SVAMPESYGDOMME

Nosemasyge
Kalkyngel
Stenyngel

AARHUS
UNIVERSITET
INSTITUT FOR AGROØKOLOGI

PER KRYGER
SENIORFORSKER

TRE ARTER AF NOSEMA

Nosema apis er den oprindelig art i Europa (Zander 1906)

Nosema ceranae beskrevet i Asien, hos *Apis cerana* (Fries 1996)

Har siden bredt sig til *Apis mellifera* til næsten hele verden

Store tab i Spanien, men ellers ligner symptomer *Nosema apis*

Forskellig kuldefølsomhed, præger udbredelse i koldt klima

Nosema neumanni en nye art fra Uganda, biologi ukendt

Navngivet igen som *Nosema*, mens *Vairimorpha apis* og *V. ceranae* er forkastet

Danske bier er ret robuste i forhold til nosemasyge

NOSEMASYGE

Rammer kun voksne bier

Dog kan sporer findes i pupper (*N. ceranae*)

Tarmsygdom der kan udløse diarré

Bugløb er derfor et tegn, mindre almindelig med *N. ceranae*

Bifamiliers forårsudvikling er hæmmet, bier dør i ung alder

Dronninger der svigter

Bugløb se på de næste billeder

Nosema ceranae in European honey bees (*Apis mellifera*) *Nosema ceranae* i europæiske bier (*Apis mellifera*)

Ingemar Fries *

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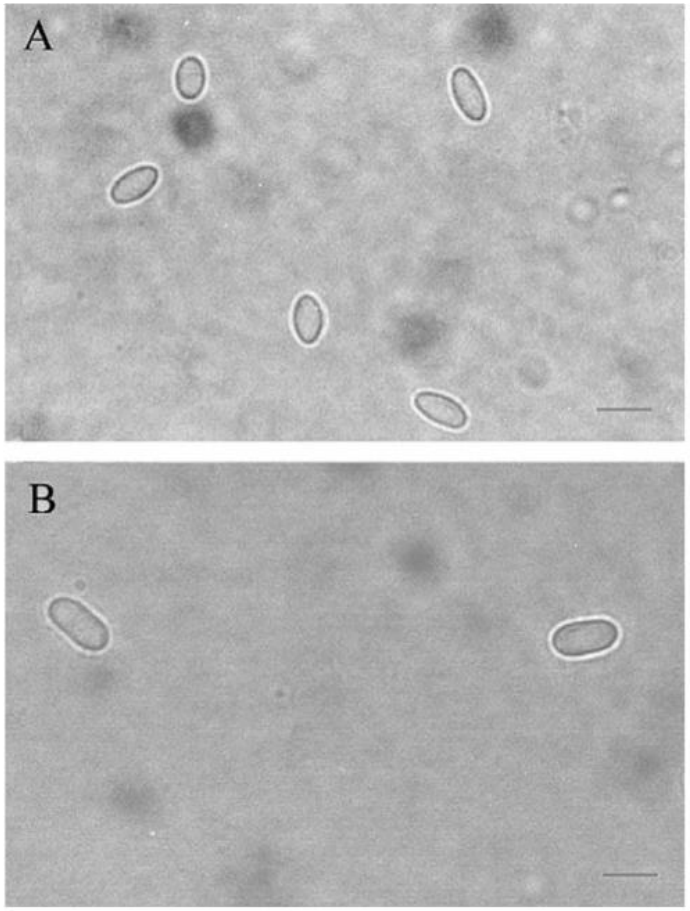

Fig. 1. Spores of *N. ceranae* (A) are distinctly smaller than spores of *N. apis* (B). Nevertheless, they can be hard to distinguish by light microscopy, in particular where mixed infections occur. Bars = 5 µm. (From Fries et al. 2006a).

