New names for rust races

The Warrior (Red) race continues to dominate samples, says Sarah Holdgate.

Technical
Disease control

Wheat pathogens have been dominating the headlines lately as they evolve, making control less predictible. *CPM* gathers the latest on UK pathogen populations from UKCPVS and gets an update on septoria management from Agrii.

By Lucy de la Pasture and Adam Clarke

> *"The old system of naming is no longer suitable."*

2017 marks the 50th anniversary of UK Cereal Pathogen Virulence Survey (UKCPVS), set up in the wake of the outbreak of a new race of yellow rust that made its mark on Rothwell Perdix in 1966.

"The objective of the survey was to provide a coordinated examination of resistant varieties to enable the early detection of new races of plant pathogens to prevent such a lack of knowledge, as evidenced in the Rothwell Perdix outbreak, from happening again," explains Dr Sarah Holdgate, outlining the history of UKCPVS at the annual stakeholder event, held at NIAB in Cambs earlier this month.

Fifty years on and UKCPVS has a proven record of flagging up newcomers in the rust population, highlighting the arrival of the Joss Cambier, Hornet, Brigadier, Madrigal, Robigus and Solstice races. Their provision of diversification tables has helped growers choose a mix of varieties to reduce the risk of yellow rust going rampant and allowed breeders to select the appropriate resistance genes in breeding programmes.

Exotic incursion

But in recent years, yellow rust has upped the ante with the arrival of the Warrior race in 2011, an exotic incursion that behaves differently and has now completely replaced the native races. The yellow rust population is currently so disparate that the production of diversification schemes has become obsolete.

The extreme diversity has also thrown up difficulties in the naming of new races, traditionally named after the variety whose resistance they first overcame. Last year this led to a revision of the Warrior sub-groups, though this was far from ideal. The fact that some Warrior races are avirulent on the variety Warrior, proves to be a mind-bender when it comes to classifying them, she explains.

Under last year's system, a sub-group of Warrior pathogens was named Warrior 3, these appeared similar to the old Solstice race but on genotyping were definitely something different, being more similar to Warrior. It's this sub-group that was provisionally re-named Invicta in the autumn of 2016.

With a completely new yellow rust population, the old system of naming is no longer suitable, so a new naming system for the races discovered in the UK has been put in place, reveals Sarah Holdgate.

"Until now, naming a race based on the variety on which it was first detected has served us well. But the system no longer copes with the complex genotypic and pathology data we're seeing and we feel it's important to avoid using a variety's name."

WYR Blue 1 and 7 are the first names to be allocated to a race under the new system (which reflects a system used in potato blight virulence surveys) and replaces the provisional name Invicta.

The discovery of WYR Blue 1 and 7 in the UK is just one of several yellow rust population changes occurring during a period which also saw radical revisions to disease ratings in the AHDB Cereals and Oilseeds Recommended List (RL) last autumn.

Sarah Holdgate describes last year as far from straightforward from a yellow rust perspective.

"By mid-March 2016, we had received a record number of infected samples from wheat crops. It was a sign that something big was happening and the season ended with major revisions to RL ratings.

"Although we're still looking to pin down the race or races responsible for the breakdown, our monitoring has detected new races in the UK population and we're keeping an eye on them."

For wheat yellow rust, the Warrior race continues to dominate samples, with the ▸

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Decision support tools can aid septoria control

Francesca Salinari is developing a septoria decision-support system to highlight risk of disease to aid fungicide selection.

With azole fungicide efficacy in steady decline and SDHI-insensitive septoria isolates present in UK fields, an indicator of septoria pressure in-season would be invaluable to ensure fungicide inputs are optimised and chemistry isn't placed under undue strain.

It's positive news then, that advisory group Agrii is pouring resource into producing decision-support tools that indicate septoria risk and help its agronomists tailor fungicide programmes accordingly.

With septoria infection and spread so dependent on weather, an accurate long term weather forecast would be the Holy Grail for predicting risk, but it's questionable whether this will ever be possible.

There are decision-support tools available across the UK and Europe — including in-crop sensors, threshold and academic models — designed to help control the disease more efficiently. However, Agrii's research and development projects co-ordinator Dr Francesca Salinari says her evaluation of a select few of these methods in UK trials provided some inconsistent results.

"Some of the models didn't perform consistently in different years, while others are event driven. These can work well for apple scab, for example, when you would go out and spray when infection occurs, but in wheat, disease control is driven by leaf emergence," she explains.

