final stage of decomposition larva rots down into a dry, dark scale
- If you rupture the sac you will find the contents to be a granular, brownish liquid





SACBROOD PREVENTION AND TREATMENT

Usually well-managed by the bees

Does not normally lead to serious colony losses.

Good hygiene on the part of the beekeeper will help prevent spread

Colonies with persistent infections may benefit from requeening with less-susceptible stock

Honey and frames from an infected colony should not be transferred to other colonies.

No treatment for viruses

Experiments with antivirals not been fully field tested

CHALK BROOD

Causative organism : *Acosphaera apis*

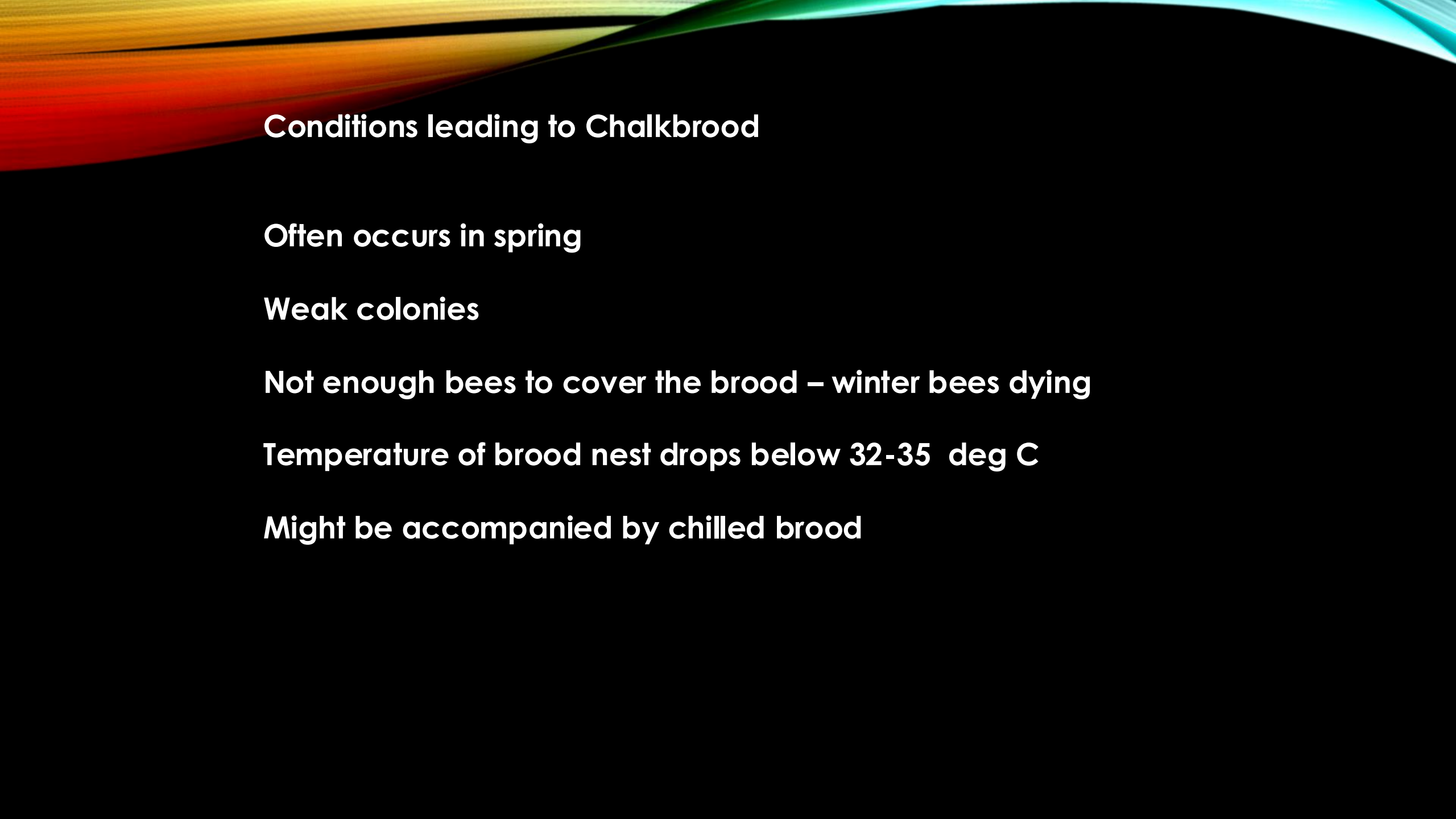
Fungus disease of developing brood

Characterized by:

- Spongy white larvae
- Dried, hard white larvae in uncapped cells
- Hard, chalk-like 'mummies' on hive floor or ground outside
- One of 3 most prevalent diseases in Britain

CHALK BROOD





Conditions leading to Chalkbrood

Often occurs in spring

Weak colonies

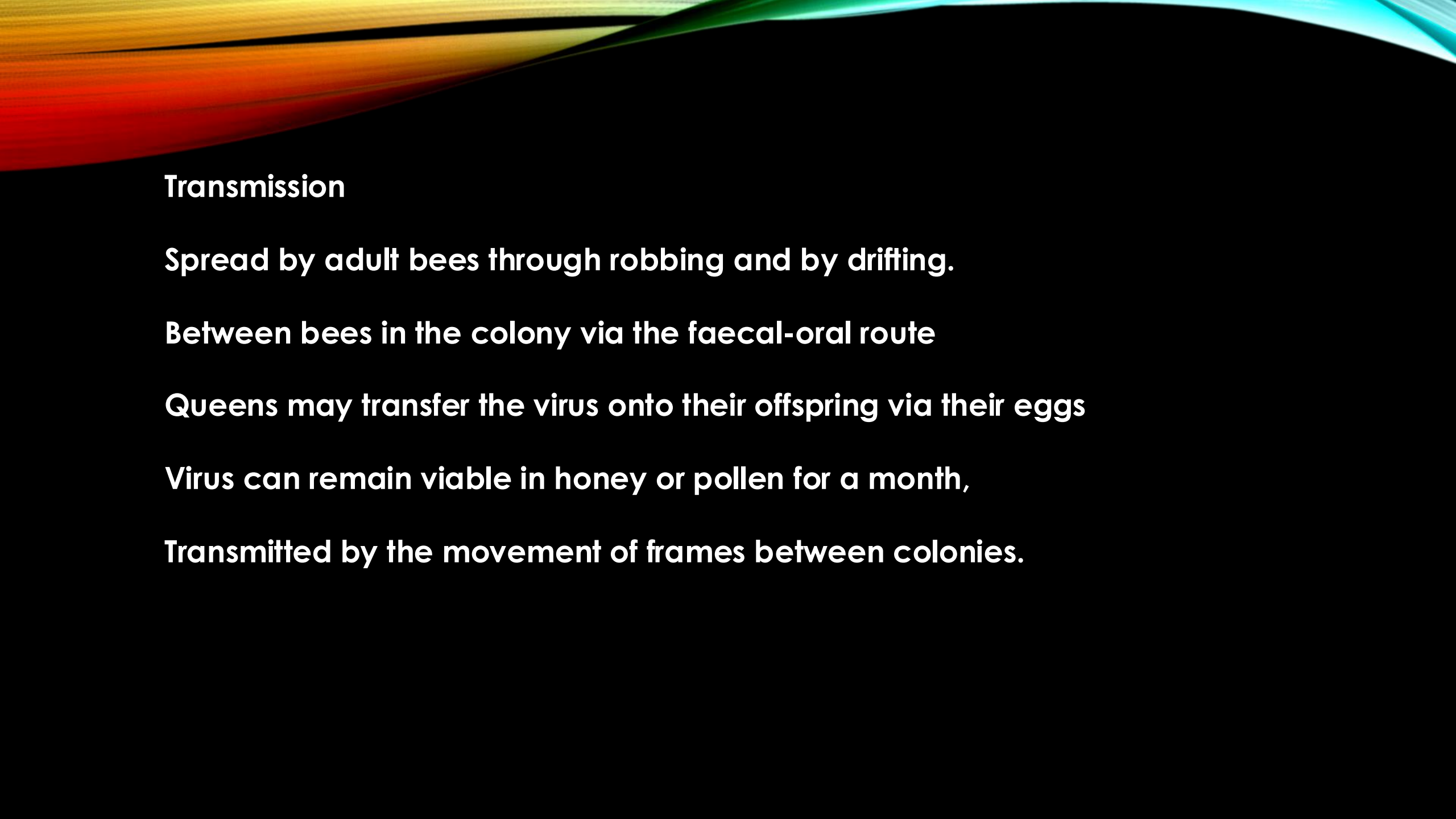
Not enough bees to cover the brood – winter bees dying