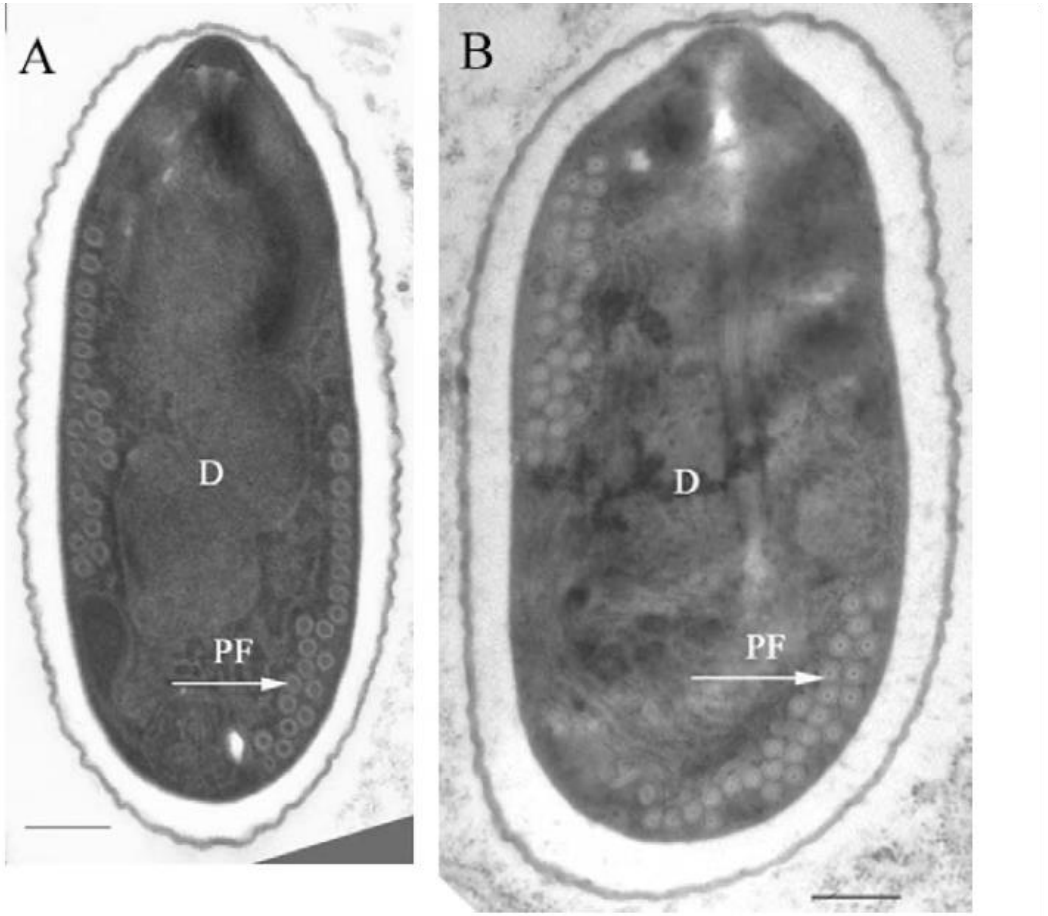

Fig. 2. The internal structures of the diplokaryotic (D) *N. ceranae* (A) and *N. apis* (B) are similar. Notably, *N. ceranae* spores contain fewer polar filamant (PF) coils compared to *N. apis*. Bars = 0.5 µm. (from Fries et al. 2006a).

Nosema ceranae in European honey bees (*Apis mellifera*) *Nosema ceranae* i europæiske bier (*Apis mellifera*)

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En markant forskel mellem
Nosema cenenae og *N. apis*
er evnen til at overleve i
køleskab og fryser.
Nosema ceranae
smitter langt mindre når sporer
har været nedkølet i en uge.

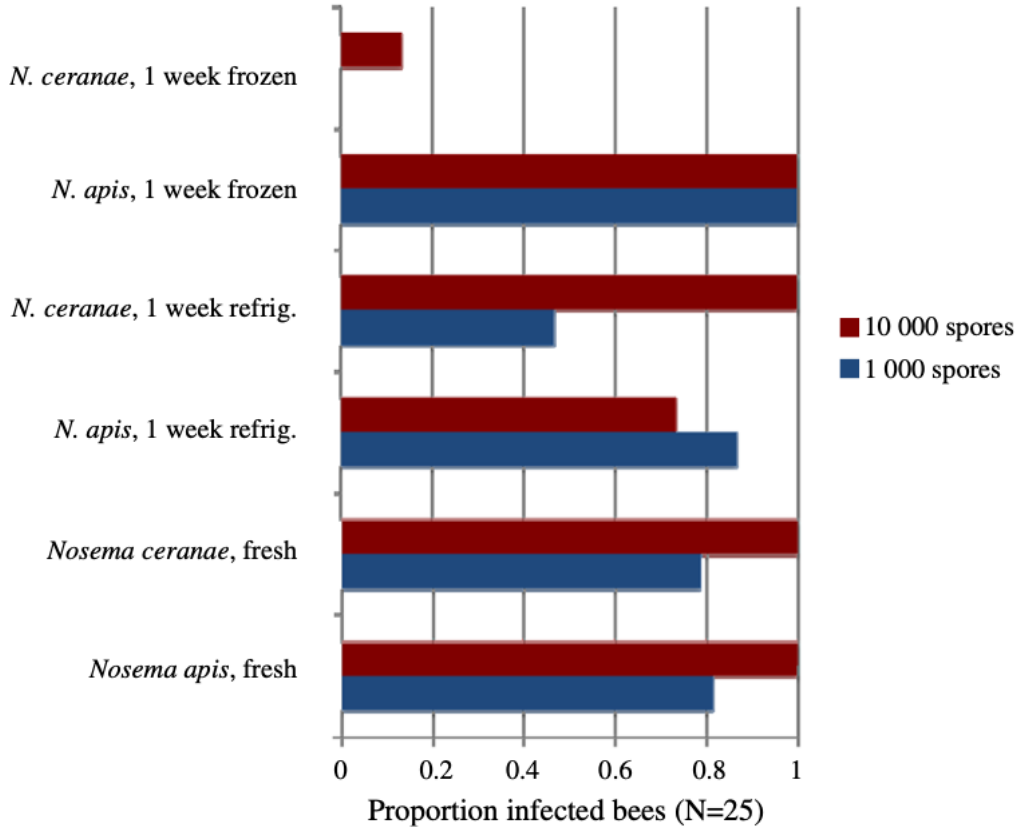

Fig. 3. The effect of freezing on *N. ceranae* spore viability is dramatic. Each bar represents 25 bees individually fed with 10 µl sugar suspension containing 1000 or 10,000 spores of either *N. ceranae* or *N. apis*. Spores were fed from fresh infections (fresh) or (using the same suspension) after one week in a refrigerator at +8 °C (refrig.) or in a deep freezer at −18 °C (frozen). (From Fries and Forsgren, 2009).

SPOREOPFORMERING I TARMEN

Livscyklus af nosema i biernes tarm. De første sporer spire i biens tarm og opformeres i celler i biens epitel. Nye sporer kan smitte flere celler i biens tarm. Sygdom udløses når biens evne til at optage sukker og aminosyre hæmmes.
Ofte føre dette til at spore frigives i stadet, som slikkes op af andre bier.
På bar ni døgn kan en bi dø af nosemasyge.

