

# **The Smuts (and non-smuts) in Rice: Kernel Smut, False Smut, Leaf Smut, Black Kernel, Sooty Mold**

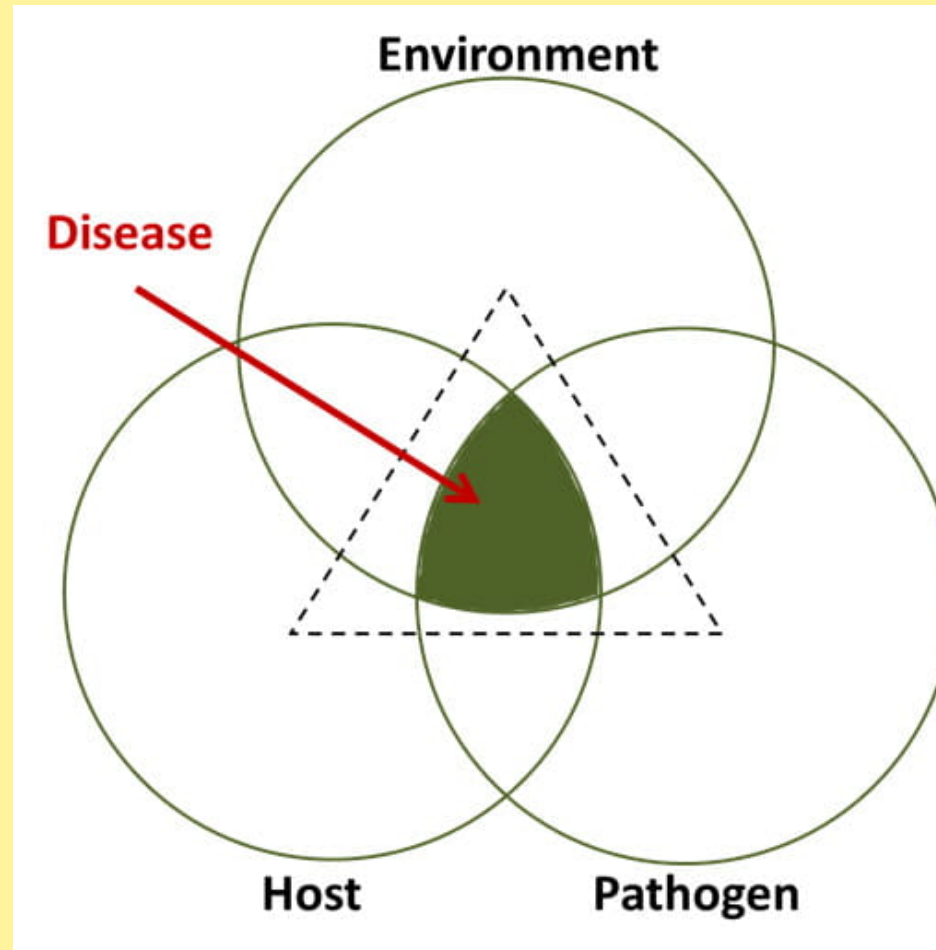
## **Causes, Sources of Inoculum, Disease Cycle, Varietal Reactions, Management and Yield Losses**

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# Definition of Plant Disease

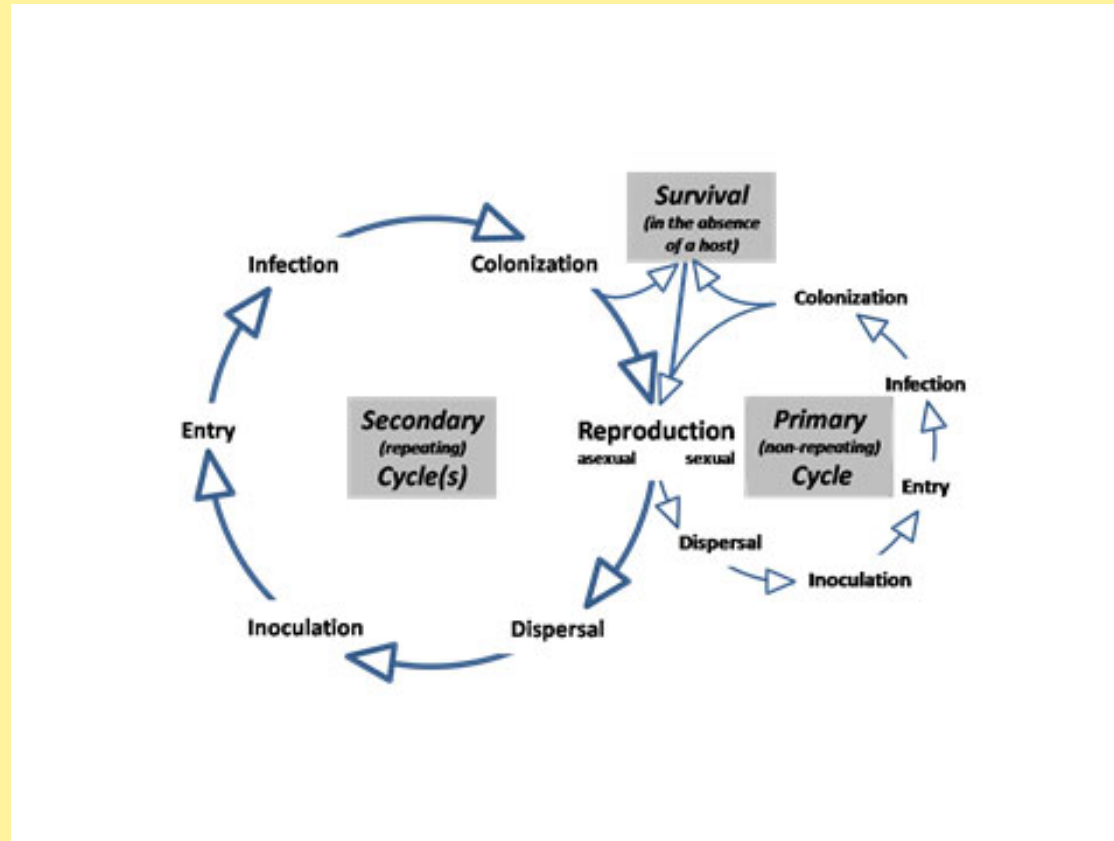
- Disease results from the continued irritation by a primary causal agent or environmental factor that leads to malfunctioning of host cells and tissues and leads to the development of symptoms.

