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Technical Yellow rust

The rust race

Every season has a new chapter to the yellow rust story. *CPM* finds out the latest twists in the tale as the UKCVPS reported the results of its surveillance last season.

By Lucy de la Pasture

Yellow rust has become unpredictable at best since the incursion of the Warrior race in 2011. The genetic diversity now present in the population means every season there's a possibility of an unexpected unpicking of resistance in varieties rated highly against the disease.

Each year in March the UKCVPS reports the results of the survey's monitoring from the previous cropping year. It throws light on the resistance genes being attacked and those that are standing firm and highlights new pathotypes which have novel combinations of virulence and avirulence for a differential set of wheat varieties.

Adult plant trials and variety seedling tests are then carried out using the yellow rust isolates with virulence profiles of

particular interest. This helps identify the risks associated with the change in the yellow rust population, explains Amelia Hubbard, reporting the results of the 2020 UKCPVS — jointly funded by AHDB and Defra's Animal and Plant Health Agency (APHA).

Under the spotlight

Since 2019, some varieties have been under the spotlight after unexpectedly high levels of yellow rust were found in some fields but not in others of the same variety. UKCPVS discovered that more yellow rust isolates were carrying virulence for Yr8, Kranich and Crusoe and two of these, found in KWS Zyatt in 2019, showed a novel virulence pattern — being avirulent on Yr1 and Yr9 but virulent on Yr8 which is similar to the Hereford race, explains Amelia.

These two 'interesting' isolates were put forward to be tested in adult plant trials, along with another three isolates exhibiting pathotypes that warranted further investigation.

"KWS Zyatt was susceptible to all five isolates but was most susceptible to isolate 19/215 with 40% of the plot area showing infection. This pathotype (Yr1,2,4,6,7,9,17,25,32,Re,Sp,Ro,So,Wa,Ca,St,Kr,Ap,Cr) was included because it showed additional virulence to Kranich, Apache and Crusoe in the differential set," she explains.

"The most susceptible variety in the test that's currently on the AHDB Recommended List (RL) was Skyfall, which was only exceeded by Robigus and Reflection. Lower levels of infection with Hereford-type isolate (19/010) were seen for the majority of varieties, with some RL varieties reacting to just one of the five isolates tested.

"In these adult plant trials Gleam was noticeably more susceptible in the trial inoculated with 19/038 and KWS Firefly was susceptible to all isolates, in particular isolate 19/215. This may help explain an outbreak on KWS Firefly reported during the 2020 season," she explains. ▶



Amelia Hubbard says two thirds of the varieties tested in adult plant trials showed good resistance to all the isolates tested.

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Yellow rust

Adult plant trial isolates, 2020

Isolate	Host	Pathotype
19/010	KWS Zyatt	2,3,4,6,7,8,17,25,32,Ro,So,Ca
19/038	Shabras	1,2,4,6,7,8,9,17,25,32,Sp,Ro,So,Wa,St,Kr
19/119	KWS Firefly	1,2,3,4,6,7,9,17,25,32,Sp,Ro,So,Wa,St,Ap,Ev
19/165	KWS Zyatt	2,3,4,6,7,8,17,25,32,Sp,Ro,So,Ca,St
19/215	KWS Extase	1,2,4,6,7,9,17,25,32,Ro,Sp,Ro,So,Wa,Ca,St,Kr,Ap,Cr

Source: UKCVPS, 2021

Adult plant trial results, 2020



Source: UKCVPS, 2021

► “KWS Extase (rated 9 for yellow rust on the RL) exhibited good levels of resistance to the five isolates, though showed 15% infection in plots inoculated with 19/215. It wasn’t alone in putting up a good performance, with fellow RL members and candidate varieties also showing good levels of adult plant resistance,” she adds.

In seedling tests 18 RL and RL-candidates were resistant to all five isolates and nine of the RL and RL- candidates were

susceptible to all five isolates, she adds.

In 2020 the survey team were busy, says Amelia, with 306 samples of yellow rust sent into UKCPVS from 88 varieties in 25 counties and April seeing double the number of samples received than in the same month in 2019.

“UKCPVS received higher than expected reports of disease in some varieties. The most commonly reported varieties in the first half of the season were KWS Firefly and

Gleam. While these two varieties topped the list, samples from KWS Zyatt, RGT Gravity, Skyfall and KWS Kinetic were also common. Very late season samples included ones from KWS Extase (rated 9 for yellow rust on the RL).

“30 isolates were tested from the samples and we saw a decrease in the frequency of virulence for Yr8 than in the previous year, with levels returning to a similar level to the years before the spike in 2019.”