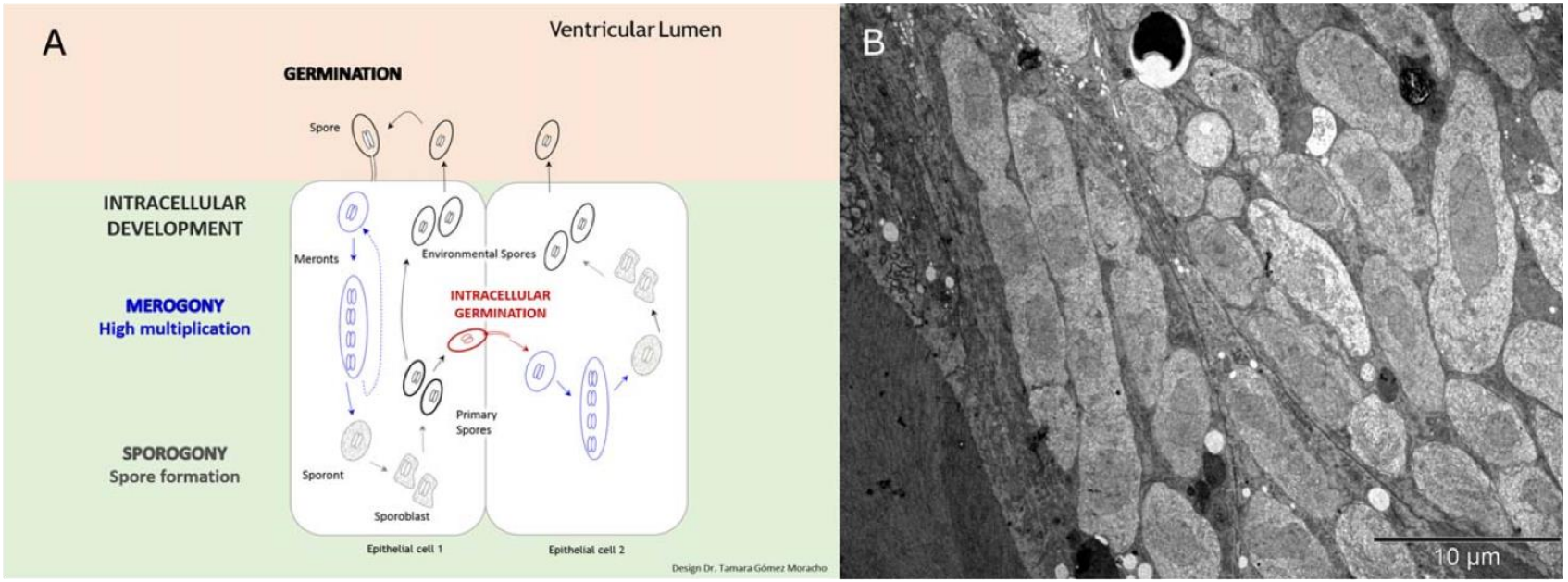

Fig. 1. *Nosema ceranae* and *Nosema apis* life cycle in honey bees. The spores ingested by the bees get to the ventricular lumen. There, spores extrude the polar filament and the sporoplasm is transferred into the epithelial cells. The sporoplasm matures into a Meront and a Merogonic phase starts that comprises binary division of binucleate stages (the number of divisions is still undetermined). Lately, electrondense material is deposited in the outer face of the plasma membrane, which indicates the sporogonial phase. This phase involves the division of the sporonts (*Nosema* spp. have been described as bisporous) and then sporonts and daughter cells mature into spores. The first generation of spores will be primary spores which can re-infect the same cell or infect neighbor cells. The second generation (after secondary meronts) will lead to environmental spores with the spore wall thicker than the primary spores (Huang and Solter, 2013). All parasitic stages develop in direct contact with the host cell cytoplasm and all phases are dyplokariotic.
A. Scheme of the *Nosema* cell-cycle inside the host cell.
B. TEM image taken from a honey bee infected by *N. ceranae*. The ventricular cells can be seen with different parasitic stages.

SYGDOMSFORLØB

Nyklækkede bier er fri for nosema, men kan smittes gennem afføring fra syge bier

Syge bier kan ikke optage næringsstoffer, det fører til diarré, fordi vand fylder tarmen, og klatter i stadet

Sukkerholdige afføring optages af unge bier

Nedsat mobilitet betyder at bierne sviner i eller nær stadet

Nosema overtager styring i biens tarm, og hindre programmeret celledød, en type immunitet der afstøder smittede celler.

Contents lists available at SciVerse ScienceDirect

Journal of Invertebrate Pathology

journal homepage: www.elsevier.com/locate/jip

Overlevelse og immunforsvar hos droner af en Nosema tolerant honningbi[SEP]stamme mod N ceranae infektioner. Det er danske bier.

Survival and immune response of drones of a *Nosemosis* tolerant honey bee strain towards *N. ceranae* infections

Qiang Huang [a,b,*], Per Kryger [c], Yves Le Conte [d], Robin F.A. Moritz [a,e,f]

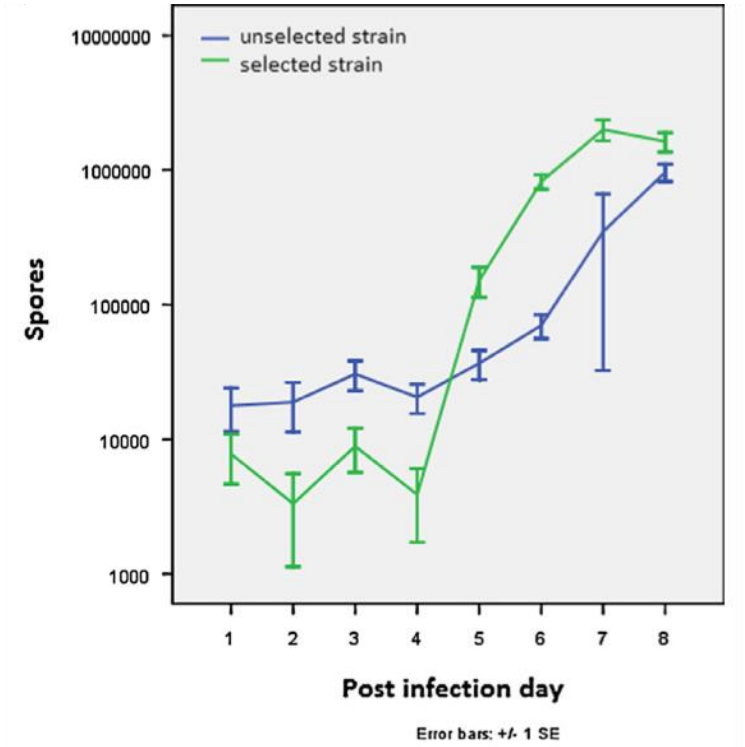

Fig. 1. Increase in *N. ceranae* spore load in the gut of artificially infected drone of the selected and unselected strain. Both strains were fed with the same number of *N. ceranae* spores. From 5 days post infection, the spore multiplication in selected tolerant strain was much higher than in the unselected strain.

