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Russian wheat aphid - learnings from 2018 and how they can inform us in 2019

EXTENSION

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Key messages

- **Contrary to expectations, Russian wheat aphid pressure in Southern Australian cereal production seems low over the last two years (2017, 2018).**
- **Dry and hot summer conditions seem to reduce green bridge survival of Russian Wheat Aphids (RWA).**
- **Barley grass and Brome grasses are major hosts (van Helden 2018) supporting RWA survival over summer. Their development will strongly depend on summer rainfall.**
- **Development of regional economic thresholds are in progress at trial sites throughout South Australia, Victoria, Tasmania, and New South Wales. Use of international thresholds are still advised until Australian thresholds are developed.**
- **Observations suggest that crop infestations occur in autumn on early growth stages, then persist over winter and can build up in spring, especially when plants are drought stressed.**

Why do the trial?

Since first being discovered in South Australia in 2016, Russian wheat aphid (RWA) has been found widespread in cereal growing regions of South Australia, Victoria, New South Wales and Tasmania.

Avila *et al* (2019) assessed the potential spread and establishment of RWA in Australasia using a re-parameterised CLIMEX model, showing that RWA has the potential to establish in all key grain growing regions in Australia.

RWA feeding results in acute and observable plant symptoms in young plants, but the presence of RWA in an area does not automatically mean the crop will be infested, and even the presence of RWA in a crop does not automatically translate into yield loss. In many areas of the world RWA is present without any significant yield loss (Savary *et al.* 2019). Reports of RWA issues to SARDI have been less than anticipated in the last two years. Overall RWA populations in Australian crops seem slightly higher in low rainfall areas (<400 mm/year).

A new GRDC investment, '*Russian wheat aphid risk assessment and regional thresholds'* has been launched to investigate regional risk and management tactics for RWA.

What happened?

The South Australian Research & Development Institute (SARDI) and cesar are assessing the regional pressure of RWA with the aim of developing regional economic thresholds and gaining a better understanding of the role that green bridges are playing in supporting RWA populations between cereal cropping periods.

Currently only provisional intervention thresholds for RWA are available, which are based on US research (Pike and Alisson, 1991): >20% of all plants infested with aphids up to GS30 and >10% of tillers infested from late stem elongation (following GS30) to the end of flowering. Since initial detection of RWA in Australia growers have been advised to use these thresholds as they represent the best current knowledge. However, this threshold is likely to vary depending on cereal variety and climatic regions.

Development of regional economic thresholds

In 2018, 15 trial sites were set up throughout South Australia, Victoria, New South Wales, and Tasmania in collaboration with regional organisations. A subset of five of these trial sites were artificially inoculated with the aphid at GS20 to ensure thresholds could be developed. This trial site work builds on SAGIT Time of Sowing trials conducted by SARDI in 2017 and 2018 in three regions: Bool Lagoon, Roseworthy and Loxton. SA trials in 2018 were done in Keith, Riverton, Loxton, Minnipa and Cummins.

Each trial site included wheat, barley and a third commodity (durum wheat, winter wheat or oat) and three treatments: Gaucho seed treatment, Chlorpyrifos treatment, and an untreated control. Yield data and observations on RWA abundance, presence of beneficials, and RWA migration times were also collected.

None of the 15 trials sites showed significant 'natural' infestation levels in 2018. The five inoculated trials (including Riverton, Keith and Loxton in SA) showed very high aphid numbers and symptoms, and yield loss on the untreated (inoculated) controls.

Since we currently have only one season of trial site data no inferences can yet be made. Trials will be repeated in 2019, which will strengthen our data set and enable further investigation into the relationship between RWA numbers, plant symptoms and yield loss across regions.

Green bridge surveillance and risk assessment

Surveillance for RWA over spring and summer from October 2018 to February 2020 on volunteer cereals and grasses (native and weedy) at the landscape scale is generating data about types of vegetation the aphid is surviving on outside of the cropping season, and what environmental conditions support its survival over this period. Relating aphid abundance to climatic conditions (such as rainfall and temperature) will allow us to predict aphid population growth over this critical period.

