

Ramularia leaf spot in barley



Figure 1. Ramularia leaf spot symptoms – the '5Rs': (1) Ringed with yellow margin of chlorosis, (2) Rectangular shape, (3) Restricted by the leaf veins, (4) Reddish-brown colouration, (5) Right through the leaf

Latest information

- Mature ramularia lesions can be distinguished from other foliar symptoms by applying the '5Rs'

Action

- In high-risk situations, use a preventative spray at booting (GS45 to GS49)
- Chlorothalonil should be included in programmes to ensure effective control and slow further spread of resistance to azoles and SDHIs
- Use identification guidelines and look for symptoms late in the season
- Avoid saving seed for re-sowing from heavily infected crops

Importance

Ramularia leaf spot symptoms have been reported with increasing frequency across the UK. However, ramularia is probably still underreported, due to unfamiliarity with the symptoms. Though previously associated with spring crops, evidence of ramularia in winter crops has increased in recent years. Trials suggest yield loss can be up to 0.5t/ha in heavily infested crops.

Life cycle and symptoms

The fungus *Ramularia collo-cygni* causes ramularia and grows from infected seed. It then moves systemically within new plant growth. Airborne spores produced on trash and crop debris, however, can also infect plants.

Infected crops do not display visible symptoms initially. Senescing leaves may show signs of infection early in the season but the main damage occurs on the top leaves after flowering.

Later in the season, rows of white spores can be seen with a hand lens on the undersides of affected leaves. As leaves senesce, these structures can be seen with the naked eye.

Stressed crops are thought to be more likely to show symptoms, including those exposed to high light levels, waterlogging and rainfall after flowering. However, even stress associated with flowering may be sufficient to initiate symptoms.

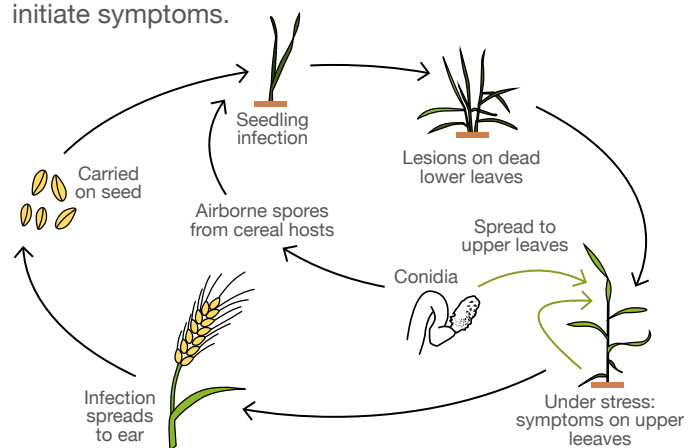


Figure 2. Life cycle of *Ramularia collo-cygni*



The '5Rs'

Symptoms appear on the upper leaves after flowering. Initial damage is a fine pepper spot (A), which darkens to a square spot, bounded by leaf veins and surrounded by a chlorotic halo (B)

Mature ramularia lesions can be distinguished from other foliar symptoms by applying the '5Rs' (see Figure 1):

- 1 Ringed with yellow margin of chlorosis
- 2 Rectangular shape
- 3 Restricted by the leaf veins
- 4 Reddish-brown colouration
- 5 Right through the leaf

Ramularia is often mistaken for other diseases, such as the spot form of net blotch, tan spot or physiological spotting. Net blotch and tan spot lesions are not rectangular or restricted by leaf veins. Physiological leaf spots, caused by oxidative stress, tend to be caused by superficial browning on upper leaf surfaces, while the undersides remain unaffected. These cause less yield loss but can trigger the production of ramularia leaf spots.