Subsequently, Agrii aimed to develop a system that would give an indication of risk for its agronomists, allowing them to adjust fungicide doses or product choices ahead of key spray timings.

To do so, Francesca Salinari delved into Agrii's vast data set, which includes historic disease progression observations in trials and records from its network of 190 weather stations dotted around the UK.

Focussing on two differing seasons — high septoria pressure in 2014 and low in 2015 — key septoria risk indicators were identified. These included frequency of rain events, conducive to spore dispersal and successful infection, and milder temperatures, which shorten latent periods and increase the speed of disease progression.

During 2016 and using these indicators, it was possible to look back at weather-station data over the previous three to four weeks and assess the likely level of disease pressure. This formed the basis for a weekly bulletin to Agrii's agronomists, giving them an extra resource on which to make disease-control decisions.

"The testing of models and development of decision support is ongoing. The weather indicators we provided in the weekly bulletin isn't the only information we can use, but it did give a good indication of risk and feedback was positive," says Francesca Salinari.

The developing support system may prove an invaluable tool for optimising fungicide programmes in the future, but septoria risk management isn't solely reliant on chemicals. Agrii's head of crop science and stewardship, David Langton, says that a fully integrated approach is critical and choosing the right variety is becoming increasingly important.

While the AHDB Recommended List provides a solid reference for variety choice, Agrii is carrying out its own interrogation of varieties around the UK and provide a more robust decision making aid.

This includes co-ordinated growing systems trials or "COGS", which assess performance of potential new and existing varieties in different rotational positions, early or late drilled and using different input programmes. The result is Agrii's own advisory list for wheat varieties.

"It's providing extra information (over the RL), gleaned from our own trials for our agronomists and their growers to aid the decision-making process," explains David Langton.

The Agrii trial site at Lenham in Kent is one of several sites throughout the country where varieties are put through their paces.

David Langton says that a fully integrated approach is critical and choosing the right variety is becoming increasingly important.

Included in the offering is an insight into yellow rust diversity groups, which in the past has helped growers choose a mix of varieties susceptible to different strains to ensure the whole area doesn't break down to the dominant strain.

"People have drifted away from using diversity groups and the information isn't there for new varieties anymore, but we still see the value. We produce a matrix based on a varieties' parentage to give an idea of diversity group," he explains.

With seven varieties on the RL possessing a septoria resistant score of 7 and the uptake of such varieties gaining momentum, Agrii's Clare Bend says this is good news for fungicides.

She argues that as resistance to the two main fungicide groups builds in septoria populations, putting the actives under less pressure by using resistant varieties and robust spray programmes will help slow the slide.

She recommends using a T0 spray early in the season, then mixed modes of action — including multisite actives such as chlorothalonil — throughout the programme to protect crops rather than firefight disease.

Regarding frequency of SDHI use for resistance management, Clare Bend is clear, "We take the view that you must use an SDHI at T1. If you don't, it puts added pressure on the T2 spray."

She also notes that Agrii produces a fungicide decision-support matrix for its agronomists based on varietal resistance scores and potential dose response to help tweak product choice and rates based on risk and reward.

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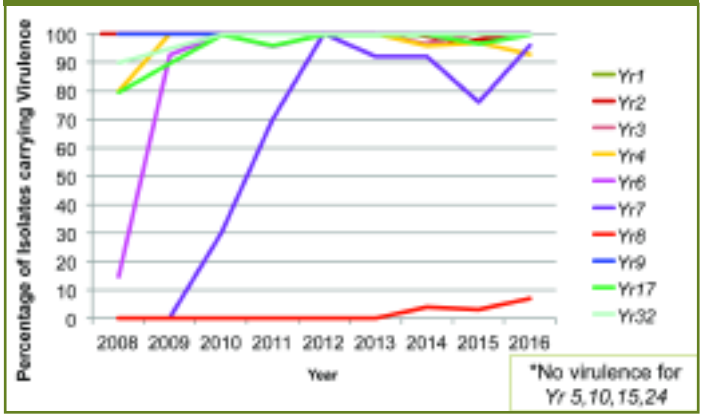
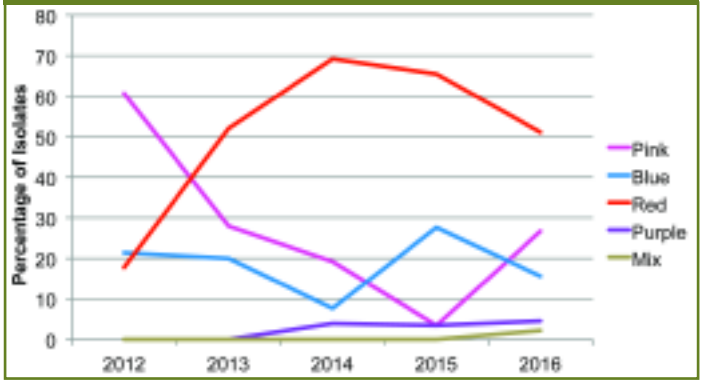
Virulence frequency – individual genes