# Disease Triangle



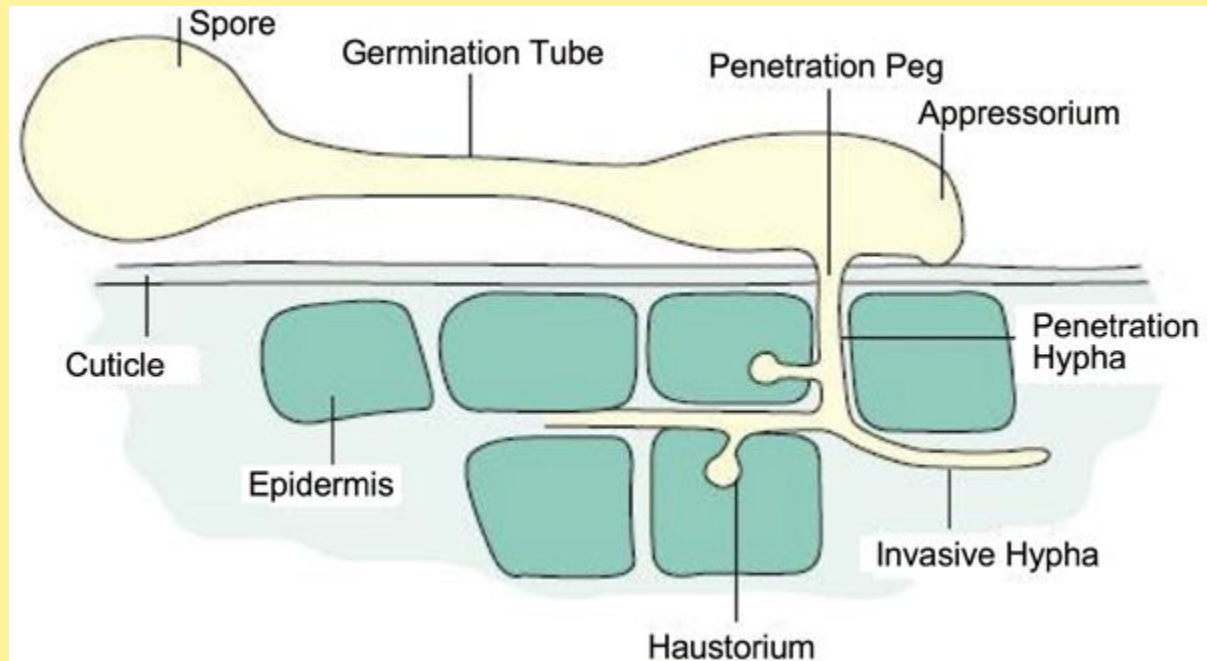
Source: Plant Disease: Pathogens and Cycles, University of Nebraska

# General Plant Disease Cycle



Source: Hollier. PLHL 4001, PPCP, LSU AgCenter

# Infection Process



Source: Common processes in pathogenesis by fungi and oomycetes.  
[bmcmicrobiol.biomedcentral.com](http://bmcmicrobiol.biomedcentral.com)

# Definition

- **Yield Loss vs Crop Loss**
  - **Yield loss is the reduction of the measurable product of a crop**
  - **Crop loss is the reduction in value and/or financial return due to damage/disease. (loss by multiple causes, quality, difference between actual yield and attainable yield)**

Nutter, FW, PS Teng and MH Royer. 1993. Terms and concepts for yield, crop loss and disease thresholds. [http://lib.dr.iastate.edu/plantpath\\_pubs/63](http://lib.dr.iastate.edu/plantpath_pubs/63).