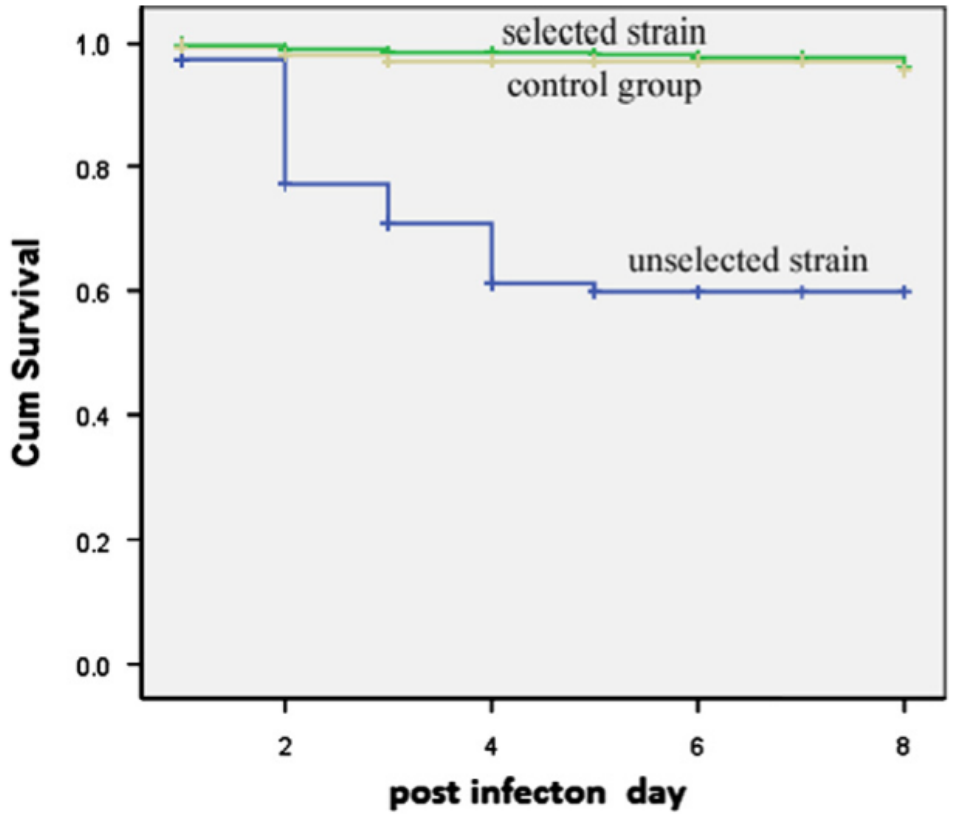

Fig. 2. Time series mortality. Three drones that were sampled every day from each cage. These three drones were treated as sensored in the survival analysis. Drones in the unselected strain had significantly higher mortality (Kaplan–Meier procedure) whereas there was no difference in survival between the uninfected control group and the drones from the selected lineage.

Nosema Tolerant Honeybees (*Apis mellifera*) Escape Parasitic Manipulation of Apoptosis

Nosema tolerant honningbi undslipper parasit manipulation af programmeret celledød

Christoph Kurze[1]*, Yves Le Conte[2], Claudia Dussaubat[2], Silvio Erler[1], Per Kryger[3], Oleg Lewkowski[1], Thomas Müller[4], Miriam Widder[4], Robin F. A. Moritz[1,5,6]