New rust race

The changes in population and virulence seen in the field in 2019, particularly in KWS Zyatt and Dunston, raised questions about whether a new race of yellow rust had evolved but genotyping data still isn’t available to confirm this.

There had been 24 different pathotypes tested, ten of which were unique. This was a big increase on the variation seen the previous year, when 14 pathotypes were present, of which three were unique.

Genotyping data is also awaited for the 2020 isolates, though Amelia has preliminary assessed the pathotypes by their phenotypes to place them in their most probable genetic groups. This indicates that the Red group was dominant in both 2018 and 2019, but there was an interesting difference. In 2018 the

population was dominated by pathogens in the Red 27 and Red 23 groups but in 2019 there wasn’t a particular pathotype that dominated the population, although Red 24 was the most common.

For 2020, her preliminary results show that the Red group still dominates, with Red 37 and Red 28 each making up 17% of the population and Red 27 representing 10% of the population tested, explains Amelia.

“The new pathotypes found were all present at low frequencies and were sent in from different parts of the UK, with no isolates detected from the Purple or Blue groups in 2020,” she adds.

Amelia also conducted further tests on five samples of yellow rust which were taken from KWS Siskin and two samples from Costello — both varieties rated 9 for yellow rust resistance on the RL.

“After 25 days some sporulation was evident on both KWS Siskin and Costello with a few of the isolates. The sporulation on KWS Siskin was particularly poor, with very unhappy pustules and chlorotic/necrotic leaves.

“This wouldn’t be classed as susceptibility in seedling tests but is something that has been noted and two of the isolates originally sampled from KWS Siskin 20/050 and 20/191 have been selected for 2021 adult plant trials,” she notes.

KWS Firefly also warranted some further investigations as it’s a variety that has previously been found to be resistant in seedling virulence tests.

“We conducted mini tests using 2020 KWS Firefly isolates and found good infection levels in separate tests using 19/119 and its re-isolate 20/506, which indicated it may be susceptible to these at the seedling stage. It’s possible that this variety could be environmentally sensitive, but we need to carry out further work to confirm these results.” ■

Variety samples in 2020



Source: UKCVPS, 2021

Agronomic factors affecting yellow rust

2020 was a season with yellow rust popping up in places where it wouldn't normally be expected, says ADAS senior scientist, Jonathan Blake. As well as the genetic changes in the yellow rust population, he highlights that both the weather and sowing date also had a part to play in the high incidence of the disease last spring.

A review of the agronomic factors affecting yellow rust carried out in 2007 looked at 4475 wheat crops over a 15-year period, says Jonathan. "The analysis showed a clear link between the number of frosts below -5°C over the winter and the prevalence of yellow rust in crops, with 6-10 hard frosts reducing the disease considerably."

According to Met Office data, there were five fewer frosts than average (30-year mean) in Dec 2019 and eight less in both Jan and Feb 2020, which would correlate with an increased risk of yellow rust. It was also very wet in the period from late autumn to early spring and as a result very few winter wheat crops were sown, with the few that were going in very late.

"Research shows there's a very clear link between the age of a plant and its susceptibility

to yellow rust — where it occurs in plants without adult plant resistance to the disease. That means later planted wheat is more at risk from yellow rust infection in the spring than crops planted at earlier timings and much of the wheat fell into that category last year."

One of the stand-out points about yellow rust control is the importance of fungicide timing on a disease that's comparatively fast-moving compared with septoria, highlights Jonathan.

"Yellow rust can have a latent period as short as 10 days, which in practice means good control can be achieved on leaf three at T1 and on the flag leaf at T2, but leaf two is less protected. Because the latent period is shorter than septoria, the yellow rust has time to cycle in between the sprays."

Minding this gap between T1 and T2 is particularly important in susceptible varieties, such as Skyfall, KWS Kinetic, KWS Kerrin, KWS Zyatt, Gleam, Shabras, SY Insitor and RGT Wolverine, he says.

"These may warrant an early fungicide to control yellow rust inoculum and possibly a spray at GS37 to cover leaf two."

Jonathan believes that there's still a lot to



Minding this gap between T1 and T2 is particularly important in susceptible varieties, says Jonathan Blake.

learn about yellow rust and, in particular, how the sporulation, infection efficiency and latent period may vary between races.

"As we move more towards an IPM strategy, we have to understand the relationship between the pathogen and host better so that we can make more informed fungicide decisions. We also don't know when adult plant resistance will kick in so it's always prudent to address the symptoms present in the field."

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