



Department
for Environment
Food & Rural Affairs

Plant Pest Factsheet

Karnal Bunt

Tilletia indica



Figure 1. Harvested grain with Karnal bunt © Fera Science Ltd

Background

Karnal bunt (also known as partial bunt) is a quarantine disease that infects wheat, durum wheat and triticale. It is caused by the fungal pathogen *Tilletia indica* Mitra. The disease was first formally reported on wheat in the Karnal district of northern India in 1930. Karnal bunt has the potential to reduce grain quality and marketability. Introduction of this pathogen to the UK could cause economic damage by limiting potential export markets. Official eradication measures would be required in the event of an outbreak occurring.

Geographical Distribution

Tilletia indica was first described in India and is widespread in the North-east of the country. It is endemic in Afghanistan, Iran, Iraq, Nepal and Pakistan, and has been introduced to Brazil, Mexico, South Africa and the USA. The pathogen is not present in the UK or Europe, but interceptions of contaminated grain have occurred in the UK and in Italy.

Host Plants

Wheat (*Triticum aestivum*), durum wheat (*T. durum*) and triticale (*x Triticosecale*), although the latter is only rarely infected.



Figure 2. Bunted ear (*Tilletia indica*) of wheat exhibiting stunted grains with streaks and some blackened areas containing spores (left). Uninfected ear of wheat (right) © Ruben Durán, Washington State University & Mary Burrows, Montana State University, Bugwood.org.

Symptoms

The pathogen is sometimes referred to as a member of the smut fungi group because affected grains have a black, sooty appearance. Infection begins at the germ end of the seed, then spreads within the periderm layer, reducing the seed to a mass of black spores (teliospores) known as sori. The infection may be limited to just the germinal end of the seed (point infection) or may spread along, and outwards, from the groove. During harvest and handling, the seed and sori ruptures, disseminating the teliospores and leaving behind a seed which is broken or hollow at the germ end, or eroded along the groove.

The disease is not readily detected in the field as typically only a few seeds in an ear become infected and infected grains are usually concealed within the glumes. Karnal bunt is more easily found when inspecting grain after harvest, either by visual inspection of a seed sample or, more reliably, by conducting a seed wash test for teliospores, in a laboratory (Fig 3).

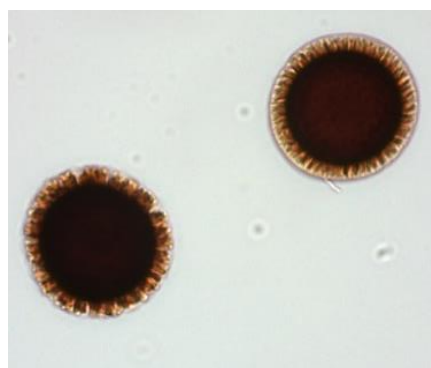


Figure 3. Magnified teliospores of *Tilletia indica* © Fera Science Ltd

Symptoms of Karnal bunt on wheat can be confused with other seed diseases including common bunt (*Tilletia caries*), which is present in the UK. It can also be very difficult to differentiate *Tilletia indica* morphologically from other *Tilletia*'s including *T. walkeri* and *T. horrida* (Fig 4). To confirm a diagnosis of *Tilletia indica* characteristic features of at least 10

teliospores are recorded. This can take several seed washings, and consequently laboratory tests to differentiate these species take some time.

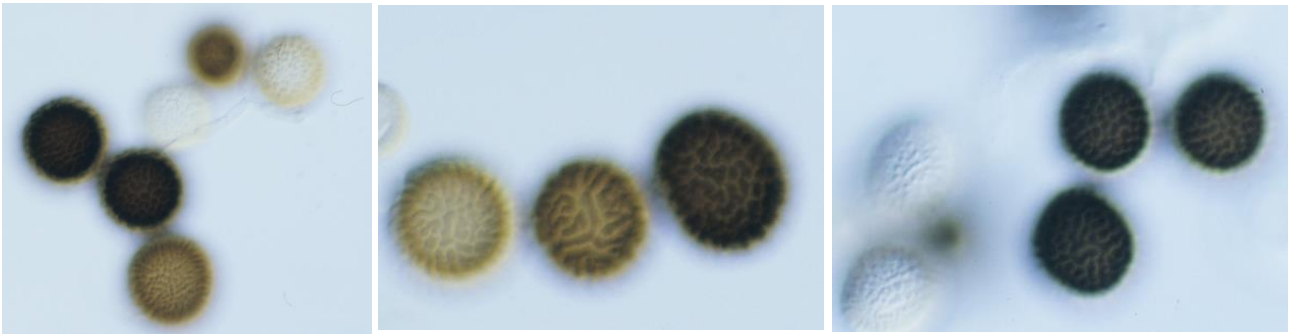


Figure 4. *Tilletia indica* (left), *Tilletia walkeri* (middle) and *Tilletia horrida* (right) spores. © Fera Science Ltd

How does it develop and spread?