# Kernel Smut

- Cause: *Tilletia barclayana*



Image Source: DE Groth

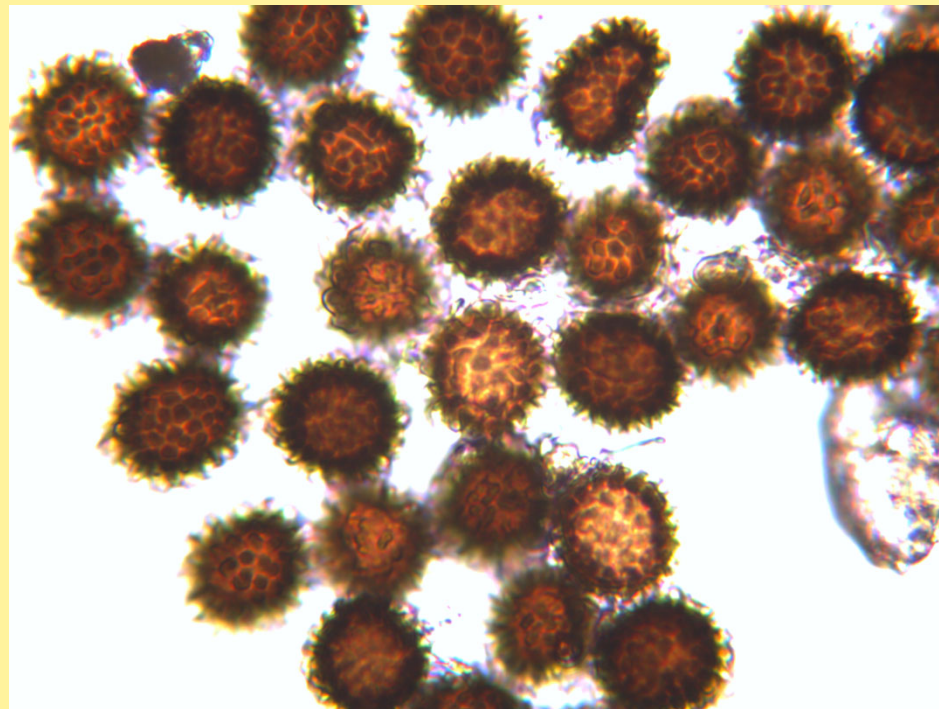


Image Source: DE Groth

# Kernel Smut

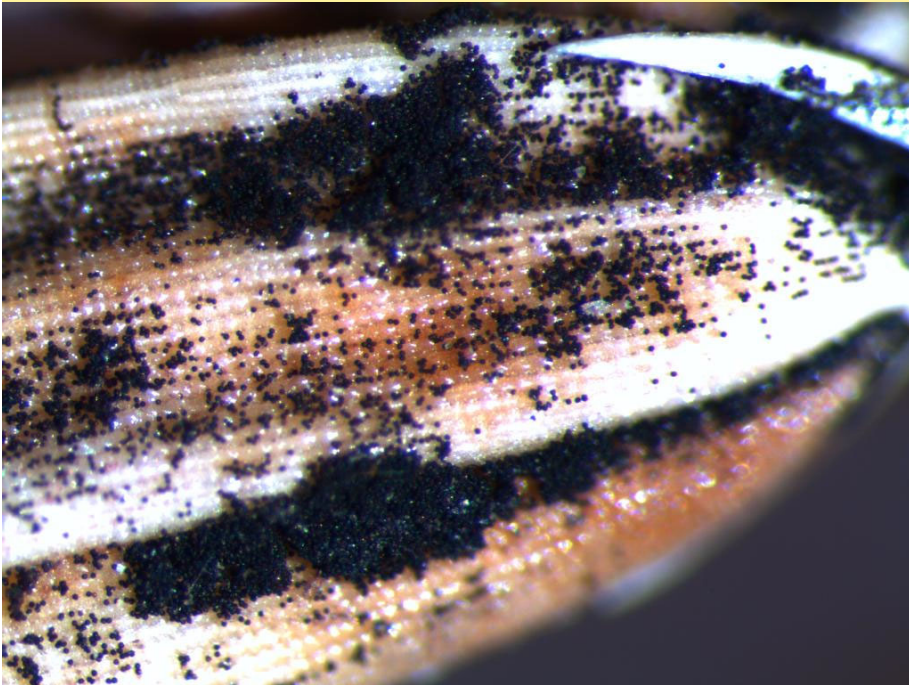


Image Source: DE Groth



Image Source: DE Groth



# Kernel Smut (KS)

- **Losses: KS reduces grain quality and yield and losses up to 15% have been reported. The disease also causes breakage and reduction in head rice yield and problems in the par-boiling process. If the percentage of smutted kernels is too high, the final milled rice product will be gray.**