Temperature of brood nest drops below 32-35 deg C

Might be accompanied by chilled brood

PREVENTION AND TREATMENT FOR CHALKBROOD

- Good apiary hygiene
- Replacing storage and brood combs regularly
- Keeping hives well-ventilated and dry
- Not transferring material between colonies if infection is present.
- Some strains of honey bee are naturally more resistant to chalkbrood than others.
- For recurring chalkbrood re-queen the colony from a more hygienic stock.
- Some have a genetic trait called social fever – the bees raise the temperature to the point where the chalkbrood infection cannot live.



Transmission

Spread by adult bees through robbing and by drifting.

Between bees in the colony via the faecal-oral route

Queens may transfer the virus onto their offspring via their eggs

Virus can remain viable in honey or pollen for a month,

Transmitted by the movement of frames between colonies.

TROPILAEAPS

- *Tropilaelaps mercedesae*

A notifiable pest



TROPILAEAPS

- Evolved as parasite of giant honey bees *Apis dorsata* & *A. laboriosa*
- Transited to *A. mellifera* in Asia
- Widespread in South-east Asia
- Confirmed in Georgia and SW Russia
- War in Ukraine ?



Tropilaelaps Morphology

- **Size** 1 mm long x 0.6 mm wide
- **Colour:** light reddish-brown
- **Shape:** Elongated
- **Legs:** 4 pairs.
- **First pair pf legs** vertically aligned and modified into antennae-like sensory appendages
- **Mouthparts** that tear when feeding