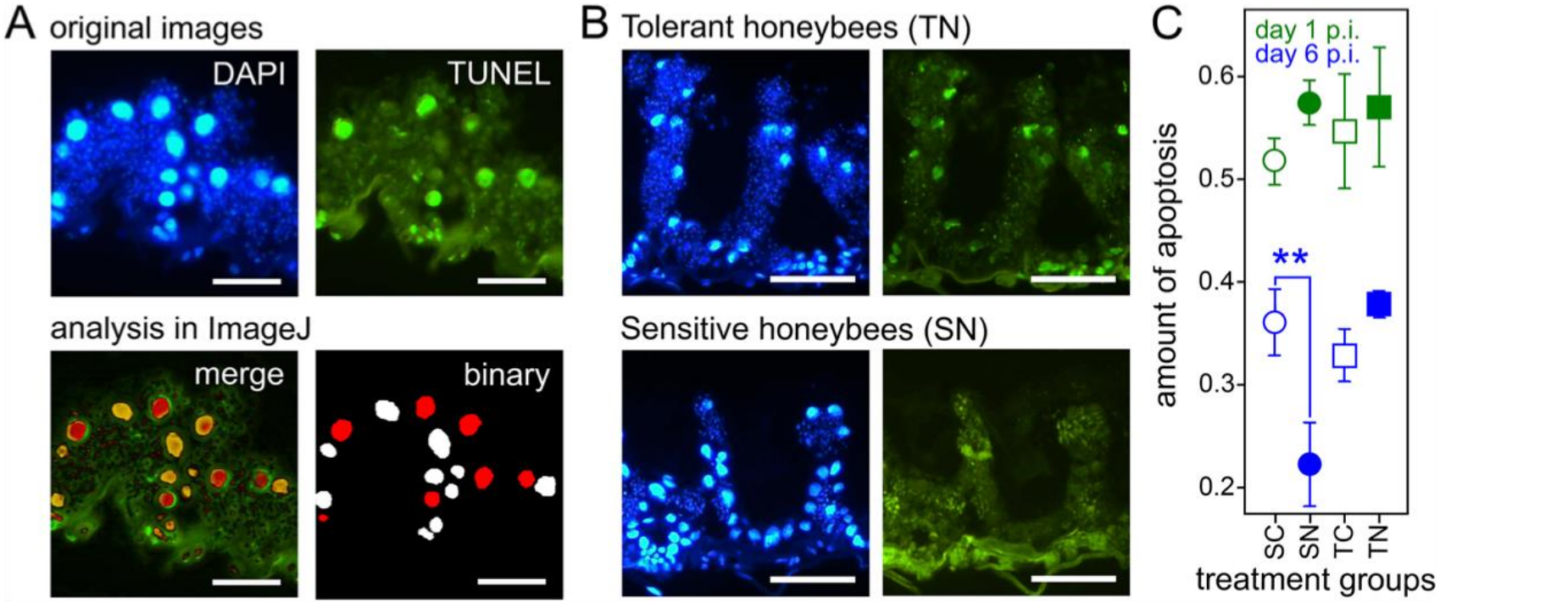

Fig 1. Quantification of apoptosis in the midgut epithelium of honeybees infected with *N. ceranae*. (A) The frequency of apoptotic cells was calculated as the numbers of TUNEL+ve relation to all (DAPI+ve) nuclei. For this, DAPI and TUNEL stained images (top) were merged (bottom left); nuclei were binarised and automatically counted using ImageJ (bottom right; red = TUNEL+ve, white = TUNEL–ve). Scale bars = 25 μm. (B) Comparison of apoptotic TUNEL+ve cells detected in the posterior end of the midgut in *Nosema* infected sensitive and tolerant honeybees on day 6 p.i. Scale bars = 50 μm. (C) Apoptosis ratio (mean ± s.e.) during *Nosema ceranae* infection in *Nosema* sensitive (SN, solid circles) and tolerant (TN, solid squares) honeybees, and their uninfected controls (SC, open circles and TC, open squares) at 1 day (green) and 6 days (blue) after inoculation. Sample sizes are given in S2 Table. Significance between treatment groups **, $P < 0.01$.

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KALKYNGEL

Forårsages af *Ascophaera apis*

Rammer biernes yngel i larvestadiet

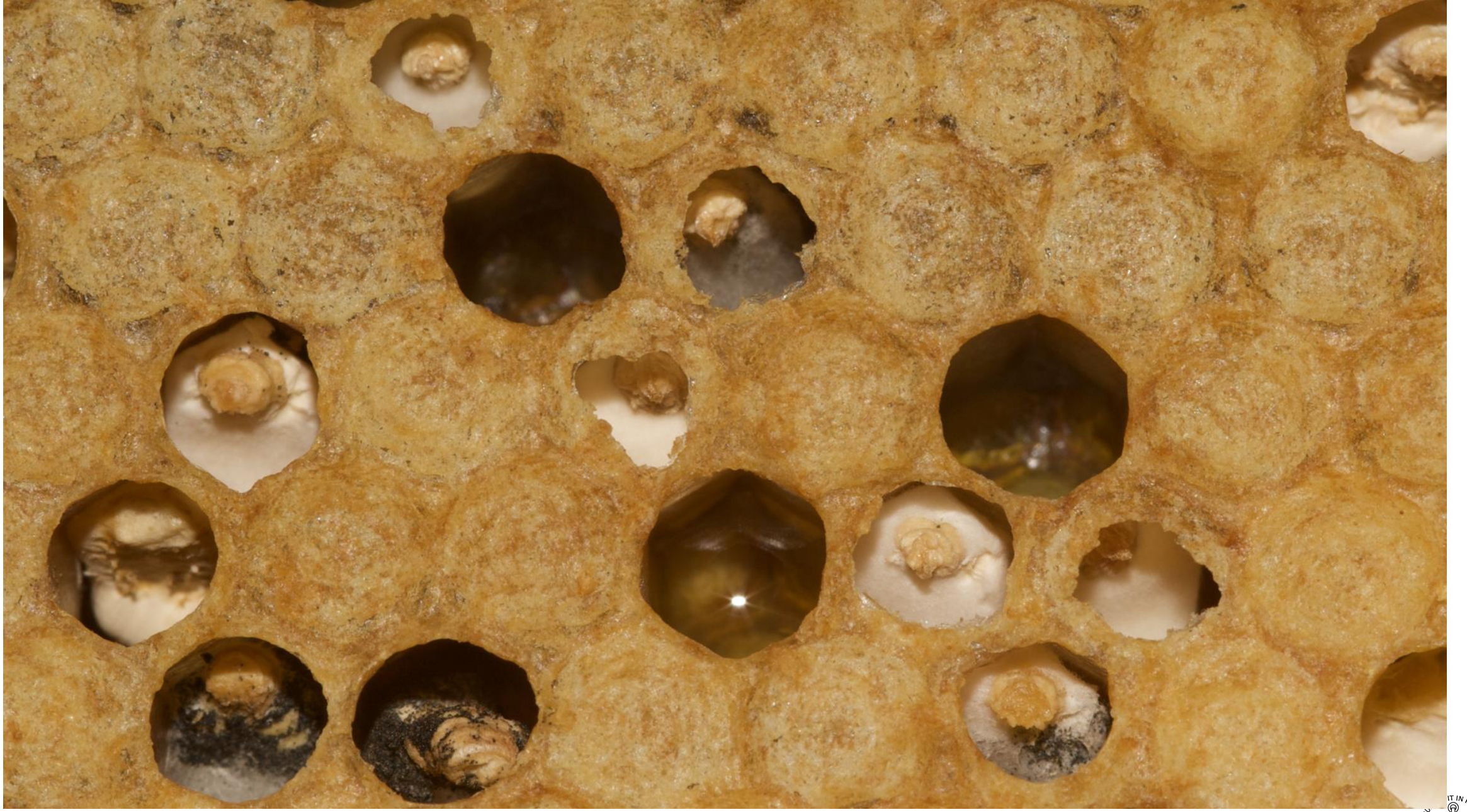
Larver kan dø, men ofte nås puppestadiet