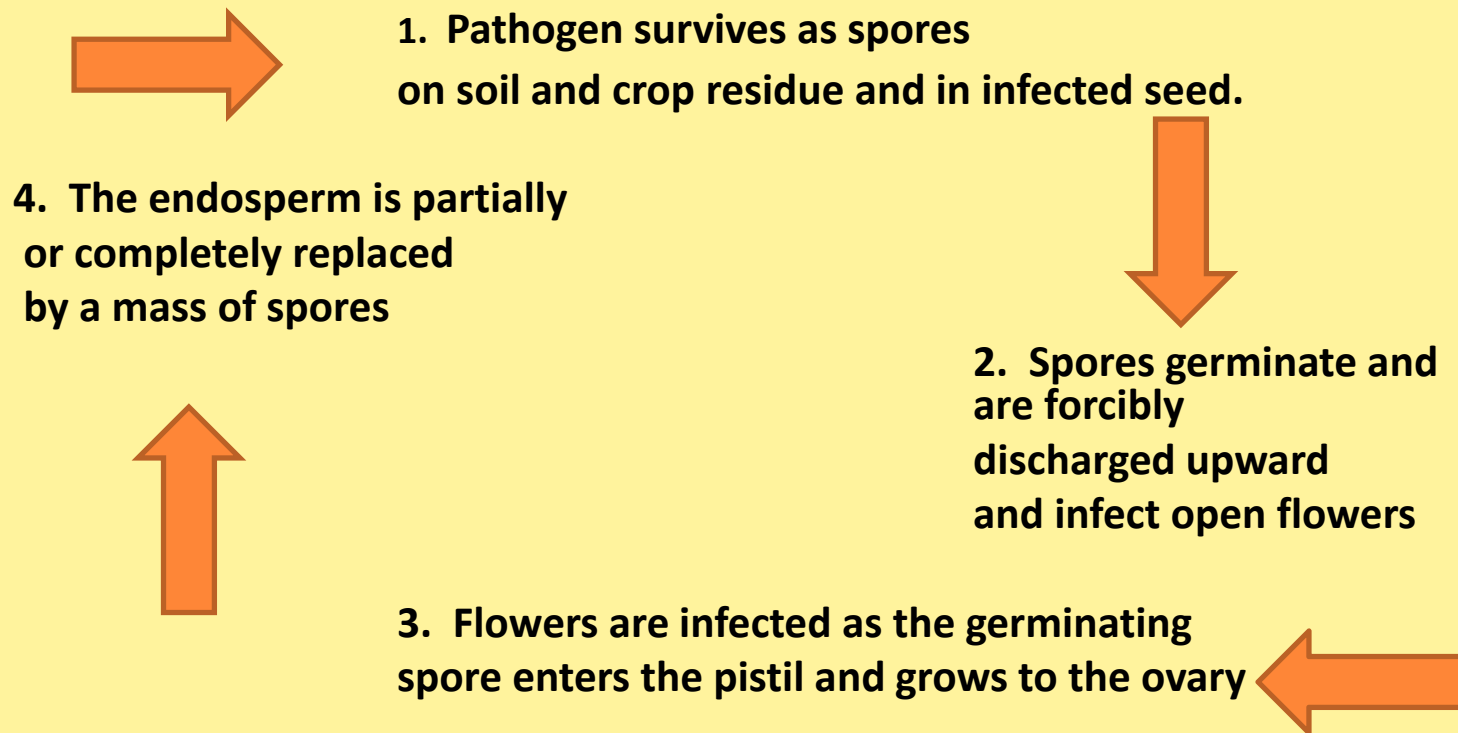
Source: Compendium of Rice Diseases and Pests, 2<sup>nd</sup> Edition

- **Louisiana losses are estimated at 1%**

Source: DE Groth

# Kernel Smut

## Disease Cycle



Source: Compendium of Rice Diseases and Pests, 2<sup>nd</sup> Edition

# Rice Flower

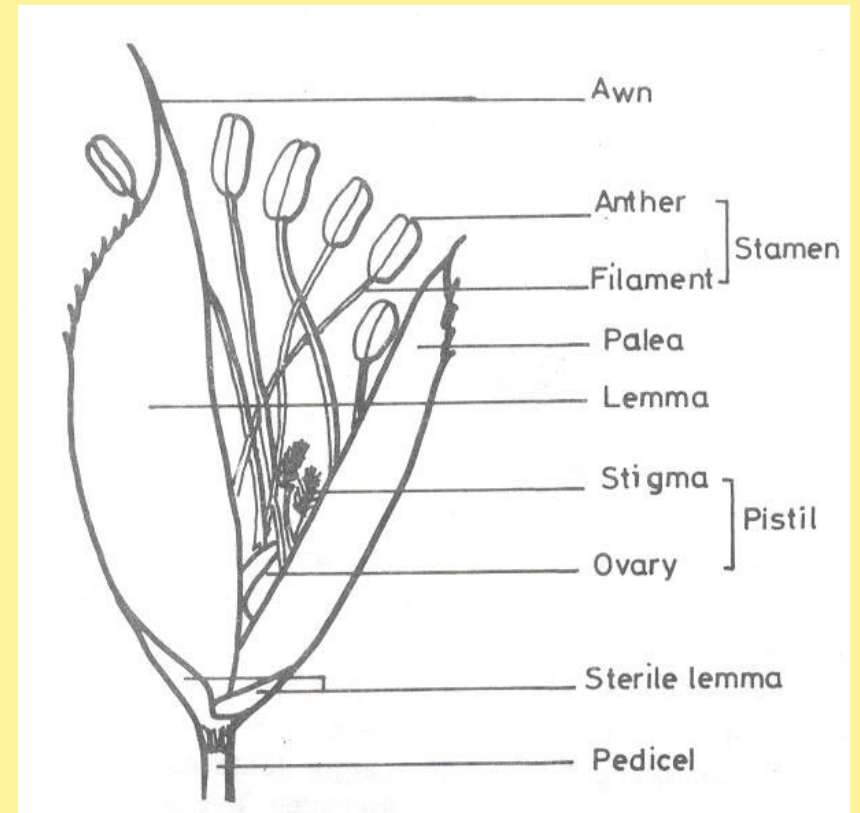


Image source: botany.org

# Kernel Smut

<b>• Cultivar</b>	<b>Kernel Smut Rating</b>
– CL153	S
– CL111	S
– Cheniere	S
– Mermentau	-
– CLXL745	S
– XP753	MS
– Jupiter	MS
– Titan	MS
– Gemini	MS
– PVL101	-
– Diamond	S