The ultimate aim of the project is to develop additional guidelines for RWA management that are regionally specific. While trial site results are not discussed here, due to limited data so far, there is information included on preliminary findings of green bridge surveillance.

Where has Russian wheat aphid been found?

Our most current data indicates that RWA is present in a large, and still expanding, area covering all cereal growing regions of South Australia, Victoria, Tasmania and most of New South Wales. Our spring sampling shows that the aphid is widespread across these regions in at least low numbers, however we do not know how typical this spring distribution is, as we have only sampled for one season. In late 2018 the aphid was detected at Coonabarabran and the Liverpool Plains (New South Wales), which is a northerly extension of range for this aphid. The second sampling round done in January 2019 shows the numbers reduced compared to earlier samples, but aphids can still be found almost everywhere.

An interactive distribution map showing reports of RWA from different sources and the results of the current green bridge sampling is available. This map updates in real time, and lists information sources for each data point, evidence of absence data, and allows users to toggle with the timeframe between 2016 and 2019. You can find it on the RWA Portal (see resources section).

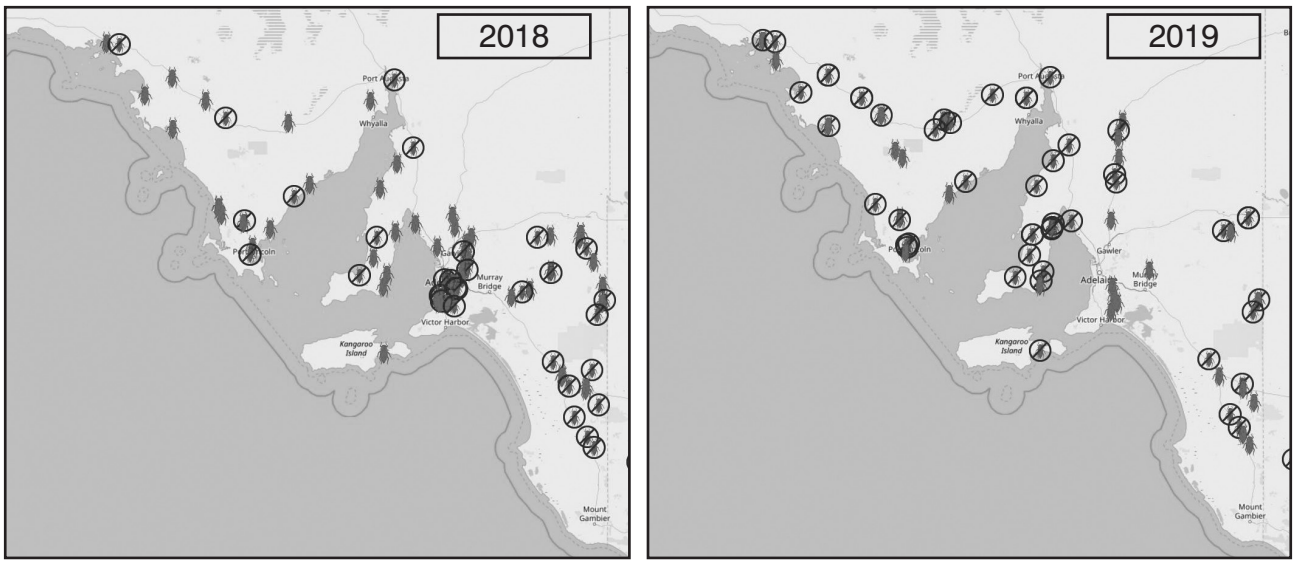

Figure 1 RWA interactive map for South Australia. Detections span 2018 (left) with data sourced from 2018 green bridge surveillance and advisor reports to PestFacts and 2019 (right) with data from the second round of green bridge survey in January/February 2019. Aphid denotes RWA present, crossed circle indicates no RWA found (Map developer: Dr James Maino, cesar).

What we know about the environmental conditions under which RWA will thrive

Despite few RWA issues reported to PestFacts services during the 2018 cereal growing season, our spring sampling detected RWA in all cereal growing regions where RWA has been reported previously and RWA was also detected around each of the trial sites. The presence of RWA in an area does not automatically mean it will cause damage to crops. RWA needs to infest cereals in early autumn in order to develop into damaging population levels in spring during booting and flowering.