Forseglet yngel dør i cellerne

Bierne fjerner de døde pupper, såkaldte mumier

Sygdommen kan ofte ses uden at åbne stadet


Kalkyngelmumier foran bistade



KALKYNGEL SYMPTOMER

Kalkyngel rammer bier yngel

Ascophaera apis foretrækker honningbier

Karakterisk er de løse mumier, der rasler i tavler

Falder ofte ud når man inspicere tavlen

Bierne har let ved at fjerne kalkyngel mumier

Man kan finder mumierne foran stadet og i bunden

TIDLIGT OG SENT STADIE AF KALKYNGEL

MUMIER

Der er to parringstyper i kalkyngel

Nye sporer dannes kun efter kønnet formering

De sorte mumier spreder nye sporer

Hvide eller gulgrønne mumier har ikke dannet sporer

Sporer af kalkyngel kan overleve mere end 10 år

Sporen spirer i larvens tarm

SPORESÆKKE - ASCOPHAERA

REVIEW ARTICLE

Standard methods for fungal brood disease research

Annette Bruun Jensen[1*], Kathrine Aronstein[2], José Manuel Flores[3], Svjetlana Vojvodic[4], María Alejandra Palacio[5] and Marla Spivak[6]

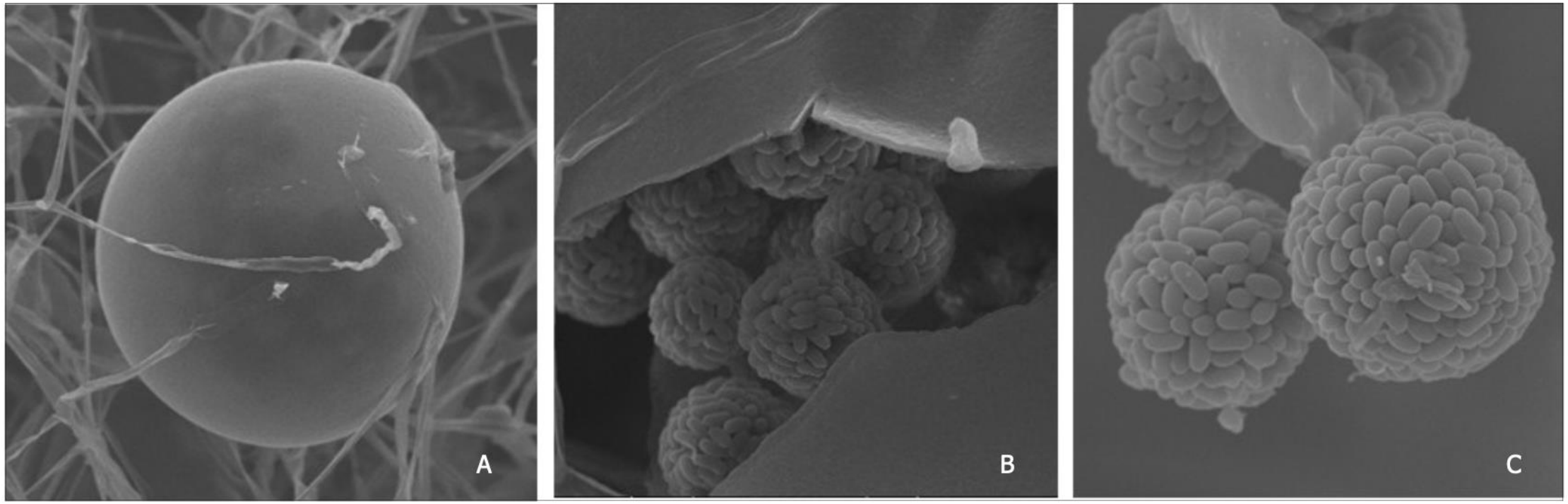


Fig. 3. Scanning electron microscope pictures of *Ascosphaera apis* fruiting body. ***A.*** Spherical fruiting body; ***B.*** Cracked fruiting body with sporeballs; ***C.*** Sporeballs with multiple ascospores.

Photos: J Bresciani and A B Jensen

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Skimmelsvamp

STENYNGEL

Forårsages af *Aspergillus flavus*, *A. niger, A. fumigatus*

Sygdom ikke set i Danmark i mere end 50 år

Det er især kendt fra biernes yngel

Men døde bier med stenyngel symptomer kan forekomme

Svampen er en saprofyt, d.v.s. døde bier angribes

Men produktion af kraftige giftstoffer kan slå ihjel

Ringe undersøgt sygdom hos honningbier


Foto fra http://windowbee.com/stony-mycosis/
Stenyngel symptomer

STENYNGEL SYGDOM

Der er meldepligt!