Source: DE Groth

# Kernel Smut

- **Conditions for Development**
  - High nitrogen rates early in the season
  - Infected seed
  - Fields that had Kernel Smut in the previous crop

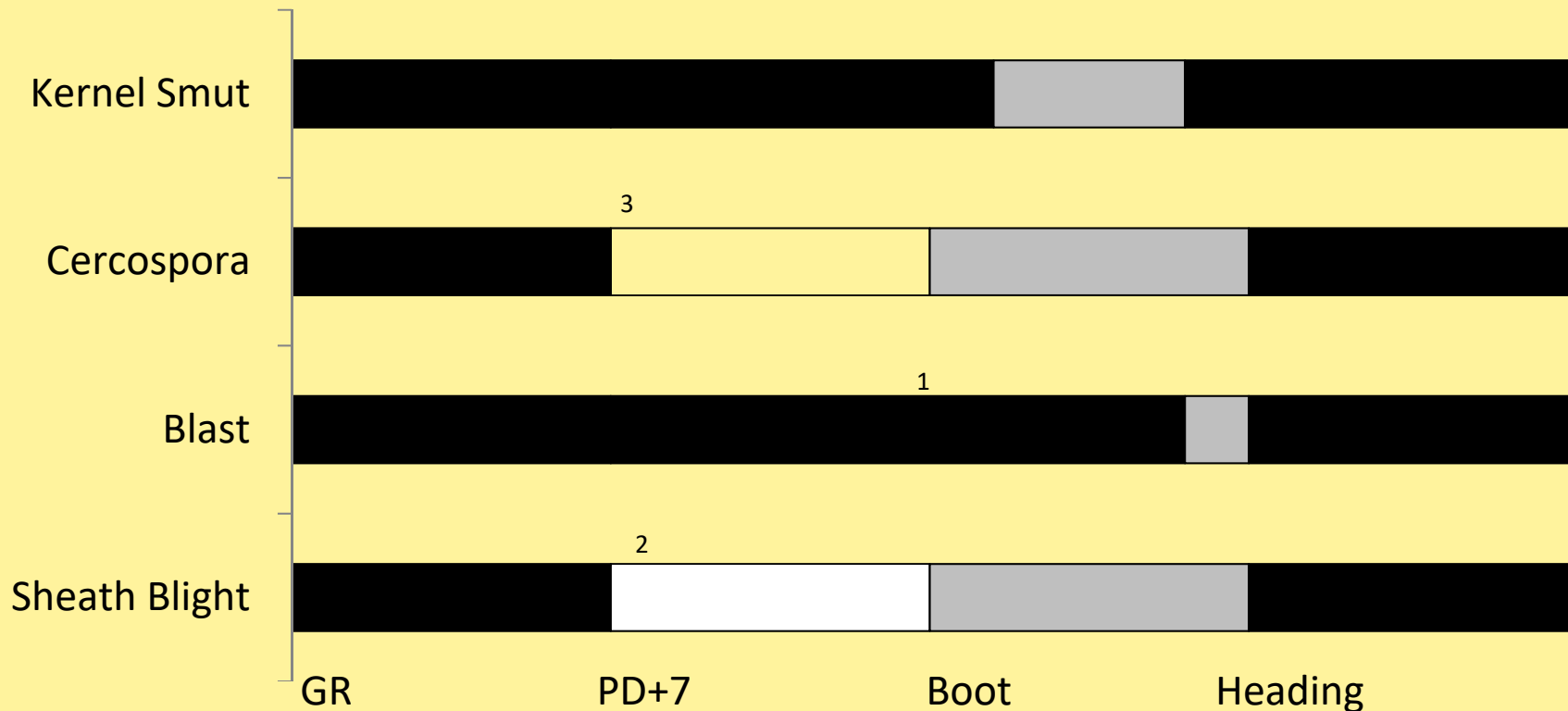
Source: Compendium of Rice Diseases and Pests, 2<sup>nd</sup> Edition

# Kernel Smut

- **Disease Management**
  - **Some less susceptible cultivars available**
  - **Plant early**
  - **Avoid excessive N**
  - **Kernel smut primary fungicide target**
  - **Propiconazole has best activity**
  - **6 oz/A at boot to boot split growth stages**
  - **Certain fields tend to have a history of disease**

Source: Compendium of Rice Diseases and Pests, 2<sup>nd</sup> Edition

# Rice Fungicide Timing



<sup>1</sup> A boot application followed by the heading spray may be necessary if diseases pressure is high and the variety is susceptible.

<sup>2</sup> An early application may be necessary if sheath blight appears early and is severe followed by the boot to heading application.

<sup>3</sup> Late planted rice requires earlier application of propiconazole for Cercospora control.



