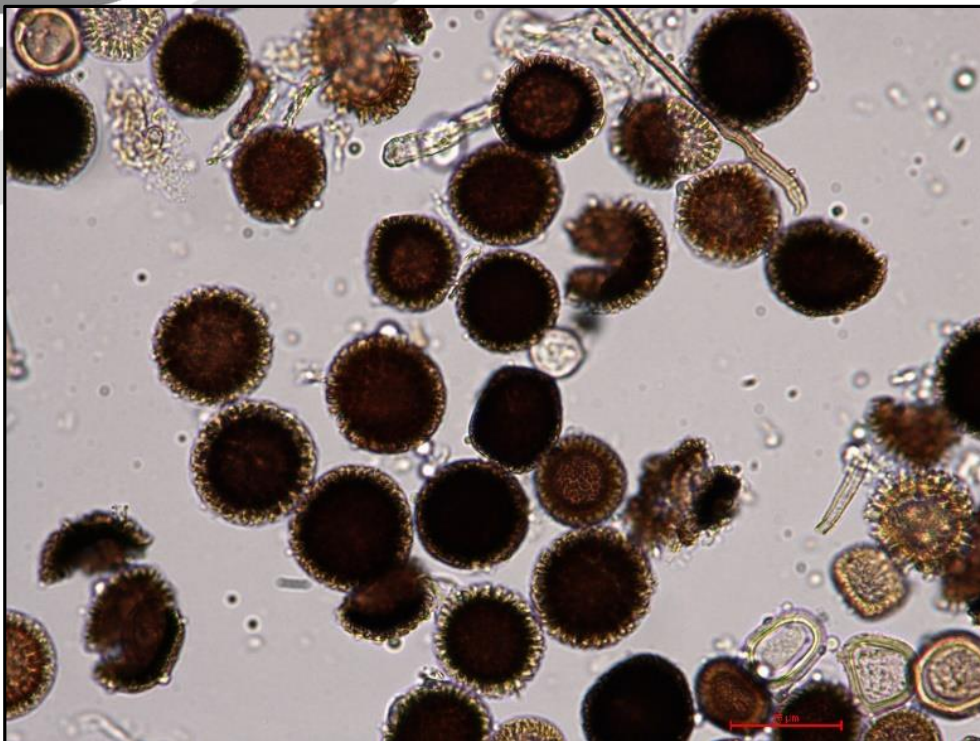


Karnal Brand

Cathy de Villiers
Small Grain Institute, Bethlehem



General Background Info.

- Fungi lack chlorophyll
- Heterotrophic (extracts nutrients from the host)
- Inoculum found in/on:
 - ❖ Seed
 - ❖ Soil
 - ❖ Diseased plants



General Background Info.

Examples of fungal dispersal:

- Wind – burning of production lands – up to 500km
- Water – overhead irrigation, rain
- Soil – clinging to implements
- Insects – spore transmission
- Animals - dung
- Equipment – planters, harvesters, etc.
- Man - movement between wheat fields



General Background Info.

Conditions necessary for infection:

Host (presence and
susceptibility of host)

Pathogen (appearance,
kiemkrachtigheid and
amount of inoculum)

Plant Disease

Environment (conditions
to favor disease)

General Background Info.

- **There are 5 *Tilletia* species present in S.A.:**
 - *T. caries* – Common bunt - Systemic
 - *T. ehrhartae* - Annual veldgrass bunt - Contact
 - *T. indica* – Partial bunt - Contact
 - *T. laevis* – Stinking smut - Systemic
 - *T. walkeri* – Ryegrass bunt, KGI lab – confirmation - Contact
- ***Tilletia* species found on maize:**
 - *T. caries*
 - *T. controversa* – Dwarf bunt
 - *T. laevis*
 - *T. indica*
 - *T. walkeri* (?)