Det skyldes at stenyngel kan angribe mennesker

Svampen har mange værter eller ofre

Honningbier, mennesker, biavlere, insekter, planter

Svampens gift virker på nervesystemet og kan dræbe

Nogle stoffer er kræftfremkaldende

SYGDOMSFORLØB

Ikke velbeskrevet hos honningbier

Kan smitte gennem larvens hud eller gennem tarmen

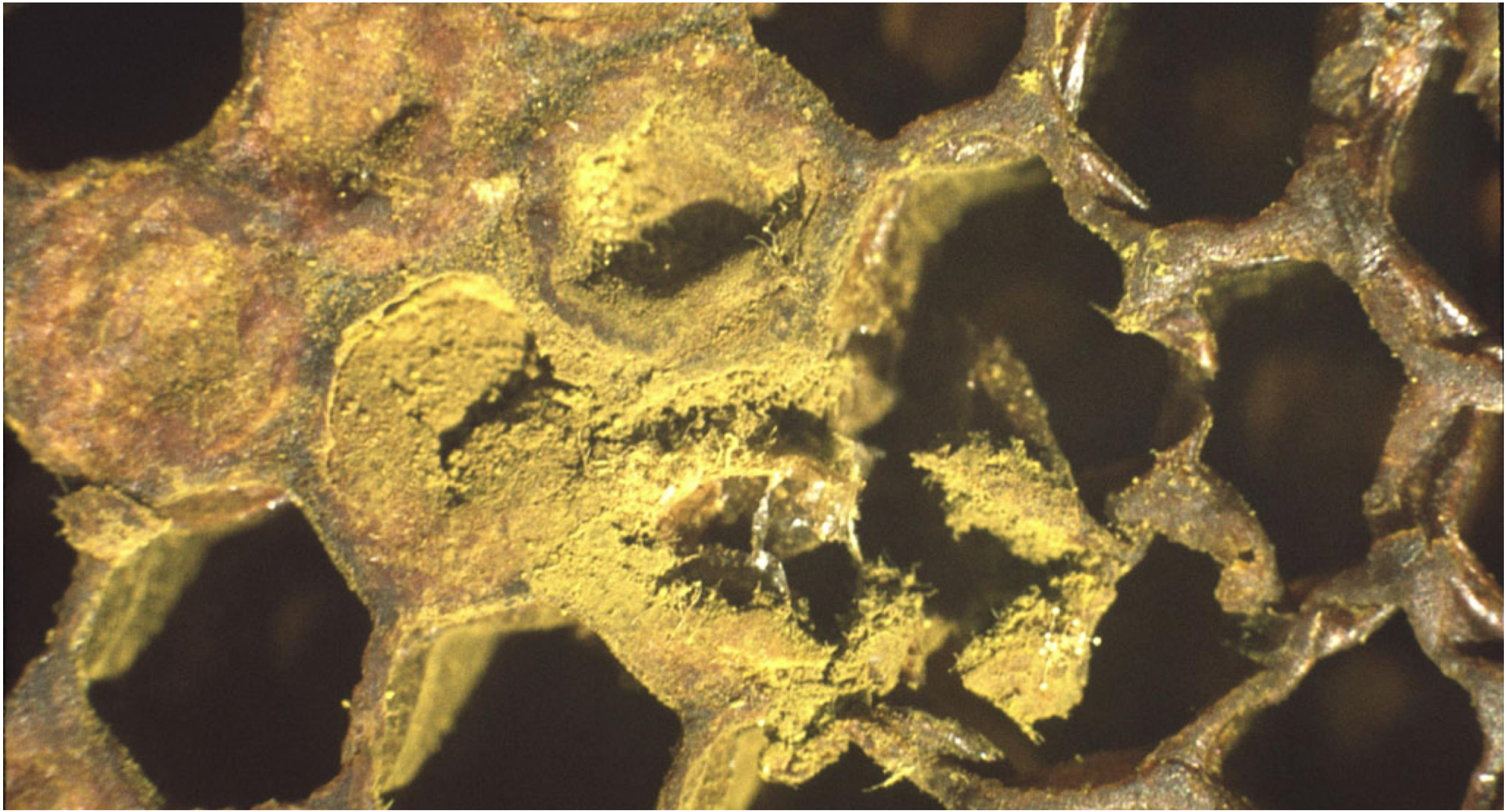
Dræber bilarver med cellegifte

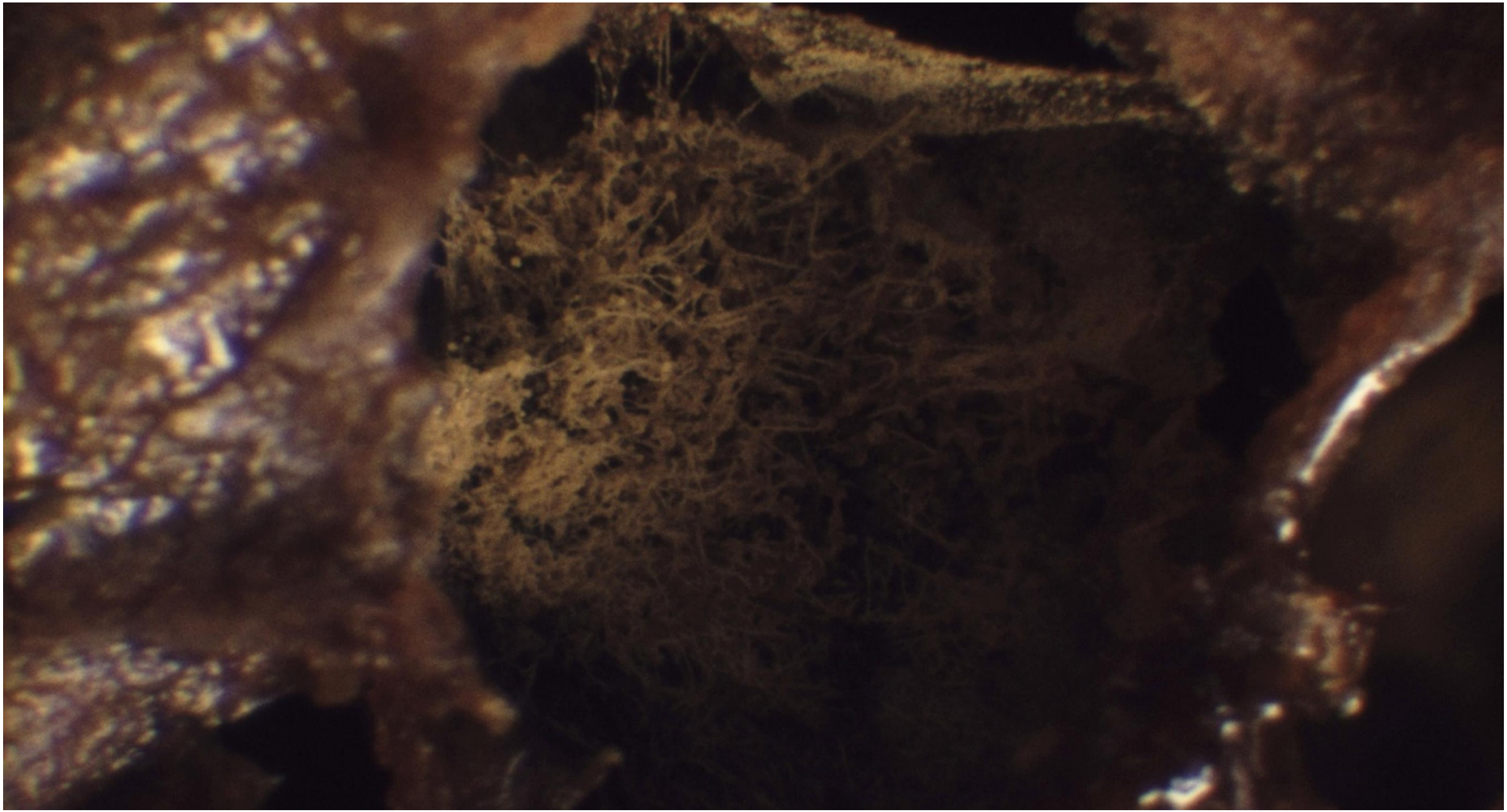
Der dannes nye sporer fra frugtlegemer

De lette sporer kan spredes med vinden

Svampen vokser ud mellem voksne biers leddele