Do not apply



Application may be needed



Best application timing

# False Smut

Cause: *Ustilaginoidea virens*



Image source: DE Groth



# False Smut

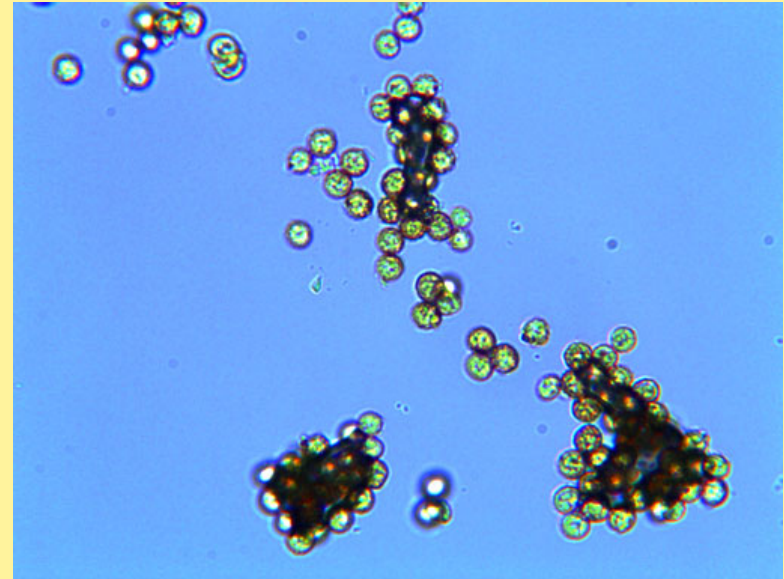


Image source: DE Groth

# False Smut

**Losses due to False Smut are not limited to the field development. Most losses are due to the rejection of loads by the buyer. As spore balls (galls) are ruptured and spores are distributed, grain discoloration occurs.**

# **False Smut**

**The disease cycle has not been completely characterized. It has been reported that infection can occur in the ovary, but other spore types can infect maturing grain.**

**The fungus survives as sclerotia or spore balls for up to 4 months under field conditions. Spores can be carried on the seed and distributed to new fields.**

# False Smut

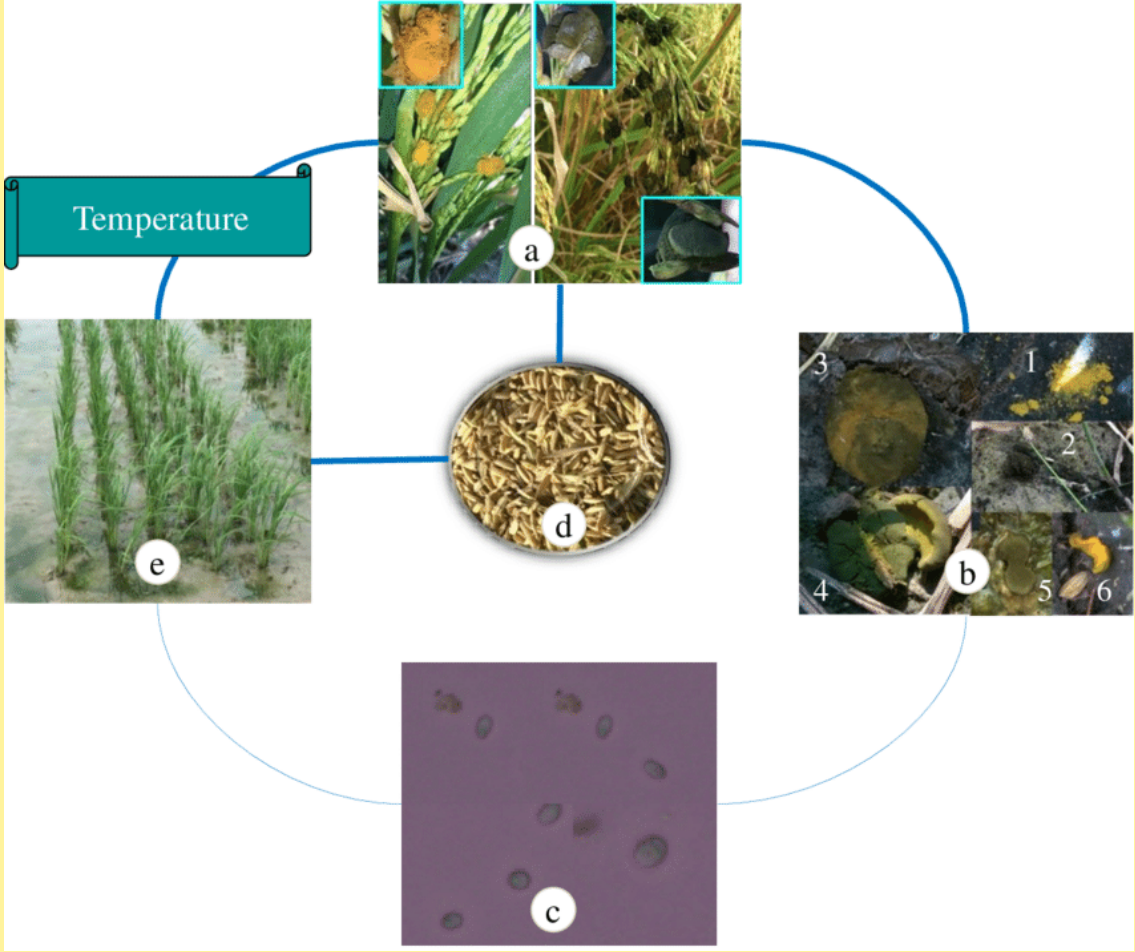


Image source: ResearchGate

# False Smut



Image source: [arkansas-crops.com](http://arkansas-crops.com)