Overlapping with KB

Ryegrass bunt
(13-26 μ m)

23-26 μ m

Stinking smut
(14-22 μ m)

1 μ m smaller

Annual veldgrass bunt
(18-22 μ m)

1 μ m smaller

Common bunt (15-
23 μ m)

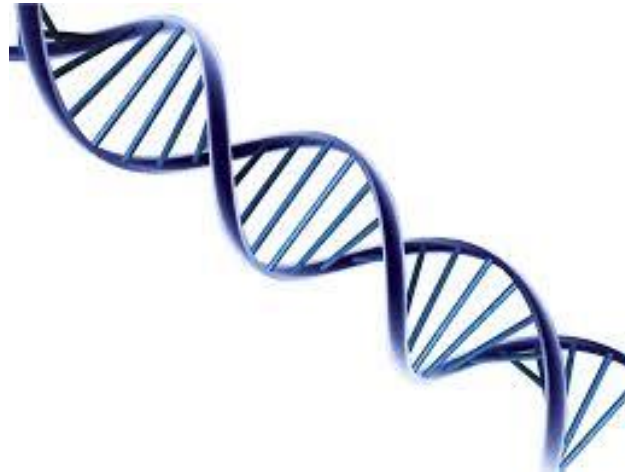
23 μ m

Karnal bunt
(23-49 μ m)

General Background Info.

Positive identification based on morphological characteristics is not easy!!

Most reliable procedure = **morphological + molecular methods**

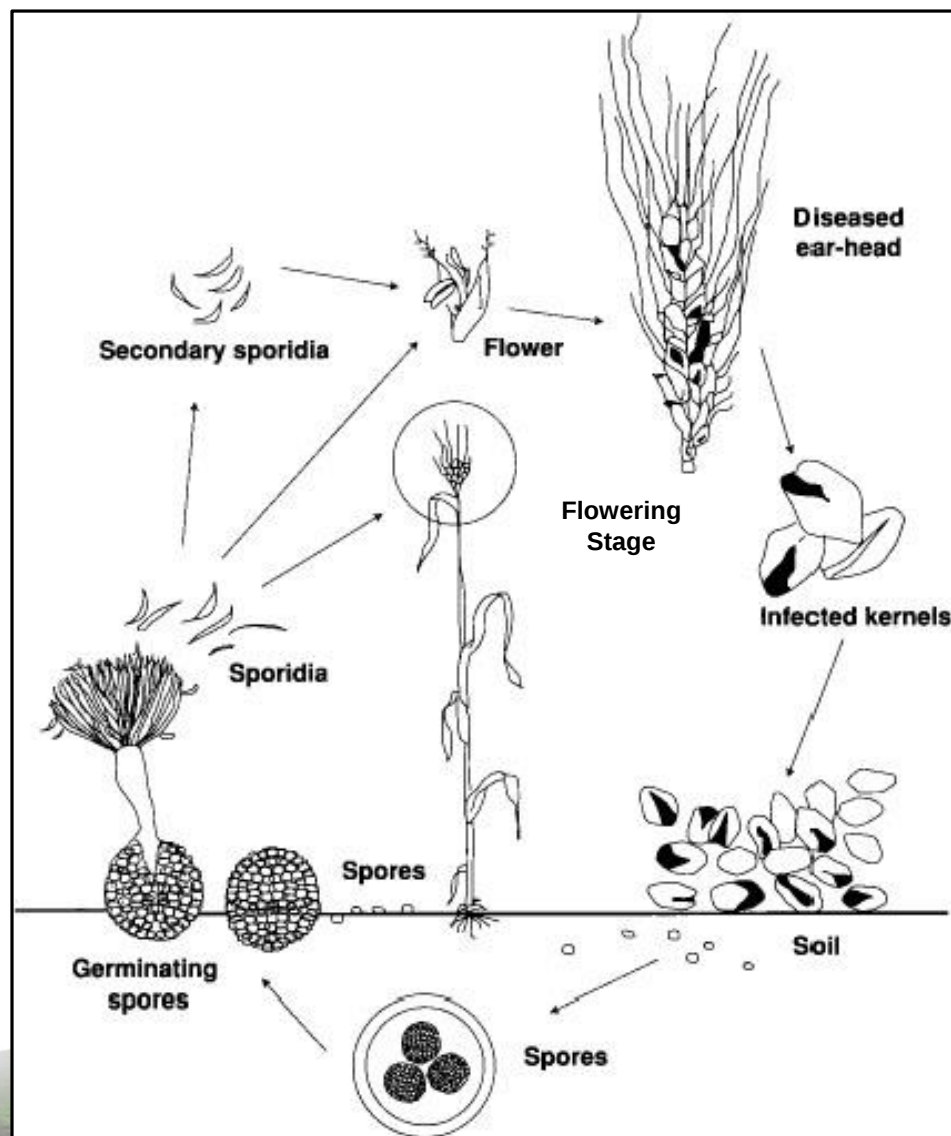


End 2015: ARC-SGI uses Polymerase Chain Reaction (PCR) to confirm ID. 3 *T. indica*-specific 'PCR' sets, namely Tin3/Tin10, Tin3/Tin6 and Tin3/Tin4