Source: UKCPVS 2017

Virulence frequency – pathotype group



Source: UKCPVS 2017

▸ Red (Warrior 4) group found in at least half of samples tested by UKCPVS. After a period of decline, Pink (Warrior 1) increased in frequency in 2016. Virulence frequencies for most genes remained relatively stable in 2016. However, the YR7 gene was more prevalent, as was the YR8 gene (which is an indicator of the Purple (Kranich) race), although it remains relatively rare.

"The Purple race did some damage last season but wasn't responsible for the majority of yellow rust infections. It may be that this particular race needs some specialism in order to increase in the population and live up to the level of damage it can cause in trials," she says.

What was apparent in the samples tested was a decrease in Blue 1 and 7, but Sarah Holdgate believes that the true extent of the problem was probably hidden in with the presence of other Warrior types.

"There may be a combination of isolates causing certain varieties to succumb to yellow rust infection but it's a complex puzzle to untangle. Evolution has now been added to the differential set to help

Common races for 2016

Race Name	Pathotype	Similar Races
Red 21	1,2,3,4,6,7,9,17,25,27,32,Re,Sp,Ro, So,Ca,Ap	Red 3 (- vir for 27 and Re)
Red 23	1,2,3,4,6,7,9,17,25,27,32,Re,Sp,Ro, So,Ca,St,Ap	Red 7 (- vir for 27 and Re)
Blue 7	1,2,3,4,6,9,17,25,32,Re,Ro,So,Ev	Blue 1

Source: UKCPVS

The powdery mildew population remains stable in wheat and barley crops.

understand some of these differences, which if we can unravel, will mean we can produce variety diversification schemes again," she explains.

"The Pink (Warrior 1) group also increased percentage-wise in the population but some of these isolates show virulence to Warrior, so these may ultimately be reclassified as belonging to the Red group (Warrior 4) when genotyping information becomes available."

What did become obvious last season was that there's very little seedling resistance remaining in current wheat varieties where the new incursion of yellow rust is concerned.

"In our seedling tests, all varieties were susceptible except Costello, KWS Crispin and KWS Siskin. So if any of these three varieties shown early signs of yellow rust infection, please send in a sample as it would indicate something new is happening.

"Also showing infection for the first time in seedling trials were Evolution, KWS Silverstone and RGT Illustrious," she adds.

So why was 2016 such a 'good' year for yellow rust infection? Sarah Holdgate points out that 2015 was also a good year and a high spore load would have been carried over last year from the previous season.

"The high inoculum, mild winter and new isolates — Blue and Purple (Kranich) — all contributed, with virulence detected at the adult plant stage for multiple varieties. I'm often asked whether the yellow rust pathogen has become more aggressive but at the moment, there's no conclusive evidence either way," she comments.

Aggressiveness

To provide further information on aggressiveness, UKCPVS will be recording the time to sporulation in the different isolates this year for the first time. This will help identify trends in the latent periods between isolates and give an indication of whether some are likely to be more aggressive than others, explains Sarah Holdgate.

For wheat brown rust, disease levels were relatively high in 2016 but no unexpected disease was reported to UKCPVS. Isolates have become more complex in recent years and investigations into the causal race associated with relatively high levels of brown rust in Crusoe continue.

For wheat and barley powdery mildews, virulence frequencies remain broadly similar to those seen in recent years.

Worthy of note was the yellow rust found in barley in 2017, advises Sarah Holdgate. Four samples were tested in the survey, with samples from three counties and four different varieties — all from the eastern counties.

"One of the isolates carried virulence for the resistant cultivar Optic. It's possible we're seeing an exotic incursion in the barley yellow rust population and genotyping may help to distinguish any differences to the previous UK population. However, it's very important to send samples into us if anything unusual appears in the field this spring so we can continue to monitor the situation," she concludes. ■