# False Smut

<b>• Cultivar</b>	<b>False Smut Rating (0-9)</b>
– CL153	1.1
– CL111	0.0
– Cheniere	2.1
– Mermentau	0.8
– CLXL745	0.1
– XP753	0.0
– Jupiter	1.2
– Titan	0.3
– Gemini	6.6
– PVL01	3.2
– Diamond	3.8

Source: DE Groth

# False Smut

- **Conditions for Development**
  - High nitrogen rates early in the season
  - Infected/infested seed
  - Late planting
  - Susceptible cultivars

Source: Compendium of Rice Diseases and Pests, 2<sup>nd</sup> Edition

# False Smut

- **Disease Management**
  - **Some less susceptible cultivars available**
  - **Plant early**
  - **Avoid excessive N**
  - **Propiconazole has best activity**
  - **6 oz/A at boot to boot split growth stages**
  - **Certain fields tend to have a history of disease**

Source: Compendium of Rice Diseases and Pests, 2<sup>nd</sup> Edition



# Arkansas Recommendations

- **PROPICONAZOLE FUNGICIDES** can be applied to suppress **kernel smut** and **false smut** of rice.
- Research has shown the most effective application timing for lower rates of propiconazole fungicides to be when the main tillers are in the **SWOLLEN BOOT STAGE BUT PRIOR TO ANY HEAD EMERGENCE**.
- Earlier applications of low rates of propiconazole fungicides may not be effective! Applications after heads start to emerge are not legal!
- Fields most likely to benefit from suppression of **kernel smut** or suppression of **false smut** with these fungicides include those with a severe history of the disease such as **FRANCIS, COCODRIE, CHENIERE, CL161, CL 152 OR CYPRESS CULTIVARS** and that received high rates (> 160 units) of nitrogen fertilizer.

Tilt, PropiMax, Bumper	6 oz/A
Stratego	19 oz/A
Quilt	21 oz/A
Amistar Top	10 oz/A

Source: University of Arkansas

# Leaf Smut

Cause: *Eballistra oryzae*

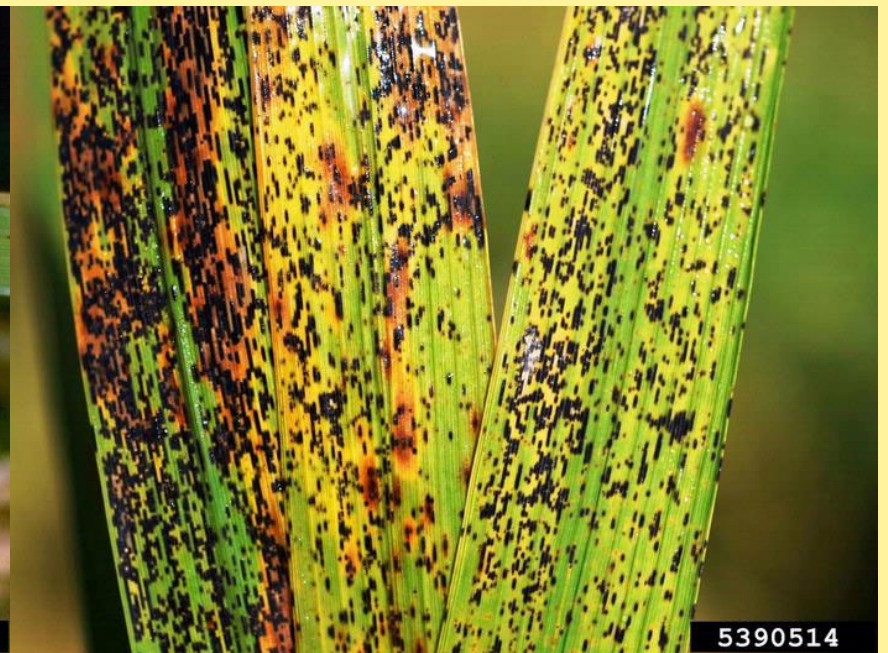


Image Source: DE Groth

# Leaf Smut



Image Source: Bugwood

# Leaf Smut

**Leaf Smut is one of the most commonly observed leaf diseases worldwide. But is considered minor and causes little yield loss. Light yield losses have been reported when severe leaf smut has caused premature desiccation of the leaves.**

# Leaf Smut

**The pathogen survives between crops as teliospores on diseased leaf debris in the soil. As the teliospores germinate, the sporidia are spread to rice leaves where they germinate and infect in the late growth stages after booting.**

# Leaf Smut

- **Conditions for development**
  - Late planting
  - High nitrogen levels

# Leaf Smut

- **Disease Management**
  - **Maintain adequate nitrogen for best grain development**
  - **Bury previous crop residue**

# Black Kernel

Cause: *Curvularia* spp.