Karnal Bunt

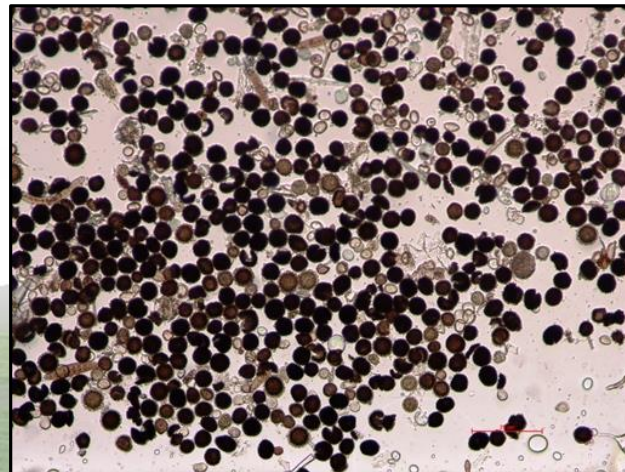
- Fungal disease that infects wheat, durum wheat and triticale.
- Karnal Brand - first reported in India in 1931 - near the town of Karnal - hence the name Karnal bunt
- Found in Asia (1931), South America (1960s), North America (1970s)
- S.A. sighted in 2000 - Douglas area – quarantined
- Worldwide Karnal bunt is seen as a quarantine organism - no research in S.A. allowed

Karnal Bunt Life Cycle



Karnal Bunt Background

- Teliospores survive for long periods in the soil (5-7 yrs)
- Teliospores survive temperatures of -5°C and have a dormancy period of 9 months
- The whole ear is not infected - usually 4-5 contaminated seeds per ear
- Difficult to see in the field - unnoticed for years



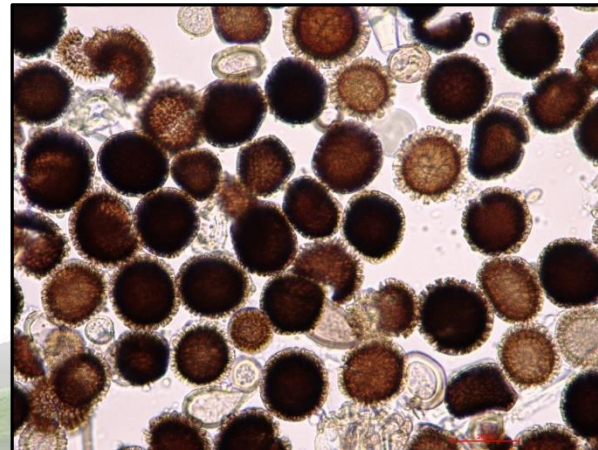
Environmental Conditions

Environmental conditions that are beneficial to the development of Karnal bunt:

- Optimum temperature: 18-22°C
- Optimum relative humidity: 70%
- At lower RH secondary sporidia will be dormant
- If weather is not cool and rainy (48h) during flowering stage, infection will be low
- Wheat is vulnerable from GS43 (ear emergence) to GS69 (soft dough)

Environmental Conditions

- High sowing rates and application of high levels of nitrogen favours disease (microclimate)
- Late plantings - possibly coinciding with favourable climatic conditions