TROPILAEAPS -V- VARROA



Tropi Look a-likes

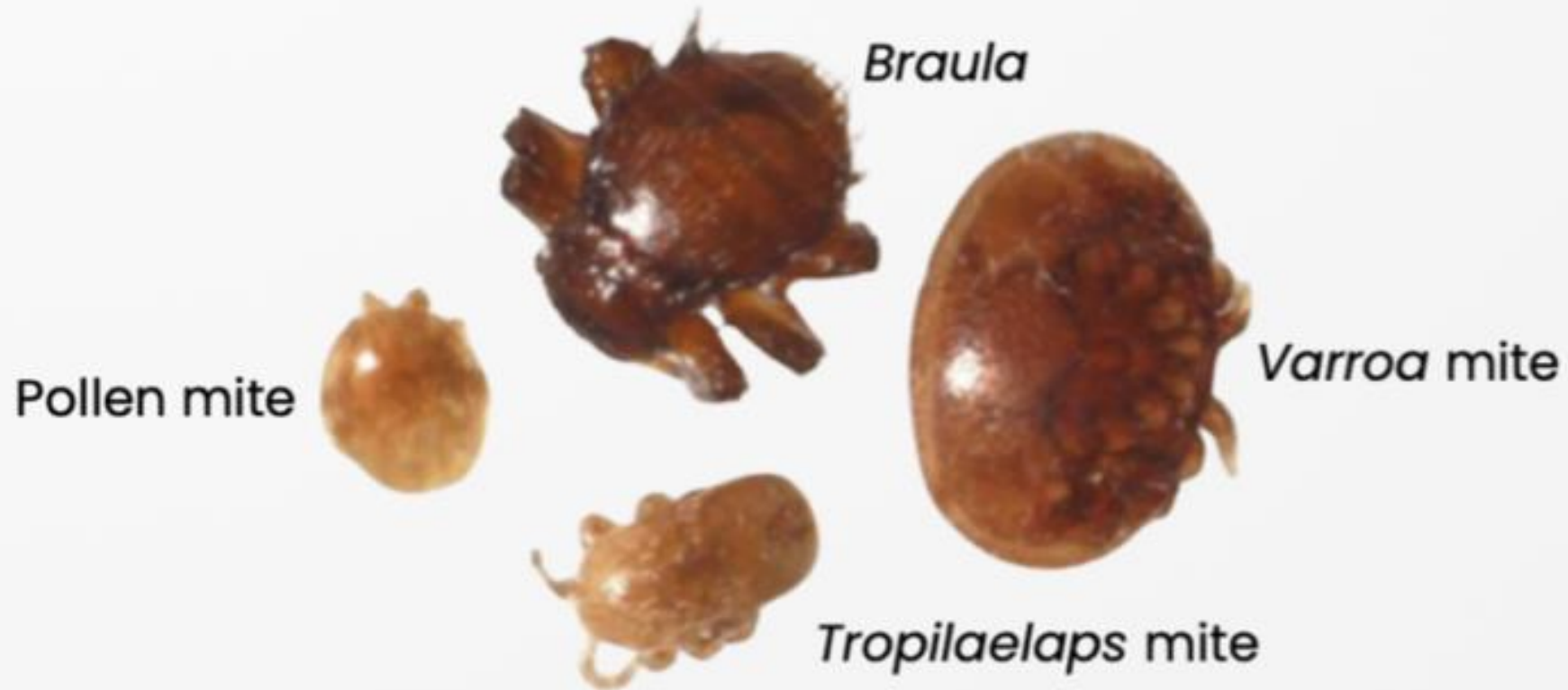


Photo by AHPA Bee Unit York. UK Crown Copyright.
OIE Terrestrial Manual 2018.

LIFE CYCLE

- **Day 8** After queen lays egg, mite enters cell
 - **Day 10** First trop egg laid and hatches
 - **Day 11** Second egg laid and hatches
 - **Day 12** Third egg laid and hatches
 - **Day 13** Fourth egg laid and hatches
 - **Day 16** First mite matures
 - **Day 17** Second mite matures
 - **Day 18** Third mite matures
 - **Day 19** Fourth mite matures
 - **Day 21** Worker bee emerges with Mother + 4 offspring
-
- **Cf Varroa** - only produces average 2.6