The primary route of introduction of Karnal bunt to new regions is on contaminated seed for planting. Grain for animal feed or human consumption also poses a potential risk, as it is imported in large volumes and, depending on transport conditions, teliospores could escape the consignment and enter wheat production areas. Spread could be facilitated by secondary contamination from conveyances such as rail freight carriages, trucks or trailers which have carried contaminated grain or contaminated field equipment. Air borne spread has also been considered, especially at a local level.

The cycle of disease starts when infected seed is harvested. The mechanical action of harvesting causes infected seeds and sori to rupture, liberating the teliospores. The teliospores fall to the ground, together with infected or contaminated seed and plant debris, where they remain viable until conditions are appropriate for their germination.

Under warm (15-25°C) and moist conditions, teliospores on or near the soil surface germinate to produce sporidia which are spread by wind or rain onto new seedlings. During flowering these sporidia invade the floret tissues and then enter the developing seed to produce a mass of black teliospores within the seed's pericarp. When these teliospores are liberated during harvest onto the soil surface, or dispersed on or in the seed, the cycle begins again. These very specific conditions required for germination and infection are believed to occur around once in 4 years in *Tilletia indica*'s native range. Teliospores can survive in the soil for at least 3 years or on stored seed for longer periods.

Economic Impact

Karnal bunt can reduce both yield and grain quality. Bunted kernels smell of fish due to the trimethylamine that is produced. If more than 3% of the grains used to make flour are 'bunted' then, the flour can have a distinct fishy odour. However, such infection levels are

rare and have never been recorded in the field in the USA. Bunted kernels present no risk to animal or human health.

Many countries will not accept imports of grain unless they originate from areas designated free from Karnal bunt. Outbreaks can, therefore, lead to significant export losses, and the main economic impact is due to export sanctions. After the introduction of Karnal bunt to the USA, phytosanitary measures implemented in Texas between 2001 and 2002 were estimated to cause economic losses of \$25 million. The USA implemented a National survey for Karnal bunt at a county level so that wheat growing areas could be declared free of Karnal bunt thus allowing export from these areas. This National survey for Karnal bunt is estimated to prevent an average annual loss of 15.1% of the export market.

Potential economic impacts of the introduction of Karnal bunt to the EU have previously been assessed and concluded that the pest could have moderate impacts on yield but a massive impact on quality, especially given the potential lack of resistance to the pathogen in European cultivars of wheat.

Pest Management and Reporting

Suspected outbreaks of *Tilletia indica* or any other non-native plant pest should be reported to the relevant authority:

For **England and Wales**, contact your local **APHA Plant Health and Seeds Inspector** or the **PHSI Headquarters**, York.

Tel: 0300 1000 313 (please select option 3 when calling)

Email: planthealth.info@apha.gov.uk

For **Scotland**, contact the **Scottish Government's Horticulture and Marketing Unit**:

Agricultural crops contact the local RPID officer:

<http://www.gov.scot/Topics/farmingrural/Agriculture/AOcontacts/contacts>

For non-agricultural crops, email: hort.marketing@gov.scot

For **Northern Ireland**, contact the **DAERA Plant Health Inspection Branch**:

Tel: 0300 200 7847 Email: planthealth@daera-ni.gov.uk

Web: <https://www.daera-ni.gov.uk/topics/plant-and-tree-health>

For additional information on UK Plant Health please see:

<https://planthealthportal.defra.gov.uk/pests-and-diseases/uk-plant-health-risk-register/>

<https://planthealthportal.defra.gov.uk/>

<https://www.gov.uk/plant-health-controls>

<http://www.gov.scot/Topics/farmingrural/Agriculture/plant/PlantHealth/PlantDiseases>

<https://www.daera-ni.gov.uk>

Authors

Victoria Barton (Fera) and Katie Lacey (Defra) Date: September 2021

Updated 2023

© Crown copyright 2023