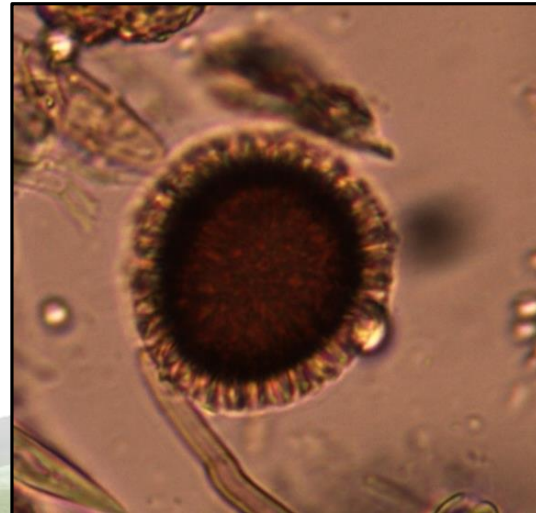
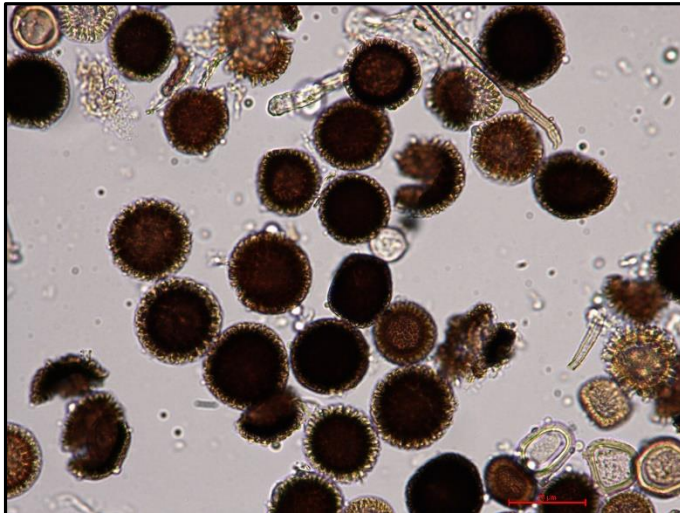


Signs/Symptoms

- Only 1 Karnal bunt infected seed may legion teliospores produce infected soil
- The infected seeds are usually smaller than healthy ones
- Infected seeds are being waved in syrup - which serves as a source of inoculum for next season
- Retention of seed
- Contaminated seeds that are planted can cause of poor germination, poor plant population and increase the amount of inoculum

Legislation

- Thresholds differ between countries
- Mexico has 10 or more teliospores necessary before sample is 'positive'
- DAFF (South Africa) - no teliospores allowed!



Signs/Symptoms



Control

Multiple options:

- S.A. cultivars tested with SA pathotypes - quarantine disease
- Chemical Control :
 - Seed treatment has not been tested (quarantine)
 - Fungicides (CropLife): Two fungicide sprays with Carbendazim/propiconazole or propiconazole. 1st spraying 25% spike appearance - 2nd application 10 days later

Beheer

Cultural practices:

- Nitrogen - split nitrogen applications
- Reduce plant density (less plants per m²)
- Plant earlier - limit favourable conditions
- Use crop rotation :
 - Oats - resistant
 - Barley - tolerant
- Use high pressure spray to clean off equipment

ARC-SGI

- Trial seed wash plant
- All SGI trials monitored
- Untreated seed samples can be tested
- Biotechnology laboratory - identification of species



Summary

- Karnal bunt found mainly under irrigation
- Come every year for non-climatic conditions is important
- Not toxic to humans and animals, but more than 3% infection is unfit for human and animal consumption (odour, colour and taste)
- Quarantine organism - no research in S.A.
- Wheat is susceptible from GS43 (ear emergence) to GS69 (soft dough)
- Resistance to S.A. cultivars against S.A. pathotypes has not been tested

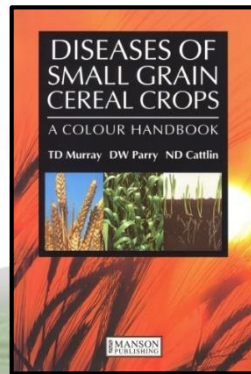
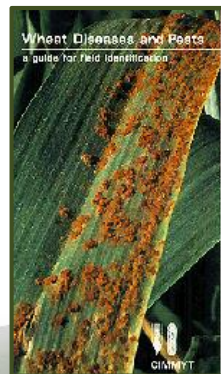
Summary

- Can make use of chemicals - not 100% effective at all (2 applications?), But reduces the incidence of the fungus
- Do not withhold seed for replanting, use certified seed
- Yield losses may occur - depending on time of infection



Bronne

- www.croplife.co.za – “Agricultural remedies database”
– all crops and chemicals - fungicides, insecticides and herbicides
- <http://wheat.pw.usda.gov/ggpages/wheatpests.html> -
wheat diseases and pests (carry guide)
- “Diseases of small grain cereal crops: A colour handbook” Murray *et al.* 2011



Thank You!



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