Karnal bunt

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Fig. 1 Partially bunted seed, infected by T. indica.

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Karnal Bunt (KB) disease of wheat, caused by the fungus Tilletia indica Mitra, is present on the Indian Subcontinent (India, Pakistan, Nepal) and in Mexico,1 and has recently been reported from the USA.2 Although one report also lists it as occurring in Iraq,3 this remains unconfirmed. As far as could be determined, this is the first report of the disease occurring on wheat in Africa.

Wheat (Triticum aestivum L.) cultivars (SST 876, SST 825) cultivated under irrigation, and harvested towards the end of the 2000 season from Douglas, Northern Cape Province, South Africa, were found to have a high percentage of partially bunted seed (Fig. 1 Partially bunted seed, infected by T. indica.), appearing distinct from the common stinking bunt (Tilletia caries (DC.) Tul. & C. Tul.).

A seed sample was subsequently sent to the Department of Plant Pathology at the University of Stellenbosch for identification. The disease was identified as Karnal bunt. The identification was confirmed by specialists at the USDA ARS Systematic Botany and Mycology Laboratory, Beltsville, MD, USA. Reference specimens were deposited at the National Fungal Collection in Pretoria, South Africa (PREM), and at Beltsville, USA (BPI).

Karnal bunt disease of wheat is characterized by its partially bunted wheat kernels, and brown to dark brown, spherical to oval, densely ornamented teliospores, 26.5-54.5(-64) µm diam.4 Bunted kernels also reek of an odour similar to rotten fish caused by trimethylamine.5
Wheat kernels from the South African collection had partially degraded endosperms and black teliospore sori. The latter occurred in strips along the length of the kernels, or were restricted to the kernel tips. Teliospores were brown to dark brown, densely echinulate, 25-45 µm in diam. (Figs. 2, 3).

Fig. 2. A surface view of teliospores and sterile cells of T. indica, showing the wall ornamentation.

Fig. 3. Dark brown teliospores of T. indica.

A short mycelial fragment representing a remnant of the sporogenous hypha that produced the teliospore, was also noted on some of the spores.

Teliospores of KB are reported to remain viable for 5-7 years under laboratory conditions, or 27-45 months when seed are buried just below the soil surface.6 Spores are chiefly disseminated during harvest, and viable teliospores have been found up to 3000 m over burning wheat fields, suggesting wind dissemination. Spores also germinate following digestion by livestock and grasshoppers, which are other means of dissemination.7

The disease is favoured by moderate temperatures and free moisture, which suggests that conditions in Douglas, South Africa, where wheat was cultivated under irrigation, was highly suitable for infection. Indications are that high levels of nitrogen applications may also increase disease incidence.8

The disease is primarily controlled via planting of resistant cultivars or lines, and several of these have already been released in countries where the disease occurs. Cultural practices have proven to be of limited value in controlling the disease. Several fungicide seed treatments have been tested over the years to determine their effect on teliospore germination. Although some studies reported fungicides to have an inhibiting effect on teliospore germination, these results have largely been contradicted by other workers.9 Foliar applications of fungicides do, however, appear promising,10 suggesting that future work should focus on this aspect. Combinations of foliar treatments with seed treatments and soil fumigation also reduce KB.11

This is the first report of Karnal bunt from wheat in South Africa. Little is presently known about the distribution, hosts, and importance of KB in South Africa. Presently it appears that the fungus is restricted to the Douglas production area in the Northern Cape, and that with good quarantine practices it could possibly still be contained within this area, and possibly eradicated. An intensive survey of wheat, durum wheat (Triticum durum Desf.) and triticale (Triticosecale sp.) will have to be initiated in an attempt to restrict and combat this disease.

* First report has been submitted to Plant Disease Notes

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