

First report in decades of a forgotten crop pathogen calls for critical close monitoring

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Stem rust. Credit: John Innes Centre

Scientists, breeders, farmers and conservation groups must continue to work in close collaboration to prepare for the potential re-emergence of a forgotten crop pathogen, a new study advises today.

Work between groups has already started following the discovery of a single [wheat](#) plant infected with stem rust - the first confirmed case of the plant disease in the UK in over 60 years. Stem rust of wheat and barley has throughout history been associated with crop failure and famine, and has recently re-emerged in western Europe.

Following the discovery of a single infected wheat plant in Suffolk in 2013, Dr Diane Saunders and Dr Brande Wulff from the John Innes Centre in Norwich, led a global team of collaborators to carry out genetic tests that compared this strain to the dominant global populations of the pathogen.

Their results showed that the UK strain belongs to the Digalu race of the fungus, which was responsible for a devastating outbreak of stem rust in Ethiopia in 2013, and smaller outbreaks in Sweden, Denmark, and Germany in the same year.

Further investigations carried out by Dr Jane Thomas at NIAB in Cambridge, UK, found that over 80% of UK wheat varieties tested are susceptible to the UK strain of this pathogen. This indicates that if the strain became established in the UK, a large proportion of UK wheat could be at risk.

The research team warns that UK and European wheat and barley crops could be under threat from a perfect storm of conditions favourable to

stem rust resurgence.

Dr Daniel Bebber at Exeter University, UK, showed that changes in climatic conditions over the past 25 years suggest increasingly conducive conditions for fungal pathogen growth and infection.

In addition to the lack of resistance in European wheat varieties, in recent years the alternate host of the pathogen, Barberry (*Berberis vulgaris*), has also been increasing in popularity. This hedgerow shrub plays a key role in the life cycle of several rust pathogens including wheat stem rust.

The Barberry shrub was largely removed across England up until the early part of the 20th century, as farmers noticed that cereal crops grown adjacent to Barberry bushes were at greater risk of stem rust. However, over the last twenty years or so Barberry shrubs have been planted in efforts to conserve the Barberry Carpet moth, an endangered species. Much of this planting is focussed on the relatively few areas where the moth is found, although other plantings have occurred elsewhere.

The next steps in this process, says Dr Saunders, is a larger study to map and sample Barberry across the UK working alongside conservation groups. "Replanting Barberry in woodlands, gardens and areas away from arable land would ensure we provide vital habitat for the endangered Barberry Carpet moth, whilst limiting its potential impact on enhancing rust pathogen diversity."

The study "Potential for re-emergence of wheat stem rust in the United Kingdom" published today in *Communications Biology* urges: "the re-initiation of resistance breeding and a review of the mass plantation of common [barberry](#) to preclude re-planting near arable land and thereby limit the ability of the pathogen to rapidly overcome any introduced resistance and/or climatic constraints to safeguard European cereals

from a large-scale re-emergence of wheat stem rust."

Paul Fenwick, cereal pathologist at Limagrain UK Ltd and co-author of the study, said: "The discovery of stem rust in Suffolk has so far been an isolated one-off occurrence in 2013; however, with global temperatures set to rise by another 1 or 2 degrees over the next century, stem rust could extend its geographic range. Therefore, there is the potential for stem rust to become an ever-increasing threat across Europe and so research, such as this, will help to underpin breeding for resistance in the future."

In the current study, the authors identified cereal rust on Barberry in the UK for the first time in decades. Dr Diane Saunders said: "This highlights the critical need for close management of Barberry planting." Worryingly in the same year Sweden also witnessed the first report in Europe for decades of a highly diverse [wheat stem rust](#) epidemic that originated from Barberry. Dr Saunders said positive work was already taking place between her group at the John Innes Centre and conservation groups working to enhance habitats for the Barberry Carpet Moth.

Mark Parsons of Butterfly Conservation said "We are very concerned about the potential risk from the possible re-establishment of stem rust in this country and the impact it could have on agriculture and the environment. The Barberry Carpet moth is an endangered species restricted to just a handful of sites in this country, it being reliant on Common Barberry for survival. We are, therefore, pleased to be working closely with the John Innes Centre both to minimize the potential risk from cereal rust, but also to enhance the populations of the Barberry Carpet, and therefore increase its chances of survival in this country."

The role of Barberry in the life cycle of stem rust: Cereal rusts have very complicated life cycles, involving five different types of spore and two

hosts that they live on in different stages of their life cycle. On cereal crops, [stem rust](#) undergoes asexual reproduction, using the plant's own resources to produce millions of genetically identical spores. The type of spores it generates on cereals can travel on the wind thousands of kilometres. However, when Barberry is next to a cereal field the pathogen uses it as an alternate host to complete its sexual cycle, potentially leading to a swath of new genetic strains. Fortunately, the spores that form on Barberry only travel short distances, likely up to 10-20 meters, so for a Barberry bush to spread rust to a cereal field, they must be in close proximity.

More information: Clare M. Lewis et al, Potential for re-emergence of wheat stem rust in the United Kingdom, *Communications Biology* (2018). [DOI: 10.1038/s42003-018-0013-y](https://doi.org/10.1038/s42003-018-0013-y)

Provided by John Innes Centre

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