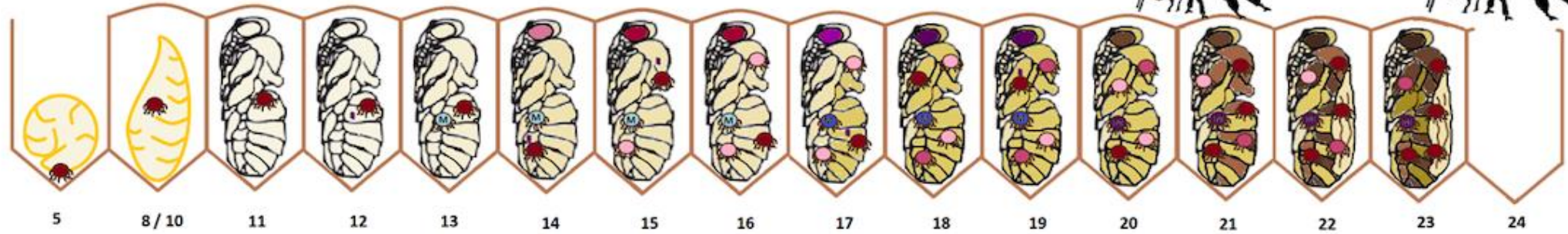


Varroa

Viable mites produced

= 1.6

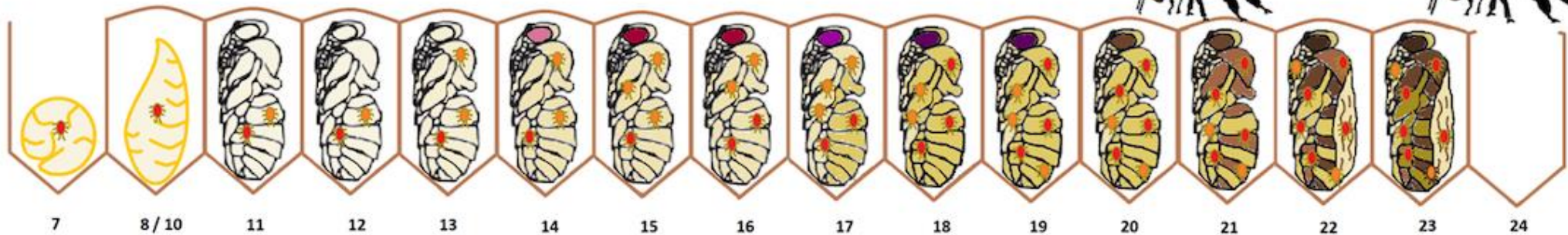
= 2.6



= 3

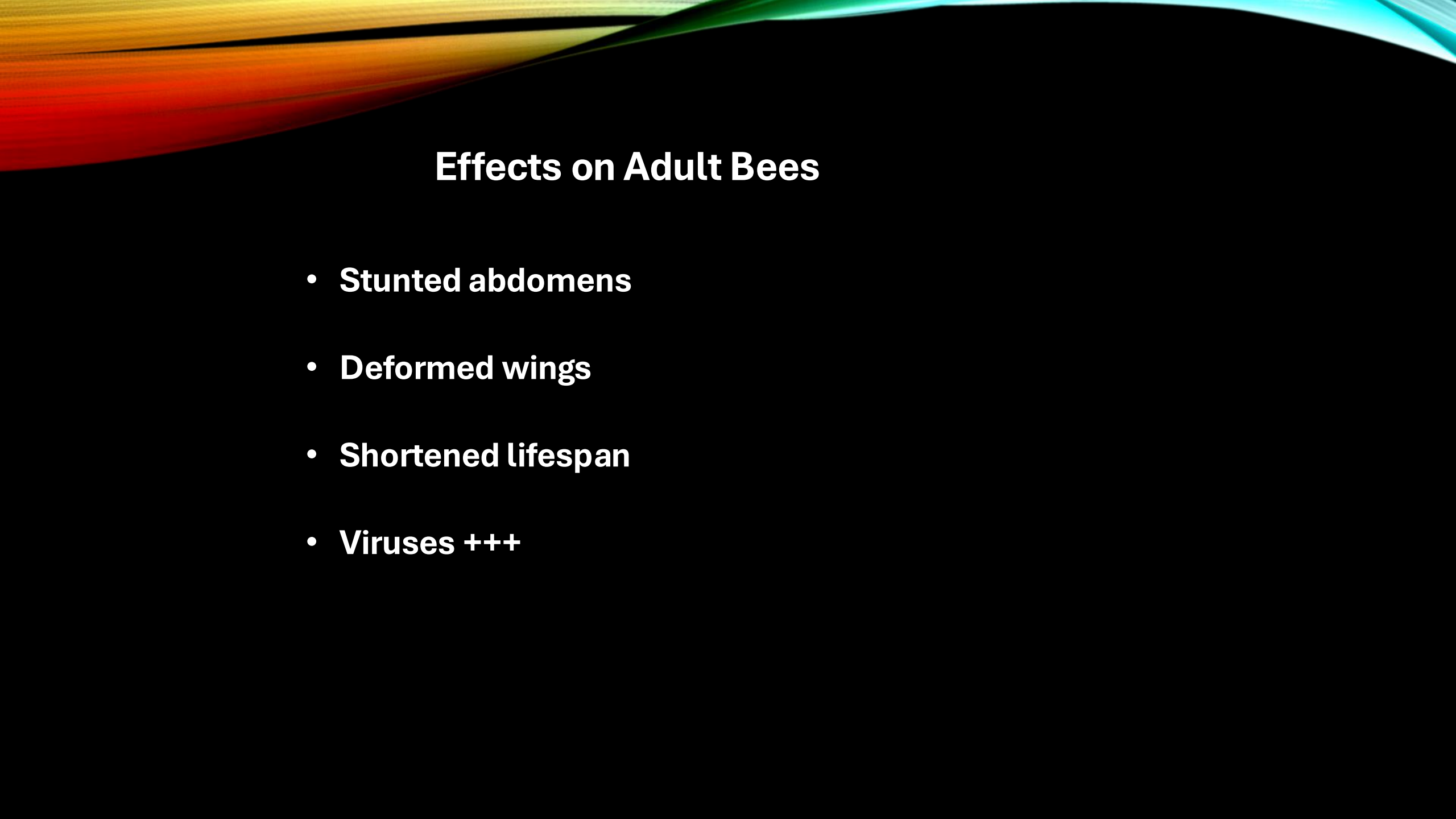
= 4.5

Tropilaelaps spp.



Effects on larva/prepupa/pupa

- Feed on uncapped and capped larvae
- Inflict numerous tear wounds
- Usually fatal to brood
- Survivors smaller and with shorter lifespan
- Vector numerous viruses incl:
 - DWV
 - CBPV
 - ABPV
 - BQCV
 - SBV – Sacbrood Virus
 - CSBV – Chinese Sacbrood Virus



Effects on Adult Bees

- **Stunted abdomens**
- **Deformed wings**
- **Shortened lifespan**
- **Viruses +++**

FURTHER INFORMATION

https://youtu.be/pxtHOhtIXQI?si=1R4Pym_qf1s2K6d

-

Any questions?



CASE STUDY – HONEY PRODUCING COLONY n° FH8

2023

- Normal spring build-up
- April – varroa test alcohol wash >1%
- April – new queen n°7/22
- May - 2 supers of spring honey extracted
- Mid June had 7 frames of brood 10 seams of bees and 2 supers
- Noticed dead bees on ground



Moved to isolated position

Removed and burnt all dead and dying bees

New clean floor

Empty super to keep unaffected bees separate from dead

New frames of drawn comb checkerboarded with older frames

Feeder thin syrup and pollen supplement

Colony appeared to recover

©24kg honey not extracted, left for bees



2024

April –tested for varroa - >1%

May- Bailey comb change

July - tested for varroa - 3%

Removed 4 supers for extraction, left 1 for bees

Treated for varroa Formic Pro

September- tested for nosema – negative

September- stimulative feeding for queen to lay winter bees

30 September – 7 seams of bees + 4 frames brood + 4 frames capped stores + 1 full super

7 December - treated for varroa – Oxalic Acid by GasVap



2025

April - Slow spring build-up

Varroa test by C02 >1%

Nosema test negative

May – bees fighting at entrance

Dead bees on ground

Bees in brood box shivering

No queen

Single supersedure cell

- DECISION POINTS

- Treat as in 2023 and hope it works again
- Risk infecting other colonies by foragers and drones mating
- Euthanize for the greater good of my and other beekeepers' apiaries, and any free-living colonies in the area.

- QUESTION

- What would you do?

-