Image Source: DE Groth



# Black Kernel



Image source: Bugwood

# Black Kernel

- **Regarded as a weak pathogen and a common saprophyte.**
- **Disease management: not warranted!**

Source: Compendium of Rice Diseases and Pests, 2<sup>nd</sup> Edition

# Sooty Mold

Cause: Several fungi...*Capnodium* spp.

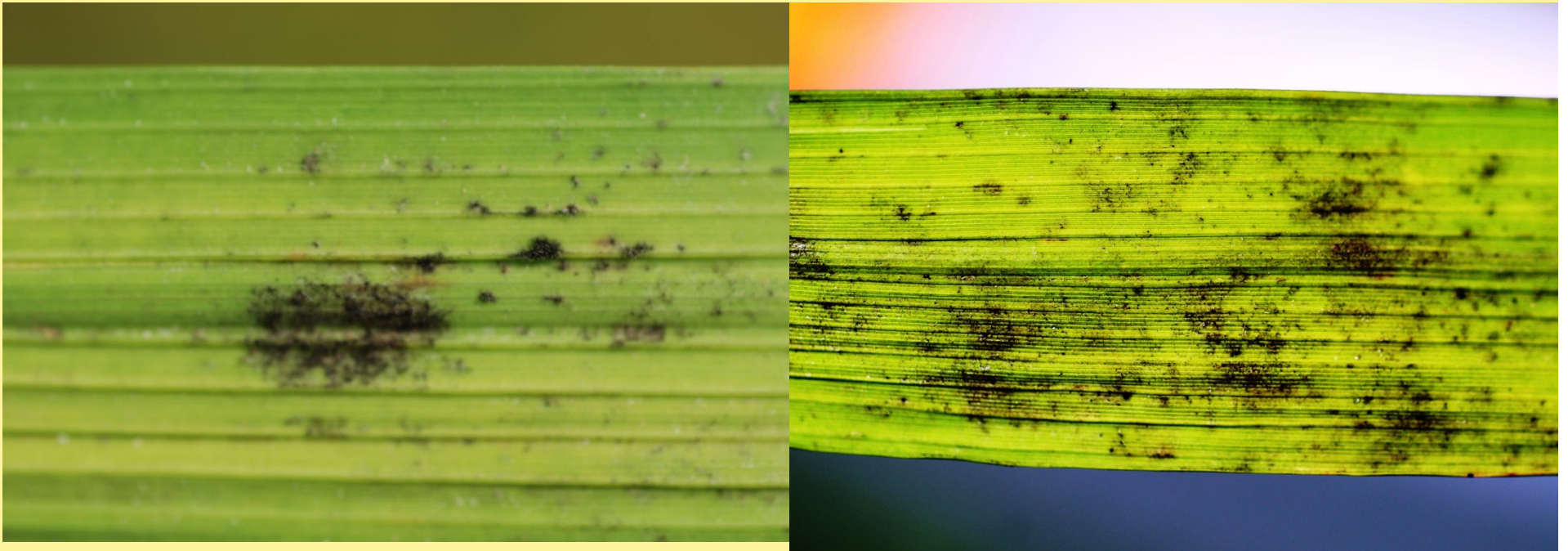


Image source: DE Groth

# Sooty Mold

**Not a disease!**

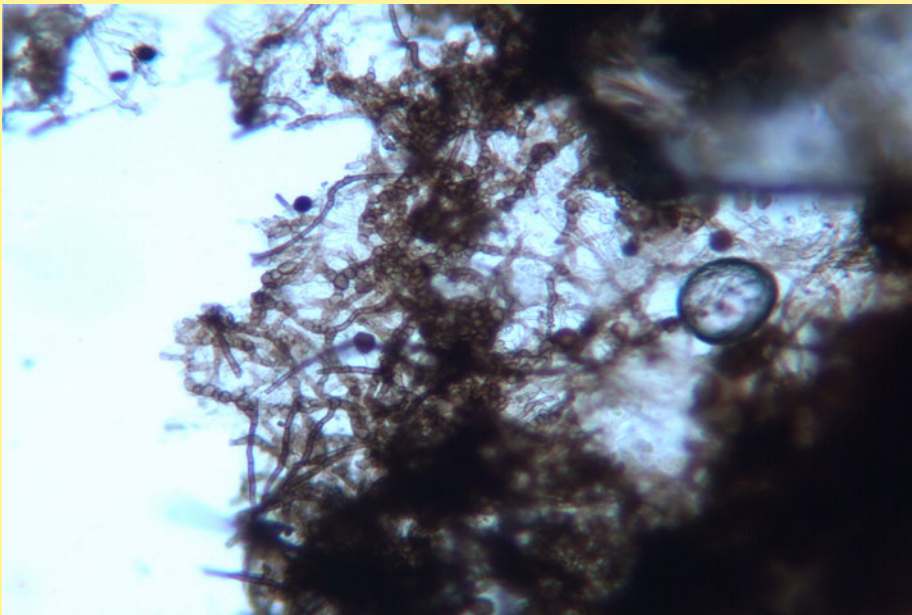


Image Source: DE Groth

# Items to Consider...

- 1. Scout the fields properly.**
- 2. Know the cultivar.**
- 3. Identify diseases correctly.**
- 4. If the pathogen can/should be managed, do so properly (choice of method; choice of fungicide; proper rate and timing; if available, rotate modes of action)**