

Supplementary **TABLE S1**. Sampling calendar and the rust life stage observed in 2019.

Date	Province	Locations	Rust life stage of sample
May 1	Huesca	Lasieso, Hostal de Ipiés	Initial infection on barberry, telia on remains of grasses
May 11	Huesca	Larrés, Lasieso, Hostal de Ipiés	Pycnia on barberry
May 18	Huesca	Larrés, Lasieso, Hostal de Ipiés, Caldearenas	Actively sporulating aecia on barberry
June 1	Teruel	Bronchales, Torres de Albarracín, Monteagudo del Castillo, Cedrillas	Active aecia on barberry
June 1	Albacete	El Balletero	Active aecial infection on barberry, with incipient necrosis (end of infection)
June 16	Huesca	Larrés, Hostal de Ipiés, Lasieso, Caldearenas	Low severity aecial infections on barberry. Profuse infection on cereal crops and grasses
June 22	Teruel	Bronchales, Torres de Albarracín, Allepuz, Monteagudo del Castillo, Cedrillas	Active aecia on barberry, uredinia on cereal crops and grasses
July 7	Huesca	Larrés, Hostal de Ipiés, Lasieso, Caldearenas	Stem rust infection on grasses, with mixture of uredinia and telia
August 24	Huesca	Larrés, Hostal de Ipiés, Lasieso	Sporadic uredinia on grasses

Supplementary **TABLE S2**. Location and main environmental attributes of surveyed sites

Province	Location	Site	Latitude	Longitude	Elevation	T(°C)	P (mm)	Eto (mm)
Huesca	Jaca	Larrés	42.56 N	0.39 W	870	9.5	925	825
		Hostal de Ipies	42.44 N	0.39 W	715			
		Lasieso	42.42 N	0.44 W	729			
		Caldearenas	42.40 N	0.50 W	641			
Teruel	Albarracín	Torres de Albarracín	40.40 N	1.50 W	1189	11.1	463	838
		Bronchales	40.52 N	1.58 W	1486			
	Gúdar	Cedrillas	40.44 N	0.86 W	1355	10.2	490	817
		Monteagudo del Castillo	40.46 N	0.81 W	1442			
		Allepuz	40.49 N	0.76 W	1376			
Albacete	Campo de Montiel	El Balletero	38.81 N	2.45 W	983	14.2	397	1200

T: Annual average temperature; P: Annual precipitation; ET₀: Annual reference evapotranspiration

Supplementary **TABLE S3**. Best BLASTN hit results for ITS sequences of 22 aecial samples collected during 2018 and 2019 rust survey in Spain

Aecial sample		BLASTN results						
Sample ID	GenBank accession No. ¹	<i>Puccinia</i> spp.	Host	% identity	Total length	Mismatch	Gaps	GenBank accession No. ²
18SPA0066	OM265439	<i>P. brachypodii</i>	<i>Brachypodium</i> sp.	98.0	971	10	4	GQ457303.1
18SPA0067	OM265440	<i>P. graminis</i>	<i>Lolium perenne</i>	99.9	969	0	1	DQ417384.1
18SPA0068	OM265441	<i>P. graminis</i>	<i>Avena sativa</i>	99.9	970	0	1	DQ460727.1
18SPA0071	OM265442	<i>P. graminis</i>	<i>Triticum aestivum</i>	99.6	975	0	1	DQ417382.1
18SPA0080	OM265443	<i>P. graminis</i>	<i>Triticum aestivum</i>	99.4	969	2	3	DQ417378.1
18SPA0085	OM265444	<i>P. graminis</i>	<i>Triticum aestivum</i>	99.9	972	0	1	DQ417382.1
18SPA0089	OM265445	<i>P. graminis</i>	<i>Triticum aestivum</i>	99.9	972	0	1	DQ417382.1
19SPA0117	OM265446	<i>P. graminis</i>	<i>Triticum aestivum</i>	99.9	972	0	1	DQ417382.1
19SPA0118	OM265447	<i>P. graminis</i>	<i>Triticum aestivum</i>	99.8	972	0	2	DQ417382.1
19SPA0119	OM265448	<i>P. graminis</i>	<i>Triticum aestivum</i>	99.8	973	0	2	DQ417382.1
19SPA0122	OM265449	<i>P. graminis</i>	<i>Triticum aestivum</i>	99.8	973	0	1	DQ417382.1
19SPA0124	OM265450	<i>P. graminis</i>	<i>Triticum aestivum</i>	99.8	972	0	2	DQ417382.1
19SPA0125	OM265451	<i>P. graminis</i>	<i>Triticum aestivum</i>	100.0	971	0	0	DQ417382.1
19SPA0126	OM265452	<i>P. graminis</i>	<i>Triticum aestivum</i>	99.8	973	0	1	DQ417382.1
19SPA0127	OM265453	<i>P. graminis</i>	<i>Avena sativa</i>	99.9	970	0	1	DQ460727.1
19SPA0128.a	OM265454	<i>P. graminis</i>	<i>Dactylus glomerata</i>	99.1	969	1	2	DQ417390.1
19SPA0140	OM265455	<i>P. graminis</i>	<i>Triticum aestivum</i>	99.6	971	2	2	DQ417382.1
19SPA0144	OM265456	<i>P. graminis</i>	<i>Triticum aestivum</i>	99.7	973	0	2	DQ417382.1
19SPA0156	OM265457	<i>P. graminis</i>	<i>Anthoroxanthum</i> sp.	99.7	969	2	1	DQ417386.1
19SPA0157	OM265458	<i>P. graminis</i>	<i>Triticum aestivum</i>	99.7	974	0	1	DQ417382.1
19SPA0165	OM265459	<i>P. graminis</i>	<i>Triticum aestivum</i>	99.9	972	0	1	DQ417382.1
19SPA0198	OM265460	<i>P. graminis</i>	<i>Triticum aestivum</i>	99.9	972	0	1	DQ417382.1

¹ GenBank accession number of the ITS sequence of aecial sample used in this study.

² GeneBank accession number of the best BLASTN hit *Puccinia* spp. for the aecial sample used in this study.