While we are still accruing data about conditions that support RWA survival and can give limited advice; here is what we can say:

- Hot and dry summer conditions reduces over-summering populations of the aphid, with RWA likely to persist where there is available moisture and green material (from rainfall or irrigation).
- Higher than average temperatures are unfavorable for RWA survival.
- Localised summer rainfall events resulting in germination of weeds like barley grass can provide summer refuges for the aphid.
- Field observations and experiments over the last three seasons indicate that RWA abundance and development on crops is higher in low rainfall zones (<400 mm per year) and on drought stressed crops.
- This year's field trial observations support international research findings that indicate mature crops (GS40 or higher) are less attractive and are less likely to be invaded by RWA in spring.

This research is ongoing; RWA is still a very new pest to Australia and we are continuing to learn about its biology as the current investment progresses. More pertinent information about environmental influences is likely to be gained at crop establishment, particularly in regard to area-wide aphid abundance and flight timing. Significant early infestation of a crop will only occur through a combination of abundant green bridge and good autumn flight conditions that would aid RWA migration to cereal paddocks during the seedling stage in early autumn. Good flight conditions for aphids are calm, warm days over 20°C. Over the 2018 season these conditions were not met in southern Australia.

What does this mean?

- Monitoring for the aphid itself on green bridge hosts is advisable, as classic RWA symptoms have been rarely observed on grass species over spring and summer.
- Volunteer cereals and weedy grasses found within next season's cereal paddocks should be controlled at least 4 weeks prior to sowing.
- Registered neonicotinoid insecticide seed treatments are very effective to avoid autumn infestation of crops if RWA are migrating. However, such migrations into crops did not occur in 2018. The decision to seed treat needs to be balanced against risks (such as increased resistance in RWA and other exposed pests).
- We urge growers to use neonicotinoid seed treatments judiciously, according to the regional risk, and using the FITE (Find, Identify, Threshold, Enact) approach.
- RWA is easy to detect in autumn and winter before yield is impacted. If RWA is present in potentially damaging numbers it can be controlled efficiently by insecticide sprays around growth-stage 32-40, eliminating the aphids before there is a risk of yield loss. The overseas threshold is >20% of all plants infested up to GS30 and >10% of tillers infested from late stem elongation (GS30 or later).

Useful resources

To view the RWA Interactive Map
http://www.cesaraustralia.com/sustainable-agriculture/rwa-portal/

GrowNotes Tips & Tactics for Russian Wheat Aphid
https://grdc.com.au/data/assets/pdf_file/0025/289321/GRDC-Tips-and-Tactics-Russian-Wheat-Aphid.pdf

Russian Wheat Aphid Tactics for Future Control
https://grdc.com.au/__data/assets/pdf_file/0027/244377/Russian-Wheat-Aphid-Tactics-for-Future-Control.PDF

Russian Wheat Aphid Dynamics in 2017 (research update)
https://grdc.com.au/resources-and-publications/grdc-update-papers/tab-content/grdc-update-papers/2017/08/russian-wheat-aphid-dynamics-in-2017

References

Avila, G., Davidson, M., Van Helden, M., and Fagan, L. (2019) The potential distribution of the Russian wheat aphid (Diuraphis noxia): An updated distribution model including irrigation improves model fit for predicting potential spread. Bulletin of Entomological Research, 109(1): 90-101

Pike KS., and Allison, D. (1991) Russian wheat aphid. Biology, damage and management. Pacific Northwest Cooperative Extension Publication PNW371Savary, S., Willocquet, L., Pethybridge, SJ.,

Esker, P., McRoberts, N. & Nelson A. 2019. The global burden of pathogens and pests on major food crops. Nature Ecology & Evolution (2019) https://doi.org/10.1038/s41559-018-0793-y

van Helden, M. (2018) Testing the suitability of Australian native and introduced grasses as host plants for Russian wheat aphid. GRDC DAS000170 SARDI Entomology Report

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