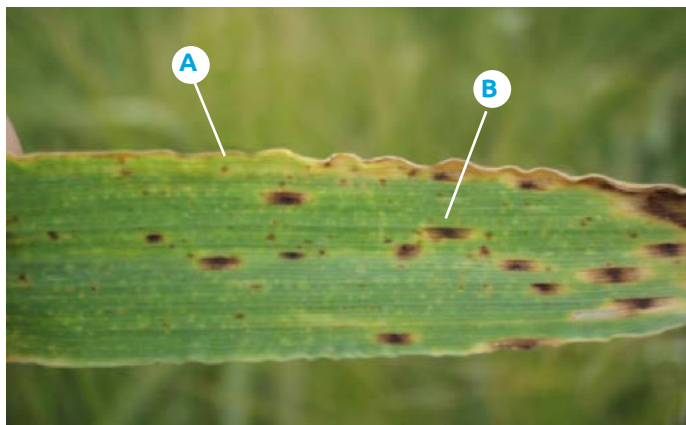
Control

Ramularia is seed borne but it is not controlled effectively by seed treatments. Farm-saved seed from crops which had high levels of ramularia symptoms should be avoided.

Some foliar fungicide treatments can control ramularia but resistance to fungicides is increasing. Resistance to strobilurin fungicides was reported many years ago. Cases of resistance to azole and SDHI fungicides have also been reported recently in the UK and Europe.

Chlorothalonil is not effected by mutations in the fungus and should be included in programmes to ensure effective control and slow further spread of resistance to azoles and SDHIs.

The most effective timing for fungicide applications against ramularia is at booting (GS45 to GS49). Later applications, up to ear fully emerged (GS59), may also be effective but may be restricted for malting barley crops. Once symptoms develop on the upper leaves post-flowering, treatment is not effective.



Varietal resistance

The development of visible ramularia symptoms in barley is driven by a complex set of environmental and genetic factors.

Due to the level of complexity, it is not possible, at present, to generate robust varietal disease ratings for inclusion within the AHDB Recommended Lists (RL).

AHDB is working with industry to improve the reliability of disease assessments and the ratings process.

Due to the importance of varietal resistance, AHDB plans to reinstate ramularia disease ratings, for both spring and winter barley, as soon as possible.

1.Disease severity: 0%

No disease.

2.Disease severity: 1 to 5%

Sparse lesions on upper leaves.



3. Disease severity: 6 to 10%

More lesions on upper leaves.



4. Disease severity: 11 to 20%

Upper leaves with some necrosis. Some lesions on middle leaves.



5. Disease severity: 21 to 30%

Many lesions and severe necrosis on upper leaves. Numerous lesions on middle leaves.



6. Disease severity: 31 to 40%

Extensive lesions on upper leaves. Many lesions on middle leaves and necrosis.



7. Disease severity: 41 to 50%

Severe damage to upper leaves. Further lesions and necrosis on middle and lower leaves.



8. Disease severity: 51 to 75%

Complete lesions (100%) on upper leaves. Severe (50 to 75%) necrosis on middle leaves.



9. Disease severity: 76 to 100%

Almost all leaves necrotic with lesions on all leaves.



Other foliar symptoms (not caused by ramularia)

Abiotic or physiological leaf spot confined to upper leaf surface



Mix of ramularia and physiological leaf spot



Unlike ramularia, physiological leaf spots tend to cause superficial browning on upper leaf surfaces and the undersides are unaffected. Although these cause less yield loss, they can trigger the production of ramularia leaf spots.

Spot form of net blotch

Unlike ramularia, net blotch and tan spot lesions are not rectangular or restricted by leaf veins.



Necrosis caused by powdery mildew



Target spot



When powdery mildew spores attack, a hypersensitive reaction is induced in some varieties which causes distinct leaf spots, commonly known as target spots.

Rhynchosporium leaf scald



Halo spot



Other foliar symptoms (not caused by ramularia)

Septoria

Tan spot



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Further information

This guide uses findings from the AHDB/Arable LINK Project 3441 'Control of ramularia leaf spot in a changing climate (CORACLE)'.
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