Findes hyppigt i pollenceller i døde bifamilier,
endnu en god grund til at omsmelte alle brugte tavler





STENYNGEL SIDDER FAST I CELLERNE

Svampen vokser ud ad pupperne og gror sammen med vokstavlen

HUSK

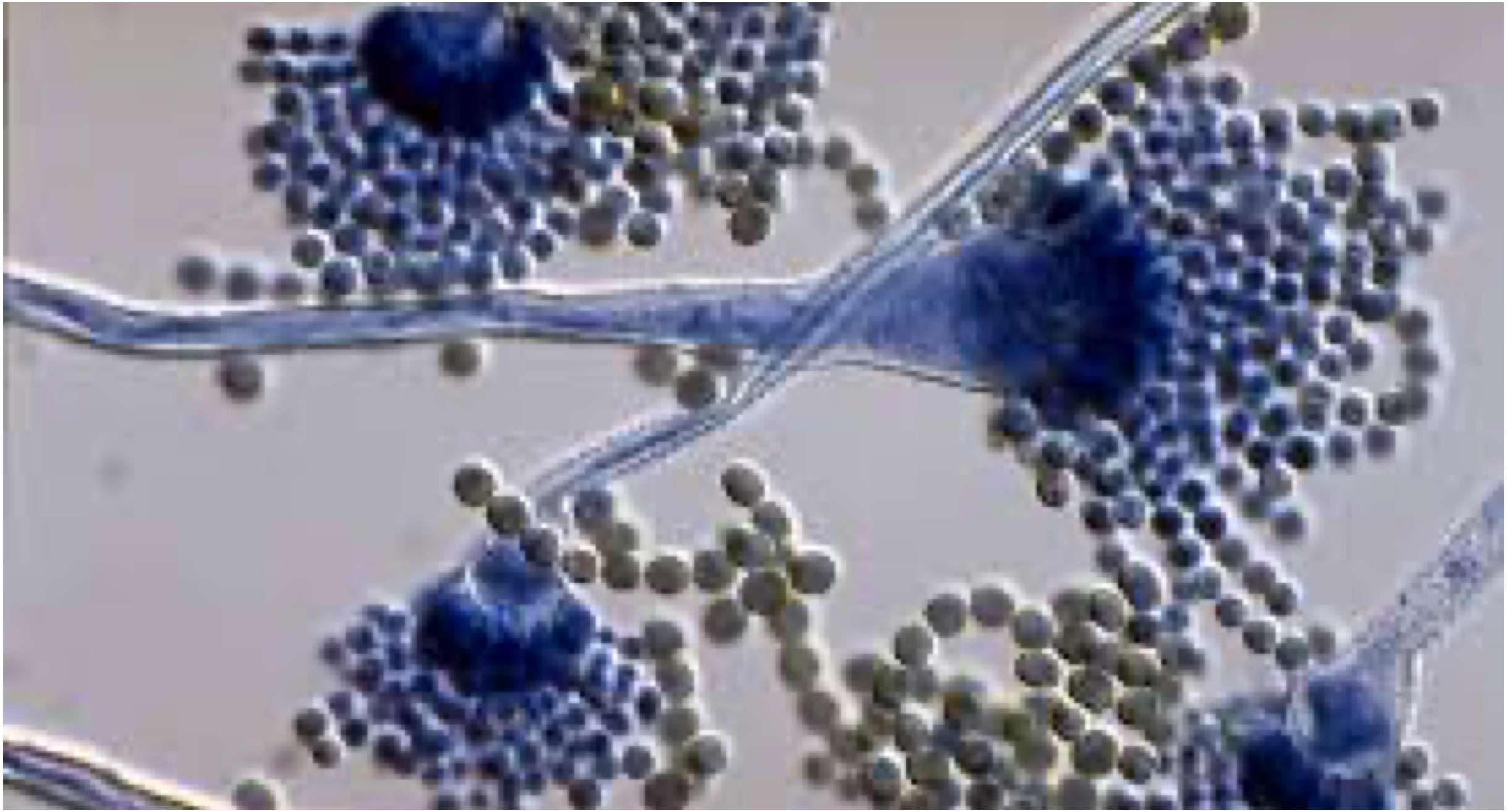
Meldepligt! Kontakt straks Offentlig Bisygdomsbekæmpelse

Angriber mennesker, via slimhinder, d.v.s. øjne, mund og lunger

Honning skal destrueres

Svampen producere nervegifte, der er kræftfremkaldende!

Hvis i tvivl, kontakt læge.



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