



Figures: White grain disorder in bread wheat: (a) bleached florets at early grain filling; (b) greyish-white affected grain amongst healthy grain; (c) fruiting bodies on stubble; (d) perithecia; (e) upper peduncles showing browning;. Photo credits: Mark Butt (c,d) and Margaret Evans (a,b,e).

Disease: White Grain Disorder

Classification: K: Fungi, D: Ascomycota, C: Dothideomycetes, O: Botryosphaeriales, F: Botryosphaeriaceae.

White grain disorder (WGD) is a problem in winter grown wheat and barley in Australia. WGD can be caused by any, or a combination, of the recently described *Eutiarospora darliae*, *E. tritici-australis*, and *E. pseudodarliae*. WGD has been recorded intermittently in Australia since 1999, with outbreaks in 2011 and 2012 in South Australia resulting in grain deliveries being downgraded or rejected. WGD symptoms are similar to those of Fusarium Head Blight, which produces toxins harmful to stock and humans. Mapping genomes of the fungi associated with WGD as well as a feeding experiment in pigs (Kopinski and Blaney 2010) indicates that WGD is not associated with such toxins.

The Pathogen: White grain symptoms were first recorded in 1999 in Queensland, and were ascribed to *Botryosphaeria zeae* (Wildermuth *et al.*, 2001) and referred to as botryosphaeria head blight. Similar symptoms have since been detected in wheat crops in New South Wales, South Australia, Victoria and Western Australia. These symptoms, now called white grain disorder (WGD), are known to be associated with a complex of closely related fungi - *E. darliae*, *E. tritici-australis*, and *E. pseudodarliae* (Thynne *et al.* 2015).

Biology: The pathogens causing WGD survive on infected stubble for at least 24 months after harvest, with fruiting bodies (Fig. 1c) maturing during autumn, winter and spring. Pycnidia (Fig. 1c) produce an ooze of pycnosporos in a sticky matrix, which suggests these spores are rain-splash distributed. Ascospores produced by the perithecia (Fig. 1d) are most likely to be wind distributed and the main cause of grain infection. Under controlled conditions, infection in bread wheat occurred from head emergence to soft dough, required at least 24 hours of high humidity and occurred between 15°C and 25°C.

Symptoms: During early to mid grain filling, affected heads may show bleaching of single, multiple or all florets. Initially, bleached florets display blue-grey 'highlights' (Fig. 1a). During mid to late grain filling, the rachis of affected heads and sometimes the upper peduncle (Fig. 1e) exhibit a brownish discolouration. Grain produced by bleached florets is greyish-white and shriveled (Fig. 1b). Affected grain will not germinate, is lighter in weight than normal and the germ is usually brittle and sunken or hollowed.

Host Range: Bread wheat (*Triticum aestivum*), durum wheat (*Triticum turgidum*), barley (*Hordeum vulgare*) and triticale (\times *Triticosecale*) are known to exhibit WGD symptoms, but the host ranges of each of the fungi associated with WGD are poorly understood.

Disease Management: One screening trial using artificial inoculation suggests that WGD expression differs between commercial bread wheat cultivars. Resistance screening and fungicide efficacy continue to be examined under controlled conditions.

Further Reading: Kopinski and Blaney(2010) *Journal of Animal Physiology and Animal Nutrition* **94**: 44–54; Thynne *et al.* (2015) *Australasian Plant Pathology* **44**:527–539; Wildermuth *et al.* (2001) Proceedings 13th Biennial Australasian Plant Pathology Conference.

Key Contact: Margaret Evans, South Australian Research and Development Institute; e-mail: marg.evans@sa.gov.au; James Walter, University of Adelaide; e-mail: james.walter@adelaide.edu.au; Hugh Wallwork, South Australian Research and Development Institute; e-mail: hugh.wallwork@sa.gov.au.